Prior to joining the faculty at UWL, I took part in graduate and postdoctoral training programs aimed at fostering my understanding of undergraduate-level biology pedagogy, particularly an emphasis on scientific teaching. While at UWL, I have relished the opportunity to put this training into practice and find out which teaching strategies work best with my classes. As I have prepared and revised my classes, I have become more familiar with the science education literature related to the subjects I teach. In addition to providing insights that improve my teaching, reading this literature has led me to initiate research projects to assess changes I make to increase student learning in my classes (Teaching evidence 1).

I teach three core classes, General Biology, Animal Biology, and Capstone in Biology, and the cross-listed elective class Evolution. I focus my effort on two outcomes for the students in these classes: 1) to thoroughly comprehend the course concepts and be able to apply them to new situations, 2) to communicate effectively through their writing to a variety of audiences. Below, I give examples of innovations in several different classes to teach evolution, a subject that is difficult for students to understand.

**Understanding core concepts in Evolution through student-centered teaching practices.**

Research on teaching undergraduates evolutionary concepts such as natural selection has shown that confusion about basic concepts is common and difficult to correct. What is clear is that simply memorizing definitions does not result in conceptual change; a student-centered approach is required. For concepts that are difficult for students to learn or fraught with misconceptions, I use active learning techniques such as incorporating in-class problem solving or laboratory-style exercises into each class period (Teaching evidence 2). In-class problems are all solved in 2-3 person groups. After students work on the problems in class, I have them write their answers on the board and then the entire class will evaluate the responses and come to consensus on the best answer. As they evaluate other student’s responses, I use guided questioning to lead them to insights they might have missed and to discuss any misconceptions that are uncovered. While I have not performed quantitative assessments on the effectiveness of the in-class problems, prior to incorporating these in-class assignments some content errors and easily corrected misconceptions were common on exams and in student questions in class. Now, those simple errors and misconceptions have disappeared from the exam and in-class comments, leaving me able to focus class time on concepts that are more complex and misconceptions that are harder to dislodge.

**Through innovative writing assignments.**

Research on evolution misconceptions has shown that even students who have taken an Evolution class often retain a set of difficult to correct misconceptions. This was my experience when teaching Evolution for the first time in S09. I ended the course dissatisfied that some students lacked the ability to internalize core concepts of the class or consistently use them to address evolutionary questions. To add to the student’s understanding of evolutionary concepts and writing skills I added several writing assignments to this class (Teaching Evidence 3). One of those writing assignments focused on misconceptions that students retained after completing the course, based on data gathered from the S09 final exam. This writing assignment asked students to pick a known evolution misconception, research the
topic, and write an essay comparing the accurate scientific conception to the misconception. This requires students to compare incorrect and correct concepts side-by-side, an approach documented to resolve misconceptions.

In the second part of the misconceptions writing assignment, students bring their papers for in-class peer review. This gives them feedback on their paper and exposes them to side-by-side comparison of two other misconceptions (Teaching evidence 4). Peer reviewers use a grading rubric to assess their classmates’ papers and their own. After revision, the papers are turned in for my evaluation. This intervention had a positive impact on the students with improved performance between S09 and S10 on final exam questions that addressed these misconceptions. In addition, the students enjoyed the misconceptions writing assignment (Teaching evidence 5) and talked about it all the time. For the rest of the class I would occasionally hear them ask each other “what was your misconception?”.

Assessment of student learning of evolution
As a teacher, I invest a great deal of intellectual and emotional energy in designing lecture materials or classroom strategies that will improve my students’ understanding of important concepts. When I implement modifications in my classes, I want to know if this investment has paid off and actually resulted in student learning gains or if I need to try a different approach. This rigorous assessment is a central tenet of scientific teaching. One type of assessment tool that can measure learning gains are concept inventories (CIs), which consist of a series of questions on a targeted set of concepts. In a series of projects that combine teaching and scholarship, I have assessed new teaching tools designed to assist student learning of evolution. I am also working on designing assessment tools to allow testing of additional concepts. I will detail two of these projects below.

from a laboratory activity on evolution understanding and acceptance.

SimBiotic, an NSF-funded software company, has developed a series of interactive simulations to teach evolutionary principles. However, most similar products have not been tested to determine if they result in greater student learning than traditional lab exercises. To assess a lab aimed at teaching students to understand common descent I worked with Joel Abraham (SimBiotic) and Nick Downey (UWL Biology), and the introductory and general biology lecture and lab instructors to teach a computer-based laboratory activity. This study included development of a conceptual inventory for pre-and post-assessment of student learning of core concepts and acceptance of evolution. We found the lab significantly increased student acceptance of evolution and resulted in clear learning gains on core evolutionary concepts, although it was not entirely successful at reducing all targeted misconceptions. This teaching and research project was the cover article in Cell Biology Education: Life Sciences Education (CBE:LSE) in May 2012 (Teaching Evidence 6).

using new assessment tools.

