Book Reviews

Noradrenaline. Chemistry, physiology, pharmacology and clinical aspects. U. S. von Euler. Thomas, Springfield, Ill., 1956. 382 pp. 88 illus. $11.50.

For many years the chemical transmitter of sympathetic nerve stimulation was considered to be adrenaline, the main sympathomimetic substance of the adrenal medulla. Many inferences regarding the physiology of the sympathetic nervous system have been drawn on the basis of experiments with adrenaline. Important dissimilarities between the actions of adrenaline and of sympathetic nerve stimulation soon became apparent, however, and led to the concept that an ambivalent transmitter "sympathin" was liberated which acquired either an excitatory or inhibitory action on various organs through combination with one or the other of the hypothetical receptor substances, E and I.

This thesis became unnecessary when Von Euler, in 1946, provided proof that noradrenaline, the demethylated analog of adrenaline, known for nearly 50 years as a chemical curiosity, is the predominant sympathetic transmitter. The discovery provoked an almost unprecedented burst of research throughout all parts of the world. Indeed, it is seldom that a compound has attracted so wide an interest in so short a time. This interest, of course, has been motivated by the important implications of the concept that the adrenergic mediator of the internal economy of the body is not adrenaline but a chemically related compound with significantly different properties.

The rapid development of this concept has necessitated a reappraisal of the physiology of the sympathetic nervous system. It is indeed appropriate that the appraisal should be presented by Von Euler in the form of a monograph on noradrenaline, for his brilliant studies have produced major advances in this important field.

Virtually everything on scientific record concerning the biochemistry, occurrence, and function of noradrenaline is recorded in this book. Some 750 references are cited, the majority of them referring to papers published since 1946. The scope of the monograph is evident from the content of the various chapters.

The first chapter gives a historical account of the scientific climate that finally led to the discovery of norepinephrine in the body and the viewpoint that it is the specific transmitter agent in adrenergic nerves. In chapter 2, a description of the chemical and physical properties of the adrenalines supplies useful background material for problems concerned with the isolation and assay of these substances. Chapter 3 is a short and lucid account of what is known and postulated about the steps and enzymes involved in the biosynthesis and metabolic fate of noradrenaline and adrenaline. Chapters 4 and 5 describe extraction procedures for the isolation of the adrenalines from tissues, and of measuring the concentration of one in the presence of the other by bioassay, chemical, and fluorescent methods. These chapters are particularly rewarding to workers undertaking the sometimes difficult problem of assaying noradrenaline and adrenaline.

Chapter 6 deals with the proof that noradrenaline as well as adrenaline is a constituent of the adrenal medulla and the implications thereof. Thus, it has been present all these years, entirely unsuspected, in the preparations of "adrenaline" prepared from animal adrenal glands! The remarkable species variation in the relative amounts of the adrenalines in the adrenal glands is discussed. For example, the rabbit and the baboon have virtually no noradrenaline, and most other mammals including man contain only a small percentage of noradrenaline in their adrenals. The cat and the lion contain a considerable fraction of noradrenaline, leading to the interesting concept that felines with their peculiar type of activity, typically one of sudden attacks, require the release of the potent vasoconstrictor noradrenaline to maintain blood-pressure homeostasis.

Of particular interest are the adrenal glands of certain whales which contain noradrenaline almost exclusively. Is this because the whale had no need for the apprehension induced by epinephrine since it had no natural enemies until man and his harpoon appeared? Recent evidence is cited in this chapter for the exciting concept that the adrenal medulla as well as certain other parts of the body have two different kinds of chromaffin cells, one manufacturing noradrenaline and the other adrenaline. During early fetal life, the chromaffin cells in rats and in man are mainly noradrenaline producers. The proportion of adrenaline steadily increases, even beyond the time of birth, perhaps in preparation for the stressful situations found after the fetus leaves the security of the womb.

Chapter 7 describes the distribution of norepinephrine in peripheral nerves and in the various organs and includes a discussion of the mode of storage of the hormone in nerve terminals.

Chapter 8 is concerned with the level of the adrenalines in blood and other body fluids under normal and stressful conditions. This chapter indicates the difficulty of accepting many of the values in the literature for the concentration of noradrenaline and adrenaline in blood, when the specificity of the analytic method has not been appraised.

To many readers, chapter 9 will be the core of the book. It compares in detail the pharmacological actions of noradrenaline and adrenaline both *in vitro* and *in vivo* and makes it apparent that, while the responses to the two compounds may be qualitatively similar in particular organs, there are qualitative and quantitative differences that create a reaction pattern that is quite distinct for the body as a whole. The marked vasoconstrictive effects of noradrenaline compared to the effects of adrenaline makes the former compound peculiarly fitted for its role as a transmitting agent, while adrenaline, by dilating the blood vessels of skeletal muscle and of the coronary arteries, by increasing the force and output of the heart, and by mobilizing the carbohydrate stores of the liver, best fits the role of a hormone secreted in situations of emergency.

Current theories on the mechanisms of action of noradrenaline and adrenaline are described. While speculations are not lacking, the biochemical nature of the actions of the compounds is still obscure. In fact, it is not even known whether the receptors for excitatory and inhibitory actions are the same or different. A detailed comparison is made in this chapter of the inhibitory effects of the various classes of adrenergic blocking agents on the actions of noradrenaline and adrenaline.

Chapter 10 particularizes the value of the evidence that norepinephrine is the actual adrenergic nerve transmitter released at postganglionic sympathetic nerve endings.

