

Book Reviews

The Flexible Phenotype: A Body-Centred Integration of Ecology, Physiology and Behaviour

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The Flexible Phenotype: A Body-Centred Integration of Ecology, Physiology and Behaviour
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EDITED BY R. TODD ENGSTROM

The following critiques express the opinions of the individual evaluators regarding the strengths, weaknesses, and value of the books they review. As such, the appraisals are subjective assessments and do not necessarily reflect the opinions of the editors or any official policy of the American Ornithologists' Union.

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The Flexible Phenotype: A Body-Centred Integration of Ecology, Physiology and Behaviour.—Theunis Piersma and Jan A. van Gils. 2011. Oxford University Press, New York. 238 pp. ISBN 9780199597246. Paper, \$52.95.—A bit of a revolution in our understanding of the relationship between genotypes and phenotypes has been taking place in recent years. The age of the genome, though still with us and providing more and more depth to our understanding of molecular processes in biology, is entering a new phase. The recognition that gene sequences do not translate directly into phenotypes, and that environmentally generated changes can be transmitted across the generations, is changing our view of evolution. The environment is being reinstated as the key component that determines what phenotype a particular genotype gives rise to. This phenotypic plasticity is the essence of this book. Piersma and van Gils want to “encourage further integration of ecology, physiology and behaviour.” They set about this with great gusto, and their enthusiasm is contagious. Their chatty and intimate style both engages and challenges the reader throughout. They write in the first-person plural—“We grew up in the Dutch countryside and...,” “We think that...”—and occasionally directly address the reader—“Do you still remember that...” This makes us feel that we are all embarking on a journey of discovery together.

The Flexible Phenotype begins with an introductory chapter that sets out the focus of the book and the attitude and aims of the authors. The authors tell us that they are putting evolution in “the back seat,” but this isn’t really the case, because evolutionary thinking still pervades the whole book. However, the environment does take center stage. Piersma and van Gils are concerned with two kinds of phenotypic plasticity: that induced by the developmental environment, which is generally not reversible, and the reversible, often cyclic changes that occur in the phenotypes of animals living in seasonal environments. They focus more on the latter, and their main example is the Red Knot (*Calidris canutus*), the small shorebird species that they know best. The cyclic phenotypic changes in this small bird as it prepares for its long migration, or to breed, are remarkable. However, although the general approach is pretty bird-centered, nonetheless they do their best

to encompass examples from other taxa, and the book is packed full of interesting comparative information. Clear, and sometimes comic, diagrams, very much in the Dutch style set by Rudi Drent (to whom the book is dedicated), are used to good effect throughout. There are also a few boxes in which particular issues or concepts, such as allometry and Basal Metabolic Rate, are explored in a bit more depth. The authors further capture the reader’s attention with intriguing subheadings such as “Dutch dream cows do not exist,” “Dying strategically,” and “It takes guts to eat shellfish.” This will make the book particularly attractive to undergraduates and reduce the risk of lapses in concentration.

The book is divided into four parts. The chapters within each part are linked, and each ends with a short synopsis that recapitulates the main points. Part I comprises two chapters dealing with aspects of organism design. These deal with various challenges that organisms face, such as thermoregulation, energy and water balance, flight, and the need to maintain homeostasis. This is a quick romp through basic physiology. Part II deals with physiological constraints such as maximum sustainable work level, heat dissipation, and excretory capabilities. It then explores the effect of the environment and examines developmental and cyclic phenotypic changes, and their costs and benefits. I found the introduction of atrophy, such as muscle wastage, somewhat confusing here, because this is a very different phenomenon. I was a little surprised that the section on phenotypic plasticity in birds did not deal with molt, for the dramatic changes in plumage that some birds undergo is one of the most marked changes in phenotype that we see. The study of molt, its costs and benefits, is not yet well integrated into a life-history framework, and this would have been a nice context in which to further emphasize the need to look at the tradeoffs involved here. Molt is not totally ignored, however, and gets a mention elsewhere in the book in relation to color change in ptarmigan. Part III then brings in behavioral flexibility, particularly focusing on foraging. This section could cover many things, of course, but the authors maintain their body-centered approach; the link between foraging and gut morphology is given particular attention, with lots of information from the knot studies.

The final section, Part IV, tries to bring things together into an integrated framework. The important selection pressures of disease and predation are examined. The need for rapid responses in both these contexts is discussed, the immune system of course being particularly flexible. The implications for conservation are also explored. In the final chapter, we come back to evolution. I felt that a bit more consideration could have been given here to epigenetic effects. The recent realization that inheritance of gene expression patterns, not just of different alleles, is important in driving phenotypic change, and that this is where environmental factors, particularly in early life, play a key role, is causing us to recast the evolutionary paradigm. However, there is a nice diagram illustrating epigenetic inheritance pathways, though the suggestion that so-called “symbolic” or cultural inheritance is confined to humans is certainly debatable.

Overall, I liked this book very much. It is full of interesting information, presented in an accessible form, and there are 33 pages of references for further detail. It will be very useful for undergraduates, but also thought-provoking for researchers. And even if you do not agree with everything the authors say, you will certainly enjoy reading and thinking about it.—PAT MONAGHAN, *Institute of Biodiversity and Animal Health, Graham Kerr Building, University of Glasgow G12 8QQ, United Kingdom. E-mail: pat.monaghan@glasgow.ac.uk.*