As part of ongoing development and assessment of the Evolution class, I have used concept inventories (CIs) to gauge student learning and compare the progress of my class in learning core concepts with students at other institutions. In the process I became dissatisfied with the limited subjects covered by existing evolution CIs. I worked with Rebecca Price at the
University of Washington-Bothell to submit a proposal to the National Evolutionary Synthesis Center (NESCent) to fill this gap in our ability to assess student learning of evolution. The proposal was funded to bring together a working group of 15 faculty from around the country to develop new CIs for evolutionary biology. Over the two-year course of the grant, we have also had three graduate student fellows funded by NESCent to work with our group (Teaching evidence 7.). This team of biologists and education specialists has surveyed ~4,000 students at 12 institutions to understand what gaps students tend to have in their knowledge and what misconceptions tend to persist across a biology curriculum. This project has resulted in one publication (Teaching evidence 8, Andrews et al. 2012) and another paper in review (Teaching evidence 9, Hiatt et al.). The four CIs we developed are in their final testing semester. The editor of CBE:LSE has encouraged us to publish the papers (assuming successful peer review) as a special section of that journal. Papers describing the four concept inventories and an editorial introduction by Dr. Price and me will be submitted together in March 2013.

**Teaching Development Activities**

This year I am a Wisconsin Teaching Fellow. As part of that program I have participated in teaching development workshops and am carrying out a project which tests the efficacy of a new series of teaching modules I developed for the Animal Biology class that aim to teach concepts in an emerging field of biology, evolution and development (evo-devo). This project combines my efforts at developing an evo-devo CI (as described in the previous section) as well as the evolution across the curriculum initiative (described below in Service Narrative).

**Response to student evaluations**

Over the last few semesters, I have analyzed written student comments in the Animal Biology class. A full set of student evaluations for the Evolution class can be seen in teaching evidence 3, but those are overwhelmingly positive, partly reflecting the fact that Evolution is an upper level elective class populated with students with high motivation (4.2 motive item score) for the subject material (average SEI 4.4). However, I receive lower SEI scores (average SEI 4.08, 3.6 motive item score) in animal biology lecture. This class is required, at the sophomore level and much larger. Peer-evaluation of my instruction in another large, required, freshmen level lecture class, introductory biology, was very positive (Teaching evidence 10) so I thought something other than the class size resulted in lower SEI scores.

To determine if some correctable aspect of my teaching is involved I examined written responses to questions given during the SEI which asks the student to comment on things the instructor does that affect their learning. In a qualitative analysis of these writings, I established categories of comments, such as: “slides are confusing” or “lecture is too fast”. This data revealed a few areas that I wanted to address. To address the comment: “slides are confusing”, I added more information outlining where the lecture was going to go and added reference to this outline to each slide, so they could keep track of where we were in the topics to be discussed. This comment went from 12.29% of student comments to 1.89% following these modifications. To address the student concern that I am lecturing too fast I have consciously worked to decrease pace. My ongoing efforts to incorporate more in-class activities has probably also affected the perception of a fast paced class, which dropped from 30.61% of student comments to 13.21%.
My scientific training is as a systematist and malacologist, which means I study evolutionary relationships of snails. That may sound limited, but I am interested in the broader question of the biogeography of organisms, particularly the role of their evolutionary history in determining their distributions worldwide.

During my time at UWL, my research effort has focused on development of research projects in local natural systems. This allows me to build collaborations that are useful for conducting research, learn about a native ecosystem that was unfamiliar to me, obtain funding, and training for undergraduate and graduate students. I have taken this approach both with a national group of researchers on land snail phylogenies and locally as I developed collaborations to study natural systems in this region. These local projects include studies of land snail communities in the Driftless region of Wisconsin and invasion genetics of an invasive freshwater snail in the Upper Mississippi River. In sum, I have received 13 grants totaling $293,097 (Research evidence 1, grant summary) and have six papers published or in review from my snail work at UWL (Research Evidence 2, snail publications).

