Course Approval Form

For instructions:
http://registrar.gmu.edu/facultystaff/catalog-revisions/course/

Action Requested: (definitions available at website above)
[X] Create NEW [ ] Inactivate
[ ] Modify (check all that apply below)

[ ] Title [ ] Credits [ ] Repeat Status [ ] Schedule Type [ ] Prereq/coreq [ ] Restrictions [ ] Grade Mode [ ] Other: _____

Course Level:
[X] Undergraduate [ ] Graduate

College/School: College of Science **Department:** Interdisciplinary Program in Neuroscience
Submitted by: Gwendolyn Lewis **Ext:** 36239 **Email:** Glewis13@gmu.edu

Subject Code: NEUR **Number:** 406
(Do not list multiple codes or numbers. Each course proposal must have a separate form.)

Effective Term: [ ] Fall [X] Spring [ ] Summer *Year* 2018

Title:
Current
Banner (30 characters max w/ spaces)
New: Zebrafish Neurodevelopment Laboratory

Fulfills Mason Core Req? (undergrad only)
[ ] Currently fulfills requirement
[ ] Submission in progress

Credits: (check one)
[X] Fixed → 3
[ ] Variable → to
[ ] Lec + Lab/Rct→ 0 or

Repeat Status: (check one)
[X] Not Repeatable (NR)
[ ] Repeatable within degree (RD) →
[ ] Repeatable within term (RT) →
Max credits allowed: (required for RT/RD status only)

Grade Mode: (check one)
[X] Regular (A, B, C, etc.)
[ ] Satisfactory/No Credit
[ ] Special (A, B C, etc. +IP)

Schedule Type: (check one)
LEC can include LAB or RCT if linked sections will be offered
[ ] Lecture (LEC)
[X] Lab (LAB)
[ ] Recitation (RCT)
[ ] Internship (INT)
[ ] Independent Study (IND)
[ ] Seminar (SEM)
[ ] Studio (STU)
[ ] Activity (ACT)
[ ] Research (RSC)
[ ] Student Teaching (STC)
[ ] Thesis (THS-798/799)
[ ] Dissertation (DIS-998/999)

Prerequisite(s) (NOTE: hard-coding requires separate Prereq Checking form; see above website):
PSYCH 300, BIOL 312 or equivalent.
BIOL 213, NEUR 327 and NEUR 335.

Corequisite(s):

Restrictions Enforced by System: Major, College, Degree, Program, etc. Include Code(s).

Equivalencies (check only as applicable):
[ ] YES, course is 100% equivalent to _____
[ ] YES, course renumbered to or replaces _____

Catalog Copy (Consult University Catalog for models)

Description (No more than 60 words, use verb phrases and present tense)	**Notes** (List additional information for the course)
Introduction to experimental methods used in neurodevelopment research, using zebrafish as a model system. Includes zebrafish embryo manipulation, microscopy, and histology, with a focus on vertebrate nervous system development and disease. Experimental design, research methods, data analysis and ethical issues are addressed. Scholarly research projects are incorporated.	This requires working with live zebrafish embryos.
Indicate number of contact hours: Hours of Lecture or Seminar per week: _____ Hours of Lab or Studio: 3	
When Offered: (check all that apply) [X] Fall [ ] Summer [X] Spring	

Approval Signatures

[redacted] 8/18/17
Date

College/School Approval Date

ealt with by any other units, the originating department must circulate this proposal for review by r to submission. Failure to do so will delay action on this proposal.

Unit Name	val Name	Unit Approver's Signature	Date

Undergraduate or Graduate Council Approval

UGC or GC Council Member | Provost's Office | UGC or GC Approval Date

Form revised 11/10/2016

Course Proposal Submitted to the College of Science Curriculum Committee (COSCC)

The form above is processed by the Office of the University Registrar. This second page is for the COSCC's reference. Please complete the applicable portions of this page to clearly communicate what the form above is requesting.

