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ABSTRACTS of Review Articles and Educational Materials in Physiology

FOREWORD

The abstracts presented here have been prepared by members of the Educational Materials Review Board under direction of the Education Committee of the American Physiological Society. Included are abstracts of review articles, texts, chapters of texts, books, manuals, surveys, audiovisuals, and other educational materials found by Board members to be useful in the teaching of physiology. This is the initial publication in the Society's program to provide, once a year, material of this nature to teachers of physiology. We hope you find these abstracts a useful addition to your educational resources, and we solicit your comments and suggestions concerning this project.

Orr E. Reynolds
Editor

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BIOMEDICAL ENGINEERING

- 1 THE CIRCADIAN MULTI-OSCILLATOR SYSTEM OF MAN. Wever, R.
International Journal of Chronobiology 3: 19-55, 1975.

The complex nature of and interactions between the overt rhythms for different biological end-points ("variables") are reviewed by Wever from intensive studies on 137 subjects. Real desynchronization (non-integral period ratios) could be demonstrated in 38 subjects while in 11 apparent desynchronization (period ratios of 1:2 or 2:1) was found. These observations reinforce the concept of multiple self-sustained oscillators which, while independent, contribute to the control of many rhythmic "variables" (see above) to varying degrees. Wever divides these fundamental oscillators into two groups, I and II. Group I (controlling rectal temperature, for example) is the group classically described as "circadian". Its periodicities are narrowly controlled around 25 hours. Group II oscillators exhibit a broad range with at least six separable peaks. This group is claimed to exert dominant control over overt activity rhythms. Group I oscillators have a persistence ("oscillatory strength") about 12 times that of Group II. The mutual interaction between these groups is proposed to account for the observed multi-modal distribution of periodicities estimated experimentally for different "variables" (biological end-points). Wever's review and discussion of the empirical observations is essential to the attempt to relate biological rhythms to underlying physiological mechanisms. It attempts to bridge the present gap between deterministic component-based physiology and the descriptive time-series analyses upon which biorhythm studies have been dependent.

L.F. Wolterink

CIRCULATION

- 2 AFTERLOAD MISMATCH AND PRELOAD RESERVE: A CONCEPTUAL FRAMEWORK FOR THE ANALYSIS OF VENTRICULAR FUNCTION. Ross, John, Jr. In: Progress in Cardiovascular Diseases 58:(4) p. 255-264, 1976.

This article provides an excellent conceptual framework which emphasizes the importance of cardiac afterload relative to preload reserve in an analysis of ventricular function. Recent clinical and experimental studies have emphasized the importance of afterload in determining ventricular function. For example, clinical studies have demonstrated the beneficial hemodynamic effects of vasodilator drugs which can reduce the afterload faced by the heart. This review presents a conceptual framework whereby the characteristics of left ventricular ejection can be described in terms of the appropriate matching between afterload and inotropic state as modulated by preload reserve. Afterload mismatch can be induced if an increase in preload is not allowed to compensate or if the limit of preload reserve has been reached. Mean VCF (mean velocity of circumferential fiber shortening) is a useful index of inotropic state in the heart under basal conditions, particularly following adaptation to a chronic pressure or volume overload. A reduction in inotropic state, however, results in a mismatch between afterload and contractility and thus will reduce VCF, even in the basal state. The concept of afterload mismatch with limited preload reserve provides an explanation for the value of ejection phase indices compared to isovolumic phase indices in measuring the basal level of inotropic state. The effects and implications of therapeutic afterload reduction as influenced by the preload are also understood within this framework.

W.W. Parmley

- 4 Capillary Exchange and Normal Fluid Convection in the Interstitial Space (chap. 8); The Lymphatic System, etc (chap. 9) A. C. Guyton, Aubrey E. Taylor and Harris J. Granger. In CIRCULATORY PHYSIOLOGY II, Chapters 8 and 9, pp 97-140, Saunders, Philadelphia, 1975.

Although I do not concur in a few aspects, this is a very sound presentation of current ideas of fluid and solute exchanges between blood, interstitial fluid and lymph. The rather exciting concept that all or nearly all convective fluid loss from blood becomes lymph is considered in some detail. If this proposal is eventually proven correct it will change our consideration of the role played by Starling forces in these exchanges. Convective fluid shift may be considered to consist of any fluid loss from blood to interstitium that could change the interstitial fluid volume. If lymph formation and removal accounts for the maintenance of the interstitial fluid volume constant under normal conditions convective fluid removal from blood becomes a one-way route. Therefore the exact route or even the forces involved under normal conditions become of secondary significance. Furthermore studies on "transcapillary exchange" using isogravimetric or isovolumetric techniques where lymph flow was not measured or ignored may not represent the true balance of forces actually in operation.

P. A. Nicoll

- 3 BLOOD CIRCULATION AND FLUID DYNAMICS IN THE EYE. Anders Bill. In: Physiological Reviews, 1975, 55, 383-417.

This review consists of a clear presentation of the difficult problem of circulation in the eye and its relationship to the existence of the blood-retina and blood-aqueous barrier. The hydrodynamics of the aqueous humor are brought up to date and the controversial situation on the actual mechanism of drainage of the fluid is considered in a lucid manner.

The review evaluates the methods utilized in this area of research which is related to the general problem of microcirculation; the characteristics of the barriers; and brings up to date the situation on the mechanisms of secretion of aqueous humor as well. This article will be of importance for those interested in the phenomenon of the blood-brain and blood-retina barriers as well as to the teachers involved in the training of residents in ophthalmology. The paper gives the formal physiological and biophysical information necessary to interpret eye diseases of the choroid, glaucoma and the retinal detachment, without entering into the pathological mechanism. It will be therefore of use to the clinical physiopathologist and the ocular physiologist alike.

Jose A. Zadunaisky

- 5 Cardiac Contractility: The ventricular function curve. William W. Parmley. American Physiological Society slide-tape study package.

This unit presents a discussion of cardiac contractility. The ventricular function curve is discussed as a representation of varying cardiac states. The topics discussed are: 1) mechanisms which increase heart muscle performance and conditions on which an index of contractility depends; 2) advantage and disadvantage of using the pressure-volume loop to describe contractility; 3) ventricular function curve; 4) shift in the ventricular function curve with increased contractile state and congestive heart failure; and 5) shift in the passive pressure-volume relation with a decrease in compliance. This package is for medical students. Some disturbance of the students was due to oversimplification specially related to the absence of homeometric regulation and the decreased compliance discussion. This package turned out to be relatively difficult. The educational value was much enhanced by post package conferences with the students.

Wendell N. Stainsby

- 6 The Cardiac Pump: Structure and Mechanisms. F. Norman Briggs. American Physiological Society slide-tape study package.

This slide-tape unit presents four major topics: 1) the heart as a pump; 2) Function of the microanatomical component; 3) molecular organization of the myofibril; and 4) mechanisms of contraction. The presentation is the common format of objectives, the presentation, and posttest. The presentation of the pump function is elementary and primitive. The function of the filament cross bridges is quite detailed. The unit should be useful for undergraduates as the end of their heart function study; for medical students at a middle level; and graduate students as a starting point. The educational value seemed high. Actual use with medical students seemed to indicate the package was most useful when details and context were additionally discussed in discussion or lectures.

Wendell N. Stainsby

- 8 THE CEREBRAL CIRCULATION. Scheinberg, P. In: The Peripheral Circulations, Ed. Robert Zelis, pp. 151-162, Grune and Stratton, Inc., New York, 1975.

This brief survey provides a well-documented outline of current theories of cerebral blood flow regulation. The author reviews control by metabolites, especially the role of PCO_2 versus H^+ concentration. Metabolic and myogenic hypotheses for cerebral autoregulation are discussed. Evidence is outlined both for and against a significant role of nervous control of blood flow regulation achieved by both α - and β -adrenergic receptors. A possible role of the brain stem in cerebral blood regulation is discussed. Evidence supportive of and contradictory to each hypothesis is reviewed. This review will be a useful and efficient summary for medical students, graduate students and physiology teachers.

L.B. Rowell

- 10 FLUID-MECHANICAL ASPECTS OF THE HUMAN CIRCULATION. Talbot, L., and S. A. Berger. Am. Sci. 62: 671-682, 1974.

This article presents an overview of circulatory fluid mechanics, including consideration of pulsatile flow in large vessels, mechanical properties of vessels, wave transmission and reflection, microcirculatory flow and its control, rheological properties of blood, and flow through heart valves. Tracheobronchial airflow is mentioned briefly. The text is written for those with at least a superficial knowledge of fluid mechanics, while the biological terms are carefully defined. Any student who has completed a year of college physics should be able to read this review profitably. For the biologist, it can serve usefully as an introduction to the ideas and vocabulary of fluid mechanics. References are many, and are well chosen. This review could be recommended to those advanced undergraduate students in physics or biology, or to beginning graduate students in physiology, as an introduction to the most important concepts of fluid mechanics as applied to flow in both large and small vessels.

T. C. Lloyd, Jr.

- 7 CARDIOVASCULAR PHYSIOLOGY. Warren, J.V., ed. In: Benchmark Papers in Human Physiology/4, pp. 441. Dowden, Hutchinson and Ross, Inc., Stroudsburg, Pa., 1975.

This volume, the fourth in a series of compendia of classical papers, deals with a period of very rapid growth in cardiovascular physiology. Most of the papers are selected from the period 1930-1968. Also, reproductions of some of the works of Harvey are included. The collection is divided into sections on: the heart and the central circulation, hemodynamics of the central circulation and cardiac electrophysiology, the blood vessels, organ blood flow, noninvasive methods of study, and molecular physiology of the heart and circulation. A total of 49 papers is presented. The papers selected cover a reasonably wide spectrum of classical cardiovascular physiology, with a heavy emphasis on the methodology utilized in the study of cardiovascular function. The monograph should serve as a useful supplementary text for advanced courses in cardiovascular physiology.

B.R. Duling

- 9 EXPERIMENTAL HYPERTENSION AND THE LONG-TERM CONTROL OF ARTERIAL PRESSURE Coleman, T.G., A.W. Cowley, Jr. and A.C. Guyton In: MTP International Review of Science: Cardiovascular Physiology, Series I pp.259-297, Butterworth, London, 1974.

This article is a comprehensive review of research findings, both historical and very recent, on experimental hypertension induced by salt loading or by partial constriction of renal artery (Goldblatt). The reviewers provide vertical and horizontal perspectives of the state of knowledge in this extremely complicated and controversial field. The authors have a strong opinion as to the pathogenesis of the renal hypertension that it is a result of serial compensatory events which are triggered by a shift in the relation between renal perfusion pressure and urinary output and involve a number of physiological mechanisms related to acute and long-term control of arterial pressure. Their viewpoint may be even more clearly understood if the reader jointly refers to another review article by the same authors (Circulation: Overall Regulation Ann. Reviews Physiol. 34: 13-46, 1972). In this article, however the authors collect an extensive set of experimental results, either for or against their point of view, and develop the theme with abundant counter arguments. It is a rare combination of an up-to-date bird's eye view of experimental findings and a systems oriented interpretation of them. It is highly recommendable to (1) those lecturers who need a quick survey of the current studies on renal hypertension, (2) investigators in the field who are lost in the forest of reports and (3) medical or graduate students who search for systems oriented approach to pathophysiology of a disease.

K. Sagawa

- 11 THE INITIATION OF THE HEARTBEAT. Noble, Denis. 155 pp., Oxford University Press, London, 1975.

This is a lucid, concise, logical account of the electrical mechanisms responsible for initiating the heartbeat, based on lectures given by the author to second-year medical students and physiology undergraduates at Oxford. The book is also of value to beginning graduate students, teachers of physiology and clinical cardiologists. The material is presented in two different ways to accommodate both mathematical and non-mathematical readers. The text reviews the principles of electrophysiology and their applications to the initiation and conduction of the cardiac impulse, calcium and excitation-contraction coupling, pacemaker activity, actions of neurotransmitters, ionic influences and abnormal electrical activity. The illustrations are excellent supplements to the text which is a pleasure to read.

J. M. Marshall

- 12 The Interaction between Intracapillary and Tissue Forces in the Overall Regulation of Interstitial Fluid Volume. A.E. Taylor; W.H. Gibson; H.J. Granger; A.C. Guyton. *Lymphology* 6, pp 192-208, 1973.

This is a review of the Starling Forces, i.e. capillary hydrostatic pressure; plasma oncotic pressure; interstitial fluid pressure; and interstitial oncotic pressure and how they interact to regulate volume changes in the interstitial fluid. The authors state in the introduction "The article describes the negative fluid pressure concept; establishes both experimentally and theoretically that the concentration of protein in lymphatic fluid most probably equals that of tissue fluid, and describes how tissue forces and flows interact to maintain the tissues in a relative 'dry' state." In the first part the nature and roles played in fluid loss from the blood capillaries such as capillary filtration coefficient, capillary pressure and negative interstitial pressure are discussed. The role of differing permeability of the exchange vessel wall to protein and the result of this on reflection coefficients in evaluating the action of plasma oncotic pressures are reviewed. The final part deals with the evidence for negative fluid pressure and that the protein composition of lymph and interstitial fluid are the same. They then emphasize the way negative interstitial pressure (fluid) and lymph flow work to keep the tissue 'dry' and reduce edema. Some models of how interstitial fluid becomes lymph are reviewed.

P.A. Nicoll

- 14 THE MEANING AND MEASUREMENT OF MYOCARDIAL CONTRACTILITY. Blink, J.R. and B.R. Jewell In: *Cardiovascular Fluid Dynamics* Vol. 1, pp. 225-285. Academic Press, London and New York, 1972.

Myocardial contractility is probably one of the most difficult subjects to teach with lucidity. The reasons are that (1) there is no unanimous fundamental concept of the term contractility and (2) basic and applied cardiologists have characterized a *change* in contractility by various operational definitions (e.g., in terms of maximum isometric force, isotonic shortening velocity, or rate of force development). The article reviews first the principal characteristics of heart muscle contraction and then systematically the relations between two muscle variables (i.e., force-time, length-time, velocity-time, force-length, velocity-length, and force-velocity relations) known up to 1970. The descriptions are clear, objective and supported by many illustrative figures. Particularly helpful is a table and summary statements at the end of each subsection which clarify what the studied relation is and what other variables were controlled or uncontrolled. The reader will understand how difficult it is to penetrate into the time-varying black box (heart muscle) and to define the state of the hypothetical contractile machine from a set of phenomenological variables that one can measure from outside of the machine. The authors conclude that myocardial contractility cannot be defined as such, but the clear presentation of recent researches will provide the reader with enriched understanding of why this is so. Recommended to instructors of cardiac physiology and graduate and medical students who are at an advanced level.

K. Sagawa

- 16 THE MICROCIRCULATION, AND LOCAL AND HUMORAL CONTROL OF THE CIRCULATION. Johnson, P.C. In: *MTP International Review of Science: Cardiovascular Physiology, Series I*, pp. 164-195. Butterworth, London, 1974.

The review is a consideration of the current thinking regarding the control of blood flow, with special emphasis on the specific microcirculatory adaptations involved in control. Neural control is considered only as it provides a vasoconstrictor input to set the level of vascular tone. The first section of the review deals with the physical and anatomical properties of the microcirculation. The bulk of the subject matter is concerned with the control of blood flow by processes related to tissue function (local control). This section includes segments on sources of arteriolar tone, and modulators of tone, and finally summarizes microvascular literature on several types of local control processes. The review should be a valuable source for teachers of mammalian physiology, and an excellent summary for courses in advanced cardiovascular physiology.

B.R. Duling

- 13 INTERACTIONS BETWEEN BEHAVIOR AND THE CARDIOVASCULAR SYSTEM. Cohen, D.H., and P. Obrist. *Circulation Research* 37(6):693-706, 1975.

This relatively brief review with an extensive bibliography should be of interest to both cardiovascular and behavioral scientists. The authors preface their review by indicating that a sizable literature has evolved treating anecdotal and correlational observations of acute and chronic cardiovascular effects of stress. The expressed intent of the review is to highlight recent developments in this area with focus on controlled laboratory models. Proceeding with definitional considerations the authors review (1) reflex behavioral models in which the stress stimuli elicit cardiovascular changes, e.g., pain, exercise and posture as well as integrated patterns such as defense, feeding and sexual activity; (2) the various training or learning situations which transform largely neutral stimuli into cardioactive ones by associating them with stimuli that reflexly affect cardiovascular activity. The latter includes classical Pavlovian conditioning as well as instrumental conditioning. According to the reviewers the instrumental type has been applied most prominently in exploring the etiology of hypertension, wherein the object has been to develop rigorous behavioral models of hypertension. The subject of "biofeedback" is also dealt with. The reviewers conclude by emphasizing that the field is still in its experimental infancy and that potentially profitable research approaches are numerous. This article should be of particular value to graduate students, medical students and all faculty members interested in the complex interaction between the central nervous system and the cardiovascular system.

