

Preface

Conventionally, architecture relates to buildings, embracing both art and science, and specifying both form and function. In scope, this closely matches the study of plant architecture. From an artistic perspective, we might marvel at the astonishing diversity of aesthetically pleasing plant structures; yet, as scientists, we know that through natural selection, very little of form is dissociated from function.

The origins of studies of plant architecture and their influences on human existence are steeped in history, but from a twenty-first century perspective, the field has been transformed from a discipline of observation and description into one in which complex networks of genetic, chemical and environmental factors can be directly manipulated and modelled. New insights are emerging on fundamental aspects of the plasticity of development – a phenomenon unique to plants and therefore charting territory not encountered in animal or microbial systems. At the same time, increasingly sophisticated knowledge has provided the foundations for many revolutionary practices in agriculture, horticulture and forestry. Arguably, manipulation of plant architecture has been one of the greatest mainstays of plant improvement, perhaps second only to the discoveries of the nutritional requirements of plants. Whereas science has been only marginally successful at tweaking improvements in the biochemistry of photosynthesis, manipulation of architecture – and hence efficiency, uniformity and ease of plant production – has improved almost beyond recognition. Genetic regulation of stem growth and manual interventions such as pruning are two notable successes. With the advent of the 'gene revolution', there are countless new opportunities for selective modification of plant architecture.

The 10 chapters of this book range from the molecular and cellular through to the whole organism. Chapter 1 explores intracellular processes, focussing on mechanisms of regulation of cell shape, division and directions of growth. Chapters 2–4 detail the structure and regulation of vegetative shoot systems, from the linear extension processes of shoot elongation to the efficient development of planar leaves and three-dimensional branching patterns. Chapter 7 succinctly presents the root version of all these aspects. Chapters 5 and 6 move to the reproductive phases of shoot development, contrasting the highly conserved ordering of floral organs with the diversity of final flower structures and inflorescence arrays. Chapters 8 and 9 cover more complex systems – perennial woody species, along with possibilities for modelling approaches to describe and predict architectures. Chapter 10 rounds off the volume with a perspective on key applications of plant architecture in horticultural and agricultural contexts.

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