

Curriculum Vitae Miriam Leah Zelditch

Personal

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Education

1989-1990 University of Michigan (NSF Postdoctoral Fellowship)
1980-1987 Michigan State University (Ph.D., Zoology)
1970-1975 Univ. of California, Santa Cruz (B.A. History)

Positions Held

1999- Associate Research Scientist, Museum of Paleontology, University of Michigan
1990-1999 Assistant Research Scientist, Museum of Paleontology, University of Michigan
1989-1990 Research Fellow (NSF Postdoctoral Fellow), Center for Human Growth and Development, University of Michigan
1987-1989 Adjunct Curator of Mammals, MSU Museum, Michigan State University

Fellowships and Grants

2006-2010 Integrated study of behavioral and morphological development in mammalian carnivores (with Kay Hollekamp and Barbara Lundrigan, Kim Scribner).
2004-2008 "Dissertation Research: Phylogenetic Persistence of Modularity of the Rodent Skull" (for Eladio Marquez)
1995-1998 NSF: "Systematics of piranha body form and ontogeny" (with W. L. Fink)
1994-1995 NSF: "Symposium: Historical patterns of developmental integration"
1993-1995 NSF: "Phylogenetic Analysis of murid skull shape ontogeny"
1990-1993 NSF: "Variation in patterns of developmental and functional integration during growth and evolution of several New World muroid rodents"
1989-1990 NSF Postdoctoral Fellowship
"Craniofacial integration in growth and phylogeny: Analysis by principal warps" (with F. L. Bookstein)
1983-1985 NSF Dissertation Improvement Grant
1981-1982 Geological Society of America field work grant

Editorial Boards

2007- Molecules and Morphology
2006- Evolutionary Biology
2006-2009 Evolution & Development
1999-2000 Systematic Biology
1998-2000 Associate Editor, Evolution

Reviewer: American Naturalist, American Journal of Physical Anthropology, Amphibia-Reptilia, Biological Journal of the Linnean Society, Copeia, Evolution, Evolution & Development, Evolutionary Biology, Integrative and Comparative Biology, Frontiers of Zoology, Journal of Vertebrate Paleontology, Journal of Anatomy, Journal of Human Evolution, Journal of Mammalogy, Journal of Morphology, Journal of Zoology; Paleobiology, Proceedings of the Royal Society of London B (Biological Sciences); Zoological Science, Zoological Journal of the Linnean Society

Offices Held

2005-2008 Scientific Committee, International Congress of Vertebrate Morphologists
 2000-2002 Chair, Division of Systematics and Evolutionary Biology, Society of Integrative and Comparative Biology
 1998-2000 Secretary, Division of Systematics and Evolutionary Biology. Society of Integrative and Comparative Biology
 1998-2000 Council Member, Society of Systematic Biologists,

Symposium Organizer

2004 ‘Mechanistic Approaches to Evolutionary Developmental Biology’ for International Congress of Vertebrate Morphologists
 1995 ‘Historical Patterns of Developmental Integration’ for Society of Integrative and Comparative Biology

Recent Invited Presentations

2013: (Un)predictability of phenotypic evolution: Sciurid responses to climate change. Johns Hopkins University
 2012: (Un)predictability of phenotypic evolution: Sciurid responses to climate change. University of California, Berkeley
 2010: Modularity and integration: The developmental basis of evolvability. Université du Québec à Rimouski
 2009: Developmental and functional morphology; XV Coloquio Internacional de Antropología Biológica “Juan Comas”

Publications

Books

2012 Zelditch, M. L., D. L. Swiderski, H. D. Sheets, and W. L. Fink. Geometric Morphometrics for Biologists: A Primer. Second Edition. Elsevier, Amsterdam.
 2001 Zelditch, M. L. (ed). Beyond Heterochrony: The Evolution of Development. John Wiley & Sons, NY

Journal Articles (Peer-reviewed)

1. La Croix, S., M. L. Zelditch, J. A. Shivik, B. L. Lundrigan, and K. E. Holekamp. 2011. Ontogeny of feeding performance and biomechanics in coyotes. *J. Zool.* 285:301-315.
2. La Croix, S., K. E. Holekamp, J. A. Shivik, B. L. Lundrigan and M. L. Zelditch.

