normal distributions in a variety of genetic, ecological, and evolutionary contexts. He then extends Russell Lande's description of conditions under which the joint distribution of individually normal allele effects at many loci remains multivariate normal.

The next section, Theory of Response and Limits to Selection, is similar in spirit. Alan Robertson contributes to both sections: a theoretical attempt to explain the common observation of selection asymmetry and a simulation study on selection with a large number of linked loci. Griffing describes a method for minimizing adverse effects of genotypic interaction, and Sved considers the opposition to artificial selection by natural selection at linked loci.

Three papers on mixed model theory relate to the use of performance records in the choice of breeding stock.

The three general papers will be of especially broad interest. Kempthorne's has already been mentioned. Comstock writes on the design of breeding programs for "*maximum* exploitation of . . . allele resources . . . in *minimum time*." Feldman and Cavalli-Sforza present one of the few attempts to break new ground, rather than to wrest the promised rewards from existing methodology. In "Quantitative inheritance, stabilizing selection, and cultural evolution," they describe an approach to the transmission of phenotypes that may apply to cultural—nongenetic—evolution as well. They begin with the original Fisher model of quantitative variation (two alleles; three genotypes with respective phenotypic contributions of $-a$, d, and a) and develop the consequences of an additional genotype-environment interaction, where the important environmental factor is the parental phenotypes.

In a special invited paper, Sewall Wright gives his views, after some 60 years as a major figure in the field, on evolutionary changes in phenotypic characters. He is challenged by a creationist (Paul Cornelius) and replies incisively.

The conference was seasoned with, among others, papers by Thoday on polygenes, Rendel on canalization, and Hartl on meiotic drive. Other major contributors include Karlin, Weir and Cockerham, and W. G. Hill, to name just a few. The book was promptly produced and is well composed and attractive. The editors did an admirable job.

Quantitative genetics is at once quantitative and inexact, successful in some of its applications and uncomfortable with some of its theory, full of inexorable arithmetic and modest conjecture. The present volume by design does not include human quantitative genetics and behavior genetics. Nevertheless it is a splendid portrait of a scientific reunion at a fitting homestead, Ames, Iowa.

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Neuroendocrinology

Hypothalamic Peptide Hormones and Pituitary Regulation. Proceedings of a workshop, Bethesda, Md., Nov. 1976. JOHN C. PORTER, Ed. Plenum, New York, 1977. viii, 366 pp., illus. $32.50. Advances in Experimental Medicine and Biology, vol. 87.

Three celebrations of progress in neuroendocrinology have been organized under the aegis of the National Institutes of Health, long the largest single sponsor of neuroendocrine research; this volume is a report of the most recent of these.

The first symposium, in 1962, was devoted to anatomical and physiological validation of the evidence that the brain controls the pituitary gland and that hormones influence brain function. Though based on sound principles, the conference had overtones of what Roger Guillemin has called the "prophetic era" of neuroendocrinology, an era characterized by clinical anecdotes and by insensitive bioassays of pituitary function.

The second symposium, in 1969, was the product of a frustrated NIH and its study sections; despite the continuing accumulation of physiological evidence of neural control of the adenohypophysis and the demonstration of biological activities in hypothalamic extracts corresponding to releasing activities for all the known anterior pituitary hormones, the crucial evidence, the identification of the structure of even one hypothalamic hormone, had still not been provided. The chemistry of the hypophysiotropic factors remained "prophetic."

But by 1969 the laboratories of A. V. Schally and of Guillemin were very close to identifying the chemical nature of thyrotropin-releasing hormone (TRH). Its structure was announced between the time of the conference and the production of galley proofs of the proceedings. This demonstration can be said to be the crucial validation of the portal-vessel chemotransmitter hypothesis of anterior pituitary control. It is the step that converted neuroendocrinology into a branch of neurobiology. All that was needed to legitimize the field was a genuine molecule. It is at this point that the era covered by the present volume begins. The field is so extensive now that no one volume can cover all the important issues. This volume contains a representative selection of some of the best work in neuroendocrinology and includes summaries of recent studies, many unpublished new data, valuable generalizing concepts, and comprehensive bibliographies of recent work.

The years since the last conference have seen the introduction and widespread use of radioimmunoassay, proper emphasis on the general phenomenon of neurosecretion, better understanding of the molecular biology of cell secretion and protein synthesis, and the elucidation of the chemical structure of two more hypothalamic hormones (luteinizing-hormone–releasing hormone, LHRH, and somatostatin) and the use of these substances by clinicians. The present volume describes these advances. Guillemin contributes an essay emphasizing that at least two of the classical hypothalamic hormones, TRH and somatostatin, are widely distributed outside the hypothalamus and that they may be derived from neuroectoderm. In fact, such cells may be part of the diffuse neuroectoderm system described by A. G. E. Pearse as part of the APUD (amine precursor uptake and decarboxylation) system. This view, reinforced by the recent dramatic discoveries of the endorphins, enkephalins, neurotensin, substance P, and the remarkable distribution of many peptides in specialized cells of both brain and gut (for example vasoactive intestinal peptide, cholecystokinin-pancreazymin, bombesin), permits a broad reconsideration of the nature of control of neuron function, which now must include a variety of specialized, pharmacologically (as well as structurally) coded connections.

There are other primarily neurobiological papers. S. Ochs reports on his work on axoplasmic transport in peripheral nerves, a phenomenon that now appears to occur in specific peptidergic neurons, which have been commonly considered to be neurosecretory. The broad distribution and variety of peptides in brain are briefly described by M. J. Brownstein. A. Barnea and colleagues describe the subcellular compartmentalization of the hypothalamic peptides, presumably a reflection of their concentration in presynaptic terminals. J. F. McKelvy summarizes the relatively modest knowledge of the biosynthesis of hypothalamic peptides, the study of which is made difficult because of the relatively small amount of secretion products made by only a small

population of cells. The greatest advances have been made in understanding neurohypophyseal hormone biosynthesis, which now appears to occur along the classical lines of protein synthesis, through the formation of a macromolecular prohormone.

