

gled blindly upon the flanks. But is such an interpretation really justified? From Burnet onwards every succeeding generation has felt just as confident in its geohistorical beliefs as we feel in ours. Their confidence was misplaced. Is ours? We reject today the geohistories devised by all ages before our own. Why, then, should we expect future generations to cherish our geohistories as representing ultimate truths? Allègre's book is a useful summary of the present state of our geohistorical thinking. Time alone will reveal whether our modern thinking has a greater durability than that enshrined in Burnet's eloquent theory of 1681. □

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Chocolate kookies

Peter A. Lawrence

Models for Embryonic Periodicity. By Lewis I. Held Jr. Karger: 1992. Pp. 119. Sfr. 195, DM 234, £84.80, \$156.

THE long-lived rift between genetics and embryology stems from the different natures of the two subjects. Genetics is a hard discipline full of calculations, statistics and measurements; even morphology is transformed into numbers representing heritability and expressivity. Embryology, at least until recently, has bordered on the philosophical and has featured wonder as much as analysis. The two disciplines have always attracted different kinds of scientists and this contributed in the past to the mutual distaste that delayed the disciplines' inevitable fusion.

One characteristic of embryologists, particularly those interested in the fundamental problem of pattern formation, is their propensity to invent theoretical models that aim to explain the mechanisms behind such diverse matters as patterning of butterfly wings, the orderly connections between retina and brain or the stripes of a zebra. Generally, perhaps because of the whimsical nature of embryologists, the models are rather loosely set out and live explanations of them are often accompanied by hand-waving and kookie looks. In this original little book, Lewis Held, whose style in science is more that of a geneticist than of an embryologist, has brought his incisive intelligence and background in computer programming to bear on a whole menagerie of models. He has scoured the literature with evident enthusiasm; he takes each model without favour,

holds it up and shakes it until the bits and bobs fall off, and presents it to us naked and unadorned. He explains the difference between related models in simple language and adds helpful diagrams and tables. The result is a very useful guide to what, no doubt, is a great deal of nonsense with a few valuable ideas mixed in.

For example, what are the essential differences between the prepattern model of Stern and the gradient-based models of Sander, Wolpert and others? If you have struggled with this conundrum in front of a class of mutinous students you will know how valuable it would be to have a copy of Held's guide at hand. The polar coordinate model (designed to explain patterns of regeneration in insect and vertebrate limbs), the epigenetic landscape of Waddington, Sperry's chemoaffinity model, Kauffman's model of transdetermination and many many others are all here, inhabiting the book like animals in a zoo. Some are well adapted and successful and others barely cling to life. All are given even-handed treatment as if there were no higher criteria that could judge them or junk them. Held has an entertaining and simple style; he uses a pleasingly large vocabulary and manages to avoid the heavy jungle jargon that becomes more and more commonplace (take a sideways look at the titles of papers in *Proceedings of the National Academy of Sciences*, for instance). Sometimes he achieves an almost startling clarity that makes the original papers he discusses look unbearably fuzzy and even makes some of the models look a bit ridiculous. But this is no bad thing.

The subjects dealt with cover a great deal of ground and include many organisms from alligators, *Anabaena* and *Antirrhinum* to *Xenopus* and zebras. The text is extensively referenced, and the list of more than 1,000 papers on patterns at the end will prove extremely useful. It is a pity there is no index.

This book will be welcomed by researchers who have a particular interest in the biology of pattern formation. It is mainly *theoretical* biology, because only a few experiments are mentioned and it is these that can allow one to evaluate models or even destroy them. But, of course, there wasn't room for the experiments and adding them would have obscured Held's purpose. The result is a short expensive book that is easier to understand than to pay for. It is not really a full scientific meal but, like a fancy box of chocolates, it makes a welcome addition to one. □

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To the heart of the matter

David Weatherall

Vital Circuits: On Pumps, Pipes, and the Workings of Circulatory Systems. By Steven Vogel. Oxford University Press: 1992. Pp. 315. £19.95, \$24.95.

IN one of the many asides in Steven Vogel's new book, there is an insert from the diary of Samuel Pepys, dated 21 January 1665. "Before I went to bed I sat up until 2 o'clock in my chamber reading Mr. Hooke's microscopical observations, the most ingenious book I have ever read in my life." Pepys' fascination with microscopy evokes feelings of nostalgia in Dr Vogel as he contemplates an age during which a newly published scientific treatise such as *Micrographia* was seized upon by the intellectual community at large. Sadly, he muses, we have progressed to the point at which the community is no longer interested, the treatise no longer intelligible, and when commercial bookstores would not dream of stocking such items. He is right, of course, which is at least one good reason why scientists who are suitably gifted should try to make their field accessible to a general audience. On the evidence of this book, Vogel has certainly succeeded in this task.

Vogel has set out to explain the complex workings of the heart and vascular system in a way that will be comprehensible to nonexperts. Using simple models derived from household plumbing, and examples culled from a wide variety of species, he leads us through the functions and regulation of the heart and circulation, and deals at length with the thorny problems of fluid mechanics and blood viscosity — topics which are so often ducked by teachers of physiology — with extraordinary clarity and lightness of touch. The sections on capillary circulation and oxygen transport are particularly well done. As part of our cardiological education, we are urged to dissect animal hearts for ourselves; a list of suppliers is included. We are even instructed on what to do with the hearts at the end of the dissection: there is an excellent recipe for a vindaloo that requires two pounds of diced ventricle. Every chapter is enlivened with a series of entertaining footnotes, the subject matter of which ranges from the reasons why Chaucer and Harvey use the female gender to describe nature to the dimensions of the *os penis* of the whale, a bone which, incidentally, seems to have changed its size quite remarkably in the 30 years since one was waved at me by an enthusiastic anatomist

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