

**Douglas H. Erwin**

Senior Scientist and Curator  
 Department of Paleobiology, MRC-121  
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Education

Ph.D., June, 1985. University of California, Santa Barbara. Dept. of Geological Sciences. Dissertation title: "The Cerithiacea, Subulitacea, Pyramidellacea and Acteonacea of the Permian Basin, West Texas and New Mexico with a consideration of Permo-Triassic Gastropod Dynamics."

A.B., May, 1980. Colgate University, Hamilton, New York. Major in Geology; Emphasis in Evolutionary Biology.

Experience

**United States National Museum of Natural History, Department of Paleobiology, Senior Scientist and Curator 2004 - present;** Curator, August 1993-2004; Associate Curator, July 1990-August 1993. Interim Director, June 2002-March 2003.

**Santa Fe Institute, Chair of Faculty July 2011 – present; Research Professor (part-time) July 2005- present;** Visiting Professor, Sept, 2003 - Nov. 2004;

Michigan State University, East Lansing, MI, Department of Geological Sciences, Assistant Professor, September 1985-June 1990; Associate Professor, July 1990-August 1990

Research Interests

Evolutionary innovation and novelty, particularly genomic, developmental and ecologic aspects of major evolutionary transitions; Origin, evolutionary dynamics and systematics of Paleozoic gastropods, particularly from the Permian; the end-Permian mass extinction and Early Triassic recovery; the taphonomic consequences of silicification.

Professional Memberships

Paleontological Society, Society for the Study of Evolution, Society for Systematic Zoology, Geological Society of America, SEPM, Palaeontological Association, International Paleontological Association; American Association for the Advancement of Science.

Honors

Charles Schuchert Award, Paleontological Society, 1996.

Overseas Visiting Scholar, St. John's College, Cambridge University, Lent Term 2001.

Editorial Service

Member, Editorial Board, Trends in Ecology and Evolution; Co-Chief Editor, Paleoworld, 2005- ; Member, Faculty of Evolutionary Biology, Faculty of 1000, ([www.facultyof1000.com](http://www.facultyof1000.com)), 2003- ; Member of Editorial Board, Journal of China University of Geosciences, 2003- ; Member of Editorial Board, Journal of Systematic Palaeontology, 2003- ; Member of Editorial Board, Evolution & Development, 1999- ;

*Past:* Member, Board of Reviewing Editors, Science, Oct. 2003-2008; Member of Editorial Board, Geobiology, 2003-2008; Member of Editorial Board, American Naturalist, 2002- 2006; Co-Editor, Paleobiology, 1995-2001; Co-Editor, Smithsonian Series in Comparative Evolutionary Biology, Smithsonian Inst. Press, 1996-2002; Associate Editor, American Zoologist, 1998-2000; Associate Editor, "Matters of the Record" Paleobiology, 1992-1995; Member, Editorial Board, Annual Reviews of Ecology and Systematics, 1994-1998; Editor, Special Issue on Biotic Recoveries, 1999. Palaeoecology, Palaeogeography, Palaeoclimatology

Grants and Awards: Past

American Chemical Society, Petroleum Research Fund, "Late Paleozoic Gastropods in the Southwestern United States: The Relationship Between Radiation and Mass Extinction." September 1986-August 1988, \$18,000.

National Science Foundation, Systematic Biology Program, "A Phylogenetic Analysis of the Subulitidae (Mollusca: Mesogastropoda) July 1988-December 1990, \$56,232.

Smithsonian Institution, Charles D. Walcott Fund, 1992: "An Integrated Approach to Evolutionary Radiations", \$14,000. 1993: "Mass extinctions and Evolutionary Radiations", \$15,000. 1994: \$18,000;

- Smithsonian Institution, Scholarly Studies Program, 1993-1995: "A High-resolution biostratigraphic database for the Permo-Triassic mass extinction", \$44,000.
- National Aeronautics and Space Administration, Exobiology Program, (Co-PI: S. Bowring, MIT), 1995-1998: "A High-resolution Paleontological and Geochronological Analysis of the Permian Mass Extinction and Triassic Recovery", \$225,000.
- National Aeronautics and Space Administration, Astrobiology Institute (PI: A. Knoll, Harvard), 1998-2002. Participation in Astrobiology Institute, c. \$20,000/year to DHE.
- National Aeronautics and Space Administration, Exobiology Program, (Co-PI: S. Bowring, MIT), 1999-2002 Tempo of the Permian Mass Extinctions and Recoveries, \$114,000 for year one. \$335,398 total.
- National Science Foundation, Geology and Paleontology, A Workshop on Computational Approaches to Theoretical Morphospaces (Co-PI: D. M. Raup) 2001, \$18,681.
- National Science Foundation, Geology, A Workshop on Geochronology and Evolutionary Rates: (Co-PI: S. Bowring, MIT) 2003, \$50k
- National Science Foundation, Geology and Paleontology, (Co-PI: S. Bowring, Luo Z. X, Jin, Y. G.) Workshop on Chinese-US Geological Collaboration, 2005, \$49,000
- National Aeronautics and Space Administration, Exobiology Program, (Co-PI: S. Bowring, MIT; F. Kyte, UCLA) EXB04-000-0101. Cooperative Investigation of Permo-Triassic impact Signatures, Meishan, China. 07/01/2005-06/30/2006. \$42,987
- National Science Foundation, Geology and Paleontology EAR 0451802: The Earthtime Network: Developing an infrastructure for high-resolution: calibration of Earth History (coPI's: Sam Bowring (MIT), Paul Renne, Berkeley Geochron. 05/01/2005-05/01/2008. Total Award: \$1,285,862. Total Funding for DHE: c\$10 ky / year.

#### Grants and Awards: Current

- National Aeronautics and Space Administration, NAI, "The Requirements for Development and Maintenance of Multicellular Life" (Co-I with: Roger Summons (MIT) PI; D. Rothman (MIT); S. Bowring (MIT); A. Knoll (Harvard); K. Peterson (Dartmouth); J. Grotzinger (Caltech); N. King (Berkeley); A. Pearson (Harvard); D. Sasselov (Harvard); D. Segré (BU); D. Jacobs (UCLA); D. Patterson (WHOI). 07/01/2007-06/30/2012.
- National Science Foundation, Social Sciences, MOD: Modeling the Dynamics of Technological Evolution" (Collaborator with Doyné Farmer and Jessika Transik (SFI) and others. \$400,000; January 1, 2008 - December 31, 2010
- National Science Foundation, EAR: "Workshop Proposal for a "Deep Time Earth-Life Observatory Network" (DETELON)", Co-PI with D. Bottjer. Administered through USC. \$49,970 03/01/2011-02/28/2012

#### Publications - Books

- 1993 Erwin, D. H. **The Great Paleozoic Crisis: Life and Death in the Permian.** Critical Episodes in Earth History Series, Columbia University Press. 327 p.
- 1994 Briggs, D.E.G., Erwin, D. H. and Collier, F. **The Fossils of The Burgess Shale.** Smithsonian Institution Press. 238p.
- 1995 Erwin, D. H. and Anstey, R. L. (eds). **New Approaches to Speciation in the Fossil Record.** Columbia University Press. 342 p.
- 1996 D. Jablonski, Erwin, D. H., and J. Lipps (eds). **Evolutionary Paleobiology: Essays in Honor of James W. Valentine.** University of Chicago Press. 484 p.
- 2000 Erwin, D. H. and Wing, S. L. (eds). **Deep Time: Paleobiology's Perspective.** (25<sup>th</sup> Anniversary Special volume of *Paleobiology*). Paleontological Society. 371 p.
- 2006 Erwin, D. H. **Extinction: How Life on Earth Nearly Ended 250 Million Years Ago.** Princeton University Press. 296 p.

