

architecture right through to the fitness surfaces in the wild. This is a book with accounts that will fascinate most biologists. Certainly Endler's final listing of sixteen questions shows how lively this field is and could keep most researchers interested in adaptive evolution active for life.

Reference

SINERVO, B., DOUGHTY, P., HUEY, R.B. AND ZAMUDIO, K. 1992. Allometric engineering: a causal analysis of natural selection on offspring size. *Science*, **258**, 1927–1930.

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Genetics – Laboratory Investigations (12th edn). Thomas R. Mertens and Robert L. Hammersmith. Prentice Hall, New Jersey. 2001. Pp. 282. Price \$50.00, paperback. ISBN 0 13 019330 5.

As a recent convenor for a genetics MSc. course, I was amazed how many students graduating with a degree in genetics lack practical laboratory experience and possess limited knowledge of classical genetics. A good foundation of laboratory investigations is important to complement the theoretical information given in lectures and tutorials, but has been adversely affected by the need to keep costs down in many academic institutions in recent years. *Genetics — Laboratory Investigations*, the twelfth edition of a book that has enjoyed success since its initial publication in 1952, addresses this problem. It is a compilation of practical exercises that form a strong foundation in both classical genetics and more recent molecular genetic techniques for students at degree level. Many of the investigations are fairly low budget, while for those that include more expensive elements, cheaper options or sample data sets are given as an alternative. For example, the exercise on PCR gives a manual procedure using dishes of heated oil as an alternative where no PCR machine is available.

I was pleasantly surprised how much I enjoyed reading this book! Although the investigations do form a logical progression through the book, it is clearly not designed to be read from cover to cover. However, for myself it was a short nostalgic trip through much of my own undergraduate degree in genetics, and I was left wondering whether earlier editions of this book had had any influence on the classical genetics practical classes I attended in the 1980s, such as using *Drosophila* stocks with curly wings and plum eye colour to locate an unknown mutant on a particular chromosome, or counting grey and black ascospores of *Sordaria* to investigate linkage and crossing-over during meiosis.

This edition brings the content right up-to-date within a field that is presently changing rapidly. The 26 exercises cover the range from classical Mendelian inheritance to molecular

techniques such as PCR, RFLPs and DNA fingerprinting. Much of the human content is discussed in relation to the Human Genome Project where relevant, and also incorporated are new ideas, photographs, data sets and updated references and source material. All students' tastes are catered for with a wide variety of experimental organisms representing microbes, animals, plants and fungi. In particular the several human-based investigations should appeal to most. The exercises on analysing fingerprint ridge numbers and patterns, and whether your urine smells foul after eating asparagus, are particularly intriguing.

I was very impressed with the organisation and layout of this book. The text is written for degree-level students and is accompanied by an *Instructors Manual* that includes hints, sources of materials, and answers to the many questions posed. Each investigation is completely individual, independent and designed for use with no necessary modifications. All relevant references, notes and appendices are included in each exercise. Indeed the pages are perforated and hole-punched for easy removal and filing. Each exercise has a relevant introduction to the investigation, very clearly stated objectives, and all other information required for the exercise. Suitable data sheets for recording results, and relevant analyses are given, together with questions to test the understanding of the investigator.

I was disappointed that the book makes so little use of online web resources. With so many students having both an interest in the Internet and also access to online computing facilities, I feel this is a weakness that should be addressed for the next edition. Another shortcoming is that the book is so clearly aimed at an American readership with all data sets provided based on American examples. Again, online resources could overcome this.

I would certainly recommend the use of this book to anyone engaged in formulating or revising a degree-level genetics course.

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The Century of the Gene. Evelyn Fox Keller. Harvard University Press, Cambridge, MA. 2000. Pp. 186. Price £15.95, hardback. ISBN 0 674 00372 1.

Evelyn Fox Keller has been observing and reflecting on genetics for decades, first as a molecular biologist, later as a historian, best known for her biography of the corn geneticist and Nobel Prizewinner Barbara McClintock, and as a philosopher of science interested in gender and language. In *The Century of the Gene*, Keller offers a new interpretation of the past of genetics and a manifesto for its future. As she sees it, the transformation of genetics into genomics is a fundamental transformation, but it will remain incomplete unless, together with new data and new techniques, there are new concepts and new words as well.

