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The Poetry of Reproduction

Beverley Glover, *Understanding Flowers and Flowering. An Integrated Approach*, 2007, Oxford University Press, x + 227 pp, £XX, ISBN: 978-0-19-856597-0

Lars Hennig

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The flower is the poetry of reproduction. It is an example of the eternal seductiveness of life.

Jean Giraudoux, *The Enchanted* (1933)

Flowers are not only “example of the eternal seductiveness of life” but flowers are also fascinating in their own rights, and “Understanding Flowers and Flowering” is an intellectually seductive journey into the fascinating world of plant reproduction (Fig. 1). Did you ever wonder how flowers might have evolved? What the German poet Johann Wolfgang von Goethe has to do with flowers? Which signalling pathways induce flowering? What happens at the shoot apical meristem after floral induction? How do flowers develop? What are the D and E in the ABC model? Which strategies exist to prevent self-pollination? How can flower development be modified to change floral shape and structure? What makes flowers so colourful? What kind of pollen vectors can mediate cross-pollination? Are flowers under selective pressure to increase attractiveness for pollinators? Do pollinators differentiate between different floral forms, colours or scents? Many of these questions have been discussed in the context of “pollination syndromes”, i.e. the matching adaptation of certain flowers and specific pollinators caused by coevolution. But what is the evidence that pollination syndromes really exist? To find answers to these and many other questions you should read this book!

“Flowers and Flowering” delivers a detailed discussion of flowering time control including a chapter about historical development of the flowering concept. Surprisingly, the famous Maryland Mammoth tobacco is never mentioned,

and William Garner’s and Harry Allard’s desperate 12-year-long search for the physiological signal that allows flowering is not mentioned. It was not pure scientific curiosity but the great economic impact a non-flowering tobacco could have that drove the first systematic and detailed analysis of flowering control eventually establishing the concept of photoperiodic control of flowering (Garner and Allard 1920). Anecdotal information could also have enriched the chapter about the famous foliar theory originally proposed by Goethe (Goethe 1790). As pointed out in the book, Goethe thought of all plant organs analogous to a single type organ (the *Blatt* = leaf), but he did not imply any evolutionary or developmental concept. Thus, while we think that petals are organs derived from leaves, he thought of petals and leaves as different manifestations of a single idea – the *Blatt*. It has been argued that this view of Goethe is essentially idealistic (Platonian) (May 1913), and the deleterious consequences of idealistic philosophy for the idea of evolution to become generally accepted has been discussed in detail (Mayr 1982). Philosophical idealisms led Goethe to propose the foliar theory, and philosophical idealisms prevented Goethe from seeing the developmental and evolutionary interpretation of the foliar theory. While focussing on the foliar theory, another revolutionary aspect is often overlooked: Goethe used mutants to derive his conclusions! While his contemporary naturalists were convinced that in order to understand the normal, one has to study the normal, Goethe proposed to study “freaks” to understand the normal. He used floral mutants, selected by gardeners for their ornamental value such as filled roses, to derive conclusions about normal development. Much later developmental genetics led to the discovery of homeotic transformations and the basic mechanisms of flower development, and these results are described in several detailed chapters in “Flowers and Flowering”.

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Fig. 1 The wonderful world of flowers. (Images from Botanische Bilddatenbank, www.unibas.ch/botimage/)



Plant reproduction—from flowering time control to pollination—is a rapidly evolving field. For a textbook, “Flowers and Flowering” is refreshingly up-to-date and refers to many recent primary research papers (e.g. Abe et al. 2005; Corbesier et al. 2007; Dyer et al. 2006; Friedman 2006; Goldraij et al. 2006; Schönrock et al. 2006; Tamaki et al. 2007). The book gives detailed insights

in the current conceptual frameworks developed within the fields of molecular and developmental genetics, ecology and evolutionary biology. Being written by a single author and not compiled by an editor greatly improves readability and digestibility of the book. Almost unavoidable for such a wide synthesis of molecular and ecological data, some minor flaws went undetected: The statement that

vernalization is usually sensed by leaves and occasionally also by shoot apices, for instance, is not reflecting the current consensus of the field. To the contrary, it is believed that vernalization acts mainly on shoot apices, and on leaves only as much as they still contain proliferating cells (see e.g. Finnegan et al. 2007; Wellensiek 1962; Wellensiek 1964). Another detail, important for the colleagues in the field but less so for the average reader, is that the credit for the late flowering *Arabidopsis constans* mutant should go to Georg Redei (Redei 1962) and not to Marten Koornneef's seminal paper on *Arabidopsis* flowering time mutants (Koornneef et al. 1991).

The subtitle of this book is *An integrated approach*, and the author managed to unite fields that often appear incompatible. Molecular genetics of flowering time control and flower development were mostly worked out using *Arabidopsis thaliana* as a model species, while mostly self-pollinating *Arabidopsis* is of no use when studying the pollination syndromes. Nonetheless, insects visit *Arabidopsis*, and there can be up to 1% out-crossing (Hoffmann et al. 2003; Tan et al. 2005). The “integrative” side of the book would benefit by including some information on insect pollination of *Arabidopsis*!

Despite these comments, this is a very carefully written, detailed and up-to-date book. It can be recommended as a text book for courses at the master's level and for PhD courses alike. It can also help the specialist to get a quick overview about this expanding field. Finally, it is a great pleasure to read just for the love of flowers!

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