**Relationships among the land snail family Polygyridae**
I am interested in adaptations of animals to different environments, specifically; the shape of snail shells. Understanding the evolution of animal shape requires understanding their evolutionary history. One of my primary research projects is developing this understanding of evolutionary history of the land snail family Polygyridae. Polygyrids are a group of snails that are very commonly encountered in U.S. forests. Several species in this group are endangered, but others are invasive species. During my PhD and postdoc, I collected thousands of snails and developed a group of collaborators to work on this project. At UWL, a faculty research grant allowed me to work with four undergraduate students to begin gathering DNA sequence data. Last year I used this data to describe a new species of land snail from Mexico (Research Evidence 3, Perez 2011). This year, after several years of gathering DNA sequences and morphological data on these snails we have submitted a manuscript describing the results of a 6-gene phylogeny for 480 individuals, representing 30% of the species in the family (Research Evidence 4, Perez et al.). One of the students (Amundson) has moved on to a M.S. degree in the lab of one of my collaborators at the University of Louisiana at Monroe (ULM). Along with my collaborators, I plan to submit an NSF pre-proposal in January to continue this project.

**Land snails of Driftless Region**
During my first semester at UWL, I brought together a group of researchers at the Wisconsin Department of Natural Resources (WDNR), UWL-Archeology, UW-Stout Biology and Physics, and University of New Mexico to submit a successfully funded grant proposal to the WDNR to work on the land snails of the Driftless region. The Driftless region of Wisconsin has a unique and globally significant fauna of land snails due to the age and geology of the region. The land snails of the Driftless region projects are structured to gather data to apply to local conservation efforts and to my biogeographical research questions.

During the first year of the grant I visited national museum collections to confirm identification of 4,400 records of land snails from the region. My UW Stout collaborators worked with several undergraduate students to use these museum records to develop a geographic model to predict locations where endangered land snail species should be found. I
then worked with two UWL undergraduate students to survey for land snails throughout the Driftless region. During 2011-2012 these students continued gathering the data for this project. In addition, we had field help from five more undergraduate students and lab help from eight more.

Both students who led the UWL portion of this work (Amundson & Lynum) have presented posters on their research at many conferences including the Midwest Ecology and Evolution Conference (Research Evidence 5, student presentations). Our initial success led us to be granted two more years of funding from WDNR, through 2013. One tangible outcome of our work is the ongoing development of the Land snails of Wisconsin websites (http://bit.ly/c7doju), which include a clickable key to Wisconsin snails and high quality images of every Wisconsin species. The students in my Animal Biology class also contribute to this page. The first manuscript from this project was recently submitted with an undergraduate student who has worked on the project since it started as the first and corresponding author (Research Evidence 6, Lynum et al.). Several other manuscripts will result following completion of the 2013 field season. This study has many valuable outcomes including exposure of ~20 undergraduate researchers to biological field work, collections-based museum work, molecular lab work, data analysis, and writing and presenting scientific work.

**Invasion genetics of Bithynia tentaculata**

When I arrived at UWL I was able to join a network of researchers already working on *B. tentaculata*, this includes researchers at UWL (Roger Haro, Greg Sandland, James Peirce), and state and federal agencies. This collaborative group has been working for several years on the species interactions and environmental conditions affecting populations of an invasive freshwater snail, *B. tentaculata*, in Upper Mississippi River and the role of this snail in transmission of parasites that have resulted in the deaths of waterfowl. My work compliments their on-going studies by investigating the recent history of colonization of this invasive snail. My research on *B. tentaculata*, is related to two of the biogeographical questions from above, the effect of evolutionary history and recent adaptation on a species distribution and the interaction with other species.

During Fall 2009 I was funded by the UW System Institute for Race and Ethnicity to develop genetic markers to determine the routes taken by *B. tentaculata* in its colonization of the U.S. To accomplish this goal, I worked with a UWL undergraduate student and the Savannah River Ecology lab. The microsatellite marker development was published with the undergraduate student as one of the contributing authors (Research Evidence 7, Henningsen et al. 2010). In addition to his contribution to this paper, he wrote and received a Dean’s fellowship to fund his role in this work, and gave several presentations on campus and at NCUR 2010 (Research Evidence 5).

Following this first phase of the research, data generation has continued with support from the River Studies Center by two additional undergraduate students and a M.S. student. The M.S. student successfully defended her thesis in June 2012 and is working with one of the undergraduates to prepare a manuscript for submission. This paper will include two UWL undergraduates and one M.S. student as co-authors (Research Evidence 8, Werren et al. in prep).
I have contributed service to the biology department and the university. I also have extensive service commitments outside UWL in scientific societies and conservation organizations.

**Departmental service**

My service in the Biology department revolves around my background in evolutionary biology. I have been involved in revision efforts of introductory biology, Capstone in Biology, and adding evolution content across the Biology core curriculum.

