Preface

Carnivorous plants have been, and continue to be, an endless source of fascination for scientists and nonscientists alike. Scientists learn much about general theoretical principles from exceptions to the rules, and the idea of "killer" plants is a staple trope of science-fiction novels, horror films, and Broadway shows. The two editors of, and the dozens of contributors to, this volume, came to our studies of carnivorous plants through a range of different routes, but all of us share an abiding curiosity in the form, function, and evolution of what Charles Darwin called "the most wonderful plants in the world."

Although a walk through any bookstore anywhere in the world will turn up a seemingly endless array of "coffee-table" books replete with lavish—and occasionally lurid—photographs of carnivorous plants, there are surprisingly few synthetic, scientific monographs about them. Charles Darwin (1875) wrote the first one; Francis Lloyd (1942) wrote the second; and Barrie Juniper, Richard Robins, and Daniel Joel (1989) wrote the third. All of these authors focused attention on the unique traits of carnivorous plants, provided detailed descriptions of carnivorous organs, and unequivocal demonstrations that some plants indeed eat animals.

Both of us editors have, at intervals, been approached by colleagues and publishers to synthesize the current state-of-the-science of carnivorous plants, but in the three decades since Juniper et al. was published, the range of studies and the number of papers published about carnivorous plants has grown far too large for any single person or small group of people to handle. This new synthesis of research on carnivorous plants, therefore, is a joint effort of many individuals and research teams working around the world, and we hope that it is as inspiring to future students of carnivorous plants as Darwin (1875), Lloyd (1942), and especially Juniper et al. (1989) have been to all of us.

In contrast to Darwin, Lloyd, and Juniper et al., we focus attention on the evolution and systematics (Chapters 3–11), physiology (Chapters 12–19), and ecology (Chapters 2, 21–26) of carnivorous plants, and use the existing data to explore how knowledge about carnivorous plants can inform our understanding of noncarnivorous ones—and *vice versa*—and provide opportunities for drug development and biomimetic technologies (Chapter 20). The application of molecular systematics in the last two decades has firmly laid to rest the hypothesis that carnivorous plants form a single evolutionary lineage (Croizat 1960). New species within established carnivorous genera continue to be described (Chapters 4–9), and carnivorous species in two other genera—*Paepalanthus* and *Philcoxia*—have been discovered (Chapter 10). The set of traits that defines the "carnivorous syndrome" has narrowed (Chapter 1) as it has become clear that carnivory not only can be gained in evolutionary lineages but lost in them, too (Chapter 3).

New details about how traps work have been revealed by a combination of technological advances (e.g., high-speed cinematography) and elegant experiments (Chapters 12–15). Biochemical analysis of digestive physiology (Chapter 16) in combination with genomic analysis (Chapter 11) have given rise to new insights into how carnivorous traits evolved from mechanisms that defend plants from herbivores and pathogens. The cost-benefit model for the evolution of carnivory in plants (Givnish et al. 1984), which has inspired decades of research into carnivorous plant ecophysiology, has been refined further (Chapter 18). Syntheses of experimental results clearly illustrate the importance of nutrient budgets for understanding the evolution of carnivory by plants while highlighting key differences between terrestrial and aquatic carnivorous plants (Ellison and Adamec 2011; Chapters 17, 19), differences that can be surprisingly large.

Studies of carnivorous plants also have moved out of the laboratory and into the field. Observational data collected in the last thirty years have amplified dramatically findings of previous generations of naturalists, while manipulative experiments have led to new discoveries about the myriad direct and indirect interactions that contribute to successful carnivorous plant lineages (Chapters 21–26). Carnivorous plants and their symbionts have been developed as model ecological systems for studies of food-web dynamics (Chapters 23–25), ecological tipping points (Sirota et al. 2013), and evolutionary responses to climatic change (Chapter 24).

Finally, Juniper et al. devoted but a single, brief paragraph at the end of their Preface to the conservation and preservation of carnivorous plants. In the last three decades, overcollection and poaching of carnivorous plants from the field, loss of unique and irreplaceable habitats, and climatic change have become existential threats to many carnivorous plant species (Chapters 4–10, 27, 28). It is no longer enough only to provide data to authorities and agencies in the hopes that they will be convinced by the data to conserve and protect carnivorous plants. As the scientists who know them best, we have an obligation to get involved in actions to ensure the integrity of their habitats and their continued persistence in them (Ellison 2016).

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