J.C. Torres

- 15 Mechanics of the Intact Heart. William W. Parmley. American Physiological Society, slide-tape study package.

The slide-tape unit presents a discussion of the mechanics of the intact heart. The topics are: 1) primary determinants of cardiac performance; 2) pressure-volume loop and processes which take place along the loop; 3) left ventricular pressure-volume relation; and 4) changes in P-V loop due to varying determinants of cardiac performance. The format is the usual presentation of the objectives, the discussions and the posttests. The package is primarily for medical students. The package requires pre or post discussion largely due to oversimplification of the presentation which leads to apparent disagreements with most available texts. Otherwise the presentation was excellent and was found useful by the students.

Wendell N. Stainby

- 17 MICROCIRCULATORY BASIS OF FLUID EXCHANGE. Intaglietta, M. and B.W. Zweifach. *Biological and Medical Physics* 15: 111-159, 1974.

This is a review of the factors controlling fluid exchange in the peripheral vasculature, with particular emphasis on microcirculatory investigations. There is a critical review of the literature. The review does not deal in great detail with the physical chemistry and physics of the process of vascular water exchange, or with rigorous mathematical developments of the problem. It includes the following seven sections. I. Background material including a review of the basic theory of the Starling mechanism. II. A description of the constituents of fluid exchange. III. An evaluation of the whole-organ approach to capillary water exchange processes with critique of the methods for the measurement of the capillary filtration coefficient. IV. A presentation of the microvessel approach to the study of the problem which includes considerations of geometry, pressures, flow patterns, red cell behavior, lymphatic microvessels, and fluid exchange in single vessels. V. A description of microvessel models of the exchange process. VI. A quantitative comparison of the magnitude of the tissue blood flow and the capillary water flux. VII. A summary statement is presented with directions for future research outlined. This article would be a useful source for teachers of medical school cardiovascular physiology and is appropriate for use in a graduate level course in vascular physiology.

B.R. Duling

- 18 **MICROCIRCULATORY BASIS OF FLUID EXCHANGE.** Intaglietta, M. and B. W. Zweifach. *Advances in Biological and Medical Physics* 15: 111-159, 1974.

The topics covered in this review include: (1) interaction of capillary and interstitial forces in governing transcapillary fluid movement; (2) structure and function of the lymphatic microcirculation; (3) geometric and rheological aspects of the capillary network; (4) macroscopic and microscopic methods for measurement of flows, pressures and permeabilities in the microcirculation. The review is recommended for medical and graduate students interested in microcirculatory dynamics.

Harris J. Granger

- 19 **THE PERIPHERAL CIRCULATIONS** edited by R. Zelis Grune and Stratton, New York 1975, 417 pp.

This multi-author monograph provides a comprehensive review of the normal and abnormal behavior of the peripheral and pulmonary vasculatures. More specifically the topics discussed include the following: (1) local and neurohumoral regulation of blood flow to skeletal muscle, skin, myocardium, kidney, splanchnic region and lung; (2) control of regional blood flow in exercise; (3) peripheral vascular disease; (4) pathophysiology of hypertension; (5) the circulation in congestive heart failure; (6) the pathophysiology of pulmonary edema and (7) pathophysiology and treatment of coronary artery disease. This monograph is recommended for graduate students and advanced medical students interested in the unique features of the individual vascular beds and the role these play in overall cardiovascular dynamics in physiologic and pathologic conditions. It can also serve as an important source of lecture material for teachers of cardiovascular physiology.

Harris J. Granger

- 20 **Regulation of Myocardial Performance.** F. Norman Briggs. *American Physiological Society Slide-Tape study package.*

This slide-tape unit presents three major topics: 1) Factors subject to regulation which alter cardiac performance during exercise; 2) Cardiac performance factors and mechanisms for changing performance factors; and 3) factors whose influence can be modified and methods modified. The presentation is the common format with objectives, presentation and posttests. The performance factors, contractility and heart rate, are presented and the mechanisms by which contractility can be changed is illustrated. The roles of sarcomere length and load are also illustrated. This tape is useful for undergraduate, medical, and graduate students when accompanied by appropriate level lead in or follow up, medical students were concerned about linear oversimplifications. Sometimes the presentation seemed a long ways away from the beating heart.

Wendell N. Stainsby

- 21 **THE RENAL CIRCULATION.** Hollenberg, W.K. In: *The Peripheral Circulations*, Ed. Robert Zelis, pp. 131-150, Grune and Stratton, Inc., New York, 1975.

This review will be of interest to those concerned with either the regulation of renal blood flow or with general renal physiology. It provides a brief, but informative survey of current thinking about major mechanisms involved in the control of this circulation. The major emphasis is upon the functional significance of intra-renal distribution of blood flow. An extensive and current reference list is provided. The subject matter includes general descriptions of (1) overall renal perfusion and special anatomical features of each region of the kidney, (2) the cortical circulation, (3) the medullary circulation, and (4) mechanisms of blood flow control including autoregulation, sympathetic nervous system, renin-angiotensin system, and other vasoactive factors (e.g., prostaglandins, metabolites, etc.). This survey will be useful to medical students, graduate students and physiology teachers.

L.B. Rowell

- 22 **SKELETAL-MUSCLE BLOOD FLOW: METABOLIC DETERMINANTS.** Skinner, N. Sheldon, Jr. In: *The Peripheral Circulations*, Ed. Robert Zelis, pp. 57-78, Grune and Stratton, Inc., New York, 1975.

This review focuses upon those local factors in skeletal muscle which regulate its blood flow during contractile activity. The major emphasis is upon the interplay of various factors. The author briefly reviews myogenic and metabolic autoregulation and the role of mechanical factors in blood flow regulation. The additive nature of metabolic dilator mechanisms is emphasized, using as an example the interaction between muscle oxygen tension, potassium concentration and osmolality in effecting muscle vasodilation during exercise hyperemia. Then the interaction of these variables with competing sympathetic vasoconstrictor nerve activity is described. The review illustrates the complex interplay of intrinsic autoregulatory phenomena, extrinsic humoral and neurogenic factors, local metabolites and mechanical factors in the regulation of skeletal muscle blood flow. The article will be valuable to graduate students, medical students, and faculty specializing in cardiovascular physiology.

L.B. Rowell

- 23 **SKELETAL-MUSCLE BLOOD FLOW: NEUROGENIC DETERMINANTS.** Shepherd, J.T., and P.M. Vanhoutte. In: *The Peripheral Circulations*, Ed. Robert Zelis, pp. 3-55, Grune and Stratton, New York, 1975.

This review provides a detailed and comprehensive treatment of the subject with extensive references. The emphasis is upon the complex nature of reflex control of skeletal muscle blood flow. The review begins by describing adrenergic innervation of resistance vessels; morphology, physiology, and pharmacology are discussed briefly. Discussion of reflex control begins with description of sympathetic vasomotor outflow, effects of stimulation, and includes nonadrenergic (cholinergic, histaminergic) innervation. On the afferent side major reflex inputs to the vasomotor centers are described - i.e., carotid and aortic baroreceptors and chemoreceptors, somatic afferents from skeletal muscle and cardiopulmonary receptors. Effects on skeletal muscle perfusion and resistance are then traced to the efferent arm of each reflex. Where possible, data from lower animals are tied together with data from man to illustrate common or unique features of reflex control. Major findings are illustrated and summarized by numerous figures from original experimental reports. Finally, concepts are synthesized in a discussion of integrated neurogenic control which deals briefly with (a) differential sympathetic outflow with activation of reflexes, (b) interaction between adrenergically mediated reflexes, and (c) central integrat. This review provides a valuable overview of some general features of reflex control for any vascular bed. It will be particularly useful for graduate students in physiology and teachers of cardiovascular physiology.

L.B. Rowell

- 24 SYSTEMIC ARTERIAL BARORECEPTOR REFLEXES. Kirchheim, H.R.
Physiological Reviews 56: 100-176, 1976.

This comprehensive and detailed review is primarily directed to cardiovascular physiologists and particularly those whose major interest is in the regulation of arterial blood pressure. This work updates Heymans and Neil's classic 1958 monograph on the topic. It provides an excellent survey of the literature. The review focuses upon the following major areas: (1) anatomy, histology and mechanical behavior of systemic arterial baroreceptors; (2) electrical activity of baroreceptor afferents with treatment of static and dynamic characteristics as determined from single- and multi-fiber preparations and also effects on these characteristics of local constrictor activity at the receptor site; (3) effect of baroreceptor afferent activity on central nervous coordinating structures - discussion of convergence of baroreceptor afferent input with other inputs and effects of anesthesia are included; (4) influence of baroreceptor afferents on cardiovascular effector organs. The latter section pulls much of the material together in its treatment of input-output relationships and baroreflex influences on the heart, on the venous system and on regional blood flow (renal, splanchnic, skeletal muscle, cutaneous and coronary vascular beds). Of particular value is the discussion of quantitative and qualitative differences in the reflex as related to species differences, anesthetics and experimental approach. The review puts the problem of arterial blood pressure regulation into uniquely broad perspective. It will be of particular value to graduate students and teachers of cardiovascular physiology.

L.B. Rowell

- 26 VEINS AND THEIR CONTROL. Shepherd, J.T., and P.M. Vanhoutte.
W.B. Saunders Co., Ltd., London, 1975.

This monograph provides a comprehensive coverage of the venous system. Topics range from the morphology, physiology and pharmacology of venous smooth muscle to participation of veins in cardiovascular reflexes. Within this broad range the authors cover the pharmacology of the adrenergic nerve ending, local control of venous reactivity via physical and chemical changes, and neural control of veins. Discussion of local control focuses upon roles of mechanical distension of veins, venous temperature, metabolic factors and ionic changes. Discussion of neural control of venous capacity treats the relationship between active and passive volume changes, connections with the central nervous system and regional distribution of adrenergic outflow to veins. Roles in the intact organism are described. Participation of veins in cardiovascular reflexes is discussed for individual vascular beds. Reflexes include carotid, aortic and cardiopulmonary baroreflexes, carotid and aortic chemoreflexes and reflexes from receptors in skeletal muscle. Physical characteristics of the human venous system and methods used to study the system in man are described in detail. The authors draw from basic animal and human studies to bring into focus current understanding of venomotor responses and their control in man in health and disease. Each chapter is well-documented with extensive references and major findings are graphically illustrated. This will be an excellent review for graduate students and teachers of cardiovascular physiology. The treatment of the human venous system is unique and of special value to medical students.

L.B. Rowell

- 25 VEINS AND THEIR CONTROL. Shepherd, J.T., and P.M. Vanhoutte. W.B. Saunders, Philadelphia, 1975, 269 pp.

In this monograph, a comprehensive and well integrated analysis of the venous circulation is presented. The major subjects covered are: (1) cellular basis of venous smooth muscle function including ultrastructural, biochemical, physiological and pharmacological considerations; (2) morphology, physiology and pharmacology of the adrenergic nerve ending and its interaction with venous smooth muscle; (3) role of physical, chemical and neural factors as determinants of venous tone; (4) role of the veins in cardiovascular reflexes; (5) the venous circulation in man in normal and clinical states (5 chapters). This is an excellent reference book for students of cardiovascular physiology with special interests in the role of the venous system in cardiovascular function and dysfunction.

Harris J. Granger

COMPARATIVE

- 27 EFFECTS OF TEMPERATURE AND ACTIVITY ON AEROBIC AND ANAEROBIC METABOLISM AND HEART RATE IN THE TURTLES Pseudemys scripta AND Terrapene ornata. Gatten, Robert E., Jr.
Comp. Biochem. Physiol. 48A:619-648, 1974.

The capacity for reptilian physiological systems to operate over a wide range of body temperatures and overt activity is illustrated by presentation of original research data along with a comprehensive review of the literature. The Q_{10} for standard metabolic rate in P. scripta, a fast-moving aquatic turtle, remains constant from 10 to 40°C whereas that of T. ornata, a slow-moving land turtle, reaches the amazingly high value of 54.38 between 10 and 15°C, tapers off to more conventional values of 1 to 3 between 15 and 30°C, and then rises to 7.34 between 35 and 40°C. The ratio of active to standard resting metabolism is 20.4 in P. scripta and 24.3 in T. ornata at 30°C which is the preferred temperature for both animals. At 30°C glycolysis supplied 60 to 75% of the energy available during a burst of activity. Primarily by increasing the A-V oxygen difference rather than increasing the heart rate, both species increase the amount of oxygen delivered to body tissues. The manuscript also describes experimental techniques which can be utilized in many classrooms with minimal equipment.

M.L. Riedesel

- 28 PROLACTIN IN THE LOWER VERTEBRATES (Symposium). Schreibman, M.P., S. Holtzman, C.S. Nicoll, A.H. Meier, M. Sage, V.L. de Vlaming, J.N. Dent and H.A. Bern. Amer. Zool. 15: 867-949, 1975.

A basic adenohypophyseal cell called a "prolactin cell" is identified by Schreibman and Holtzman who also summarize different routes for its control. Nicoll continues his criticisms of radioimmune assays and receptor assays for both prolactins and growth hormones. Meier reviews circadian sensitivities to prolactin and temporally dependent interactions with corticosteroid rhythms. Longer cycles, including annual cycles, are also mentioned. The seasonal changes, particularly those involving day length specifically, are the subject of the review by Sage and de Valming. Dent reviews the effects of prolactin on secretory functions of the integumentary glands and their embryological relatives. A variety of other "skin" effects are summarized. Finally, the possible interactions of prolactins and cortisol in regulating water and ion transports are discussed by Bern. The role of osmotic factors in regulating prolactin secretion is mentioned. This symposium provides a basic state-of-the-art overview of modern endocrinology. These papers are critical summaries of interest to students in their first year of comparative physiology or endocrinology as well as to teachers attempting to broaden the range of physiological understanding in their students.

L.F. Wolterink

- 29 PTEROSAUR FROM THE LATEST CRETACEOUS OF WEST TEXAS: DISCOVERY OF THE LARGEST FLYING CREATURE. Lawson, D.A., Science 187 No. 4180, 947-948, 1975.

This article describes the discovery of three partial skeletons of a large pterosaur in the cretaceous non-marine rock of West Texas. The fossils include jaw remnants, cervical vertebrae and a well preserved humerus which indicate the reptile had thin elongate jaws and a long neck similar to other species, pterodactylus already thoroughly studied. Comparison of the immense size of the humerus and vertebrae to those of the far smaller pterosaur and other species has led by extrapolation to an estimate of 11.4 meters to 15.5 meters wing span, the largest known for an airborne creature. Correspondence concerning the question "Could pterodactyls fly"? (Greenewaldt, C., Science 188 No. 4189, 1975, Lawson, D.A. *ibid*) and "Aerodynamics of the Long Pterosaur Wing" (Stein, R., 1975, Science 191 No. 4230) suggests that pterosaurs anatomically differed markedly from birds and bats, yet were structurally capable, extremely efficient slow flapping flight owing to membrane twist by wing finger rotation and high aspect ratio, that is wing span to wing area ratio. Wind tunnel analysis of pterosaur models indicate the wings appear to be the direct natural counterpart of the high aspect ratio cylindrically cambered Rogallo wing now flown as hang gliders. How giant pterosaurs took off without hill or cliff assistance remains an unresolved question.

Ernest B. Wright

DEVELOPMENT AND AGING

- 30 BIOLOGY OF AGING AND DEVELOPMENT. J. Jeanette Thorbecke, editor, FASEB, Bethesda and Plenum Press, New York, 1975.

This book, a compilation of six symposia sponsored by FASEB Societies, provides a useful contribution in an area of increasing interest for the physiologist. The book is interdisciplinary in its approach and by including information on widely different research subjects, presents a valid, overall view of the current status in the area of development and aging. The topics are grouped under the following major subjects: theories in development and aging, as well as sociological aspects of aging; genetic aspects of development using various immune responses as models; the eternal life of certain cell lines; aging of homeostatic control systems; the lymphoid tissue and its cell populations as models of development and aging at the organ level; and finally, some molecular aspects of development and aging. Even though it is inevitable that in a book of this type with multiple authors and topics, the quality of the presentations may vary, the book constitutes a good introduction to the major current topics in development and aging. Of particular interest to the physiologist is the effort throughout the book to correlate developmental and aging phenomena. This book can serve both as an introduction to the study of development and aging for students and faculty and as an information source for those already actively engaged in this field of research.

P.S. Timiras

- 31 CELL BIOLOGY OF AGING. Hayflick, L. Bioscience 25, 629-37, 1975.

