

SYDNEY BIRCH

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EDUCATION

- PhD** University of New Hampshire, May 2022
Molecular and Evolutionary Systems Biology
Dissertation Topic: Sensory Integration in Hydrozoans
Minor: College Teaching
Committee: Dr. David Plachetzki (chair), Dr. Matt MacManes, Dr. W. Kelley Thomas, Dr. Arturo Andrade, Dr. Jennifer Dijkstra
- BS** Michigan State University, *Zoology* May 2014
Specializations: Marine Biology and Animal Behavior and Neurobiology

HONORS AND AWARDS

- The American Microscopical Society Best Student Presentation** Jan. 2022
The American Microscopical Society awards a student who presents a talk at the Society for Integrative and Comparative Biology
- AAC&U K. Patricia Cross Future Leaders Award Finalist** Dec. 2021
A competitive award from The Association of American Colleges & Universities for graduate students who show promise as future leaders of higher education
- UNH SMSOE Graduate Student Research Fund Recipient** May 2021
Received \$3000 for a competitive research proposal from the School of Marine Science and Ocean Engineering for a population genetics study on *Ectopleura crocea*
- UNH Marine Biology Graduate Program Research Grant Recipient** May 2021
Received \$5000 for a competitive research proposal from the School of Marine Science and Ocean Engineering
- Martha and Theodore Frizzell Fund Recipient** May 2019
A competitive scholarship offered through the UNH College of Life Sciences and Agriculture
- NSF Graduate Research Fellowship Program (GRFP)** April 2019

National Science Foundation

3 Minute Thesis Competition 1st Place Awardee April 2019
UNH competition among graduate students to present research in 3 minutes

Graduate Research Assistantship Fall 2017, Fall 2018
University of New Hampshire Spring 2019

Research Communication Academy Member 2019
Selective program offered through UNH to develop research communication

Graduate Teaching Assistantship Spring 2018
University of New Hampshire

Broadening Participation Award 2018
Society for Integrative and Comparative Biology

Charlotte Magnum Award 2018
Society for Integrative and Comparative Biology

Travel Award 2018
Graduate School of UNH

Travel Award 2018
Cnidarian Model Systems Meeting

Dean's List Recipient Fall 2010, Fall 2011
Michigan State University Spring 2012, Fall 2014

PUBLICATIONS

Birch, Picciani, Oakley, Plachetzki. *In Press*. Diversity and evolution of jellyfish visual systems. Chapter 2 in *Distributed Vision: From simple sensors to sophisticated combination eyes*. Springer.

Birch and Plachetzki. **2022**. Multisensory integration (MSI) by polymodal sensory neurons dictates larval settlement in a brainless cnidarian larva. bioRxiv.
doi: <https://doi.org/10.1101/2022.11.02.514770>

Birch, Chan, Plachetzki. *In Progress*. Adenylate cyclase is involved in modulating the photosensory response in *Hydra vulgaris*.

Birch, Provencher, DiMeo, Pankey, Plachetzki. *In Progress*. Phototactic preference and its genetic basis in the planulae of the colonial Hydrozoan *Hydractinia symbiolongicarpus*.

RESEARCH EXPERIENCE

Sensory Integration in Hydrozoans, UNH, Durham 2017-2022

Advisor: Dr. David Plachetzki

- Generating transgenic *Hydra* by creating expression vectors using an opsin (photosensory) promoter and performing pharmacological experiments to assess the photosensory pathway components
- Using Fluorescents *in situ* Hybridization to identify key components of sensory transduction pathways in *Hydra* and actinula and planula larvae
- Examining the settlement response to environmental sensory cues in the actinula larva of *Ectopleura crocea* and investigating the underlying molecular genetics of sensory integration in actinula via RNA-Seq, EdgeR, and a custom bioinformatics pipeline
- Investigating the photoresponse and molecular genetics of sensory integration in planula larva of *Hydractinia* during settlement

Michigan State University, East Lansing 2012 – 2014

Undergraduate Research, Dr. Michael Gottfried

- Performed complete dissection of shark pectoral fins
- Conducted analysis of evolutionary changes in shark pectoral fins by using comparative approach

TEACHING EXPERIENCE

University of New Hampshire, Durham, NH Fall 2017 – Spring 2022

Graduate Student Mentor, The Plachetzki Lab

- Teaching undergraduate students in the lab how to use molecular biology tools such as PCR, gel-electrophoresis, RNA and DNA extractions, DNA Library Prep, in-situ Hybridization, and Confocal Microscopy
- Teaching undergraduate students in the lab how to code in R, Bash and python, and how to use bioinformatics tools for gene expression and phylogenetic studies
- Providing weekly instructions, guidance, and deadlines for active research
- Creating a schedule and instructing undergraduate students in the lab how to care for *Hydra*
- Aiding students in searching for Graduate Schools, helping with their applications and interview preparation

