ELAINE C. SEAVER, Ph.D.
Professor of Biology

My research interests are in the areas of developmental biology, evolution of development, and regeneration. I have been trained in the fields of molecular biology, developmental neurobiology and embryology.

I am broadly interested in the cellular and molecular control of patterning during development and regeneration. Many of our studies have utilized marine annelids, which exhibit a highly stereotypic early developmental program, and have robust regenerative abilities. My lab has pioneered the use of the annelid *Capitella teleta* as a model for developmental studies. We have established several cellular, molecular and imaging techniques for this animal including microinjection, laser deletion, and functional manipulations. I am an expert in animal husbandry of *C. teleta*, and have optimized conditions to maximize reproduction output. I was instrumental in getting a completely sequenced and annotated genome for *Capitella* by the Joint Genome Institute, which has facilitated our molecular investigations of the development and regeneration of this species. Our current areas of focus include evolution of cell lineages, regeneration of the germline, and investigating the relationship between development and regeneration. Our long-term goals are to understand how developmental programs evolve and how changes in the developmental program lead to the diversity of animals.

Education:

1995	Ph.D. in Biology, University of Utah
1986	B.S. in Biology, McGill University

Professional Experience:

2012-Present	Professor, Whitney Laboratory for Marine Bioscience, University of Florida
2014-Present	Member, University of Florida Genetics Institute
2013-Present	Graduate Faculty, Department of Biology, University of Florida
2012	Professor, Kewalo Marine Laboratory, University of Hawaii
2007-2012	Associate Professor, Kewalo Marine Laboratory, University of Hawaii
2003-2012	Graduate Faculty, Department of Zoology, University of Hawaii
2002-2007	Assistant Professor, Kewalo Marine Laboratory, University of Hawaii
2001-2002	Junior Researcher, Kewalo Marine Laboratory, University of Hawaii
1988-1989	Graduate Teaching Fellow, Department of Biology, University of Utah
1986-1987	Laboratory technician, Cornell University (Dr. Thomas Fox)
1985	Research assistant, Cornell University (with Dr. Thomas Fox)

Research Interests:

- Patterning in the spiralian embryo and the evolution of identified cells
- Regenerative biology
- Neurogenesis
- Regeneration of the germline
- Life history evolution
- Evolution of segmentation
- Comparative development
- Patterning of the gut
- Evolution of mesoderm

Membership in Professional Societies:

Society for Invertebrate Morphology
Society for Integrative and Comparative Biology
Society for Developmental Biology
American Association of University Women

Honors:

- National Research Service Award 1F32GM19257-01, “Determinants of annelid segmental patterning”, 1997-2000
- Evelyn and Melvin Spiegel Endowed Fellow, 1998
- Post course Research Award, Marine Biological Laboratory, Woods Hole, Mass. NASA Center for Advanced Studies in the Space Life Sciences, 1997
- Society for Developmental Biology Scholarship, Marine Biological Laboratory, Woods Hole, Mass., 1997
- National Institute of Health, Genetics Training Grant, University of Utah, 1990–1994

National /International Professional Service (since 2006):

- Editorial Board, BMC Evolutionary Biology, 2017–present
- Participant, NSF BIO REU PI workshop, Arlington, VA, 2014, 2017
- Panelist, Division of Integrative and Organismal Systems, National Science Foundation, 2007, 2010, 2013, 2017
- External examiner, PhD assessment committee, University of Copenhagen, 2016
- Member, Graduate Student Admissions Committee, Dept. of Biology, 2016-present
- Co-Organizer, South West Regional Developmental Biology meeting, Whitney Laboratory for Marine Bioscience, 2106
- Co-Instructor, Embryology Course, Marine Biological Laboratory, Woods Hole, MA, 2004-2007, 2009–2017
- Editorial Board, *JEZ Part B*, 2012–present
- Editorial Board Member, *EvoDevo*, 2010–present
- Member, Strategic Planning Committee, Dept. of Biology, 2014–present
- Director, Whitney Laboratory REU program, 2014–present
- Host, EDEN Research Exchange Grant recipient Kate Rawlinson from Wellcome Trust Sanger Institute, 2014
- Embryology Course Admissions Committee, Marine Biological Laboratory, Woods Hole, MA 2014
- Faculty Search Committee, Whitney Laboratory for Marine Bioscience, U. Florida, 2013, 2015
- Visiting Scholar, Sars International Centre for Marine Molecular Biology, Bergen, Norway, 2011
- Co-organizer, West Coast Regional Developmental Biology Meeting, Honolulu, HI, 2011
- Co-chair, Contributed papers for Comparative Developmental Biology. Second International Congress on Invertebrate Morphology, Harvard University, Boston, MA, 2011
- Visiting Scholar, Sars International Centre for Marine Molecular Biology, Bergen, Norway, 2011
- Nominating committee, Secretary position, Division of Evolutionary Developmental Biology, Society for Integrative and Comparative Biology, 2011
- Invited Workshop Participant, ‘Evolutionary Transitions in Marine Invertebrate Larval Forms’, Colgate University, NY, 2010
- Co-organizer, Symposium on ‘Spiralian Development: Conservation and Innovation’, Society for Integrative and Comparative Biology Annual Meeting, 2010.
- Secretary for the Division of Evolutionary Developmental Biology, Society for Comparative and Integrative Biology, 2009-2011
- Invited reviewer of book project proposal, Springer Science, New York, NY, 2007
- Secretary-elect for the Division of Evolutionary Developmental Biology, Society for Comparative and Integrative Biology, 2008-2009
- Faculty Search Committee, Dept. of Zoology, U. Hawaii, 2008, 2009

