

Ernst Mayr



Principles of Systematic Zoology



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Dedicated to my friends

**E. Gorton Linsley
and
Robert L. Usinger**

without whose constant encouragement
and inspiration this work could not have
been undertaken nor completed.

Preface

Systematics has had a remarkable renaissance during the last generation. The reasons for this are diverse. Taxonomists played a leading role in the new synthesis of evolutionary theory, and they have demonstrated that the study of organic diversity, the main concern of systematics, is a major integral branch of biology. Systematics has also been very important in initiating the entire field of population biology, including population genetics. The recognition of the importance of taxonomy has been helped by the realization that there are two great scientific methods, the experimental method and the comparative method (based on observations). Observational data are rather meaningless unless they are classified prior to comparison. Understanding this methodological necessity has created a new interest in methods and theory of classification in all comparative sciences. This interest has been enhanced by the coming of the computer and concurrent endeavors to automate classifying through electronic data processing. All this is superimposed on the increasing need for the applied aspects of taxonomy, such as the correct identification and classification of species in agriculture, public health, ecology, genetics, and behavioral biology.

In 1953 when *Methods and Principles of Systematic Zoology* was published, no other text on the systematic method was available except Hennig's specialized German volume. The current vigor of systematics is indicated by the number of recently published texts in this area (see Chap. 1), by the flourishing of the journal *Systematic Zoology* since its founding in 1952 and of similar periodicals in England and Germany, and by the annually increasing number of articles in journals throughout the world dealing with the methods

and principles of systematics. The only way to cope with this massive accumulation of new information and new theory has been to prepare a radical revision of the 1953 volume.

Two of the three coauthors of this earlier volume (E. Gorton Linsley and Robert L. Usinger) were unfortunately too heavily committed by professional duties to participate in the time-consuming task of a revision. By mutual agreement Ernst Mayr, therefore, assumed full responsibility. In the course of the work it became apparent that more was needed than a mere revision. The outcome was a new work with a new title. Nevertheless it is a direct descendant of the 1953 book, and much that was valuable in the old volume is incorporated in the new one. A first draft of the manuscript was, therefore, critically read by the former coauthors. I deeply appreciate the help and encouragement I have had from my two friends, who continue to maintain an undiminished interest in this volume.

It has been a frequent complaint in the past that the training of the young taxonomist is too empirical, consisting too much in merely conditioning him to carry out the operations of experienced taxonomists. Such criticism is legitimate when this practical training is not supplemented by a study of the theory. Yet, at the same time, taxonomy is a subject which is so operational that it could not possibly be learned merely by reading a book. The main objective of this volume, therefore, is to serve as a guide and companion for those learning the subject and perhaps even more so for those who are teaching it. However, it cannot take the place of a laboratory in which the procedures of classification are actually demonstrated. The problems of taxonomy are different in every group of animals, and every teacher will want to use material and illustrations from the zoological groups with which he himself is most familiar. This is the reason why this volume does not cite more examples to illustrate basic principles and methods. The teacher himself will know best what examples will be most instructive in a given case. The problems of taxonomy are far too diverse to provide, as the beginner might love to have it, a set of recipes which can be applied to every situation. Actually, a clear presentation of the theory will be more helpful in the carrying out of practical tasks than such a recipe book.

It is for this reason that the theoretical aspects of taxonomy have received so much attention in this work. The object is not so much to make a contribution to theoretical biology as to establish a sound foundation for practical operations. It is important for the taxonomist at every stage of his work to understand exactly the meaning of such terms as species, taxon, category, classification, and type. The clearer these terms, and the concepts underlying them, are understood, the greater will be the agreement among taxonomists and the less time they will waste on sterile controversy.

The 1953 book, while presenting some original ideas of the authors, concentrated on presenting a balanced digest of the published literature of

taxonomy. The new work goes somewhat further in offering original material, particularly on the theory of taxonomy (Chap. 4), on the procedures of classification (Chap. 10), and on the theory of nomenclature (Chap. 13). It is hoped that this will make the volume important even for the experienced worker without interfering with its utility for the beginner. As far as the theory of nomenclature and the procedure of classification are concerned, there are no other comprehensive treatments available in the literature. To add to the usefulness of the volume the main text of the Rules of Zoological Nomenclature is incorporated in Chap. 12.

In order to compensate for the considerable expansion of the volume through the addition of new material, an effort was made to shorten the presentation of subjects that are well covered in recent publications. The new Code of Zoological Nomenclature, for instance, gives so much detail on the formation of scientific names (in Appendix D) that it seemed advisable to omit this topic from the new edition. Likewise, the revised edition of *Quantitative Zoology* by Simpson, Roe, and Lewontin (1960) covers the aspects of statistics relevant to taxonomy so excellently that it was possible to shorten our own account drastically. The recent publication of several books devoted to scientific illustration and the techniques of drawing (Chap. 11) permitted shortening the section devoted to this subject.

Finally, the author's recent publication of a wide-ranging volume on evolution, *Animal Species and Evolution* (1963), made it unnecessary to cover the same subject matter in the present volume, as important as an understanding of the evolutionary processes is for the taxonomist. The exhaustive bibliography of that volume permits convenient access to the primary evolutionary literature, and the volume is therefore—specifically for this purpose—frequently quoted in the present work.

No author can ever adequately thank all those who by their constructive criticism have contributed to the improvement of the manuscript. The present work is one more example of such helpfulness. A first draft of the entire manuscript was read by E. G. Linsley, R. L. Usinger, Michael Ghiselin, Donn E. Rosen, W. F. Blair, and Richard D. Alexander. Of the next version Herbert Levi, K. Boss, and J. Lawrence read most chapters. Chapters 8 and 9 were read by S. Gould and R. A. Reymont and Chaps. 12 and 13 by J. Corliss, Eugene Eisenmann, W. J. Follett, R. P. Higgins, Myra Keen, Alfred and Helen Loeblich, Hobart M. Smith, and Ellis Yochelson. Every one of them, but particularly R. D. Alexander, made valuable suggestions. Each found a number of errors and inconsistencies in my treatment which I was able to correct. Those faults which still remain are entirely my own responsibility.

John Lawrence undertook the great labor of compiling the information on the number of known species presented in Table 1-1, much of it secured from the leading specialists in the respective groups.

I am greatly indebted to Susan Martin, Sabine Wespi, and Sally Loth for the careful typing of three consecutive versions of the manuscript and to William Jolly as well as to Vojislav Jovanovic for literature search, help with the bibliography, and other editorial assistance, which greatly lightened my own burden. More than anyone else it was my wife who has assisted me in numerous ways and has truly made the completion of this volume possible.

Ernst Mayr

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