This review is written for those who want an overview of cellular aging as exemplified by tissue culture models. A distinction is made between "immortal" cell lines, i.e., those which vary in their chromosome constitution (e.g., HeLa and L cells) and live indefinitely in culture, and "mortal" cells, i.e., those which undergo a finite number of serial subcultivations or population doublings in culture and then die (e.g., normal embryonic human and animal fibroblasts). The latter cells remain diploid in culture and have been used as an *in vitro* model of cellular aging. Discussion of this model includes the following: (1) the population doubling potential of normal fibroblasts decreases with increasing age of the donor; (2) the population doubling potential of normal embryonic fibroblasts from various species increases as the mean maximum lifespan of those species increases, though the correlation is still tentative; (3) a consideration of metabolic parameters that increase, decrease or do not change as normal human fibroblasts age *in vitro*; (4) a comparison of the lifetime of normal cells *in vivo* and *in vitro*; and (5) an interpretation of the death of cells as the result of genetic instability, i.e., cells may be "programmed to run out of program." This article will be of interest to students and to faculty members who wish an overview of aging phenomena at the cellular level and of a possible *in vitro* model of cellular aging.

D. E. Buetow

- 32 LACTATION. Bruce L. Larson and Vearl R. Smith (eds.), Academic Press, New York, 1974.

This three volume synopsis of the anatomy, physiology and biochemistry of lactation is the first comprehensive treatment of this aspect of reproduction in thirteen years. The 28 chapters, written by a total of 40 authors, cover a wide range of information. The first volume deals with mammary gland transitions between non-functional and functional states. The second concentrates on the cellular mechanisms involved in the synthesis and secretion of milk. The third deals with the biochemical, and thus the nutritional, aspects of milk itself. This work, primarily directed toward the interests of the lactational physiologist, can also serve as an encyclopedic source of information for other physiologists. In most physiology curricula (even those in reproductive physiology) the study of lactation is generally of low priority; this superb compendium may help to raise that priority by focussing attention on the highly complex physiology of lactational processes, including cellular transport, biosynthesis of large amounts of fats, proteins and carbohydrates, and selective secretion of and sequestration in milk of both the products of synthesis and a variety of other substances (including water) which are not made in the mammary gland but selectively extracted from the blood. We think this book presents heuristic parallels with renal and G.I. physiology which might not become generally appreciated in its absence.

E.M. Bogdanove and J.M. Nolin

- 33 PHARMACOKINETICS IN THE AGED. Triggs, E.J. and R.L. Nation. J. Pharmacokin. Biopharm. 3: 387-418, 1975.

Neither the rate nor the extent of gastrointestinal absorption of the nearly twenty drugs reviewed appeared to be altered appreciably in elderly patients. However, drug disposition parameters were frequently altered. These include reduced apparent volumes of distribution, reduced renal and extrarenal clearances and reduced plasma protein binding capacities, with marked differences between the drugs in the precise pharmacokinetic behavior. Since in many of the studies, the elderly patient group was selected from those seeking medical care, and considering the differing ways in which age changes are manifested, it is not unexpected that generalizations are limited. Nonetheless, the most common finding reported is a prolonged half-life of the drug. With constant dosage, the time to approach a steady state is often extended, its level is frequently elevated and fluctuations around the steady state level are reduced. The review considered only kinetic parameters. Differences in drug metabolism in the aged were not considered, except as they may have influenced extrarenal clearances. This is an excellent review for medical students during their introduction to physiology and pharmacology.

L.F. Wolterink

EDUCATIONAL TECHNOLOGY

- 34 INDEX TO COMPUTERIZED TEACHING IN THE HEALTH SCIENCES. Kamp, M. Association for the Development of Computer-based Instructional Systems, Alexandria, 1975, 183 pp.
- This index is a revision and extension of the "Guide to Computer-Assisted Instruction in the Health Sciences" published in 1972. The information on 300 computerized instructional units represents 743 hours of student-computer interaction reported by 46 institutions. Fifteen of the units (18 hours of student-computer interaction) are categorized under physiology but many other programs listed could be of interest to physiologists. The volume contains a comprehensive introduction which summarizes the state of computer assisted instruction (CAI) and makes comparisons between this index and the earlier guide. The categories for each entry include: subject, source, audience, computer language, program name, author, computer, strategy, average time, terminal, other materials required, and a brief description. In addition to program descriptions which are presented alphabetically by subject, a number of key word in context indices by subject, source, computer language and author are presented. Institutional data is also available which includes the names, addresses, and telephone numbers of contact persons as well as a brief description of the institution's plans for CAI implementation. The appendix includes copies of the covering letter and instructions which accompanied the forms which were used to solicit both institutional and program information. The volume is useful to indicate what programs are currently available, although the categorization by subject is unstructured and does not guarantee that one finds what one is looking for at the first try. The author hastens to acknowledge the incompleteness of the data and explains the difficulty in making such a compilation. Adequate information is available to guide those who desire to attempt local implementation of any given program. It is recommended that the assistance of the contact persons be solicited. Copies of the volume may be obtained for \$4.50 payable to ADCIS-HSIG and sent to HSIG Treasurer, 2114 Mason Hill Drive, Alexandria, VA 22306.
- C.S. Tidball
- 35 SURVEY OF THE USE OF COMPUTER IN INSTRUCTION. Lefever, B.D. and J.K. Johnson. Association of American Medical Colleges, Washington, 1976, 173 pp.
- This survey contains responses from 80 American and 4 Canadian medical schools to a detailed questionnaire developed by the Department of Academic Affairs of the Association of American Medical Colleges (AAMC). Tabulated "Curriculum Descriptions" include: Department/Unit, Subject/Course, Required, Year 1st Taught, Programming language, Use, and Intended Educational Level. In addition, information is provided on: computer systems used in instruction, computer terminals used in instruction, average number of students using computer each month, average number of hours each month computer is used by students, on-line access to program from other institutions, presence of a permanent facility for computerized instruction within the medical school, exchange of programs with other institutions, generation of original programs within the institution, and comments by the individual providing information who is identified by name with telephone number. There are 48 programs indicated as being utilized by departments of Physiology which vary widely in subject matter. An additional 48 programs which are identified more broadly, i.e., basic science, pre-clinical science, or medical education, might also be of interest to physiologists. No attempt is made to summarize data or to present generalizations. A covering letter from the authors suggests that computer assisted instruction (CAI) is still an emerging phenomenon. This work is especially recommended to those who have a general interest in the development of CAI; but it may also be useful because of the information contained about the computers and the computer languages used at each site, to those seeking specific materials suitable for local implementation. Copies of this report have been sent to every medical school; additional copies may be acquired from the authors at the offices of the AAMC, One Dupont Circle, N.W., Washington, D.C. 20036.
- C.S. Tidball

ENDOCRINOLOGY AND METABOLISM

- 36 THE BIOSYNTHESIS OF HORMONES BY NON-ENDOCRINE TISSUES - A REVIEW. Rees, L.H. In: Journal of Endocrinology, v 67, 143-175, 1975.
- In recent years, it has become increasingly recognized that non-endocrine tumors secrete a variety of hormonal peptides and proteins. The subject matter in this review includes: 1) the evidence for the secretion of hormones by non-endocrine tumors; 2) processes of their formation and release; 3) possible mechanisms of their secretion; and 4) a detailed literature dealing with the secretion of ACTH, TSH, gonadotropins, growth hormone, prolactin, oxytocin, ADH, insulin, calcitonin, erythropoietin, and gut hormones from ectopic sites. The clinical aspects of ectopic hormone secretion are not considered in any detail, though pathological features of the tumors are discussed where clear information is available. This article should be of particular interest to medical and graduate students, as well as to research and clinical endocrinologists.
- C.E. Grosvenor
- 37 HUMAN ENDOCRINOLOGY. A DEVELOPMENTAL APPROACH. Dorothy B. Villee, W.B. Saunders Co., Philadelphia, 1975.
- This book represents an overall view of development and function of endocrine glands from fetal life to adulthood. The major topics considered include: the placenta; fetal development of endocrine glands; role of endocrine glands in regulation of metabolism in the newborn and infant; etiopathology of abnormal sexual differentiation; development of homeostasis; growth and sexual maturation. A final section discusses some of the endocrinological changes which occur during postmaturation and senescence. Well-documented and clearly written, this book will be particularly valuable to graduate students, medical students and faculty members who are interested both in a basic discussion of endocrinological function and in the clinical consequences of endocrinological disturbances.
- P.S. Timiras
- 38 HYPOTHALAMIC LH- AND FSH-RELEASING HORMONE: REEVALUATION OF THE CONCEPT THAT ONE HYPOTHALAMIC HORMONE CONTROLS THE RELEASE OF LH AND FSH. Arimura, A. and A.V. Schally. In: Biological Rhythms in Neuroendocrine Activity, pp. 73-90, M. Kawakami (ed.), Igaku Shoin, Ltd., Tokyo, 1974.
- This is a clearly written review pertaining to the precise identity(ies) of the hypothalamic "releasing factor(s)" which regulate secretion of pituitary LH and FSH (luteinizing and follicle-stimulating hormones). It deals with a) a historical overview of the anatomical and physiological evidence that one or more such factors must exist, b) early isolation studies suggesting existence of separate factors for LH and FSH, c) ultimate isolation, purification and synthesis of the decapeptide, LH-RH, which can release both LH and FSH, and d) a critical evaluation of evidence suggesting that a separate FSH releasing hormone may yet prove to exist (also reviewed in more detail in the subsequent chapter by Igarashi et al. in the same book). This chapter presents a fair evaluation of the possibility that a single LH-RH might not satisfactorily account for the wide variations in the ratio of LH to FSH release seen under varying physiological conditions, and discusses criteria which would have to be met to demonstrate the existence of dual or multiple control factors. This review should help non-partisans to distinguish smoke from fire in the current conflict over the unity or multiplicity of hypothalamic gonadotrophin-controlling mechanisms.
- E.M. Bogdanove and M.S. Aiyer
- 39 QUALITATIVE AND QUANTITATIVE GONAD-PITUITARY FEEDBACK. E.M. Bogdanove, J.M. Nolin and G.T. Campbell. In: Recent Progress in Hormone Research, 31:567-626, 1975.
- This review presents a new idea, that gonad-pituitary feedback may influence not only the rate of secretion of FSH (follicle-stimulating hormone) but also the quality of the FSH secreted by the rat pituitary. This idea is based on evidence that androgens and ovarian hormones can alter both the physicochemical and biological characteristics of FSH secreted in vivo. These findings are analyzed in relation to the quantitative changes resulting from androgen and estrogen feedback and appear to be dissociable, since the direction of quantitative change is similar with both types of sex steroid while the qualitative changes induced are opposite in direction. (However, subsequent work in monkeys - see Peckham and Knobil, Endocrinology 98: in press for April - has not shown similar directional divergence of qualitative and quantitative change. Extension of these heuristic findings to other species clearly is needed.) This paper will be of primary interest to reproductive physiologists interested in control of the anterior pituitary. In addition to the convincing data and sound and careful analysis, the report also relates the history of a long pursuit of shifting and evasive answers to seemingly simple questions, culminating in the idea presented here. This history deals, in an honest and uncommon way, with a personal psychology of research which may provide some poignant nostalgia for the older reader and, hopefully, some encouragement for younger investigators who also cannot always see where their work will lead.
- E.M. Bogdanove

- 40 SOME RECENT DEVELOPMENTS IN BRAIN-PITUITARY-OVARIAN PHYSIOLOGY. Sawyer, C.H. Neuroendocrinology 17: 97-124, 1975.

The material in this review is written primarily for those who have special interests in the interrelationships between the nervous and endocrine systems. The review is specifically concerned with the influence of the brain on luteinizing hormone (LH) secretion and includes: 1) modulation of the secretion of LH by specific hypothalamic areas; 2) electrophysiological evidence of the feedback of gonadal steroids and the "short" feedback loop of LH upon LH secretion; and 3) evidence involving adrenergic mechanisms in the regulation of LH secretion. This article, though written for the specialist, also would be of interest to graduate students whose interests lie in the broad areas of behavior, systems analysis, and neurophysiology.

C.E. Grosvenor

- 41 THE RECEPTORS OF STEROID HORMONES. Bert W. O'Malley and William T. Schrader. Scientific American, vol. 234, no. 2, February, 1976.

The identification of specific receptors for hormones in hormone-sensitive target cells of several tissues and organs represents one of the recent major advances in endocrinology. This excellent review summarizes clearly and completely the pertinent information, taking the receptors for steroid hormones as example of receptor-hormones relationships. The topics considered include: structure and cellular site of receptor molecules; relationships between degree of tissue responsiveness to steroid hormones and amount of steroids bound to specific receptors; changing in number and affinity of receptors with aging, the physiologic state, and the presence of other hormones; actions of receptors on cellular genetic material. Should be particularly useful to graduate students, medical students and faculty who, even though not endocrinologists, want to keep abreast of important developments in this area.

P.S. Timiras

- 42 THE REGULATION OF GROWTH BY ENDOCRINES. Daughaday, W.H., A.C. Her- ington and L.S. Phillips. In: Annual Review of Physiology, Vol. 37, pp. 211-244. Annual Reviews, Inc., Stanford, 1975

This is an excellent review of growth as it is influenced by a number of endocrines and other factors which may be effective through one or more hormonal routes. The review includes recent considerations of the chemical characteristics of pituitary and chorionic somatomammotropins (the current term for growth hormones), the emerging role of somatomedin as the intermediate factor for growth, and the specific roles of insulin, thyroid, corticosteroids, androgens and estrogens in growth. What is of special interest and importance is a discussion of the current understanding of the role of the hormones affecting growth in such disorders as dwarfism, kwashiorkor, marasmus and psychosocial deprivation. Functional control during puberty and by the hypothalamus is also discussed and useful comparisons are made between growth hormones and the growth-promoting factors secreted by *S. mansoni* (the cat tapeworm). This review is particularly recommended to physiology teachers at any level and for medical and graduate students with some special interest in growth. It is lucid, interesting and refreshingly free of excessive detail.

L.M.N. Bach

- 43 SYMPOSIUM ON "THE MECHANISM OF ACTION OF NONSTEROID HORMONES", 8th ANNUAL MEETING OF THE SOCIETY FOR THE STUDY OF REPRODUCTION. In: Biol. Reprod. 14: No. 1, pp. 1-107, February, 1976.

This issue of Biol. Reprod., devoted almost entirely to six clear and scholarly treatments of a rapidly moving field, closes on a grace note: the 7th annual Carl Hartman memorial lecture, by L.E. Casida. The juxtaposition serves to point up how very far our understanding of reproductive endocrinology has advanced in only a few decades, a view well worth a few moments of a student's time (whatever his or her age). The symposium papers, which indicate how much farther we need to go, present a concise review of current efforts to go beyond the stage of membrane receptor:second messenger system discoveries. Three papers (Catt and Dufau, Marsh, and Means et al.) focus on the known and possible intermediate steps between adenylate cyclase activation and steroidogenesis in the testis and ovary and suggest multiple mechanisms for cellular response. The paper by Niswender et al. examines the relation to cellular events of a response which cannot even be seen *in vitro*, the ovarian hyperemic response to LH. Richards and Midgley seek, using autoradiographic studies of gonadotrophin binding, to unscramble the mixed generations of follicles and corpora lutea in the rat ovary and, through this, to define the hormonal stimuli to follicular and luteal growth, maintenance and regression. Not least in interest is the sharply critical discussion by Ryan and Lee of theoretical and practical pitfalls in studies of hormone binding kinetics. This is not textbook reading. It is a useful overview of a field for people in or near the action.

E.M. Bogdanove

ENVIRONMENTAL AND EXERCISE

- 44 ADAPTATION OF SKELETAL MUSCLE TO ENDURANCE EXERCISE. Holloszy, J.O. In: Medicine and Science in Sports 7:155-164, 1975.

This review has been prepared for a rather broad readership and provides an excellent presentation of the author's interpretation of the current state of knowledge. Endurance exercise is typified as running and the ultimate outcome of regular running is increased capacity for aerobic metabolism. The mitochondrial fraction of muscle develops an increased capacity to oxidize pyruvate and long chain fatty acids. There is an associated increase in a number of mitochondrial enzymes. Enzyme protein is increased, there is a doubling of cytochrome-C concentration and a 60% increase in the protein content of the mitochondrial fraction of skeletal muscle. The number of mitochondria is increased as well as their size. Not all mitochondrial enzymes are increased eg α -glycerophosphate dehydrogenase, creatine phosphokinase and adenylate kinase. It is suggested that the exercise adapted skeletal muscle tends to become more like heart muscle in its enzyme pattern.

E.R. Buskirk

- 45 BIOCHEMICAL ADAPTATIONS TO ENDURANCE EXERCISE IN MUSCLE. John O. Holloszy and Frank W. Booth. In: Annual Reviews of Physiology, 38:273-291, 1976.

