to growth factor signals which in many respects resembles the changes in gene activity of 'classical' differentiation. Furthermore, as knowledge of growth factor action increases, they also seem to fit nicely into the theoretical framework of signals and interpreters-of-signals developed by pattern formationists, with the advantage of being equipped with a body of understanding on their molecular mechanisms of action.

So where does the embryologist, seeking after knowledge and inspired by these thoughts, turn for information? Unfortunately there are few simple field guides to be recommended to the general reader. This may be because the area is growing so quickly, and encompasses so many diverse apsects that few have had the nerve (or the time) to try. However, *Oncogenes and Growth Control* edited by Kahn and Graf, comes close to fitting the bill. It comprises 46 chapters on diverse aspects of growth factors, oncogenes (now inexorably conjoined), signalling systems and receptors. Each chapter is admirably brief (ideally suited to those, like me, with the attention span of a five year old) and succintly summarizes a single topic. The reviews are mostly just that, pointing the reader towards the primary data rather than regurgitating it, and generally close with an outline of current preoccupations and likely developments. This fragmentation technique works well, encouraging readers to dip into the book at random and link different topics together for themselves rather than ploughing through a predigested version of somebody else's views. Again, because of the number of chapters, the coverage is generally good, and most of the major topical themes are dealt with. The editors have done a praiseworthy job with that often ugly creature, the multiauthor book, as the general standard of each chapter is uniform and good. They exhibit a light touch with their own contributions, which are confined to short overview pieces at the beginning of each section which can be read in their own right. The child-like jacket design is also delightful, and will hopefully find favour as a summary slide (copyright permitting), replacing the 'integrated circuit' design currently fashionable.

The drawbacks? well, as usual, the volume is cunningly priced to discourage a casual individual purchase and, perhaps inevitably, it essentially offers a snapshot of a rapidly moving field and will soon become outdated. Perhaps a paperback second edition will emerge next year?

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Organogenesis of the Kidney

L. Saxen
Cambridge: Cambridge University Press, 1987

It is a great pleasure for me to review this book. As the Preface to the book makes abundantly clear, its writing was a labour of love, summarizing and celebrating a quarter-century of devoted and rewarding study of kidney development by Saxen and his colleagues at the northern end of the European Developmental Axis.

The book is straightforward in its organization and clear in its presentation. There are successive chapters on the ontogenesis of the vertebrate excretory system, the experimental methods used to study kidney development, the important advantages of the kidney for study of morphogenetic tissue interactions, the status of knowledge about experimental tubulogenesis, and the special problem of renal vascularization and glomerular formation. The account will certainly be useful to those interested in the kidney, it is essential reading for those working in the intersecting plane of mechanisms of organogenesis and differentiation in complex developmental systems. Both will appreciate the fact that the volume is clearly and amply illustrated and provides an abundant bibliography.

Chapters 3 and 4 contain a detailed analysis of available information bearing on possible mechanisms of induction of nephric tubules, particularly the distance over which these mechanisms may act. As Saxen notes, interpretation of this information remains problematic and the situation is too complex to be adequately conveyed in a brief review. It is sufficient to say that the author makes available the explanatory options and notes that more than one may be operative.

The options include: free molecular diffusion of the agents involved; diffusion limited in some fashion to short range; interaction of cell-surface-associated molecules; interaction through matrix molecules; and molecular transfer 'through intercellular channels'. In the opinion of the Helsinki group, as I understand it, matrix molecules are likely to be involved but available evidence does not preclude participation of diffusible molecules as well. The uncertainty of the evidence dervies from the properties of various filter samples that have been used to block or transmit the inductive stimulus. I add my own view that, given current molecular techniques, more discriminating and precise approaches than filter barriers are called for.

In his concluding remarks (p. 143 onwards), Saxen makes clear that the book is a progress report that summarizes substantial advance but still lacks definitive conclusions. A diagram (Fig. 6.1) depicts 'much of our present knowledge of various molecular and structural events linked to the early, post-inductory development of the secretory nephron – but it is still not easy to find causal relationships within the general framework'. It was, of course, the hope of finding such relationships that generated my own interest in the kidney more than 30 years ago. It submit that hope springs eternal and this book renews it. The kidney remains an ususually favourable target for experimental studies on the detailed mechanisms of organogenesis and the extensive contributions of the Helsinki group have enlarged the foundation for continuing progress.