- Acting Director, Kewalo Marine Laboratory, U. Hawaii, 2008, 2010, 2011
- Contact person for DOE Joint Genome Institute *Capitella* sp. I genome project, provider of high quality genomic DNA and cDNA libraries for 8x coverage complete genome sequencing project 2004-2006
- Graduate Admissions Committee, Dept. of Zoology, U. Hawaii, 2004, 2008, 2009
- Ad Hoc Graduate Admissions Review Committee, Dept. of Zoology, U. Hawaii, 2007
- Chair, Graduate Student Advisory Committee, Cell and Molecular Program, U. Hawaii, 2007, 2008
- Organizer, Kewalo Marine Laboratory seminar series, PBRC, U. Hawaii, 2007, 2008
- University of Hawaii Institutional Biosafety Committee, U. Hawaii, 2005–2008
- Departmental Personnel Committee, Pacific Biosciences Research Center, U. Hawaii, 2007
- Graduate Student Advisory Committee, Cell and Molecular Program, U. Hawaii, 2004–2006
- Graduate Student Instructional Committee, Dept. of Zoology, U. Hawaii, 2005–2006

Community Service:

- Facilitator for 'Girls Can' professional outreach event for 10th grade girls, Putnam County, FL, 2018
- Led panelist discussion for Flagler County local AAUW branch visit to Whitney Laboratory for Marine Bioscience, St. Augustine, FL, 2017
- Participant, Open House, Whitney Laboratory for Marine Bioscience, St. Augustine, FL, 2016
- Invited public lecture and lab visit for older adults 'Embryology in Annelids' Whitney Laboratory for Marine Bioscience, St. Augustine, FL, 2016
- Lecture, 'How to replace lost body parts: insights from worms'. Cedar Key Library, Cedar Key, FL, 2016.
- Invited lecture, UF Marine Biology Club, 2015.
- Invited lecture, Coastal Systems Masters Naturalist Course, 2015.
- Invited lecture, 'I dig worms: biodiversity, development and regeneration'. Whitney Board of Trustees, 2014.
- Invited lecture, 'I dig worms: insights into generation of animal biodiversity'. Evening at Whitney Lecture Series, Whitney Laboratory for Marine Bioscience, 2013.
- 'Wet lab' demonstration of local marine fauna to High School Student Science Training Program (University of Florida) visit to Whitney Laboratory for Marine Bioscience, St. Augustine, FL, 2013.
- 'Wet lab' demonstration of local marine fauna to University of Florida HHMI undergraduate student visit to Whitney Laboratory for Marine Bioscience, St. Augustine, FL, 2013.
- Participant in Eastern Florida State College student visit to Whitney Laboratory for Marine Bioscience, St. Augustine, FL, 2013.
- Invited lecture for docents of 'Day at Whitney' marine science educational program for 5th graders, Whitney Laboratory for Marine Bioscience, St. Augustine, FL, 2013.
- Member, Medical Research Advisory Committee, Hawaii Community Foundation, 2011–2013.
- Judge, Hawaii State Science and Engineering Fair, Hawaii Academy of Science, 2006, 2007, 2009.
- Organized and hosted Waipahu High School Marine Science student visit to Kewalo Marine Laboratory, 2008.