This forthcoming and updated review from one of the more productive laboratories in the United States pertains to changes in skeletal muscles associated with endurance training. The review contains 132 references of which 61% have been published since 1970. The material is well organized into ten major headings which include: introduction, background information, mitochondrial adaptations to endurance exercise, triglyceride metabolism, myoglobin, physiological consequences of the exercise-induced increase in the capacity of skeletal muscle for aerobic metabolism, enzymes of glycolysis, glycogenolysis and glycogen synthesis, adenine nucleotide cycle enzymes, and adaptive responses to endurance exercise in different types of muscle. Of these sections, mitochondrial adaptations and the physiological consequences of exercise on aerobic metabolism are the most extensively reviewed and discussed. This review should be of interest and use to muscle and exercise physiologists as well as to graduate students and instructors in advanced physiology and biochemistry courses.

Charles M. Tipton

- 46 BIOMEDICAL RESULTS OF APOLLO. Johnston, Richard S., Dietlein, Lawrence F., and Berry, Charles A. In: NASA SP-368, 1975,* viii + 592 p.

This book, describing the biomedical results of the Apollo Program, is a definitive summary of the medical, life sciences and life support activities conducted to ensure that man could reach the Moon, perform useful scientific work there and return safely to Earth. It includes crew health information gathered before launch, during flight, on the Moon and after return to Earth. The quarantine program designed to ensure crew health and protect the Earth against any contamination by extraterrestrial organism is included. All Life Sciences experiments are described and the results are presented. The life support systems are discussed in detail. The information contained in this book reflects the efforts of only a small part of the team that took man to the Moon. However, for those interested primarily in the Life Sciences, it is the most complete work yet offered.

W. E. Hull

*For sale by the Superintendent of Documents,
U. S. Government Printing Office,
Washington, DC 20402

- 48 HEAT STRESS IN OCCUPATIONAL WORK. Astrand, Irma, O. Axelsson, U. Eriksson, and L. Olander. In: *Ambio* 4, pp. 37-45. 1975.

This review of occupational physiology is clearly written and superbly illustrated. The following aspects of heat responses in man are considered: thermal balance, heart rate response, sweating, dehydration, evaluation of total heat load, acclimatization, thermal indices. The analysis of heat stress under current occupational conditions is less than satisfactory. This review describes methods and guidelines for evaluating heat stress. An index, The Swedish Wet Bulb-Globe Temperature Index (SWBGT), is derived. The recommended index applies primarily to assessment of mean thermal loading during shift work. Short exposures to intense heat must be judged on an individual basis. For any biologist who needs a rapid, authoritative summary of heat stress in working man, this review is recommended. There are 41 references given.

Charles G. Wilber

- 50 MECHANISMS OF WORK INDUCED HYPERTROPHY OF SKELETAL MUSCLE. Goldberg, A.L., J.D. Ettinger, D.F. Goldspink, and C. Jablecki. In: *Medicine and Science in Sports* 7:185-198, 1975.

Rapid growth can occur in skeletal muscle (soleus) when it is worked. An enlargement of muscle fibers occurs with occasional longitudinal splitting. Since hypertrophy can be induced in hypophysectomized or diabetic animals, the process appears to be independent of growth hormone and insulin as well as testosterone and thyroid hormones. Sarcoplasmic protein in particular is increased as a result of greater protein synthesis and reduced breakdown. Nuclear DNA and RNA synthesis is also increased but most of these increases occur in interstitial and satellite cells. Proliferation of non-muscle cells appears linked to muscle fiber growth. In vitro electrical stimulation on passive stretch retarded protein degradation but no change in synthesis was detected. It is suggested that increased tension development, whether active or passive, is the critical event in initiating hypertrophy. Thus, the article presents both original data and a review of the cellular events leading up to work-induced hypertrophy in a straight forward pedagogical manner.

E.R. Buskirk

- 47 HEAT LOSS FROM ANIMALS AND MAN: ASSESSMENT AND CONTROL. Monteith, J.L. and L.E. Mount (Eds.). Butterworths, London, 457 pp. 1974.

Each year a symposium (The Easter School of Agricultural Science) is held at the University of Nottingham; two titles in recent years were: (1) Reproduction in the Female Mammal and (2) Lactation. The topic of the 20th School was the Assessment and Control of Heat Loss from Animals. A main theme was the efficiency of providing food in relation to heat loss, age, growth rate and exercise. A second theme was "Thermal Neutrality"; a final chapter was added in an attempt to reach a common view on this controversial matter. The volume includes four sections as presented in the 20 papers: I Physical Principles, II Physiology, Behaviour and Adaptation, III Farm Animals, IV Man, V Economic Aspects of Environmental Control. An unusual article was that of Fox who showed that heat acclimatization can occur in a sitting man, without the supposed requirement of exercise. Goldsmith and J. Aschoff reviewed the controversial topic of Acclimatization to Cold in Man; some architects expressed their need for physiological theory in order to design buildings with better awareness of physical aspects of heat loss. The article by K. Cena on Radiative Heat Loss from Animals is unusually well illustrated with six color plates of color thermograms. This collection will be useful in the design of large buildings for sheep, cattle, pigs and fowl, and for teaching the biophysics of Heat Loss. The volume will be valuable to zoologists, medical students, adaptation physiologists, and environmental physiologists.

G. Edgar Folk, Jr.

- 49 MAN IN THE COLD. LeBlanc, J. C. C. Thomas, Springfield, 195 pp. 1976.

This monograph is written for those who need a state of the art summary of human functional responses to cold exposure. Teachers of physiology will find it useful in tying together the various parts of the overall pattern of human responses to cold. The coverage of material includes: general responses to cold; metabolic effects of cold; endocrines; cardiovascular responses; adaptation in laboratory animals and in man; interstress adaptation; hypothermia; frostbite; facial responses to cold. Teachers, graduate students, and medical students with particular interests in cold exposures of man will find the monograph valuable. The book concerns itself primarily with the responses of human beings to low environmental temperatures.

Charles G. Wilber

- 51 METABOLIC ADAPTATIONS TO PROLONGED EXERCISE. H. Howald and J. R. Poortmans. In: Birkhauser Verlag, Basel, 1975, 1-482.

Despite the fact that it has taken two years for the Proceedings of the Second International Symposium on the Biochemistry of Exercise to be published, graduate students, teachers and investigators interested in the areas of exercise physiology and exercise biochemistry should become acquainted with the contents of this book. Included are more than 60 separate communications with seven being of a review type; namely, energy requirements for muscular work, carbohydrate metabolism, lipid metabolism, protein metabolism, hormonal regulation, electrolyte consideration, the ultrastructure of muscle and cellular enzymes. At the end of the book is a synopsis of a round table discussion concerning the main topics of the symposium and possible directions for future research in these areas. Of interest to cardiovascular physiologists will be the summary section on capillarization and muscle blood flow.

Charles M. Tipton

- 52 TEMPERATURE REGULATION: THE SPINAL CORD AS OF SITE OF EXTRAHYPO-THALAMIC THERMOREGULATORY FUNCTIONS. Simon, E. In: Reviews of Physiology Biochemistry and Pharmacology, vol. 71, pp. 1-76. Springer-Verlag, Berlin, 1974.

As it became obvious that the hypothalamus could not account for all the control of deep body temperature, other sites for regulation have been advanced. This review presents experimental data and discussion of the evidence for some portion of deep body temperature control residing in the spinal cord. Evidence for spinal cord temperature responses affecting skin blood flow, shivering and non-shivering thermogenesis, panting, sweating and piloerectum is discussed. There is also a discussion of the role of the spinal temperature sensor in overall thermoregulation. The review ends with a discussion of multiplicity and redundancy of components in the regulatory system. The article is extensively documented and would have its greatest value to advanced students and faculty preparing to work in the area of control of body temperature.

H.M. Frankel

- 53 WORK SCHEDULES AND BIOLOGICAL CLOCKS. Johnsson, A. and J. E. Fröberg. In: *Ambio* 4, pp. 46-50. 1975.

The importance of rhythmic biological functions in plants and animals is better appreciated now than in the past. The present review points out that if human biological clocks are disrupted by work in shifts or by air travel across time zones, physiological changes occur and work performance deteriorates. The biological problems faced by a subject who attempts to adjust to sudden changes in scheduled work are outlined. Aircraft personnel are shown to be a good example of such stressed individuals. Attempts to design work schedules that are responsive to internal clocks in men are described. It is admitted that none are satisfactory. The problem is critical and needs attention. Nearly 75 references and notes are included. Here is an article that will give you a quick briefing on biorhythms and human occupational endeavors.

Charles G. Wilber

GASTROINTESTINAL

- 54 ABSORPTION OF LIPIDS. Simmonds, W.J. In: MTP International Review of Science: Gastrointestinal Physiology, Series I, pp. 343-376. Butterworth, London, 1974.

This review describes current information about small intestinal digestion and transport of lipids. The treatment, although verbal, is oriented toward the physical chemistry involved in these processes by which water-insoluble nutrients are dissolved, digested and transported across aqueous and lipid phases into the blood. The metabolic as well as the physical changes occurring are described. This chapter will be useful to advanced graduate students, fellows and faculty who wish to gain insight as well as information about the absorption of fat.

E.D. Jacobson

- 55 ABSORPTION OF WATER SOLUBLE SUBSTANCES. Leviton, R. and D.E. Wilson. In: MTP International Review of Science: Gastrointestinal Physiology, Series I, pp. 293-341. Butterworth, London, 1974.

The field of intestinal transport of water and of solutes soluble in water has grown so rapidly in the past two decades that it is surprising to find a comprehensive treatment which retains lucidity and an obvious organization. The emphasis in this chapter is on information about the physiology of intestinal absorption gained from studies in conscious human subjects mainly. Separate sections deal with absorption of carbohydrates, peptides, water, ions, iron and aqueous soluble vitamins. This chapter will prove valuable to advanced level individuals trying to update memories of the field, as well as to the physiologist or clinical scientist wishing to acquire a well-referenced overview of intestinal absorption.

E.D. Jacobson

- 56 BASIC MECHANISM OF HCl PRODUCTION. W.S. Rehm. In: Functions of the Stomach and Intestine, pp. 123-143. University Park Press, Baltimore, 1975.

This paper will be of primary interest to physiologists and biophysicists whose research interests are directed to the cellular biophysics of secretion. The discourse proceeds logically from the requirement that energy is required to transport ions up electrochemical and concentration gradients and the osmotic gradient which results. An early concept of electrically coupled ion pumps (separate site theory) on the secretory side is used to explain that portion of the Cl^- transport which is not equal to H^+ transport, with the balance indicated by an electrically neutral pump. The author cites evidence that ATP may provide the energy for secretion, but he then describes experiments by himself and others which have failed to prove this. The postulate that water flux is via the surface cells is questioned on the basis that measured permeability insufficient to account for net water flux. The separate site theory fails to provide sufficient osmotic drive to account for water flux, so a model was developed whereby parietal cells secreted H^+ and surface cells secreted Cl^- . The author has not been able to demonstrate that this model is electrically feasible. Rehm takes his leave by expressing the heretical question as to which mucosal cells actually secrete ions inasmuch as he doubts that implication of the parietal cell is conclusive. The beginner is advised not to read this paper prior to receiving stock indoctrination in this area or prior to taking his examinations.

M.F. Tansy

- 57 ELECTRICAL ACTIVITY OF GASTROINTESTINAL MUSCLE. A. Bortoff. In: Functions of the Stomach and Intestine, pp. 17-29. University Park Press, Baltimore, 1975.

This paper is of interest to physiologists and clinicians whose professional interests are directed toward the electrical and propulsive activities of the intestines. The material is understandable by any graduate or professional student who has completed a basic graduate level course in mammalian physiology. The governing principle is to provide a mechanistic explanation of the inherent rhythmicity and polarity of the bowel. The material progresses logically and easily, beginning with a thoughtful discourse upon the dependence of the waveshapes of intestinal electrical activity upon particular electrode configurations. Current knowledge concerning the charge carriers involved in the production of slow waves and spike potentials is presented, after which the author proceeds directly to the work of himself and others which establishes a relationship between propagating spike potentials and propagating contractile activity. Propulsive polarity is explained in terms of an intrinsic frequency gradient. He implicitly acknowledges a concept of the production of spike potentials as a stochastic process and he explains gastric influence upon duodenal motor activity in this context. Bortoff's paper is definitely presented as an exposition of his own viewpoint, but he is not parochial. However, the most current references are of 1973 vintage, and those readers interested in further models and frequency domain analyses of electrical activities should consult later references.

M.F. Tansy

- 58 FUNCTIONAL CONTROL OF THE BILIARY TRACT. Stasiewicz, J. and K.G. Wormsley. Acta Hepato-Gastroenterol 21:450-468, 1974.

This review is of primary interest to physiologists, pharmacologists, and clinicians whose areas of interest are directed to the physiology and pathophysiology of the extrahepatic biliary system. It is suitable as a guide to the literature for advanced graduate students who have reached the stage of development where area of interest is established and specific information is sought. The primary objectives are to identify the mechanisms which initiate and control the flow of bile into the duodenum. The specific topics include 1) gallbladder contraction and factors which act directly on this organ, 2) factors which affect the resistance of the sphincter of Lutkens, 3) factors which influence the motricity of the common bile duct, 4) influences on the occlusive competency of the choledochoduodenal sphincter, 5) the initiation of bile discharge by stimuli applied to the small intestine, and 6) factors which inhibit bile discharge. The authors acknowledge that considerable conflict and ignorance exist, and they maintain a reasonable balance between conflicting viewpoints. They cite 224 abstracts and papers as references and currency is good. A comprehensive review of this nature places a burden upon the reader to evaluate the adequacy and believability of those references of interest. This is not a good reference for a model builder who seeks experimentally determined constants for his differential equations. However it is a useful supplement to those who would seek to construct models.

M.F. Tansy

- 60 THE GASTROINTESTINAL CIRCULATION. Grayson, J. In: MTP International Review of Science: Gastrointestinal Physiology, Series I, pp. 105-138. Butterworth, London, 1974.

This chapter provides a comprehensive coverage of the gastrointestinal vasculature including both a consideration of microcirculatory phenomena and the matter of regulation of blood flow, especially in relation to organ function. Subdivisions of the work deal with the morphology of this vasculature, methods used to measure gastrointestinal blood flow, the phenomenon of autoregulation, sympathetic and parasympathetic influences over the circulation, the effect of shock, the pancreatic circulation, gastric circulation and intestinal circulation. This review will be useful to advanced graduate students, fellows and faculty who seek a comprehensive coverage which has been well organized.

E.D. Jacobson

- 59 GASTRIC SECRETION. Konturek, S.J. In: MTP International Review of Science: Gastrointestinal Physiology, Series I, pp. 227-264. Butterworth, London, 1974.

This review presents current concepts and information about the production of exocrine gastric secretions. The chapter is subdivided into: 1) anatomical considerations, including epithelial growth, the mucosal circulation and the barrier to back-diffusion of secreted ions; 2) methodology used by investigators in studying gastric secretion; 3) composition of gastric juice; 4) inorganic secretions; 5) organic secretions; and 6) regulation of gastric secretions by neurohumoral entities. This chapter allows the beginner in the field, whether student or faculty level, to advance rapidly in his ideas and information about gastric secretion to an intermediate level. The review will be valuable to participants in an advanced course in gastrointestinal physiology.

E.D. Jacobson

- 61 GASTROINTESTINAL HORMONES. Johnson, L.R. In: MTP International Review of Science: Gastrointestinal Physiology, Series I, pp. 1-44. Butterworth, London, 1974.

This review is written for those who are concerned with gaining background knowledge about the control of gastrointestinal functions by gastrointestinal hormones, particularly gastrin, secretin and cholecystokinin. The history, chemistry, physiological actions, assay procedures and mechanisms regulating release of each of these hormones is considered. Interactions between these hormones is also described. A brief survey of related agents is noted. This chapter will be of most use to advanced graduate students, fellows and faculty desiring a good overview of a rapidly-changing field.

E.D. Jacobson

- 62 GASTROINTESTINAL MOTILITY. Weisbrodt, N.W. In: MTP International Review of Science: Gastrointestinal Physiology, Series I, pp. 139-181. Butterworth, London, 1974.

This survey presents its subject without assuming any great knowledge of motility on the part of the reader. Gradually the chapter develops the concepts of its field leading to current ideas and recent references. It is divided into its traditional parts, namely motor activity of the separate gastrointestinal organs: esophagus, stomach, small intestine, colon and biliary tract. Where applicable, each section includes a description of the patterns of motility, a consideration of propulsive action and a discussion of the regulation of motility in the particular organ. This review will be useful to advanced graduate students, fellows and faculty desirous of a rapid and fairly comprehensive survey of the field as background for investigation or for an advanced course in gastrointestinal physiology.

E.D. Jacobson

- 63 GASTROINTESTINAL MUCOSAL METABOLISM. Sernka, T.J. In: MTP International Review of Science: Gastrointestinal Physiology, Series I, pp. 45-68. Butterworth, London, 1974.