2011. Ontogenetic relationships of the cranium and mandible in the coyote and comparison to a hypercarnivore. *Journal of Morphology*. 272: 662-674
3. 2011. Webster, M. and M. L. Zelditch. Evolutionary lability of integration in Cambrian ptychoparioid trilobites. *Evolutionary Biology* 38:144-162
 4. 2011: Webster, M. and M. L. Zelditch. Modularity of a Cambrian ptychoparioid trilobite cranium. *Evolution & Development* 13: 96-109.
 5. 2010 Arnegard, M.E., P. B. McIntyre, L. J. Harmon, M. L. Zelditch, W. G. R. Crampton, J. K. Davis, J. P. Sullivan, S. Lavoué and C. D. Hopkins. Sexual signal evolution outpaces ecological divergence during electric fish species radiation. *American Naturalist*. 176: 335-356
 6. 2010 Swiderski, D. L. and M. L. Zelditch. Morphological diversity despite isometric scaling of lever arms. *Evolutionary Biology* 37: 1-18
 7. 2010 Tanner, J. B., M. L. Zelditch, B. L. Lundrigan, and K. E. Holekamp.. Ontogenetic change in skull morphology and mechanical advantage in the spotted hyena (*Crocuta crocuta*). *Journal of Morphology* 271:353-365.
 8. 2009 Fischer-Rousseau, L., R. Cloutier, and M. L. Zelditch.. Morphological integration and developmental progress during fish ontogeny in two contrasting habitats. *Evolution & Development* 11:740-753.
 9. 2009 Zelditch, M. L., A. R. Wood, and D. L. Swiderski.. Building developmental integration into functional systems: Function-induced integration of mandibular shape. *Evolutionary Biology* 36: 71-87.
 10. 2008 Zelditch, M. L., A. R. Wood, R. M. Bonnet, and D. L. Swiderski. Modularity of the rodent mandible: Integrating muscles, bones and teeth. *Evolution & Development* 10: 756-768.
 11. 2008 Keller, J. M., M. L. Zelditch, Y. Huet-Hudson, and L. J. Leamy. Dioxin-induced stress causes changes in mandible morphology and developmental homeostasis that differ among inbred strains of mice. *Toxicologic Pathology*. 36: 1006-1013
 12. 2007 Wood, A. R., Wood, M. L. Zelditch, A. N. Rountrey, T. P. Eiting, H. D. Sheets, P. D. Gingerich. Multivariate stasis in the dental morphology of the Paleocene-Eocene condylarth *Ectocion*. *Paleobiology*. 33: 248–260.
 13. 2007 Jones, D. C., M. L. Zelditch, P. L. Lightfoot and R. Z. German. The effects of muscular dystrophy on the craniofacial shape of *Mus musculus*. *Journal of Anatomy* 210: 723–730.
 14. 2006 Zelditch, M. L., J. Mezey, H. D. Sheets, B. L. Lundrigan, and T. Garland Jr. Developmental regulation of skull morphology II: Ontogenetic dynamics of covariance. *Evolution & Development* 8:46-60.
 15. 2006 Hallgrímsson, B., J. Y. Brown, A. Ford-Hutchinson, H. D. Sheets, M. L. Zelditch, and F. R. Jirik. The Brachymorph mouse and the developmental-genetic basis for canalization and morphological integration. *Evolution & Development* 8:61-73
 16. 2006 Willmore, K. E., M. L. Zelditch, N. Young, A. Ah-Seng, S. Lozanoff, B. Hallgrímsson. Canalization and developmental stability in the Brachyrrhine mouse. *Journal of Anatomy* 208: 361-372.
 17. 2005 Webster, M. and M. L. Zelditch. Evolutionary modifications of ontogeny: heterochrony and beyond. *Paleobiology* 31: 354-372