FOR ALL COURSES (required)

Course Number and Title: NEUR 406: Zebrafish Neurodevelopment Laboratory

Date of Departmental Approval: August 17, 2017

FOR INACTIVATED/REINSTATED COURSES (required if inactivating/reinstating a course)

- Reason for Inactivating/Reinstating:

FOR MODIFIED COURSES (required if modifying a course)

- Summary of the Modification:
- Text before Modification (title, repeat status, catalog description, etc.):
- Text after Modification (title, repeat status, catalog description, etc.):
- Reason for the Modification:

FOR NEW COURSES (required if creating a new course)

- Reason for the New Course: This course has been created to expand the laboratory offering of the neuroscience program. Students will gain a greater understanding of the vertebrate nervous system through experiments using zebrafish embryos. This course also gives students a forum to complete scholarly research projects. This course has received funding from OSCAR for its development. We plan to apply for designation as an RS (Research and Scholarship) course.
- Relationship to Existing Programs: This is a new course and number in the neuroscience program. A version of this course was run during Spring 2017 as NEUR 461: Analytical Methods. The course was very successful.
- Relationship to Existing Courses: n/a
- Semester of Initial Offering: Spring 2018
- Proposed Instructors: Dr. Gwendolyn Lewis
- Insert Tentative Syllabus Below

Zebrafish Neurodevelopment Laboratory
NEUR 406: Spring 2018

Instructor: Dr. Wendy Lewis
Instructor e-mail: glewis13@gmu.edu
Course Time:
Course Location: Exploratory Hall L509
Office: Krasnow 254
Office Hours:

Course Overview:
Zebrafish (*Danio rerio*) are a powerful model system used in neuroscience, biology and pharmacology research. This is primarily because zebrafish embryos are optically transparent and develop externally, which means that developmental processes can be directly visualized and manipulated beginning at the one-cell stage! Zebrafish are also vertebrates, and their nervous system has more in common with humans than you might think. In this laboratory, you will use zebrafish as a model system to study vertebrate nervous system development. You will learn basic techniques for manipulating, imaging, and analyzing zebrafish embryos, while performing experiments to investigate the structure and function of the nervous system in healthy and diseased states. You will work with other students to design and carry out a novel scholarly research project.

Research and Scholarship Learning Goals
During this course you will work in small groups to design, execute, and present an original research project. Each group's project will be different and will make important contributions to our knowledge of nervous system development. Research and scholarship related learning goals and the course activities that support them are listed below.

Core: Articulate and refine a question, problem, or challenge.
- Project proposal

Discovery: Distinguish between personal beliefs and evidence.
- Project proposal
- Lab reports

Ethics: Identify relevant ethical issues and follow ethical principles.
- Lab reports
- Lectures/discussions

Method: Choose an appropriate research method for scholarly inquiry.
- Project proposal
- Investigation of live imaging, morphology, and locomotor behavior
- Free project work

Method: Gather and evaluate evidence appropriate to the inquiry.
- Investigation of live imaging, morphology, and locomotor behavior
- Immunohistochemistry
- Free project work

Method: Appropriately analyze scholarly evidence.
- Investigation of live imaging, morphology, and locomotor behavior
- Immunohistochemistry
- Free project work
- Project presentations
- Lab reports

Context: Explain how scholarly inquiry has value to society.
- Project presentations

- Lab reports
- Lectures/discussions

Context: Explain how knowledge is situated and shared in relevant scholarly contexts.

- Lectures/discussions

Creation: Take responsibility for creating and executing an original scholarly or creative project.

- Project proposal
- Project consultations
- Investigation of live imaging, morphology, and locomotor behavior
- Immunohistochemistry
- Free project work

Communication: Communicate knowledge from an original scholarly or creative project.

- Project presentations

Course Specific Learning Goals:

By the end of this course, you should be able to...

- Compare and contrast the organization of the nervous system in zebrafish and humans
- Describe the advantages and disadvantages of zebrafish as a model system
- Describe common experimental techniques used in zebrafish research
- Perform basic zebrafish manipulations, including staging embryos, dechorionating, removing unfertilized embryos, and exchanging media
- Anesthetize zebrafish embryos and perform live imaging
- Analyze embryo morphology and locomotor behavior
- Explain the concept of immunohistochemistry and use this technique to analyze neurons and glia in whole-mount embryos
- Analyze data using appropriate statistics
- Explain how alcohol and other drugs affect nervous system development at the molecular, cellular, and morphological level
- Diagram and explain the development of the zebrafish nervous system
- Develop a research question, design an experiment, collect data, carry out analyses and interpret results
- Effectively present your research in written and oral format

Opportunities to Present Research

Students will have the opportunity to present their research projects within and outside of Mason. These opportunities will be discussed in class and assistance will be provided in preparing applications and abstracts. Opportunities include: The Society for Neuroscience Annual Meeting, the Mid-Atlantic Society for Developmental Biology Annual Meeting, the COS Undergraduate Research Colloquium, the OSCAR Celebration of Student Scholarship, and more.