This chapter provides a review of a newly-emerging field and contains information and insights in one article which would otherwise require perusal of many papers and books. The chapter is devoted to three major phenomena in the gastrointestinal mucosa, namely: 1) applications of the second messenger hypothesis, 2) kinetics of growing epithelia and 3) transport energetics. This chapter gives an excellent background for advanced graduate students and fellows interested in investigating certain metabolic processes of the gastrointestinal lining.

E.D. Jacobson

- 64 PANCREATIC EXOCRINE SECRETION. Preshaw, R.M. In: MTP International Review of Science: Gastrointestinal Physiology, Series I, pp. 265-291. Butterworth, London, 1974.

The processes by which the pancreas produces its unique digestive juice are ably surveyed in this work. The author divides the chapter basically into two parts, the first dealing with the mechanisms involved in secretion and the second concerned with the neurohumoral regulation of secretion. Transport of individual components of the juice is detailed along with a consideration of stimulus-secretion coupling. Regulatory elements in pancreatic exocrine secretion and their interactions is also presented. This review is well organized and lucid. It will rapidly transport the intelligent student or physiologist from a state of ignorance about pancreatic secretion to a state of understanding.

E.D. Jacobson

- 66 PRINCIPLES OF ELECTROPHYSIOLOGY AND THEIR APPLICATION TO EPITHELIAL TISSUES. Schultz, S.G. In: MTP International Review of Science. Gastrointestinal Physiology, Series I, pp. 69-103. Butterworth, London, 1974.

This chapter is a treatise on sheet membrane transport of ions, especially this phenomenon in the gastrointestinal mucosa. The treatment of concepts describing forms of transport across visceral epithelia is fairly rigorous, although the text relies on words more than equations to develop its points. This chapter has separate sections dealing with ion fluxes, various solutions of the Nernst-Planck equation, rheogenic pumps, equivalent circuits and specific epithelia (gastric mucosa and intestinal mucosa). This work would be best suited for an advanced graduate level course in the biophysics of membrane transport.

E.D. Jacobson

- 65 PATHOLOGICAL AND PHYSIOLOGICAL FACTORS AFFECTING DRUG ABSORPTION, DISTRIBUTION, ELIMINATION, AND RESPONSE IN MAN. Prescott, L. F. In: Handbook of Experimental Pharmacology, Vol. XXVIII, Part 3, pp. 234-257. Springer, Berlin-Heidelberg-New York, 1975.

This article reviews available data obtained in studies on human subjects showing that physiological and pathological factors may modify drug responses to a clinically significant degree. Gastrointestinal physiologists will be particularly interested in cited studies dealing with the effects on drug absorption of food, pH of secretions, gastric emptying time, malabsorption syndromes, G.I. surgery and mesenteric blood flow. The effects of liver and biliary tract disease on drug action are also covered. Data illustrating that drug distribution, and, hence, drug action can be influenced by physiological and pathological factors are presented. The influence on drug distribution of regional tissue blood flow (e.g., in exercise), cardiac output, pH gradients, plasma protein binding and the permeability of cell membranes (e.g., in inflammation) are included. Renal physiologists will be interested in the clinical data illustrating modification of the renal excretion of drugs in the presence of renal disease. Some therapeutic problems that can arise in patients on drugs which undergo hemodialysis are also considered. Full appreciation of this review requires some general knowledge of the physicochemical and pharmacokinetic factors that govern the absorption, distribution and elimination of drugs. Data presented in this article should be particularly useful for instructors in medical schools who seek clinically relevant studies to illustrate the importance of understanding basic physiology in the practice of medicine.

P. H. Bogner

- 67 SALIVARY SECRETION. Schneyer, L.H. and N. Emmelin. In: MTP International Review of Science: Gastrointestinal Physiology, Series I, pp. 183-226. Butterworth, London, 1974.

This review is short but comprehensive in its coverage of a complex, old field of physiology. For physiologists interested in gastric or pancreatic secretion, renal tubular function or epithelial membrane transport, the salivary glands offer remarkable parallels to events in many other organs. This review is divided into subsections dealing with: 1) development of the concept of the salivum; 2) fluid and electrolyte secretion; 3) secretion of protein; and regulation of salivary gland secretion. The approach used by the authors indicates their breadth of information and ideas outside their own field. They are able to describe clearly events involving electrophysiological, metabolic, microcirculatory and neurophysiological implications. This chapter is intended for advanced graduate students, fellows and faculty seeking a perceptive and complete short survey of an unusual topic.

E.D. Jacobson

GENERAL

- 68 ALLOSTERIC INTERPRETATION OF HAEMOGLOBIN PROPERTIES. Schulman, R.G., J.J. Hopfield and S. Ogawa. Quart. Rev. Biophysics 8: 325-420, 1975.

The objective of this review is to enlighten the structural basis for biological functions specified in the various parameters describing both equilibrium and kinetic reactions of haemoglobin. Many experiments have been reported with no *a priori* relations. Those which have produced kinetic models with structural predictions are a relatively small sub-set of about 50 papers. The basic two-state model of Monod, Wyman and Changeux, 1965, referred to as MWC, is the starting point. However, the authors regard proof to be difficult because the real set of about twelve structural monitors observed to have only two values (one at high and one at low affinity) is not only incomplete but is also ambiguous in its structural predictions, particularly for energy storage sites. Very little energy is found at the haem bonds. Thus delocalization is greater in haemoglobin than in chymotrypsin, for example. The ligand-induced tertiary structural changes emphasized by Koshland seem to be important in determining which quaternary structure is energetically favored. An additional simplified but valuable review of the kinetic aspects is that of Hammes, G.G. and C-W Wu, Kinetics of Allosteric Enzymes, in Ann. Rev. Biophys. Bioeng. 3: 1-33, 1974. Cell physiologists in particular are the audience for reviews of this kind.

L.F. Wolterink

- 69 CATION PERMEATION MECHANISMS AND CATION SELECTIVITY IN "TIGHT JUNCTIONS" OF GALLBLADDER EPITHELIUM. Moreno, J.H. and J.M. Diamond. In: Membranes, vol. 3, Lipid Bilayers and Biological Membranes: Dynamic Properties, G. Eisenman (Editor), Marcel Dekker, Inc., New York, 1975.

The far reaching advances that have been made over the last seven years in the understanding of passive ion permeation across the gall bladder epithelium have been reviewed in this chapter. The authors document the evidence that shows that greater than 96% of the passive ion fluxes pass through the so-called tight junctions, and not through the epithelial cells. The morphology of the junctions is summarised, and possible mechanisms of ion permeation are considered in detail. They proceed to discuss the physical origin of ion selectivity, i.e. they explain how the tight junctions can discriminate between cations and anions and distinguish between sodium and potassium ions. The final section concerns the use of organic cations to probe the detailed architecture of the ion selective "tight junctions". Throughout the chapter they draw attention to the evidence available about ion permeation across other "leaky" epithelial membranes, such as the intestine, proximal renal tubule, and choroid plexus. Consequently, this review is strongly recommended to those interested in the transport physiology of all epithelial tissues. Although the review is primarily written for research workers in membrane transport, it will prove very useful to students and teachers of biology who are just coming to grips with the physical basis of ion permeation and selectivity, and to students and teachers in the physical sciences who are venturing into the realm of modern biology.

E.M. Wright

- 70 CELL MEMBRANES: BIOCHEMISTRY, CELL BIOLOGY & PATHOLOGY. Weissman, G. and R. Claiborne (Editors). Hospital Practice Publishing Co., Inc., New York, 1975.

This book provides an excellent introduction to current concepts in membrane biology. The topics cover aspects of modern work on the molecular architecture and function of cell membranes. It is divided into three sections: the first, deals with the composition of membranes, and provides much of the background for the current model of membrane structure - the Singer-Nicolson model; the second, which covers membrane functions ranging from ion and protein transport across plasma membranes to neural transmission across synaptic junctions; in the third, the "pathology" of membranes is discussed, and among the topics presented are immune reactions; the surface properties of neoplastic cells, and the action of narcotics and anesthetics. All 26 contributors are internationally recognised authorities, and they have been most successful in portraying important recent advances in membrane biology. Unlike many multiauthor volumes, the style is uniform, the editing superb, the illustrations pertinent, and it is reasonably priced. It is highly recommended to students (both undergraduate and graduate), teachers, and those interested in a refresher course in fundamentals of modern cell biology.

E.M. Wright

- 71 ESSENTIAL HUMAN ANATOMY AND PHYSIOLOGY. Barbara R. Landau, Scott, Foresman and Co., Glenview, Ill., 1976.

This text is intended for undergraduates beginning the study of anatomy and physiology. Although it is assumed that most of the students using the book intend to enter health care careers and are taking a course required in their curriculum, the book is not addressed exclusively to them. It would be suitable for use in any human biology course at the high school or elementary college level. The emphasis in the initial chapters is on anatomy but more and more physiology is introduced as the various systems of the body are explored. Appropriately, there is little reliance on the student's knowledge of fundamental laws of physics and principles of chemistry and the explanations of physiological phenomena suffer somewhat in consequence. Although the book deals almost exclusively with human anatomy and physiology, an excellent reference list at the end of each chapter is offered which would lead the reader to a broader appreciation of the material discussed. The final section on the endocrine and reproductive system is very well adapted for students first learning this material. A section devoted to an explanation of current birth control methods is lacking, however. The illustrations for all chapters are clear and well-chosen, and labelled exhaustively. They contribute much to this text. An author who can deal authoritatively with such a large amount of material and make it comprehensible to underclassmen is rare. Ms. Landau is to be commended for the style of her book and the excellent development of the material presented.

Nancy S. Milburn

- 72 INSTRUCTOR'S MANUAL TO ACCOMPANY "HUMAN PHYSIOLOGY -- THE MECHANISMS OF BODY FUNCTION", 2nd ed., 1975. A. J. Vander, J. H. Sherman and D. S. Luciano. McGraw-Hill, Inc., N.Y., 276 pages.

This paperback manual was written as a guide for instructors who use the parent text, usually at the undergraduate level. The manual has 9 pages of introduction: suggestions on how to tailor a course, a two-page discussion of behavioral objectives, and explanation of the manual. The rest of the manual provides 5 items for each chapter of the parent text: a) a less-than-one-page summary of the chapter; b) a list of objectives; for example, "Describe carbon dioxide transport in the blood including a discussion of the role of carbonic anhydrase" is among the three and one half pages of objectives for Chapter 10, Respiration; c) additional references with comments, mostly to review articles; d) a list of movies or other aids, many of which have already been reviewed in *The Physiologist*, May 1973; and e) examination questions with answers (multiple choice or short answers). I recommend this manual to instructors; in addition, the objectives and questions could be very helpful in student hands as an aid to independent study.

Hugh D. Van Liew

- 73 PHARMACOKINETIC DATA. Pagliari, L.A. and L.Z. Benet. J. Pharmacokin. Biopharm. 3: 333-383, 1975.

This "Critical Compilation of Terminal Half-Lives, Percent Excreted Unchanged, and Changes of Half-Life in Renal and Hepatic Dysfunction for Studies in Humans with References" lists about 200 drugs with original references for each. Six other compilations of half-lives are cited, as is "The Fate of Drugs in the Organism -- a Bibliographic Survey" of the Société Française des Sciences et Techniques Pharmaceutiques Working Group chaired by J. Hirtz (Marcel Dekker, Inc., New York). This very useful list covers human data only, from papers which contain sufficient detail to be reasonably evaluated, and on drugs in clinical use. It is a valuable guide for researchers and students alike.

L.F. Wolterink

MUSCLE

- 74 THE CONDUCTION OF THE CARDIAC IMPULSE. Crane, P.F., Futura Publishing, Mt. Cisco, New York, 1975.

This monograph contains a very complete comparative physiological description of the bioelectrical events associated with heart muscle and its mechanical activity. Emphasis has been placed upon the slow response, rhythmicity and variations of the latter, cardiac arrhythmias, their causes and effects. Particularly well presented is the dual response or two component concept, first put forward by this reviewer (Wright and Ogatta, 1961) to explain the "Spike Dip Plateau" contour of the cardiac muscle action potential and the more extensive experimental treatment of this idea by the author and colleagues (Paes de Cavalho, 1966 and others including Reuter, 1973, Nobel, 1975), wherein calcium ion movement has been identified with the slow component. Initiation of oscillatory activity and effects of many agents are discussed along with the development and causes arrhythmias and various cardiac muscle tissues in the opinion of this reviewer. This book contains an extremely informative survey of the subject for both the clinical cardiologist and cardiac electrophysiologist, but does not include the more quantitative theoretical treatment and mathematical analysis of voltage clamp studies.

Ernest B. Wright

- 75 DEVELOPMENTAL AND PHYSIOLOGICAL CORRELATES OF CARDIAC MUSCLE. Lieberman, M. and T. Sano, editors. Raven Press, New York, 1976.

This book focuses on recent developments in which electron microscopic, electrophysiological, biochemical and tissue culture methods have been applied to problems in developmental and comparative cardiac physiology. The first section of the book contains data of developmental and morphologic interest obtained from embryonic and fetal hearts and heart cells in tissue culture. The second and third sections deal with several aspects of membrane permeability and electrophysiological considerations of embryonic and cultured avian and mammalian heart cells. The last section is concerned with physiological correlates of embryonic, neonatal adult, and comparative forms of cardiac muscle. The book should provide the basic and clinical scientist with stimulating insights into physiological and developmental correlates of cardiac muscle.

M. Lieberman

- 76 EXCITATION-CONTRACTION COUPLING IN CARDIAC MUSCLE. Nayler, W.G., and R. Seabra-Gomes. Prog. Cardiovas. Dis. 18: 75-88, 1975.

This concise review covers the following subject matter: (1) fine structure and cytochemistry of myocardial basement membrane, plasma membrane, sarcoplasmic reticulum and T-system; (2) role of these structures in excitation, contraction and relaxation of the myocardial cell; (3) contribution of Na^+ and Ca^{++} transmembrane fluxes to the cardiac action potential; and (4) central role of the Ca^{++} ion in myocardial excitation-contraction coupling. This review is recommended for medical and graduate students seeking an easy-to-read and concise introduction to the cellular basis of myocardial contraction and relaxation.

Harris J. Granger

- 77 THE INITIATION OF THE HEARTBEAT. D. Noble. Clarendon Press, Oxford, 1975.

The book was developed from a lecture series to medical students on the subject of cardiac excitation. The material is highly selected and presented in a well-organized format. The subjects range from a quantitative and analytical introduction to the principles of electrophysiology to a description of several important aspects of cardiac excitation as they relate to pacemaker activity, the initiation of contraction and actions of autonomic transmitters. A brief account is presented concerning the relevance of cardiac electrophysiology to clinical problems such as arrhythmias. A few chapters are designed to contain a concluding section which treats the subject of excitation and conduction from a mathematical approach. The author attempts to provide the reasons for the apparent complex nature of the ionic currents in cardiac membranes in terms of an updated version of his earlier modification of the Hodgkin-Huxley theory. The book should provide graduate students, medical students and physiology teachers with a succinct introduction to the complex subject of cardiac excitability.

M. Lieberman

- 78 THE INITIATION OF THE HEARTBEAT. Noble, D., Clarendon Press, Oxford, England, 1975.

This monograph is an extremely well put together presentation of cardiac muscle bioelectrical data. The contents are written in such a way as to be within the scope of those interested in the subject with or without extensive mathematical backgrounds. In contrast to the book by Cranefield, "The Conduction of the Cardiac Impulse", this monograph is primarily directed to and specialized in excitable membrane ionic currents, theoretical electrical schematic formulations with particular emphasis upon the relationships between transmembrane electrical events and the electrocardiogram. This reviewer was particularly impressed by the separation of high powered mathematical and theoretical treatment from experimental descriptions and results. The former are placed near the ends of chapters marked by vertical margin lines to indicate these portions may be omitted if desired, without loss of basic material. The contents include excellent descriptions of the very latest microelectrode techniques as well as the experiments themselves and results. Bioelectric analysis of some typical cardiac disorders are also included. This book, in the opinion of this reviewer is a must for all those interested in the modern experimental approach to the electrophysiology of the heart.

Ernest B. Wright

- 79 THE KINETICS OF MUSCLE CONTRACTION. White, D.C.S. and J. Thorson In: Pergamon Studies in the Life Sciences. 1-85, 1975.

This article first appeared in Progress in Biophysics and Molecular Biology 27, 1973. With slight revision, it is a review directed primarily to those who have special interests in muscle physiology. The subject matter that is reviewed includes the following: (1) historical development of the muscle model; (2) some structural consideration of the sliding filament theory; (3) biochemical kinetic study; (4) high-time-resolution mechanical experiments; (5) theories of contraction in muscle; and (6) links between the mechanical and biochemical kinetics. This article is especially valuable to graduate students and teachers of physiology who wish to up-date their basic knowledge in muscle physiology.

