

## BROOKE J. VETTER

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### EDUCATION

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#### **PhD:** 2011–2016

University of Minnesota – Duluth, MN

Integrated Biosciences Graduate Program

Dissertation: Behavior and Bioacoustics of Invasive Silver (*Hypophthalmichthys molitrix*) and Bighead Carp (*H. nobilis*)

Mentor: Allen Mensinger, PhD

#### **Bachelor of Arts, Summa Cum Laude:** 2004 – 2008

St. Catherine University – St. Paul, MN

Major: Biology; Minor: Chemistry

### PROFESSIONAL APPOINTMENTS

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#### **University of St. Thomas:** 2020 – Present

Assistant Professor: Biology – St. Paul, MN

#### **University of Washington:** 2017 – 2020

Postdoctoral Fellow: Department of Psychology (Animal Behavior) – Seattle, WA

Mentor: Joseph Sisneros, PhD

#### **U.S. Geological Survey Columbia Environmental Research Center:** 2016 – 2017

Postdoctoral Research Contractor – Columbia, MO

#### **University of Minnesota Duluth:** 2014

Instructor on Record: Biology Department – Duluth, MN

#### **General Mills, Inc.:** 2008 – 2011

Technician II – Golden Valley, MN

### PUBLICATIONS

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11. **Vetter BJ**, Sisneros JA (2020) Swim bladder enhances lagenar sensitivity to sound pressure and higher frequencies in female plainfin midshipman (*Porichthys notatus*). *Journal of Experimental Biology.* 223: jeb225177
10. **Vetter BJ**, Seeley LH, Sisneros JA (2019) Lagenar potentials of the vocal plainfin midshipman fish, *Porichthys notatus*. *Journal of Comparative Physiology A.* 205:163-175.
9. Colleye O, **Vetter BJ**, Mohr RA, Seeley LA, Sisneros JA (2019) Sexually dimorphic swim bladder extensions enhance the auditory sensitivity of female plainfin midshipman fish, *Porichthys notatus*. *Journal of Experimental Biology.* 222(14): jeb204552.
8. Nissen AC<sup>+</sup>, **Vetter BJ**, Rogers LS\*, Mensinger AF (2019) Impacts of broadband sound on silver (*Hypophthalmichthys molitrix*) and bighead (*H. nobilis*) carp hearing thresholds as determined using auditory evoked potential audiometry. *Fish Physiology and Biochemistry.* 45(5):1683-1695
7. **Vetter BJ**, Rogers LS\*, Mensinger AF (2018) The effect of light stimuli on dark-adapted visual sensitivity in invasive silver *Hypophthalmichthys molitrix* and bighead *H. nobilis* carp. *Journal of Fish Biology: The Sensory Ecology of Fishes (special issue).* DOI: 10.1111/jfb.13880.

6. **Vetter BJ**, Brey MK, Mensinger AF (2018) Reexamining the frequency range of hearing in silver (*Hypophthalmichthys molitrix*) and bighead (*H. nobilis*) carp. *PLoS ONE* 13(3): e0192561.
5. **Vetter BJ**, Murchy KA<sup>+</sup>, Cupp AR, Amberg JJ, Gaikowski MP, Mensinger AF (2017) Acoustic deterrence of bighead carp (*Hypophthalmichthys nobilis*) to a broadband sound stimulus. *Journal of Great Lakes Research*. 43: 163-171.
4. **Vetter BJ**, Calfee RD, Mensinger AF (2017) Management implications of broadband sound in modulating wild silver carp (*Hypophthalmichthys molitrix*) behavior. *Management of Biological Invasions*. 8(3): 371-376.
3. **Vetter BJ**, Casper AF, Mensinger AF (2017) Characterization and management implications of silver carp (*Hypophthalmichthys molitrix*) jumping behavior in response to motorized watercraft. *Management of Biological Invasions*. 8(1): 113-124.
2. Murchy KA<sup>+</sup>, Cupp AR, Amberg JJ, **Vetter BJ**, Gaikowski MP, Mensinger AF (2017) Potential implications of acoustic stimuli as a non-physical barrier to silver carp and bighead carp. *Fisheries Management and Ecology*. 24(3): 208-216.
1. **Vetter BJ**, Cupp AR, Fredricks, KT, Gaikowski MP, Mensinger AF (2015) Acoustical Deterrence of Silver Carp (*Hypophthalmichthys molitrix*). *Biological Invasions*. 17(12): 3383-3392

*Invited Book Chapters:*

**Vetter BJ** (2019) Role of the lagena in fish hearing and its susceptibility to anthropogenic noise. *Proceedings of Meetings on Acoustics (POMA): The Effects of Noise on Aquatic Life* 37(1):10.1121/2.0001031.

