

Heather J. Ray

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Professional Employment

- **Assistant professor of Developmental Biology, Idaho State University** **2020-present**
 - My research focuses on elucidating the molecular functions of genes associated with developmental disorders of the neural and neural crest using the African clawed frog, *Xenopus laevis*, as a model system
- **Postdoctoral Fellow, University of Alabama Birmingham** **2016-2020**
 - **Advisor: Dr. Chenbei Chang, Department of Cell, Development and Integrative Biology**
 - My research focused on understanding how the transcription factor Hic1 regulates neural crest cell development
- **Adjunct Instructor, Lawson State Community College** **2019**
- **Predoctoral trainee, University of Colorado Anschutz Medical Campus** **2010-2016**
 - **Advisor: Dr. Lee Niswander, Department of Pediatrics**
 - My research focused on understanding how the non-neural ectoderm contributes to development of the mammalian neural tube and the gene regulatory network downstream of the transcription factor Grainyhead-like 2.
- **Research Science Associate I, University of Texas at San Antonio** **2006-2010**
 - **Principal investigator: Dr. Bernard Arulanandam, Department of Biology**
 - Worked in the area of vaccine development against the select agent *Francisella tularensis*

Education

- **Developmental Biology Teaching Workshop** **July 2019**

Darling Marine Science Center, University of Maine
- **Teaching certificates at the Associate and Practitioner level** **Dec 2018**

Center for Integration of Research, Teaching and Learning (CIRTL)
- **Cell and Developmental Biology of *Xenopus* Course** **April 2017**

Cold Spring Harbor Laboratory
- **Doctor of Philosophy in Cell Biology Stem Cells and Development** **May 2016**

University of Colorado Anschutz Medical Campus
- **Master of Science in Biology** **Dec 2009**

University of Texas at San Antonio
- **Bachelor of Science in Biology** **June 2006**

Oregon State University

Publications

1. **Ray, H.J.**, Chang, C. (2020) The transcription factor Hypermethylated in Cancer 1 (Hic1) regulates neural crest migration via interaction with Wnt signaling. *Dev. Biol.* 463: 169-181
2. Popov, I.K., **Ray, H.J.**, Skoglund, P., Keller, R., Chang, C. (2018) The RhoGEF protein Plekhg5 regulates apical constriction of bottle cells during gastrulation. *Development* 145:dev168922
3. Alkobtawi, M.*, **Ray, H.J.***, Barriga, E. H., Moreno, M., Kerney, R., Monsoro-Burq, AH., Saint-Jennet, JP, Mayor, R. (2018) Characterization of Pax3 and Sox10 transgenic *Xenopus laevis* embryos as tools to study neural crest development. *Dev. Biol.* 444: S202-S208 *Authors contributed equally
4. **Ray, H.J.**, Niswander, L (2016) Dynamic behaviors of the non-neural ectoderm during mammalian cranial neural tube closure. *Dev Biol* 416 (2): 279-85
5. **Ray, H.J.**, Niswander, L. (2016) Grainyhead-like 2 Downstream Targets act to suppress epithelial-to-mesenchymal transition during neural tube closure. *Development* 143 (7): 1192-204
6. Massarwa, R., **Ray, H.J.**, Niswander, L. (2013) Morphogenetic movements in the neural plate and neural tube: mouse. *WIREs Dev Biol.* doi: 10.1002/wdev.120
7. **Ray, H.J.**, Niswander, L. (2012) Mechanisms of tissue fusion during development. *Development* 139: 1701-1711
8. Signarovitz, A.L., **Ray, H.J.**, Yu, J.J., Guentzel, M.N., Chambers, J.P., Klose, K.E., Arulanandam, B.P. (2012) Mucosal immunization with live attenuated francisella novicida U112 Δ IgIB protects against pulmonary *F. tularensis* SCHU S4 in the fischer 344 rat model. *PLoS One.* 7(10): e47639
9. Li, L., Zeng, Y., Fang, K., Xiao, Y., Jin, H., **Ray, H.**, Chan, J. (2102) Anetodermic pilomatricoma: molecular characteristics and trauma in the development of its bullous appearance. *Am J Dermatopathol.* 34(4): e41-5
10. **Ray, H.J.**, Chu, P, Wu, T.H., Lyons, C.R., Klose, K.E., Guentzel, M.N., Arulanandam, B.P. (2010) The Fischer 344 rat reflects human susceptibility to *Francisella* pulmonary challenge and provides a new platform for virulence and protection studies. *Plos One* 5 (4): e9952
11. **Ray, H.J.**, Cong, Y., Murthy, A.K., Selby, D.M., Klose, K.E., Barker, J.R., Guentzel, M.N., Arulanandam, B.P. (2009) Oral live vaccine strain induced protective immunity against pulmonary *Francisella tularensis* challenge is mediated by CD4⁺ T cells and antibodies including IgA. *Clin Vaccine Immunol.* 16: 444-452.
12. **Powell, H.J.***, Cong, Y., Yu, J., Guentzel, M.N., Berton, M., Klose, K.E., Murthy, A.K., Arulanandam, B.P. (2008) CD4⁺ T cells are required during priming but not the effector phase of antibody-mediated IFN- γ -dependent protective immunity against pulmonary Francisella infection. *Immunol. Cell. Biology.* 86: 515-522. *Author's maiden name

