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**Education:**

1973 A.B., Princeton University, Biology and Physics  
1977 Ph.D., Duke University, Physiology and Pharmacology  
1977-1978 Postdoctoral Research, Max Planck Institute, Munich, Germany, Biophysics  
1979-1980 Postdoctoral Research, Harvard Medical School, Neurobiology

**Research and Professional Experience:**

1971-1973 Undergraduate researcher with Alan Gelperin, Princeton University  
1973-1977 Graduate researcher with John Moore, Duke University, Durham, NC  
1977-1978 Research Associate with Dieter Lux, Max-Planck-Institut, Munich, Germany  
1979-1980 Research Associate with Eric Frank, Neurobiology Department, Harvard Medical School, Boston, MA  
1980-present Assistant, then Associate, then Professor, Institute of Neuroscience and Department of Biology, University of Oregon, Eugene, OR  
1987-1988 Sabbatical fellow with Walter Gehring and John Nichols, Biocenter, University of Basel, Switzerland  
1988-1990 NSF Developmental Neurobiology Review Panel  
1988-1989 Instructor, Neurobiology, Marine Biological Laboratory, Woods Hole, MA  
1989-1995 Associate Editor, *Journal of Neuroscience*  
1990-1998 Director, Institute of Neuroscience, University of Oregon, Eugene, OR  
1991-present Editor, *Zebrafish Science Monitor*  
1994 Visiting lecturer, University of Auckland, Auckland, New Zealand  
1994-present Director, ZFIN - the Zebrafish Model Organism Database  
1995 Sabbatical fellow with Nigel Holder and Stephen Wilson, Kings College, London, United Kingdom  
1996 Organizer and Instructor, EMBO workshop on Development and Genetics of Zebrafish and Medaka, Würzburg, Germany  
1996 Organizer, 1996 Cold Spring Harbor Laboratory Conference on Zebrafish Development and Genetics  
1997 DOE Subcommittee on the Human Genome Project  
1998 Organizer, EMBO workshop on Development, Genetics and Genomics of Zebrafish and Medaka, Freiburg, Germany  
1998-present Director, Zebrafish International Resource Center  
1999-2005 Vice President and Secretary, Winter Conference on Brain Research  
2001-2002 Sabbatical fellow with Wolfgang Driever, Department of Developmental Biology, University of Freiburg, Freiburg, Germany  
2001-2002 Mouse Genome Informatics Advisory Board  
2001-2005 Advisory Council, National Institutes of Health, NCCR  
2002 Organizer, EMBO course on Molecular and Genetic Tools for the Analysis of Medaka & Zebrafish Development, Heidelberg, Germany  
2002-2006 Editorial Board, *Journal of Anatomy*  
2003-2005 Chair, Scientific Program Committee, Winter Conference on Brain Research

2003-present	Advisory Council, Oregon Deafblind Project
2004-present	Editor, BMC Developmental Biology
2004-present	Advisory Board, EU consortium for ZF-MODELS
2005-2008	Advisory Board, NeuronBank
2005-present	Advisory Board, Xenbase, the <i>Xenopus</i> Model Organism Database
2009-2013	Advisory Board, Mouse Genome Database
2011-2014	Advisory Board, Sanger Institute Mouse and Zebrafish Genetics Program
2013-present	Advisory Board, TEFOR
2013-present	Advisory Board, National <i>Xenopus</i> Resource
2013-present	Advisory Council, National Institutes of Health, NIDCD
2014-present	Advisory Board, ZENCODE
2015-present	Undiagnosed Diseases Network Steering Committee
2017-present	Advisory Board, FlyBase
2017-present	Advisory Board, <i>Saccharomyces</i> Genome Database
2017-present	Advisory Board, Wormbase
2018-present	Board of Directors, The Usher Syndrome Coalition

### Scholarships and Awards:

Biomedical Engineering Pre-doctoral Fellow, 1974-1977  
Talbot Award, 1976  
Duke University Graduate School Research Award, 1976-1977  
Fulbright-Hays Scholarship, 1977-1978  
Max Planck Society Senior Research Fellowship, 1977-1978  
NIH Postdoctoral Training Fellowship, 1979  
Muscular Dystrophy Postdoctoral Fellowship, 1979-1981  
Alfred P. Sloan Fellow, 1981-1982  
Research Career Development Award, 1986-1991  
US-Switzerland Scientist Exchange Fellow (NSF), 1987-1988  
Fogarty Senior International Fellow, 1987-1988  
McKnight Development Award, 1991-1993  
Auckland Foundation Fellow, 1994  
Fellow of the Anatomical Society of Great Britain & Ireland, 1995  
US-UK Cooperative Research Program Fellow, 1995-1996  
Guggenheim Fellow, 2001-2002  
Alexander von Humboldt Prize, 2001  
Medical Research Foundation Discovery Award, 2002  
Research Innovation Award, 2006  
Fellow, American Association for the Advancement of Science, 2017  
Christiana Nüsslein-Volhard Award, 2018  
George Streisinger Award, 2018

