presumed rules, and that accounts for evolution. It is not clear how a primaeval bacterium can have the incipient structure of both a mammal and an angiosperm, but I assume that these laws of structure allow for — even require — a rigid, prescribed sequence of change. It is also possible, as some of the authors suggest in this symposium volume, that one might have a mixture of natural selection and these laws of structural transformation, the latter dealing with the important changes in form. It is argued, for instance by M. Ito, that convergence in evolution is not explained by the standard idea of similar selection pressures producing similar structures, but that the reverse is true: the primordial structure is the same and that is why different kinds of organisms produce the same shapes. There is even the interesting suggestion by K. Ikeda that these structural rules might be exerting their influence directly on the DNA of the genome in the form of super control elements.

The problem of development receives considerable attention from a number of authors, especially Brian Goodwin. He seeks these laws of structure and asks whether perhaps some of the reaction-diffusion models of development inspired by Alan Turing, or the mechanochemical model of Murry, Odell, Oster and others, might lead us into the structural laws. The arguments for this and other more directly genetic influences on development are intelligent and sophisticated, but Goodwin has not made me a convert. For me, the quest of the grail of developmental biology is not some hidden set of laws, but a simple unravelling of the web of mechanisms that control development. I see the experimentalist who does developmental genetics as being on the right track, and there is much in current progress to encourage that view.

There is another aspect to structure and evolution development that should be mentioned. Many authors have recently pointed out that organisms can only build in one generation, or change over many, if they use the building blocks which are available to them. They have called these 'constraints' and made much of the obvious point that neither evolution nor development can make wildly abrupt morphological shifts. It is in these very constraints where structuralists see the hidden power that will explain all.

To return to the volume, let me say that it is a mixed bag of essays. Gerry Webster introduces the topic and many of the papers directly address the idea of structuralism, some clearly also embracing darwinism. A few are wonderfully impenetrable, while others, such as the short paper of K. Ikeda, are models of clarity.

D'Arcy Thompson's *On Growth and Form* is often referred to in the book, and this adds yet another facet to the psychological problem. For Thompson a satisfying explanation was a mathematical description. I understand and respect this, but it does not satisfy me. For the structuralist there is an unknown set of rules that govern form, but that does not satisfy me either, for I feel they may not exist and certainly it is unlikely that we will ever find out what they are. I am quite happy with vulgar natural selection and developmental genetics. □

John Tyler Bonner is in the Department of Biology, Princeton University, Princeton, New Jersey 08544, USA.

New development

Tim Hunt

Genes and Embryos. Edited by D. M. Glover and B. D. Hames. *IRL/OUP Press: 1989. Pp.228. Hbk. £27, $59; pbk. £18, $38.*

UNDERSTANDING how genes control embryonic development is one of the most important and exciting aims of biology. Thomas Hunt Morgan and his colleagues at Columbia University understood this when they provided the basis of modern genetics, but they made only modest progress in discovering how genes actually shape the organism. In the fruitfly *Drosophila melanogaster*, however, they chose the right organism to solve their problems, as Morgan's followers have since triumphantly demonstrated. The many advances in cell and molecular biology of the past 20 years or so were required, however, to confirm and flesh out the *Theory of the Gene* (Yale University Press, 1926).

But let us not forget that creatures that 'don't have genetics' have also shed light on development: amphibians led and arguably continue to lead the way in the study of induction (with nematodes coming up fast on the inside). Good progress (considering the formidable technical problems posed by development within a womb) has been made in describing and analysing mouse embryogenesis. Surprisingly, many of the key genes that control development in flies are found in vertebrates too, where they probably work in not-too-dissimilar ways. In fact, a tremendous amount is now known, and astonishing principles are emerging at an accelerating pace.

Now is a good moment to tell the world about these new understandings. People like me sense that these are stirring times but have trouble keeping their segments, parasegments, gap- and pair-rule genes in their correct conceptual slots. Stripey flies, mammalian homoeobox genes and growth-factor receptor homologues in worms and flies are frequently reviewed in specialist journals, but it would be wonderful if someone could put it all together and tell, if not *the* story, at least a well-illustrated outline of what the story is going to be. This will take more than a minireview in *Cell* or an article in *Trends in Genetics*. Perhaps the nearest approach to this ideal is chapter 16, "Cellular Mechanisms of Development", in *Molecular Biology of the Cell* (eds B. Alberts *et al.*, 2nd edn; Garland Press, 1989).

I had hoped that *Genes and Embryos* was the book I was looking for, but sadly it is not. Perhaps its opening sentence gives the game away: "This book reviews the exciting discoveries made over recent years which contribute to our understanding of development at a molecular level." It is the *molecular* that presents the problem, I think, for the authors are all excellent and their organisms apt.

Almost half the book is allotted to *Drosophila*; Kathryn Anderson, Michael Levine and Katherine Harding give commendably up-to-date accounts of developments in this fast-moving and tremendously impressive field. But their densely worded chapters are too sparsely illustrated for easy comprehension. My favourite chapter is that by Kenneth Kemphues on the nematode worm. He achieves a nice balance of background information, methodological explanation, shows some striking pictures and provides food for thought. Comparatively less is understood of frogs and mice, and it is understandable that the chapters by Tom Sargent and Ian Jackson are increasingly devoted to descriptions of particular genes that happen to have been studied and, particularly for the mouse, to purely methodological considerations. Less attempt is made to give an integrated or comparative view of the principles of development of these more complicated organisms. Perhaps it is still a bit too soon.

The dream book of late twentieth-century embryology thus remains to be written. It will need expert authors who meet to argue and refine their ideas and their presentation as well as a sympathetic editor and a gifted illustrator. The result will be a fantastic story — one that I had never thought to hear in my lifetime. □

Tim Hunt is in the Department of Biochemistry, University of Cambridge, Tennis Court Road, Cambridge CB2 1QW, UK.

In paperback

■ Just published by Cold Spring Harbor Press is *Molecular Genetics of Early* Drosophila *and Mouse Development*, edited by Mario R. Capecchi. Part of the series Current Communications in Molecular Biology, the book reports the proceedings of the Banbury Center meeting held on 20–23 April 1989. Price is $24.00.

■ Also just published in the same series is *Polymerase Chain Reaction*, edited by Henry A. Erlich, Richard Gibbs and Haig H. Kazazian Jr. Price is $22.00.