Service

- **Search committee member, ISU Biological Sciences new faculty position** 2020
- **Alternate scientist member, ISU IACUC committee** 2020
- **Advising, ISU undergraduate students** 2020
 - Currently advising 18 students designated as Biology majors with a concentration in Biomedical Sciences
- **Co-organizer, 2019 SE Regional Society of Developmental Biology Conference, UAB** 2018-2019
 - Coordinate all aspects of planning and hosting a conference for approximately 125 people from around the southeast. Specific individual responsibilities included managing conference finances, organizing program and booklet printing, catering and facilities oversight, writing the conference proposal, creating a website and acting as liaison between our committee and the national Society that sponsors this conference
- **Social Media Coordinator, Cell and Developmental Biology of *Xenopus* Course,** 2018-present
Cold Spring Harbor Laboratories
 - Develop and utilize social media platforms to promote continued community among course alumni and attract interest for future course participants
- **Vice-chair, Post-doctoral Association, UAB** 2018-2019
 - Assist the Chair with running of the PDA and organizing activities, including planning and running Postdoc Appreciation Week activities, Postdoc Research Day, and the postdoc peer support group
- **Member, Post-doctoral Association Executive Committee, UAB** 2017-present
 - Assist with various duties of the postdoc association
 - Co-chair of the mental health and wellness committee that runs seminars and events, including

- a monthly postdoc peer support group meeting
- > **Student Representative, Graduate Advisory Committee**, UCD Anschutz Medical Campus 2013-2016
 - o Nominated and voted to this position by the student body. This committee served to guide graduate students through the first years of their program until they achieved candidacy. As the student representative, I worked directly with all of the students to help and advise them in their early education and represent student interests to the committee, including when enacting new guidelines and mediating disputes.
- > **Chair, Student Committee to Appoint Graduate Program Director**, UCD Anschutz Medical Campus 2014
 - o Appointed to this position by the graduate program faculty. Organized student committee to review applicant applications, conduct interviews, generate a summary report for the student body, conduct a vote, and represent students' choice to the faculty committee to hire a new CSDV graduate program director
- > **Chair, CSDV Graduate Program Retreat Planning Committee**, UCD Anschutz Medical Campus 2012-2014
 - o Nominated and voted to this position by the student body, to plan and organize our annual graduate program retreat along with a faculty advisor. Duties included inviting and hosting a student-invited keynote speaker, soliciting abstracts and session chairs, creating our event schedule and program, and hosting the 2-day event held in Breckenridge, CO