Recent Publications (2010-Present):

Lanza, A. R. and **Seaver**, E. C. (2018). An organizing role for the TGF-β signaling pathway in axes formation of the annelid *Capitella teleta*. Developmental Biology 435 (1): 26- 40. *This article was selected for the cover image.

de Jong, D. M. and **Seaver**, E. C. (2017). Investigation into the cellular origins of posterior regeneration in the annelid *Capitella teleta*. Regeneration 00:1-17. DOI: 10.1002/reg2.94

Sur, A., Magie, C. R., **Seaver**, E. C. and Meyer, N. P. (2017). Spatiotemporal regulation of nervous system development in the annelid *Capitella teleta*. EvoDevo 8:13 (https://doi.org/10.1186/s13227-017-0076-8)

Seaver, E. C. (2017). Annelids shed light on the evolution of spiralian development. Canadian Journal of Zoology (https://doi.org/10.1139/cjz-2016-0261).

Seaver, E. C. Annelid models I: *Capitella teleta* (2016). Current Opinion in Genetics and Development 39: 35–41. http://dx.doi.org/10.1016/j.gde.2016.05.025

de Jong, D.M., **Seaver,** E.C. (2016) A Stable Thoracic Hox Code and Epimorphosis Characterize Posterior Regeneration in Capitella teleta. PLOS ONE 11(2): e0149724. doi: 10.1371/journal.pone.0149724

Yamaguchi*, E., and Seaver, E. C. (2016) Regulative capacity for eye formation by first quartet micromeres of the polychaete *Capitella teleta*. Developmental Biology 410 (1): 119 – 130. (doi: 10.1016/j.ydbio.2015.12.009).

Meyer, N. P., Carrillo-Baltodano, A, Moore*, R. E. and Seaver, E. C. (2015) Nervous system development in lecithotrophic larval and juvenile stages of the annelid *Capitella teleta*. Frontiers in Zoology 12: 15 (doi:10.1186/s12983-015-0108-y).

Seaver, E. C. (2014). Variation in spiralian development: insights from polychaetes. International Journal of Developmental Biology 58: 457-467. 10.1387/ijdb.140154es.

Boyle*, M. J., Yamaguchi*, E. and Seaver, E. C. (2014). Molecular conservation of metazoan gut formation: Evidence from expression of 'endomesoderm genes' in *Capitella teleta* (Annelida) EvoDevo 5: 39.

Yamaguchi*, E., and Seaver, E. C. (2013). The importance of larval eyes in the polychaete *Capitella teleta*: effects of eye deletion on formation of the adult eye. Invertebrate Biology 132 (4): 352-367 (doi: 10.1111/ivb.12034).

Amiel, A., Henry, J. Q. and Seaver, E. C. (2013). An organizing activity is required for head patterning and cell fate specification in the polychaete annelid *Capitella teleta*: new insights into cell-cell signaling in Lophotrochozoa. Developmental Biology 379: 107-122 (doi: 10.1016/j.ydbio.2013.04.011).

Simakov, O., Marletaz, F., Cho, S.-J., Edsinger-Gonzales, E., Havlak, P., Hellsten, U., Kuo, D.-H., Larsson, T., Lv, J., Arendt, D., Savage, R., Osoegawa, K., de Jong, P., Grimwood, J., Chapman, J. A., Shapiro, H., Kuo, A., Otillar, R. P., Terry, A. Y., Boore, J. L., Grigoriev, I. V., Lindberg, D. R., Seaver, E. C., Weisblat, D. A., Putnam, N. H., Rokhsar, D. S. (2013). Insights into bilaterian evolution from three spiralian genomes. Nature 493(7433): 526-531 (doi: 10.1038/nature11696.).

Pernet, B., Amiel, A. and Seaver, E. C. (2012). Effects of maternal investment on larvae and juveniles of the annelid *Capitella teleta* determined by experimental reduction of embryo energy content. Invertebrate Biology 131(2): 82-95 (DOI: 10.111/j.1744-7410.2012.00263.x).

Seaver, E. C., Yamaguchi, E*. Richards, G. S. and Meyer, N. P. (2012). Expression of the pair-rule gene homologues *runt*, *Pax3/7, even-skipped-1* and *even-skipped-2* during larval and juvenile development of the polychaete annelid *Capitella teleta* does not support a role in segmentation. EvoDevo 3:8.

Giani*, V. C. Jr., Yamaguchi, E. and Seaver, E. C. (2011). Somatic and germ line expression of *piwi* throughout the life cycle of the polychaete annelid *Capitella teleta*. EvoDevo 2:10.

Jackson, D. J., Meyer, N. P., Seaver, E. C., Pang K., McDougall, C., Moy, V. N., Gordon, K., Degnan, B. M., Martindale, M. Q., Burke, R. and Peterson, K. J. (2010). Developmental expression of COE across the Metazoa supports a conserved role in neuronal cell-type specification and mesodermal development. Development, Genes and Evolution 220:221-234.

