

Cheryl Y. Hayashi
Curator/Professor and Director of Comparative Biology Research
Division of Invertebrate Zoology

Highest Degree Earned

Ph.D.

Area of Specialization

Functional genomics of adaptive molecules

Academic Preparation

1996 Ph.D., Biology, Yale University
1993 M.Phil., Biology, Yale University
1990 M.S., Biology, Yale University
1988 B.S., Biology, Yale University

Academic Employment

1/2017 – current Curator/Professor, American Museum of Natural History
7/2008 – 12/2016 Professor of Biology, University of California, Riverside
7/2006 – 6/2008 Associate Professor of Biology, University of California, Riverside
4/2001 – 6/2006 Assistant Professor of Biology, University of California, Riverside
1/1996 – 3/2001 Postdoctoral Researcher, University of Wyoming

Teaching and Training

UC Riverside: Organisms in the Environment (Biol 003), Evolutionary Biology (Biol 105),
Introduction to Genomics and Bioinformatics (Biol 119)

Graduate Advisees

Sandra **Correa-Garhwal**, UC Riverside, Ph.D. candidate
Thomas **Dugger**, UC Riverside, Ph.D. student, co-advised with D. Kisailus
Cynthia **Dick**, UC Riverside, Ph.D. candidate, co-advised with D. Reznick
James **Starrett**, UC Riverside, Ph.D. awarded 2012
Matthew **Collin**, UC Riverside, Ph.D. awarded 2010

PhD Dissertation Committees

UC Riverside: Evolution, Ecology, & Evolutionary Biology – Sandra **Correa-Garhwal** (chair),
Cynthia **Dick** (co-chair), Layla **Hiramatsu**, Kevin **Jagnandan**, Mingna **Zhuang**, Michael
McGowen, Robin **Tinghitella**
UC Riverside: Genetics, Genomics & Bioinformatics – Matthew **Collin** (chair), Robert **Hannon**,
Amanda **Hollowell**, James **Starrett** (chair)
UC Riverside: Chemical & Environmental Engineering – Chris **Salinas**
UC Riverside: Material Science and Engineering – Thomas **Dugger** (co-chair)
San Diego State University/UC Riverside: Joint Doctoral Program in Evolutionary Biology – Ketan
Patel, Shahan **Derkarabetian**, Casey **Richart**, Andrew **Gottscho**

Postdoctoral Scholars

2014 onward Matthew **Collin**
2012 onward R. Crystal **Chaw**
2012 – 2014 James **Starrett**
2010 – 2011 Jie **Wei**, present: Associate Professor, Liaoning University, China
2009 – 2012 Yonghui **Zhao**, present: postdoc, University of California, Riverside
2005 – 2009 Laura **Baldo**, present: postdoc, University of Barcelona, Spain

- 2005 – 2009 Nadia **Ayoub**, present: Associate Professor, Washington and Lee University, VA
 2004 – 2007 Jessica **Garb**, present: Associate Professor, Univ. of Massachusetts, Lowell
 2004 – 2005 Brook **Swanson**, present: Associate Professor, Gonzaga University, WA
 2003 – 2004 Todd **Blackledge**, present: Professor, University of Akron, OH

Extramural Grants

Current

- Army Research Office (\$450,000) Genomic Profiling of Spider Silk Glands across Development and Evolution. May 2015 – April 2018. PI Hayashi, co-PI R. Chaw.
 Air Force Office of Scientific Research (\$7,500,000) Convergent Evolution to Engineering: Multiscale Structures and Mechanics in Damage Tolerant Functional Bio-composite and Biomimetic Materials. October 2014 – October 2019. Hayashi is co-PI on this multidisciplinary university research initiative award to UCR, lead PI D. Kisailus.

Recent Publications (2012-2016)

- Chaw, R., S. Correa-Garhwal, T. Clarke, N. Ayoub, and C. **Hayashi**. 2016. Candidate egg case silk genes for the spider *Argiope argentata* from differential gene expression analyses. *Insect Molecular Biology*. DOI: 10.1111/imb.12260
- Springer MS, Emerling CA, Fugate N, Patel R, Starrett J, Morin PA, **Hayashi** C, and Gatesy J. 2016. Inactivation of cone-specific phototransduction genes in rod monochromatic cetaceans. *Front. Ecol. Evol.* 4:61. doi: 10.3389/fevo.2016.00061
- Richart, C.H., **Hayashi**, C.Y., Hedin, M. 2016. Phylogenomic analyses resolve an ancient trichotomy at the base of Ischyropsalidoidea (Arachnida, Opiliones) despite high levels of gene tree conflict and unequal minority resolution frequencies. *Molecular Phylogenetics and Evolution*, 95:171-182.
- Springer, M.S., Starrett, J., Morin, P.A., Lanzetti, A., **Hayashi**, C., and Gatesy, J. 2016. Inactivation of C4orf26 in toothless placental mammals. *Molecular Phylogenetics and Evolution*, 95:34-45.
- Collin, M.A., Clarke, T.H., Ayoub, N.A., and **Hayashi**, C.Y. 2016. Evidence from multiple species that spider silk glue component ASG2 is a spidroin. *Scientific Reports*, 6.
- Haney, R.A., T.H Clarke, R. Gadgil, R. Fitzpatrick, C.Y. **Hayashi**, N.A. Ayoub, and J.E. Garb. 2016. Effects of gene duplication, positive selection, and shifts in gene expression on the evolution of the venom gland transcriptome in widow spiders. *Genome Biology and Evolution*, 8:228-242.
- Clarke, T., J. Garb, C. **Hayashi**, P. Arensburger, and N. Ayoub. 2015. Spider transcriptomes identify ancient large-scale gene duplication event potentially important in silk gland evolution. *Genome Biology and Evolution* 7:1856-1870.
- Vetter, R.S., Tarango, J., Campbell, K.A., Tham, C., **Hayashi**, C.Y., and Choe, D.H. 2015. Efficacy of several pesticide products on brown widow spider (Araneae: Theridiidae) egg sacs and their penetration through the egg sac silk. *Journal of Economic Entomology*, tov288.
- Padilla, D., T. Daniel, P. Dickinson, D. Grünbaum, C. **Hayashi**, D. Manahan, J. Marden, B. Swalla, and B. Tsukimura. 2014. Addressing grand challenges in organismal biology: the need for synthesis. *BioScience* 64:1178-1187.
- Haney, R., N. Ayoub, T. Clarke, C. **Hayashi**, and J. Garb. 2014. Dramatic expansion of the black widow toxin arsenal uncovered by multi-tissue transcriptomics and venom proteomics. *BMC Genomics* 15:366.
- Clarke, T., J. Garb, C. **Hayashi**, R. Haney, A. Lancaster, S. Corbett, and N. Ayoub. 2014. Multi-tissue transcriptomics of the black widow spider reveals expansions, co-options, and functional processes of the silk gland gene toolkit. *BMC Genomics* 15:365.
- Xu, S., Z. Xu, J. Starrett, C. **Hayashi**, and X. Wang. 2014. Cross-plane thermal transport in micrometer-thick spider silk films. *Polymer* 55:1845-1853.