As to the precise nature of those mechanisms, few today doubt that much of the answer lies in the molecular information at the interface of embryonic tissues of differing developmental history. In what form the critical information exists and over what distances it can be transmitted is still not clear and there are differing interpretations of the available indications. But what is most important to understand is the informational code of the materials in the transitional interspace, particularly in their native combinations and resultant configurations

Nonetheless, information about the nature of these and similar materials in other circumstances is growing apace. Such matrix molecules as the collagens, laminin, and fibronectin are well characterized and others are being steadily added to the list. The concept of intercellular matrix being much more than structural packing no longer needs defense. For those interested in penetrating further into this fundamental biological problem, this book and the developing kidney provide a potentially most rewarding challenge.

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Developmental Biology

Virginia Walbot and Nigel Holder
New York: Random House, 1987

Another new undergraduate biology text, the title of which includes the word 'Development,' has in recent years arrived on my desk every few months. Depending on one's point of view, it either is or is not surprising that each has a distinctive character, a different concept of what the field of development encompasses, a particular flavour. Of course they all share

certain features as well, e.g. photomicrographs of various well-known embryos, and a plethora of beautiful and informative diagrams, the sort with which the college biology texts of my undergraduate era were never endowed Their similarities make it nearly impossible in evaluating any one of these books to avoid comparison. Nor is it possible to discuss their dissimilarities of 'flavour' in a wholly objective fashion, reactions to flavours being essentially a personal matter.

The latest arrival in my collection is *Developmental Biology*, by Virginia Walbot and Nigel Holder. According to the Preface, about half this book was written by these authors, the other half having been edited from drafts on special subjects produced by eleven 'contributors;' including some well-known developmental biologists such as John Gerhart, Roger Pedersen, and Joan Ruderman. Although individual pieces are not signed, their attribution, at least in some cases, is fairly obvious, and it can be said in general that this book actually presents two quite distinct flavours. The latter portion of the text consists of self-contained teaching chapters on a variety of particular topics, and some of these are truly excellent, e.g. the chapters entitled 'The Immune System', '*Drosophila* Development', 'Development of the Nervous System', 'The Development of *Caenorhabditis elegans*', 'Early Mouse Development', 'Genetic Control of Development in Corn', and 'The Genetic Control of Sex Differences'. Of these the first two listed are for my taste superior, but all are of unusual quality, both clear and sophisticated in treatment. One may easily quarrel with the selection of topics for special treatment, including topics not selected that should have been. For example, in Part 6, 'Development in Selected Organisms' in view of the current status of knowledge, it seems to me to have been a foolish choice to omit both *Xenopus* and sea urchin embryos, while including separate detailed chapters on both mouse and human embryos. Similarly, Part 5, 'Development of Organs', includes a chapter on vertebrate limb development, which consists largely of an abstract, nonmechanistic presentation of regeneration phenomenology, a chapter on sex differentiation and chapters on the nervous and immune systems, while the endocrine system, liver, muscle, skin differentiation, etc., as well as any mention of organogenesis in nonvertebrate animals or in plants, are all omitted from this major unit of the book. Some information on these various topics is scattered about in earlier regions of the work, however. In general the 'special topics' portion of this text has an intelligent quality, in which most of the main points of those topics considered are pleasingly dealt with. One feature, however, that I find very irritating if not downright nonscholarly, is the poor frequency of attribution with respect to the particular scientists who are responsible for the various findings cited in detail. There are no references in the text and the occasional citations of names seem in choice very capricious, and in number grossly inadequate.