**Vetter BJ**, Mensinger AF (2016) Broadband sound can induce jumping behavior in invasive silver carp (*Hypophthalmichthys molitrix*). *POMA* 27(1):10.1121/2.0000279.

Murchy KA<sup>+</sup>, **Vetter BJ**, Brey MK, Amberg JJ, Gaikowski MP, Mensinger AF (2016) Not all carp are created equal: Impacts of broadband sound on three invasive carp's swimming behavior. *POMA* 27(1): 10.1121/2.0000314.

*In Review:*

Murchy KA<sup>+</sup>, **Vetter BJ**, Brey MK, Mensinger AF. Behavioral responses of native and invasive fishes of the Upper Mississippi River to 100 hp boat motor acoustic stimulus. *In Review: Management of Biological Invasions*.

(<sup>+</sup>M.S. Student Collaborators; \*Undergraduate Mentees)

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## FELLOWSHIPS

NIH Auditory Neuroscience Training Grant (\$144,000): February 2017

3M Fellowship for Graduate Study (\$64,000): September 2011

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## PRESENTATIONS

**Invited Lectures:**

Listening underwater: the neural basis of sound detection in the vocal plainfin midshipman fish.

*Minnesota State University Mankato*. Mankato, MN. March 2019

The neural basis of sound detection and auditory driven social behavior in the plainfin midshipman fish (*Porichthys notatus*). *University of Minnesota Duluth Biology Department Seminar Series*.

Duluth, MN. March 2019

Listening underwater: hearing physiology in flying carp and the vocal plainfin midshipman. *Hope*

*College*. Holland, MI. January 2019

How fish are adapted to hear underwater: lessons from flying carp and the vocal plainfin midshipman.

Wittenberg University. Springfield, OH. January 2019.  
Bioacoustic control and management of invasive silver and bighead carp. St. Croix River Association  
Aquatic Invasive Species Workshop. Sturgeon Lake, MN. June 2016  
Bioacoustic Control and Management of Invasive Bigheaded Carp. St. Catherine University Biology  
Department Seminar Series. St. Paul, MN. May 2014

**Conference Presentations:** (†M.S. Student Collaborators; \*Undergraduate Mentees)

**Vetter BJ**, Sisneros JA. The swim bladder enhances sound pressure sensitivity and bandwidth of the lagena in female plainfin midshipman (*Porichthys notatus*). *Society for Integrative and Comparative Biologists (SICB)*. Austin, TX. January 2020.

**Vetter BJ**. Role of the lagena in fish hearing and its susceptibility to anthropogenic noise. *5<sup>th</sup> Conference on The Effects of Noise on Aquatic Life*. The Hague, The Netherlands. July 2019.

**Vetter BJ**, Sisneros JA. Effect of swim bladder removal on auditory lagena sensitivity in plainfin midshipman fish (*Porichthys notatus*). *Association for Research in Otolaryngology (ARO)*. Baltimore, MD. February 2019

Hom KN, Perelmuter JA, **Vetter BJ**, Sisneros JA, Forlano PM. Exposure to male advertisement call alters dopamine synthesis in the hindbrain auditory efferent nucleus of female plainfin midshipman fish. *ARO*. Baltimore, MD. February 2019

Sisneros JA, Lozier NR, Perelmuter JA, **Vetter BJ**, Forlano PM. Near-field sound source localization by the plainfin midshipman fish. *ARO*. Baltimore, MD. February 2019

Rogers LS\*, **Vetter BJ**, Mensinger AF. The effect of light stimuli on dark-adapted visual sensitivity in invasive silver (*Hypophthalmichthys molitrix*) and bighead (*Hypophthalmichthys nobilis*) carp. *SICB*. January 2019