Publications [1-206] (abstracts not included):

1. Burrage, L.C., J.J. Reynolds, N.V. Baratang, J.B. Phillips, J. Wegner, A. McFarquhar, M.R. Higgs, et al. (2019). Bi-allelic Variants in TONSL Cause SPONASTRIME Dysplasia and a Spectrum of Skeletal Dysplasia Phenotypes. *Am J Hum Genet*, **104**, 1-17.
2. Clement, A., B. Blanco-Sanchez, J.L. Peirce, and M. Westerfield. (2019). Cog4 is required for protrusion and extension of the epithelium in the developing semicircular canals. *Mech Dev*, **155**, 1-7. PMC6226009.
3. Blanco-Sanchez, B., A. Clement, J. Fierro, Jr., S. Stednitz, J.B. Phillips, J. Wegner, J.M. Panlilio, et al. (2018). Grxcr1 promotes hair hundle development by destabilizing the

- physical interaction between Harmonin and Sans Usher syndrome proteins. *Cell Rep*, **25**(5), 1281-1291 e4. PMC6284068.
4. Dona, M., R. Slijkerman, K. Lerner, S. Broekman, J. Wegner, T. Howat, T. Peters, et al. (2018). Usherin defects lead to early-onset retinal dysfunction in zebrafish. *Exp Eye Res*, **173**, 148–159. PMC6054812.
  5. Ferreira, C.R., Z.J. Xia, A. Clement, D.A. Parry, M. Davids, F. Taylan, P. Sharma, et al. (2018). A Recurrent De Novo Heterozygous COG4 Substitution Leads to Saul-Wilson Syndrome, Disrupted Vesicular Trafficking, and Altered Proteoglycan Glycosylation. *Am J Hum Genet*, **103**(4), 553-567. PMC6174323.
  6. Mabee, P., W. Dahdul, J. Balhoff, H. Lapp, P. Manda, J. Uyeda, T. Vision, and M. Westerfield, *Phenoscape: Semantic analysis of organismal traits and genes yields insights in evolutionary biology*, A. Thessen, Editor. 2018, IOS Press. p. 207-224.
  7. Matthews, J.L., J.M. Murphy, C. Carmichael, H. Yang, T. Tiersch, M. Westerfield, and Z.M. Varga. (2018). Changes to Extender, Cryoprotective Medium, and In Vitro Fertilization Improve Zebrafish Sperm Cryopreservation. *Zebrafish*, **15**(3), 279-290. PMC5985902
  8. Ruzicka, L., D.G. Howe, S. Ramachandran, S. Toro, C.E. Van Slyke, Y.M. Bradford, A. Eagle, et al. (2018). The Zebrafish Information Network: new support for non-coding genes, richer Gene Ontology annotations and the Alliance of Genome Resources. *Nucleic Acids Res*.
  9. Splinter, K., D.R. Adams, C.A. Bacino, H.J. Bellen, J.A. Bernstein, A.M. Cheatle-Jarvela, C.M. Eng, et al. (2018). Effect of Genetic Diagnosis on Patients with Previously Undiagnosed Disease. *N Engl J Med*, **379**, 2131-2139.