University of New Hampshire, Durham, NH Spring 2018

Graduate Teaching Assistant, Genetics

- Designed and lead recitation sections of 20 students once a week to enhance undergraduate students' understandings of key concepts from lecture
- Implemented Cognitive Load Theory and an Integrative Course Framework when designing learning activities and giving presentations

- Provided office hours once a week to help address students' questions
- Created and graded weekly homework assignments for the course and uploaded assignments online to MyCourses
- Aided in creating and grading exam questions for the course

WyzAnt Tutor, Livonia, MI

Fall 2015 – Spring 2016

Certified Tutor, Zoology, Biology, and Ecology

- Tutored high school students in the above topics by creating objectives based on course syllabus, explained concepts and theories, and answered questions about the material

Michigan State University, East Lansing, MI

Fall 2013 – Fall 2014

Undergraduate Teaching Assistant, Applications of Environmental and Organismal Populations

- Collaborated on curriculum and exam development and graded all written work including final exam papers
- Held office hours and met with students upon request

PROFESSIONAL WORK EXPERIENCE

United Road Transportation, Livonia, MI

Feb. 2017 – Aug. 2017

Account Coordinator (*promotion*)

- Managed four sales representatives' new business by entering in new orders, acquiring paperwork to meet compliance, and processing payments
- Collaborated with the dispatch department, the accounting department, supervisors, dealerships, and clients to solve problems if any arose at any step of the process

United Road Transportation, Livonia, MI

June 2016 – Feb. 2017

Pre-Qualifying Administrative Assistant

- Collaborated with co-workers and other departments on reports and presented information to supervisors
- Verified qualifying information for vehicle transport, determined if the vehicle met guidelines, and activated, canceled, or put orders on hold

Medwest Medical Supply (Rotech Health Care), Livonia, MI

Sept. 2015 – June 2016

Customer Service Representative II

- Communicated with patients and referral sources both verbally and in writing to ensure patient questions and concerns were processed in a timely manner
- Coordinated all patient information, processed paperwork, including preparation of file for the billing department, compliance team, and assisted with patient setups
- Worked directly with sales representatives, local and regional managers, medical professionals, and customers to insure all paperwork was processed properly

Great Lakes Environmental Center Inc., East Lansing, MI Nov. 2014 – June 2015
Diatom Laboratory Technician Assistant

- Handled glassware, micropipettes, and chemicals in a professional and safe manner
- Acid cleaned diatoms and created microscope slides using Naphrax
- Calculated dilutions for chemical solutions and properly labeled dilutions of diatom solutions on microscope slides

Michigan State University Museum, East Lansing, MI Dec. 2011 – May 2013
Special Collections Undergraduate Assistant

- Handled and classified vertebrate and invertebrate specimens with scientific nomenclature
- Cataloged specimens and their corresponding documentation
- Aided in educational tours to the public and students by describing scientific processes and giving background information on the specimens

RELEVANT COURSE WORK

Bioinformatics, Applied Bioinformatics, Intro to Programming (Python), College Teaching, Course Design, Marine Biology, Oceanography, Marine Ecosystems Management, Neurobiology, Genetics, Evolution, Comparative Genomics, Design, Analysis, and Interpretation of Experiments

PRESENTATIONS

Society for Integrative and Comparative Biology Meeting, Phoenix, AZ. Jan. 2022
Talk: “The actinula larva of *Ectopleura crocea* utilizes multisensory integration (MSI) in the larval settlement decision”

Cnidarian Model Systems Meeting (Cnidofest), Virtual Oct. 2021
Talk: “The actinula larva of *Ectopleura crocea* utilizes multisensory integration (MSI) in the larval settlement decision”

Society for Integrative and Comparative Biology Meeting, Virtual Jan 2021
Talk: “A Hierarchy of Sensory Cues Control Larval Settlement in the Actinula Larva of *Ectopleura crocea* (Hydrozoa)”

Regional Northeastern Association of Graduate Schools (NAGS) Dec 2020
3 Minute Thesis Competition, Virtual
“Location, Location, Location: How Ectopleura larva choose where to live”

MCBS Departmental Seminar, University of New Hampshire (Virtual) Nov 2020
“A Hierarchy of Sensory Cues Control Larval Settlement in the Actinula Larva

of *Ectopleura crocea* (Hydrozoa)”