#### Publications - Papers

- 1983 **Valentine, J.W. and D.H. Erwin.** Patterns of diversification of higher taxa: a test of macroevolutionary paradigms. *In:* J. Chaline (ed.), Modalities et Rythmes de L'Evolution Mechanismes de Speciation, CNRS, Paris, no. 330, p. 220-223.
- 1984 **Erwin, D.H. and J.W. Valentine.** Hopeful monsters, transposons and metazoan radiation. *Proc. National Academy of Sciences, U.S.A.* 81: 5482-5483.
- 1987 **Erwin, D.H., J.W. Valentine and J.J. Sepkoski, Jr.** A comparative study of diversification events: the early Paleozoic vs. the Mesozoic. *Evolution* 37:1177-86
- Valentine, J.W. and D.H. Erwin.** Interpreting great developmental experiments: the fossil record. *In:* R.A. Raff (ed.), *Development as an Evolutionary Process.* pp. 71-107. MBL Lectures in Biology Series, A.R. Liss, Inc. New York.
- 1988 **Erwin, D.H.** Permian gastropoda of the southwestern United States. Subulitacea. *Journal of Paleontology* 62:57-69.
- Erwin, D.H.** Permian gastropoda of the southwestern United States. Cerithiacea, Acteonacea and Pyramidellacea. *Journal of Paleontology* 62:566-575

- Erwin, D.H.** The genus *Glyptospira* (Gastropoda: Trochacea) from the Permian of the southwestern United States. *Journal of Paleontology* 62:868-879
- 1989 **Erwin, D.H.** The end Permian Mass Extinction. *Trends in Ecology and Evolution*. 4:225-229.  
**Erwin, D.H.** Molecular clocks, molecular phylogenies and the origin of phyla. *Lethaia* 22:251-256.  
**Erwin, D.H.** The end-Permian extinction event. IN: *Paleobiology: A Synthesis*, ed. by D.E.G. Briggs and P.R. Crowther. The Palaeontological Association and Blackwell Scientific, London.  
**Erwin, D.H.** Regional Paleoeecology of Permian gastropod genera, Southwestern United States and the end-Permian mass extinction. *PALAIOS* 4(5):424-438.
- 1990 **Erwin, D.H.** The end-Permian mass extinction. *Annual Review of Ecology and Systematics*. 21:69-91.  
**Erwin, D.H.** Diversity patterns in Mississippian-Triassic Gastropod genera and the end-Permian mass extinction. *Paleobiology* 16:187-203.
- 1991 **Erwin, D.H.** Metazoan phylogeny. *Trends in Ecology and Evolution*. 6:131-134.  
**Erwin, D.H. and Signor, P.W.** Extinction in an extinction-resistant clade: the evolutionary history of the gastropoda. Pp 152-160. In; Dudley, E. C. *The Unity of Evolutionary Biology*, Vol. I. Proceedings of the Fourth International Congress of Systematic and Evolutionary Biology. Dioscorides Press, Portland, OR
- 1992 **Erwin, D.H.** A preliminary classification of radiations. *Historical Biology* 6:133-147.  
**Erwin, D.H. and Vogel, T.** Testing for causal relationships between large pyroclastic volcanic eruptions and mass extinctions. *Geophysical Research Letters*. 19:893-896
- 1993 **Tracey, S., Todd, J. A. and Erwin, D.H.** Mollusca: Gastropoda. pp. 131-167. In: The Fossil Record 2, M.J. Benton, ed. Chapman & Hall, London.  
**Benton, M.J. and Erwin, D.H.** Amphineura and Monoplacophora. pp. 125-130, In: The Fossil Record 2, M.J. Benton, ed. Chapman & Hall, London.  
**Erwin, D.H.** The Origin of Metazoan Development: A Paleobiological perspective. *Biological Journal of the Linnaean Society* 50:255-274.
- 1994 **Erwin, D. H.** The end-Permian mass extinction. *Nature*. 367:231-236.  
**Erwin, D. H.** Major Morphologic Innovations. *Acta Palaeontologica Polonica* 38:281-294.  
**Stanley, G. D., Jr., C. Gozalez-Leon, M. R. Sandy, B. Senowbari-Daryan, P. Doyle and D. H. Erwin.** Upper Triassic (Karnian-Norian) Invertebrates from the Antimonio Formation, Sonora, Mexico. *Paleontological Society. Memoir* 36, (*Journal of Paleontology*, v. 68, no. 4, supp.), 33 p.  
**Pan, H. Z. and D. H. Erwin.** Gastropod diversity patterns in South China during the Chihshia-Ladinian and the Permo-Triassic mass extinction. *Paleoworld, Nanjing Institute of Geology and Palaeontology*, 4:249-262.
- 1995 **Erwin, D.H.** The End-Permian Mass Extinction. In Permian of the Northern Continents edited by P. Scholle. Springer-Verlag. pp. 20-34.  
**Erwin, D. H.** Diversity crises in the geologic past. In Encyclopedia of Environmental Biology, edited by W. A. Nierenberg. Academic Press, San Diego. Vol. 1, pp. 507-516.  
**Erwin, D. H. and R. L. Anstey.** Speciation in the fossil record. In New Approaches to Speciation in the Fossil Record, edited by D. H. Erwin and R. L. Anstey. Columbia University Press. pp. 11-38  
**Wagner, P. J. and D. H. Erwin.** Phylogenetic patterns as tests of speciation models. In New Approaches to Speciation in the Fossil Record, edited by D. H. Erwin and R. L. Anstey. Columbia University Press. pp. 87-122.
- 1996 **Erwin, D. H.** Permian Bio-Events. In Global Bio-Events in Earth History. Final volume of IGCP 216. Edited by O. H. Walliser. Springer-Verlag. Berlin. p 251-264.  
**Erwin, D. H.** The Geological History of Diversity. In Biodiversity in Managed Landscapes edited by R. Szaro and D. W. Johnson. Oxford University Press. New York. pp 3-16.  
**Valentine, J. W., D. H. Erwin and D. Jablonski.** 1996. Developmental evolution of metazoa: the fossil evidence. *Developmental Biology* 173:373-381.  
**Erwin, D. H. and Pan, H. Z.** Recoveries and radiations: gastropods after the Permo-Triassic mass extinction. In: Biotic recovery from Mass Extinction Events ed. by M. B. Hart, Special Volume No. 102, Geological Society of London. pp. 223-229  
**Erwin, D. H.** Understanding Biotic Recoveries: extinction, survival and preservation during the end-Permian mass extinction. In: D. Jablonski, D. H. Erwin and J. H. Lipps, eds. Evolutionary Paleobiology. University of Chicago Press. pp. 398-418.
- 1997 **Erwin, D. H., D. Jablonski, and J. H. Lipps.** James W. Valentine: An Appreciation. In: D. Jablonski, D. H. Erwin and J. H. Lipps, eds. Evolutionary Paleobiology. University of Chicago Press. pp. 1-17.  
**Erwin, D. H., J. W. Valentine, and D. Jablonski.** The Origin of Animal Bodyplans. *American Scientist*. 85:126-137.  
**Schubert, J. K., D. L. Kidder and D. H. Erwin.** Silica replacement of fossils through the Phanerozoic. *Geology*