  10. Anderson, W., R. Apweiler, A. Bateman, G.A. Bauer, H. Berman, J.A. Blake, N. Blomberg, et al. (2017). Towards coordinated international support of core data resources for the life sciences. *bioRxiv*.
  11. Anderson, W.P., R. Apweiler, A. Bateman, G.A. Bauer, H. Berman, J.A. Blake, N. Blomberg, et al. (2017). Data management: A global coalition to sustain core data. *Nature*, **543**(7644), 179.
  12. Blanco-Sanchez, B., A. Clement, J.B. Phillips, and M. Westerfield. (2017). Zebrafish models of human eye and inner ear diseases. *Meth Cell Biol*, **138**, 415-467.
  13. Bradford, Y.M., S. Toro, S. Ramachandran, L. Ruzicka, D.G. Howe, A. Eagle, P. Kalita, et al. (2017). Zebrafish Models of Human Disease: Gaining Insight into Human Disease at ZFIN. *ILAR Journal*, **58**(1), 4-16. PMC5886338.
  14. Detrich, H.W., 3rd, M. Westerfield, and L.I. Zon, *The Zebrafish: Disease Models and Chemical Screens*. 4 ed. Meth Cell Biol, ed. L. Wilson and P. Tran. Vol. 138. 2017, San Diego, CA: Academic Press.
  15. Howe, D.G., Y.M. Bradford, A. Eagle, D. Fashena, K. Frazer, P. Kalita, P. Mani, et al. (2017). The Zebrafish Model Organism Database: new support for human disease models, mutation details, gene expression phenotypes and searching. *Nucleic Acids Res*, **45**(D1), D758-D768. PMC5210580.
  16. Manolio, T.A., D.M. Fowler, L.M. Starita, M.A. Haendel, D.G. MacArthur, L.G. Biesecker, E. Worthey, et al. (2017). Bedside Back to Bench: Building Bridges between Basic and Clinical Genomic Research. *Cell*, **169**(1), 6-12. PMC5511379.
  17. The Gene Ontology, C. (2017). Expansion of the Gene Ontology knowledgebase and resources. *Nucleic Acids Res*, **45**(D1), D331-D338. PMC5210579.
  18. Wangler, M.F., S. Yamamoto, H.T. Chao, J.E. Posey, M. Westerfield, J. Postlethwait, N. Members of the Undiagnosed Diseases, et al. (2017). Model Organisms Facilitate Rare Disease Diagnosis and Therapeutic Research. *Genetics*, **207**(1), 9-27. PMC5586389.
  19. Detrich, H.W., 3rd, M. Westerfield, and L.I. Zon, *The Zebrafish: Cellular and Developmental Biology, Part A Cellular Biology*. 4 ed. Meth Cell Biol, ed. L. Wilson and P. Tran. Vol. 133. 2016, San Diego, CA: Academic Press.
  20. Detrich, H.W., 3rd, M. Westerfield, and L.I. Zon, *The Zebrafish: Cellular and Developmental Biology, Part B Developmental Biology* 4ed. Meth Cell Biol, ed. L. Wilson and P. Tran. Vol. 134. 2016, San Diego, CA: Academic Press.

