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Curriculum Development Grant Application

Name Libby Haywood Year of tenure-track appointment N/A- 2nd year Instructional Professor

Department Biology

Type of Grant Sought:

☑ Individual

☐ Group – please list additional member(s)

_____ _____

Course(s): General Biology 102 lab _____

_____ _____

- Has any of the applicants received funding from the Mellon Grant to develop this course? ☐ Yes ☑ No

- Will the course use human beings as experimental subjects? ☐ Yes ☑ No
  - If yes, please explain in narrative.
  - If you have questions about whether IRB approval or exemption is required for your
  - project, please see the pdf link on "Policies and Procedures" at
  - https://www.iwu.edu/irb/forms/IRB_PolicyProcedure.pdf.

- Will the course use animals as experimental subjects? ☑ Yes ☐ No
  - If yes, please explain in narrative.
  - (See the IACUC link to protocol forms at http:www.iwu.edu/associateprovost)

- If your proposal is funded, would you be willing for the Mellon Center to use it as an exemplary submission in the online *Handbook*? ☑ Yes ☐ No

Please complete the following checklist by placing a check mark against each item to ensure that your application is complete. Incomplete applications will be returned to the applicant without further consideration.

1. Summary of Prior CD Grants (if applicable) ☑
2. Narrative (formatted as requested) ☑
3. CD Budget Page ☑
4. CD Grant Supervisor's Form(s) ☑

Signature Libby Haywood Date 3/1/21

Narrative

A. Course Description.

General Biology 102 (BIOL102) is the second of a two-course required series for Biology and Biochemistry students. I am seeking support to revise and revamp the laboratory portion of this course which makes up 30% of the total course grade. Currently, the laboratory is taught as discrete, weekly modules that are largely independent of one another. Each topic (statistics, evolution, taxonomy, plant diversity, animal diversity, ecology, digestion, respiration, circulation, and sensory systems) has its own activities and objectives, and no experimentation takes place. The revision proposed here is to create three 4-week modules, in which students will conduct research on their chosen model organism. Throughout their focused study, each student will apply the scientific concept and skills objectives to their specific organism. This will shift the type of learning our students are doing from a "look and see," approach that one might experience in a museum, to more of a "discover and interrogate" mindset, which is a more authentic laboratory experience. Students will have a better appreciation for how scientific researchers utilize these concepts to come to a more integrated and holistic understanding of living systems. Through this more applied curriculum, it is my hope that the laboratory will spur genuine interest and increase student engagement.

The opening module will center around plant evolution and integrate what used to be the taxonomy, evolution and plant diversity objectives, and introduce statistics. Student pairs will be assigned a specific plant group to research over the course of the module. In lecture, students learn about the transition of plants from water to land, so in lab we will probe those characteristics that enabled this evolutionary transition. The students will be allowed to choose the plant character they want to investigate and choose the most appropriate method from a list of available organisms and materials. Regardless of the type of data students choose to acquire during their study, we will determine the appropriate types of statistical tests for those experiments and learn to implement them. During their studies, students will be required to generate an evolutionary tree that depicts the evolutionary history of that organism in comparison to other plant groups. Currently, in our taxonomy lab, students only use physical characteristics to categorize a set of fake, cartoon organisms. While valid, this approach is not applied to actual living systems, which are often more complex than the simple cartoon examples we use. This classification based on physical characters also only highlights one approach to classification. More and more frequently, scientists are now relying on genotypic, or sequence-based tools, to analyze an organism's evolutionary history using their DNA. During this new module, I will also teach students how to investigate relatedness and propose evolutionary hypotheses using sequence-based tools, such as the National Center for Biotechnology Information Database, an online, free and widely-utilized biological research database.

In order for these projects to be successful, they must be feasible to accomplish in 4 weeks and with the equipment available here at Illinois Wesleyan University. This will be one of the main areas of development that this grant supports. I need time to research, identify, and test out a series of experimental methods to ensure they are appropriate and then make their protocols available in a student-friendly and accessible way. Multiple new protocols and prep lists will need to be developed to allow the students autonomy to interrogate those experimental questions using methods that are of interest to them. For example, students can create controlled

environmental chambers to manipulate specific variables, such as CO_2, humidity, light, and temperature on a variety of species of algae, moss, ferns, or flowering plants.

