Book Reviews

Gonadal Hormones

The Sex Steroids. Molecular Mechanisms. KENNETH W. MCKERNS, Ed. Appleton-Century-Crofts, New York, 1971. x, 454 pp., illus. $24.95. Biochemical Endocrinology.

Work at the forefront in endocrinology has been preoccupied with a search for the primary effects of hormones on cells they specifically regulate. Efforts are directed toward localizing a subcellular site of action and defining the precise one-to-one molecular association of the hormone with a structural or metabolic element, an interaction that somehow directs and amplifies specialized responses by the target cells. Researchers on gonadal (sex) hormones have often pioneered or led the way in generating ideas on this complex problem, and students of hormone mechanisms should therefore find *The Sex Steroids* of unusual interest.

This compendium, third in a series on biochemical endocrinology, contains 15 articles, dealing mostly with two subjects. Well over half the papers deal with hormone-stimulated turnover, synthesis, and qualitative changes in classes of RNA and synthesis of special proteins. At least implicit in experimental design of these studies is the hypothesis that the primary effect of the hormones is on the genome. Presentations include descriptions of methodology and of effects, mainly of estrogen and progesterone, on histones, polymerases, DNA template activity, and translational events. The other subject category, to some extent overlapping the first, is steroid-binding ("receptor") proteins. Extensions are reported of the basic discovery that each steroid hormone is specifically recognized and held by one or more proteins of its target cells. The function of these steroid binders is unknown, but their possible action as obligatory intracellular steroid carriers or primary modulators of gene activity has stimulated a great deal of descriptive work and much discussion. A variant of the binding theme is addressed in three chapters wholly or partly devoted to properties of binding to isolated chromatin, pure DNA, and other nucleic acids. Other chapters examine possible roles of lysosomes and cyclic adenosine monophosphate in estrogen and progesterone action and effects of these hormones on energy metabolism involving preexisting enzymes.

Steroid-responsive target organs studied by authors include the uterus, vagina, mammary gland, hypothalamus, pituitary, and kidney. An emphasis on mammals reflects the fact that information at the molecular level for lower vertebrates is virtually nonexistent. The notable exception is work summarized in this volume on the chick oviduct, a model system of promise because of its function in producing egg proteins, one of which is synthesized in specific response to progesterone. With regard to emphasis, it is remarkable that a book on sex steroids deals almost entirely with the female. For no apparent reason, though consistent with a current social revolution, testosterone and its metabolites receive only oblique treatment in one paper and cursory description in another of effects on RNA labeling and turnover in kidney. Better balance might have been achieved by including, for example, important work on nuclear events in prostate, seminal vesicles, and other male sex accessory tissues. In like vein, an arbitrary decision was made to exclude from the definition of molecular mechanisms hormone effects on transport (though that of nucleotides is mentioned in passing), catecholamines and other amines, and target-organ bioconversion of hormones.

The format of the volume is commendable. Preliminary drafts of the chapters were presented at a symposium, and discussions, reproduced in full after each paper, are as good as this reviewer has seen outside the Laurentian Hormone Conferences. The reader, however, is left to guess when the symposium took place; examination of reference lists suggests it was some time in 1969. Authors were provided opportunity to update presentations before publication, and a few did so comprehensively, but most were content to insert 1970–71 material from their own laboratories. Interested students will find the volume useful for its intensive coverage of the major topics selected, though it will be rough going for all but the advanced. Introductions to most chapters are overly brief and in some are virtually absent. Full-citation reference lists are comprehensive, particularly for the past ten years, and the volume is adequately indexed.

For the specialist, the volume is recommended principally for the following: (i) The opening chapter. The theme is lysosomes, but the article doubles as a tour de force discussion of hormone action. It is difficult to read but worth the effort, for it develops an interesting and entirely new mechanism concept. (ii) At least one very good article on recent work on the mammary gland, a subject infrequently reviewed. (iii) Two informative, theory-oriented chapters on the physical biochemistry of steroid-macromolecule binding that should be mandatory reading for those in the field; one is on estrogen and protein and the other on steroids and nucleic acids. (iv) The discussions, which are laced with wit, frequently hard-hitting, and loaded with information. The primary action mechanisms of gonadal steroid hormones remain unknown, but experimental results thus far obtained nurture a conviction that correct avenues are being explored. In any case, much of the work presented in this volume illustrates the degree of skill in design and imagination in approach that will be required to solve the problem.

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Tall Woody Plants

Trees. Structure and Function. MARTIN H. ZIMMERMAN and CLAUD L. BROWN. With a chapter by Melvin L. Tyree. Springer-Verlag, New York, 1971. xiv, 336 pp., illus. $19.80.

A schoolmaster is said to have spoken of the author of the *Odyssey* as follows: "No one knows for sure whether Homer really lived; what is quite certain, however, is that he was blind." His testament provides an appropriate introduction to this review; for, although we

know a great deal about the physiological minutiae of tree growth, no one is really sure whether the large size and structure of these woody perennials confer upon them anything that is physiologically unique. The publication of a book on the structure and function of trees is a rare and consequently welcome event; when the book is professedly concerned with "those aspects of the physiology which are peculiar to tall woody plants" it is even more so. The only disappointed readers of this book will be those who have no stomach for long-standing controversy or those who, from the title, may have expected a wider-ranging treatment of the subject than a review virtually restricted to growth and the movement of assimilates.

