Course Change Request

New Course Proposal

Date Submitted: 03/03/20 4:12 pm

Viewing: BIOL 502 : ADAPTATION IN BIOSYSTEMS

Last edit: 03/03/20 4:12 pm

Changes proposed by: kharrism

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. 03/03/20 4:14 pm Iosif Vaisman (ivaisman): Approved for BIOL Graduate Representative

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

Yes

Requestor:

Name	Extension	Email
Lance Liotta	3-4263	lliotta@gmu.edu

Effective Term: Fall 2020

Subject Code: BIOL - Biology

Course Number: 502

Bundled Courses:

Is this course replacing another course? No

Equivalent Courses:

Catalog Title: ADAPTATION IN BIOSYSTEMS

Banner Title: ADAPTATION IN BIOSYSTEMS

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:

Biological communication networks adapt and maintain robust function in the face of external stress, challenges or assaults. In order to survive, the cell, and the organism, must create meaning from a complex array of external and internal signals, and make decisions as to how it should respond. This class encompasses a novel integrative life science perspective, namely adaptation, or maladaptation, in the face of constant change.

Justification:

Class is created in response to 50% common core requirement for MS BIOL program. It spans the curriculum for all concentrations in MS in biology and reflects a need for integrating multilevel evolutionary and systems biology frameworks into conceptual understanding of individual disciplines in biosciences.

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

Learning Outcomes:

Understand biological complexity at the level of population (molecules, cells, organisms)
Understand genetic and phenotypic adaptation
Understand biological foundation for stress and resilience
Improve ability to analyze and synthesize acquired information
Demonstrate proficiency and excellence in the core concepts.

Attach Syllabus

AdaptationSys Biol.pdf

Additional Attachments

Staffing:

Lance Liotta, Mariaelena Pierobon

Relationship to Existing Programs:

Class is created in response to 50% common core requirement for MS BIOL program.

Relationship to Existing Courses:

New class created to expand systems biology expertise for MS Biology program.

Additional Comments:

Reviewer Comments

Key: 16798

Adaptation and maladaptation in systems biology: from molecular dynamics to ecology and evolution.

SHORT NAME: ADAPTATION IN BIOSYSTEMS

Instructors

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Principles of the course.

Biological communication networks adapt and maintain robust function in the face of external stress, challenges or assaults. In order to survive, the cell, and the organism, must create meaning from a complex array of external and internal signals, and make decisions as to how it should respond. A central question in biologic networks, ranging from individual molecule interactions, to cells, organisms, and extending to large ecosystems is how do these complex networks evolve, adapt and heal without becoming fragile and crashing when subjected to external stress, change, or assault? This class encompasses a novel integrative life science perspective, namely adaptation, or maladaptation, in the face of constant change. Adaptation to external sources of stress takes place at the level of the molecule, the

cell signaling network, communication between cells, networks and populations of organisms, and entire ecosystems. Students will learn how biological systems react to stress and how maladaptation leads to disease, addiction, global climate change, or ecosystem collapse. Viewing living systems from this viewpoint provides a fresh and career-relevant framework for graduate science education. Our philosophy is exactly the opposite of conventional programs of instruction using a reductionist approach. Main training elements of the course encompass systems biology, principles of coding, control theory, biostatistics, a choice of different levels of biological system investigation: structural biology, cell signaling and cellular networks, environmental network systems.

Short modular lecture series will be offered by different instructors, covering the following topics:

1. Principles of resiliency and robustness in biological systems. How organisms adapt and survive in the face of disease related or environmental stresses. (Lance Liotta)
2. Principles of robustness and adaptation at the molecular level. How 3-dimensional conformation and energetic landscapes of molecules stabilize systems. (Amanda Haymond)
3. From molecules to signaling networks in the cell: Signaling pathways, cytokines, growth factors, autocrine and paracrine signals, electrical signals and how signal-responding systems follow principles of robustness and adaptation in face of stimuli. (Claudius Mueller)
4. Overview of human and animal physiology in health, and what may go wrong in disease. Basic pathophysiological processes. Healing processes and embryologic resilience in developmental systems: embryology and morphogenesis, wound healing. (Mariaelena Pierobon)
5. Principles of cancer somatic evolution. Cancer as an example of a maladapting system: oncogenes, tumor suppressor genes, chromosomal rearrangement, clonal cooperation, drug resistance. Principles of host adaptation to invading pathogens and microbiome. Role of microbiome in physiological homeostasis. (Virginia Espina)
6. Maladaption in addiction and chronic pain: adaptation of sensory systems in the brain to addictive substances and neurological pain signaling. (Lance Liotta)
7. Human populations: adaptation to various environments, variation, bottle necks and why some diseases are ethnic specific. (Alessandra Luchini)

Course Grading

Grades will be based on 1) mid-term take home exam, 2) Final presentation (group Power Point presentation + individually written project report, with references, including description of individual contribution to presentation, submitted as a Word file) and class participation; 3) Final exam (35%, 30%, 35%, 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.

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. In addition to group presentation, each student with individually write a project report, with references, including description of individual contribution to presentation, submitted as a Word file)

Final exam (open book) – type on your laptop and email it at the end of exam.

The presentation should include:

1. Description of the research study that investigates adaptation of one or another biological system

2. Explanation of what is new/breakthrough in this study. What novel insights are gained
3. Understanding and presenting of the methodology of the study, both wet lab and computational components.
4. Explaining where this finding takes us, and what does it mean for other biological systems
5. Charting the plan for future research. What would you do to take this line of study further.

Course Learning Outcomes:

- Understand biological complexity at the level of population (molecules, cells, organisms)
- Understand genetic and phenotypic adaptation
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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	Principles of resiliency and robustness in biological systems.
Week 2	Principles of resiliency and robustness in biological systems.
Week 3	Principles of robustness and adaptation at the molecular level.
Week 4	Principles of robustness and adaptation in signaling networks in the cell.
Week 5	Principles of robustness and adaptation in signaling networks in the cell.
Week 6	Overview of human and physiology and pathophysiology
Week 7	Overview of human and physiology and pathophysiology
Week 8	Principles of evolution and adaptations in cell populations. Cancer
Week 9	Principles of evolution and adaptation in cell populations. Chronic diseases
Week 10	Maladaption in addiction and chronic pain
Week 11	Human populations: adaptation to various environments
Week 12	Students' presentations
Week 13	Students' presentations
Week 14	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.