- Chaw, R., Y. Zhao, J. Wei, N. Ayoub, R. Allen, K. Atrushi, and C. Hayashi. 2014. Intragenic homogenization and multiple copies of prey-wrapping silk genes in *Argiope* garden spiders. *BMC Evolutionary Biology* 14:31.
- Lane, A., C. Hayashi, G. Whitworth, and N. Ayoub. 2013. Complex gene expression in the dragline silk producing glands of the Western black widow (*Latrodectus hesperus*). *BMC Genomics* 14:846.
- Perea, G., C. Riekkel, G. Guinea, R. Madurga, R. Dava, M. Burghammer, C. Hayashi, M. Elices, G. Plaza, and J. Pérez-Riguero. 2013. Identification and dynamics of polyglycine II nanocrystals in *Argiope trifasciata* flagelliform silk. *Scientific Reports* 3:article 3061.
- Starrett, J., M. Hedin, N. Ayoub, and C. Hayashi. 2013. Hemocyanin gene family evolution in spiders (Araneae), with implications for phylogenetic relationships and divergence times in the infraorder Mygalomorphae. *Gene* 524:175-186.
- Garb, J. and C. Hayashi. 2013. Molecular evolution of alpha-latrotoxin, the exceptionally potent vertebrate neurotoxin in black widow spider venom. *Molecular Biology and Evolution* 30:999-1014.
- Starrett, J. and C. Hayashi. 2013. Mosaic evolution of silk genes in *Aliatypus* trapdoor spiders (Mygalomorphae, Antrodiaetidae). *Journal of Molecular Evolution* 76:216-227.
- Ayoub, N., J. Garb, A. Kuelbs, and C. Hayashi. 2013. Ancient properties of spider silks revealed by the complete gene sequence of the prey-wrapping silk protein (AcSp1). *Molecular Biology and Evolution* 30:589-601.
- Hedin, M., J. Starrett, and C. Hayashi. 2012. Crossing the uncrossable: novel trans-valley biogeographic patterns revealed in the genetic history of low-dispersal mygalomorph spiders (Antrodiaetidae, *Antrodiaetus*) from California. *Molecular Ecology* 22:508-526.
- Miller, K., C. Hayashi, M. Whiting, G. Svenson, and J. Edgerly. 2012. The phylogeny and classification of Embioptera. *Systematic Entomology* 37:550-570.
- Starrett, J., J. Garb, A. Kuelbs, U. Azubuike, and C. Hayashi. 2012. Early events in the evolution of spider silk genes. *PLoS ONE* 7:e38084.
- Guinea, G., M. Elices, G. Plaza, G. Perea, R. Daza, C. Riekkel, F. Agulló-Rueda, C. Hayashi, Y. Zhao, and J. Pérez-Riguero. 2012. Minor ampullate silks from *Nephila* and *Argiope* spiders: tensile properties and microstructural characterization. *Biomacromolecules* 13:2087-2098.

Special Recognition/Awards

- 2010 TED talk: *The magnificence of spider silk*. Theme of TED2010 was “Ideas worth spreading.” Long Beach, CA.
- 2007 MacArthur Fellowship – From the John D. and Catherine T. MacArthur Foundation to “individuals who show exceptional creativity in their work and the prospect for still more in the future.” (description from www.macfound.org)
- 2007-2012 Chancellor’s Chair Award – From the UC Riverside Chancellor’s Office to “recognize professors of outstanding merit, who have shown strong evidence of an exciting and highly visible research program.”
- 2007-2010 University Scholar Award – From the UC Riverside Office of the Executive Vice Chancellor and Provost to “recognize early career tenured faculty of outstanding merit.”
- 1996 –1998 NSF/Sloan Postdoctoral Fellowship in Molecular Evolution
- 1989 –1993 National Science Foundation Graduate Research Fellowship