Keller aims less to supply the new concepts and words than to clear intellectual space for their arrival. Her main target for removal is the concept of the gene. According to Keller, that reductionist concept dominated the science of heredity in the twentieth century, her 'century of the gene'. In each of her four chapters, she aims to show how a certain feature of the concept emerged, and how recent discoveries about heredity, development and evolution have stretched the concept to its limits, indeed beyond them. Although she declares the concept defunct, she predicts that the word 'gene' will live on, for reasons to do with, among other things, the way its ambiguities can be exploited and contained in the cultures of individual laboratories, and its usefulness to biotech firms, which depend on gene talk to conjure reassuringly simple images of their products.

The first two chapters deal with gene structure and function, respectively. Genes retain their basic structure with remarkable fidelity over the generations. On the concept of the gene, Keller argues, genes were like atoms, and their stability taken for granted. But it now appears that stability arises through the active interplay of molecules that proof-read, repair and so on. This shift in understanding gene stability has, in turn, led to a shift in understanding gene instability. The genetic changes that feed natural selection now appear to be copying errors left untidied; it may even be that maintenance systems have evolved to become error-prone under stressful conditions (Keller borrows Richard Dawkins' phrase, 'the evolution of evolvability', to describe this possibility). As for gene function, Keller holds that the concept of the gene was guilty not so much of omission as oversimplification. Since the discovery that genes can come in parts, in exons separated by introns, the cell has been reconceived as combining transcripts of the parts in different ways, enabling it to synthesize different enzymes from the same bit of DNA, according to the needs of the organism at a particular moment. Once assembled, these enzymes can have their structures and functions further modified through the binding of other molecules.

The third and fourth chapters stay with the theme of gene function, but explore it in connection with the development of the organism. Keller argues that talk of 'gene activation' and a 'genetic programme', while going some way towards picturing genes as interacting with one another, nevertheless reinforced one of the core features of the gene concept, that chains of causation affecting development begin with the genes. In the third chapter, Keller discusses recent findings about the causal

contributions of chromatin and the cytoplasm, and urges new talk of a 'developmental programme', distributed throughout the fertilized egg. The fourth chapter makes a similarly anti-reductionist case against regarding genes as controlling the regulation of development. When genes in the developing organism are 'knocked out' experimentally, the organism often will develop just fine, thanks to the existence of lots of other genes capable of performing the same function. Such massive redundancy leads Keller to speculate that perhaps what is selected is not so much the gene or the organism but the organism's life-cycle.

Although brief, this book is packed with good things. The historical analysis is unfailingly interesting, the scientific reportage lucid. Best of all, perhaps, is the sheer excitement the book communicates about the state of genetics and the need to get that state into proper focus, using all the intellectual resources going. Whether Keller's own attempt succeeds is another matter. Like many historians and philosophers of science, I am impressed by the diversity of gene concepts contained within what Keller sees (with caveats, and apologies in the footnotes) as a single concept. Keller's position has its defenders, however, and her own contribution to the case for conceptual unity is an important one. Less fortunate is her reticence about the connections between her anti-reductionist message and the arguments on gender politics that previously sustained that message. In brief, Keller used to argue that there were ideological affinities between the reductionist concept of the gene (linear, hierarchical) and male domination of women; indeed, that the reductionist concept of the gene was a masculine concept, against which McClintock, with her woman's 'feeling for the organism', had to struggle. Perhaps Keller gestures obliquely towards this argument when she suggests in her final sentence that 'new concepts can open innovative ground where scientists and lay persons can think and act together to develop policy that is both politically and scientifically realistic.' As it stands, however, that sentence has the ring of platitude. Such an impassioned book deserved better.

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Books received

The Origin, Expansion and Demise of Plant Species. Donald A. Levin. Oxford University Press, Oxford. 2000. Pp. 230. Price £24.95, paperback. ISBN 0 19 512729 3.