The second module will feature animal physiology and reinforce earlier objectives from taxonomy, evolution, and statistics, while integrating additional objectives for ecology, animal diversity, and select physiological functions (digestion, respiration, excretion, circulation, sensory transduction). Student pairs will select a model organism that they are most interested in studying and experimentally interrogate at least one physiological function within that animal. I intend to draw upon the expertise of the Illinois Wesleyan University faculty to make use of experimental equipment and approaches that are used here on campus. By drawing on the collective expertise of the faculty, I aim to introduce our first-year students to IWU's wide-array of biological research systems and techniques, while encouraging them to explore research opportunities as they progress in their studies. For example, Will Jaeckle studies the development and nutrient acquisition of small marine invertebrates, some of which are both easily cultivatable and transparent, and would allow students to view their digestive tracts and explore a variety of microscopy techniques to quantify digestion and/or excretion. Once again, when the students complete their investigations, they will use statistics to analyze their results and present them to their peers.

Assessments for the first and second modules will include low-stakes weekly check-ins and an end of module summative presentation or poster. The low-stakes weekly check-ins will feature updates on the research progress and mini-assignments that integrate recent lecture concepts for each model organism, such as body design, life cycles, development and evolutionary history. Since students pairs will be applying lecture concepts to different model organisms, each week they will present one slide to their peers describing their findings from their work of the previous week. This ensures that the entire lab section has exposure to all of the plant and animal groups being studied and offers a venue to compare and contrast the features of each plant or animal. This is strikingly different from current assessment strategies, as students currently have weekly pre-lab readings and post-lab activities or quizzes to complete that reinforce recall of facts, comprehension checks, or case-study applications. This change from discrete, concept-specific quizzes toward long-term, integrated study is an effort to create authentic assessments and learning outcomes that more closely model real world situations, like museum exhibits, research lab meetings, and conference-style presentations.

The third and final module will be a largely dissection-based examination of animal anatomy and physiology. Currently, in the final 4-weeks of the semester students dissect a fetal pig and examine the anatomy of its digestive, circulatory, respiratory, and nervous systems. In speaking with past students, the dissection is often the highlight of the semester, so I want to preserve this essential skill-building opportunity, but continue to build upon it. In the redesign, students will not only dissect the fetal pig, but also concurrently dissect other specimens (sea stars, crayfish, squid, earthworms, clams, etc.) that display different types of body construction. Such a comparative, in parallel examination allows students to compare and contrast the anatomies of these animals as we discuss how they have adapted to accomplish the necessary functions of life (energy acquisition, homeostasis, gas exchange, digestion, signal transduction, etc.). This module will expand upon the body systems introduced in module 2 and explore the structure/function relationships of the organs and tissues that carry out these processes and how they are adapted to the animals' habitats and lifestyles. Assessment of the final module will consist of a mid-module formative quiz (at 2-weeks in) and a final laboratory practical examination.

As this is a laboratory course, the teaching approach relies heavily on active-learning and application of lecture concepts through observation and experimentation. Students are provided with curated handouts with information about the representative organisms and biological concepts to supplement their lecture materials. Currently, my teaching assistants and I are also creating a video library of Methods Tutorials to help students quickly pick up new laboratory techniques. Students utilize the handouts and videos to decide how they want to approach their studies. Most, if not all, of the time students are encouraged to learn by doing, so I encourage them to develop their own questions and methods of inquiry, while asking probing questions and providing feedback to help them vet their ideas and analyze their conclusions.

While I have existing handouts and supplemental materials, there is still much work to be done to condense and organize the litany of resources. Currently, the students are also required to purchase a photo guide that has high quality images and examples of labeled slides and specimens that the students reference as we learn plant and animal anatomy. While I value this resource, I would like to move away from required purchases and make use of open educational resources and other free materials to decrease the financial strain of laboratory courses on the students. This will take time to curate, but ultimately will provide a more equitable lab. I also intend to locate and provide literature from a more diverse set of scientists. My teaching assistants and I are currently performing a review of the literature utilized in the general biology lab. Preliminary analysis shows that while we do have representation of female authors and authors of Asian descent, there is an urgent need to feature the work of more Black, Latinx, Indigenous, and LGBTQIA+ scientists, and scientists with disabilities.

