

# Lucas C. Wheeler, PhD

POSTDOCTORAL ASSOCIATE · DEPARTMENT OF ECOLOGY AND EVOLUTIONARY BIOLOGY · CU BOULDER

✉ lucas.wheeler@colorado.edu | 🌐 <https://lcwheeler.github.io/> | 📷 lcwheeler | 🐦 @LCWheeler9000

## Education

### Ph.D. in Biochemistry

UNIVERSITY OF OREGON

Eugene, OR

Sep. 2012 - Dec. 2017

- Department: Chemistry and Biochemistry
- Advisor: Michael Harms
- Dissertation: Evolution of Metal and Peptide Binding in the S100 Protein Family.

### B.S. in Biochemistry

MONTANA STATE UNIVERSITY

Bozeman, MT

Sep. 2009 - June 2012

- Department: Chemistry and Biochemistry
- Advisor: Trevor Douglas

## Research Experience

### Postdoctoral Researcher

UNIVERSITY OF COLORADO

Jan 2018 – present

Boulder, CO

- Coordination of field trips in Brazil and Argentina to collect samples from the Petunieae clade of Solanaceae. Phylogenetics to reconstruct species relationships. Transcriptomics, biochemical analyses, and bioinformatics to study the evolution of floral traits. Handling large sequencing datasets.
- Development of computational approaches to 1) simulate the evolution of metabolic pathways and 2) perform segregant analyses of back-cross transcriptomic data to identify genes responsible for flower color transitions.
- Acquisition of funding for the development of computational tools, management of data storage and organization for large-scale international collaborative projects.
- Volunteer efforts: Field work at Niwot Ridge Long-term Ecological Research Program collecting soil moisture and plant community composition data, and in the desert Southwest collecting samples of *Physalis* to study self-incompatibility and *Larrea* to study polyploidization.

### Graduate Research Fellow

UNIVERSITY OF OREGON

Sep 2012 – Dec 2017

Eugene, OR

- Development of high-throughput binding experiments and implementation of statistical approaches to quantitatively measure the evolution of protein-peptide interaction specificity in the S100 protein family.
- Phylogenetics and biochemical analyses to characterize the evolution of metal binding affinity, specificity, and structural effects in the S100 protein family.
- Managed laboratory tasks, supply ordering, sample storage information. As first student, helped to build the lab infrastructure and foundational projects.

### Undergraduate research assistant

MONTANA STATE UNIVERSITY

Sep 2009 – June 2012

Bozeman, MT

- Engineering of virus-like particles as templates for biomedical applications.

## Publications

\*Corresponding author †Undergraduate co-author ‡Co-first author

**Wheeler LC\***<sup>†</sup>, Walker JF, Ng J, Deanna R, Dunbar-Wallis A, Backes A, Pezzi PH, Virginia Palchetti M, Monaghan A, Brandão de Freitas L, Barboza GE, Moyroud E, Smith SD. Dynamics of pigment pathway evolution in the Petunieae clade (Solanaceae). (In prep for Molecular Biology and Evolution)

Sinnott-Armstrong M, Deanna R, Pretz C, Liu S, Harris J Dunbar-Wallis A, Stacey SD, **Wheeler LC\***. How to study syndromes in macroevolution. (In review at Ecology and Evolution)

**Wheeler LC**, Harms MJ (2021). **Were ancestral proteins less specific?** Molecular Biology and Evolution

**Wheeler LC\***, Wing BA, Smith SD (2020). **Structure and contingency determine mutational hotspots for flower color evolution.** Evolution Letters

**Wheeler LC\***<sup>‡</sup>, Perkins A, Wong CE<sup>†</sup>, Harms MJ (2020). **Learning Peptide Recognition Rules for a Low-Specificity Protein.** Protein Science

**Wheeler LC\***, Smith SD (2019). **Computational modeling of anthocyanin pathway evolution: Biases, hotspots, and trade-offs.** Integrative and Comparative Biology