- 25:1031-1034.
- 1998 **Erwin, D. H.** After the end: Recovery from mass extinction. *Science* 279: 1324-1325.  
**Bowring, S. A., D. H. Erwin, Y.G., Jin, M. W. Martin, K. Davidek, and W. Wang.** Geochronological constraints on the end-Permian mass extinction. *Science* 280:1039-1045.  
**Erwin, D. H.** The end and the beginning: Recoveries from mass extinctions. *Trends in Ecology and Evolution* 13:344-349.  
**Bowring, S. A. and D. H. Erwin.** A new look at evolutionary rates: uniting paleontology and high-precision geochronology. *GSA Today*, September 8(9):1-8.
- 1999 **Erwin, D. H.** Biospheric perturbations: from the Neoproterozoic-Cambrian radiation to the end-Permian crisis. *Journal of African Earth Sciences* 28:5-27.  
**Erwin, D. H.** The origin of bodyplans. *American Zoologist* 39:617-629.  
**Valentine, J. W., Jablonski, D. and Erwin, D. H.** Fossils, molecules and embryos: new perspectives on the Cambrian explosion. *Development*. 126:851-859.  
**Glenister, B. F., Wardlaw, B. R., Lambert, L. L., Spinosa, C., Bowring, S. A., Erwin, D. H., Menning, M., and Wilde, G. L.** Proposal of Guadalupian and component Roadian, Wordian and Capitanian stages as International standards for the Middle Permian Series. *Permian*. No. 34, p 3-11.
- 2000 **Erwin, D. H.** Macroevolution is more than repeated rounds of microevolution. *Evolution & Development* 2:78-84.  
**Nützel, A., Erwin, D. H. and Mapes, R. H.** Identity and phylogeny of the late Paleozoic Subulitoidea (Gastropoda). *Journal of Paleontology* 74: 575-598.  
**Jin, Y. G., Y. Wang, W. Wang, Q. H. Shang, C. Q. Cao, and D. H. Erwin.** Pattern of Marine mass extinction near the Permian-Triassic boundary in South China. *Science* 289:432-436.  
**Erwin, D.H. and Kidder, D.L.** Depositional controls on selective silicification of Permian Fossils, southwestern United States. *Smithsonian Contributions to the Earth Sciences* 32:407-415.
- 2001 **Erwin, D. H.** Lessons from the past: Biotic Recoveries from Mass Extinctions. *Proceedings of the National Academy of Sciences*. 98:5399-5403.  
**Erwin, D. H.** Metazoan origins and early evolution. *Palaeobiology II*, ed. by D. E. G. Briggs, and P. R. Crowther. Blackwell Science, Oxford. p. 25-31.  
**Kidder, D. L., and Erwin, D. H.** Secular distribution of biogenic silica through the Phanerozoic: comparison of silica-replaced fossils and bedded chert at the series level. *Journal of Geology*. 109:509-522.  
**Nützel, A. & Erwin, D. H.** New Late Triassic Gastropods from the Wallowa Terrane (Idaho) and their biogeographic significance. *Facies* 45: 87-92.  
**Tong Jinnan and D. H. Erwin.** Triassic gastropods of South Qinling Mountains, *Smithsonian Contributions to Paleobiology*, No. 92, 47 p.
- 2002 **Erwin, D. H. and E. H. Davidson.** The last common bilaterian ancestor. *Development* 129: 3021-3032  
**Erwin, D. H., Bowring, S. A., and Jin, Y. G.** The End-Permian Mass Extinctions. In: *Catastrophic Events and Mass Extinctions: Impacts and Beyond*. C. Koeberl and K. G. MacLeod, eds. *Geological Society of America Special Paper* 356: 363-383.  
**Nützel, A. & Erwin, D. H.** *Battenizyga*, a new early Triassic gastropod genus with a discussion on the gastropod evolution at the Permian/Triassic boundary. *Paläontologische Zeitschrift*. 76:21-27.  
**Pan Hua-zhang and D. H. Erwin.** Gastropods from the Permian of south China. *Journal of Paleontology*. 76, Suppl. To No. 1, Memoir 56. 49 p.  
**Solé, R. V., J. M. Montoya and D. H. Erwin.** Recovery after mass extinction: evolutionary assembly in large-scale biosphere dynamics. *Philosophical Transactions of the Royal Society B*, 357:697-707.  
**Nützel, A., Pan, H. Z. & Erwin, D. H.** New taxa and some taxonomic changes of a latest Permian gastropod fauna from South China. *Documenta naturae* 145: 1-10.
- 2003 **Pan Hua-zhang, D. H. Erwin, A. Nützel, and Zhu Xiang-shui.** *Jiangxispira*, a new gastropod genus from the Early Triassic of China with remarks on the phylogeny of the Heterostropha at the Permian/Triassic boundary. *Journal of Paleontology* 77:44-49.  
**Erwin, D. H.** Impact at the Permo-Triassic boundary: a critical evaluation. *Astrobiology (Rubey Symposium Special Issue)* 3:67-74.
- 2004 **Erwin, D. H.** Mass extinctions and radiations. In: *Evolution: From Molecules to Ecosystems*, ed. by A. Moya and E. Font, Oxford University Press. P 218-228.  
Olszewski, T. and **Erwin, D. H.** Dynamic response of Permian brachiopod communities to long-term environmental change. *Nature*. 428:738-741.  
Nützel, A. and **Erwin, D. H.** Late Triassic (Norian) Gastropods from the Wallowa Terrane (Idaho, USA). *Palaontologische Zeitschrift*, 78:361-416.

