## A Process in Cell Regulation

**Protein Phosphorylation**. Papers from a conference. ORA M. ROSEN and EDWIN G. KREBS, Eds. Cold Spring Harbor Laboratory, Cold Spring Harbor, N.Y., 1981. In two volumes. xl, 1422 pp., illus. $140.

*Protein Phosphorylation* is the proceedings of the largest and most comprehensive conference ever held on the subject, and the 95 contributions in it reflect the ubiquity of protein phosphorylation as a regulatory device. Book A describes recent investigations of cyclic-nucleotide– and calcium-ion–dependent protein kinases, protein phosphatases, and the regulation of carbohydrate and lipid metabolism. Book B deals with insulin and growth factors and the role of protein phosphorylation in the control of muscle contractility, protein synthesis, nuclear and cytoskeletal function, cell transformation, and neuronal and membrane function. The papers are of a high standard, and the volumes give a reasonably complete account of ongoing research at the time of the meeting.

Some of the exciting developments that had emerged at that time are the discovery that epidermal growth factor activates a protein kinase that phosphorylates tyrosine residues specifically and shows intriguing similarities with the virally coded protein kinases that elicit cell transformation; the observation that insulin and growth factors increase the phosphorylation state of ribosomal protein S6; the discovery of a novel allosteric effector of phosphofructokinase, later identified by Van Schaftingen and Hers as fructose 2,6-bisphosphate; and the description of a new type of protein kinase that is completely dependent on calcium ions, diacylglycerol, and phospholipids. This last-mentioned enzyme may mediate the actions of some extracellular stimuli that do not use cyclic adenosine monophosphate as a "second messenger."

The papers in the book appear in the order of presentation at the meeting, with little apparent editorial control of length or content. Perhaps it would have been better to group all the papers dealing with calcium-ion– and calmodulin-dependent protein phosphorylations in a separate section, and a paper by Nishizuka and Takai describing the new calcium ion and diacylglycerol-dependent protein kinase should have been placed directly after the contribution 300 pages later by Exton and co-workers, who review the action of hormones that do not work through cyclic adenosine monophosphate. More generally, a different arrangement of some sections would have helped nonspecialists to realize how protein phosphorylation has linked areas of research that were previously thought of as being quite separate. Since no one paper can be regarded as an adequate review of any particular subject, it might have been useful had each section been prefaced by an introductory paper describing the background of and outstanding problems in the subject discussed in that section. This might then have avoided the repetitive introductions in each paper, which are particularly tedious in section 1.

However, the editors are to be congratulated for assembling such a comprehensive and talented array of contributors, and for publishing so complete an account of the proceedings within one year. These books are essential reference works for everyone involved in this area.

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## Auditory Physiology

**Neuronal Mechanisms of Hearing**. Proceedings of a symposium, Prague, July 1980. JOSEF SYKA and LINDSAY AITKIN, Eds. Plenum, New York, 1981. xii, 444 pp., illus. $45.

This book of symposium proceedings is divided into nine sections. The first two sections, on cochlear mechanisms, are highlighted by a paper by Russell and Sellick on hair cell intracellular recording that describes their work demonstrating that inner hair cells respond to basilar membrane velocity at low frequencies and that outer hair cells respond to basilar membrane displacement. It is suggested that the role of the coupling of the cilia to the tectorial membrane is to avoid biasing at high frequencies, where the alternating-current component is quite small. Katsuki presents a model of receptor sites and Furukawa and Matsuura review their model of multiple release sites. Studies in the caiman have suggested that a traveling wave may not exist in all species. However, using auditory nerve recording, Smolders and Klinke demonstrate that the necessary conditions for a traveling wave do exist in the caiman. Ross and Jones present evidence that efferents are part of the parasympathetic system and that collaterals of spiral ganglion nerve fibers supply both afferent and efferent terminals.

Several issues concerning the cochlear nerve and cochlear nucleus are addressed in the third section. On the question of dynamic range—how do our ears operate over a 100-decibel range when the majority of cochlear nerve fibers have a dynamic range of 20 to 30 decibels?—Evans suggests that not all cochlear nerve fibers have restricted dynamic ranges, that a temporal code (phase-locking) can carry information about the relative levels of stimulus components, that background noise can bias the rate level function, and that care must be exerted in comparing the data from anesthetized cats with those from humans, since the efferent system is not functional in the anesthetized animal. Møller discusses the coding of complex sounds. He demonstrates that nerve fibers transmit temporal information even though the average discharge rate is in saturation. This result is supported by Voigt *et al.*, who demonstrate that a temporal-place mechanism can reflect formant structure even at signal-to-noise ratios less than one. Anatomical knowledge of the circuitry of the dorsal cochlear nucleus is reviewed by Osen and Mugnaini. Young and Voigt describe type II-III units in the dorsal cochlear-nucleus that have low spontaneous rates and primary-like response rates and cannot be driven anti-dormically. Type IV units have marked spontaneous activity, nonmonotonic rate curves, and inhibitory regions. Evidence has previously been provided that type II-III units may be the inhibitory input to type IV units, which may be fusiform cells.

The next two sections cover central auditory mechanisms, with an excellent review by Suga *et al.* of how biosonar information is represented in bat cerebral cortex. The review brings together much of the prior research on this important topic. The authors suggest that there are information-bearing parameter filters in the auditory system that are aggregated in identified regions of cerebral cortex. They suggest that the recognition of the overall acoustic image is directly related to spatiotemporal patterns of neural activity rather than to neural activity in a particular area.

Several papers discuss the inferior colliculus and medial geniculate body. Syka *et al.* report that neurons with different binaural response properties are distributed differentially in the inferior colliculus. Semple and Aitkin report that the ascending inputs to the inferior colliculus remain partially segregated with a fine pattern of integration.