Hiranmayi Duvvuri<sup>†</sup>, **Wheeler LC**, Harms MJ (2018). **pytc: open source python software for global analyses of isothermal titration calorimetry data.** Biochemistry

**Wheeler LC**, Anderson JA, Morrison AJ, Wong CE<sup>†</sup>, Harms MJ (2017) Conservation of specificity in two low-specificity proteins. *Biochemistry*

**Wheeler LC**, Harms MJ (2017). **S100A5 binds Ca<sup>2+</sup> and Cu<sup>2+</sup> independently**. *BMC Biophysics*

**Wheeler LC**, Donor MT, Prell JS, Harms MJ (2016). **Multiple Evolutionary Origins of Ubiquitous Cu<sup>2+</sup> and Zn<sup>2+</sup> Binding in the S100 protein Family**. *PLoS ONE*

**Wheeler LC<sup>†</sup>**, An-Lim S, Marqusee S, Harms MJ (2016). **The thermostability and specificity of ancient proteins**. *Current Opinions in Structural Biology*

## Workshops, trainings, & courses

2021	<b>Diversity, Equity, and Inclusion Workshop</b> , CU	<i>Boulder, CO</i>
2020	<b>ALTEC Spanish Advanced Conversation</b> , CU	<i>Boulder, CO</i>
2018	<b>Navigating the NSF Review Process as a Beginning PI</b> , CU	<i>Boulder, CO</i>
2017	<b>Individual Development Plan (IDP) workshop</b> , UO	<i>Eugene, OR</i>
2016	<b>Illumina Metagenomics Workshop</b> , UO	<i>Eugene, OR</i>

## Funding

2019	<b>Research Innovation Office Seed Grant</b> , \$50,000	<i>CU Boulder</i>
2015	<b>Mechanisms of Protein Evolution III: Student Travel Award</b> , \$600	<i>SMBE</i>
2013-2016	<b>Molecular Biology and Biophysics Training Grant (UO-IMB)</b> , \$75,000	<i>NIH</i>
2011-2012	<b>Montana INBRE Research Award</b> , \$1500	<i>MT INBRE</i>
2011	<b>Swager Summer Research Award</b> , \$600	<i>MSU</i>
2011	<b>Geer-Howald-Callis Summer Research Award</b> , \$1200	<i>MSU</i>

## Teaching Experience

### Guest lecturer

PHYLOGENETICS AND COMPARATIVE BIOLOGY

Invited to give lecture and lead discussion of forensic phylogenetics for tracing the origin of viral infections

*University of Colorado (Boulder)*  
2021

### Co-instructor

PLANTS AND SOCIETY

Assembled remote lectures and assignments on topics ranging from genetic engineering to ethnobotany

*University of Colorado (Boulder)*  
2020

### Guest lecturer

CONVERGENCE AND CONSTRAINT: LESSONS FROM THE EVOLUTION OF FLOWER COLOR

Invited to give a remote guest lecture on pleiotropy and genetic constraints for upper level evolution class

*University of Hawai'i at Mānoa*  
2020

### Guest Instructor

BIOCHEMISTRY OF FLOWER COLOR

Developed and taught a lecture and lab exercise for visiting high-school students with CU Upward Bound

*University of Colorado (Boulder)*  
2018

### Instructor

BIOCHEMISTRY RECITATION: METABOLISM

Led article discussions and group activities for this course to supplement the primary lecture course

*University of Oregon (Eugene)*  
2013

### Teaching assistant

BIOCHEMISTRY LABORATORY

Helped to plan, organize, and lead the laboratory that accompanied the upper-level biochemistry course

*University of Oregon (Eugene)*  
2013

### Teaching assistant

GENERAL CHEMISTRY LABORATORY

Helped to test activities and lead the laboratory that accompanied the introductory chemistry course

*University of Oregon (Eugene)*  
2012

### Volunteer Instructor

ADVANCED 5TH GRADE MATH

Designed and taught a pre-algebra course for a group of advanced 5th grade students