Teaching

- > **Instructor**
 - o **Biol 1101 – Introductory Biology lecture** 2020
 In this first semester of a two-semester series for Biology and Health Science majors, material is focused on the chemical and molecular nature of biological systems and how changes at the molecular level drive evolutionary processes. 200 students
 - o **Biol 3324 – Developmental Biology lecture and lab** 2020
 This upper-division elective course (20 students) focuses on the genetic, cellular and morphogenic processes that drive embryonic development. The associated lab utilizes both vertebrate and non-vertebrate embryos to help students understand the complex processes of development and focuses on hypothesis generation, experimental design and data collection and interpretation
 - o **GBSC 700 – Developmental Biology Journal Club**, Graduate Biomedical Sciences, UAB 2019-2020
 Administer a semester-long journal club course for ~15 graduate students in the field of developmental biology
 - o **Biology 250 – Practical Skills in Scientific Research**, Lawson State Community College 2019
 Developed and taught a semester-long course (8 students) designed to introduce community College students to scientific research and develop skills for success in STEM fields. Topics Include data interpretation, reading primary literature, writing abstracts, ethics and reproducibility, and giving presentations. Students also completed short research internships at UAB
 - o **Biology 103**, Lawson State Community College 2018
 Team-taught 2 semester-long undergraduate courses in introductory Biology for 35 science majors with Dr. Mary Smith-Ellison
 - o **STEAM Professionals Club**, Stillman College 2017-2018
 Organized a monthly distance learning seminar series from UAB to Stillman College through the GoToMeeting platform for 10-15 students
 - o **Cell and Molecular Biology Lab**, M.S. in Biomedical and Health Sciences Programs, UAB 2017
 Taught a weekly four-hour lab course for 30 students designed to teach students molecular Biology techniques while conducting a real research project related to the course director's
 - o **Summer Student Research Bootcamp**, UCD Anschutz Medical Campus 2014-2015
 Assisted in design and implementation of a new two-day course for ~20 high school and undergraduate student interns in research labs in Cell and Developmental Biology
- > **Lecturer:**
 - o **Model Systems of Genetic Disorders**, University of Alabama Birmingham 2018, 2019
 Designed and taught two one-hour lectures for undergraduates on the *Xenopus* model system and use to study human genetic disorders
 - o **Chemistry Seminar course**, Oakwood University 2018
 Presented a seminar on the relationship between embryonic development and cancer
 - o **Cell Signaling Graduate Course**, University of Alabama Birmingham 2018, 2019
 Designed and taught a two-hour lecture and paper discussion on forward genetic screens
 - o **Developmental Biology Graduate Course**, University of Alabama Birmingham 2017, 2019
 Designed and taught a two-hour lecture and paper discussion on axis specification
 - o **Stem Cells and Development: An Integrated Approach**, UCD Anschutz Medical Campus 2013-2015

- Designed and taught a two-hour lecture and lab course on somitogenesis
- **Developmental Neurobiology**, UCD Anschutz Medical Campus 2013-2014
- Taught two classes (lecture and paper discussion) on early neural patterning
- **Biomedical Core Courses**, UCD Anschutz Medical Campus 2011-2015
- Prepared introductory lectures and led small group paper discussions for first year graduate students on various topics related to cell signaling, cell biology and developmental biology

Mentored Research

➤ Graduate students

- **Nazia Jamil**, UAB PREP Scholar 2019-2020
- **Saeid Mohammad-Parast**, PhD student, Graduate Biomedical Sciences program 2017-2020
- Lab of Dr. Chenbei Chang
- **Colby Fees**, rotating graduate student, Cell Biology Stem Cells and Development Program 2012
- **Ashley Pacheco**, rotating graduate student, Human Medical Genetics and Genomics Program 2013

➤ Undergraduate students

- **Kathryn West**, Undergraduate in Microbiology 2020-present
- **Maaha Jamshaid**, Undergraduate in Biology 2020
- **Jared Nessen**, Undergraduate in Biology 2020-present
- **Yihan Zhong**, summer intern, undergraduate student volunteer 2019
- **Autumn Beavers**, summer intern volunteering to gain research experience prior to beginning medical school in Fall 2018 2018
- **Onika Abrams**, summer intern, undergraduate Senior, Minority Health Research Center Summer Enrichment Program, program poster presentation winner 2017

➤ High School Students

- **Mason Munro-Ehrlich**, summer intern, high school junior 2014
- **Lara Melkjorsen**, summer intern, high school senior 2013
- **Evan Provan**, summer intern, high school junior, senior 2012, 2013