Y. Matsumoto

- 80 MECHANICS AND MODELS OF MUSCULAR CONTRACTION. Simmons, R.M. and B.R. Jewell. In: Recent Advances in Physiology. Number 9, pp.87-147. ed. R.J. Linden. Churchill Livingstone, Edinburgh and London, 1974.

This review analyzes for the reader with some general knowledge of muscle physiology the impact of recent research on the usefulness of classical mechanical analogs in understanding the dynamics of muscle force development and shortening. Topics include (1) a particularly concise and clear review of the Hill contractile component-series-elastic component model, its use in understanding the relationship between twitch and tetanus, the concept of the active state, and advantages and shortcomings of this approach; (2) a summary of the sliding filament model and recent single fiber studies exploring its applicability; (3) a brief review of current notions concerning molecular models for contraction; (4) discussion of transient responses to rapid changes of load or length; and (5) a statement of the current formulation of the A.F. Huxley-Simmons model. A short appendix clarifies some of the terminology used in mechanical studies, and there is an adequate but not over-long list of key references. The article should be particularly suitable for students and teachers who want to relate overall mechanical performance to the ultrastructure and molecular interactions within the muscle; important revisions in classical notions current in many textbooks are required. A useful and related article with more detail in some respects such as historical development is the Review Lecture on Muscular Contraction by A.F. Huxley [J. Physiol. (London) 243(1974):1-43]

B.D. Lindley

- 81 R. M. Simmons and B. R. Jewell. Mechanics and Models of Muscular Contraction. Recent Adv. in Physiology 9, 87-147, 1974

MECHANICS AND MODELS OF MUSCULAR CONTRACTION. Simmons, R.M. and B.R. Jewell. In: Rec. Adv. in Physiol., Series 9, pp 87-147, 1974.

This review is directed primarily to those who have special interests in modeling muscle based on the mechanical response of the system. The subject matter that is reviewed consists of the following: (1) The classical approach to muscle mechanics; (2) The contemporary approach to muscle mechanics; (3) Shortcomings in the classical approach to muscle mechanics; (4) Mechanical implications of the Sliding Filament Hypothesis; (5) Nature of the Sliding Mechanism; and (6) Crossbridges and dynamic characteristics. The article will be useful to graduate students and also to clinicians and faculty members of physiology not working in the field but who wish to grasp the basic discussion of the subject matter.

Yorimi Matsumoto

- 82 MUSCLE PHYSIOLOGY. Carlson, F. D. and D. R. Wilkie. In Prentice-Hall Biological Science Series; W. D. McElroy and C. P. Swanson, Edit. 1-170, 1974

This book attempts to cover the full scope of muscle physiology and directs the interest towards medicine, biology, physiology, biophysics and molecular biology. The subject matter that is treated consists of the following: (1) Control sequence in vertebrate skeletal muscle; (2) Mechanical aspects of muscular contraction; (3) myofibrillar composition, organization, and function; (4) chemical and energetic changes during contraction; (5) heat production of muscle; (6) thermodynamics and muscular contraction; and (7) the contractile process in various types of muscle. The treatment of muscle physiology in this book should be valuable to upper division undergraduate, graduate, medical, and post doctoral students who wish to grasp the basic discussion of the mechanism of muscle contraction.

Y. Matsumoto

- 84 THE VOLTAGE CLAMP AND CARDIAC ELECTROPHYSIOLOGY. Fozzard, H.A. and G.W. Beeler, Jr. Circulation Research 37:403-413, 1975.

This brief review attempts to put into perspective the technique of voltage clamp as applied to cardiac muscle. The article is directed to investigators and students who have not been engaged directly in problems of voltage clamp methodology. The authors have reviewed the difficulties and limitations of voltage clamp analysis as applied to complex tissues such as cardiac muscle. Although limitations of the method have constrained precise quantification of the data, the underlying events responsible for the generation of the cardiac action potential are described in terms of two different inward currents and four outward currents. The authors imply that the apparent unusual number of the ionic currents in heart muscle will be more clearly understood either when improvements in the technique such as those involving improved preparations (e.g., tissue-cultured heart cells) are found or analytical methods involving mathematical modeling are developed in order to quantitatively estimate the experimental errors. This article is recommended to the student or researcher interested in an abbreviated review of the controversial issues of past and present studies related to voltage clamping cardiac muscle.

M. Lieberman

- 83 PHYSIOLOGY OF SMOOTH MUSCLE. Eds. Bülbüling, E. and M. F. Schuba. 438 pp., Raven Press, 1976.

This is a publication of the proceedings of a symposium on smooth muscle held at Kiev, USSR, in September, 1974. It contains information on the physiology of many different types of smooth muscles obtained with a great variety of experimental approaches. The subject matter includes: (1) ionic composition, ion transport and ion currents, (2) electromechanical coupling and activation mechanisms, (3) origin and characteristics of spontaneous activity, (4) structure, neuromuscular relations and nervous influences, (5) actions of acetylcholine, catecholamines and other drugs. Each contribution is by a recognized authority in the specific area and is not a review but rather the presentation of new and original findings. The book is of value to muscle physiologists and to teachers of graduate and advanced undergraduate courses in nerve-muscle physiology.

J. M. Marshall

NEUROBIOLOGY

- 85 ARTERIAL CHEMORECEPTORS. Biscoe, T.J. In: The Peripheral Nervous System, Ed. Hubbard, J.I., pp. 487-505, Plenum Press, New York, 1974.

The notion, now frequently apparent in physiology textbooks, that the mechanism of chemoreceptor function is relatively well understood is soon dispelled in this most concise, innovative and well documented account on arterial chemoreceptors. This chapter deals with an evaluation of the nature of the receptor lying within the carotid and aortic bodies and the role of various nerves which innervate these structures. The morphology of arterial chemoreceptors as revealed by light and electron microscopy is reviewed in terms of the blood vessels, parenchymal cells and with particular emphasis on the nerve fibers and nerve endings located within these structures. The role of efferent nerve endings in a chemoreceptor is discussed in terms of: 1.) the function of the sympathetic nerves in modifying chemoreceptor discharge and 2.) a group of fibers of brain stem origin which are sensitive to changes in blood gases and circulating catecholamines. Evidence delineating the "nature" of the chemical transmitters which are released from these nerves is reviewed. The "received view" of the mechanism of afferent impulse initiation including the nature of the actual receptor cell is challenged and a new hypothesis is presented embodying an inhibitory efferent control system which modulates chemoreceptor activity. This chapter will be appreciated by medical students and in particular by graduate students for its clear dissection of the facts, deductive reasoning and innovative reappraisal of the evidence into a new hypothesis.

D.H. York

- 86 ELECTRORECEPTORS AND OTHER SPECIALIZED RECEPTORS IN LOWER VERTEBRATES: VOL. III/3 HANDBOOK OF SENSORY PHYSIOLOGY. Edited by A. Fessard Springer-Verlag Berlin 1974.

This volume, one in a distinguished series on receptor physiology, opens with a chapter by Bullock in which he considers the problems of exploring a sensory modality not possessed by human beings. He reviews the history of research with electroreceptors, the prediction of their existence, their discovery and the current state of our knowledge of them as a case in point. Five excellent chapters follow, each on some aspect of electroreception. The authors of these are T. Szabo, A. Fessard, R.W. Murray, Ad. J. Kalmijn and Scheich and Bullock. The most recent information about the structure, capabilities, classification and use of electroreceptors is to be found here. It is a fascinating and well-presented story. All the chapters are good, but Kalmijn's review of the detection of electric fields from inanimate and animate sources other than electric organs is especially interesting. Three additional chapters follow. One is on lateral line mechanoreceptors in fish and amphibia by Schwartz; another by Laurent is on teleost pseudobranchial receptors; and the final one by P. Hartline is a discussion of snake thermoreceptors. These three chapters are not closely related to the others but they can and do stand alone as reviews of the functional information about receptors which are still not well understood. Sensory physiologists or biophysicists will find this good reading; anyone teaching courses in perception or sensory physiology will benefit by reviewing practical and philosophical problems met in these researches. Bullock's question, "How may we expect new receptors to be found?" remains as a challenge.

Nancy S. Milburn

- 87 FUNCTIONS OF THE NERVOUS SYSTEM: Ganong, W.F. In: Review of Medical Physiology, Seventh Edition. Section III, pp. 65-196, Los Altos, CA, 1975.
- This section of the well-known review book by Ganong provides an excellent review for medical students who have previously studied neurophysiology in more detail. It is comprehensive, current and concise. The eleven chapters devoted to the central nervous system and special senses review standard material including reflexes sensory pathways and processes, peripheral aspects of the special senses, sleep and EEG, posture and movement, autonomic system and its central regulation, instinctual behavior and emotions and learning and memory. Some distinct advantages include the author's efforts to introduce a little humor, the excellent use of standard diagrams taken from original sources, an up-to-date bibliography and provision of brief discussions of relevant clinical examples of nervous system disorders. There are also a number of very useful tables which quickly summarize salient relationships or data for the student who needs a quick review of neurophysiology. There is just enough neuroanatomy to provide the necessary guidelines. This book is just the thing for a medical student preparing for his boards or for the non-neurophysiologically oriented instructor who must quickly prepare some remarks on the nervous system.
- L.M.N. Bach
- 89 HYPOTHALAMIC SUBSTANCE P AS A CANDIDATE FOR TRANSMITTER OF PRIMARY AFFERENT NEURONS. Otsuka, M., Konishi, S., and Takahashi, T. Fed. Proc., Fed. Am. Soc. Exp. Biol. 34, 1922-1928, 1975.
- The historical development is reviewed of the concept that substance P, a relatively short polypeptide, is the transmitter compound of the primary afferent neurons. It is pointed out that a peptide in extracts of dorsal spinal roots and substance P show a marked similarity in their chemical properties such as the molecular weight, electrophoretic mobility, etc., and in their action on the intestine, the blood pressure and in their depolarizing effect on spinal motoneurons. Substance P is 200 times as potent as L-glutamate as a depolarizing agent. There is about 10 x more substance P in dorsal than in ventral roots. The concentration of this polypeptide is very high in the dorsal horn. One sided transection of a dorsal root results in a marked reduction of the substance P content in the dorsal horn on that side. These findings are of interest for all students of central transmitter compounds and are part of the developing concept that relatively short polypeptide chains may be involved in a multitude of functions.
- A. Van Harreveld
- 90 NERVE AND MUSCLE CELLS IN CULTURE. Nelson, P. G. Physiol. Rev. 55, 1-61, 1975.
- Several types of cultures of nervous and muscular tissue have been used extensively in investigations of developmental- and other problems. In organ cultures a whole organ is maintained for considerable periods of time, allowing the study of its functions uninfluenced by the other organs of the body, as for instance the circadian rhythms in Aplysia ganglia. Explants of tissue (part of an organ) show a large degree of disorganization and cell death. Such preparations of central nervous tissue have been useful for the observation of the outgrowth of neurites and their myelination, the development of synapses within the nervous tissue and the formation of neuromuscular synapses with muscle present in the culture. Electrophysiological and biochemical studies have been carried out on such cultures. In reaggregation cultures the formation of tissues from dissociated cells has been observed. Finally isolated cells have been cultured. Unlike normal neuronal elements, glia proliferates in cultures. Human and mouse neuroblastoma cells can be cultured and develop complex axonal and dendritic patterns. The development of multinucleate muscle fibers from mononucleate myogenic cells can be seen in cultures. This review provides a great deal of information on the possibilities inherent in the tissue culture technique.
- A. Van Harreveld
- 91 NEURAL MECHANISM OF LEARNING AND MEMORY. Preliminary Report on a Conference held at Asilomar Conference Grounds, Pacific Grove, California. U.S. Dept. of Health, Education and Welfare, National Institute of Education, Washington, D.C. 20208. August, 1975.
- This report should be of interest to anyone who has wondered about the mysteries of learning and memory. It summarizes in about 50 pages the highlights of 40 papers concerned with biological and behavioral research on memory. These papers cover a diverse gamut of experimental techniques including clinical observations of damaged human brains, behavioral studies of the acquisition of taste-aversion in the "sheep-sparing" coyote, developmental studies of infantile amnesia, brain plasticity in a kitten's visual cortex, biochemical correlates of memory and formation of neural networks from an isolated neuron. Regardless of the reader's background, he will comprehend any of these studies equally well because of the reporting skills of I. S. Bengeldorf. First, these diverse papers have been organized into an integrated framework devoid of traditional disciplinary boundaries and exemplary of today's Neuroscience. Second, adequate details have been provided to make the text sufficiently comprehensive for most readers. However, addresses are supplied for readers to contact contributing scientists directly if additional information is desired. This report will be particularly valuable to graduate students, medical students, or faculty who wish a comprehensive but concise overview of the current problems and research approaches to the study of the neural mechanisms of memory.
- Beverly Bishop
- 92 NEURONAL PLASTICITY IN THE SEPTAL NUCLEI. Raisman, G. PHYSIOLOGICAL EVIDENCE OF COLLATERAL SPROUTING AND FORMATION OF NEW SYNAPSES IN THE RED NUCLEUS FOLLOWING PARTIAL DENERVATION. Tsukahara, N., Hultborn, H., Murakami, F., and Fujito, Y. THE RESPONSE OF THE DENTATE GYRUS TO PARTIAL DEAFFERENTATION. Lynch, G., Rose, G., Gall, C., and Cotman, C.W. In: Golgi Centennial Symposium 1973: Perspectives in Neurobiology, pp. 295-317. Raven Press, New York, 1975.
- The three articles deal with the plastic changes which develop in the central nervous system after injuries. Axons of intact neurons form branches which make synaptic connections with synaptic sites having become unoccupied after degeneration of fibers involved in the lesion. The resultant connections of this axon sprouting do not repair the original pathways as regeneration in the peripheral nervous system tends to do, but abnormal connections are formed. This active field of investigation is of great importance for the understanding of the plastic potentialities of the central nervous system.
- A. Van Harreveld
- 88 THE HIPPOCAMPUS. VOLUME I. STRUCTURE AND DEVELOPMENT. Robert L. Isaacson and Karl H. Pribram, editors. Plenum Press, New York, 1975.
- This book in two volumes offers a comprehensive and detailed view of structure, development and function of the hippocampus. Volume I considers: anatomy, pre- and postnatal development, the hippocampus as a model of adult brain plasticity, neurotransmitter substances, role of hormones, hormone receptors, hormonal cyclicality, hippocampal-hypothalamic-pituitary-adrenal axis, protein synthesis and memory. Volume II considers: electrophysiology, experimental and clinical implications of hippocampal function in learning and memory. This up-to-date reference book for a broad range of students (of all levels) will be useful to neurophysiologists, neurochemists, neuroendocrinologists and psychologists.
- P.S. Timiras

- 93 NEURONAL SPECIFICITY REVISITED. Hunt, R. K. and Jacobson, M. Current Topics in Dev. Biol., 8, 203-259, 1974.

Sperry (1950) proposed a theory of neuronal specificity which holds that the self-assembly of neuronal circuits is brought about by selective biochemical affinities between nerve cells. This theory accounts for the orderly embryological development of nervous connections as well as for the reestablishment of the original connections in adult animals after injuries, which has been studied most extensively in the retino-tectal relationship of amphibia and fish. Objections against this theory have recently been formulated mainly on the basis of experiments in which a disparity between retina and tectum was artificially produced. In the review these and other experiments are discussed and the concept of contextuality is introduced which takes into consideration the effect of the surrounding neurons of the specificity of the nerve cells under investigation. The review supplies an insight in the complexity of this important field of investigation.

A. Van Harreveld

- 94 NOCICEPTION. Dykes, R. W. Brain Res. 99, 229-245, 1975.

The analgesia produced by acupuncture and by electrical and tactile stimulation of the skin can be ascribed to the activation of large afferent fibers served by mechano receptors. This has been explained by the "gate theory" (Melzack and Wall, 1965) which proposes that cells in the substantia gelatinosa of the dorsal horn act as a gate to the anterolateral pathway which subserves pain. These cells would block synaptic activation of this pathway until small afferent fibers are stimulated by noxious procedures. A number of old and new observations which seem to disagree with the gate theory are discussed in the review. They may necessitate modifications of this concept. The interaction of noxious and innocuous stimuli is of importance because of the current interest in acupuncture.

A. Van Harreveld

- 95 NOTES ON THE HYPOTHESIS OF COLUMNAR ORGANIZATION IN SOMATOSENSORY CEREBRAL CORTEX. Towe, A. L. Brain, Behavior and Evolution, 11, 16-47, 1975.

Mountcastle proposed in 1957 that the somatosensory cortex of the cat exhibits a columnar organization. The columns, which are located normal to the cortical surface, would respond to only one modality of sensory input. Furthermore, all cells of a column would have a nearly identical receptive field and would respond with nearly the same latency after peripheral stimulation. The columns representing different modalities would be sharply delineated from each other. A columnar organization was subsequently found in the visual and auditory cortex and proposed even for the motor cortex. A particularly interesting columnar organization was described (Woolsey and Van der Loos) in layer IV of the somatosensory cortex of the mouse, each "barrel" correlating to a contralateral vibrissa or other facial sinus hair. This review offers a thoughtful and penetrating discussion and criticism of this concept which is of interest to those concerned with the connectivity of cortical elements.