- 18.2004 Zelditch, M. L., B. L. Lundrigan. Developmental regulation of skull morphology I. Ontogenetic dynamics of variance. *Evolution & Development* 6: 194-206.
- 19.2004 Hallgrímsson, B., C. Dorval, M. L. Zelditch and R. Z. German. Craniofacial variability and morphological integration of the skull in mice susceptible to cleft lip and palate. *Journal of Anatomy*. 205: 501-517
- 20.2003 Zelditch, M. L., H. D. Sheets, and W. L. Fink. The ontogenetic dynamics of shape disparity. *Paleobiology* 29 139-156.
- 21.2003 Zelditch, M. L., B. L. Lundrigan, H. D. Sheets and T. Garland, Jr. Do precocial mammals have a fast developmental rate? A comparison between *Sigmodon fulviventer* and *Mus musculus domesticus*. *Journal of Evolutionary Biology* 16: 708-720.
- 22.2002 Sheets, D. H., M. L. Zelditch and D. L. Swiderski. Growth and shape: Measurement and metrics. *Systematic Biology* 51: 817-822.
- 23..2000 Zelditch, M. L., H. D. Sheets and W. L. Fink. Spatiotemporal reorganization of growth rates in the evolution of ontogeny. *Evolution* 54:1363-1371
- 24.2000 Swiderski, D. L., M. L. Zelditch and W. L. Fink. Phylogenetic analysis of skull shape evolution in marmotine squirrels using landmarks and thin plate splines. *Hystrix* 11:49-75.
- 25.1998 Reis, R.E., M. L. Zelditch and W. L. Fink. Spatial integration and ontogenetic allometry of body shape in the Neotropical catfish *Callichthys* (Teleostei: Siluriformes). *Copeia* 1998: 177-182.
- 26.1998 Zelditch, M. L., W. L. Fink, D. L. Swiderski and B. L. Lundrigan. Morphometrics and phylogenetic systematics: A reply to Rohlf. *Systematic Biology* 47: 159-167.
- 27.1998 Zelditch, M. L. and W. L. Fink. Ontogeny and phylogeny: A reply to Adams and Rosenberg. *Systematic Biology* 47: 345-348.
- 28.1998 Swiderski, D. L., M. L. Zelditch and W. L. Fink. Why morphometrics isn't special: Coding quantitative data for phylogenetic analysis. *Systematic Biology* 47:508-519.
- 29.1997 Fink, W. L. and M. L. Zelditch. Shape analysis and taxonomic status of *Pygocentrus* piranhas (Ostariophysi, Characiformes) from the Paraguay and Parana river basins of South America. *Copeia* 1997: 179-182.
- 30.1966 Zelditch, M. L. and W. L. Fink. Heterochrony and heterotopy: Innovation and stability in the evolution of form. *Paleobiology* 22:241-254.
- 31.1996 Myers, P., B. L. Lundrigan, B. W. Gillespie and M. L. Zelditch. Phenotypic plasticity in skull and dental morphology in the Prairie Deer Mouse (*Peromyscus maniculatus bairdii*). *Journal of Morphology* 229: 229-237.
- 32.1996 Zelditch, M. L. Introduction to the symposium: Historical patterns of developmental integration. *American Zoologist* 36: 1-3.
- 33.1996 Fink, W. L. and M. L. Zelditch. Historical patterns of developmental integration in piranhas. *American Zoologist* 36: 61-69
- 34.1995 Zelditch, M. L., and W. L. Fink. Allometry and developmental integration of body growth in a piranha, *Pygocentrus nattereri* (Teleostei: Ostariophysi). *Journal of Morphology* 223:341-355.

35. 1995 Zelditch, M. L., W. L. Fink and D. L. Swiderski. Morphometrics, homology, and phylogenetics: Quantified characters as synapomorphies. *Systematic Biology* 44: 179-189.
36. 1995 Fink, W. L. and M. L. Zelditch. Phylogenetic analysis of ontogenetic shape transformations: A reassessment of the piranha genus *Pygocentrus* (Teleostei). *Systematic Biology* 44: 343-360
37. 1993 Zelditch, M. L., F. L. Bookstein and B. L. Lundrygan. The ontogenetic complexity of developmental constraints. *Journal of Evolutionary Biology* 6: 121-141.
38. 1992 Zelditch, M. L., F. L. Bookstein and B. Lundrygan. Ontogeny of integrated skull growth in the cotton rat *Sigmodon fulviventer*. *Evolution* 46: 1164-1180
39. 1990 Zelditch, M. L., D. O. Straney, D. L. Swiderski, and A. C. Carmichael. Variation in developmental constraints in *Sigmodon*. *Evolution* 44: 1738-1747
40. 1989 Zelditch, M. L., R. W. DeBry and D. O. Straney. Triangulation measurement schemes in the multivariate analysis of size and shape. *Journal of Mammalogy* 70: 571-579.
41. 1989 Zelditch, M. L. and A. C. Carmichael. Growth and intensity of integration throughout postnatal ontogeny in the skull of *Sigmodon fulviventer*. *Journal of Mammalogy* 70:477-484.
42. 1989 Zelditch, M. L. and A. C. Carmichael. Ontogenetic variation in patterns of developmental and functional integration in skulls of *Sigmodon fulviventer*. *Evolution* 43:814-824.
43. 1988 Zelditch, M. L. Ontogenetic variation in patterns of phenotypic integration in the laboratory rat. *Evolution* 42:28-41.
44. 1987 Zelditch, M. L. Evaluating models of developmental integration in the laboratory rat using confirmatory factor analysis. *Systematic Zoology* 36:368-381.

