

Emily Furbee
Assistant Professor of Biology



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PALM Fellowship Proposal

I just accepted my “dream” job offer: to teach upper-level undergraduates in my favorite subject areas at a small college in my own community. I will be a full-time visiting professor at Washington and Jefferson College (W&J), teaching courses in Molecular Biology and Developmental Biology in the fall semester and Genomics and Experimental Biology in the spring. In teaching these lecture-intensive courses for the first time, I have a perfect opportunity to incorporate active learning components into a class from the start.

My passion for teaching has been growing steadily since I delivered my first guest lecture as a graduate student TA. I’ve been inspired while participating in future faculty and pedagogical training programs and workshops that emphasize the theory of the active-learning philosophy. As a postdoc, I have taught several unique research and inquiry-based laboratory courses designed by others. Last year, I designed and taught a Genomics course at W&J as an adjunct instructor. I joined the Genomics Education Partnership (GEP)¹, attended a training workshop, and implemented that training in my course. Consequently, my students became research collaborators, contributing to novel annotation work as they learned genomic concepts. I will present my experience at a national GEP alumni workshop this month. My engagement with the GEP community has empowered me to use active learning strategies in my genomics classroom. My new and present challenge is to effectively, practically, and sustainably infuse active-learning strategies into the content-heavy and lecture-laden courses that I will begin teaching this fall.

One opportunity I had as postdoc at Pitt was co-teaching a laboratory course designed by Dr. Joseph Ayoob. With his experience and our established mentor relationship, he is ideally suited to assist my design of a lecture-based course. He has agreed to mentor me through the process of re-designing these traditional courses. While the experience I gain in working with Dr. Ayoob will certainly ramify through all my courses, our initial target will be Developmental Biology. In this course, a group of 7-10 upper class undergraduate students, meeting for two 1:35 min “lectures” plus one ~3 hour laboratory period per week. The small class size is ideal for fostering a student-centered

¹ Sarah C.R. Elgin, Charles Hauser, Teresa M. Holzen, Christopher Jones, Adam Kleinschmit, Judith Leatherman, The GEP: Crowd-Sourcing Big Data Analysis with Undergraduates, *Trends in Genetics*, Volume 33, Issue 2, 2017, Pages 81-85, ISSN 0168-9525, <http://dx.doi.org/10.1016/j.tig.2016.11.004>.

classroom, implementing lesson plans I will develop under Dr. Ayooob's experienced mentorship. Beginning immediately and continuing bi-monthly throughout the fall semester, I will meet with Dr. Ayooob at Pitt to develop and evaluate the efficacy of novel active-learning lesson plans. We will begin by defining clearly articulated and measurable course student learning objectives (SLOs), a crucial foundation for selecting effective targeted active learning strategies. We will then:

1. Identify and implement appropriate active learning techniques for particular student learning objectives.

Although I am still in the process of refining the final topic list and content for the course, one module of the course that I will develop in my sessions with Dr. Ayooob includes:

- Incorporating a think-pair-share or journal club activity to learn about the various key developmental gene pathways and what they are responsible for. These activities will require students to actively find information about aspects of this broader topic themselves and share them with the rest of the group.
- Having students explore the evolutionary or human-disease implications of mutations in developmental gene regulatory networks through collaborative learning groups, student presentations, and physical model-building activities. Students will be presented with advanced questions that will call upon them to use their recently acquired knowledge on developmental gene networks.
- A student bioethics debate challenging students to present scientific data supporting arguments on either side of a multitude of compelling contemporary dilemmas relevant to developmental biology. Bioethics debates and content on human malformations and disorder research will connect course content to topics my students find relevant.

2. Evaluate the effectiveness of the active learning approaches in an informative and interpretable way.

We will collect data to measure the effectiveness of our active learning strategies in a number of ways. We will administer pre and post quizzes on content presented in the class to compare student learning gains in content areas specifically targeted with active learning assignments versus lecture-only content. We will measure classroom activity in at least two class sessions via a COPUS assessment²; a technique Dr. Ayooob has experience in conducting. I will also recruit at least one other faculty member at W&J to conduct an additional COPUS assessment. Finally, we will collect and analyze student survey feedback to better understand their perspective on our active learning modules.

3. **Disseminate our results.** I am enthusiastically willing to fully participate as a PALM network member, to include submitting videos, completing long-term surveys, and presenting my efforts and outcomes at a national Lilly or other professional society meeting in summer 2018. (I could possibly attend as soon as Spring 2018, depending on my teaching

² Smith MK, Jones FHM, Gilbert SL, Wieman CE. The Classroom Observation Protocol for Undergraduate STEM (COPUS): A New Instrument to Characterize University STEM Classroom Practices. Dolan EL, ed. *CBE Life Sciences Education*. 2013;12(4):618-627. doi:10.1187/cbe.13-08-0154.

schedule that term.) I intend to earn a permanent position here at W&J, where my department colleagues have voiced strong interest in broadly refreshing our biology curriculum. Leveraging my strong relationship with Dr. Ayoob and the research at Pitt will provide exciting opportunities for our whole department to increase student learning gains through active learning modules in other courses, and eventually to add research-based course offering at this small liberal arts college.