Layden, M. J., Meyer N. P., Pang K., Seaver, E. C. and Martindale, M. Q. (2010). Expression and phylogenetic analysis of the zic gene family in the evolution and development of metazoans. EvoDevo 1:12.

Meyer, N. P., Boyle*, M. J., Martindale, M. Q. and Seaver, E. C. (2010). A comprehensive fate map by intracellular injection of identified blastomeres in the marine polychaete *Capitella teleta*. EvoDevo 1:8.

Meyer, N. P. and Seaver, E. C. (2010). Cell lineage and fate map of the primary somatoblast of the polychaete annelid *Capitella teleta*. Integrative and Comparative Biology 50(5):756-67.

Boyle*, M. J. and Seaver, E. C. (2010). Expression of *FoxA* and *GATA* transcription factors correlates with regionalized gut development in two lophotrochozoan marine worms: *Chaetopterus* (Annelida) and *Themiste lageniformis* (Sipuncula). EvoDevo 1:2.

Cho, S.-J., Valles, Y., Giani*, V. C., Seaver, E. C. and Weisblat, D. A. (2010). Evolutionary dynamics of the Wnt gene family: a lophotrochozoan perspective. Molecular Biology and Evolution 27(7): 1645-1658 doi:10.1093/molbev/msq052.

Shimeld, S. M., Boyle*, M. J., Brunet, T., Luke, G. N. and Seaver, E. C. (2010). Clustered Fox genes in lophotrochozoans and the evolution of the bilaterian Fox gene cluster. Developmental Biology 340: 234-248.

Research Support:

Current

PI, NSF (03/01/2016 – 02/28/2021) “REU site: Marine Biodiversity: lessons from molecules, development and behavior” ($431,912)

PI, NSF, (02/01/2015 – 01/31/2019) “Collaborative Proposal: Cellular and molecular dissection of "organizing activity" during development in the Spiralia” ($600,418)

Previous

Co-PI, NSF DBI-1156528, (03/01/2012-02/29/2016). “REU Site: Research in molecular, cellular, neuro- and population biology using marine and other comparative models at the Whitney Laboratory for Marine Bioscience.” ($240,409)

PI, NSF IOS09-23754, (7/1/09 – 6/30/14). “Mechanisms of neurogenesis in a segmented polychaete” ($400,000)

Co-PI, NSF, (7/1/2013 – 6/30/2014). “FSML: Upgrading the Whitney Laboratory's capability for marine genomics” ($343,111)

PI, Hawaii Community Foundation (5/16/12 – 2/01/13), “An emerging model for regeneration studies“ ($50,000)

Co-PI, NSF, (6/1/2010 – 5/31/2013). “FSML: Pacific Ocean Marine Lab Technology and Research Space Optimization” ($350,000)

Co-PI, NSF DBI-0922789, (9/1/09 – 8/31/11). “MRI: Acquisition of a versatile single cell labeling and high resolution multi-channel imaging system” ($470,751)

PI, NSF IOB05-44869, (6/1/06 – 5/31/10). “Multiple origins of mesoderm in a model polychaete” ($300,000)

PI, NSF, 07/01/08. REU supplement to “Multiple origins of mesoderm in a model polychaete” ($6000)

PI, Hawaii Community Foundation HCF42992, 11/01/08-6/04/10, “Functional investigations of early neurogenesis”. ($50,000)

Co-PI, NSF EF05-31558, (1/1/06 – 12/31/09) “ATOL: Collaborative proposal: Assembling the protostome tree of life” (PI: Gonzalo Giribet, Harvard University), ($975,000)

PI, Hawaii Community Foundation, 5/10/07 – 11/10/2008, “Functional investigations of cell fate specification during embryonic and adult nervous system formation” ($50,000)

Co-PI, NSF EAR-0120646, 10/1/01 – 6/30/2007, “Wormnet: Reconstructing the early evolution of segmented annelid worms”. (PI: Ken Halanych, Auburn University), ($212, 503)

Co-PI, NSF EF03-34871, 1/1/04 – 12/31/06, “Assembling the tree of life: Collaborative Research: An integrated approach to the origin and diversification of protostomes” (PI: Gonzalo Giribet, Harvard University) ($370,349)

PI, Hawaii Community Foundation, 1/1/04-12/31/05, “Molecular regulation of asymmetric segregation of developmental regulatory genes in identified embryonic cells”. ($44,625)

Co-PI, NSF IBN00-94925, 1/1/01 – 12/31/2004, "The formation and evolution of the metameric body plan in basal annelids". (PI: Mark Martindale, University of Hawaii) ($258,566)