B. Rationale for Grant Requests.

This Curriculum Development grant will provide the funding to support a significant revision of laboratory materials, activities and assessments. Currently, my role is both to coordinate the lab, hire and train lab prep workers, animal care workers, and teaching assistants to help conduct the labs, and deliver the four 3-hour lab sections each week. These coordination, training, supervision, and instructional roles leave little time for significant rework of the curriculum. The proposed changes will require many hours of literature review across multiple disciplines outside my area of expertise, as well as vetting and troubleshooting new experimental techniques, and the curation of new laboratory handouts, protocols, and assessments. The $2,000 stipend requested of this grant will support that work which will take place over the summer of 2021. Without it, this redesign will take multiple years to implement.

The proposed course revisions will have a lasting impact on my own pedagogical development as I work to integrate discipline-specific experimental approaches to provide a more authentic study of living systems. Introductory courses, require the memorization of many facts, vocabulary, and concepts. Too often, this type of knowledge is assessed via quizzes and exams that reinforce rote memorization rather than application, analysis, or evaluation of the material. I previously worked as a Graduate Affiliate at the University of Illinois Urbana-Champaign's Center for Innovation in Teaching and Learning and am a two-time Scientific Teaching Fellow of the Summer Institutes on Scientific Teaching. I am well versed in the changes that need to be made to create this new laboratory learning environment that we desire in our department, but do not have the discipline-specific knowledge to provide the students with new and engaging lines of experimentation that are representative of plant and animal anatomy, physiology and

development. This grant will support the time it takes to explore the relevant literature and techniques that will provide the students with a more authentic snapshot of the work done in these fields. I will be utilizing the skills I have acquired through my previous pedagogical development to create authentic assessment strategies that better align with our departmental skill development goals- for students to be able to apply the process of science, use quantitative reasoning and modeling/simulation, communicate and collaborate within the biology discipline, and understand issues related to science and society.

While I have always been an outcome-centric instructor, during this redesign process I look forward to further enhancing the visualization and organization of learning objectives for not only my lab, but for how it fits within the biology curriculum. I intend to map out the alignment of departmental objectives, course objectives, and module objectives to ensure that our students are being prepared for the next step in the biology program. This objective map will also be made available to students so that the skills that the activities and assessments help them develop are explicitly communicated to them. This will not only provide clarity, but also help improve transparency and signify my investment in the students and their continual development.

C. IRB/IACUC Review.

Not Applicable- All the animal subjects I plan to use are either dead, preserved, or invertebrates, which do not require IACUC approval.

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CD Grant Budget Page

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1. **Estimated expenses** (make sure to include a description of each of the expenses in the 2-3 page narrative). If you are requesting books or DVDs, please provide titles and approximate costs.

Item	Amount
_____	$_____
_____	$_____
_____	$_____
_____	$_____
_____	$_____
_____	$_____
_____	$_____
Total	$_____

2. **Stipend(s) requested** (see grant description for specific requirements):

Name	Amount
Libby Haywood	$2000
_____	$_____
_____	$_____
_____	$_____
Total	$2000

3. **Total amount requested**: $2000

Please note: Materials purchased with CD and ID grant funds, including, for example, software, CDs, and DVDs, are subject to all applicable copyright laws. Faculty members are responsible for upholding these laws. Materials for use in the library collection should be purchased through The Ames Library with allotted departmental funds. For details about copyright issues, please go to http://libguides.iwu.edu/copyright, or contact University Librarian Karen Schmidt or your department's liaison librarian.

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Curriculum Development
Grant Supervisor's Form

Name of applicant(s) Libby Haywood

Please provide the information below and return this form to the applicant(s).

1. Is/are the course(s) proposed:
   - [ ] new to the IWU curriculum?
   - [x] substantial revision of existing course(s)?

2. What part of the curriculum is served by the proposed course? (check all that apply)
   - [x] major/minor
   - [x] Gen Ed
   - [x] interdisciplinary program(s)
   - [ ] elective

3. How frequently will the course be offered? Every Spring semester

4. Why is this course a welcome addition to the curriculum? This lab has long been in need of significant revision. The biology depeartment has been reworking the curriculum to emphasize content and skills outcomes, as addressed in Vision and Change, and this revision centers vital skills outcomes that will make our students competitive. The collaborative and authentic learning environment this redesign offers will also help retain first year students and dispel the myth that biology "weeds out" students in the General Biology sequence.