Nissen AC†, **Vetter BJ**, Rogers LS,\* Mensinger AF. Measuring Impacts of Anthropogenic Sound on Hearing Sensitivities of Bigheaded Carps. *Upper Midwest Invasive Species Conference (UMISC)*. Rochester, MN. October 2018

Nissen AC†, **Vetter BJ**, Rogers LS,\* Mensinger AF. Impacts of anthropogenic sound on hearing sensitivities of bigheaded carps. *Minnesota Chapter of the American Fisheries Society Meeting (MN AFS)*. St. Cloud, MN. February 2018.

**Vetter BJ**, Mensinger AF. Understanding the behavior and auditory physiology of flying carp. *Society for Integrative and Comparative Biologists*. San Francisco, CA. January 2018

Mackiewicz AG,\* **Vetter BJ**, Mensinger AF. Auditory Sensitivity of Invasive Bighead (*Hypophthalmichthys nobilis*) and Silver Carp (*H. molitrix*). *University of Minnesota Duluth. Undergraduate Research Opportunities Program Symposium (UMD UROP Symposium)* Duluth, MN. April 2017.

Rogers LS,\* **Vetter BJ**, Mensinger AF. *UMD UROP Symposium*. Visual Sensitivity and Impact of Strobe Light on Invasive Carp. Duluth, MN. April 2017.

Mackiewicz AG,\* **Vetter BJ**, Mensinger AF. Long Term Exposure of Bighead (*Hypophthalmichthys nobilis*) and Silver Carp (*H. molitrix*) to Broadband Sound. *National Council on Undergraduate Research*. Memphis, TN. April 2017.

**Vetter BJ**. Invasive silver carp behavior and bioacoustics. *Twin Ports Early Career Scientists Symposium*. Duluth, MN. March 2017.

**Vetter BJ**, Murchy KA†, Amberg JJ, Calfee RD, Gaikowski MP, Mensinger AF. Bigheaded Carp Behavior and Bioacoustics *UMISC*. La Crosse, WI. October 2016

Murchy KA†, **Vetter BJ**, Brey MK, Amberg JJ, Gaikowski MP, Mensinger AF. Native and Invasive fish behavior in response to anthropogenic noise. *UMISC*. La Crosse, WI. October 2016

Mackiewicz AG,\* **Vetter BJ**, Mensinger AF. Long Term Exposure of Bighead and Silver Carp to Broadband Sound. *Biology Undergraduate Research in Science & Technology Symposium*. Duluth, MN. August 2016.

**Vetter BJ**, Murchy KA†, Amberg JJ, Calfee RD, Gaikowski MP, Mensinger AF. Bigheaded Carp Behavior and Bioacoustics. *American Fisheries Society National Meeting (AFS)*. Kansas City, MO. August 2016

Murchy KA†, Cupp AR, **Vetter BJ**, Gaikowski MP, Mensinger AF. Bioacoustic deterrence of Bigheaded carp. *AFS*. Kansas City, MO. August 2016

Scott E, Calfee RD, **Vetter BJ**, Thompson GT, Mensinger AF. The potential use of a complex auditory stimulus as a deterrent for Asian Carp. AFS. Kansas City, MO. August 2016

**Vetter BJ**, Mensinger AF. Effect of outboard motor sound on invasive silver carp (*Hypophthalmichthys molitrix*) jumping behavior. 4<sup>th</sup> Conference on *The Effects of Noise on Aquatic Life*. Dublin, Ireland. July 2016

Murphy KA<sup>+</sup>, **Vetter BJ**, Brey MK, Amberg JJ, Gaikowski MP, Mensinger AF. The effects of anthropogenic sound on native and invasive fishes in the Upper Mississippi River. 4<sup>th</sup> Conference on *The Effects of Noise on Aquatic Life*. Dublin, Ireland. July 2016

**Vetter BJ**, Murphy KA<sup>+</sup>, Cupp AR, Amberg JJ, Gaikowski MP, Mensinger AF. Bigheaded Carp Behavior and Bioacoustics. 19<sup>th</sup> International Conference on *Aquatic Invasive Species*. Winnipeg, MB. April 2016