Six papers address the organization and coding properties of units in the medial geniculate body. Aitken *et al.* report finding long latencies, labile responses, and wide tuning curves in the dorsal region of the principal division. Heierli *et al.* studied functional interactions between pairs of cells and report finding almost none displaying inhibitory interaction. Rouiller *et al.* examined temporal jitter and conclude that temporal information is preserved well enough up to 1 kilohertz to deal with the fundamental frequency of most species' vocalization and with their fine structure.

The sixth section deals with auditory localization. Masterton *et al.* show that at the level of the lateral lemniscus or higher each side of the auditory pathway contains a neural representation of its contralateral hemifield sufficient to support normal sound localization. The possibility of a monaural component for localization is reported by Casseday and Smoak on the basis of deficits resulting from lesion of the anteroventral cochlear nucleus in the tree shrew. Altman directs attention to the perception of moving sound sources. Data from psychoacoustic, physiological, and clinical studies demonstrate that memorization of some properties of the stimulus must be made in order for a "fused image" to be formed, to estimate movement, and to respond to the moving sound stimulus.

The topic of section 7 is neural coding of speech and complex stimuli. Both simple artificial and species-specific vocalizations are used by Manley and Müller-Preuss to study the response of inferior colliculus neurons in the squirrel monkey. They found that vocalization elicited a higher percentage of tonic responses with clear stimulus envelope following. Müller-Preuss used electrical stimulation to induce phonation and compare the response from higher auditory centers during phonation and playback. About half the cells studied responded more weakly during phonation. Langner *et al.* report formant responses in the mynah bird to be very similar to those found in humans. Bibikov and Gorodetscaya report that adaptive changes considerably increase the synchronization of the discharges with the modulation waveform and that midbrain units are less likely than central nervous system units to respond tonically to amplitude modulation. Several papers also deal with the use of tritiated amino acids and deoxyglucose to map the auditory system.

The eighth section, on deprivation and developmental studies, has several papers dealing with the use of deoxyglucose. In particular, Taniguchi reports the demonstration of a marked decrease in inferior colliculus activity following cochlear destruction, with a normal level of activity returning in one month.

The last section deals with auditory prosthesis. The discussion of the physiological background of hearing prosthesis by Keidel is very well done. He addresses many important questions and relates much of the research performed in his own lab. A couple of other papers relate the improvements in lipreading that take place following a single channel implant.

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## The Solar Outer Atmosphere

**Solar Active Regions.** A Monograph from Skylab Solar Workshop III. FRANK Q. ORRAL, Ed. Colorado Associated University Press, Boulder, 1981. 350 pp., illus. $17.50.

Although historically solar physics has had much to contribute to astrophysics, the remarkable level of detail achieved in observational and theoretical solar physics over the past decade has contributed to setting it somewhat apart from the rest of astronomy. This isolation has many aspects, the most worrisome of which is perhaps the separation between the respective research communities; it is a pity because there is much in recent solar research that is of interest to the larger astronomical community. The book under review, the third and last of a workshop series dealing with data from the Skylab solar observatory, represents a valuable effort to bridge this gap: it describes our current understanding of the quiescent solar atmosphere, a subject that is of some importance not only in its own right but also from the point of view of understanding the outer atmosphere of other stars (for which data are now available) and (perhaps) other astronomical objects in which—as on the sun's surface—magnetic fields that are exposed to turbulent buffeting of fluid motions alter local plasma transport properties.

The past decade has seen a radical revision in our conceptual view of the solar atmosphere. The central role of magnetic fields in the more dramatic manifestations of solar surface activity (such as solar flares) has long been recognized; but it was not until the Skylab data were analyzed that the extent to which magnetic fields control the geometric structure and energetics of even the most quiescent portions of the solar atmosphere was widely appreciated. The importance of this book largely derives from the central role played by Skylab observations in defining our new view of the solar corona and associated solar activity.

The hot solar corona and the underlying transition region separating it from the far cooler photosphere seem to be largely the product of magnetic activity. By focusing on the basic physical processes, the workshop organizers have succeeded in producing a monograph of considerable usefulness. Each chapter deals with a major theoretical issue, the issues ranging from the geometric structure of the hot plasma, and its mass and energy balance, to the vexing problems of plasma diagnostics and plasma heating; each chapter is written by the "leader" of the working group that focused on the particular topic. A nice feature of these presentations is the close tie maintained between the observations (principally from Skylab, but also from much more recent sources, such as Orbiting Solar Observatory 8 and various rocket experiments) and theory. Much attention is paid to the ambiguous nature of the data; the healthy skepticism of solar experimenters toward theorists' constructions (a habit born of experience) is much in evidence. It should thus be enlightening to those unacquainted with solar astronomy that the basic why of the hot solar corona is still not understood. We now know that magnetic fields play an essential role in the coronal heating process and have eliminated a (very) few candidate theories, but it is also clear that deciding between the remaining contenders is observationally far more difficult than was previously imagined. For example, some theories for solar coronal heating hypothesize regions of active local heating as small as a kilometer or less in extent; when viewed from the earth, such regions subtend angular dimensions well below 0.01 arc second and are thus orders of magnitude smaller than can be resolved at present. This and related observational difficulties are in fact addressed in the final chapter, on the future of observational solar astronomy. From today's rather dismal funding perspective, this book also teaches a valuable lesson: although the Skylab flight lasted less than a year, it has taken almost a decade to absorb the scientific implications; such science cannot be carried out on the operational time scale of space experiments.

Virtually all presentations are marked by a balanced treatment of (often diver-