5. How will a CD grant support this applicant(s)'s professional development as a teacher(s)?

Libby is a relatively new addition to the biology department, but has been a pedagogical resource for us, leading departmental conversations on curriculum. I am confident that she will design a student-centered experience that benefits our students. She is a molecular biologist teaching general biology and this grant will help her identify experimental methods outside her area of expertise and apply them to create a project-based learning lab.

6. What, if any, resource implications are connected to this course? Libby has spent significant time considering cost reduction measures to this laboratory, including working with other courses and departments to share resources and cultivate sustainable research specimens. She's committed to cost-saving measures.

If preferred, the chair/director can submit a formal letter of support in lieu of questions 4-6.

Signature of supervisor [signature] Date March 1 2021

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2016-2017
Curriculum Development Grant Application

Name Tyler Schwend Year of tenure-track appointment 2016-17

Department Biology

Type of Grant Sought:

MAR 2 1 2017

X Individual

_____ Group – please list additional member(s)

_____ _____

Course(s): BIOL 307 - Animal Physiology _____

_____ _____

- Will the course use human beings as experimental subjects? ☐ Yes ☑ No
  If yes, please explain in narrative.
  If you have questions about whether IRB approval or exemption is required for your project, please see the pdf link on "Policies and Procedures" at https://www.iwu.edu/irb/forms/IRB_PolicyProcedure.pdf.

- Will the course use animals as experimental subjects? ☑ Yes ☐ No
  If yes, please explain in narrative.
  (See the IACUC link to protocol forms at http:www.iwu.edu/associateprovost)

- If your proposal is funded, would you be willing for the Mellon Center to use it as an exemplary submission in the online *Handbook*? ☑ Yes ☐ No

Please complete the following checklist by placing a check mark against each item to ensure that your application is complete. Incomplete applications will be returned to the applicant without further consideration.

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2. Narrative (formatted as requested) ☒
3. CD Budget Page ☒
4. CD Grant Supervisor's Form(s) ☒

Signature Robert Tyler Schwend Date 3/20/2017

Tyler Schwend
Assistant Professor of Biology

Application for Curriculum Development Grant

Summary of Previous CD Grants: This is my first CD grant proposal at Illinois Wesleyan.

A. Narrative:

Course Description: The course is a full redesign of an existing animal physiology laboratory offered in the biology department, the laboratory component of BIOL 307 Animal Physiology. Typically, junior and senior level students take the course, though it is open to students at any level that have completed the general biology BIOL 101-102 or human anatomy and physiology BIOL 107-108 sequence. The redesign will incorporate an authentic research project that spans the entirety of the semester. The research will model diabetes pathology as it relates to impaired blood vessel formation using the chick embryo animal model. Students will engage with the primary literature to develop a novel hypothesis and experimental strategy aimed at describing the mechanistic link between blood vessel deficits in diabetics. This research course is meant to engage students in an authentic investigation that could produce exciting results in the research field of diabetes, a disease that impacts roughly 29 million Americans representing between 9-10% of the population. Students will further learn core concepts recommended for undergraduate students by the American Physiological Society, become familiar in scientific grantsmanship and the peer-review process carried out by US government agencies, and will be introduced to modern cell biological techniques.

Course Content: The overarching objective for students in animal physiology is twofold. First, to gain an appreciation and understanding of how animal organ systems function. Second, to recognize how the coordination between multiple organ systems is necessary to achieve health and well-being of the animal. A long recognized trend in physiology education is that while students are often well equipped to describe the functional importance of a particular organ, students often poorly grasp how different organs and systems are integrated[1]. Student's poor perceptions of the complex interrelationships between organs is likely a consequence of traditional physiology pedagogy which introduces students to each organ and system separately in a sequential fashion, one by one, rather than presenting physiology in a more integrated manner.

