
Methods in Cell Biology

VOLUME 100

The Zebrafish: Cellular and Developmental Biology, Part A
Third Edition

Edited by

H. William Detrich III

Department of Biology, Northeastern University, Boston, MA, USA

Monte Wésterfield

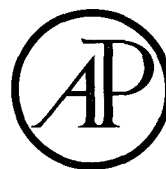
Institute of Neuroscience, University of Oregon, Eugene, OR, USA

Leonard I. Zon

Division of Hematology/Oncology, Children's Hospital of Boston,
Department of Pediatrics and Howard Hughes Medical Institute, Harvard Medical School, Boston, MA, USA



AMSTERDAM • BOSTON • HEIDELBERG • LONDON
NEW YORK • OXFORD • PARIS • SAN DIEGO
SAN FRANCISCO • SINGAPORE • SYDNEY • TOKYO
Academic Press is an imprint of Elsevier



CONTENTS

Contributors	xi
Preface	xiii
I. Cellular Biology	1
1. Analyzing Retinal Axon Guidance in Zebrafish	
<i>Fabienne E. Poulain, John A. Gaynes, Cornelia Stacher Hornldi, Mei-Yee Law, and Chi-Bin Chien</i>	
I. Introduction	4
II. Visualizing Retinal Axons	5
III. Perturbing the Retinotectal System	13
IV. Future Directions	21
References	22
2. Imaging Blood Vessels in the Zebrafish	
<i>Makoto Kamei, Sumio Isogai, Weijun Pan, and Brant M. Weinstein</i>	
I. Introduction	28
II. Imaging Vascular Gene Expression	29
III. Non-vital Blood Vessel Imaging	30
IV. Vital Imaging of Blood Vessels	39
V. Conclusion	51
References	52
3. Medaka Haploid Embryonic Stem Cells	
<i>Yunhan Hong</i>	
I. Introduction	56
II. Methods	58
III. Applications of Haploid ES Cells	63
IV. Summary	67
References	68

II. Developmental and Neural Biology	71
4. Neurogenesis	
<i>Prisca Chapouton and Leanne Godinho</i>	
I. Introduction	74
II. Neurogenesis During Development and in the Adult Brain	75
III. Methods for Studying Neurogenesis in the Developing and Adult Brain	81
IV. Specific Protocols to Study Adult Neurogenesis	103
V. Conclusion	108
References	108
5. Studying Peripheral Sympathetic Nervous System Development and Neuroblastoma in Zebrafish	
<i>Rodney A. Stewart, Jeong-Soo Lee, Martina Lachmit, A. Thomas Look, John P. Kanki, and Paul D. Henion</i>	
I. Introduction	128
II. The Peripheral Autonomic Nervous System	128
III. The Zebrafish as a Model System for Studying PSNS Development	134
IV. Zebrafish as a Novel Model for Studying Neuroblastoma	144
V. Conclusion and Future Directions	146
VI. Acknowledgments	146
References	147
6. Analysis of the Retina in the Zebrafish Model	
<i>Andrei Avanesov and Jarema Malicki</i>	
I. Introduction	154
II. Development of the Zebrafish Retina	155
III. Analysis of Wild-Type and Mutant Visual System	162
IV. Analysis of Gene Function in the Zebrafish Retina	182
V. Summary	191
References	192
7. Photoreceptor Structure and Development: Analyses using GFP Transgenes	
<i>Brian D. Perkins and James M. Fadool</i>	
I. Introduction	206
II. Transport Mechanisms	209
III. Regulation of Photoreceptor Size	210
IV. Photoreceptor Synapse Structure	211
V. Regeneration	211
VI. Future Directions	215
VII. Conclusions	216
References	216

8. Physiological Recordings from Zebrafish Lateral-Line Hair Cells and Afferent Neurons	
<i>Josef G. Trapani and Teresa Nicolson</i>	
I. Introduction	220
II. Zebrafish Mounting and Immobilizing	221
III. Microphonics	223
IV. Action Currents	225
V. Summary	228
VI. Discussion	228
References	229
9. Zebrafish Kidney Development	
<i>Iain A. Drummond and Alan J. Davidson</i>	
I. Introduction	234
II. Structure of the Zebrafish Pronephros	236
III. Formation of the Pronephros	238
IV. Methods to Study Pronephros Function	245
V. Conclusions	256
References	256
10. Molecular Regulation of Pancreas Development in Zebrafish	
<i>Robin A. Kimmel and Dirk Meyer</i>	
I. Introduction	262
II. Pancreas Development	262
III. Analysis of Beta-Cell Migration and Proliferation	268
IV. Future Directions	276
References	276
11. Monitoring Sleep and Arousal in Zebrafish	
<i>Jason Rihel, David A. Prober, and Alexander F. Schier</i>	
I. Introduction	282
II. Behavior, Genetics, and Pharmacology of Zebrafish Sleep	282
III. Methods for Monitoring Sleep/Wake Behavior in Zebrafish	288
IV. Conclusion	291
References	291
12. Use of Flatbed Transparency Scanners in Zebrafish Research: Versatile and Economical Adjuncts to Traditional Imaging Tools for the <i>Danio rerio</i> Laboratory	
<i>Charles A. Lessman, Michael R. Taylor, Wilda Orisme, and Ethan A. Carver</i>	
I. Introduction	296
II. Scanner Basics	297
III. Motility Analysis	302

IV. Oocyte and Egg Assays	309
V. Using Scanners to Count and Measure	316
VI. Other Potential Applications of Scanners	319
VII. Summary: Inexpensive Adjunct to Microscopy	321
References	321
Subject Index	323
Volumes in Series	339