A. Van Harreveld

- 96 OPIATE RECEPTOR MECHANISMS. Snyder, S.H. and Matthysse, S. Neurosciences Res. Prog. Bull., 13, 3-166, 1975.

Stereospecific receptors for opiates are present in the brain. The degree to which opiates bound to the tissue can be displaced by antagonists (e.g., naloxone) correlates with their pharmacological potency. The opium binding is greatest in the anterior part of the amygdalae, less in other regions of the cerebrum and very low in cerebellum and white matter. The binding is most pronounced in the synaptosomal fraction of centrifuged brain homogenates. The opiate receptors do not exist by chance, but form part of a neurotransmitter or modulator system that functions through the mediation of a naturally occurring "morphine-like" compound, the endogenous ligand. From brain extracts a compound (probably a small polypeptide) has been isolated which inhibits electrically induced activity of the mouse vas deferens (as opiates do) which is counteracted by naloxone. Stimulation of periaqueductal- and periventricular gray areas causes analgesia, which would be due to the release of the morphine-like endogenous ligand. As expected from this concept naloxone counteracts the analgesic effect of stimulation. This review is of importance to all concerned with the pharmacological and addictive properties of the opiates.

A. Van Harreveld

- 97 ORGAN PHYSIOLOGY: STRUCTURE AND FUNCTION OF THE NERVOUS SYSTEM. Guyton, A.C. Second Edition. W.B. Saunders, Philadelphia, 1976.

This book will particularly be useful for the average medical student, paramedical students and other undergraduate students in physiology or psychology. The book consists of a section on muscle and nerve (3 chapters), central nervous system (12 chapters) and special senses (5 chapters). It is essentially extracted from the author's Fifth Edition of Medical Physiology in a convenient form for those students beginning their study of neurophysiology. Coverage of the subject is standard, comprehensive, current and, in the usual style of Guyton, easily read and understandable. Adequate attention is given to the most useful clinical disorders of the nervous system primarily to illustrate the functional concepts of the brain. Less attention is given to the necessary neuroanatomy than the author claims and the beginning student would be well-advised to have access to a basic neuroanatomy resource. The Illustrations could have been more numerous and in several instances more specifically developed but, by and large, are quite helpful. Subjects included are excitation, contraction, junctional transmission, information processing, sensory processes, motor mechanisms, including reflexes, posture, and locomotion, EEG, sleep, memory and learning, emotion and autonomic system, special senses.

L.M.N. Bach

- 98 PHYSIOLOGY OF THE NERVOUS SYSTEM. Eyzaguirre, C. and S.J. Fidone. Second Edition. Year Book, Chicago, 1975.

This textbook is aimed at advanced undergraduate, graduate, medical students and board-studying residents who wish to learn or review the basic principles of neurophysiology. This aim is essentially realized insofar as graduate or advanced undergraduate students are concerned but there are probably more relevant resources for the non-research oriented medical student or resident. Section 1 deals with excitation, transmission and contraction in nerve, synapses and muscle. Section 2 provides considerable emphasis on sensory systems, especially the detailed physiology of peripheral receptors. Part 3 has to do with motor systems, again with major emphasis on cord reflexes and peripheral aspects of motor control. The fourth section emphasizes central and peripheral control of autonomic activity while Section 5 is concerned with neurobiological rhythms such as sleep, wakefulness and the EEG. The final section 6 is a very useful part on regenerative and supportive systems of the nervous system including effects of denervation, trophism, circulation and glia. Illustrations are generally of poor quality, there is a real paucity of clinical emphasis and a deliberate lack of discussion of any aspect of learning or behavior. This book deals conventionally with peripheral emphases on neurophysiology.

L.M.N. Bach

A book including all the papers that might be considered milestones in neurophysiology is clearly impossible yet the authors of this book have assembled "a collection of papers which mark several related turning points in research--describing the simplest reflex in the spinal cord, the myotatic reflex". The importance of understanding the mechanisms which underly and influence this reflex may be directed to an appreciation of basic neurophysiological principles, neurological examination and rehabilitation of patients with spinal cord injuries. The book is aimed at undergraduate and graduate students by arrangement of these classic papers according to the anatomical components of the myotatic reflex, from the afferent side to the effector. This begins with the paper of Liddell and Sherrington on the first study of the myotatic reflex per se, then papers dealing with (1) muscle receptors (2) action potential (3) spinal cord potential (4) the monosynaptic reflex (5) influence of afferent inputs on the monosynaptic reflex (6) recurrent inhibition (7) the gamma efferents (8) myoneural junction. Preceding each section is an introductory commentary which places the papers in perspective historically and gives an ample list of references, bibliography and suggested texts for further reading.

D.H. York

This review contains discussions of the following topics: (1) anatomy and histology of receptors located in the walls of the atria and ventricles; (2) electrophysiological characteristics of atrial and ventricular receptors; (3) reflex effects of atrial receptor stimulation on heart rate, myocardial contractility, peripheral resistance and urinary output; (4) effects of ventricular receptor stimulation on the cardiovascular system; and (5) significance of the cardiac reflexes, especially those originating from the atria, in control of cardiovascular function in physiological and pathological conditions. This review is recommended for graduate and medical students interested in nervous control of the circulation.

Harris J. Granger

The subject areas of this exhaustive review include the following: (1) anatomy, histology and mechanical properties of arterial baroreceptors; (2) electrical activity of baroreceptor afferents and the influence of static and dynamic mechanical deformation of vessel wall; (3) effect of baroreceptor afferent activity on structures in central nervous system responsible for coordinating cardiovascular function; and (4) effects of baroreceptor reflexes on behavior of the heart, regional vasculature and venous system. This review is recommended for graduate students, advanced medical students and faculty members seeking a comprehensive analysis of the arterial baroreceptors and their role in cardiovascular homeostasis.

Harris J. Granger

It has been apparent for over half a century that nerve cells play an important role in "neurotrophic" effects which are quite distinct from their ability to propagate action potentials. A neurotrophic effect relates interactions between nerves and other cells which initiate or control molecular modification in the other cell. The major distinction between trophic influences and excitability phenomena is the long term nature of their effects. In this chapter trophic influences are evaluated in 1) regulation of taste buds, 2) regulation of amphibian limb regeneration and 3) regulation of physiological and metabolic properties of muscle. This latter most fascinating area is explored in depth and such topics as acetylcholine sensitivity, membrane potential, role of acetylcholine release, effects of cross-reinnervation, influence of exercise and plasticity of the motor unit are reviewed. The actual mechanism underlying neurotrophic regulation, which is alluded to briefly, may involve a neural influence on gene expression. This chapter is loaded with fascinating observations of a collection of phenomena, collectively referred to as neurotrophic effects, which have but scratched the surface of a whole new realm of regulatory mechanisms inherent in neuronal function. This chapter is of interest to graduate students primarily, although its concise nature makes it also readily digested by undergraduates. A more indepth review of trophic functions of the neuron can be found in Ann. N.Y. Acad. Sci. 228, 1-423(1974)

D.H. York

RENAL AND ELECTROLYTE

This provocative review will be of particular interest to those immediately involved in the area of volume control, as well as to those who may have a more peripheral interest in the area. It is unusual in that the authors analyze the relevant literature concerning what is termed the Henry-Gauer reflex and arrive at the conclusion that it adds little to our understanding of the regulation of body water. I would expect that those who do not have an immediate interest in the area will be intellectually seduced by the arguments developed by the authors. Indeed, there are certain observations (a number of which are the authors' own) which lend support to their position. For example, it has been generally considered that the Henry-Gauer reflex is involved in the diuresis of atrial tachycardia. However, atrial tachycardia in the heart blocked dog does not produce a diuresis, whereas atrioventricular pacing with a suitable delay does. In addition, increasing heart rate decreases atrial receptor discharge per cardiac cycle and has no significant effect on receptor discharge per minute. If the contribution of this review is limited, it would relate to the periodic bias of the authors' interpretation of the work of other investigators. However, this is more than balanced by the valuable resource that this review will provide for many years to workers in the field.

J.P. Gilmore

In this review, the concept that the body possesses low pressure volume receptors in the atrium that are of significance in the regulation of ADH secretion and extracellular fluid volume is carefully evaluated with a considerable degree of healthy skepticism. The material is well organized and the various experimental procedures that have been utilized to study this problem are discussed. The short summaries that are provided at the end of the individual sections are very helpful. In essence, the authors point out that the case for the left atrial receptor has been built largely on circumstantial and indirect evidence. They suggest that, while the volume-receptor hypothesis is appealing, solid evidence in its support is probably not sufficient to warrant its general acceptance, in particular as it relates to physiological mechanisms that regulate extracellular fluid volume. This review offers many thought provoking objections to certain concepts which are accepted by a substantial number of investigators and deserves study by those interested in the control of body fluid volumes.

L.G. Navar

- 105 COUNTERCURRENT MULTIPLICATION SYSTEM WITHOUT ACTIVE TRANSPORT IN INNER MEDULLA. Kokko, J.P. and F.C. Rector, Jr. In: *Kidney International*, 2:214-223, 1972.

This article describes a model for concentration of urine which takes advantage of the passive permeability characteristics of the descending and ascending thin limbs of Henle's Loop and of the medullary and papillary collecting ducts. Former models have required that the ascending thin limb actively transport NaCl, despite the fact that the ascending thin limb lacks structural features characteristic of actively transporting epithelia, such as numerous mitochondria and rich infoldings of basal plasma membranes. By use of this model, it is possible to explain how urinary concentration is absolutely dependent upon the active transport of NaCl (recently shown to be active transport of Cl⁻ with passive reabsorption of Na⁺) in the water impermeable thick ascending limb. The model explains: (1) the generation of a high tubular fluid (TF) concentration of Na in the thin descending limb due to passive abstraction of water from the water permeable thin descending limb, (2) the generation of the high medullary interstitial concentration of Na due to diffusion of Na out of the relatively water impermeable thin ascending limb, (3) thereby causing in the thin ascending limb dilution of TF relative to interstitium, (4) concentration of urea in TF in the distal and cortical collecting tubules, (5) the generation of the high medullary interstitial concentration of urea due to diffusion of urea out of the medullary and papillary collecting ducts, and (6) the concentration of urine. We have successfully taught this model to first year medical students for the past two years.

Darrell D. Fonestil

- 107 EFFECT OF ALTERATIONS IN EXTRACELLULAR FLUID VOLUME ON SEGMENTAL SODIUM TRANSPORT. Stein, J.H., and H.J. Reineck. *Physiol. Rev.* 55: 127-141, 1975.

This review is written for those interested in mechanisms at the nephron level, responsible for controlling Na⁺ excretion, as a means of regulating extracellular fluid volume (ECFV). Each segment of the nephron is evaluated in terms of its rate of Na⁺ reabsorption as altered by expansion of ECFV. The evaluation, based primarily on free-flow micropuncture studies, is as follows: (1) in the proximal convoluted tubule, volume expansion results in a significant decrease in fractional reabsorption of Na⁺, caused by a decrease in absolute reabsorption and an increase in GFR, (2) in the loop of Henle and distal tubule, volume expansion has no direct effect on Na⁺ handling but because of a decrease in proximal reabsorption, there is an increase in absolute reabsorption caused by a greater delivery rate of Na⁺, and (3) in the collecting ducts, volume expansion causes a decrease in fractional Na⁺ reabsorption. A suggestion of the mechanism responsible for the decrease in Na⁺ reabsorption by collecting duct cells put forth by the reviewers is a decrease in local release of prostaglandin E. This review should be of specific value to graduate students, medical students and faculty, who would like an explanation of the sites of the nephron that are responsive to ECFV expansion and which are responsible for controlling volume output.

H.M. Randall

- 109 MEMBRANE TRANSPORT IN THE KIDNEY. Giebisch, G. and R.W. Berliner. In: *Kidney International* 9:67-230. Springer-Verlag, New York, 1976.

This symposium on membrane transports focuses on various aspects of renal transport processes. Those interested in renal transport process will find this a valuable collection of facts and references. The subject matter that is covered includes 1) epithelial transport; 2) electrolyte transport; 3) organic solute transport; 4) urinary acidification; 5) electrical activity along the nephron; 6) the concentration mechanism in the renal medulla and 7) the mechanism of action of antidiuretic hormone. This symposium will be of primary value to advanced graduate and medical students and faculty who desire an up-to-date discussion of the state of membrane transport processes in the kidney.

E.G. Schneider

- 106 CURRENT CONCEPTS OF SODIUM CHLORIDE AND WATER TRANSPORT BY THE MAMMALIAN NEPHRON. Mercer, E. S., D. A. Maddox, and B. M. Brenner. *West. J. Med.*, 120:33-45, 1974.

This review summarizes the present status of several areas of renal physiology in which basic concepts have been undergoing rapid change. These include: (1) factors which determine glomerular filtration rate; (2) mechanisms of fluid reabsorption along the different nephron segments; (3) controversies concerning the countercurrent system for renal concentration. Because it has not been written specifically for the expert in the field, it should be readily understood by physiologists, in general, medical students, and clinicians.

A. J. Vander

- 108 MECHANISMS REGULATING RENIN RELEASE. Davis, J.O., and R.H. Freeman. *Physiol. Rev.* 56:1-56, 1976.

This review is written for those interested in the various mechanisms responsible for regulating the renal release of renin. Each regulatory mechanism is discussed initially as a single entity and again in combination as found in several clinical situations, including hemorrhage and congestive heart failure. The mechanisms involve 2 intrarenal receptors whose activities can be modified by neural and humoral agents. Both the mechanisms and means by which renin release is effected are: (1) the vascular receptor of the afferent arteriole which is thought to respond to changes in wall tension, (2) the second receptor, the macula densa, which is sensitive to the delivery load of Na⁺ or Cl⁻, (3) the renal sympathetic nerves which alter renin release by direct action in the juxtaglomerular (JG) cells and by altering afferent arteriolar tone, and (4) humoral agents including epinephrine and norepinephrine which alter renin release in the same manner as sympathetic nerves, and are mediated by β-adrenergic receptors, while angiotensin II and antidiuretic hormone act on the JG cells and inhibit the release of renin. This review should be of value to graduate students, medical students, and faculty who desire a comprehensive appraisal of the several mechanisms responsible for regulating renin release.

H.M. Randall

- 110 PHYSICAL FORCES AND TRANSTUBULAR MOVEMENT OF SOLUTES AND WATER. Schnermann, J. In: *MTP International Review of Science: Kidney and Urinary Tract Physiology*, Series I, Vol. 6, pp. 157-198, 1974.

This review presents an extensive well organized and well documented evaluation of the present status of the concept that alterations in peritubular physical forces have an important role in regulating tubular reabsorption of solutes and water. It is divided into three sections: 1) The facts, 2) Mechanisms, and, 3) Modes of Operation. In the first section, the various experiments that have been conducted to alter the peritubular hydrostatic pressure and the peritubular colloid osmotic pressure are discussed and evaluated. One conclusion is that the evidence in support of the physical factor concept is not as definitive as might be expected - especially when evaluated from a quantitative standpoint. In the second and third sections, the various possible mechanisms, both direct and indirect, that have been suggested to explain the means by which changes in peritubular physical forces can alter transtubular fluid and solute movement are evaluated. Several potential models of operation are discussed. This review should be of value to individuals interested in obtaining an understanding of this topic beyond that available in the standard texts in renal physiology.

L.G. Navar

- 111 A PROPOSED CYBERNETIC SYSTEM FOR SODIUM AND POTASSIUM HOMEOSTASIS: COORDINATION OF ALDOSTERONE AND INTRARENAL PHYSICAL FACTORS. Sealy, J. E., and J. H. Laragh. *Kidney International*, 6:281-290, 1974.

This review is the most succinct and up-to-date description of the important interrelationships between the homeostatic systems for sodium and potassium. It attempts to integrate the renal-adrenal hormonal mechanisms with the self-contained intrarenal mechanisms for handling sodium and potassium. This over-all concept is not found in most recent texts, and the review is therefore of particular value.

A. J. Vander

- 112 SOME REFLECTIONS ON THE MECHANISM OF RENAL TUBULAR POTASSIUM TRANSPORT. Gerhard Giebisch. *Yale Journal of Biology and Medicine*, 48: 315-336, 1975.

