Course Change Request

New Course Proposal

Date Submitted: 03/03/20 4:27 pm

Viewing: BIOL 689 : Interdisciplinary Tools in Biosciences

Last edit: 03/03/20 4:27 pm

Changes proposed by: kharrism

Programs referencing this course

SC-MS-BIOL: Biology, MS

In Workflow

1. **BIOL Graduate Representative**
2. **SC Curriculum Committee**
3. SC Associate Dean
4. Assoc Provost-Graduate
5. Registrar-Courses
6. Banner

Approval Path

1. 04/10/20 3:43 pm Iosif Vaisman (ivaisman): Approved for BIOL Graduate Representative

Are you completing this form on someone else's behalf?

Yes

Requestor:

Name	Extension	Email
Alessandra Luchini	3-4263	aluchini@gmu.edu

Effective Term: Fall 2020

Subject Code: BIOL - Biology **Course Number:** 689

Bundled Courses:

Is this course replacing another course? No

Equivalent Courses:

Catalog Title: Interdisciplinary Tools in Biosciences

Banner Title: Interdisciplinary Tools

Will section titles vary by semester? No

Credits: 3

Schedule Type: Lecture

Hours of Lecture or Seminar per week: 3

Repeatable: May only be taken once for credit (NR)
GRADUATE ONLY

Default Grade Mode: Graduate Regular

Recommended Prerequisite(s):

Recommended Corequisite(s):

Required Prerequisite(s) / Corequisite(s) (Updates only):

Registrar's Office Use Only - Required Prerequisite(s)/Corequisite(s):

And/Or	(	Course/Test Code	Min Grade/Score	Academic Level	)	Concurrency?

Registration Restrictions (Updates only):

Registrar's Office Use Only - Registration Restrictions:

Field(s) of Study:

Class(es):

Level(s):

Degree(s):

School(s):

Catalog Description:

Class provides experiential learning of the basic tools necessary for a scientist career development. The tools covered in this class enable conducting biosciences research, namely, identifying unmet needs in science, performing scientific and patent literature search, designing experiments, understanding and applying state of the art –omics technology, performing statistical analysis of data and mathematical modeling, interpreting study results, recognizing and eliminating sources of bias, building knowledge from data, and communicating results of scientific research to peers and to general public. Students will be guided on how to recognize emerging trends in science, and be given the tools to creatively explore these trends, so that their own research will be timely and competitive.

Justification:

Class is created in response to 50% common core requirement for MS program. It spans the curriculum for all concentrations in MS in biology and reflects a need for providing a framework for the professional development in laboratory and in silico biosciences. Class falls into category of "introduction to profession and its methods", where students will have a choice of a particular professional development class, each tailored to a specific aspect of this development. This class is intended to be an interactive experience which cannot be achieved in a large size classroom.

Does this course cover material which crosses into another department? No

Learning Outcomes:

Demonstrate ability to apply acquired literature and data analysis skills

Formulate an original research topic and design the research plan

Demonstrate proficiency and excellence in the core concepts

Improve ability to analyze and synthesize acquired information

Attach Syllabus

Interdisciplinary tools.pdf

Additional Attachments

Staffing:

Alessandra Luchini, Lance Liotta

Relationship to Existing Programs:

Class is created in response to 50% common core requirement for MS program. It spans the curriculum for all concentrations in MS in biology and reflects a need for providing a framework for the professional development in laboratory and in silico biosciences.

Relationship to Existing Courses:

Class falls into category of "introduction to profession and its methods", where students will have a choice of a particular professional development class, each tailored to a specific aspect of this development. This class is intended to be an interactive experience which cannot be achieve in a large size classroom. Because of that, there are other classes which fall in the same category. Examples; BIOL 691/BIOS 702 Research methods (3 credits) – same class cross-listed under two numbers, NEUR 612 Neuroethics (3 credits) or BIOL 691 Creativity and Innovation (3 credits)

Additional Comments:

Reviewer Comments

Key: 16799

Interdisciplinary Tools in Biosciences.