- Kues, B. S., Batten, R. L., **Erwin, D. H.**, and Pan, H. Z. A Late Permian Chinese Gastropod Species, possibly larval, In the Middle Pennsylvanian of New Mexico. *Journal of Paleontology* 78: 420-423.
- 2005 Ward, P.D., Botha, J., Buick, R., **Erwin, D.H.**, Garrison, G., Kirschvink, J. and Smith, R. Integrated carbon isotope stratigraphy, biostratigraphy and magnetostratigraphy across four Permian/Triassic boundary sections in the South African Karoo: evidence against a K/T -type impact extinction at the end of the Permian. *Science*
- Flessa, K. W., Jackson, S. T., Aber, J. D., Arthur, M. A., Crane, P. R. **Erwin, D. H.**, Graham, R. W., Jackson, J. B. C., Kidwell, S. M., Maples, C. G., Peterson, C. H. and Reichman, O. J.. The Geological Record of Biosphere Dynamics. National Research Council.
- Erwin, D. H.** Robustness in the history of life? Robust Design. A repertoire of Biological, Ecological and Engineering case studies, SFI Studies in the Sciences of Complexity. Edited by E. Jen, Oxford University Press. P. 191-205.
- Erwin, D. H.** Development, Ecology, and Environment in the Cambrian Metazoan Radiation. Special Issue of the Proceedings of the California Academy of Sciences. 56 (Suppl 1): 24-31.
- Erwin, D. H.** The Origin of Animal Bodyplans. *Form and Function. Essays in Honor of Adolf Seilacher*, ed by D. E. G. Briggs, Yale Peabody Museum. pp. 67-80.
- 2006 Tong, J. N., Zhou, X. G., **Erwin, D. H.**, Zuo, J. X. and Zhao, L. S. 2006. Some fossil fish from the Lower Triassic of Majiashan, Chaohu, Anhui Province, China. *Journal of Paleontology* 80:146-161.
- Erwin, D. H.** Date and Rates: Temporal resolution in the deep time stratigraphic record. *Annual Review of Earth and Planetary Sciences* 34:369-390.
- Davidson, E. H. and **Erwin, D. H.** Gene regulatory networks and the evolution of animal body plans. *Science*. 311:796-800.
- Wagner, P. J. and **Erwin, D. H.** Patterns of convergence in general shell form among Paleozoic gastropods. *Paleobiology*. 32:315-336.
- Jackson, J. B. C. and **Erwin, D. H.** What can we learn about ecology and evolution from the fossil record. *Trends in Ecology and Evolution*. 21:322-328.
- Erwin, D. H.** The developmental origins of animal bodyplans. *Neoproterozoic Geobiology and Paleobiology*, ed by Shuhai Xiao and A. J. Kauffman. Kluwer Press. Pp 159-197.
- 2007 **Erwin, D. H.** Disparity: Morphological patterns and developmental context. *Palaeontology* 50:57-73.
- Bambach, R. K., A. M. Bush and **D. H. Erwin**, Autecology and the realized ecospace of marine metazoa. *Palaeontology* 50:1-22.
- Erwin, D. H.** Increasing returns, ecological feedback and the Early Triassic recovery. *Palaeoworld* 16:9-15.
- Zhang, X. L., Shu, D. G. and **D. H. Erwin**. Cambrian Naraoiids (Arthropoda) *Journal of Paleontology Memoirs*.
- 2008 Dunne, J. A., R. J. Williams, N. D. Martinez, R. A. Wood, and **D. H. Erwin**. Compilation and network analysis of Cambrian Food webs. *PLoS Biology* 6:e102 [doi:10.1371/journal.pbio.0060102](https://doi.org/10.1371/journal.pbio.0060102)
- Erwin, D. H.** Wonderful Ediacarans, Wonderful Cnidarians? *Evolution and Development*. 10:263-264.
- Erwin, D. H.** Ecosystem engineering, niche construction and macroevolution. *Trends in Ecology and Evolution*. 23:304-310. [doi:10.1016/j.tree.2008.01.013](https://doi.org/10.1016/j.tree.2008.01.013)
- Clauset, A. and **D. H. Erwin**. The evolution and distribution of species body size. *Science*. **321**:399-401. [Doi:10.1126/science.1157534](https://doi.org/10.1126/science.1157534)
- Erwin, D. H.** Extinction as the loss of evolutionary history. *Proceedings of the National Academy of Sciences, USA*. **105**:11520-11527. [www.pnas.org/cgi/doi/10.1073/pnas.0801913105](https://www.pnas.org/cgi/doi/10.1073/pnas.0801913105)
- 2009 Krakauer, D. C., Page, K. and **D. H. Erwin**, Diversity, dilemmas and monopolies of niche construction. *American Naturalist*. 173:26-40.
- Erwin, D. H.** and Davidson, E. H. The evolution of hierarchical gene regulatory networks. *Nature Reviews Genetics*. 10:141-148.
- Olszewski, T., and **D. H. Erwin**, Change and Stability in Permian Brachiopod Communities from West Texas. *Palaios* 24: 27-40.
- Erwin, D. H.** Early genomic origins of the bilaterian developmental toolkit. *Philosophical Transactions of the Royal Society, B* 264:2253-2261. [doi: 10.1098/rstb.2009.0038](https://doi.org/10.1098/rstb.2009.0038)
- Erwin, D. H.** Climate as a driver of evolutionary change. *Current Biology*. 19:R575-R583. DOI 10.1016/j.cub.2009.05.047
- Erwin, D. H.** 2009. Understanding Biodiversity. *Nature*. 462: 282-283.
- 2010 **Erwin, D. H.** 2010. Microevolution and macroevolution are not governed by the same processes. Pp. 180-193. In Contemporary Debates in Philosophy of Biology, ed. By F. J. Ayala and R. Arp. Blackwell.
- Davidson, E. H. and **D. H. Erwin**. Evolutionary innovation and stability in animal gene networks. *Journal of Experimental Zoology (Mol. Dev. Evol)*. 314B:182-186.
- Davidson, E. H. and **D. H. Erwin**. An integrated view of Precambrian eumetazoan evolution. *Cold Spring Harbor*

*Symposia in Quantitative Biology*, Cold Spring Harbor Laboratory. 79:65-80

Maloof, A. C., Rose, C. V., Calmet, C. C., Beach, R., Samuels, B. M., **Erwin, D. H.**, Poirier, G.R., Yao, N., Simons, F. J., Probable animal body-fossils from pre-Marinoan limestones, South Australia. *Nature Geoscience* **3**, 653 – 659.

Solé, R.V., Saldaña, J., Montoya, J.M. and **Erwin, D.H.** Simple model of recovery dynamics after mass extinction, *Journal of Theoretical Biology*, 267:193-200. doi:10.1016/j.jtbi.2010.08.015

2011 **Erwin, D. H.** Evolutionary uniformitarianism. *Developmental Biology* <http://dx.doi.org/10.1016/j.ydbio.2011.01.020>

Bush, A. M., Bambach, R. K., and **D. H. Erwin**. Ecospace utilization during the Ediacaran radiation and the Cambrian Eco-plosion. In: “Quantifying the Evolution of Early Life” pp. 111-133. Edited by: M. LaFlamme, J. Schiffbauer, and S. Dornbos. Springer. Topics in Geobiology 36.

**Erwin, D. H.** A Paleontologist looks at history. *Cliodynamics* 2:27-39.

Krakauer, D. C., Collins, J., **Erwin, D. H.**, Flack, J. C., Fontana, W., Laubichler, M., Prohaska, S. J., West, G.B., Stadler, P.F., The challenges and scope of theoretical biology. *Journal of Theoretical Biology* 276:269-276.

#### Publications -Book Reviews and Commentary

- 1989 Erwin, D. H. Review of Extinction and Survival in the Fossil Record ed. by G. P. Larwood. Systematics Association Special Volume No. 34. Geological Magazine 126:734
- 1990 Erwin, D.H. Invertebrate Paleontology - 1989 Review. *Geotimes* 35(2):40-41.  
Erwin, D. H. Review of Morphogenesis and Evolution by K. S. Thompson. *Paleobiology* 16:96-101.
- 1991 Erwin, D. H. Review of Invertebrate Relationships by. P. Wilmer. *Quarterly Review of Biology* 66:213.  
Erwin, D.H. Invertebrate Paleontology - 1990 Review. *Geotimes* 36(2):31-32  
Erwin, D.H. The mother of mass extinctions. (Online editorial) *Palaios* 6(6):517-518.
- 1992 Erwin, D.H. Invertebrate Paleontology - 1991 Review. *Geotimes* 37(2):31-32  
Erwin, D.H. Gastropoda - Fossils. McGraw-Hill Encyclopedia of Science and Technology. 7th Ed.
- 1993 Erwin, D. H. Invertebrate Paleontology - 1992 Review. *Geotimes* 38(2):25.  
Erwin, D. H. Explosions, extinctions and evolutionary trends. *The Earth Scientist* 11(1):3-5  
Erwin, D. H. and Droser, M. L. Elvis taxa. *Palaios* 8:623-624.  
Erwin, D. H. Review of O. H. Schindewolf, Basic Questions in Paleontology *American Paleontologist*.  
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Erwin, D. H. Review of J. D. Archibald, Dinosaur Extinction and the End of an Era; N. MacLeod and G. Keller, Cretaceous-Tertiary Mass Extinction. Biotic and Environmental Changes. and C. Officer and J. Page, The Great Dinosaur Extinction Controversy. *American Paleontologist* 5(1):9-10.  
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- 1998 Erwin, D. H. Review of W. Arthur, The Origin of Animal Body Plans *Palaios* 13:608.
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- Erwin, D. H. Paleontology in Museums and Institutes. *Fossils and the Future: Paleontology in the 21<sup>st</sup> Century*. ed. by R. H. Lane, F. F. Steininger, R. L. Kaesler, W. Ziegler and J. Lipps, Senckenberg-Buch Nr 74, pp. 103-108.
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- 2003 Erwin, D. H. The Goldilocks Hypothesis. Review of "Life's solution" by Simon Conway Morris. *Science* 302:1682-1683.
- 2004 Erwin, D. H. One Very Long Argument. Review of "The Structure of Evolutionary Theory" by Stephen Jay Gould. *Biology and Philosophy* 19:17-28.
- Erwin, D. H. The Evolution of form. Review of "Origination of Organismal Form" ed. By G. Muller and S. Newman. *BioEssays*. 26:459-460.
- Erwin, D. H. and Krakauer, D. Innovations and Inventions. *Science (Perspective)* 304:1117-1119
- Erwin, D. H. The Power of Evolution. Review of "Nature. An Economic History" by Geerat Vermeij. *Science*
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- 2005 Erwin, D. H. End-Permian mass extinction. *Encyclopedia of Life Sciences*, Nature Publishing Group, London. [www.els.net](http://www.els.net). Revised version.
- Erwin, D. H. Biotic recoveries after extinction. *Encyclopedia of Life Sciences*, Nature Publishing Group, London. [www.els.net](http://www.els.net). Revised version.
- Erwin, D. H. Searching for the Tree of Life. Review of "Assembling the Tree of Life" ed. by J. Cracraft and M. J. Donoghue. *American Scientist*. 93:365-367.
- Erwin, D. H. Seeds of Diversity. *Science*. 308:1752-1753.
- Erwin, D. H. Presentation of the Charles Schuchert Award of the Paleontological Society to Peter J. Wagner, III. *Journal of the Paleontological Society*. 79:828
- Erwin, D. H. A Variable look at Evolution. Review of "The Plausibility of Life" by Marc Kirschner and J.C. Gerhart. *Cell* 123:1-3.
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- 2006 Erwin, D. H. Presentation of the Paleontological Society Medal to Andrew H. Knoll. *Journal of the Paleontological Society*. 80:801.
- Erwin, D. H. Review of "Catastrophes and Lesser Calamities" by Anthony Hallam. *Palaeontological Society Newsletter* No. 61, p 112-113.
- Erwin, D. H. Opportunities and Challenges of a highly resolved geological timescale. *Paleontological Society Short Course Notes*, ed. By T. Olszweski and W. D. Huff.
- Erwin, D. H. Quick Guide: Contingency and Constraint: A Cosmic Convergence? *Current Biology* 16:R825-826.
- 2007 Erwin, D. H. Natural Selection for everyone (Review of "Survival of the Fittest" by Sean B. Carroll) *American Scientist* 95:76-77.
- Erwin, D. H. Review of "Endless Forms Most Beautiful" By Sean B. Carroll, *Artificial Life* 13:87-89.
- Erwin, D. H. Review of "Biological Emergences" By R. Reid, *Trends in Ecology and Evolution*. 22:567-568.
- 2009 Erwin, D. H. La terre en pleines transformations. *La Recherche* No. 428 (March 2009) 39-42.
- Erwin, D. H. Off to a good start. [Review of "Evolution: The first four billion years", edited by M Ruse and J. Travis]. *American Scientist* 97:336-337.
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- 2011 Jahren, A. H., Bottjer, D. J., Erwin, D. H., Smith, D. M., and Norris, R. D. Otherworldly Earths: The Future of Deep Time Research. *EOS*