The first three chapters (by Brown), comprising about half the book, deal with primary and secondary growth and the relation between growth and habit. Inevitably, such a review is selective, but this one provides a balanced, if unadventurous, account of current knowledge that will be valuable to students and teachers; it could do much to broaden the horizon of cell physiologists (if only they will read it), and it discovers a treasure trove of potentially rewarding research topics.

This section is followed by two chapters (by Zimmerman) on xylem and phloem transport—the latter described by a manuscript reviewer as "a clear statement of party line" but subsequently balanced by brief notes of alternative postulates, including the pump concept of the sieve plates. An iconoclastic and provocative chapter by Tyree on steady-state thermodynamics of translocation introduces the Onsager equations and argues a case for the experimental detection and measurement of translocation by electrical phenomena. The concluding chapter (by Zimmerman) treats the storage, mobilization, and circulation of assimilates, again highlighting several potential research fields.

Zimmerman and Brown set out to produce a textbook that would bridge part of the gap between modern standard plant physiology texts (with their inevitable molecular and cell biology bias) and ecological treatises on tree growth. They have succeeded admirably and we should be grateful to them; on the question of "what is a tree?," however, we still have no better authority than Gertrude Stein.

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Sleep Studies

Normal Sleep in Man. An Experimental Contribution to Our Knowledge of the Phenomenology of Sleep. UROŠ J. JOVANOVIČ. Hippokrates, Stuttgart, 1971. 328 pp., illus. $30.

An impressive variety of multidisciplinary investigations have led to major advances in the detailed phenomenological description of sleep in man and in lower animals. Extensive studies of the phylogeny, ontogeny, neurochemistry, psychology, neuroendocrinology, and physiology of sleep in recent years have led to a number of theoretical formulations of sleep-waking mechanisms. These include concepts regarding the anatomy and chemistry of biogenic amines in the central nervous system and of neural circuitry, as well as of biorhythmic aspects of sleep. On the basis of these data and new concepts, there is increasing interest in and evaluation of the nosology and etiology of sleep disorders in man.

This monograph is a report of a series of studies carried out by the author with major emphasis on the polygraphic recording and direct behavioral observation of nocturnal sleep in man. The author plans to follow this with a second monograph on "Problems of Disturbed Sleep." By the use of the electroencephalogram (EEG), myogram (EMG), oculogram (EOG), cardiogram, respirogram, phallogram, and dermatogram, 491 nights of "normal" sleep were monitored for 189 healthy subjects. The results are analyzed in terms of repetitive observational polygraphic descriptions and not in relation to specific hypotheses generated by a sharply focused research inquiry. Unfortunately, it is difficult to compare Jovanovič's polygraphic descriptions with modern concepts of sleep-stage patterns, since both his recording methods and his electroencephalographic sleep staging are significantly different from present generally accepted procedures. He classifies EEG "depth of sleep" patterns into five major categories (A, B, C, D, and E) or stages, with each stage having three substages, there thus being a total of 15 separate patterns. The concept of "depth" is defined solely by the persistence of EEG wave pattern, with no independent measure of arousal threshold used. The lack of mentalis EMG recording in most studies and the use of only one EOG channel recording also create difficulties in comparing results to other studies. Surprisingly, no comparison or even reference is made to the accepted standard manual of sleep-stage recording and classification (A. Rechtschaffen and A. Kales, *A Manual of Standardized Terminology, Techniques and Scoring System for Sleep Stages of Human Subjects*, U.S. Public Health Service Neurological Information Network, Bethesda, Md., 1968).

In spite of these methodological difficulties, the author essentially confirms the well-accepted findings that normal nocturnal sleep is composed of a sequence of 80-to-90-minute cycles; that relative duration of phases of the cycles, as well as EEG wave pattern, changes according to time of night; and that rapid eye movements are correlated with desynchronized sleep 96 percent of the time. In addition, the results confirm previous findings regarding the pattern of myoclonic twitches, heart rate and respiratory rate, and penile erections, as well as the high correlation (80 to 90 percent) of vivid dream reports with "desynchronized" (REM) sleep. Surface EMG recordings were made from both arms during sleep, and several interesting findings are reported. In right-handed individuals (without left-handed family members), there were twice as many group discharges from muscles of the left arm as from the right. For left-handed individuals the opposite result was found. These results were the case for total sleep as well as during "desynchronized" sleep.

Although most of this monograph is devoted to reports of sleep in normal adult man, results of a study of sleep in 17 children ages 2 to 14 and 8 adolescents ages 15 to 18 are also included. The findings essentially confirm previous reports regarding sleep-stage cycling and percentage relationships of these sleep stages in these age groups as well. One interesting section is the report of results of an attempt to totally deprive two young adults of sleep for a period of 5 days. Neither could be kept awake beyond 114 hours, and after 2½ days both subjects developed increasing transient sleep periods, lasting a few seconds, with significant psychological and performance decrements. The recovery sleep was prolonged, with increased "deep" sleep as well as increased percentage of REM sleep. The subjects felt fully recovered after 12 and 16 hours of sleep respectively.

This monograph cannot be recommended as a general text for nonexperts in the field, for the differences in methodology make direct comparisons