

Preface

In the twenty-first century, plant anatomy remains highly relevant to systematics, paleobotany, and the relatively new science of developmental genetics, which interfaces disciplines and utilizes a combination of techniques to examine gene expression in growing tissues. Modern students need to consider information from an increasingly wide range of sources, most notably integrating morphological and molecular data. The third, thoroughly revised, edition of this book presents an introduction to plant anatomy for students of botany and related disciplines.

Although the simple optical lens has been used for centuries to examine plant structure, detailed studies of plant anatomy originated with the invention of the compound microscope in the seventeenth century. Nehemiah Grew (1641–1712) and Marcello Malpighi (1628–1694), physicians working independently in England and Italy respectively, were early pioneers of the microscopical examination of plant cells and tissues. Their prescient work formed the foundation that eventually led to the development of our understanding of cell structure and cell division²⁷. Other early outstanding figures included Robert Brown (1773–1858), who discovered the nucleus, and the plant embryologist Wilhelm Hofmeister (1824–1877), who first described the alternation of generations in the life cycle of land plants. In the nineteenth and twentieth centuries plant anatomy became an important element of studies of both physiology and systematic biology, and an integral aspect of research in the

developing field of anatomical paleobotany, led by such luminaries as Dukinfield Henry Scott (1854–1934). The physiologist Gottlieb Haberlandt (1854–1945) utilized anatomical observations in his ground-breaking work on photosynthetic carbon metabolism. One of the most notable plant anatomists of the twentieth century was Katherine Esau (1898–1997), recognized particularly for her work on the structure and development of phloem and her influential textbooks on plant anatomy³⁰. Other important textbooks include works on paleobotany, morphology, anatomy and embryology^{13,34,68,106}.

The invention of the transmission electron microscope (TEM) in the mid twentieth century allowed greater magnification than any optical microscope, and hence revitalized studies in cell ultra-structure and pollen morphology⁹⁸. The subsequent invention of the scanning electron microscope (SEM) provided greater image clarity and much greater depth of focus than light microscopes, and thus further increased accessibility of minute structures, including seeds, pollen grains and organ primordia^{28,98}. More recent innovations, including fluorescence microscopy, differential interference contrast (DIC) microscopy and confocal imaging, have allowed enhanced visualization of tissue structure. Others, including nuclear magnetic resonance (NMR) imaging and high-resolution X-ray computed tomography (HRCT) facilitate enhanced visualization of three-dimensional objects.