Invited articles and book chapters

1. Sheets, H. D. and M. L. Zelditch. 2013. Studying ontogenetic trajectories using resampling methods and landmark data. *Hystrix, the Italian Journal of Mammalogy*. doi:10.4404/hystrix-24.1-6332
2. Zelditch, M. L. and D. L. Swiderski. 2011. Epigenetic interactions: The developmental route to functional integration. PP. 290-315 *In* B. Hallgrímsson and B. K. Hall (eds). *Epigenetics: Linking Genotype and Phenotype in Development and Evolution*
3. 2008 Hallgrímsson, B., M. L. Zelditch, T. E. Parsons, E. Kristensen, N. M. Young, S. K. Boyd. Morphometrics and biological anthropology in the post-genomic age. PP. 207- 236 *In*: M. A. Katzenberg and S. R. Saunders (eds). *Biological Anthropology of the Human Skeleton*. Wiley, N. Y.
4. 2008 Webster, M., and M. L. Zelditch. 2008. Integration and regulation of developmental systems in trilobites. Pp. 427-433 *In* Rábano, I., Gozalo, R., and García-Bellido, D (eds.), *Advances In Trilobite Research*. Cuadernos del Museo Geominero 9. Instituto Geológico y Minero de España, Madrid.
5. 2005 Zelditch, M. L. Developmental regulation of variability. Pp. 249-276 *In* B. Hallgrímsson and B. K. Hall (eds). *Variation: A Central Concept in Biology*. Elsevier, London.

6. 2004 Zelditch, M. L. and R. A. Moscarella. Form, function and life-history: Spatial and temporal dynamics of integration. Pp, 274-301 *In* M. Pigliucci and K. Preston (eds). Phenotypic Integration: Studying the Ecology and Evolution of Complex Phenotypes. Oxford University Press, Oxford.
7. 2003 Zelditch, M. L. Space, Time and Repatterning. Pp. 341-348 *in* B. K. Hall and W. Olson (eds). Keywords in Evolutionary Developmental Biology. Harvard University Press, Cambridge.
8. 2002 Zelditch, M. L. Heterotopy. *In* S. A. Frank, C. Godfray, B. K. Hall, K. Hawkes, D. M. Hillis, A. Kodrick-Brown, R. Lenski and A. Pomiankowski (eds). Encyclopedia of Evolution. Oxford University Press, Oxford. .
9. 2002 Swiderski, D. L., M. L. Zelditch and W. L. Fink. Comparability, morphometrics and phylogenetic systematics. Pp. 67-99 *in* N. MacLeod and P. Forey (eds). Morphometrics, Shape and Phylogenetics. Taylor and Francis, N. Y.
10. 2001 Zelditch, M. L., D. L. Swiderski and W. L. Fink. Homology, characters and morphometric data. Pp. 145-196 *in* J. Adrain and B. Lieberman (eds). Fossils, Phylogeny and Form: An Analytical Approach. Plenum Press, N. Y.
11. 2001 Zelditch, M. L., H. D. Sheets and W. L. Fink. The spatial complexity and evolutionary dynamics of growth. Pp. 145-194 *in* M. L. Zelditch (ed.). Beyond Heterochrony: The Evolution of Development. John Wiley & Sons, Inc. N. Y
12. 2000 Zelditch, M. L., D. L. Swiderski and W. L. Fink. Discovery of phylogenetic characters in morphometric data. Pp. 37-83 *in* J. Wiens (ed). Morphological Data in Phylogenetic Analysis: Recent Progress and Unresolved Problems. Smithsonian Press