**Curriculum revision**

- During my first semester at UWL, I worked with Scott Cooper on a complete revision of the evolution lecture module in introductory biology. I have then continued to contribute to development and revision of the evolution lab activities for this class.
- I was a member of the Capstone in Biology revision committee, which modified this course to have an evolutionary theme and provide a more integrative capstone experience, requiring students to synthesize information across the biology curriculum.
- I am a member of the Evolution across the curriculum committee. This committee was charged with assessing the biology core curriculum’s current coverage of evolutionary topics and infusing evolutionary concepts into core classes. To begin, we determined coverage of evolutionary concepts in the core classes and successfully proposed a UW System curriculum improvement grant to fund further work (Service Evidence 1). To begin the work of year 2, I led a 2-day workshop on evolution pedagogy and then we each developed new materials to integrate evolution concepts into all of the core classes. This fall, we launched a trial run of these materials. I am leading the assessment of the effectiveness of this effort in each class and across the entire biology curriculum.

**Biology Department service assignments**

- As a member of assessment committee, I have assisted in gathering qualitative data from student comments about the biology curriculum and quantitative data on student learning. I have also acted as a liaison between the assessment committee and the capstone course, the biology department vehicle for assessment.
- I advise ~25 pre-Physical Therapy students each semester. I meet with each of them for 15 minutes at least once a semester to plan their course schedules and career plans.
- I have served on three search and screen committees for the biology department.
- I served on the departments planning and goals committee developing our five-year plan.
- I have served on the graduate committees of two UWL graduate students, three graduate students at ULM, and three graduate students with NESCent fellowships.

**University service**

At the university level I have been involved with service opportunities related to recruitment and retention of a diverse student body.

- I served on the search committee for the inclusive excellence coordinator.
- For two years, I was a member of the Joint Minority Affairs Committee.
- During my time here at UWL I have been sought out by a series of Latino students and have developed informal mentoring relationships with these students.
• I have participated in a formal mentoring activity by working with two biology undergraduate students who are in the Eagle Mentoring Program.
• I was also a REU mentor for a Hmong student who trained in my research lab for the summer.

Academic society and professional service

Editorial and Peer review
During my first semester at UWL, I edited a special issue of the American Malacological Bulletin, the national journal of malacology. This involved editorial responsibilities and handling the review process for eight manuscripts. While at UWL I have reviewed 18 manuscripts and 3 grant proposals for various journals and funding agencies. In fall 2011, I served on a National Science Foundation review panel, which included reviewing and writing reviews for 16 grant proposals. I have also reviewed three chapters for an introductory biology textbook (Russell Biology, Cengage Learning) and six chapters for an evolutionary biology textbook (Roberts & Company Publishers).

Scientific and Professional Society Service
Aside from editorial and review activities, I participate in committee work in several scientific societies. I am an elected member of electorate Nominating Committee of the Section on General Interest in Science and Engineering for AAAS. I am on the conservation status committees for two malacological organizations. My work on those two committees led to an invitation by the International Union for the Conservation of Nature to join the international species survival commission for gastropods which requires ~30 hours of work per year evaluating conservation status of snail species worldwide.

I have also contributed to teaching-related professional organizations. During my first semester at UWL, I co-organized and taught the NESCent teaching workshop at the meeting of the National Association of Biology Teachers. I taught an evolution-teaching workshop at the Evolution 2010 meeting and currently, I am on the planning committee for an evolution pedagogy workshop to be held with the Evolution 2013 national meeting.

Service to local, state, and federal natural history and conservation organizations
My expertise in malacology has led to successful collaboration with local, state, and federal agency personnel, as well as local businesses. I have taught workshops on land and freshwater snail identification or field methods to Wisconsin DNR personnel, members of the Wisconsin aquatic invasive working group snails, and DeSoto Middle School (Service Evidence 2, snail identification workbook). I have led snail natural history expeditions for the Wisconsin Natural Resources Foundation. I have advised the Wisconsin aquatic invasive species regulatory committee and the Wisconsin committee revising the state conservation ranks for snails. I have also helped two other states develop their state conservation ranks for threatened and endangered snails, Texas and Arkansas. Finally, I carry out habitat assessments or survey for endangered snails each year for Wisconsin DNR and various local businesses. While portions of this work are compensated, each project requires pro-bono advisory meetings with WDNR, local businesses, and landowners. In addition to these formal activities, I respond to ~20 requests per year for snail information from the public and agency personnel (Service Evidence 3, snail requests).