thin films, mainly anthracene, are treated by M. Pope, and internal photoemission (mainly for SiO_2) and the corresponding junction problem by A. M. Goodman.

It is a pity that the typography of the volume does not do justice to the contents, which should be appealing to many readers. Figures are presented at the end of each paper, in the manner used for a preprint. It would have been more helpful if they had been inserted in the appropriate places in the text.

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Cows, Sheep, Pigs

Growth and Development of Mammals. Proceedings of the 14th Easter School in Agricultural Science, Nottingham, England, 1967. G. A. LODGE and G. E. LAMMING, Eds. Plenum, New York; Butterworths, London, 1968. xii + 528 pp., illus. $32.

The intent of the 14th Easter School at the University of Nottingham was to provide an interchange between workers in fundamental sciences related to growth and experts in animal husbandry. The stated objective of the resulting volume is to review factors that govern growth and development of mammals. The book is coherently organized into sections on tissue growth, hormonal influences, prenatal and postnatal development, genetic and nutritional influences, carcass quality and assessment, and practical implications of factors affecting growth. As often happens with collections of papers, the volume contains a mixture of pedantic summaries, reviews of work from specific laboratories, extolment of favorite hypotheses, and presentation of original data. The coverage is about equally divided between the basic and the applied sciences. Chapter summaries rarely do so, but thoughtful readers will find that the presentations usually lead into timely and significant problems.

Anthropometric data derived from parallel radiograms illustrate how proportions of bone, muscle, and fat can be estimated during growth. Superposition of such data after phasing growth has exposed sex differences in rate of growth during childhood and adolescence which previously had been obscured by chronological summations. The implication is that seasonal and cyclical growth phenomena in other animals may similarly be obscured by nondiscriminate summations of growth parameters.

A discussion of the development of skeletal muscle gives a provocative but belabored review of the electron microscopy of muscle and the embryonic origin of multinucleate muscle fibers. Several pages are devoted to the latter although developmental biologists have regarded the controversy as settled for some eight or nine years. Adipose tissue is reviewed as a dynamic organ which synthesizes fatty acids and triglycerides. The roles of glucose, insulin, adrenalin, and the sympathetic nervous system as regulators of deposition and mobilization of fats are reviewed.

In adults as well as in children both lipolysis and protein synthesis correlate positively with concentrations of growth hormone in blood plasma. The authors suggest that "growth" hormone may have been a misnomer, since its pattern of secretion in children and adults appears to differ only quantitatively. The review, although speculative and teleological, is a synthesis of possible mechanisms for regulation by growth hormone.

A positive correlation between rate of growth and the quantity of RNA per cell (RNA : DNA ratio) in the pituitary gland is supported by original data. The growing animal thus has more protein-production machinery per cell and possibly, therefore, a higher rate of production of protein hormones by the pituitary gland. This interesting thesis apparently has not been reinforced by serum concentrations of pituitary gonadotropins or related to RNA : DNA ratios from growing but nonsecretory tissues.

Young, growing individuals have high and delicately balanced levels of output of thyroid hormone. Attempts to optimize thyroid hormone output in growing animals presuppose knowledge of endogenous thyroid activity for each animal and the optimum dose for that particular animal.

Potentials for production of wool, milk, and meat may be determined during gestation. Furthermore, knowledge of growth during prenatal life becomes increasingly more important as improved husbandry makes slaughter possible at earlier ages and an increasing proportion of the life span of the meat-producing animal is spent *in utero*. A calf, for example, may spend twice as much time in the uterus as it does in independent existence. It is reported that in the sheep compensation for undernutrition during gestation may require seven months, whereas lambs can be slaughtered at four or five months of age. Effects of reduced nutrition on prenatal growth in the pig, and polytocous mammals in general, are less detectable—in fact, it is controversial whether or not such exist. (Unfortunately the term "multiparous" is used in the loose medical and not in the precise zoological sense.) Because of this uncertainty a reduction in protein and energy intake in sow herds is suggested. A 30-percent reduction in daily protein intake might affect the compositions and weights of piglets at birth. (It is estimated that 30-percent reduction in protein intake has the value of less than one-half of one weanling pig saved.) Since the effects of reduced prenatal nutrition are difficult to detect and since reservations about the consequences remain, studies appear needed on the biological quality and economic performance of pigs after high and low planes of prenatal nutrition.

The last half of the volume is devoted largely to the more practical aspects of animal husbandry for meat production. Genetics of growth of cattle, sheep, and pigs, for example, covers breed differences in utilization of food, selection for growth characteristics, and heritability of body weight. The chapter on minerals in growth and development gives a generalized discussion emphasizing mineral elements as cofactors of hydrolysis, uptake, and biosynthesis. The titles "Assessment of carcass quality" and "Practical implications of factors affecting growth" speak for their contents.

The volume will be of more interest to those who are concerned with livestock production than to basic biologists. Because most of the eight sections are neatly subdivided into chapters on cattle, sheep, and pigs, this reviewer finds the title *Growth and Development of Mammals* misleading. The diversified topics are skillfully organized into a volume with more continuity than one usually expects from 24 contributed papers. The objective of relating basic research to practical problems of meat production has been achieved.

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