*Juniper Elementary (Bend, OR)*  
2007

## Mentorship & Service

### RESEARCH MENTORSHIP

#### Eduardo Alejandro Lozano-Garcia

UNDERGRADUATE STUDENT

Co-mentoring development of improved tools for evolutionary simulations of metabolic pathways

*Remote*  
2021-present

#### Clair Huffine

PHD STUDENT

Co-mentoring a project to model the evolution of the cyanobacterial carboxysome

*Boulder, CO*  
2021-present

#### Mikayah Oxendine

UNDERGRADUATE (SUMMER STUDENT)

Oversaw mentorship (by graduate student Sukuan Liu) of project on carnivorous plants in Southeastern North America

*Remote*  
2020

<b>Chandra Jacobs</b> UNDERGRADUATE (SUMMER STUDENT) Oversaw mentorship (by graduate student Jesse Harris) of project on phylogenetic relationships between medicinal plants	Remote 2020
<b>Chantelle Yazzi</b> UNDERGRADUATE (SUMMER STUDENT) Oversaw mentorship (by graduate student Chelsea Pretz) of project on analysis of flavonols in Navajo Tea ( <i>Thelesperma</i> )	Remote 2020
<b>Luis Allende</b> MASTERS STUDENT Advised on statistical analyses of protein sequence data and the application of phylogenetic comparative methods	Boulder, CO 2019-2020
<b>Ashley Hamilton</b> UNDERGRADUATE (SUMMER REU STUDENT) Guided a project in the bioinformatic analysis of transcriptomic data from the genus <i>lochroma</i>	Boulder, CO 2019
<b>Alice Backes</b> VISITING MASTERS STUDENT Guided a project in the bioinformatic analysis of transcriptomic and genomic data in online databases	Boulder, CO 2018
<b>Jocelyn Hernandez</b> UNDERGRADUATE (SUMMER PROGRAM FOR UNDERGRADUATE RESEARCH) Helped student to develop tools to study epistasis in protein evolution	Eugene, OR 2017
<b>Amber Rolland</b> PHD ROTATION STUDENT Helped to guide a project studying metal binding in the S100A8/A9 heterodimer complex	Eugene, OR 2016
<b>Erik Burlingame</b> MASTERS STUDENT Guided a group project to develop an analysis pipeline for high-throughput phage display sequencing data	Eugene, OR 2016
<b>Samantha Sivagnanam</b> MASTERS STUDENT Guided a group project to develop an analysis pipeline for high-throughput phage display sequencing data	Eugene, OR 2016
<b>Wendy Su</b> MASTERS STUDENT Guided a group project to develop an analysis pipeline for high-throughput phage display sequencing data	Eugene, OR 2016
<b>Caitlyn Wong</b> UNDERGRADUATE (HONORS THESIS) Guided a project characterizing the structural response of S100 proteins to binding of metals and peptides	Eugene, OR 2015 - 2017
<b>Hiranmayi Duvvuri</b> UNDERGRADUATE STUDENT Helped student to learn techniques and carry out isothermal titration calorimetry experiments	Eugene, OR 2015-2016
<b>Sarina Pollat</b> UNDERGRADUATE (SUMMER PROGRAM FOR UNDERGRADUATE RESEARCH) Guided a project measuring the thermodynamics of metal and peptide binding in S100 proteins	Eugene, OR 2015
<b>Abigail Tami</b> UNDERGRADUATE (SUMMER PROGRAM FOR UNDERGRADUATE RESEARCH) Guided a project measuring the thermodynamics of metal and peptide binding in S100 proteins	Eugene, OR 2014
<b>Sunny Ketchum</b> GRADUATE ROTATION STUDENT Guided a project developing the molecular tools to study the S100A8/A9 protein complex	Eugene, OR 2014
<b>Kevin McKnaught</b> GRADUATE ROTATION STUDENT Helped student to develop a method for expression and purification of certain S100 proteins	Eugene, OR 2014
<b>Kendall Saboda</b> UNDERGRADUATE STUDENT Helped student with the engineering and molecular cloning of custom virus-like particles	Bozeman, MT 2012
<b>Kristen Hyberg</b> UNDERGRADUATE STUDENT Helped student with the molecular cloning, expression, and purification of custom virus-like particles	Bozeman, MT 2011-2012
<b>SERVICE ACTIVITIES</b>	
<b>Solanaceae seminars</b> CO-ORGANIZER Helping to organize the SOL Seminar Online international seminar series	Colorado 2021-present
<b>CDA Noxious Weed Advisory Committee</b> COMMITTEE MEMBER At-large member, helping to advise CO department of agriculture on strategies for noxious weed management	Colorado 2021-present
<b>Smith lab Summer research experience for Native American undergraduates</b> VOLUNTEER Helped to coordinate a Summer research experience for former students from the CU Upward Bound program	Remote/in-person 2020-2021
<b>Bridge Program Choose Research Panel</b> VOLUNTEER Sat on a panel discussion for community college transfer students interested in undergraduate research	Remote 2020
<b>McKenzie school district outreach</b> VOLUNTEER Science discussions for 2nd grade classroom in the McKenzie school district in Oregon	Remote 2019-present

