Book Reviews

Flowering and its manipulation edited by Charles Ainsworth volume 20 in the Annual Plant Reviews series, Blackwell Publishing (11 chapters, 285 pages).

This handy book in the Annual Plant Reviews series is intended to be a convenient source of topical and up-to-date material on the biology of flowers and flowering for researchers and postgraduates. By and large, it succeeds.

Part 1 covers "Core development and genetics" including floral induction and patterning. Part 2 covers "Specialized components of development" such as monoecy and cytoplasmic male sterility (CMS). Part 3 is curiously called "A developmental genetic model for the origin of the flower." This must be a typographical error as this is the title of a stimulating chapter in the first part by Baum and Hileman. This part has nothing to do with the origin of the flower, but does contain useful chapters on flower colour and scent. A single chapter on flower senescence (appropriately the final chapter) is given a "part" of its own (Part 4).

Baum and Hileman's developmental genetic model for the evolutionary origin of the flower is one of the most interesting and innovative chapters in the book. Baum and Hileman propose a three-stage model for the origin of the flower from a unisexual lax cone. The first step (according to them) is the evolution of a bisexual axis via a gynomonoecious intermediate. They speculate that homeotic conversion of microsporophylls to megasporophylls in a pollen cone is responsible, probably involving changes in the B-class and C-class floral MADS-box genes.

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The next step, they posit, is that the axis became compressed and determinate as C-class genes became negative regulators of the meristem gene, WUSCHEL. Then a petaloid perianth evolved by sterilization of the outer stamens. Baum and Hileman speculate that this arose by WUSCHEL evolving a reciprocal regulatory function for the C-class genes. Finally, a dimorphic perianth evolved (calyx and corolla). This, they suggest, coincides with B-class gene function becoming dependent on the expression of the gene UNUSUAL FLORAL ORGANS (UFO). This model is highly speculative, but as the authors point out, it fits the facts and makes testable predictions.

Kramer (chapter 3) gives a very useful state-of-play review of floral patterning by MADS-box and other genes. The ABC model originally put forward by Coen and Meyerowitz 15 years ago has stood the test of time remarkably well. Elements have been added but the original core model has come through intact. As Kramer points out the more recently discovered E-class genes could not have been found by the original mutagenesis screens because of their high redundancy. However, our understanding still relies heavily on *Arabidopsis* and *Antirrhinum*. Further refinements will almost certainly come from the investigation of a wider range of flowering plants.

Generally, the book is timely with excellent quality and good coverage of the subject. If I have one quibble it is with the references. Mostly these are fine. However three chapters (2, 4 and 5) unaccountably have no titles of articles in the references. This inconsistency makes it hard for the reader to judge the subject matter and relevance of this mysteriously title-less cited literature.

Biology of the Plant Cuticle
edited by Markus Riederer and Caroline Müller
2006
Blackwell Publishing. ISBN: 1-4051-3268-X

The plant cuticle is the interface between the plant and its environment. Thus, its biological properties must reflect the important roles it plays in both biotic and abiotic interactions. Composed of both waxes and cutin, a bio-polyester the structure of which is still unknown, this multi-functional hydrophobic layer is the focus of intense research. This book presents a thorough and comprehensive review of this research covering every aspect of the biology of this important surface, the first of its kind in many years. Significant progress has been made in this field in recent years making the publication of this volume very timely.

The introductory chapter provides a logical and succinct overview of the essential functions of the cuticle and serves as an introduction to the subsequent chapters. It also provides an extensive literature review of every function that has been attributed to the cuticle, briefly describing the supporting evidence that demonstrates the properties of the cuticle with respect to these functions.

Chapter 2, nearly a book on its own, is a detailed analysis of the cuticle from the perspective of ultra microscopy technique. A careful review of the literature with descriptive figures and excellent micrographs provides an in depth analysis of the ontogeny and developmental aspects of the cuticle. In addition, the author provides extensive descriptions of the different structural kinds of cuticles that have been described as well as the distribution of these types within plants and plant organs. A similar extensive review of the morphology and distribution amongst plants of epicuticular wax types is also in this chapter. In short, this is perhaps the most extensive literature review of the ultrastructure of

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plant cuticles ever published. As a reference, it is invaluable, as it will serve as a comparative index of cuticle structures from a staggering number of plants.

Cutin is a polyester, made up of monomers derived from C16 and C18 fatty acids. However, like many plant polymers such as lignin, the three dimensional structure of the assembled polymer is still a mystery. Chapter 3 is a succinct description of what is known about the properties and structure of the cutin biopolymer matrix. This chapter describes analytical techniques in polymer chemistry that are not familiar to the typical plant biologist, nevertheless, even a casual read provides an interesting overview of this fascinating polymer matrix. It is important to mention here that the authors do not lose sight of the biological relevance of the physico-chemical properties that have been described using advanced techniques such as solid state NMR. For example, the elasticity of tomato fruit cuticles is important to prevent fruit cracking, which is a costly disorder in tomato crops.

Chapters 4 and 5 provide a careful review of the composition and biosynthesis of cuticular waxes, respectively. With a special emphasis on the experimental approaches used to determine these compositions, chapter 4 provides the reader not only with a very useful review of available methodologies, but also an extensive and critical examination of the current literature describing the composition of waxes in plants studied to date. The biosynthetic pathways responsible for the waxes are described in the subsequent chapter providing an extensive and up-to-date review of the genes and enzymes involved in these pathways. As well, a thoughtful discussion on the little-understood secretion and transport of the waxes from the presumed site of biosynthesis to the plant surface is also provided.

The optical properties of the plant surface are potentially important to the plant with respect to UV radiation. Chapter 6 describes the current methods available for studying surface optics with special reference to the plant cuticle.

Chapters 7 and 8 describe the cuticle with respect to its permeability to both lipophyllic and polar compounds. The issue of transport across the cuticle is relevant to not only fundamental biological questions

such as the release of defensive plant secondary metabolites, but also agricultural applications such as herbicide efficacy. These chapters provide an introduction to the approaches used by researchers in this field as well as useful literature reviews.

The main physiological function of the cuticle is the prevention of water loss; the transpiration of water through the cuticle is the focus of chapter 9. Much of the literature describing the permeability of plant cuticles to water requires a good understanding of the theory that addresses the transport of water through a membrane. This chapter provides an explanation of these models and the application of them in describing the environmental effects on water transpiration through plant cuticles and the significance of stomatal closure with respect to water loss.

In addition to its role in water relations, the cuticle is also important in post-embryonic development, being required for the prevention of organ fusion. The biological significance of the phenotypes of known cuticle mutants is discussed in Chapter 10. Special emphasis is made on the model plant *Arabidopsis thaliana*, where much of the recent advances in this area have been made.

The role of the cuticle in the interactions between plants and microorganisms and insects is the focus of the last three chapters. Like the previous chapters, clear explanations of the methodologies, and their respective pros and cons, are provided in addition to a review of the state of knowledge in these fields.

Biology of the Plant Cuticle is not only comprehensive in its content, but also the chapters are well integrated. Individual chapters do not stand alone, but refer to the other chapters where relevant. Moreover, an extensive index is provided as well. I would strongly recommend this text as an authoritative reference for anyone interested in this aspect of plant biology.