Instructors

Emanuel Petricoin

Office: Institute for Advanced Biomedical Research, rm 2006,

Office Hours: By appointment

Phone: 703-993-8646

Email: epetrico@gmu.edu, best way to reach me

Web page: http://capmm.gmu.edu/

Mariaelena Pierobon

Office: Institute for Advanced Biomedical Research, rm 2016,

Office Hours: By appointment

Phone: 703-993-9839

Email: mpierobo@gmu.edu, best way to reach me

Web page: http://capmm.gmu.edu/

Principles of the course.

The purpose of this class is to provide experiential learning of the basic tools necessary for a scientist career development. The tools covered in this class enable conducting biosciences research, namely, identifying unmet needs in science, performing scientific and patent literature search, designing experiments, understanding and applying state of the art –omics technology, performing statistical analysis of data and mathematical modeling, interpreting study results, recognizing and eliminating sources of bias, building knowledge from data, and communicating results of scientific research to peers and to general public. Students will be guided on how to recognize emerging trends in science, and be given the tools to creatively explore these trends, so that their own research will be timely and competitive. The format of this class will be a combination of a serial modular lectures from experts with group projects that will allow the students to practice the skills learned. Interdisciplinary team collaboration will be encouraged to achieve synergistic outcome. Integration of the research and training will foster development of cognitive synergy, sense of self, and professional capacity. There will be the following areas of emphasis:

- Biostatistics, experimental design, power calculations, statistical methods in biology, design of animal model study experiments to minimize number of human and animals subjected to experimental risk. (Ruben Magni)
- Emerging trends in mathematical biology including machine learning, deep learning, game theory, genetic algorithms, system theory, compartmental analysis, stochastic systems, predator-prey models. Application of machine learning to biomedicine and epidemiology. Basics of using the command line: introduction to programming languages for bioscientists. (Claudius Mueller)
- Introduction to study design in biohealth. Clinical trial design: phase I, II and III. Sequential truncated and accelerated trial design. Common problems in clinical trials and how to solve them (Mariaelena Pierobon)
- Overview of public access databases for biological data, and what types of studies can be performed without spending a penny. (Alessandra Luchini)
- Overview of OMICS technologies (genomics, transcriptomics, metabolomics, microbiomics, proteomics, etc.). Challenges and opportunities in Big Data in–omics research. (Emanuel Petricoin)
- Science communication: how to read and analyze a scientific paper, how to pitch a scientific idea, how to perform a scientific literature search, citation manager software Zotero. Science communication training will follow principles set forth in the Neil DeGrasse Tyson Master class. Dr. Tyson is a role model who provides inspirational lectures on 1. Turning a hypothesis into a theory, 2. The value of skepticism, 3. Understanding and correcting sources of cultural bias, 4. Generating curiosity, 5. Knowing your audience, 6. Getting your ideas across, 7. Utilizing humor, and 8. Assessing your communication success. (Mariaelena Pierobon)
- Emerging hot topics in sciences: designer proteins, designer DNA, DNA origami, personalized and precision medicine, artificial intelligence, robotics in surgery, gene editing and gene therapy, gene modified organisms, transcranial electromagnetic brain stimulation, over-the-counter medications, pathogen emergence. (Lance Liotta)
- Grant funding trends, how to build a research budget. Costs and efficiency of scientific progress. Strategic placement of efforts during career development (Fatah Kashanchi)
- Creativity and innovation: how to identify unmet challenges in environment, medicine and society. Brainstorming and stimulation of innovative thinking. Theories on the origin of creativity. Prototyping and experimental. Case history of Intellectual Property in Biosciences. How to perform a patent search. (Lance Liotta)

Course Grading

Grades will be based on 1) mid-term take home exam, 2) final presentation (Power Point presentation and project description in a Word file) and 3) class participation (35%, 35%, 30%, respectively).

Mid-term take home exam: Students will be given three essay questions. Students will have one week to answer to the questions. This assignment will be open book and carried out individually.

Final presentation: in groups of four, students will propose a solution to a given challenge using the principles of the class. Students will prepare a power point presentation and deliver it to the class during the final three classes of the semester.

The presentation should include:

1. Description of the problem.
2. Explanation of why past solutions have failed.

3. Description for a variety of ways to solve the problem. Choose one solution and explain why it is the best idea.
4. Description of how to implement your idea (experimental plan of prototype development milestones).
5. Describe commercial potential and societal potential of the solution you provided .