My preferred approach for integrating the physiology of different organs is to use examples of common clinical disease, such as diabetes. Understanding diabetes pathology requires knowledge of normal pancreatic function. Yet, as any diabetic could attest, diabetes-related pathologies far outreach pancreatic dysfunction. Rather, the normal function of organs that are interrelated physiologically with the pancreas are affected. For example, diabetes-related symptoms include poor metabolism, dehydration and vision problems to name a few. In this regard, studying a disease like diabetes enables students to learn the functional relationships between different organs. A secondary benefit, I believe, is that studying physiology in the context of well-known diseases tends to build student interest.

This course will enable students to assess diabetes pathogenesis and consider novel methods of diabetes treatment through the implementation of a course-based undergraduate research experience, herein referred to as CURE. CUREs are meant to replace traditional methods of

teaching undergraduate laboratories, which rely on students conducting experiments that are small-scale, short-term (1-2 week in duration) and have a known outcome. Instead, CUREs engage students in a semester-long research experience that models the types of things that scientists actually do; asking novel questions, doing literature research, designing their own studies, analyzing data in the context of a research project where the answers are unknown. Studies focused on identifying student gains after participating in a CURE include greater self-efficacy, gains in research skills, enhanced critical thinking and problem solving and an increased intent to persist in science[2-8].

The research in this course will integrate cutting-edge cellular biology approaches and incorporate live animals to investigate diabetes pathophysiology. Diabetes is associated with abnormal angiogenesis, or the formation of new blood vessels. Angiogenesis is necessary for a number of physiological processes, including would healing. In this course, students will initiate novel lines of experimentation using chick embryos to examine the mechanistic basis of the elevated blood sugar state of diabetes and impaired angiogenesis. Chick embryos are the most widely used animal model to study angiogenesis in a living system and have also been widely used to model diabetes pathophysiology[10].

Course Assignments: The overall goal of the course is to engage students in authentic research that could generate novel and publication worthy results considered to be impactful to the world. The assignments are designed in a sequential manner that aim to lead students through process of inquiry and investigation, while also providing essential instruction on chick embryo husbandry and modern cellular biological techniques. For this reason, the course will be carried out in three separate sections, with a variety of assignments embedded in each. These are outlined below:

Section 1 (4-5 weeks): *Begin the scientific process: Acquire background knowledge and technical expertise that seeks to test a specific hypothesis.*

1) Students receive instruction on diabetes and review the organs and systems involved in diabetes pathophysiology. Homework assignments and quizzes will test understanding.
2) Students receive instruction on reading the primary literature and will engage with a selected list of 5-8 journal articles[9-15]. Selected articles raise putative, non-mutually exclusive hypotheses relevant to impaired angiogenesis in diabetes[10-15]. To deepen student understanding of the articles, student groups will one-by-one present a "journal-club style" class-wide discussion on each article. Student participation will be evaluated.
3) Students engage in 1-2 week-long lab exercises to acquire the technical skills necessary to carry out angiogenesis experiments in chick embryos. Lab reports will be evaluated.
4) To culminate this section, student groups will rely on learned knowledge of diabetes (#1), primary literature (#2) and technical skills (#3) to write a specific aims page that articulates how they will experimentally address a hypothesis of their choice.

Section 2 (2-3 weeks): *Peer review*

1) Student groups will give an oral presentation outlining their aims pages, including relevant background, preliminary data, justification of hypothesis and proposed experiments.
2) A panel of 3-4 "experts" (the instructor, TA, other faculty member(s)) will consider the student presentations and specific aim pages. Projects will either be funded or sent back for revision. Student groups will need to address any concerns raised by the expert panel.

3) Among the projects proposed in the student group's aim pages, 2-3 will be chosen for students to carry out. The projects chosen to pursue will be balanced among 4 criteria, (1) overall student interest in the project, (2) financial considerations (3) feasibility (most likely to be completed in 8 weeks) and (4) competitiveness (best score among expert panel).

Section 3 (8-9 weeks): *Carry out proposed research*

1) Students will submit and be evaluated on an experimental agenda detailing their experimental design, budget and experimental timeline.
2) Students work independently to carry out the experiments, mainly in allotted class time. Students keep a detailed lab notebook.
3) To culminate this section, students present their research findings, analysis and conclusions in a poster presentation that is open to all biology faculty and interested peers.