#### Manuscripts - In Press

- Erwin, D. H. Novelty that change carrying capacity. *Journal of Experimental Zoology (Mol Dev Bio)*.
- Erwin, D. H. and Tweedt, S. Ecosystem Engineering and the Ediacaran-Ordovician diversification of Metazoa. From Clones to Conservation: Essays on the application of time-series approaches to biology. *Evolutionary Ecology* Special issue Ed. by J. M. Pandolfi and A. F. Budd.

#### Manuscripts - Submitted

Flack, J., Erwin, D. H., Elliot, T., and Krakauer, D. Evolution and construction of slow variables and the emergence of aggregates. Rubidge, B. S. A. Bowring, D. H. Erwin, B. DeKlerk. A clock for Permian tetrapod evolution and extinction: U/Pb radiometric dates from the Karoo Supergroup, South Africa. To *Geology*

#### Manuscripts - in Preparation

Erwin, D. H. Paleontology beyond *Paleobiology*. For *Paleobiology*.

Shen, S. Z., J. L. Crowley, Y. Wang, S. A. Bowring, D. H. Erwin, P. M. Sadler, C. Q. Cao, C. M. Henderson, J. Ramezani, Y. Shen, X. D. Wang, W. Wang, H. Zhang, W. Z. Li, Y. G. Tang, X. L. Liu, Y. Zeng, Y. F. Jiang, Y. G. Jin. Calibrating the end-Permian mass extinction.

#### Book - in Preparation

*The Cambrian Explosion: The Construction of Animal Biodiversity* (with James W. Valentine) Ben Roberts Publishing.  
*Innovation and the Construction of Biodiversity*. (Publication expected June 2011).

#### Publications - Abstracts

- 1981 Erwin, D.H. and R.M. Linsley. Punctuated equilibrium and reverse transcriptase: a proposed model for evolution. *Geol. Soc. Amer. Abstr. with Prog.* 13(7):447.
- 1982 Erwin, D.H. and J.W. Valentine. Early Paleozoic and Mesozoic invertebrate diversification events: a comparative study. *Geol. Soc. Amer. Abstr. with Prog.* 14(7):485.
- 1984 Erwin, D.H. and J.W. Valentine. Differential gastropod extinctions: possible role of larval strategies. *Geol. Soc. Amer. Abstr. with Prog.* 16(6):503
- 1984 Valentine, J.W. and D.H. Erwin. Hopeful monsters, rapid morphologic evolution and the metazoan radiation. *Geol. Soc. Amer. Abstr. with Prog.* 16(6):681.
- 1986 Erwin, D.H. Mechanisms, models and metazoa: molecular and developmental approaches to the origin of phyla. *N. Amer. Paleo. Conv. IV*, A14.  
Erwin, D.H. Paleoecology of Permian gastropod faunas, southwestern United States: a preliminary analysis. *N. Amer. Paleo. Conv. IV*, A14.
- 1987 Erwin, D.H. and R.L. Anstey. The significance of the Ordovician Radiations. North-Central Section, *Geol. Soc. Am.*, *Abstr. with Prog.* 19(4):197.  
Erwin, D.H. Speciation Patterns in Permian *Glyptospira* (Gastropoda) *Geol. Soc. Amer. Abstr. with Prog.* 19(7):656.
- 1988 Erwin, D.H. Diversity patterns in Late Paleozoic Gastropod Genera. *Geol. Soc. Amer. Abstr. with Prog.* 20(7):A49
- 1989 Erwin, D.H. Establishment of genomic and developmental architectures as a source of novelty and constraint: the Cambrian Metazoan Radiation. *UCLA Symposium on Molecular Biology. Molecular Evolution. Journal of Cellular Biochemistry Suppl.* 13C:108  
Erwin, D.H. The Permo-Triassic mass extinction: patterns of extinction and survival in the Gastropoda. *Geol. Soc. Amer. Abstr. with Prog.* 21(4):11  
Erwin, D.H. A comparison of the Tournasian-Visean and Anisian-Carnian gastropod radiations. *Geol. Soc. Amer. Abstr. with Prog.* 21(7):A30.
- 1990 Erwin, D.H. A preliminary classification of radiations. *Geol. Soc. Amer. Abstr. with Prog.* 22(2):14.  
Erwin, D.H. Occupation of Morphologic Space: The use of phylogenetic and morphometric analysis in the Cambrian Radiation. Abstracts for 3rd International Cambrian Symposium, Novosibirsk, USSR. August 1990.  
Signor, P.W. and Erwin, D.H. Extinction in an extinction-resistant clade: evolutionary history of the Gastropoda. *International Congress of Systematic and Evolutionary Biology, College Park, MD USA.*  
Erwin, D.H. Constraints on the origin of Metazoa: insights from the genome. *Geol. Soc. Amer. Abstr. with Prog.* 22(7):52  
Erwin, D.H. A phylogenetic analysis of major Paleozoic gastropod clades. *Geol. Soc. Amer. Abstr. with Prog.* 22(7):112.  
Erwin, D.H. A new view of the causes of the end-Permian mass extinction. *Global Bioevents Meeting, Oxford.*
- 1991 Erwin, D.H. Is Evolution uniformitarian? *Geol. Soc. Amer. Abstr. with Prog.* 23( ):
- 1992 Erwin, D. H. Morphometric and phylogenetic analyses of the Paleozoic Subulioidea (Gastropoda). 5th NAPC (Chicago). *Paleontological Society Special Publication No. 6: 93.*  
Wagner, P. W. and Erwin, D. H. Cladograms as tests of speciation patterns. *Geol. Soc. Amer. Abstr. with Prog.* 24(7):A139
- 1993 Erwin, D. H. The Permian mass extinction and its evolutionary impact. *Extinction Dynamics in the Biosphere, Museu de la Ciència de la Fundació "la Caixa", Barcelona.*