Course Learning Outcomes:

- Demonstrate ability to apply acquired literature and data analysis skills
- Formulate an original research topic and design the research plan
- Demonstrate proficiency and excellence in the core concepts

Definition of Grades for Graduate Courses

Grade	Quality Points	Graduate Courses
A+	4.00	Satisfactory/Passing
A	4.00	Satisfactory/Passing
A-	3.67	Satisfactory/Passing
B+	3.33	Satisfactory/Passing
B	3.00	Satisfactory/Passing
B-	2.67	Satisfactory*/Passing
C	2.00	Unsatisfactory/Passing
F	0.00	Unsatisfactory/Failing

* Although a B- is a satisfactory grade for a course, students must maintain a 3.00 average in their degree program and present a 3.00 GPA for the courses listed on the graduation application.

Information about additional grade notations that apply to graduate students including “IN” Incomplete and “IP” In Progress as well as grading for undergraduate students may be found in the Academic Policies section of the catalog under Grading System. Graduate students are not required to take midterm exams.

Weekly schedule

Date	**Topic**
Week 1	Biostatistics, experimental design, power calculations

Week 2	Emerging trends in mathematical biology including machine learning
Week 3	Emerging trends in mathematical biology including machine learning
Week 4	Study design in biohealth. Clinical trial design
Week 5	Study design in biohealth. Clinical trial design
Week 6	Overview of public access databases for biological data
Week 7	Overview of OMICS technologies
Week 8	Science communication
Week 9	Emerging hot topics in sciences
Week 10	Grant funding trends
Week 11	Creativity and innovation
Week 12	Practicing Creativity: students' presentations
Week 13	Practicing Creativity: students' presentations
Week 14	Practicing Creativity: students' presentations

Plagiarism:

Plagiarism is the presentation of someone else's ideas or work as one's own. Students must give credit for any information that is not either the result of original research or common knowledge. If a student borrows ideas or information from another author, he/she must acknowledge the author in the body of the text and on the reference page. Students found plagiarizing are subject to the penalties outlined in the Policies and Procedures section of the University Catalog, which include a hearing by the Honor Code Committee and may include a failing grade for the work in question or for the entire course. The following website provides helpful information concerning plagiarism for both students and faculty: http://oai.gmu.edu/the-mason-honor-code-2/plagiarism/

Honor Code:

- George Mason University has an Honor Code, which requires all members of this community to maintain the highest standards of academic honesty and integrity. Cheating, plagiarism, lying, and stealing are all prohibited
- All violations of the Honor Code will be reported to the Honor Committee.
- See http://oai.gmu.edu/the-mason-honor-code-2/ for more detailed information.

Enrollment:

- Students are responsible for verifying their enrollment in this class.
- Schedule adjustments should be made by the deadline published on the Registrar's website.
- Note the add/drop dates in the Academic Calendar published on the Registrar's website.
- After the last day to drop a class, withdrawing from this class requires the approval of the

dean and is only allowed for nonacademic reasons.
- Undergraduate students may choose to exercise a selective withdrawal.
- See http://registrar.gmu.edu for selective withdrawal procedures.

Ethics:
Ethical behavior in the classroom is required of every student. The course will identify ethical policies and practices relevant to course topics.

Technology:

Students are expected to be competent in using current technology appropriate for this discipline. Such technology may include presentation software. Students are required to become familiar with Mason's Responsible Use of Computing Policy #1301 http://copyright.gmu.edu/?page_id=301

Diversity:

Learning to work with and value diversity is essential in every class. Students are expected to exhibit an appreciation for multinational and gender diversity in the classroom.

Civility:

As a diverse community of learners, students must strive to work together in a setting of civility, tolerance, and respect for each other and for the instructor. Rules of classroom behavior (which apply to online as well as onsite courses) include but are not limited to the following:

- Conflicting opinions among members of a class are to be respected and responded to in a professional manner.
- Side conversations or other distracting behaviors including cell phone use or non-class online access are not to be engaged in during lectures, class discussions or presentations
- There are to be no offensive comments, language or gestures

Students not complying will be asked to cease immediately or leave the class session.

Students with Disabilities:

If you are a student with a disability and you need academic accommodations, please see me and contact the Office of Disability Resources at 703.993.2474. All academic accommodations must be arranged through that office.