**Vetter BJ**, Casper AF, Mensinger AF. Characterization of *in situ* silver carp jumping behavior in response to outboard motors. MN AFS. Duluth, MN. February 2016

Murphy KA<sup>+</sup>, Cupp AR, **Vetter BJ**, Gaikowski MP, Mensinger AF. Bioacoustic deterrence of Bigheaded carp. MN AFS. Duluth, MN. February 2016

**Vetter BJ**, Murphy KA<sup>+</sup>, Cupp AR, Amberg JJ, Gaikowski MP, Mensinger AF. Silver Carp Behavior and Bioacoustics. *Midwest Fish and Wildlife Conference (MWFWC)*. Grand Rapids, MI. Jan 2016

**Vetter BJ**, Murphy KA<sup>+</sup>, Cupp AR, Gaikowski MP, Mensinger AF. Silver Carp Phonotactic Behavior: Using sound to deter a harmful invasive species. *Animal Behavior Society Annual Meeting*. Anchorage, AK. June 2015

**Vetter BJ**, Murphy KA<sup>+</sup>, Cupp AR, Gaikowski MP, Mensinger AF. Bioacoustic Control and Management of Invasive Bigheaded Carp. MN AFS. Brainerd, MN. March 2015

Mauch S,\* Vetter BJ, Mensinger AF. Effect of salinity on the round goby (*Neogobius melanostomus*). MN AFS. Brainerd, MN. March 2015

**Vetter BJ**, Cupp AR, Fredricks KT, Gaikowski MP, Mensinger AF. Bioacoustic Control and Management of Invasive Bigheaded Carp. *MWFWC*. Indianapolis, IN. February 2015

Murphy KA, Cupp AR, **Vetter BJ**, Gaikowski MP, Mensinger AF. Bioacoustic deterrence of Bigheaded carp. *MWFWC*. February 2015.

**Vetter BJ**, Cupp AR, Fredricks KT, Gaikowski MP, Mensinger AF. Bioacoustic Control and Management of Invasive Silver Carp. *UMISC*. Duluth, MN. October 2014

**Vetter BJ**, Cupp AR, Fredricks KT, Gaikowski MP, Mensinger AF. Bioacoustic Control and Management of Invasive Silver Carp. *AFS*. Quebec City, QB. August 2014

**Vetter BJ**, Cupp AR, Fredricks KT, Gaikowski MP, Mensinger AF. Bioacoustic Control and Management of Invasive Silver Carp. *MN AFS*. Mankato, MN. March 2014

**Vetter BJ**, Cupp AR, Fredricks KT, Gaikowski MP, Mensinger AF. Bioacoustic Manipulation of Silver Carp Jumping and Movement. *MN AFS*. St. Cloud, MN. March 2013

Santo M,\* Annoni K,\* Thompson A,\* Leino J, **Vetter BJ**, Mensinger AF. Age Distribution of the Round Goby (*Neogobius melanostomus*) in the Duluth-Superior Harbor. *MN AFS*. St. Cloud, MN. March 2013

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## TEACHING AND MENTORING

### University of Minnesota Duluth Biology Department Instructor

BIOL 3703: Animal Physiology: Fall 2014

Primary instructor: prepared syllabus, gave lectures (2x/week), wrote and graded exams, managed undergraduate and graduate TA's, taught one lab section, assigned final grades

### University of Minnesota Duluth Biology Department Graduate Teaching Assistant

BIOL 3701: Animal Diversity: Spring 2015

Lead Teaching Assistant and Lab Coordinator: taught lab sections, prepped laboratories, designed and graded lab practical exams, mentored students with research projects, graded lab reports, managed undergraduate TA's

BIOL 3703: Animal Physiology: Fall 2013

Teaching Assistant: taught lab sections, graded lab reports and lecture exams, designed and graded lab practicals, managed undergraduate TA's

BIOL1011: General Biology I

Teaching Assistant (Spring 2013); Lead Teaching Assistant and Lab Coordinator (Spring 2014): taught lab and discussion sections, graded lab reports, prepped laboratories, designed and graded lab practicals

BIOL 3761: Field Studies in Marine Biology: May 2013, 2014, 2015

Lead Teaching Assistant: drove vans to transport students, assisted with all laboratory exercises and field experiences, mentored students with independent research projects, designed and graded lab practicals, graded student presentations and lecture exams

*Coursework Completed in Teaching and Writing Instruction:*

BIOL 5001: Teaching and Learning in the Life Sciences: Spring 2014

A semester-long course that explored educational practices and pedagogical theory, with an emphasis on incorporating active learning practices into science lecture.