Itemized cost

Mileage W&J →Pitt (\$.0575/mi x 66 mi/trip x 10 visits July-Dec)	\$379.50
Parking (\$22 per trip)	<u>\$220.00</u>
TOTAL	<u>\$599.50</u>



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July 18, 2017

Dear Members of the ASCB PALM Selection Committee,

I am enthusiastically writing this letter of support for Dr. Emily Furbee's application for the Promoting Active Learning and Mentoring (PALM) Program. I have known Emily for about eight years and have gotten to see her progress through graduate school, a postdoctoral fellowship, and now into an independent faculty position. In short, she is one of the most passionate scientists that I know and has a real zeal for inspiring others by passing on her knowledge and infectious love for science. She will be a great inspirational instructor, who will benefit tremendously from additional training and mentoring in active learning techniques.

Promise to mentor the mentee throughout the duration of the proposed activities

From her previous teaching experience, Emily has identified a need to employ active learning techniques in her future teaching endeavors and has developed a solid plan to achieve this goal. Her experience, training, willingness to learn, and enthusiasm well-position her to benefit greatly from this exciting mentoring partnership that the American Society for Cell Biology has created. I commit my full and enthusiastic support to mentor Emily in effective active learning strategies throughout the duration of her PALM project and beyond.

Emily has been working with me as a postdoctoral fellow for the past few years. She has always shown an interest and great skill in teaching and mentoring. As such, I was able to involve her in teaching one of the classes that I direct – Laboratory Methods for Computational Biologists (LMCB) Course, which is a core course in the Joint Carnegie Mellon—University of Pittsburgh PhD Program in Computational Biology (CPCB). She has been able to observe and assist with some of the implementation of active learning techniques through this course. Moving forward, she has a great opportunity to take the lead and design her own active learning strategies and transform a lecture-heavy course that she will be taking over and teaching in Fall 2017. I have reviewed her proposed plan and look forward to helping her morph these ideas into practice. I am also excited about the data that we will be able to generate by comparing her new active learning-based module to a lecture-heavy module within the same course to further examine the effect of the active learning approaches on student gains via pre and post surveys and tests and on in-class practices through COPUS assessments, which I am also committed to facilitate.

Mentor's experience in active learning and with Vision and Change principles

As an instructor and/or course director of 3 different courses over the past 8 years, I am weirdly proud of the fact that I don't consider myself a particularly good lecturer. This is mostly because I rarely see the advantage of this teaching approach versus many others that more highly engage my students. As such, I put a priority on incorporating active learning strategies into my courses. For example, early iterations of my LMCB course alternated lectures and "cookbook" experiments. After changing this class to more of an immersive experiential experience, where students play an active role in the course and spend the bulk of class time designing, performing, and discussing their own experiments that span a range of areas, student engagement and interest in the course have dramatically improved. Therefore, I have made it a point to incorporate active learning approaches, and specifically those proposed by Emily, in all of my teaching and teaching-/mentoring-related activities.

For Emily's project, I will use my experience in incorporating active learning approaches to help her transform the course that she will be teaching, and we will use the principles in Vision and Change to guide our work. While my experience with Vision and Change has mostly been implemented in the context of a Research Experiences for Undergraduates (REU) program that I direct, I am also familiar with the tenets of this important movement with regard to classroom instruction. As Emily pointed out in her proposal, we will first make sure that the student learning objectives are appropriate and align well with important key concepts and competencies. I will certainly guide Emily to use the "less is more" mantra to focus her efforts more deeply on a few topics versus a broad survey of many. She is already interested in using multiple modes of instruction and that will instill lifelong learning competencies in her students and has a knack for relating abstract concepts to real world examples; these are things that I will encourage and foster in her. Lastly, she is in a great position to promote and potentially lead a campus-wide commitment to change when it comes to teaching approaches at Washington and Jefferson. While this may be out of the scope for this particular project, I will definitely encourage and support Emily to pursue this role at her new institution, which is seemingly open to and looking for a driver for these efforts.

Emily is uniquely situated to have a real impact on undergraduate STEM education in her new teaching position. I look forward to working with her on her plans for incorporating active learning approaches in her upcoming course. She has my full support and confidence.

Sincerely,



Joseph C. Ayoob, Ph.D.
Associate Professor