More conventional but no less exciting aspects of neuroendocrinology are covered in the remaining portions of the book. Schally and D. H. Coy report their own studies and those from other laboratories on structure-activity relations of LHRH, the chemical structure of which was elucidated by the Schally laboratory in 1971. In addition to the intrinsic biological interest of these relations, structural analogs with increased activity may have therapeutic benefit in infertility (already demonstrated for several analogs); antagonistic analogs have a potential for regulation of fertility, including contraceptive control. Products effective either by nasal insufflation or through absorption over long periods of time have been developed. One of the most unexpected findings is that powerful stimulating analogs may actually inhibit or impede fertility.

W. Vale and collaborators present a summary of an extensive study of analogs of LHRH, TRH, and somatostatin. One interesting point is that analogs of somatostatin that have different potencies with respect to the inhibition of growth hormone, insulin, and glucagon secretion have been developed. One such compound, [D-Cys^{14}]-somatostatin, has, compared with somatostatin itself, potency of 270, 10, and 310 percent respectively to block secretion of growth hormone, insulin, and glucagon. F. Labrie and collaborators summarize their systematic studies of the molecular mechanism of hypophysiotropic hormone action on the pituitary and the mode of interaction of hypothalamic hormones, with peripheral organ feedback effects.

J. C. Porter and collaborators report data on the concentration of hypophysiotropic factors in rat portal-vessel blood obtained by a technique Porter popularized. They show that stimulation of the brain leads to release of LHRH together with an increase in plasma levels of LH. Similar studies in the monkey by J. D. Neill and collaborators suggest that at the time of ovulation there is an increase in portal-vessel levels of LHRH and that castration leads to an increase in hypophyseal portal blood levels, direct evidence of feedback control of hypothalamic hormone secretion.

A view at variance with the traditional view that the direction of flow of the hypophyseal portal blood is from hypothalamus to anterior pituitary is restated in the chapter by Porter and collaborators and is supported by the authors' measurement of the concentration of adenohypophyseal and neurohypophyseal hormones in blood removed from the long portal veins. They write, "Hormones from the pars distalis, pars intermedia, and pars nervosa are transported retrograde in the pituitary stalk." Thus "a mechanism exists whereby posterior pituitary hormones can reach in high concentrations the anterior pituitary." Further, "retrograde blood flow in the pituitary stalk provides a means of delivering pituitary hormones to the hypothalamus." The functional significance of high hormone levels in the hypothalamus, the result of retrograde flow, is unknown.

Knowledge of some of the other hypophysiotropic hormones is reviewed. Uncertainties about the chemistry of corticotropin-releasing factor, still obscure after more than two decades of work, are recorded by M. Saffran. The identity of the physiological prolactin-inhibitory factor is still unknown. In this case there are too many potential candidates, including dopamine, norepinephrine, and gamma-aminobutyric acid, all of which inhibit prolactin secretion. Of these, dopamine seems the most likely. Its presence in hypophyseal portal blood has been demonstrated by Barnea and collaborators, but, as is pointed out by Porter and collaborators in this volume, the concentration does not correspond to the functional state of prolactin secretion.

The final chapters of the volume deal with clinical applications of the releasing hormones: the elucidation of the interaction of LHRH and ovarian hormones in the control of the menstrual cycle (S. S. C. Yen and collaborators), the role of TRH in the regulation of TRH and prolactin secretion (A. G. Frantz), and the use of somatostatin for the study of the role of regulatory hormones in the control of carbohydrate homeostasis and its potential use in the therapy of diabetes (J. E. Gerich). Each of the clinical chapters is timely and well written and provides a level of conceptualization far more satisfying than is usual in primary publications.

The summary chapter by R. Gorski once again emphasizes the neurological aspects of neuroendocrinology. Although this volume will be the most valuable to active workers in the field, it will expand the horizons of any person interested in physiological regulation, brain function, and peptides. In common with its two predecessors the volume is in essence a progress report, and it records a staggering list of advances. The NIH can rest assured that it has supported a winning subject.

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Effects of Wind

Plant Response to Wind. J. GRACE. Academic Press, New York, 1977. xii, 204 pp., illus. $19.25. Experimental Botany, vol. 13.

Considering the large amount of work that has been devoted to the understanding and control of wind effects on plants, it is surprising that we have had to wait so long for an adequate description and evaluation of the subject within the covers of a single book. In this timely monograph, Grace introduces to the botanical investigator the physical concepts and techniques for studying plant response to wind and reviews our present knowledge about wind effects. Grace himself has made significant contributions to the subject through his studies of wind effects on leaf photosynthesis and water relations.

The book contains five chapters and a valuable list of more than 550 references. The text is lucid, excellently printed, and well illustrated. There are only a few, typographical errors, mostly fairly obvious. More significant, the index contains several incorrect page references and is incomplete.

The first chapter considers the nature, measurement, and control of air flow. The section on instrumentation includes outlines of advanced techniques of laser-Doppler and pulsed-wire anemometry and a comment on their possible application to studies of heat and mass transfer in leaf canopies. In considering the use of windbreaks to vary the wind for studies of plant response, the author points out the confounding of the effects of wind reduction with those of other environmental variables and makes a strong plea for more studies using the controlled environment of wind tunnels to complement field studies.

Chapters 2 through 4 deal with the physical concepts and physiological processes associated with wind response. Grace has avoided undue emphasis on the derivation of the mathematical equations underlying the con-