

Preface

The field of taxonomy or systematics has undergone many dramatic changes over the past three decades. Although this field was at the center of the life sciences for several centuries, technological breakthroughs of the 20th century led to the development of strong studies in medicine, genetics, ecology, physiology, and molecular biology. Recently, the field of taxonomy has shown an amazing resurgence. The fields of medicine, genetics, ecology, physiology, and molecular biology are now strongly influenced by tools developed within the systematic community to reconstruct the evolutionary history of life. Growth within the field of taxonomy/systematics has turned this field of study into one of the more exciting areas of investigation in the life sciences.

The vibrant field of taxonomy/systematics faces many new challenges. The impact of humans on the earth makes it imperative that we train a new generation of biologists with a solid foundation in the understanding of biodiversity and evolution. If we give developing biologists a strong understanding of taxonomy/systematics, they will possess the basis of the skill set needed to address the significant challenges facing the biosphere in the 21st century.

Given this need to educate developing biologists about organismal and field biology, it is critical that we have textbooks that effectively convey the needed information in a dynamic and up-to-date fashion. There are many excellent taxonomy/systematics textbooks that attempt to accomplish this task. However, the field of taxonomy/systematics is an integrative field of study with a lengthy history. This, coupled with a recent dramatic period of development, has lead textbook authors to construct encyclopedic textbooks in order to cover the field in detail. Although these texts are of great value to the systematics community, they are simply overwhelming to the average undergraduate student.

The goal of this textbook is to provide an introduction to taxonomy that is thorough enough to provide a solid background for students, but not so detailed that the students feel overwhelmed by the

subject matter. The evolution of this text through the six editions has been fundamentally shaped by the desire to produce a text that excites students and provides them with the resources needed to extend their own studies in any of the myriad directions that attract their curiosity.

We live in a time when information is accumulating at a blinding pace. This text is designed to provide a manageable amount of information that the student can master in a single semester. By providing a text that can be completed in a single semester, the instructor can instill a sense of confidence in the student that they have gained a mastery over the fundamental aspects of taxonomy/systematics. Although we have developed this text with a fundamental goal to not be encyclopedic, we provide up-to-date descriptions of authoritative Internet Web sites where instructors and students can augment the text with ever-increasing Web-based information. As the field of bioinformatics develops, modern students of systematics should be encouraged to scour the Web for information and also learn to become data providers. This text emphasizes the latest Web-based efforts in taxonomy/systematics that can be used to enhance the information provided in the text.

Dirk Walters and David Keil developed the first two editions of this text as study guides or laboratory manuals. They determined that a thorough text would be more useful to their students, and redesigned the third edition to present an introductory survey that covered both a survey of plant families and the experimental methods of taxonomy. In the third edition they attempted to include enough information to provide students with a basic understanding of the topics and to enable and encourage students to seek more information in the many popular and technical sources that were available in libraries. The fourth edition continued in this tradition, updating coverage of selected topics and providing selected references at the end of each chapter to serve as sources of additional information for both students and instructors. The fourth edition also included exercises at the end of each chapter to assist students

in organizing their studies. Some of these exercises are designed for individual and class activities in the lab, some are outside projects, and some are study questions for individual review.

I feel very fortunate to have been offered the opportunity to become a co-author for the fifth edition of this text. Although it was daunting to contemplate making changes to the excellent work of Drs. Walters and Keil, I was thrilled to have the opportunity to be a part of the development of that text. In the tradition of the first four editions, we wanted the scope of the fifth edition to be reasonably mastered by students over the course of a typical college semester.

The field of taxonomy/systematics has undergone tremendous change over the past twenty years. We have developed new methods to explore evolutionary relationships of plants and new kinds of data (especially molecular data) that can be used to shed some light on our understanding of plant relationships. These new methods and data are generating changes in our classification system and we attempted to reflect some of these changes in the layout of the diversity chapters (Chapters 8–15) in the fifth edition. The system presented in the fifth edition and continued in the sixth edition follows the phylogeny advocated by the Angiosperm Phylogeny Group. This was a departure from the Cronquistian system used in the first four editions of this text. Although Cronquist's subclass system of classification appeared clear-cut and easily learned, it was not representative of our understanding of the evolutionary relationships of flowering plants. The reorganization implemented in the fifth edition sought to remedy this situation and to provide a text that mirrored our current classification of plants.

In the sixth edition, I have followed the organization used in the fifth edition. The text is organized into four parts. Part 1 introduces the study of taxonomy, vegetative terminology and collecting techniques. The chapters emphasize plant structure as a way to engage students in the wonders of plant form and function. Many students come to a taxonomy/systematics class having very little experience with plant diversity. Hopefully, these chapters provide an opportunity for the teacher to create excitement with an initial introduction to plants. Part 2 provides an exploration of the classification systems that have been used in the past, along with the currently accepted system we use to name plants and recovery their evolutionary history. Part 3 includes an introduction to plant diversity among the Lycophytes, Monilophytes (ferns and fern allies), gymnosperms and flowering plants. Finally, Part 4 describes ways

we can document plant diversity through experiments, revisions and monographs. The book includes an appendix of an artificial key to families of vascular plants and a glossary of the terms used in the text.

Family circumscription has been a particularly difficult aspect of “modernizing” this text. The sixth edition has generally used the most recent determinations of monophyletic groups as a guide for family recognition. I have also tried to indicate the more traditional circumscriptions, even if they are not currently recognized by the Angiosperm Phylogeny Group. As in earlier editions, I have not attempted to discuss each family equally. Certain families have been emphasized that are commonly encountered by temperate botanists or are considered to be evolutionarily significant. The families considered most important are illustrated and have at least a full-page discussion of morphology, distribution and economic importance. Families of secondary importance are presented with the technical descriptions, size, and distribution. Those families deemed of least importance for the purposes of this text are listed by name with only size and distribution.

The family descriptions included here are presented in a standard format with a limited technical vocabulary. The descriptions have been deliberately written without geographical limits and include variations that are not necessarily encountered in representatives of the families growing in particular regions of North America. This inclusiveness was designed to avoid the problem of locally biased descriptions that are often a feature of local floras. Cultivated plants, often from distant locations, may not “fit” descriptions based solely on local wild representatives of a family.

The keys are designed for use in determination of family for plants regardless of their wild or cultivated status. The key is designed to include most families that will be encountered within the continental United States, but the diversity of the cultivated flora in North America will undoubtedly provide some specimens that do not fit the keys.

Most of the illustrations in this book are original line drawings prepared from living plants or photographic slides. Some of the phylogenetic trees are new to the sixth edition. Attempts have been made to illustrate features likely to be encountered among members of a family students can expect to see. For large and diverse families, however, only a few of the representatives can be illustrated and students can expect to encounter variations that are not illustrated in the text.

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