21. Detrich, H.W., 3rd, M. Westerfield, and L.I. Zon, *The Zebrafish: Genetics, Genomics, and Transcriptomics*. 4 ed. Meth Cell Biol, ed. L. Wilson and P. Tran. Vol. 135. 2016, San Diego, CA: Academic Press. 577.
22. Edmunds, R.C., B. Su, J.P. Balhoff, B.F. Eames, W.M. Dahdul, H. Lapp, J.G. Lundberg, et al. (2016). Phenoscope: Identifying Candidate Genes for Evolutionary Phenotypes. *Mol Biol Evol*, **33**(1), 13-24. PMC4693980.
23. Howe, D.G., Y.M. Bradford, A. Eagle, D. Fashena, K. Frazer, P. Kalita, P. Mani, et al. (2016). A scientist's guide for submitting data to ZFIN. *Meth Cell Biol*, **135**, 451-81.
24. Li, T., J. Fan, B. Blanco-Sanchez, N. Giagtzoglou, G. Lin, S. Yamamoto, M. Jaiswal, et al. (2016). Ubr3, a Novel Modulator of Hh Signaling Affects the Degradation of Costal-2 and Kif7 through Poly-ubiquitination. *PLoS Genet*, **12**(5), e1006054. PMC4873228.
25. Deans, A.R., S.E. Lewis, E. Huala, S.S. Anzaldo, M. Ashburner, J.P. Balhoff, D.C. Blackburn, et al. (2015). Finding Our Way through Phenotypes. *PLoS Biol*, **13**(1), e1002033. PMC25562316.
26. Elsayed, S.M., J.B. Phillips, R. Heller, M. Thoenes, E. Elsobky, G. Nurnberg, P. Nurnberg, et al. (2015). Non-manifesting AHI1 truncations indicate localized loss-of-function tolerance in a severe Mendelian disease gene. *Hum Mol Genet*, **24**(9), 2594-603. PMC4383865.
27. Gene Ontology, C. (2015). Gene Ontology Consortium: going forward. *Nucleic Acids Res*, **43**(Database issue), D1049-56. PMC4383973.
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29. Ruzicka, L., Y.M. Bradford, K. Frazer, D.G. Howe, H. Paddock, S. Ramachandran, A. Singer, et al. (2015). ZFIN, The zebrafish model organism database: Updates and new directions. *Genesis*, **53**(8), 498-509. PMC4545674.
30. Vize, P.D. and M. Westerfield. (2015). Model organism databases. *Genesis*, **53**(8), 449.
31. Beck, B.B., J.B. Phillips, M.P. Bartram, J. Wegner, M. Thoenes, A. Pannes, J. Sampson, et al. (2014). Mutation of POC1B in a Severe Syndromic Retinal Ciliopathy. *Hum Mutat*, **35**(10), 1153-62. PMC25044745.
32. Blanco-Sánchez, B., A. Clement, J. Fierro, Jr., P. Washbourne, and M. Westerfield. (2014). Complexes of Usher proteins preassemble at the endoplasmic reticulum and are required for trafficking and ER homeostasis. *Dis Model Mech*, **7**(5), 547-59. PMC4007406.
33. Köhler, S., S.C. Doelken, C.J. Mungall, S. Bauer, H.V. Firth, I. Bailleul-Forestier, G.C. Black, et al. (2014). The Human Phenotype Ontology project: linking molecular biology and disease through phenotype data. *Nucleic Acids Res*, **42**(Database issue), D966-74. PMC24217912.
34. Phillips, J.B. and M. Westerfield. (2014). Zebrafish models in translational research: tipping the scales toward advancements in human health. *Dis Model Mech*, **7**(7), 739-743. PMC24973743.
35. Van Slyke, C.E., Y.M. Bradford, M. Westerfield, and M.A. Haendel. (2014). The zebrafish anatomy and stage ontologies: representing the anatomy and development of *Danio rerio*. *J Biomed Semantics*, **5**(1), 12. PMC3944782.
36. Consortium. (2013). Gene Ontology annotations and resources. *Nucleic Acids Res*, **41**(Database issue), D530-5. PMC3531070.
37. Doelken, S.C., S. Kohler, C.J. Mungall, G.V. Gkoutos, B.J. Ruef, C. Smith, D. Smedley, et al. (2013). Phenotypic overlap in the contribution of individual genes to CNV pathogenicity revealed by cross-species computational analysis of single-gene mutations in humans, mice and zebrafish. *Dis Model Mech*, **6**, 358-372. PMC3597018.
38. Howe, D.G., Y.M. Bradford, T. Conlin, A.E. Eagle, D. Fashena, K. Frazer, J. Knight, et al. (2013). ZFIN, the Zebrafish Model Organism Database: increased support for mutants and transgenics. *Nucleic Acids Res*, **41**(D1), D854-60. PMC3531097.
39. Howe, K., M.D. Clark, C.F. Torroja, J. Tarrant, C. Berthelot, M. Muffato, J.E. Collins, et al. (2013). The zebrafish reference genome sequence and its relationship to the human genome. *Nature*, **496**, 498-503. PMC3703927.