Education Outreach

- **CDIB Science Outreach Program**, Birmingham, AL
 - Volunteered in local elementary schools with CDIB department-sponsored outreach program to increase student interest in science and teach basics of human cardiopulmonary physiology
- **Oakwood Academy**, Huntsville, AL
 - Volunteered as a judge for middle and high school student science fair
- **Rock Canyon High School**, Littleton, CO
 - Provided job shadow experiences for students taking the Biotechnology course
 - Participated in skype interviews with students to discuss working in biomedical research
 - Mentored several high school students during summer research internships
- **Children's Hospital Colorado**, Aurora, CO
 - Provided lab tours and discussed research in lay terms to philanthropists and others associated with the hospital, including patient families
- **Denver Public School District**, Denver, CO
 - Volunteered as a judge at the Denver city-wide science fair
- **Wildlife Rescue and Rehabilitation**, Kendalia, TX
 - Ran community outreach program for organization in the San Antonio, TX area
 - Visited with local groups (schools, boy/girl scout troops, community groups, etc.) to teach about local wildlife, conservation, and human/wildlife interactions

Awards and Honors

- 6th annual NIGHTSEA/EMS KEY Award for new faculty, **2020**
- Postdoctoral Career Enhancement Award from the Office of Postdoctoral Education and the University of Alabama Birmingham to attend the Developmental Biology Teaching Workshop at the University of Maine Darling Marine Science Center, **2019**
- Best talk in both "full-length" and "3MT" divisions, UAB Postdoctoral Research Day, UAB, **2019**

- Travel Award from the Office of Postdoctoral Education at the University of Alabama Birmingham to present my work at the 17th International *Xenopus* Meeting in Seattle, WA, **2018**
- Best poster presentation award at the 2018 National IRACDA Conference in Atlanta, GA, **2018**
- Best oral presentation by a post-doctoral fellow, Southeast Regional Society of Developmental Biology conference, Athens, GA, **2018**
- Best research talk by a post-doctoral fellow, 2nd place, Department of Cell, Development and Integrative Biology retreat, Guntersville, AL, **2017**
- Postdoctoral Career Enhancement Award from the Office of Postdoctoral Education at the University of Alabama Birmingham to attend the Cell and Developmental Biology of *Xenopus* course at Cold Spring Harbor Laboratory, NY, **2017**
- **Mentored Experiences in Research, Instruction and Teaching (MERIT) Fellowship**, UAB and NIH National Institute of General Medical Sciences, **2016-2020**
- Developed the proposal and preliminary data, and wrote the progress reports for Cancer League of Colorado Award: Grhl2 Developmental Network to Identify Novel Suppressors of EMT in Breast Cancer, **2014-2015**.
- HIRS Travel Award from the University of Colorado Denver Graduate School to attend the Society for Developmental Biology National Conference, Snowbird, UT, **2015**
- Nominated for the University of Colorado Anschutz Medical Campus Excellence Award for Outstanding Community Service by an Individual Student, **2015**
- Best Student Talk, Cell Biology Stem Cells and Development Graduate Program Retreat, Breckenridge, CO, **2014**
- Travel Award from the Society for Developmental Biology National Conference, Seattle, WA, **2014**
- Best Student Presentation runner-up, Southwest Regional Society for Developmental Biology Meeting, Denver, CO, **2014**
- HIRS Travel Award from the University of Colorado Denver Graduate School to attend the 8th Winter Conference of the European Society for Molecular Imaging, Les Houches, France, January **2014**
- **Ruth L. Kirschstein National Research Service Award (NRSA)**, NIH National Cancer Institute **2013-2106**
- Travel Award from the International Tularemia Conference, Berlin, Germany, **2009**
- **Oregon Laurels Scholarship** awarded by the state of Oregon, **1995-1998**

