

Preface

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This handbook of laboratory exercises was first conceived at the Third Congress of the Spanish Society of Developmental Biology held in Málaga, Spain, in 2001. At the time, Professor Antonio García-Bellido suggested including collaborators from the United States and the rest of Europe to give the project a more international scope. The resulting book is a handbook intended to provide a bridge between top scientific researchers and practical laboratories taught at both the undergraduate and postgraduate level. Each chapter introduces a short, inexpensive, and, for the most part, straightforward laboratory project designed to be carried out by students in a standard lab environment. The book uses some of the most popular and best studied model organisms to examine the processes of development. Each chapter is written by specialists in the field describing, in most instances, original pioneering experiments that profoundly influenced the field. The book also demonstrates a historical bridge from classical embryological concepts, using Aristotle and Driesch's entelechia concept (Driesch, 1908) (Chapters 2 and 15) or morphogenetic gradient concept (i.e., Wolpert, 1969) (Chapters 1 and 16) to modern cellular, genetic, and molecular analyses of development such as homeotic genes (Chapters 11 and 20), compartmentalization (Chapter 14), or cell–cell interactions (Chapters 2, 13, and 22). In addition, the high-impact techniques of vertebrate cloning (Section IX) and embryonic stem cells (Section X), as well as the emerging discipline of evolution and development (Evo–Devo, Section XI), are also considered. Finally, although there is much still to learn in this field, Section XII is devoted to computational modelling in the search for a link between genotype and phenotype. During each laboratory exercise, it is our intent that the students imagine themselves working with these highly respected scientists, traveling the same road pioneered by the authors of each chapter.

The format of each chapter is intended to merge the format of standard scientific papers and practical laboratory protocols – a format inspired by texts with similar intent (Stern and Holland, 1993; Halton, Behnke, and Marshall, 2001). Each chapter also includes parts called “Alternative Exercises” and “Questions for Further Analysis” that will permit laboratory instructors or advisors to carry out an “inquiry-based” lab format as

supported by the National Research Council of the United States (NRC, 2000). With the guidance provided in each chapter, students can design and carry out their own, related experiments, potentially culminating in the writing of original papers. For most of the laboratory exercises described, the standard laboratory safety protocols maintained in all labs are sufficient; where necessary, more information is given about the controlled use of hazardous substances. IN GENERAL, CAUTIONS MUST BE TAKEN. MANY OF THE CHEMICALS USED IN THESE LABORATORY EXERCISES ARE HAZARDOUS. TO PREVENT EXPOSURE TO THESE CHEMICALS, YOU SHOULD WEAR GLOVES AND SAFETY GLASSES AND WORK WITH THE CHEMICALS IN A FUME HOOD. THIS IS PARTICULARLY IMPORTANT WHEN WORKING WITH SUBSTANCES LIKE PARAFORMALDEHYDE, GLUTARALDEHYDE, RETINOIC ACID, DEAB, DAB XYLENE, OR CHLORAL HYDRATE. MORE DETAILED INFORMATION ON PROPER HANDLING OF THESE CHEMICALS CAN BE OBTAINED FROM MATERIAL SAFETY DATA SHEETS (MSDS), WHICH ARE SUPPLIED BY THE CHEMICAL MANUFACTURERS. The animals used in each laboratory exercise can be obtained from the curators of many international stock centers around the world. In most countries, Home Office approvals are required so that appropriate responsibilities must be taken by receiving departments.

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