## **St. Catherine University Undergraduate Teaching Experience**

Laboratory Teaching Assistant:

BIOL 1720: Foundations of Biology II: Spring 2008

BIOL 2510: Human Anatomy: Fall 2006

BIOL 2520: Human Physiology: Spring 2007, 2008

Carried out responsibilities of a graduate TA including: leading laboratory exercises, mentoring students in independent research projects, prepping laboratories, designing and grading lab practicals, and grading quizzes, exams, and lab reports

Organic Chemistry Tutor 2006 – 2007

Held regular tutoring sessions for students in Organic Chemistry I and II

Assistantship Mentoring Program: May 2007 – December 2007

Workshop series for student/faculty pairs to complete collaborative projects

Role: Developed curriculum for the laboratory component and was the TA for The History of Medicine, an integrated science/history course for honors students and non-science majors that is still offered at SCU.

## **Teaching Conferences Attended**

Inclusive Science Conference – St. Catherine University; St. Paul, MN: June 2008

Received funding through the Abigail Quigley McCarthy Center for Women to cover registration for this national symposium on adapting teaching pedagogy such that it is more inclusive to individuals from under-represented groups in STEM subjects.

## **M.S. Student Collaborators**

Andrew Nissen (M.S. University of Minnesota, Integrated Biosciences Department, 2018)

Career progress: Biology Teacher; Duluth Public Schools

Kelsey Murchy (M.S. University of Minnesota, Integrated Biosciences Department, 2016)

Career progress: PhD: University of Victoria (in progress)

## **Undergraduate Mentees**

William Palmer (University of Washington, B.S. 2019)

Career progress: Applying to PhD programs  
Alayna Mackiewicz (University of Minnesota Duluth, B.S. 2018)  
Career progress: PhD: University of North Carolina, Chapel Hill (in progress)

Loranzie Rogers (University of Minnesota Duluth, B.S. 2017)  
Career progress: PhD: University of Washington (in progress); M.S. University of Minnesota (2019); NSF Graduate Research Fellowship Program (2018); Diversity of Views and Experience Fellowship Program (2016); McNair Scholar (2015 – 2016)

Lee Austin (University of Minnesota Duluth, B.S. 2016)  
Career progress: College of St. Scholastica: B.S. Nursing (in progress)  
McNair Scholar (2014 – 2015)

Graham Hanson (University of Minnesota Duluth, B.S. 2015)  
Career progress: Researcher at US EPA Mid-Continent Ecology Division, Duluth, MN

Sydney Mauch (University of Minnesota Duluth, B.S. 2015)  
Career progress: Veterinary Assistant Block Creek House Animal Hospital  
McNair Scholar (2014 – 2015)

Hannah Nylander-Asplin (University of Minnesota Duluth, B.S. 2014)  
Career progress: Senior Research Associate NOAA; M.S. Nova Southeastern University (2018)

Matt Santo (University of Minnesota Duluth, B.S. 2013)  
Career progress: Researcher at Natural Resources Research Institute; University of Minnesota

Ann Thompson (University of Wisconsin Superior, B.S. 2013)  
Career progress: Conservation Specialist St. Louis County Soil & Water Conservation

## **High School Student Mentees**

Christine Newmann (Cloquet High School, Class of 2016)  
Career progress: St. Mary's University of Minnesota – BA (in progress)

Megan Mensinger (Hermantown High School, Class of 2016)  
Career progress: Truman State University – BA (in progress)

## **WORK EXPERIENCE**

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### **Technician II**

General Mills Inc. - Golden Valley, MN: August 2008 – August 2011  
Performed high performance liquid chromatography, gravimetric, and mass spectroscopy analyses on food products

