

Elizabeth Heath-Heckman  
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## Professional Appointments

**Michigan State University**, July 2020 – present  
Assistant Professor, Department of Integrative Biology

## Education and Training

**University of California – Los Angeles**, January 2018 – June 2020  
Postdoctoral Researcher/Fellow  
Advisor: David Jacobs, Ph.D.  
Research: Using comparative genomics of bobtail squid to identify adaptations to symbiosis

**University of California – Berkeley**, April 2014 – December 2017  
Postdoctoral Researcher/Fellow  
Advisor: David Weisblat, Ph.D.  
Research: Characterizing determinants and development of mechanosensitivity using leeches as a model system/Elucidating symbiotic interactions in the pond leech *Helobdella austinensis*

**University of Wisconsin – Madison**, August 2007 – February 2014  
Ph.D., Microbiology (Microbiology Doctoral Training Program)  
Advisor: Margaret McFall-Ngai, Ph.D.  
Research: Day/Night Cycles in the *Euprymna scolopes/Vibrio fischeri* Symbiosis

**University of Chicago**, September 2003 – June 2007  
B.A., Biology with Honors, 2007  
Advisor: Susan Boyle-Vavra, Ph.D.  
Research: Analysis of the *van* operon in highly vancomycin resistant *Staphylococcus aureus* mutants

## Fellowships/Awards

NIH Ruth L. Kirschstein Postdoctoral National Research Service Award, 12/2015 - 12/2018  
NIH Travel Grant, 5<sup>th</sup> ASM Meeting on Beneficial Microbes, 2014  
NIH Molecular Biology Training Grant, 8/2008 – 8/2012  
SICB Charlotte Magnum Student Support Award, 2010  
Zoology Poster Award, 6<sup>th</sup> International Symbiosis Society Congress, 2009

## Publications

### In Preparation

*Submitted or in Final Draft:*

**Heath-Heckman, E.A.C.**, Yoo, S., Pellegrino, M., Angstadt, J., Bautista, D., Fernandez De Miguel, F., and Weisblat, D. Transcriptional Profiling of Identified Neurons in Leech. Submitted to *BMC Genomics*.

Flores, V., **Heath-Heckman, E.A.C.**, Rodriguez, R., and Weisblat, D.A. Patterns of Expression and Evolution of the Innexin Gene Family in *Helobdella austinensis*. In preparation for submission to *Development, Genes, and Evolution*.

*Experiments ongoing:*

**Heath-Heckman, E.A.C.**, Dill-McFarland, K., Suen, G., and Weisblat, D. Definition of the Microbiome of *Helobdella austinensis*, a Model System for the Study of Organismal Development.

**Heath-Heckman, E.A.C.** \*, Spies, B. \*, Bates, A., Welchel, M., Glick, M., and Jacobs, D. Infection Dynamics of a Microsporidian Parasite of the Tidewater Goby along the California Coast.

### Published or Accepted

Kuo, D-H., De-Miguel, F., **Heath-Heckman, E.**, Szczupak, L., Todd, K., Weisblat, D., and Winchell, C. 2020. A Tale of Two Leeches: toward the Understanding of the Evolution and Development of Behavioral Neural Circuits. *Evol. Dev.* In Press.

Kim, R.C., Le, D., Ma, K., **Heath-Heckman, E.A.C.**, Whitehorn, N., Kristan, W.B., and Weisblat, D.A. 2019. Behavioral Analysis of Substrate Texture Preference in a Leech, *Helobdella austinensis*. *J. Comp. Physiol A.* **205(2)**:191-202

Kremer, N., Koch, E., El Filali, A., Zhou, L., **Heath-Heckman, E.A.C.**, Ruby, E., and McFall-Ngai, M. 2018. Persistent interactions with bacterial symbionts directs mature host cell morphology and gene expression in the squid-vibrio symbiosis. *mSystems.* **3(5)**.

Nawroth, J.C., Guo, H., Koch, E., **Heath-Heckman, E.A.C.**, Hermanson, J.C., Ruby, E.G., Dabiri, J.O., Kanso, E., and McFall-Ngai, M. 2017. Motile Cilia Create Fluid-Mechanical Microhabitats for the Active Recruitment of the Host Microbiome. *Proc. Natl. Acad. Sci. U.S.A.* **114(36)**: 9510-9516.

Peyer, S.M., **Heath-Heckman, E.A.C.**, and McFall-Ngai, M.J. 2017. Characterization of the Cell Polarity Gene Crumbs During the Early Development and Maintenance of the Squid-Vibrio Light Organ Symbiosis. *Dev. Genes. Evol.* **227(6)**:375-387.

**Heath-Heckman, E.A.C.** 2016. The Metronome of Symbiosis: Interactions Between Microbes and the Host Circadian Clock. *Integr Comp Biol.* **56(5)**: 776-783.