The various factors that evoke the secretion of adrenaline and noradrenaline from the adrenal glands are taken up in chapter 11. It is especially interesting that the ratio of adrenaline to noradrenaline in the secretion may differ from that in the gland. For instance, splanchnic nerve stimulation evokes mostly adrenal-

ine, while stimulation of the hypothalamus results in a variable ratio of noradrenaline to adrenaline that depends on the location of the stimulus. The implication that there are specific centers in the brain for the release of adrenaline or noradrenaline from the adrenal medulla raises the question of their function.

Chapter 12 is an account of the urinary excretion of noradrenaline and adrenaline normally and during various diseases and physiological situations. Tumors of adrenal medullary tissue and the evidence that the main pressor substance in the chromaffin cells of these tumors is noradrenaline are described in chapter 13.

Of particular interest to the physician and to investigators in cardiovascular research is the last chapter, which describes the therapeutic implications of the ability of noradrenaline to raise blood pressure without materially increasing the cardiac output. Many potential uses, including the support of blood pressure in certain types of shock and in operative and postoperative hypotension, are cited.

The difficult task of bringing together a huge mass of scattered data has been superbly accomplished, and the result is a book that is simply and interestingly written. The unsolved problems in the field are clearly and provocatively defined, and the plethora of suggestions for future research will be appreciated by young investigators. It cannot fail to be of interest to the biochemist concerned with the biochemistry of function, and it is virtually indispensable to the physiologist and pharmacologist working on fundamental mechanisms of the autonomic nervous system and to the physician who is curious how drugs interact with the nervous system.

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The Changing Universe. The story of the new astronomy. John Pfeiffer. Random House, New York, 1956. 243 pp. Illus. $4.75.

This is the first popular-level book on radio astronomy, and it is a good one. In fact, it is very good. The author has taken unusual pains to become thoroughly conversant with this new science, aided by two successive Guggenheim Fellowships. He has visited many of the radio astronomers in England, Netherlands, France, Canada, and the United States. He has used every available opportunity to talk with Australians visiting this country and has corresponded extensively with most of the others. In one way or another, he has been in contact with nearly 100 scientists working in this field.

Pfeiffer begins by telling the story of Karl Jansky's discovery of "cosmic static" in 1931 at the age of 26, and of his failure to secure support for continued pure research at Bell Laboratories. "Rarely in the history of science has a pioneer stopped his work completely, at the very point where it was beginning to get exciting. Yet Jansky did just that . . ." Industry has developed a more enlightened attitude toward pure research during the past 25 years, but this has not prevented us from lagging far behind other countries in the development of radio astronomy. It is noteworthy that the first large research facility to be supported by the National Science Foundation, and with specific Congressional approval, is a Radio Astronomy Observatory to be located near Green Bank, West Virginia.

The book continues with Grote Reber's pioneer researches, all paid for out of his own pocket and done on his own time. In 1937 Reber built in his backyard a radio telescope 31 feet 5 inches in diameter, and in October 1938 he made his first successful observations. He confirmed Jansky's discovery of the Sagittarius source, and he also found other sources in Cygnus, Cassiopeia, and elsewhere. He also found that radio waves are not coming from the brightest stars one can see in the sky. "The implication of this notion is sensational. It means that the universe contains things never before observed. There are unique objects in the radio skies, objects whose light—if any—is too faint to see and which we can know only through their radio waves."

Wartime developments in radar and electronics have been helpful in accelerating the advance of radio astronomy. Reber tried to detect radar signals reflected from the moon, but without success. Signal Corps engineers did this with ease after World War II, using more advanced equipment.

The remainder of the book describes results from all branches of radio astronomy: solar, planetary, meteor, galactic, extragalactic, and the radio sextant. The concluding chapter, entitled "The future," describes some of the equipment now in the planning stages and ends with a discussion of the cosmologic problems that may be solved with the aid of radio astronomy.

The drawings of Sol Ehrlich add much to the attractiveness of the book. However, an old-fashioned optical astronomer, such as I am, cannot accept the implication of the drawing on page 220, which shows the Palomar Observatory draped with cobwebs. The apparent division between radio astronomy and optical astronomy is an artificial division due to technology, and it is all just plain unmodified *astronomy* as far as the basic problems and goals are concerned. A more likely picture would show two Palomar Observatories working twice as hard trying to keep up with the new problems being brought in by radio astronomy.

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New Lives for Old. Cultural transformation—Manus, 1928–1953. Margaret Mead. Morrow, New York, 1956. 548 pp. Plates, $6.75.

"The mid-twentieth century is an emergency for humankind . . . . Peasant, feudal, and primitive economies [are] crumbling before the onset of new ideas and new technologies. Traditional faith and traditional practice [are] disappearing. What [is] happening to those who [are] asked to skip centuries in the way they ordered their lives? How [do] these rapid changes inevitably involve those individuals who [live] through them in disturbances of personality which would leave their mark on society for many generations to come?" Accepting the challenge of these facts and questions, Margaret Mead decided that ". . . the most pressing problem, in the range of problems which anthropology was equipped to attack, seemed . . . to be how change occurred within a single generation." And so deciding, she spent 7 months living with "a people who have moved faster than any people of whom we have records, a people who have moved in fifty years from darkest savagery to the twentieth century, men who have skipped over thousands of years of history in just the last twenty-five years" —the Manus.

This was not her first experience with this small group of Melanesians; 26 years before, she had lived with them and consequently had written *Growing Up in New Guinea,* a standard reference for social scientists in particular and for a startlingly large lay audience in general. It was indeed a felicitous circumstance that such a careful scientist and lucid writer should have been an intimate observer of this profoundly important human "quantum jump" both before and after its occurrence.

And what has been this change? "Today they are friendly, where formerly they would have been harshly competitive; they are actively concerned with the prevention of types of behavior which they would formerly have regarded as natural and desirable; they are relaxed and unworried where they would formerly have been tense; they are rearing their children with a kind of indulgence