Text and Readings

There is no required text and weekly readings will be posted on Blackboard

Grading and Assessments:

Lab Notebook	15%
Participation	15%
Reading Quizzes	15%
Lab Reports and Assignments	25%
Research Project	30%
Total Grade	**100%**

Grading Scale
A 90-100%
B 80-89%
C 70-79%
D 60-69%
F 0-59%

Assignment Details:
Lab Notebook- Maintaining a lab notebook according to guidelines provided by the instructor will count for **15%** of your grade. Someone unfamiliar with the lab procedures should be able to look at your lab notebook and replicate the procedures that we conducted during class. Details about what should be included in lab notebooks will be provided on a weekly basis.

Participation: Your grade in this course will include a participation score ranging from 0 – 5 points per class meeting. A score of 5 points will be given to a student who reports to lab on time, is prepared by having completed the readings ahead of time, is properly dressed, and actively participates in all lab activities and class discussions. A score below 5 points will be given to a student who does not fully demonstrate 100% effort in a given lab session. This could include things like arriving late, being unprepared, inappropriate phone usage during class, not having done the readings, not actively participating in lab activities and discussions, disrupting other students, failing to cooperate, leaving lab before all the work (including cleaning) is done, etc. The participation score will count for a total **15%** of your final grade.

Reading Quizzes: Assigned readings will include lab protocols, textbook chapters, and journal articles. These readings will be distributed via Blackboard. Successful and efficient labs depend on each of you coming to lab prepared. This means that you have to complete the readings **BEFORE** you come to lab. In order to ensure that all students are reading before class, short quizzes will be given at the beginning of each lab session. You will have the first 10 minutes of class to complete the quiz. If you are late to class and miss the quiz, then you cannot make it up. Reading quizzes will count for a total of **15%** of your grade.

Lab Reports and Assignments: You will complete written lab reports to assess your knowledge of classroom activities. Some reports may include statistical analysis that require you to use GMU's computer labs. Other reports will include the objective of the experiment, the hypothesis tested, reporting of results, and conclusions regarding the results. You may also be assigned in-class or out-of-class assignments. Together these reports and assignments will account for **25%** of the final grade.

Research Project: You will work in small groups to design, conduct, and present an original research project using zebrafish embryos and the techniques covered in class. You and your group will work together on this project throughout the semester. Your group will give an oral presentation of your findings and will report results in written format in lab reports throughout the semester. Detailed information about this project will be distributed in class. The research project proposal and final oral presentation will account for a total of **30%** of your final grade.

Attendance Policy, Make-up, and Late Work

You are expected to attend class and participate in all discussions and activities. Attendance is an integral part of this course, and absences will result in significant missed information. Unexcused absences will result in a deduction of 1% off the final course grade (to a maximum of 15%). There will be no make-up labs available. Late work will incur a penalty of 10% of the earned grade per day.

All policies may be modified on an individual basis at the discretion of the instructor. Excused absences may require a doctor's note or other documentation

Communication and E-mail

If you need to contact me, please do so using e-mail **from your university account only**, and **include the course name in the subject line and include your name in the e-mail**. Check your e-mail and course Blackboard account daily and before each class meeting. I will use e-mail and Blackboard to communicate with you regarding changes related to the course, syllabus, and other essential information. You are responsible for all announcements posted and sent via Blackboard and e-mail, in addition to announcement make in class.

Student Conduct Policies

Be kind and respectful to your classmates, Disruptive, disrespectful, or rude behavior will lead to dismissal from class and will count as an absence for the day. You will also miss out on all the cool things we do in lab!

Cell phones in the lab: Please silence phones during class. Texting is not allowed. Cell phone use/ringing (other than for emergency) during class may result in deduction of points from the course participation grade.

Computers in the lab: Computers will only be allowed in the lab during specified times.

Laboratory Dress: You **must wear long pants and closed toed shoes** in the laboratory. If you are improperly dressed, you will not be allowed into the lab.

Food and Drink: There is absolutely **no food or drink** allowed in the lab.

Academic Integrity

Honesty and integrity are issues at the very core of this course and of science as a whole. George Mason has an honor code with clear guidelines for academic integrity. A few of the most important rules that pertain to this course are as follow: 1) All work submitted must be your own should be done individually unless explicitly stated otherwise. You will be encouraged to discuss ideas, collaborate, and brainstorm with your classmates, but actual assignments need to be completed individually. 2) When referencing the work of others (this includes published and non-published work or ideas), full credit must be given through appropriate citations. 3) If you are ever unsure about the rules for an assignment, ask for clarification. Cheating and plagiarism of any form is not tolerated. Plagiarism means using the exact words, opinions, or information from another person without giving the appropriate credit. Any offense will result in a grade of F for the course and will be dealt with in accordance with university regulations.