Teaching Approaches: Prior to my hire in 2016, the Animal Physiology curriculum has remained essentially unchanged for decades and has not adhered to best practice pedagogies. This course redesign adheres to multiple lines of effort at the institutional and departmental level to incorporate active learning, student-driven inquiry and efforts to improve student information literacy and communication, both in oral and written form, while involving students in authentic research.

At the institutional level, this course will directly address two desires of the university's signature work initiative. First, it will engage students in research and study that connects their scholarly activity and professional development with real-world problems (diabetes therapy). Second, it provides more widespread access of signature work to students by incorporating authentic research into coursework.

At the departmental level, this course redesign complements existing efforts in the Biology department to restructure its curriculum in a manner that involves students in the *process of science* throughout their four years in the biology curriculum. Departmental curricular reform currently underway seeks to revise freshman level introductory coursework from traditional lecture to several small courses, each addressing biology inquiry, information literacy and emphasizing reading and writing. The impetus for such curricular change is based on reported student gains in critical thinking, inquisitiveness and communication when students engage in this type of coursework. This course revision serves to scaffold similar types of learning strategies, and seek similar student gains, within upper-level coursework.

I have experience implementing and leading classroom instruction in a CURE based course (Introductory Biology: A Modular-Based Laboratory Course for Engaging Introductory Students in Research at Hope College. Spring 2016 Source: CUREnet). I have recently supplemented this experience by engaging in a workshop proctored by Ellen Goldey, a leader in active learning and CURE curriculum design in the biological sciences. In light of these experiences, I am excited to retire the outdated Animal Physiology lab manual, filled with predictable exercises of known outcomes. With the aid of this CD grant, I will revise the course in a manner that rewards student inquiry, innovative thinking and one's ability to articulate their ideas, rather than one's ability to prescriptively follow the leader at the laboratory bench.

B. Rationale for Grant Request

Though I am well-equipped to deliver a CURE using chick embryos as the main animal model, the topic of diabetes represents a new area of research for me. I have spent many years over the course of my post-doctoral and faculty research career using chick embryos as my primary model organism and have incorporated them into past teaching courses. Further, I have both the direct technical experience required to teach students in the necessary research protocols for this course, as well as ample experience in the scientific grant-writing (aims page) and peer review process which students will mimic in this course. Despite this, my prior training has not prepared me for leading student inquiry in the field of diabetes pathophysiology and therapy and such an endeavor will require a considerable time investment for me.

Four aspects of course design and preparation will require significant time investments: 1. Immersion in physiology and medical texts will be necessary to become proficient in introducing the topic of diabetes and to develop content for student assessments. 2. Library research to compile and review the most recent and relevant journal articles and time to organize them onto a digital platform for student engagement. 3. Bench research to become fully equipped in carrying out and writing up research protocols that will be needed to test student hypotheses involving diabetes. 4. Assignment design and preparation to deliver a course requiring students to give oral presentations, participate in peer review involving multiple biology faculty and to deliver a public poster presentation. To carry out these necessary aspects of course design and preparation I will require a stipend of $2,000 to buy the necessary time. Texts and journal articles required are freely available through the Ames library resource network. Laboratory materials will be acquired using departmental funds associated with the Biology 307 course.

This grant will have a lasting impact on my own scholarship. A theme of my research has been to use animal embryos to model human disease. This grant will enable me to stay true to my theme, while broadening my research questions into new arenas. Diabetes represents one of the most common diseases in America, and its incidence will grow in an ever-aging society. Its disease symptoms are multifactorial and external research opportunities are plentiful in this field. To provide further signature work opportunities for faculty-student research, it will be fruitful to gain experience in a "fundable" field of research.

This grant will further aid me in my efforts to respond to best practice pedagogy in biological education. Undergraduate biology education is changing. Catalyzed by the 2015 *Vision and Change* document in undergraduate biology education, educators are becoming more aware of the pitfalls of traditional lecture-based pedagogy as well as the learning gains associated with active-learning strategies and laboratory investigations that promote inquiry, information literacy and open-ended lines of investigation. It is clear that biology departments that fail to adapt to lessons learned in *Vision and Change* are being outcompeted in attracting students by peer institutions and are providing inferior learning experiences to their current students. In line with current CURE based courses in the department, such as the SEA-Phages course and the currently revised BIO 101 laboratory, this revised course aims to provide our current biology students with the most cutting edge pedagogy.