- Erwin, D. H. Was the end-Permian extinction caused by a run-away greenhouse? Carboniferous-Jurassic Pangea Conference (1993 Annual Convention of Canadian Society of Petroleum Geologists)
- Erwin, D. H. Evolutionary trends in Paleozoic gastropods: grades and clades. *Geol. Soc. Amer. Abstr. with Prog.* 25:
- 1994 Erwin, D. H. The end-Permian mass extinction: a complex, multi-causal extinction. *New Developments regarding the K/T Event and Other Catastrophes in Earth History.* Lunar and Planetary Institute.
- Erwin, D. H. The biogeographic context of extinction and survival during the end-Permian mass Extinction. *Geol. Soc. Amer. Abstr. with Prog.* 26:174
- 1995 Erwin, D. H. The Evolutionary effect of the end-Permian mass extinction. *GAC/MAC Annual Meeting*, 20:A-29.
- 1996 Erwin, D. H. The fine structure of extinction: phylogeny and mass extinction/recovery episodes. *The Phylogeny of Life and Accomplishments of phylogenetic Biology - Univ. Arizona.* October.
- Erwin, D. H. Taphonomic effects and 'pulse' versus 'press' extinction patterns during the Permo/Triassic interval. *6th North American Paleontological Convention, Abstracts (Paleo. Soc. Sp. Pub. No. 8)*, p. 115.
- Erwin, D. H. The role of taphonomic effects during the 'delayed' Early Triassic recovery. *30th International Geological Congress Abstracts.*
- Erwin, D. H. The end-Permian mass extinction: what do we know in 1996? *30th International Geological Congress Abstracts.*
- Valentine, J. W., D. Jablonski and D. H. Erwin. Reconstructing the protostome/deuterostome ancestor: the uses of history. *Geol. Soc. Amer. Abstr. with Prog.* 28(7): A52-53.
- Kosnik, M. A. and D. H. Erwin. Quantitative analysis of Late Neoproterozoic/ Early Cambrian trace fossil occurrences: The origination of bodyplans. *Geol. Soc. Amer. Abstr. with Prog.* 28(7): A53.
- Suter, S. J. and D. H. Erwin. Timing the Late Permian extinctions: Lazarus genera suggest a significant Signor Lipps Effect. *Geol. Soc. Amer. Abstr. with Prog.* 28(7): A54.
- Erwin, D. J. Extinctions and Renewals. *Geospective II: Canadian Institute for Advanced Research.*
- 1997 Erwin, D. H. The origin of bodyplans. *Amer. Zool.* 37(5):A171
- 1998 Kidder, D. L., Schubert, J. K. and Erwin, D. H. Flints and coals in cyclothems as possible burial sinks for 'Missing' Carboniferous silica. *Geol. Soc. Amer. Abstr. with Prog.* 30:
- Kidder, D. L., Worsley, T. R., Schubert, J. K., and Erwin, D. H. Series-level analysis of silica-replaced fossils and bedded cherts through the Phanerozoic. *Geol. Soc. Amer. Abstr. with Prog.* 30(7):221.
- 1999 Erwin, D. H. Biotic survival and recovery during the Neoproterozoic > snowball earth=. *Geol. Soc. Amer. Abstr. with Prog* 31(7): A-372.
- 2001 Erwin, D. H. Biotic recoveries from mass extinctions: insights from evolutionary innovation. *Earth System Processes Meeting (GSA/ Geol. Soc. Lond), Prog. w/ abstracts.* P. 67.
- 2002 Erwin, D. H., Neoproterozoic Snowball earth? Insights from Biology. *Abstracts, 1<sup>st</sup> International Palaeontological Congress; Geological Society of Australia Abstracts Number 68*, p. 49-50.
- Erwin, D. H. Testing alternative scenarios for the end-Permian mass extinction. *Abstracts, 1<sup>st</sup> International Palaeontological Congress; Geological Society of Australia Abstracts Number 68*, p. 50.
- Nutzell, A. and Erwin, D. H. Evolution of gastropod species-level diversity and turnover after the end-Permian mass extinction. *Abstracts, 1<sup>st</sup> International Palaeontological Congress; Geological Society of Australia Abstracts Number 68*, p. 49-50.
- Erwin, D. H. Constraints on causes of the end-Permian mass extinction. *Journal of Vert. Paleo, Abstracts w/ Papers 22: Suppl to No. 3*, p. 1A
- 2003 Erwin, D. H. Development, Ecology and Environment in the Cambrian Metazoan Radiation. *Proceedings of the Am. Assoc. Adv. Sci, Pacific Section, V. 22, Part I*, p. 49.
- Erwin, D. H. & Olszewski, T. Permian brachiopod communities of west Texas I. community paleoecology. *Geol. Soc. Amer. Abstr. with Prog.* 35(6), p. 86.
- Olszewski, T. & Erwin, D. H. Permian brachiopod communities of west Texas I. Application of Neutral Ecological Theory. *Geol. Soc. Amer. Abstr. with Prog.* 35(6), p. 86.
- D. H. Erwin, J. A. Dunne, R. K. Bambach, J. B. C. Jackson, C. Labandeira, N. D. Martinez, A. I. Miller, R. J. Williams & R. A. Wood. A new look at paleo-food webs and the evolution of ecosystem structure. *Geol. Soc. Amer. Abstr. with Prog.* 35 (6): 419.
- Erwin, D. H. The roles of development, ecology and environment in evolutionary innovation: the Cambrian Radiation. *Geol. Soc. Amer. Abstr. with Prog.* 35(6), p. 516.
- 2004 Olszewski, T & Erwin, D. H. Influence of sea level changes on diversity of Permian brachiopod communities (Glass Mtns, Texas). *Geol. Soc. Amer. Abstr. with Prog.* 36(1), p.
- 2005 Erwin, D. H. Evolutionary Rates, macroevolution and biotic recoveries. *PaleoBios V. 25, Suppl to No 2*, p. 41 (NAPC)

- Bowring, S. A. Erwin, D. H., Condon, D., and Schmitz, M. D. The Earthtime network: a high-resolution calibration of earth history. *Geol. Soc. Amer. Abstr. with Prog.*37(7), p 149.
- Erwin, D. H. Invention, Innovation and Ergodicity: an alternative approach to macroevolution. *Geol. Soc. Amer. Abstr. with Prog.*37(7), p. 305.
- Olzewski, T. D. and Erwin, D. H. Discontinuity but no stability in Permian Brachiopod communities of west Texas. *Geol. Soc. Amer. Abstr. with Prog.*37(7), p. 460-461.