## **AWARDS AND HONORS**

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Aquatic Noise Conference Travel Award (\$1300): July 2019  
ARO Postdoctoral Fellow Travel Award (\$800): February 2019

*Graduate:*

Aquatic Noise Conference Travel Award (\$1800): July 2016  
U of MN Council of Graduate Students Travel Award (\$1200): April 2016  
UMD Biology Department Travel Award (\$2000): March 2016  
Janice Lee Fenske Memorial Award Finalist: January 2015, 2016  
UMD Graduate Student Travel Support (\$500): June 2015  
Integrated Biosciences Travel Award (\$1000): June 2015, February 2016  
UMD Swenson College of Science and Engineering Student Travel Award (\$400): June 2015  
Great Lakes Fisheries Commission Travel Award (\$1500): August 2014

*Undergraduate:*

Vetter—CV

Salutatorian: May 2008  
St. Catherine University Dean of Students Award (\$750): May 2008  
Phi Beta Kappa – Gamma Chapter of Minnesota: April 2008  
NSF STEM Scholar: September 2008  
Beta Beta Beta - Biological Honors Society: April 2007

#### **OUTREACH**

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McNair Scholar Mentor: June – September 2014; June – September 2016  
Advised three students on independent research projects and with preparations for poster presentations at the MN American Fisheries Meeting, the National American Fisheries Meeting, and/or the Society for Integrative and Comparative Biology Meeting

UMD Summer Biology Undergraduate Research Program Mentor: June – August 2016  
Mentored an undergraduate student conducting a summer independent research project and attended two of the weekly meetings as a guest panelist for graduate school discussions; helped student prepare poster presentation for the National Council on Undergraduate Research annual meeting.

Undergraduate Research Opportunity Program at UMD Mentor: May 2012 – May 2017  
Mentored and advised undergraduates on research project and with preparations for the annual UMD undergraduate research poster sessions.

Northwoods Women in Science (NWIS) Member: September 2011 – May 2017  
NWIS Scholarship Committee Member: January 2016

Science Fair Mentor: August 2012 – May 2016  
Worked with a high school student team to prepare science fair projects  
Students placed in top 3 at the Regional Science Fair in Duluth, MN (2014, 2015, 2016) and qualified to participate in national science competitions such as I-SWEEP, Genius Olympiad, Stockholm Junior Water Prize, and the Intel International Science and Engineering Fair

Regional Science Fair Judge—Duluth, MN: February 2012, 2013, 2014, 2016, 2017

Brain Awareness Week Outreach—Duluth, MN: April 2012, 2013

#### **ACADEMIC SERVICE**

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Twin Ports Early Career Scientist Symposium: 2017  
Organization Committee Chair

Minnesota American Fisheries Society Student Subunit: 2015 – 2016  
Co-Founder & Vice President  
Organizing Committee for statewide Minnesota American Fisheries Society Annual Meeting in Duluth, MN February 2016

Professional Memberships  
Association for Research in Otolaryngology: September 2018 – Present  
Society for Integrative and Comparative Biology: October 2017 – Present  
Animal Behavior Society: 2015 – 2016  
American Fisheries Society: 2013 – 2016

Reviewer  
Journal of Comparative Physiology A (1), Behavioral Processes (1), Journal of Fish Biology (2), Biological Invasions (1), Hydrobiologia (1), Transactions of American Fisheries Society (1), PLoS One (3), Journal of Great Lakes Research (1), Marine and Freshwater Research (1), North American Journal of Fisheries Management (1), Fisheries Management and Ecology (1), Management of Biological Invasions (4), Environmental Biology of Fishes (1)

## REFERENCES

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Dr. Joseph Sisneros  
University of Washington  
Psychology Department  
Postdoc Research Advisor  
sisneros@uw.edu  
206-543-8893

Dr. Allen Mensinger  
University of Minnesota  
Biology Department  
PhD Dissertation Advisor  
amensing@d.umn.edu  
218-726-7259

Dr. Jennifer Liang  
University of Minnesota  
Biology Department  
PhD Dissertation Committee  
joliang@d.umn.edu  
218-726-7681