## CU Upward Bound

INSTRUCTOR

Leading virtual and in-person outreach activities for high school students

Colorado

2018-present

## Pinhead Institute

INSTRUCTOR

Leading "Punk Science" outreach activities for K-12 students

Telluride, CO

2019

## 2019 Mayors' Climate Panel

CO-ORGANIZER

Helped to organize the 2019 Mayors' Climate Panel. Managed online registration and speaker invitations

Denver, CO

2019

## Citizens' Climate Lobby

VOLUNTEER

Helped to organize tabling events, educational presentations, and lobby meetings with US representatives

Golden, CO

2018 - present

## Quantitative Problem Solving & Research Communication Consortium

CO-CHAIR & CO-FOUNDER

Helped to organize presentations & brainstorming sessions for graduate students and postdocs

Eugene, OR

2016 - 2017

## UO SafeRide Program

VOLUNTEER

Helped to provide free, safe rides at night for members of the university community

Eugene, OR

2016 - 2017

## Mad Duck Science Fridays

VOLUNTEER

Helped to organize and run engaging science learning activities for middle school students

Eugene, OR

2013 - 2017

## Associated Students of MSU

STUDENT SENATOR

Served on several committees and acted as liaison to several student groups

Bozeman, MT

2010 - 2011

## Undergraduate Chemistry Society

SECRETARY & VICE-PRESIDENT

Helped to organize fundraisers and to provide educational activities for local and rural Montana schools

Bozeman, MT

2009 - 2012

## Sacajawea Middle School

VOLUNTEER MENTOR

Mentored a gifted student in advanced math; oversaw development of a project on fractals

Bozeman, MT

2009-2010

## Juniper Elementary School

VOLUNTEER MENTOR

Provided tailored educational activities to students with special needs

Bend, OR

2005 - 2008

## Presentations and Seminars

### Sol International Conference

"PHYLOTRANSCRIPTOMIC ANALYSIS OF FLOWER COLOR EVOLUTION IN PETUNIEAE"

- Submitted poster

Online

November 2020

### Solanaceae Seminar Series

"AN INTEGRATIVE APPROACH TO STUDYING THE EVOLUTION OF FLORAL PIGMENTATION"

- Invited talk

Online

September 2020

### Botany virtual meeting

"PHYLOTRANSCRIPTOMICS OF THE PETUNIEAE CLADE OF SOLANACEAE"

- Submitted talk

Online

July 2020

### Evolution meeting

"PREFERENTIAL FIXATION OF STRUCTURAL OR REGULATORY MUTATIONS DEPENDS ON PATHWAY POSITION"

- Submitted talk

Providence, RI

June 2019

### Society for Integrative and Comparative Biology

"COMPUTATIONAL MODELING OF ANTHOCYANIN PATHWAY EVOLUTION"