C. IACUC Review

Use of chick embryos in the Biology 307 is carried out under the active IACUC protocol 15-016 and will not expire until August 30th, 2019. This protocol will be amended in advance of the Fall 2017 semester to include all relevant details of the diabetes research proposed within this CD grant proposal.

References:

[1]Rodriguez-Barbero A, Lopez-Novoa JM. Teaching Integrative Physiology using the Quantitative Circulatory Physiology Model and Case Discussion Method: Evaluation of the Learning Experience. *Adv Phys Ed* 2008. 32(4):302-311.

[2]Lopatto D, Tobias S. Science in Solution: The Impact of Undergraduate Research on Student Learning. Washington, DC: Council on Undergraduate Research; 2010.

[3]Shaffer CD, et al. The Genomics Education Partnership: successful integration of research into laboratory classes at a diverse group of undergraduate institutions. CBE Life Sci Educ. 2010;9:55–69.

[4]Harrison M, Dunbar D, Ratmansky L, Boyd K, Lopatto D. Classroom-based science research at the introductory level: changes in career choices and attitude. *CBE Life Sci Educ.* 2011;10:279–286.

[5]Rowland SL, Lawrie GA, Behrendorff JB, Gillam EM. Is the undergraduate research experience (URE) always best? The power of choice in a bifurcated practical stream for a large introductory biochemistry class. *Biochem Mol Biol Educ* 2012. 40:46–62.

[6]Rodenbusch SE, Hernandez PR, Simmons SL, Dolan EL. Early Engagement in Course-Based Research Increases Graduation Rates and Completion of Science, Engineering, and Mathematical Degrees. *CBE Life Sci Educ* 201615(2).

[7]Jordan TC, Burnett SH, Carson S, Caruso SM, Clase K, DeJong RJ, Dennehy JJ, Denver DR, Dunbar D, Elgin SCR, et al. A broadly implementable research course in phage discovery and genomics for first-year undergraduate students. MBio. 2014;5:e01051–13.

[8]Corwin LA, Graham MJ, Dolan EL. Modeling Course-Based Undergraduate Research Experiences: An Agenda for Future Research and Evaluation. *CBE Life Sci Educ* 2014;14(1)1-13.

[9]Datar SP, Bhonde RR. Modeling Chick to Assess Diabetes Pathogenesis and Treatment. *Rev. Diabetic Studies* 2011. 8(2) 245-53.

[10]Ribatti D, Vacca A, Roncali L, Dammacco F. The chick embryo chorioallantoic membrane as a model for in vivo research on angiogenesis. *Int J Dev Biol* 1996. 40:1189-1197.

[11]Martin A, Komada MR, Sane DC. Abnormal angiogenesis in diabetes mellitus. *Med Res Rev* 2003. 23:117-124.

[12]Larger E, Marre M, Corvol P, Gase JM. Hyperglycemia-induced defects in angiogenesis in the chicken chorioallantoic membrane model. *Diabetes* 2004. 53(3):752-761.

[13]Di Marco GS, Alam A, Dol F, Corvol P, Gase JM, Larger E. Angiogenesis and diabetes: different responses to proangiogenic factors in the chorioallantoic membrane assay. *Mol Med* 2008. 14(11-12):705-714.

[14]Okamoto T, Tanaka S, Stan AC, Koike T, Kase M, Makita Z, Sawa H, Nagashima K. Advanced glycation end products induce angiogenesis in vivo. *Microvasc Res* 2002. 63(2):186-195.

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CD Grant Budget Page

1. **Estimated expenses** (make sure to include a description of each of the expenses in the 2-3 page narrative). If you are requesting books or DVDs, please provide titles and approximate costs.

Item	Amount
Total	0

2. **Stipend(s) requested** (see grant description for specific requirements):

Name	Amount
Tyler Schwend	$2,000.00
Total	2000

3. **Total amount requested**: 2000

Please note: Materials purchased with CD and ID grant funds, including, for example, software, CDs, and DVDs, are subject to all applicable copyright laws. Faculty members are responsible for upholding these laws. Materials for use in the library collection should be purchased through The Ames Library with allotted departmental funds. For details about copyright issues, please go to http://libguides.iwu.edu/copyright, or contact University Librarian Karen Schmidt or your department's liaison librarian.