**Heath-Heckman, E.A.C.**, Foster, J., Apicella, M.A., Goldman, W.E., McFall-Ngai, M. 2016. Environmental cues and Symbiont MAMPs function in concert to drive the daily remodeling of the crypt-cell brush border of the *Eupryma scolopes* light organ. *Cell Microbiol.* **18(11)**: 1642-1652.

Schwartzman J., Koch E., **Heath-Heckman E.A.C.**, Zhou L., Kremer N., McFall-Ngai M., and Ruby E. 2015. The chemistry of negotiation: Rhythmic, glycan-driven acidification in a symbiotic conversation. *Proc. Natl. Acad. Sci. U.S.A.* **112(2)**:566-71.

**Heath-Heckman, E.A.C.\***, Gillette, A.A.\*, Augustin, R., Gillette M.X., Apicella, M.A., Goldman, W.E., McFall-Ngai, M.J. 2014. Shaping the microenvironment: evidence for the influence of a host galaxin on symbiont acquisition and maintenance in the squid-vibrio symbiosis. *Environ Microbiol.* **16(12)**:3669-82.

Koropatnick, T., Goodson, M. S., **Heath-Heckman, E.A.C.**, and McFall-Ngai, M. 2014. Identifying the cellular mechanisms of symbiont-induced epithelial morphogenesis in the squid-vibrio association. *Biol. Bull.* **226(1)**:56-68.

**Heath-Heckman, E.A.C.**, S.M. Peyer, C.A. Whistler, M.A. Apicella, W.E. Goldman, and M.J. McFall-Ngai. 2013. Bacterial bioluminescence regulates expression of a host cryptochrome gene in the squid-vibrio symbiosis. *mBio* **4(2)**:e00167-13.

### Selected News Features

Ecology: Symbionts set squid's clock. 2013. *Nature* **496**: 273

Kahrstrom, C.T. 2013. Symbiosis: Bacteria seize control of the clock. *Nature Reviews Microbiology* **11**: 362-363

Herzog, K. UW studies how bacteria affect squid's internal clock. *Milwaukee Journal Sentinel* April 20, 2013.

Pignataro, A. How the Unassuming Hawaiian Bobtail Squid May Help Us Understand Human Health. *MauiTime* May 30, 2013.

Kremer, N.K., Philipp, E., Charpentier, M-C., Brennan, C., Kraemer, L., Altura, M.A., Augustin, R., Haesler, R., **Heath-Heckman, E.A.C.**, *et al.* 2013. Initial symbiont contact orchestrates organ-wide transcriptional changes that prime tissue colonization. *Cell Host Microbe* **14(2)**: 183-194

Altura, M.A., **Heath-Heckman, E.A.C.**, Gillette, A.A., Kremer, N., Krachler, A-M., Brennan, C., Ruby, E.G., Orth, K., and McFall-Ngai, M.J. 2013. The first engagement of partners in the *Euprymna scolopes* – *Vibrio fischeri* symbiosis is a two-step process initiated by a few environmental symbiont cells. *Environ. Microbiol.* **15(11)**: 2937-2950.

Chaston, J.M., Murfin, K.E., **Heath-Heckman, E.A.C.**, and Goodrich-Blair, H. 2013. Previously unrecognized stages of species-specific colonization in the mutualism between *Xenorhabdus* bacteria and *Steinernema* nematodes. *Cell. Microbiol.* **15(9)**: 1545-1559.

McFall-Ngai, M.J., **Heath-Heckman, E.A.C.**, Gillette, A.A., Peyer, S.M., and Harvie, E.A. 2012. The secret languages of coevolved symbioses: insights from the *Euprymna scolopes* – *Vibrio fischeri* symbiosis. *Semin. Immunol.* **24(1)**: 3-8.

Mandel, M.J., Schaefer, A.L., Brennan, C.A., **Heath-Heckman, E.A.C.**, Deloney-Marino, C.R., McFall-Ngai, and M.J., Ruby, E.G. 2012. Squid-derived chitin oligosaccharides are a chemotactic signal during colonization by *Vibrio fischeri*. *Appl. Environ. Microbiol.* **78(13)**: 4620-4626.

**Heath-Heckman, E.A.C.**, and McFall-Ngai, M.J. 2011. The occurrence of chitin in the hemocytes of invertebrates. *Zoology (Jena)*. **114(4)**: 191-198.

*(Underlined authors were direct undergraduate or high school mentees of E. Heath-Heckman)*

## Teaching Experience

### **Instructor (UCLA):**

Winter 2019: EEB 105 – Biology of the Invertebrates (lecture and laboratory)

- Upper-division undergraduate topics class
- Designed new curriculum after 5-year hiatus in UCLA offering the course
- New curriculum was phylogeny-based and integrated novel assessment strategies in laboratory activities, such as the production of short nature documentaries using smartphones.