#### Invited Talks (since 1995)

- 1995 Walter Reed Army Medical Center - Global Molecular Epidemiology of HIV-1.  
University of Maryland, Dept. of Entomology  
Geological Association of Canada - Symposium on "Biotic Recoveries from Mass Extinctions" (co-organizer)  
5th European Congress on Evolutionary Biology - Edinburgh - Plenary and Invited speaker  
National Research Council, Planning Meeting on "Biotic Effects of Anthropogenic Extinctions"
- 1996 Pennsylvania State University, Department of Geology.  
The Phylogeny of Life and Accomplishments of Phylogenetic Biology - Univ. Arizona.  
Dept. of Geology, Williams College  
Dept. of Ecology and Evolution, SUNY Stony Brook.  
Canadian Institute for Advanced Studies, symposium on Earth as A System, Toronto, Canada.  
Dept. of Earth, Atmospheric and Planetary Sciences, MIT  
Dept. of Earth and Planetary Sciences, Harvard University
- 1997 Dept. of Geological Sciences, University of California, Los Angeles  
Dept. of Geological Sciences, University of Maryland  
Pharmaceutical Products Divisional Meeting, FMC Corporation  
NIST Chapter, Sigma Xi, Annual Banquet
- 1998 Invited Speaker, SICB Annual Meeting Symposium on ADevelopment of Body Plans@  
Gondwana-10, Plenary Speaker, Capetown, South Africa  
Participant, Penrose Conference on Paleoeology  
Participant, NASA Conference on Evolutionary Biology, New Hampshire  
Participant, Earth History Workshop, Space Policy Institute, George Washington University  
Invited Speaker, First Japanese-American Frontiers of Sciences Meeting, National Academy of Sciences, Irvine, CA.  
Department of Geological Sciences, University of South Florida  
Participant, 1<sup>st</sup> General Meeting, NASA Astrobiology Institute, Ames Research Cntr., CA 5-7 Nov.  
Invited Speaker, Canadian Institute of Advanced Research meeting on Critical Transitions in Earth History, Santa Cruz, CA 2-4 December.
- 1999 University of Minnesota, Dept. of Geological Sciences  
University of Maryland, Behavior, Ecology Evolution and Systematics Seminar,  
Cornell University, Dept. of Geological Sciences  
Santa Fe Institute.  
Plenary Address, AThe Developmental Basis of Evolutionary Change, Univ. of Chicago 13-15 May.  
Darling Marine Center, University of Maine.  
University of California, Riverside  
Invited Speaker, 11<sup>th</sup> Annual Frontiers of Science Mtg, National Academy of Science, 11-13 Nov.  
Invited Speaker, ADynamics of Evolution@ Annual Mtg. Of Business Network, Santa Fe Institute.
- 2000 Invited Speaker, AFuture of Evolution@ National Academy of Sciences Colloquium, Irvine, CA 16-19 March  
Moderator, American Institute of Biological Sciences Ann. Meeting, Washington, D.C., 22-24 March  
Invited Speaker, American Astronautical Association, Beltsville, Maryland, 29-30 March.  
Short course: AEvolutionary Dynamics and Paleobiology@, Santa Fe Institute, 11-14 April.  
Invited Speaker, ABiological Evolution and Statistical Physics@,Max Plank Inst meeting, Dresden, 11-13 April  
Invited Speaker, Science Board Meeting, Santa Fe Institute. 4 May  
Invited Public Lecture, Santa Fe Institute, 15 June.  
Invited Plenary Address, 4<sup>th</sup> Snowbird Conference on Impacts and Mass Extinctions, Vienna, 5-8 July  
University of Wyoming, Dept. of Geology  
Invited Speaker, Echinoderm Meeting on Developmental Biology, Woods Hole, MA, 29 Sept - 1 October  
California Institute of Technology, Dept. of Geological and Planetary Sciences.  
Invited Speaker, Conference on AEvolution: from molecules to Ecosystems@, Universitat de Valencia, 2-5 Nov.

- 2001 Dept of Earth Sciences, University of Cambridge  
The Natural History Museum, London  
Dartmouth University, Department of Biology  
University of Kansas, Department of Geological Sciences  
Invited Speaker, SEPM Diamond Jubilee Symposium, Denver, CO.
- 2002 College of William and Mary, Department of Geology  
University of Cincinnati, Dept of Geology  
Harvard University, Earth History and Paleontology Program  
College of Wooster, Dept of Geology, 21<sup>st</sup> Osgood Memorial Lecture  
Plenary Speaker, 2002 Astrobiology Science Conference, NASA Ames  
Invited participant, Evolutionary Innovations meeting, Czech Inst. for Advanced Study and SFI, Prague,  
Plenary Speaker, 20<sup>th</sup> Ann. Meeting, Canadian Institute for Advanced Research, Victoria, Canada  
Invited Speaker, NASA Meeting on Evolution of Developmental Mechanisms, CASSLS, Woods Hole  
Invited Speaker, Intl. Symposium Mesozoic-Cenozoic Bioevents, Museum of Natural History, Berlin
- 2003 Participant, NSF Workshop on Preservation of Geoscience Research Cores and Collections, IU,  
Rockefeller University, Statistical Physics and Biology Colloquium  
Invited Speaker, AAAS Pacific Section Symposium on Biodiversity, Past, Present and Future. June
- 2005 Invited Speaker, Yale University, Adolf Seilacher Symposium  
Invited Speaker, Echioderm Meeting, Marine Biological Lab, Woods Hole  
Invited Speaker, Deakin Memorial Lectures, Melbourne, Australia.  
Invited Speaker, Santa Fe Institute, Laws of Life Working Group  
Participant, SFI working Group on Laws of History.  
Invited Speaker, Brown University, NSF Workshop on Siberian Flood Basalt Volcanism and PT extinction  
Participant, Royal Society Meeting on Origin and Evolution of the Eukaryotic Cell.  
Invited Speaker, Colgate University, Department of Geology  
Co-Organizer, NSF Workshop on Sino-US Geological joint research, NMNH  
Invited Speaker,  
Keynote Speaker, Palaeontological Association (UK) Annual Meeting, Oxford
- 2006 Participant, SFI Working Group on Evolution of Gene Regulatory Networks  
Invited Speaker, Pennsylvania State University, Geology  
Distinguished Speaker, Michigan State University, EEBB and Geological Sciences  
Invited Speaker, Texas A&M University, EEP and Geology  
Invited Speaker, Paleontological Society Short Course on Geochronology  
Co-Organizer, Earthtime III meeting, Santa Fe Institute  
Invited Speaker, U. Michigan-SFI Workshop on Complex Systems
- 2007 Invited Speaker, University of Chicago, EEB Program  
Invited Participant, Univ California Comparative Integrative Genomics Meeting on Chordate Evolution, Moorea  
Invited Speaker, Notre Dame Dept. of Biology  
Invited Participant, NESCent meeting on Evolution of Chemoreception  
Invited Keynote Speaker, International Carboniferous-Permian Congress, Nanjing, China  
Invited Symposium Speaker on Key Innovations, Society for Molecular Biology and Evolution.
- 2008 Organizer, SFI Working group meeting on New Statistical Approaches to SW Archaeology  
Participant, Gordon Conference on Origin of Life  
Invited Speaker, Department of Geology, Virginia Tech  
Invited Speaker, Department of Biology, University of New Mexico  
Invited Symposium Speaker, AAAS Annual Meeting, Origin of Major Evolutionary Transitions  
Invited Participant, SFI Workshop on Language Evolution  
Invited Participant, SFI Workshop on Laws of History  
Invited Participant, SFI Workshop on Repurposing in Evolution  
Invited Theme Day Speaker, International Geological Congress, Oslo  
Invited Participant, Sci-Foo Camp (Google/Nature/O'Reilly)  
Invited Participant, SFI Working Group on Technological Evolution  
Co-Organizer, SFI Working Group on International Relations and Complexity
- 2009 Invited Symposium Participant, International Biogeography Society, Merida, Mexico  
Invited Speaker, Origins Conference, ASU

