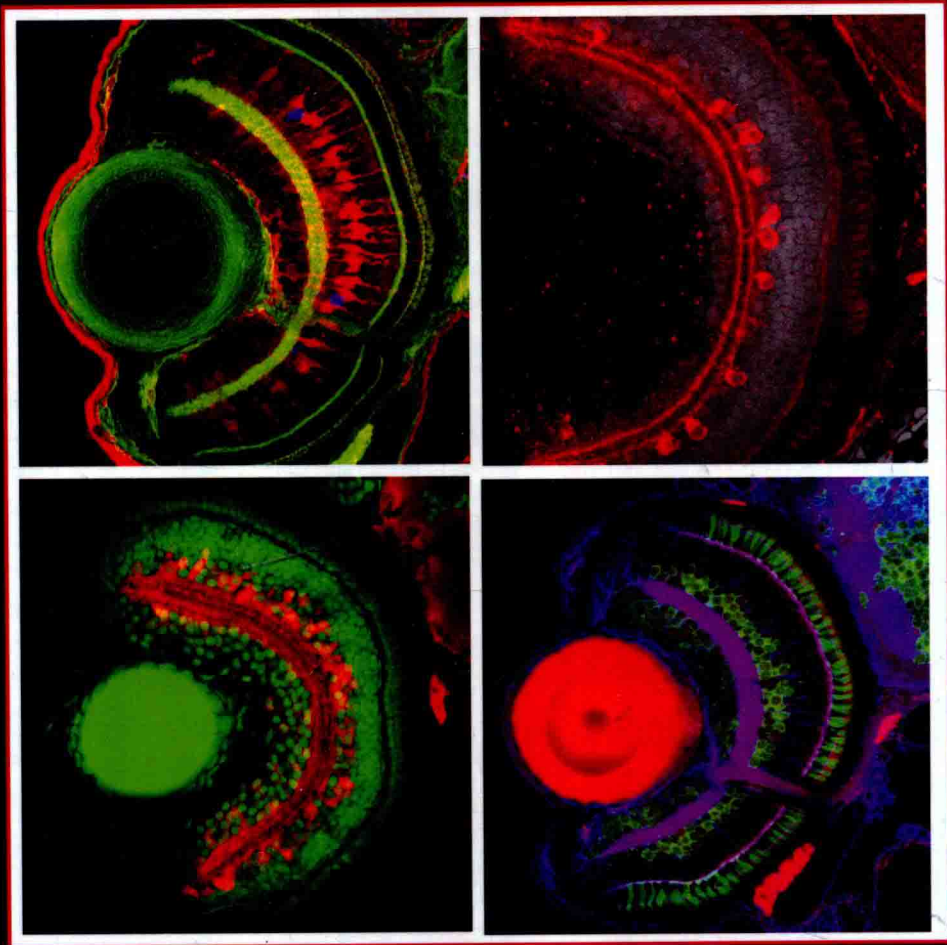


Methods in Cell Biology • Volume 134

THE ZEBRAFISH: CELLULAR AND DEVELOPMENTAL BIOLOGY, PART B DEVELOPMENTAL BIOLOGY, 4TH EDITION



Edited by

H. William Detrich III, Monte Westerfield, Leonard I. Zon



Methods in Cell Biology

The Zebrafish: Cellular and Developmental Biology, Part B Developmental Biology

Volume 134

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*Len, Monte, and I dedicate the 4th Edition of Methods in Cell Biology:
The Zebrafish to the postdoctoral fellows and graduate students who
conducted the genetic screens that established the zebrafish as a
preeminent vertebrate model system for analysis of development.*

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Preface

Len, Monte, and I are pleased to introduce the fourth edition of *Methods in Cell Biology: The Zebrafish*. The advantages of the zebrafish, *Danio rerio*, are numerous, including its short generation time and high fecundity, external fertilization, and the optical transparency of the embryo. The ease of conducting forward genetic screens in the zebrafish, based on the pioneering work of George Streisinger, culminated in screens from the laboratories of Wolfgang Driever, Mark C. Fishman, and Christiane Nüsslein-Volhard, published in a seminal volume of *Development* (Volume 123, December 1, 1996) that described a “candy store” of mutants whose phenotypes spanned the gamut of developmental processes and mechanisms. Life for geneticists who study vertebrate development became *really* fine.

Statistics derived from ZFIN (The Zebrafish Model Organism Database; <http://zfin.org>) illustrate the dramatic growth of research involving zebrafish. The zebrafish genome has been sequenced, and as of 2014, more than 25,000 genes have been placed on the assembly. Greater than 15,500 of these genes have been established as orthologs of human genes. The zebrafish community has grown from ~1,400 researchers in 190 laboratories as of 1998 to ~7,000 in 930 laboratories in 2014. The annual number of publications based on the zebrafish has risen from 1,913 to 21,995 in the same timeframe. Clearly, the zebrafish has arrived as a vertebrate biomedical model system *par excellence*.

When we published the first edition (Volumes 59 and 60) in 1998, our goal was to encourage biologists to adopt the zebrafish as a genetically tractable model organism for studying biological phenomena from the cellular through the organismal. Our goal today remains unchanged, but the range of subjects and the suite of methods have expanded rapidly and significantly in sophistication over the years. With the second and third editions of *MCB: The Zebrafish* (Volumes 76 and 77 in 2004; Volumes 100, 101, 104, and 105 in 2010–11), we documented this extraordinary growth, again relying on the excellent chapters contributed by our generous colleagues in the zebrafish research community.

When Len, Monte, and I began planning the fourth edition, we found that the zebrafish community had once more developed and refined novel experimental systems and technologies to tackle challenging biological problems across the spectrum of the biosciences. We present these methods following the organizational structure of the third edition, with volumes devoted to *Cellular and Developmental Biology*, to *Genetics, Genomics, and Transcriptomics*, and to *Disease Models and Chemical Screens*. Here we introduce the first two volumes, *Cellular and Developmental Biology, Parts A and B*.

CDB Part A is devoted to cellular techniques. Here the reader will find methods for culturing zebrafish cells, and advanced light-microscopic strategies for imaging cells and multicellular structure in living or fixed embryos. Additional chapters

cover the direct measurement of morphogen gradients, the analysis of lipid metabolism, methods to determine the structure and function of cilia, and techniques for functional calcium imaging and measuring sensory transduction in lateral line hair cells.

In *CDB Part B*, we transition to the study of developmental phenomena. A chapter on germ cell specification leads off, followed by several devoted to various aspects of central and peripheral nervous system development and function. Chapters on the inner ear, lateral line, and retina provide excellent examples of the relevance of the zebrafish to vertebrate developmental biology. Methods for studying organogenesis in the zebrafish cover the cardiovascular system, kidney, pancreas, liver, cartilage, and bone. The final chapters consider cancer from an organ perspective, associative learning and memory, and methods for working with larval and juvenile zebrafish.

We anticipate that you, our readership, will apply these methods successfully in your own zebrafish research programs and will develop your own technical advances that may be considered for a future edition of *Methods in Cell Biology: The Zebrafish*. The zebrafish is a remarkable experimental system—the preeminent vertebrate model for mechanistic studies of cellular and developmental processes in vivo.

We thank the series editors, Leslie Wilson and Phong Tran, and the staff of Elsevier/Academic Press, especially Zoe Kruze and Sarah Lay, for their enthusiastic support of our fourth edition. Their help, patience, and encouragement are profoundly appreciated.

H. William Detrich, III
Monte Westerfield
Leonard I. Zon

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