Genes of Change

Biochemistry of Differentiation. By Charles A. Pasternak. Pp. xiii+189. (Wiley-Interscience: London and New York, 1970.) £2.75.

THE aim of this book is to explain in fairly simple terms the biochemical approaches to understanding differentiation. The level can be fairly described as second year undergraduate, although Dr Pasternak says that the book is based on a lecture course given to third year students at Oxford. Although the author seems to be aware of the difficulties of developing a coherent theme on such a diffuse subject, he has perhaps remained too true to his lectures and has not been entirely successful in translating them into written form.

Most of the book seems to be taken up with establishing what most workers would now regard as an *ex hypothesi* starting point; that differentiation is achieved by the controlled action of specific genes, although this control may be exerted either of transcription or of translation (or indeed, in between—for example, at the level of the nuclear membrane). The discussion of differentiation in sea urchins and frogs is a good example of this concentration on symptoms rather than causes. Essentially, this chapter describes what is known about nucleic acid and protein synthesis during successive stages of embryogenesis. But while this is all doubtless very important, the real question remains unanswered, and indeed, unasked: what controls this differential gene action?

After six chapters leading to the conclusion that differentiation involves the specific syntheses of certain enzymes and structural proteins, Pasternak comes to two chapters concerned with the control of these processes. The first is devoted to excluding the idea that genes are differentially lost from differentiated cells.

It is only the final chapter which attacks the nub of the problem; but this general discussion of the levels at which control may be exercised both misses the central issue and is too simplified and compressed in what it does say. Can differentiation and development be explained solely by actions encoded in the genetic information of DNA or are there independent forms of information which cannot be reduced to nucleotide sequences in DNA, perhaps gradients in cells or positional information in membrane structure? Pasternak is too readily concerned with the mechanisms of differential gene action and not enough with the wider issue of whether these mechanisms, although necessary, are sufficient. This issue may be as much philosophical as scientific, and certainly one does not expect a full ex-

position; but the problem should at least be pointed out.

And the discussion about control of gene action leaves much to be desired. The section about whether histones are gene repressors, for example, although accurate is rather sketchy. Nucleic acid hybridization experiments are mentioned, but there is no caveat to explain why they are of only limited reliability in higher organisms. The problem of accounting for excess DNA—surely a central one—is not mentioned; the puffing of salivary gland chromosomes and its control by ecdysone and ionic levels is mentioned only in passing.

Surely a book on this topic should mention the Britten-Davidson model, if only to point out the very considerable drawbacks which there are to explaining the control of gene action in higher organisms by models analogous to those for bacterial systems? It is notable that 'operon' is not even cited in the index; it may perhaps be misguided to look for operons in eukaryotes, but so many workers think along these lines that it is imperative to explain how and why bacterial-like control systems relate or fail to relate to the systems which Pasternak discusses.

But of course, it is difficult to present an all round view of differentiation, especially in so small a book as this. So notwithstanding its defects, the book has its uses, to define some of the sorts of approach used to tackle differentiation. Certainly, it will confer a familiarity with the terms used and the systems which are popular. To end on a more mundane note, however, the volume seems expensive for so superficial a view of the subject, and it is a pity that it was not issued in a much cheaper edition.

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Physiology of Vision

Physiology of the Retina and Visual Pathway. By G. S. Brindley. Second edition. (Monographs of the Physiological Society.) Pp. xi+315. (Arnold: London, November 1970.) £4.50.

THIS second edition of Professor Brindley's well-known book, first published in 1960, has been carefully revised and the additional literature up to the time of going to press (September 1969) is well covered.

The opening chapter on the photochemistry of the retina contains an account of the changes that occur following irradiation of visual pigment. It deals satisfactorily with the complexities of the subject, and sufficient references are given to introduce the reader to the points of conflict in the literature. Greater prominence might have been given, however, to the views

of Bridges on the thermal regeneration of visual pigment from low-temperature photoproducts. Brindley also states that Lythgoe and Quilliam's transient orange is almost certainly pararhodopsin (metarhodopsin₄₆₅ or metarhodopsin III), though it is arguable that the transient orange stage in the bleaching of frog rhodopsin includes metarhodopsin I. The three chapters that follow—on the signals of rods and cones, the nerve cells of the retina, and the central pathway of vision—are wide ranging and a valuable guide to a diverse literature that is scattered both in time and language. These accounts I found to be both satisfying and stimulating.

The second half of the book is concerned with sensory experiments. After a brief introduction to the important distinction between Class A and Class B observations (those that respectively can and cannot be expressed as the identity or non-identity of two sensations) there is a chapter on visual illusions, that is, sensory observations that involve neither matching nor threshold. This clears the way for an excellent discussion of spatial, temporal and adaptational aspects of the visual threshold.

The concluding chapter is on human colour vision, with a detailed statement of trichromacy and its implications. Poor Hering gets short shrift. . . . "The arguments for Hering's theory may seem to some readers so feeble that they wonder why I mention the theory". Brindley rightly makes the point that the principal plank in Hering's theory is his argument from the appearance of colours—a Class B phenomenon which "though non-rigorous is not necessarily bad". Brindley's view is "that we must postpone judgement until it has been determined whether those aspects of the subjective appearance of colours from which Hering argued are independent of the environment of the subjects during childhood. Among terrestrial natural objects, green and blue are commoner colours than blue-green, and many languages have simple words for green and blue and a compound word for blue-green. It might be that for a child brought up in an environment where all these three colours were equally common, and with a mother-tongue in which all three had equally simple names, the assertions from which Hering argued would not hold. . . . But if the subjective simplicity of red, yellow, green and blue and the incompatibility of redness with greenness and of blueness with yellowness prove to be independent of upbringing, then Hering's argument is vindicated." Brindley's argument seems to me to imply a less than credible tyranny of words.

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