Invited Participant, SFI Working Group meeting on the Nature of the Gene  
 Invited Lecturer, SFI Complex Systems Summer School, Santa Fe.  
 Organizer and Speaker, Plenary Symposium, North American Paleontology Convention, Cincinnati  
 Invited Speaker, Teaching Paleontology conference, Ithaca  
 Co-Organizer and Invited Plenary speaker, International Congress on Cambrian Explosion, Banff, Canada  
 Co-Organizer and Speaker, Darwin Symposium, NMNH  
 Invited Speaker, SFI Business Network Theme Week: "The Future is not what it used to be"  
 Invited Speaker, Madrid Darwin Conference, Spanish Academy of Sciences  
 2010 Invited Speaker, Rare Events Meeting, Center for Theoretical Sciences, Princeton University  
 Invited Speaker, Dept of Ecology and Evolution, Princeton University  
 Invited Speaker, Darwin Day, Paleontological Research Institute and Cornell University  
 Invited Speaker, Dept. Biological Sciences, University of Akron  
 Invited Speaker, NAI meeting on Evolutionary Rates, UCLA  
 Co-Organizer, DETELO meeting (NSF-sponsored), NMNH  
 Invited speaker, Dept Evolution & Systematics, University of Jerusalem  
 Invited speaker, Jacques Loeb Workshop on Evo-Devo, Ben-Gurion University  
 Invited speaker, Institute of Evolution, University of Haifa  
 Invited speaker, SFI Complex System Summer School, Santa Fe  
 Centennial Lecture, NMNH  
 Keynote speaker, 3<sup>rd</sup> International Palaeontological Congress, London  
 Invited Speaker, Global Sustainability Summer School, SFI, Santa Fe.

#### Recent NMNH and SI Service

Member, Darwin Exhibits team  
 Chair, Curatorial Search Committee, Dept. of Paleobiology, 2006-2007  
 Member, Search Committee for Sant Chair for Marine Sciences, 2005-2006  
 Member, Search Committee for Dept. of Mineral Sciences, 2006  
 Member, PAEC Taskforce, 2005  
 Chair, Task force on Interdisciplinary Centers, 2004-2005  
 Extended Team, Oceans Hall, 2004 - 2007  
 Interim Director, National Museum of Natural History, June 2002 - March 2003  
 Chair, Dept. of Paleobiology, NMNH, Oct. 2001- June 2002  
 Member, Smithsonian Institution Science Commission, 2001-2002  
 Member, Science Council, NMNH, 2000-2002  
 Member, Search Committee, Associate Director for Research and Collections, NMNH, 1998  
 Member (1997) & Chair (1998-1999), Professional Accomplishments Evaluation Committee, NMNH  
 Lead Curator, Smithsonian Traveling Exhibit Service exhibit on the Burgess Shale (1998-2001) (exhibiting through 2006)  
 Member, Research Training Program Selection Committee, 1999

#### External Service

Member, NSF GEO Directorate Advisory Council (AC-GEO) (2009-2011)  
 Member, Advisory Committee, ORIGINS program, Arizona State University (2009- )  
 President, Paleontological Society (2008-2010); President-Elect, (2006-2008)  
 Member, NASA Selection Team for Astrobiology Institute, CAN-5  
 Invited Participant, NESCent Planning meeting for next 5 years (2008)  
 Member, Operational Review taskforce (SFI Board of Trustees), 2005  
 Organizer, SFI Working Group Meeting on Evolutionary Innovation, 2005.  
 Co-Organizer, NSF Workshop on Sino-US Geological joint research, NMNH, 2005.  
 Co-Chair, Science Steering Committee, Santa Fe Institute, 2004-2008  
 Co-Director, Complex Systems Summer School, Santa Fe Institute, Qingdao University, China 2004  
 Member, NASA Planetary Protection Advisory Committee, 2004-2006  
 Member, NASA Solar System Exploration Subcommittee (Office of Space Sciences), 2003-2005  
 Member, National Geosciences Advisory Board (on Geological Collections)  
 Member, NASA Evolutionary Biology Review Committee (Fundamental Biology Program), 2003  
 Organizer, Symposium on Early Life on Earth, NASA Astrobiology Meeting 2003

Co-Organizer, SFI Workshop on Evolutionary Innovation, 2003, 2004  
 Member, Visiting Committee, Dept of Earth and Planetary Sciences, Harvard University, 2002-2005  
 Member, Exobiology Grant Review Panel, NASA, 2000-2001 (Chair, 2001)  
 Member, American Geophysical Union Biogeosciences Planning Meeting, 2001  
 Member, Exobiology External Advisory Panel, NASA, 1999  
 Member, NASA Astrobiology Institute Selection Panel, 1998  
 Organizer, World Congress of Malacology, Symposium on Bridging Temporal Scales, 1998.  
 Member, External Review Committee, Univ. of California, Berkeley, Museum of Paleontology, 1997  
 Member, NSF Earth Sciences Review Panel, Paleontology & Geology, 1996-1998  
 Member, Scientific Committee, Workshop on Paleontology in the 21st Cen. 1996-1997.  
 Member, Paleontological Society International Research Program, 1994-1995  
 Member, Organizing Committee, 6th North American Paleontological Convention  
 Co-Organizer (w\ D. Jablonski and J. Lipps), 1994 Paleo. Soc. Symp. "Evolutionary Paleobiology".  
 Paleontological Society, Representative to AAAS, 1993-1995  
 Paleontological Society, Committee on Nominations. 1992-1995  
 Co-Project Leader (with Erle Kauffmann, Univ. of Colorado) International Geological Correlation Program Project on Biotic Recoveries from Mass Extinctions. 1993-1997  
 Treatise on Invertebrate Paleontology, Technical Advisory Committee Member, 1992-1994  
 Member, Committee on Grants in Aid of Research, Sigma Xi. 1992-1996, 1997-1998  
 Treatise on Invertebrate Paleontology, Caenogastropod Advisory Committee Member, 1991  
 Co-Organizer (with Brian Huber) 1992 NAPC Symposium on Morphometric Analysis  
 Co-Organizer (with Robert Anstey) 1992 Paleo Society Symp. Speciation in the Fossil Record.

#### Reviewer Service (Since 1995)

Cambridge University Press, Columbia University Press, Earth and Planetary Sciences Letters, Evolution, Geology, GSA Today, Historical Biology, Journal of Paleontology, Molecular Biology and Evolution, Molecular Phylogenetics and Evolution, Nature, Oxford University Press, Palaeontology, Paleobiology, Palaeoecology, Palaeogeography and Palaeoclimatology, Proceedings of the National Academy of Sciences, Records of the Australian Museum, Review of Paleobotany and Palynology, Science, Smithsonian Institution Press, Trends in Ecology and Evolution  
 National Geographic Society, National Science Foundation, NASA - Exobiology Program, National Environmental Research Council (UK), Royal Society (UK), CSIRO (Australia)

#### Advisees, Students and Collaborators

Collaborators: Samuel A. Bowring, Eric Davidson, Gunter Eble, David L. Kidder, Jin Yugan, David Jablonski, Pan Hua-Zhang, Alexander Nutzel, Ricard Sole, Tong Jinnan, James W. Valentine, Wang Wei.  
 Post Doctoral: Gunther Eble (1997- 1998), Nigel Hughes (1992-1993), Alexander Nützel (1998-1999), Thomas Olzewski (2002-2003), Sherman Suter (1994-1995, 1996-1998), Chris Sidor (2001), Peter Wagner (1995-1996), Matthew Wills (1995)  
 Pre-Doctoral: Peter Wagner  
 Summer Interns: Stephen Schellenberg (1993); Matthew Kosnik (1994, 1996), Jonathon Marcot (1994, 1997); Phillip Gottchalk (1995, 1996), Eugene Hunt (1995), Carla Nappi (1997), William Pastor (2001).