

following a tortuous path along with the issues that were raised, eventually jumping 200 years to the latest developments which came with the marked progress in our understanding of nonlinear phenomena.

Throughout, Fleury avoids giving any equations. Would equations frighten non-physicist readers? This is a reasonable concern, but it tends, in my view, to hamper the presentation of several important aspects of the subject. For instance, crystal growth, which can be succinctly described by the diffusion equation, is here arduously represented in terms of a drunk's random way of walking. The outstanding progress made in the past decade on growth phenomena, which relies mostly on subtle mathematics, is laboriously presented. The reader may be reminded here of Richard Feynman's remark that the role of formulae is to shorten the description of laws that are otherwise cumbersome to state. This policy of rejecting any formal material in favour of lengthy discussions nonetheless provides the reader with a solid, bottom-up understanding of growth phenomena.

The breath of inspiration flows poetically through the book, but even so, the industrial applications of morphogenesis are not overlooked. The role of dendritic growth in electrochemical battery recycling, and why electrochemical growth on electrodes, whether fractal or dendritic, is a major obstacle to the development of electric cars, are clearly explained. The discussion of dendrite formation in the glass industry is also interesting. I would have expected more space to be given to dendritic and fractal crystal growth in metallurgy — perhaps the most important field for research, whether applied or theoretical. The author is clearly not attempting exhaustive coverage of his subject. However, the chapter on plants is probably the best a physicist can say on subjects such as phyllotaxy or pattern formation in biology.

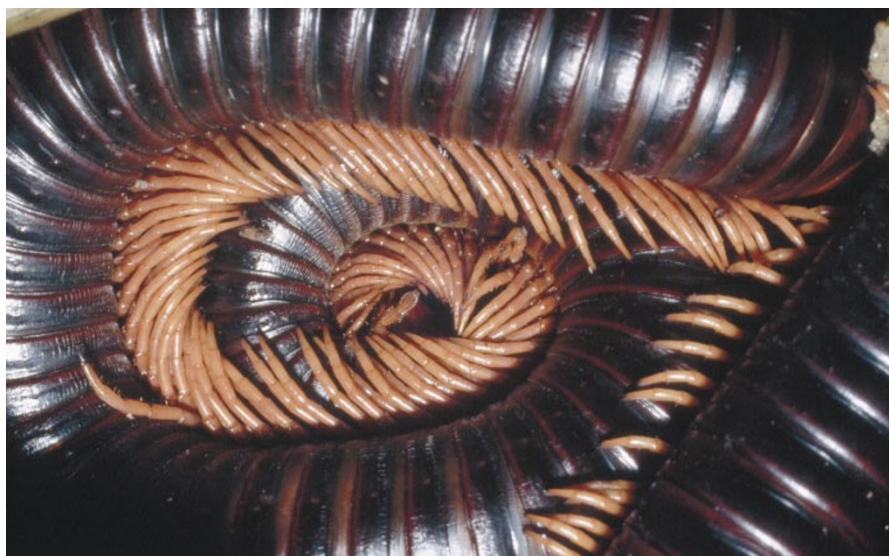
Those most likely to enjoy this book are physicists — researchers, teachers or students — interested in the formation of morphologies. But others with a background in physics might also find it interesting. The book offers physical insights, enlightening historical perspectives and up-to-date presentation of discoveries and concepts in morphogenesis. It is sometimes said that research problems are simply those that strike the human mind. Morphogenesis is one of them, and this book is a vivid and delightful account of it. □

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More, morphologically speaking

Universalités et Fractales: Jeux d'Enfant ou Délits d'Initié?

by Bernard Sapoval
Flammarion, FF160 (pbk)



Size is relative: the giant millipede *Spirostreptus giganteus*.

Stumbling about the world of little things

Waiting for Aphrodite

by Sue Hubbell
Houghton Mifflin: 1999. 242 pp. \$24

Martin Wells

For the past 40 years I have been trying to persuade students to do just what Sue Hubbell has done. I give them an essay title, tell them to go to the libraries and find out everything they can about it, ask advice, discuss it with their colleagues and then write an account for an interested layperson, in good English, with the minimum of scientific jargon. I point out, hoping to appeal to venality where an appeal to scholarship may fail, that there is money in this. You can flog the output as well as passing your exams. I tell them about David Attenborough, who did the same courses as I did at Cambridge two years ahead of me and then went on to base much of his glorious "Life on Earth" series on the biology we were both taught.

A pushover, I say, an example of the immediate cash value of education.

This is a lie. Whatever else it is, it isn't a pushover. You have to be rather good at it to make it stick. Hubbell is very good at it. In this random walk among the invertebrates, she picks her essay subjects cleverly, selecting animals, like millipedes and woodlice, sea urchins and spiders, that we all know but know very little about. She does her library work, tracks down the experts — she says that experts, particularly those in the less fashionable areas of biology, are always willing to talk about their specialities (I suspect she has charm as well as the capacity to do her homework) — and then writes up some very

interesting revelations. For example, I now know how a parasite of woodlice manages to include starlings in its life history, despite the normally cryptic habits of woodlice; about the regulation of sea-urchin fisheries, suffering now on the US Eastern seaboard because the Japanese love eating the gonads. I know about monoculture and the inadequate flight range of most species of bee; and why the generic name *Aphrodita*, far from being a tribute to the golden-haired goddess, is the result of a tasteless joke by Linnaeus based on the animal's common name, the 'sea mouse', and 'mouse', which just happens also to be a Northern European term for a woman's sexual parts. The man was a Swede. One lives and learns.



I hadn't read any of Hubbell's five other books before following this random walk. I shall now. She obviously gets fun out of biology, makes life more interesting for other people as well as herself, and — as far as I can detect — doesn't make mistakes. There is a bibliography at the end of each chapter which very sensibly includes elementary textbooks as well as more specialized material, just in case you want to check on her. There are occasional folksy bits (well, Americans are like that, aren't they?) that I am not too keen on, although I guess they help fill in the background. Actually, I do like to know something about the authors I read; the stuff on the dust-jackets rarely tells one anything significant. And, unlike Hubbell, good countrywoman as she is, I've always been a dog-hater — they rush about and disturb the wildlife. But all is forgiven, because this is top-level popularization and I wish we had more of it. □

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