- Submitted talk

Tampa, FL

Jan. 2019

### Geobiology Supergroup Seminar

"COMPUTATIONAL MODELING OF FLOWER COLOR EVOLUTION"

- Invited talk

Boulder, CO

Nov. 2018

### Quantitative Think Tank

"DEVELOPING A COMPUTATIONAL MODEL OF THE ANTHOCYANIN PATHWAY"

- Submitted talk

Boulder, CO

Oct. 2018

### Society for Molecular Biology and Evolution

"PHAGE DISPLAY AND DEEP SEQUENCING TO STUDY THE EVOLUTION OF BINDING SPECIFICITY"

- Submitted poster

Austin, TX

July 2017

### Institute of Molecular Biology Seminar Series

"EVOLUTION OF METAL AND PEPTIDE BINDING IN THE S100 PROTEIN FAMILY"

- Annual seminar

Eugene, OR

May. 2017

### Third International Symposium on Protein Folding and Dynamics

"TRACING THE EVOLUTION OF PEPTIDE BINDING SPECIFICITY IN THE S100 PROTEIN FAMILY USING PHAGE DISPLAY AND DEEP SEQUENCING"

- Submitted talk

Bangalore, India

Nov. 2016

### Gibbs Conference on Biological Thermodynamics

"PREFERENTIAL FIXATION OF STRUCTURAL OR REGULATORY MUTATIONS DEPENDS ON PATHWAY POSITION"

- Submitted talk

Carbondale, IL

Sep. 2016

## Life at the Nanoscale mini-symposium

“TRACING THE EVOLUTION OF PEPTIDE BINDING SPECIFICITY IN THE S100 PROTEIN FAMILY USING PHAGE DISPLAY AND DEEP SEQUENCING”

- Submitted poster

## Institute of Molecular Biology Seminar Series

“TRACING THE EVOLUTIONARY HISTORY OF TRANSITION-METAL BINDING AND PEPTIDE BINDING SPECIFICITY IN THE S100 PROTEIN FAMILY”

- Annual seminar

## Mechanisms of Protein Evolution III: Origins

“TRACING THE EVOLUTIONARY FLUCTUATIONS OF PEPTIDE BINDING SPECIFICITY IN THE S100 PROTEIN FAMILY”

- Submitted talk

## Gibbs Conference on Biological Thermodynamics

“TRACING THE EVOLUTIONARY FLUCTUATIONS OF PEPTIDE BINDING SPECIFICITY IN THE S100 PROTEIN FAMILY”

- Submitted poster

## Protein Folding Consortium Workshop

“PROBING THE EVOLUTIONARY HISTORY OF PEPTIDE BINDING SPECIFICITY IN THE S100 PROTEIN FAMILY”

- Submitted talk

## Institute of Molecular Biology Seminar Series

“PROBING THE EVOLUTION OF PEPTIDE-BINDING SPECIFICITY IN THE S100 PROTEIN FAMILY”

- Annual seminar

## Gibbs Conference on Biological Thermodynamics

“EVOLUTIONARY BIOPHYSICAL STUDIES OF PEPTIDE SPECIFICITY IN THE S100S”

- Submitted poster

## Grad Talk Series

“EVOLUTION AS A MOLECULAR MATCH MAKER: HOW DO BIOLOGICAL MOLECULES EVOLVE TO RECOGNIZE EACH OTHER?”

- Invited talk

## Protein Folding Consortium Workshop

“EVOLUTIONARY BIOPHYSICAL STUDIES OF PROTEIN FUNCTION IN THE S100 FAMILY”

- Submitted poster

*Eugene, OR*

*Jun. 2016*

*Eugene, OR*

*Apr. 2016*

*Denver, CO*

*Nov. 2015*

*Carbondale, IL*

*Sep. 2015*

*Berkeley, CA*

*May. 2015*

*Eugene, OR*

*May. 2015*

*Carbondale, IL*

*Sep. 2014*

*Eugene, OR*

*Nov. 2014*

*Ann Arbor, MI*

*May. 2014*