40. Köhler, S., S.C. Doelken, B.J. Ruef, S. Bauer, N. Washington, M. Westerfield, G. Gkoutos, et al. (2013). Construction and accessibility of a cross-species phenotype ontology along with gene annotations for biomedical research. *F1000 Research*, **2**, 30. PMC3799545.
41. Midford, P.E., T.A. Dececchi, J.P. Balhoff, W.M. Dahdul, N. Ibrahim, H. Lapp, J.G. Lundberg, et al. (2013). The vertebrate taxonomy ontology: a framework for reasoning across model organism and species phenotypes. *J Biomed Semantics*, **4**(1), 34. PMC24267744.
42. Phillips, J.B., H. Vastinsalo, J. Wegner, A. Clement, E.M. Sankila, and M. Westerfield. (2013). The cone-dominant retina and the inner ear of zebrafish express the ortholog of CLRN1, the causative gene of human Usher syndrome type 3A. *Gene Expr Patterns*, **13**(8), 473-481. PMC3888827.
43. Smedley, D., A. Oellrich, S. Kohler, B. Ruef, M. Westerfield, P. Robinson, S. Lewis, and C. Mungall. (2013). PhenoDigm: analyzing curated annotations to associate animal models with human diseases. *Database*, **2013**, bat025. PMC3649640.
44. Sullivan, J., K. Karra, S.A. Moxon, A. Vallejos, H. Motenko, J.D. Wong, J. Aleksic, et al. (2013). InterMOD: integrated data and tools for the unification of model organism research. *Sci Rep*, **3**, 1802. PMC3647165.
45. Chen, C.K., C.J. Mungall, G.V. Gkoutos, S.C. Doelken, S. Kohler, B.J. Ruef, C. Smith, et al. (2012). MouseFinder: Candidate disease genes from mouse phenotype data. *Hum Mutat*, **33**(5), 858-66. PMC3327758.
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48. Gao, J., C. Zhang, B. Yang, L. Sun, M. Westerfield, and G. Peng. (2012). Dcc Regulates Asymmetric Outgrowth of Forebrain Neurons in Zebrafish. *PLoS One*, **7**(5), e36516. PMC3351449.
49. Mabee, P., J. Balhoff, W. Dahdul, H. Lapp, P. Midford, T. Vision, and M. Westerfield. (2012). 500,000 fish phenotypes: The new informatics landscape for evolutionary and developmental biology of the vertebrate skeleton. *J Appl Ichthyol*, **28**, 300-305. PMC22736877.
50. Bradford, Y., T. Conlin, N. Dunn, D. Fashena, K. Frazer, D.G. Howe, J. Knight, et al. (2011). ZFIN: enhancements and updates to the Zebrafish Model Organism Database. *Nucleic Acids Res*, **39**(Database issue), D822-9. PMC3013679.
51. Detrich, H.W., 3rd, M. Westerfield, and L.I. Zon, *The Zebrafish: Genetics, Genomics and Informatics*. 3 ed. Meth Cell Biol. Vol. 104. 2011, San Diego CA: Academic Press.
52. Detrich, H.W., 3rd, M. Westerfield, and L.I. Zon, *The Zebrafish: Disease Models and Chemical Screens*. 3 ed. Meth Cell Biol. Vol. 105. 2011, San Diego, CA: Academic Press.
53. Detrich, H.W., 3rd, M. Westerfield, and L.I. Zon, *The Zebrafish: Cellular and Developmental Biology, Part B*. Meth Cell Biol. Vol. 101. 2011, San Diego, CA: Academic Press. 289.
54. Howe, D.G., K. Frazer, D. Fashena, L. Ruzicka, Y. Bradford, S. Ramachandran, B.J. Ruef, et al. (2011). Data Extraction, Transformation, and Dissemination through ZFIN. *Meth Cell Biol*, **104**, 311-25.
55. Murray, K.N., J. Bauer, A. Tallen, J.L. Matthews, M. Westerfield, and Z.M. Varga. (2011). Characterization and management of asymptomatic Mycobacterium infections at the Zebrafish International Resource Center. *Journal of the American Association for Laboratory Animal Science : JAALAS*, **50**(5), 675-9. PMC3189671.
56. Murray, K.N., M. Dreska, A. Nasiadka, M. Rinne, J.L. Matthews, C. Carmichael, J. Bauer, Z.M. Varga, and M. Westerfield. (2011). Transmission, diagnosis, and recommendations for control of Pseudoloma neurophilia infections in laboratory zebrafish (Danio rerio) facilities. *Comp Med*, **61**(4), 322-9. PMC3155398.
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- photoreceptor synaptic development and function. *Dis Model Mech*, **4**(6), 786-800. PMC3209648.
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  59. Balhoff, J.P., W. Dahdul, C. Kothari, H. Lapp, J. Lundberg, P. Mabee, P. Midford, M. Westerfield, and T. Vision. (2010). Phenex: Ontological Annotation of Phenotypic Diversity. *PLoS ONE*, **5**(5). PMC286476.
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  65. Detrich, H.W., 3rd, M. Westerfield, and L.I. Zon. (2010). The Zebrafish: Cellular and Developmental Biology, Part A. Preface. *Meth Cell Biol*, **100**, xiii.
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  71. Detrich, H.W., 3rd, M. Westerfield, and L.I. Zon. (2009). Essential Zebrafish Methods Cell & Developmental Biology. *Reliable Lab Solutions*, 546.
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84. Hans, S., J. Christison, D. Liu, and M. Westerfield. (2007). Fgf-dependent otic induction requires competence provided by Foxi1 and Dlx3b. *BMC Dev Biol*, **7**, 5. PMC1794237.
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