Disability Accommodations

If you have a documented learning disability or other condition that may affect academic performance you should: 1) make sure this documentation is on file with Office of Disability Services (SUB I, Rm. 4205; 993-2474; http://ods.gmu.edu) to determine the accommodations you need; and 2) talk with me to discuss your accommodation needs.

Mason Diversity Statement*

George Mason University promotes a living and learning environment for outstanding growth and productivity among its students, faculty and staff. Through its curriculum, programs, policies, procedures, services and resources, Mason strives to maintain a quality environment for work, study and personal growth.

An emphasis upon diversity and inclusion throughout the campus community is essential to achieve these goals. Diversity is broadly defined to include such characteristics as, but not limited to, race, ethnicity, gender, religion, age, disability, and sexual orientation. Diversity also entails different viewpoints, philosophies, and perspectives. Attention to these aspects of diversity will help promote a culture of inclusion and belonging, and

an environment where diverse opinions, backgrounds and practices have the opportunity to be voiced, heard and respected.

** This is an abbreviated statement, full statement is available at http://ctfe.gmu.edu/professional-development/mason-diversity-statement/*

Privacy and E-mail Use

Students must use their MasonLive email account to receive important University information, including communications related to this class. I will not respond to messages sent from or send messages to a non-Mason email address.

Add/Drop Deadlines

Schedule Overview

Week 1
Introduction to Zebrafish
Lecture: Introduction to Zebrafish; Laboratory Safety/ Zebrafish Zoonosis
Activity: Field trip to Krasnow Institute zebrafish room
*Introduce projects
HW: Zebrafish CITI training

Week 2
Staging and Development
Lecture: Staging and Nervous System Development
Activity: Staging embryos, identify unfertilized, dechorionate, draw images of embryos in lab notebook, label embryos and anatomy
HW: Read Kimmel
HW: Staging Assignment (staging by images)

Week 3
Live Imaging I
Lecture: Live Imaging I (Anesthesia, Mounting, Live Imaging and Brightfield Microscopy)
Activity: Anesthetize 2dpf (wt) embryos, mount using methylcellulose, take a brightfield image
HW: Read a paper about transgenics

Week 4
Living Imaging II
Lecture: Live Imaging II (Transgenic Technology and Fluorescence Microscopy)
Activity: Anesthetize 2dpf (wt) embryos, mount using LMP, take a fluorescent image
*Assign project proposals, schedule project consultations

Week 5
Morphology Analysis
Lecture: Scoring Morphological Features
Activity: Score morphology of embryos
*Have chosen chemical for project (meet with groups individually to discuss and approve)
HW: Project Proposals

Week 6
Data Analysis and Graphing
Lecture: From Raw Data to Publication-Quality Figures
Activity: Tutorial of SPSS and ImageJ
*Project proposal due
HW: Data Analysis Lab Report

Week 7
Locomotor Analysis
Lecture: Development of the Locomotor Circuit
Activity: Analysis of spontaneous tail coiling and touch-evoked responses
*Make stock solutions and dilutions for projects
HW: Locomotor Lab Report

Week 8
Project Work I
Activity: Live Imaging, Morphology and Locomotor Analysis, Day 1
HW: Lab Report of Findings

Week 9
Project Work II
Activity: Live Imaging, Morphology and Locomotor Analysis, Day 2
HW: Lab Report of Findings

Week 10
Immunohistochemistry I
Activity: Day 1 IHC- primary antibody, IHC will be performed on treated embryos for project
HW: Schedule meetings for injections

Week 11
Immunohistochemistry II
Lecture: Zebrafish Research Methods
Activity: Day 2 IHC- Secondary antibody, IHC will be performed on treated embryos for project
HW: CRISPR/Cas9 Podcast and Worksheet

Week 12
Immunohistochemistry III
Activity: Imaging and analysis of IHC
HW: Lab Report of IHC Findings

Week 13
Free Project Work
Activity: Repeat previous experiments, analyze data, assemble presentations
HW: Work on Project Presentations

Week 14
Project Presentations and Research Celebration
Activity: Oral presentations of project work