Curriculum Development Grant
Supervisor's Form

Name of Applicant(s) Tyler Schwend

Category of Grant:

X Individual
_____ Group

Please provide the information requested below, and return this form and your letter to the applicant(s).

- Is/are the proposed course(s) _____ new to the IWU curriculum?
  X substantial revision(s) of existing course(s)?

  Please Comment Tyler Schwend is a new faculty member and plans to revise the BIOL 307 laboratory

- How frequently will the proposed course(s) be offered? Offered annually in the Fall semester

- Please attach a brief statement of support addressing the significance and desirability of the proposed course(s) to your department or program's curricular offerings, as well as the applicant(s)' qualifications to develop the course(s).

Signature of Supervisor [signature] **Date** March 20th 2017

ILLINOIS WESLEYAN
UNIVERSITY

March 20, 2017

To: Adriana Ponce, FDC Chair
From: Loni Walker, Chair of the Biology Department

I fully endorse Tyler Schwend's CD grant proposal to redesign the Animal Physiology laboratory (BIOL 307). Tyler is the newest (tenure-line) member of the Biology Department and is finishing his first year at Illinois Wesleyan University. He was hired to replace Bob Hippensteele and as part of his responsibilities, teaches the Animal Physiology (BIOL 307) course every Fall Semester. This course fulfills the curricular requirement for a course in Systems or Organismal Biology or students may count it as one of the three upper level elective courses required for the major. Students in other majors who meet the prerequisites (completion of organic chemistry) may also enroll in the course. In the past 5 years, this course has annually enrolled between 12-24 biology majors.

Significance and desirability of the course
Animal Physiology is taught in every biology department and is a foundational course for students interested in pursing graduate studies in animal biology and/or health related fields. For the last 35+ years by Bob Hippensteele has taught this course and now Tyler is developing the course as his own. Tyler's course redesign aligns with our department's current curricular reform which is based on current best practices in biology education laid out in the *AAS Vision and Change Report, the BioCore Guide: A Tool for Interpreting the Core Concepts of Vision and Change for Biology Majors* document and the Biology Department external review. Curricular changes to existing courses, like those described in this proposal, will benefit IWU students by engaging them in the *process of science* and incorporating high impact educational practices, namely active-learning, critical thinking, reading and writing throughout the curriculum. The redesign is also in line with the IWU mission statement that affirms the university's role in providing an education that *"fosters creativity, critical thinking, effective communication, strength of character and a spirit of inquiry."* Furthermore, this course will significantly increase the number of biology students engaged in authentic (*i.e.* original) research and as the curriculum revision in the Biology department progresses, likely to count towards or be incorporated as signature work. Finally, BIOL 307 is an especially popular course among our pre-medical and pre-veterinary students and since students will engage in research that relates to a common disease (diabetes), I anticipate that the changes in course content will be well received by students.

Tyler's qualifications
One of the assets that Tyler brought to the department upon his hire in 2016 was hands-on classroom experience in carrying out a course-based undergraduate research experience, which he gained during his time in a tenure-track position at Hope College. At Hope, nearly a quarter of the biology laboratories are operated in a manner consistent with authentic (original) research. Spending time in that department has equipped Tyler with both direct and second-hand exposure to strategies required of creating CURE based coursework. More recently, Tyler and the rest of the biology faculty participated in a weekend workshop aimed at incorporating high impact educational

practices in lecture based instruction and launching CURE based laboratory courses. The workshop was led by Dr. Ellen Goldey (Dean of the Harriet L. Wilkes Honors College, Florida Atlantic University), a leader in best practices in biology education. For these reasons, Tyler is well qualified to develop and carry out the revisions proposed in his Curriculum Development grant. The proposed changes to the Animal Physiology laboratory are substantial, essentially new and wonderfully unique. Tyler is a great addition to the Biology department and his enthusiasm for student-centered pedagogy is a positive and inspiring influence on students and faculty alike.

Sincerely,

Loni Walker

Loni Walker
Biology Department Chair
Associate Professor of Biology
Illinois Wesleyan University