- Mini-Symposium for Benthic Ecology Meeting**, Virtual April 2020
“Investigating Sensory Integration and Settlement Response to Sensory Stimuli in the Hydrozoan *Ectopleura crocea*”
- Society for Integrative and Comparative Biology Meeting**, Austin, TX Jan 2020
Talk: “Investigating Sensory Integration and Settlement Response to Sensory Stimuli in the Hydrozoan *Ectopleura crocea*”
- MCBS Departmental Seminar**, University of New Hampshire Nov 2019
“Investigating Sensory Integration and Settlement Response to Sensory Stimuli in the Hydrozoan *Ectopleura crocea*”
- 3 Minute Thesis Presentation for NH Board of Trustees**, UNH April 2019
“Investigating the sensory systems of *Ectopleura* larva”
- 3 Minute Thesis Competition (Final round – 1st place)**, UNH April 2019
“Investigating the sensory systems of *Ectopleura* larva”
- UNH Graduate Research Conference**, University of New Hampshire April 2019
Poster: “The genomic characterization of larval settlement in the biofouling invertebrate *Ectopleura larynx*”
- 3 Minute Thesis Competition (1st round)**, University of New Hampshire March 2019
“Investigating the sensory systems of *Ectopleura* larva”
- MCBS Departmental Seminar**, University of New Hampshire Jan 2019
“The genomic characterization of larval settlement in the biofouling invertebrate *Ectopleura larynx*”
- Society for Integrative and Comparative Biology meeting**, Tampa, FL Jan 2019
Poster: “The genomic characterization of larval settlement in the biofouling invertebrate *Ectopleura larynx*”
- Shoals Marine Lab Seminar**, Appledore Island, ME June 2018
“Establishing a transgenic *Hydra magnipapillata* line using CRISPR/Cas9 & The genomic characterization of larval settlement of *E. larynx*”
- MCBS Departmental Seminar**, University of New Hampshire April 2018
“Establishing a transgenic *Hydra magnipapillata* line using CRISPR/Cas9”
- Science Sleuths Presentation**, University of New Hampshire Jan 2018
“Spectacular Creatures of the Serengeti”

PROFESSIONAL SERVICE

Mentor Judge for Oral Presentations at Society for Advancing Chicanos/Hispanics & Native Americans in Science (SACNAS) Oct. 2022

Participated as mentor judge for Graduate Student oral presentations in Neurosciences, Genetics & Other Life Sciences session.

Representative on the Graduate Student Council SMSOE Nov. 2020 – May 2022

Currently a representative on the School of Marine Science and Ocean Engineering Graduate Student Council where we work with the SMSOE Executive Committees and advocate for the needs and interests of current graduate students in SMSOE

Planning Committee Member for Benthic Ecology Meeting 2022. Oct. 2019–April 2022

Previously a member of the planning committee for BEM 2022 (originally for 2021) which is being hosted by UNH. Additionally, I was an active member of the DEI committee for this conference.

Executive Secretary for NASA Exobiology Proposal Review Oct. 2019

Performed as the executive secretary for NASA proposals under review by taking notes on proposal discussions and keeping reviewers on track

Poster Judge for the Junior Science and Humanities Symposia, UNH March 2019

Participated as a poster judge for the Northern New England JSHS High School program

Co-Creator and Vice President of the MSU Shark Club 2013 – 2014

Aimed at promoting education and conservation of sharks, skates and rays

COMMUNITY SERVICE & OUTREACH

Created and led “Why the PhD” McNair Scholars Program Workshop Sept. 2021

Designed and led a workshop about the value of obtaining a PhD, how graduate school works, and how to apply. This workshop was geared towards first generation college students and historically underrepresented groups to help prepare them for the application process for graduate school.

Radio Interview with WNTK highlighting *Ectopleura* Research June 2021

Gave an interview with WNTK about my research with *Ectopleura* which is a local biofouling species and the impact my research has on developing environmentally safe anti-fouling strategies for the aquaculture industry

Interview with UNH Today and Granite Geek journalist April and June 2021

Gave two interviews to journalist about my research with *Ectopleura* which is a local biofouling species and the impact my research has on developing environmentally safe anti-fouling strategies for the aquaculture industry

UNH Graduate Student Peer Mentor, UNH Dec. 2020 – May 2022
Mentoring fellow underrepresented minority graduate students in the MCBS department by organizing and leading bi-weekly meetings and helping students navigate graduate school. The aim of this mentorship program is to create a safe inclusive environment to help students navigate grad school and prepare students for successful careers.

McNair Scholars Program Graduate Student Peer Mentor. June. 2021 – July 2021
Mentored 14 undergraduate McNair Scholars during their summer research experience where I provided guidance and feedback on research plans, presentations, and graduate school applications. This program aims to prepare undergraduate students for graduate school and provides research experience and skills needed for a successful graduate career and beyond.

Mentoring undergraduates in the McNair Scholars Program Jan. 2021 – May 2022
Mentoring and teaching two undergraduate students how to navigate and conduct research in a molecular biology lab and aiding them in writing research proposals, designing presentations, and applying to graduate school

Panelist on NSF GRFP for UNH GRFP Course Aug. 2020, Aug. 2019
Participated as a panelist for a UNH NSF GRFP course on how to write a successful GRFP proposal and personal statement

Science Sleuths Co-Instructor, UNH April 2019 – May 2022
A monthly program introducing science to young children (pre-K and Kindergarten) by giving presentations on different STEM topics and providing hands on activities to reinforce concepts taught

“Let’s talk about biology and college” Volunteer, UNH March 2019
Volunteered to talk to Dover Middle School students about college, biology, and becoming a scientist.