A gateway to the historical background and a critical reassessment of present concepts of potassium transport by the renal tubule is provided by this essay. The topics covered include the segment transport patterns of potassium along the nephron, uncertainties about the tubular sites of potassium secretion, the cellular mechanism of renal tubular potassium transport, evidence for electrogenic sodium transport across the peritubule cell membrane, properties of the luminal cell membrane, and functional differences between late distal tubule and the cortical collecting tubule. Finally these basic principles are applied to regulation of potassium excretion in the urine. For example, the flow dependency of potassium secretion is related to the kaliuretic effects of diuretics. Graduate students, medical students, and faculty in both basic and applied sciences will find this an excellent mechanism for either updating their knowledge of the field or providing an introduction at a relatively sophisticated level.

F.G. Knox

- 113 REGULATION OF GLOMERULAR FILTRATION AND PROXIMAL TUBULE REABSORPTION. Knox, G.F., J.-L. Cuche, C.E. Ott, J.A. Diaz-Buxo, and G.M. Marchand. In: *Circulation Research* 36 (Suppl. 1):1107-1118, 1975.

This review considers some of the current conceptual developments related to regulation of glomerular filtration rate and proximal tubule function. Emphasis is given to some of the more controversial topics. The possible role of the process of "filtration equilibrium" in the control of GFR in species in which GFR does not appear to be plasma flow dependent such as the dog or man is examined. Also, the current theories related to the phenomenon of renal autoregulation are evaluated and some of the conflicting experimental studies are presented. The possible role of physical factors in the regulation of proximal tubule fluid reabsorption is examined. The authors suggest that although changes in physical factors may have a marked effect on proximal tubule reabsorption under conditions where there is an enhanced backleak into the proximal tubule, it is unlikely that this mechanism can serve as a sensitive regulator of reabsorption in the absence of volume expansion. Overall, a number of apparent inconsistencies related to several of the currently developed concepts in this area are discussed. This review should be of interest to those wishing to understand some of the complexities associated with our current understanding of glomerular dynamics and proximal tubule function.

L.G. Navar

- 114 RENAL PHYSIOLOGY. Vander, A.J. pp 1-162. McGraw-Hill, Inc., New York, 1975.

This textbook is a concisely written text on the fundamentals of renal function and the regulatory role of the kidney in the maintenance of the internal environment. The book covers basic glomerular and tubular function and discusses the regulation of extracellular volume, extracellular osmolarity, potassium balance, hydrogen ion balance and calcium-phosphate balance. Each chapter is introduced with a set of behavioral objectives describing what the student should be able to accomplish by the end of each chapter. The author has included a set of problems with answers and a suggested reading list for each major topic. Faculty who teach undergraduate, graduate or medical students will find this text useful, especially if a limited amount of teaching time is available.

E.G. Schneider

- 115 RENAL PHYSIOLOGY. Vander, A.J. McGraw-Hill, New York, 1975.

This short, clearly written, and inexpensive text provides an introduction to renal physiology. Major topics include: (1) renal structure, (2) glomerular filtration, (3) tubular transport, (4) clearance, (5) renal blood flow, (6) renal transport of sodium, chloride, and water, (7) regulation of extracellular fluid volume and osmolarity, and (8) regulation of potassium, acid-base, and calcium balance. Each chapter is headed by a list of behavioral objectives. The material is up-to-date, and concepts are clearly explained. The figures are kept simple, and often neatly summarize complex relations. Study questions (with answers) and selected references for each chapter are included in the back of the book. The book is intended primarily for medical students. The organization of the text permits the student to study the core of renal physiology by himself.

G.A. Tanner

- 116 RENIN-ANGIOTENSIN SYSTEM. Peart, W. S. *New England J. Med.* 292:302-306, 1975.

This is a brief review of the salient features of the renin-angiotensin system. It includes: (1) the chemistry of the system, (2) mechanisms governing release of renin, (3) pharmacological effects, (4) methods of assessing activity, (5) function in various physiologic and pathologic states. The review is intended for the general reader and provides a painless way of getting up to date on the essentials of this hormonal system.

A. J. Vander

- 117 ROLE OF THE COLLECTING DUCT IN THE REGULATION OF SODIUM BALANCE. Stein, J.H., Kirschenbaum, M.A., Bay, W.H., Osgood, R.W., Ferris, T.F. In: Supplement 1 to Circ. Res., 36 & 37L 1-119-124, 1975.

The main emphasis of this review is to localize the sites of altered sodium transport in the distal nephron participating in the regulation of the extracellular fluid volume. Thus the role of the proximal tubule is not covered in this review, however, the scope is broader than might be deduced from the title. Specifically, the role of the loop of Henle, the distal convoluted tubule and the collecting duct are addressed. The literature which leads to the general conclusion that the collecting duct is of paramount importance in the final regulation of sodium excretion is reviewed with hypothesis stated for the possible role of prostaglandins in the regulation of sodium excretion. This review may contain more basic experimental information than might be appropriate for an introduction to the topic for medical students but would clearly be appropriate for those medical students with a particular interest in this subject. Further, it provides a lucid review of the area for graduate students and faculty.

F.G. Knox

- 118 SODIUM TRANSPORT IN THE DISTAL NEPHRON. Burg, M., and Stoner, L. In: Federation Proceedings, 33:31-36, 1974.

The present state of knowledge of the anatomy and physiology of the distal nephron is reviewed in a most scholarly fashion in this brief publication. Particular attention is devoted to the different segmental characteristics that are covered under the umbrella of the distal nephron. Thus in addition to anatomic differences there are significant differences in the transport processes in these various segments. The characterization begins at the point in the thick ascending limb of Henle's loop where it crosses from the outer medulla into the cortex. Subsequently, the distal convoluted tubule, the cortical collecting tubule and the papillary duct are characterized. The result of this segmental approach is a coherent picture of distal nephron function without the inappropriate generalizations that accompany approaches which ignore the heterogeneity of this terminal portion of the nephron. As such this approach provides ready clarification for seeming inconsistencies in a more generalized treatment of the subject. From this vantage the usefulness will be as a course for clarification for students that wish to sort out the complexities of the distal nephron.

F.G. Knox

- 119 SYMPOSIUM ON KIDNEY AND HORMONES. Massry, S. G., Editor. Nephron, 15(3-5):161-408, 1975.

This large issue of the journal *Nephron* is devoted to reviews of the effects of various hormones on the kidney. These include ADH, the catecholamines, parathyroid hormone, thyroid hormone, calcitonin, adrenocortical hormones, renin, insulin, erythropoietin, vitamin D, and natriuretic hormone. The articles vary considerably in their depth of coverage and approach, but the volume provides the best single source of information on this rapidly expanding field. Even a rapid perusal of it should be of benefit to teachers of physiology. Another work which has a somewhat similar aim but the articles of which tend to be more detailed (and, therefore, of greater use to experts but of lesser use to general teachers) is *Hormones and the Kidney*, Kidney International, 6(5):261-376, 1974.

A. J. Vander

RESPIRATION

- 120 BREATHING -- PHYSIOLOGY, ENVIRONMENT AND LUNG DISEASE. Arend Bouhuys, Grune and Stratton, N.Y., 1974, 511 pages.

Although intended by the author "to provide physicians and medical students with basic concepts of respiratory physiology and environmental lung disease," this book can also be a big help for educators from basic sciences backgrounds who are called upon to teach respiratory physiology to students who are mainly interested in health care. Of the eighteen chapters, the final seven are on environmental health and lung disease. The first part of the book, subtitled "Physiology" is a good review of basic material by an author whose career bridges between the basic and the applied. The author's prefatory remark that "many chapters resemble review articles on specific subjects" is buttressed by a wealth of up-to-date references. The exposition covers more topics and goes into more depth than usual for beginning courses in respiratory physiology, but the book is so well written that it will be valuable for readers with only modest knowledge.

Hugh D. Van Liew

- 121 THE CONNECTIVE TISSUE OF LUNG. Hance, A. J., and R. G. Crystal. American Review of Respiratory Disease: 112: 657-711, 1975.

This extensive, detailed review of present knowledge of connective tissue in the lung will be especially useful to pulmonary physiologists who are interested in the mechanical properties of lung, and particularly the effects of aging and disease. The subject matter includes: (1) detailed discussion of collagen including its biochemistry, degradation and morphology; (2) elastic fibers including fine structure and degradation; (3) quantification of connective tissue in normal lung and the factors that control tissue metabolism; (4) emphysema including protease-induced emphysema; (5) pulmonary fibrosis including a discussion of animal models; (6) relationship of lung connective tissue to lung function. The article will be particularly valuable to research workers and graduate students because it is an authoritative survey of a rapidly moving field.

J. B. West

- 122 GENERAL ANESTHESIA AND THE LUNG. Rehder, K., A. D. Sessler, and H. M. Marsh. *American Review of Respiratory Disease*, 112: 541-563, 1975.

This short review article contains a useful discussion of the effect of anesthesia on pulmonary function. The subject matter that is reviewed covers: (1) pulmonary gas exchange, including causes of hypoxemia and CO₂ retention during anesthesia; (2) intrapulmonary gas distribution, including the effects of mechanical ventilation versus spontaneous breathing; (3) mechanisms of uneven ventilation, including a discussion of the pleural pressure gradient, compliance of the respiratory system, and airway closure. The article will be particularly valuable to faculty and trainees in anesthesiology, medical students, and graduate students and post-doctoral fellows who are concerned with how anesthesia affects pulmonary function.

J. B. West

- 123 HANDLING OF BIOACTIVE MATERIALS BY THE LUNG. Fishman, A.P. and G.G. Pietra. In: *The New England Journal of Medicine*, pp. 884-890 and 953-958, October 24 and October 31, 1974.

This review appeared in two parts deals primarily with the metabolic activity of the mammalian lung. The subject matter dealt are the following: (1) structure and function of different alveolar cells; (2) structure and function of pulmonary capillary endothelium; (3) ultrastructure of alveolar interstitial space; (4) structure and function of "non-living" cells e.g. alveolar macrophages and mast cells; (5) the interdependence of the two metabolic organs, the lung and the liver; (6) fates of various substances in the lung including inhaled materials and injected materials; and (7) the role of lung in relation to various hormones. These two parts of the review are particularly valuable to medical students, graduate students, internists and faculty members interested in non-respiratory functions of the lung.

C. M. Banerjee

- 124 METABOLISM, PRODUCTION, AND RELEASE OF HORMONES AND MEDIATORS IN THE LUNG. Junod, A. L. *Am. Rev. Respir. Dis.* 112: 103-103, 1975.

Classically, physiology of the lung has been a consideration of gas exchange, relying heavily upon physical approaches to describe lung function. Recently it has become evident that lung function also includes biochemical processes of importance, and two lines of interest are discernible: 1) maintenance of lung integrity and, 2) metabolism of hormones and mediators. This review surveys the latter. Although written for pulmonologists, it would be a useful adjunct for graduate courses in pulmonary physiology, endocrinology and cardiovascular physiology. Synthesis, release and degradation of serotonin, norepinephrine, histamine, prostaglandins, angiotensin, bradykin, and other less-well characterized kinins and peptides are presented. The article concludes with a discussion of the general questions of the role and importance of pulmonary metabolism of these compounds in homeostasis and of the even less-well understood processes whereby their metabolism may be controlled. Assimilation of this review requires some foreknowledge of general biochemistry, basic endocrinology, and pharmacology of biogenic amines. The usefulness of incorporating this review in graduate teaching is that it both summarizes and directs attention to a potentially large and important aspect of pulmonary physiology now in its infancy.

T. C. Lloyd, Jr.

- 125 NEURAL REGULATION OF RESPIRATION. Mitchell, R.A. and A.J. Berger. *Amer. Rev. Resp. Dis.* 111:206-224, 1975.

This review provides a thoughtful analysis and discussion of the neurophysiological mechanisms underlying the central regulation of breathing. The authors emphasize the existence of both voluntary (behavioral) and automatic (metabolic) control systems, served by functionally and anatomically separate neural structures. A large part of the review is devoted to the historical development and present understanding of the organization and function of respiratory neurons in the medulla and pons. A second major section concerns descending pathways and the integration of neural information from several sources at the level of respiratory motoneurons in the spinal cord. The final section describes a number of central nervous system lesions that affect respiration in man, and relates these observations to the concepts developed earlier. This article will be of particular value to readers with serious interest in the neurophysiology of the central genesis of respiratory rhythm. It will also be of interest to clinicians concerned with respiratory manifestations of central nervous system disease.

D. Bartlett, Jr.

- 126 NORMAL AND ABNORMAL LUNG FUNCTION: A PROGRAM FOR INDEPENDENT STUDY. Modell, H.I., A.J. Olszowska, R.A. Klocke, and L.E. Farhi. School of Medicine, SUNY at Buffalo. Available through: Supply Service, American Lung Association, 1740 Broadway, New York, New York 10019.

Those who have a special responsibility for teaching the quantitative fundamentals of pulmonary physiology to undergraduate medical students, house staff, postdoctoral fellows, or practicing physicians in continuing education may be attracted to this program as an adjunct to lecture and reading. The program consists of fifteen exercises where the user interacts with a computer (a mini-computer is sufficient) in BASIC or as a tie-in to the local outlet of the GE time-sharing system. The programs are in English and require no previous computer experience. Principal areas of coverage are: (1) respiratory mechanics, (2) chemoregulation, (3) gas exchange and (4) acid-base relationships. In each of these a model is set up on the basis of known physiological relationships. The student has the opportunity to vary a number of inputs and is told how the "preparation" would respond. From the relation between what he has done and what the results are, the student is expected to examine the underlying mechanisms just as if he had a real experiment. The students are helped in their endeavors by a "lab manual" which provides guidance in terms of possible changes they may want to introduce and also supplies room for answers, tables to be filled in, and graph grids to be used. Most of the experiments are based on clinical situations but require no knowledge of pulmonary pathology. Our general experience is that small groups of users interact better than one-on-one and that a near by instructor familiar with the material is desirable for maximal benefit.

D.W. Rennie, M.D.

- 127 ON THE RESPIRATORY FUNCTION OF HAEMOGLOBIN. Bauer, C. In: *Reviews of Physiology Biochemistry and Pharmacology*. vol. 70, pp. 1-31. Springer-Verlag, Berlin, 1974.

This review is a summary of the biochemical and physiological role of hemoglobin in the transport of O₂ and CO₂. It covers the chemical structure, the allosteric effects of O₂ and CO₂ binding, factors which affect O₂ affinity and the pathophysiological effects of altered O₂ affinity. In addition it discusses the role of hemoglobin in the transport of CO₂. It will be of value to graduate students, medical students and clinical personnel who wish a concise yet detailed discussion of hemoglobin in respiration.

H.M. Frankel

- 128 RESPIRATORY PHYSIOLOGY -- THE ESSENTIALS. John B. West. Williams and Wilkins, Baltimore, 1974, 185 pages.

This paperback provides a solid first glimpse into respiratory physiology, primarily written as a core course for medical students, but good reading for anyone. I mean "anyone", not just anyone interested in health sciences. The book is attractively put together, generally comprehensive, and especially good in illustrative material. A special feature is that 7 to 14 questions with answers are provided for each of the 10 chapters. Selected references for each chapter are also provided.

Hugh D. Van Liew

- 129 TEACHING TAPES ON RESPIRATORY PHYSIOLOGY. John B. West. (1974). School of Medicine Univ. of California at San Diego, La Jolla, California, 92037. Available from Cal-Med Photo, P.O. Box 3147, San Diego, California 92103.

This package contains 3 kinds of media: a) typewritten scripts in booklet form for 8 lectures; b) 8 tape cassettes with John West's voice reading the scripts; and c) 245 illustrative 35mm slides, to be synchronized with the lectures by hand. The material covered is the same as in the first 8 chapters of West's ten-chapter book "Respiratory Physiology, the Essentials" (Williams and Wilkins, 1974) but there is additional illustrative material and explanation. Study of the book is not presupposed. The lectures are 25 to 58 minutes long; total running time for the 8 cassettes is 5 hours, 42 minutes. West intended the material for medical students; for others a knowledge of histology and some background in the medical sciences are advisable. There are occasional touches of experimental science and mention of clinical applications. The material is probably best used for independent study, but could be used for group instruction. The written script could free students who wish to move more rapidly than the spoken version. Students will appreciate the business-like but warm "let's work together" attitude of the lectures.

Hugh D. Van Liew

- 130 TRANSLATIONS IN RESPIRATORY PHYSIOLOGY. J. B. West (ed.). Dowden, Hutchinson and Ross, Stroudsburg, Pa.

This book contains translations of 22 key articles in respiratory physiology. Most of the papers were published in the first three decades of this century although three were published earlier. The authors include Rohrer, Neergaard, Wirz, Donders, Einthoven, Sonne, Pfluger, Basch, Fredericq, Winterstein, Nielsen, Bohr, Hasselbalch and Krogh. The papers were selected because of their potential value to research workers and students. Several of the articles for example those by Rohrer and Wirz are full of stimulating ideas and could well prompt new research projects. The papers are divided into six groups of 3 or 4 articles each and there are brief introductions to each group.

J. B. West

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