
Preface

Flowers are the features of plants that most endear them to human beings. We grow flowers in our gardens, we display them in our homes, and they feature prominently in our artistic history. Scientists, too, have been fascinated by flowers, and there is a long tradition of botanical study of floral structure and floral ecology. However, it is only in the last few decades that the tools of molecular genetics have been applied to flower induction, development, and morphology. The data arising from these studies, when combined with painstaking observation and analysis of the interactions of plants with their pollinators, are beginning to provide the first truly integrated understanding of both how and why flowers take the forms we so admire.

Traditionally, flowers are studied from one of a number of viewpoints. Molecular biologists may study the genetic control of flower induction or flower development, usually focusing on a single model species. Evolutionary biologists may study how flowers evolved, the forms of the earliest flowers, or the morphology of flowers of ancient lineages alive today. Pollination biologists may study the interactions between plants and their pollinating animals, the natural selection exerted by those pollinators, and how these pressures affect plant population dynamics. However, it is becoming clear that these various disciplines each have enormous power to inform and shape the work of the others. An understanding of how flower colour is controlled biochemically and genetically, for example, can be of great benefit when studying how pollinator-imposed selection might have influenced the evolution of petal colour within a group of plants. Similarly, an understanding of how time of flowering influences competition with other species in the same community can be of great help in

understanding why and how certain genetic components of the floral transition mechanism are conserved and others are less so.

I hope that this book might serve as a starting point for those interested in taking such an integrated approach to the study of flowers. I have written it, and revised it for this second edition, with the intention of helping to bridge the gaps between the different disciplines that work with flowers. My aim is to provide students and researchers studying one aspect of floral biology with an overview of other important aspects of flowers, both to help them to set their own work in context and to encourage them to consider experiments which might lead to greater integration of the field. In particular, I hope that this book will encourage dialogue between floral biologists of all varieties, with a long-term view to ensuring a continuing increase in interdisciplinary studies of flowers.

The book is divided into three main sections. Section I is introductory, giving some necessary background to the evolution of flowers and to the history of scientific thought on flowers and flowering. In this second edition the chapter on the evolution of flowers has been extensively revised and updated. Section II considers the molecular mechanisms that control flower induction, flower development, and floral mating type, providing coverage of the genetic material available for shaping by natural selection. This section is initially focused on a very few species of model plants, looking at the molecular similarities which unite all flowers. In the later chapters it considers the development and reproductive strategies of plants from a range of species, with a new chapter on the floral transition in diverse species, and extensive revision of the chapter on floral development in various groups. Section III extends

this analysis much further, considering the explanations for the differences between flowers, rather than their similarities. This section moves between molecular explanations for flower morphology and the ecological consequences of that morphology, in an attempt to integrate what we know both of how and why different flowers take their different forms. A new chapter on the lability of floral form considers how floral traits change within phylogenetic contexts. Finally, the epilogue attempts to draw out some themes which persist throughout the book, suggesting possible future directions for the field.

Many people have contributed to the development of both the first and second editions of this book, and I am particularly grateful to all members of my own research laboratory, past and present, for enthusiastic support and helpful discussions at many points in the process. The second edition has benefited from the suggestions and advice of reviewers of the first edition, and I am particularly grateful to Doug Soltis, Elena Kramer, and Martin Ingrouille for constructive comments. John Parker, Caroline Dean, David Hanke, Cathie Martin, Jeff Ollerton, Rob Raguso, and Nick Waser read various sections of the book in detail, and I must thank them all for the time and care that they took and for their excellent suggestions and advice. Many people were kind enough to provide me with images for figures. While these are acknowledged in the relevant figure legends, I particularly thank Nick

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