Science Sleuths Presenter, University of New Hampshire January 2018
Introduced the ecology of Antarctica to young children by giving a presentation and providing hands on activities

MSU Museum’s Darwin Day Volunteer, Michigan State University Feb. 2011 & 2012
Led tours for the general public through the MSU Museum’s Special Collection Department

Mother Teresa Service Day Clean-Up, Detroit, MI October 2010
Participated in an environmental clean-up in Detroit, MI

PROFESSIONAL TRAINING

Faculty Launch Workshop

Jan. 2022

Society for Integrative and Comparative Biology, Phoenix, AZ

Hydra EDGE Workshop, Marine Biological Laboratory, Woods Hole, MA October 2021

A workshop geared towards understanding the *Hydra* nervous system and how to perform common techniques such as microinjections in *Hydra*

Transferrable skills in academia Workshop

Society for Integrative and Comparative Biology, Virtual January 2021

Series of Mentoring Workshops, UNH Graduate School, Virtual

Nov. 2020

Focused on developing and sustaining mentor-mentee relationships and how to become an impactful mentor

Molecular Visualization Workshop

University of New Hampshire, Durham, NH, March 2019

Planning and Writing Successful Grant Proposals Workshop

AtKisson Training Group, LLC, hosted at UNH, March 2019

Alda Center for Communicating Science Workshop

Stony Brook University, hosted at UNH, January 2019

The art of persuasive communication: when acting meets science Workshop

Society for Integrative and Comparative Biology, Tampa, FL, January 2019

Responsible Conduct of Research and Scholarly Activity Certification

University of New Hampshire, Oct. 2017

PROFESSIONAL AFFILIATIONS

Society of Advancing Chicanos/Hispanics & Native Americans in Science, 2022 –Present

Benthic Ecology Meeting Society, 2019 - Present

American Microscopical Society, 2019 – Present

Society for Integrative and Comparative Biology, 2018 – Present

National Society of Collegiate Scholars, 2011 – 2014

Charles Drew Science Scholars, 2010 – 2014

COMPUTER SKILLS

Programming: basic LINUX/UNIX, Bash, Python, Rstudio, QIIME2 platform

Applications: Microsoft Office, Geneious, FigTree, Seaview, Visual Molecular Dynamics (VMD), GitHub, SnapGene, Hydra 2.0 Genome Project Portal, NCBI

RELEVANT EQUIPMENT AND PROCEDURAL EXPERIENCE

Laboratory Equipment:

- Dissecting microscope – identifying actinulae larvae and microinjecting *Hydra* embryos with plasmids
- Thermal cycler – used for various protocols such as PCR and DNA Library preps
- Centrifuge – used for various protocols such as PCR purification, DNA and RNA extractions, and Library preps
- Gel doc Imaging System – used for imaging electrophoresis gels
- Tape Station – used for quantifying DNA libraries for sequencing
- Confocal Microscopy – produced high quality confocal images of nervous systems and specific cell types

Laboratory Procedures:

- *Hydra magnipapillata*, *Ectopleura crocea*, and *Hydractinia symbiolongicarpus* maintenance and dissection
- Creating homology direct repair templates and gRNAs for CRISPR/Cas9
- Designing primers for PCR via Geneious and Primer3
- Performing PCR and PCR Purification
- Conducting gel electrophoresis with imaging of
- Performing CTAB DNA extractions on *H. magnipapillata*
- Conducting RNA extractions on Mixini sp. And *E. larynx*
- Quantifying DNA and RNA from extractions via Qubit, Nanodrop, and tape station
- Creating DNA libraries by using the Poly A - RNA prep protocol
- Designing behavioral experiments and statistically analyzing settlement factors for *E. crocea* actinulae
- Performing Immunohistochemistry (IHC) on actinula larvae and *Hydra* with monoclonal antibodies, phalloidin and DAPI
- Performing Fluorescent *in situ* Hybridizations (FISH) on actinula larvae and *Hydra* using Stellaris RNA FISH
- Developed and conducted a 7x2x2 split-plot Randomized Complete Block (RCBD) experimental design for an actinula larval settlement study
- Designing plasmids to generate transgenic *Hydra* via microinjection and performing microinjections
- Performing bacterial transformation, creating and streaking LB Agar plates, inoculating liquid bacterial cultures, and purifying plasmid DNA using Qiagen Mini Prep kit

REFERENCES

Dr. David Plachetzki, Assistant Professor
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