Most of the earlier part of this volume has unfortunately a much less acceptable character. I would characterize it as a sort of trendy pastiche. Everything and anything that might provide background for browsing in some *au courant* molecular/cell biology journal in the year 1986, is stuck in somewhere, whether important or unimportant, probably right or probably off the beam, related to a major theme or not. Thus there suddenly occur tidbits on alleged gene inactivation by methylation, on the yeast *mat* locus, on antibody screening of cDNA clone libraries, on DNA sequencing methods, on unimportant detailed peculiarities of tissue culture cell behaviour, on giant mice produced by transgenesis with the growth hormone gene etc., etc. Not that these are uninteresting or unimportant items; they simply do not represent equivalent levels of sophistication or certainty, or do not bear an organic relation to the train of the presentation. The underlying weakness, of which the above is a mild symptom, is a lack of organization of this text according to thematic, intellectual principles. Thus, there is a large section called 'Molecular Biology', which is a clear enough but not very critical regurgitation of what has already been well enough done in several recent cellular and molecular biology texts. The character of this particular section aside, it should most certainly not have been separated out from developmental topics such as those considered from an almost completely nonmolecular point of view, in Chapter 12, 'Developmental Control in Eggs' (largely meaning embryos). This is scarcely an unavoidable choice in an undergraduate text, as a glance at the central region of Scott Gilbert's book of the same name (Sinauer, 1985) will show. From the latter, a student might gain in an organized way both the central features of morphological developmental processes and at least a general mechanistic view of the underlying molecular regulatory processes. The balance in Gilbert's book as to what should and should not be stressed is in my view superior (and unlike the Walbot–Holder book Gilbert's includes a decent set of text references, author index, and bibliography to boot). One key aspect of the relative lack of central themes in the Walbot and Holder text is that these authors seem at their most shallow in dealing with the central matter of gene regulation in animal cells. Thus there is a great deal of description and discussion regarding chromatin and nucleosomes, including nucleosome phasing, which has been seriously demonstrated in only a very few cases, and about DNase I hypersensitive sites; however, the simple, main interpretive fact that hypersensitivity often denotes sites of high specificity *cis–trans* DNA–protein interactions, is not dealt with. Such interactions, an essential part of regulation molecular biology, are barely touched upon, in contrast to histones, protamines, and the HMG proteins. The sole exception here is a brief discussion of interactions on the 5S rRNA gene. Discussion of *cis* regulatory sequences in the text is confined to TATA and CAT (sic) boxes (p. 180). The many minor problems in this area of the text include misstatements of the size of the *Drosophila* genome (p. 143), which is about 50% different from what is given; the probable number of genes in *Drosophila* given on p. 144 is likely to be two to three times too high; the cDNA kinetic method is given in great detail for RNA complexity measurements (p. 173), though it is in fact most useful for prevalence calculations, while in a completely different location in the book (p. 144) the more appropriate single copy saturation method is diagrammed. The authors, to their credit, have tried to cure or at least alleviate the sensation that the early regions of their text induce, of being subjected to an eclectic scatter of various information, by including summaries at frequent intervals. However, these are sometimes misleading, or anyway scarcely useful, e.g. 'Gametogenesis highlights the generation of cell diversity and the gradual epigenetic nature of development' (p. 26); the summary on p. 37 states that the rate of cell division is very rapid in cleavage, incorrect for lobsters and mice; the 'Catalogue of Cell Types in Animals' on pp. 240–245 would be absurd for insects or sea urchins, which for example do not generate neural crest cells, hair, mammary gland cells, or sebaceous gland cells; and all cells do not go through a process of terminal differentiation (p. 263). Finally, there is the question of taste, to return toward the quest for an adequate description of the flavour of this text. Where Gilbert's taste, with which I here agree, requires him to spend about ten pages on the crucial amphibian nuclear transplantation experiments and related

data in a discussion of nuclear totipotency, Walbot and Holder spend one third of one page. However, they describe at length (pp. 379–380) experiments on induction carried out with 'heat killed liver', 'a good head inducer', and 'coagulated marrow', 'a good tail inducer', which some people might think belong in the chant of the weird sisters of 'Macbeth' rather than in a modern developmental biology text. Taste dictates omission as well as commission. There is very little in this book on those aspects of embryogenesis where molecular and cytological development now merge, *viz.*, the spatial imposition of differential gene function in the embryo, save a brief mention of muscle mutants in *C. elegans* and a bit on *ftz* and the Bithorax complex in the *Drosophila* chapter. Much more should have been said earlier about *Drosophila*, as well as about the molecular biology of localized gene expression in the several other embryos where this is a major field of study.

For the reviewer too there is a question of balance. Do the excellent terminal chapters in this book outweigh the deficiencies noted? Would one use this book to teach undergraduate developmental biology? Should one use it for anything? My answers to these questions are no, no, and yes. For particular aspects such as the plant developmental biology that is interspersed throughout, as well as the special topics chapters cited above, it would provide a good supplementary teaching source. However, in my view, the science of development can begin to be treated in a more relevant manner than is done in this book, centred on the genetic and molecular basis of the process of epigenesis. The challenge is to wrap the layers of descriptive paraphernalia with which the field is clothed around this conceptual armature, without losing sight of its basic form.

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