### **Invited Lecturer (University of Wisconsin – Madison):**

Fall 2010, 2011, 2012: MMI 554 Emerging Infectious Diseases

Fall 2012: MMI 302 Medical Microbiology Laboratory

### **Teaching Assistant:**

#### **University of Wisconsin – Madison**

Fall 2008, 2009: MMI 554 Emerging Infectious Diseases

#### **University of Chicago**

Winter 2005, 2006, 2007: BIOS 15106 Plagues: Past and Present

Autumn 2006: BIOS 20184 Biodiversity

Spring 2007: BIOS 10110 Biological Issues and Paradigms

### **Intensive programs (UCLA):**

Fall 2018, Bioscience Postdoc Educational Leadership Program (Focus on Immunity and Inflammation)

## Professional Societies

American Society for Microbiology

Society for Integrative and Comparative Biology

International Symbiosis Society

Biophysical Society

## Professional Presentations

### **Organizational Positions:**

Co-Chair for the Upcoming Gordon Research Seminar on Ecological and Evolutionary Genomics, 2021

Discussion Group Co-Leader, Discussion on “Beneficial Microbes and Circadian Rhythms”, 5<sup>th</sup> ASM Conference on Beneficial Microbes, 2014, Washington, D.C.

### **Invited Talks:**

Invited speaker for the Upcoming Symposium “Genomic Perspectives in Comparative Physiology of Mollusks: Integration across Disciplines” at the Society for Integrative and Comparative Biology Annual Meeting, 2021

“Bacterial regulation of host cryptochrome expression in a squid photophore”, Society for Integrative and Comparative Biology Annual Meeting, 2016 (Symposium: Extraocular, non-visual, and simple photoreceptors), Portland, OR

“Symbiont luminescence entrains daily host-tissue rhythms through direct regulation of a host cryptochrome gene”, Society for Integrative and Comparative Biology Annual Meeting, 2013 (Symposium: Keeping time during animal evolution: conservation and innovation of the circadian clock), San Francisco, CA

“*Luceat lux vestra*: light production and perception in the *Euprymna scolopes* – *Vibrio fischeri* symbiosis”, 7<sup>th</sup> International Symbiosis Society Congress, 2012, Krakow, Poland

### **Accepted Talks:**

“Using Leeches to Discover Novel Ion Channels Involved in Mechanotransduction”, Biophysical Society Thematic Meeting on Emerging Concepts in Ion Channel Biophysics, 2017, Mexico City, MX.

“Using leeches to identify molecular mechanisms mediating cellular responses to touch”, Society for Integrative and Comparative Biology Annual Meeting, 2016, Portland, OR

“*Veritas est lux*: Bacterial Light Regulates Cryptochrome Transcription in the Squid-*Vibrio* Symbiosis”, General Meeting of the American Society for Microbiology, 2012, San Francisco, CA

“Chitin as a Component of the Invertebrate Immune System”, Society for Integrative and Comparative Biology Annual Meeting, 2010, Seattle, WA

### **Poster Presentations:**

"Using Comparative Genomics to Reveal the Underpinnings of Bioluminescence Symbioses in Bobtail Squid", Gordon Research Symposium and Conference on Ecological and Evolutionary Genomics 2019, NH

"Characterization of the Microbiome of *Helobdella austinensis*, a Novel Model for the Effects of Symbiosis on Animal Development", American Society for Microbiology General Meeting 2017, New Orleans, LA

“Host Chitin Synthesis and Presentation in the *Euprymna scolopes* – *Vibrio fischeri* Mutualism”, American Society of Microbiology Conference on Beneficial Microbes 2010, Miami, FL

“Sweet Talk: Host Chitin Production and its Role in Maintenance of the Squid-*Vibrio* Symbiosis”, 6<sup>th</sup> International Symbiosis Society Congress, 2009, Madison, WI

“Sweet Talk: Host Chitin Production and its Role in the *Euprymna scolopes/Vibrio fischeri* Symbiosis”, American Society of Microbiology Conference on Beneficial Microbes 2008, San Diego, CA

### **Outreach**

Exploring Your Universe, Ask a Scientist Volunteer, UCLA: 2018

NPR Science Friday Cephalopod Movie Night, Panelist, Los Angeles, CA: 2018

Darwin Day, Lab Exhibition Coordinator, University of Wisconsin – Madison: 2011, 2012, 2013

Science Expeditions, Lab Exhibition Coordinator, University of Wisconsin – Madison: 2011, 2012, 2013

USA Science and Engineering Festival, Exhibitor, Washington, D.C.: 2010