Invited Presentations / Conferences

1. Investigating the Role of Mannan-binding Lectin Associated Serine Protease 1/3 (masp1/3) during early development, Northwest Regional Society of Developmental Biology Conference, virtual, **September 2020 (talk)**
2. The Transcription Factor Hypermethylated in Cancer 1 (Hic1) Interacts with Canonical and Non-canonical Wnt Signaling Pathways During Neural Crest Migration, Society of Developmental Biology National Conference, Boston, MA, **July 2019**
3. Design of a hybrid classroom/laboratory course to increase community college student awareness of and interest in research science careers, National IRACDA Conference, Ann Arbor, MI, **June 2019 (talk)**
4. The Transcription Factor Hypermethylated in Cancer 1 (Hic1) Interacts with canonical and Non-canonical Wnt Signaling Pathways During Neural Crest Development, Southeast Regional Society of Developmental Biology Conference, Birmingham, AL, **May 2019**
5. The Transcription Factor Hypermethylated in Cancer 1 (Hic1) Interacts with Wnt Signaling Pathways During Neural Crest Migration, 17th International *Xenopus* Conference, Seattle, WA, **August 2018 (talk)**
6. The Tumor Suppressor Hypermethylated in Cancer 1 (Hic1) Interacts with Wnt Signaling Pathways During Neural Crest Migration, Society of Developmental Biology National Conference, Portland, OR **July 2018**
7. The Tumor Suppressor Hypermethylated in Cancer 1 (Hic1) Interacts with Wnt Signaling Pathways During Neural Crest Migration, National IRACDA Conference, Atlanta, GA, **July 2018**
8. The Tumor Suppressor Hypermethylated in Cancer 1 (Hic1) Interacts with Wnt Signaling Pathways During Neural Crest Migration, Southeast Regional Society of Developmental Biology Conference, Athens, GA, **May 2018 (talk)**
9. Investigating Hypermethylated in cancer 1 (Hic1) Function during Early *Xenopus* Development, Society of Developmental Biology National Conference, Minneapolis, MN, **July 2017**
10. Investigating Hypermethylated in cancer 1 (Hic1) Function during Early *Xenopus* Development, National IRACDA Conference, Birmingham, AL, **June 2017**
11. Grainyhead-like 2 Suppresses Epithelial-to-Mesenchymal Transition During Neural Tube Closure through Activation of Novel EMT Suppressors. International Conference on Neural Tube Defects, Austin, TX, **October 2015 (talk)**
12. Grainyhead-like 2 Suppresses Epithelial-to-Mesenchymal Transition During Neural Tube Closure and Cancer Progression through Activation of Novel EMT Suppressors. Society of Developmental Biology National Conference, Snowbird, UT,

July 2015

13. Grhl2 as a suppressor of EMT during murine neural tube closure. Society of Developmental Biology National Conference, Seattle, WA, **July 2014**
14. Grhl2 as a suppressor of EMT during murine neural tube closure. Southwest Regional Meeting for the Society of Developmental Biology, Denver, CO, **February 2014 (talk)**
15. A Novel Live Imaging System for the Study of Epithelial Dynamics in the Mammalian Embryo. 8th Winter Conference of the European Society for Molecular Imaging, Les Houches, France, **January 2014 (talk)**
16. Grhl2-regulated suppression of EMT in non-neural ectoderm during murine neural tube fusion. International Conference on Neural Tube Defects, Austin, TX, **October 2013 (talk)**
17. The role of Grhl2-regulated non-neural ectoderm during murine neural tube fusion. Southwest Regional Meeting for the Society of Developmental Biology, Salt Lake City, Utah, **February 2013**
18. Analysis of phagocytic activity of rat macrophages for *Francisella tularensis*. 6th International Conference on Tularemia, Berlin, Germany, **September 2009**.
19. A defined intranasal vaccine against pulmonary tularemia requires the effective induction of MHC Class II-dependant humoral immunity. 13th International Congress of Mucosal Immunology, Tokyo, Japan, **July 2007 (talk)**
20. Intranasal vaccination with a defined attenuated *Francisella novicida* strain induces MHC Class II-dependant protection against tularemia. 5th International Conference on Tularemia, Woods Hole, Massachusetts, **October 2006**

Professional Engagements/Affiliations

- Society for Developmental Biology

- European Society for Molecular Imaging
