BIOLOGY (BIOL)

BIOL 503: Critical Elements of Genetics and Molecular and Cellular Biology

4 Credits

Foundational topics and critical analysis in evolution, genetics, molecular and cellular biology and cell differentiation. BIOL (/BMMB/MCIBS/ VB SC) 503 Critical Elements of Genetics and Molecular and Cellular Biology (4) Central elements in genetics, genomics and molecular and cell biology will be covered. The course will focus on foundational principles and concepts that will allow students to understand the behavior of proteins and organelles within cells, and to appreciate how intracellular events influence interactions of cells with one another in multicellular systems and during development. Another major focus will be genome architecture, both in the context of evolution and gene expression. Students will also learn how genetic approaches can be used to understand cell and molecular biology, and will develop critical thinking skills through the analysis of the primary scientific literature. The course will include lecture and discussion sessions.

Cross-listed with: MCIBS 503, VBSC 503

BIOL 514: Topics in Systematics and Evolution

2 Credits

Discussion of pertinent current literature in systematic biology and evolution.

BIOL 519: Ecological and Environmental Problem Solving

4 Credits

Overview of processes involved in solving environmental problems. Provides students with toolkit for understanding ecological and environmental problems. Untitled Document BIOL 519 Ecological and Environmental Problem Solving (4) The course will provide a general overview of the process involved in studying a variety of ecological and environmental problems. It will provide a toolbox of techniques for understanding ecological and environmental problems, and discuss how they can be used to address questions and generate testable predictions. It will examine connections between individuals and populations and communities as well as between theory and data. The focus will be on theoretical and computer modeling approaches, while maintaining a strong link to data and real systems.After an introduction to modeling, students will learn to develop and use simple and stochastic optimization models for individual organisms, as well as applying basic game theory to interactions between individuals. Many of the class meetings will be held in computer laboratories where they will be actively engaged in working on applying these models. They will explore a sequence of population demographic models of increasing complexity, ranging from unlimited unstructured population growth to density-dependent, structured population growth, in non-spatial and spatial contexts, culminating an individual-based models for population dynamics. The students will then apply these models to interacting species, learning about mutualistic, competitive and host-natural enemy interactions. Finally, we will explore theory for communities of species in space and time. Applied problems will be drawn from all areas of conservation, harvesting, pest control and epidemiology.Graduate students will additionally be required to attend a once a week case study, where we will focus on a paper from the recent literature that uses the techniques or theory learned that week in class. Additionally, graduates will develop models of their own, based on their own research, or on some other subject of interest. They will be expected to meet with me twice in a group and individually during office hours throughout the semester, to discuss the development of their projects. They will have to complete a written report on the motivation, model development, and results and implications of their work. This work will take the form of a short manuscript (as if for publication to a representative journal in their field). They will also have to make a verbal presentation to the entire class on their project (15 minutes, as if attending a professional conference). The course will be offered once/ year.

Prerequisite: BIOL 220 or an introductory ecology course

BIOL 555: Statistical Analysis of Genomics Data

3 Credits

Statistical Analysis of High Throughput Biology Experiments.

Cross-listed with: MCIBS 555, STAT 555

BIOL 559: Charles Darwin's On the Origin of Species

3 Credits

Each week will be dedicated to one chapter of the first edition (1859) of Charles Darwin's masterpiece On the Origin of Species. Each chapter is divided by Darwin himself in a series of sections (usually about 10 sections per chapter). Each chapter will be commented on through an open discussion which will proceed section by section. The main goal of the open discussion will be to extract from each section the main argument(s) presented by Darwin. During the open discussion, the instructor will give students an overview of the historical background: ideas and knowledge at the time; each person cited by Darwin will be commented on; Darwin also sometimes refers to other people's findings or ideas without citing their names, and those will be revealed and commented on too. We will critically discuss the data that Darwin mentions, whether they are from his own observations or not. We will also pay special attention to his writing style (vocabulary, repetitions, etc.) which is very precise. Occasionally, changes that Darwin made in the later editions will also be highlighted (using the variorum edition). At the end of this course, students will be able to use a rigorous method to critically study any important work in history of science (by putting any text within its own historical, cultural, and scientific context). The students will understand in depth Darwin's remarkable achievement in On the Origin of Species, which will allow them to take it back to their classrooms with undergraduate students as well as apply it to their own research. Students will be able to make direct connections between Darwin's masterpiece and modern biology because Darwin touched upon many of the questions that we are still struggling with. After this course, students will be able to realize that vocabulary, rhetoric, and writing style do matter, because On the Origin of Species is a masterpiece of scientific communication, and apply that to their own scientific writing.

BIOL 571: Integrative and Cellular Mammalian Physiology I

3 Credits

Mammalian cardiovascular, respiratory, renal, and gastrointestinal systems. This course in Cellular and Integrative Mammalian Physiology covers all major aspects of physiology. A special emphasis will be placed on how cellular aspects of physiology are integrated with organ and systems physiology. It is designed for students that either major in Physiology or are interested in integrating physiology concepts into their education. An in depth presentation of membrane biophysics, muscle dynamics, cardiovascular and circulatory regulation, respiratory and renal function, as well as acid base balance are addressed.

Prerequisite: BIOL 472
Cross-listed with: PHSIO 571

BIOL 590: Colloquium

1-3 Credits/Maximum of 3

Continuing seminars which consist of a series of individual lectures by faculty, students, or outside speakers.

BIOL 591: Molecular Evolutionary Biology Seminar

1 Credits

Continuing seminars in Molecular Evolutionary Biology consisting of individual lectures by faculty, students, or outside speakers.

BIOL 592: Critical Evaluation of Literature in Biology

1 Credits

Weekly readings and critiques of recent papers from primary literature are used to teach independent thinking and effective scientific communication. BIOL 592BIOL 592 Critical Evaluation of Literature in Biology (1)This course teaches beginning graduate students how to evaluate new findings reported in primary literature in the biological sciences. Each week, a recently published paper is evaluated according to 8 basic criteria as follows:1. Does the author adequately establish a context for the issues addressed in the paper? Are the issues addressed in the paper important in the field? Why or why not? 2. What is the hypothesis? Is it clearly stated? Is it operational (i.e. "falsifiable")? 3. Are the methods adequate to test the hypothesis? Why or why not? What are the controls? Are they adequate? 4. Are the data clearly presented? Are the results properly analyzed? Are statistical inferences stated appropriately? Do the data meet the assumptions of the statistical tests? 5. What conclusions are drawn from the results? Do the conclusions follow from the data? Have some conclusions been overlooked? Are there reasonable alternative interpretations of the data? Did the authors consider alternative hypotheses? 6. What could be done to improve the paper? Consider written format as well as the overall experimental design. For example, is the title appropriate? Does the abstract accurately summarize the results and conclusions? Does the paper use recent and appropriate references? 7. What is your overall opinion of the size of contribution that the paper makes to the body of knowledge in its field? Is this work creative? Does it provide new insights or a framework to understand previously disparate data? Defend your position. 8. What would be the next set of tests of the hypothesis or the next hypotheses to test? How should these hypotheses be examined experimentally? To what extent do you think this paper will stimulate further studies? The goal of the course is to provide students with opportunities to sharpen their thinking in regard to what constitutes meaningful scientific experimentation, interpretation of results, and effective presentation of information in text, figures, and tables. Near the end of the course each student prepares a written critique of a paper, and meets individually with the faculty to discuss their critique. The course follows a format very similar to the Ph.D. candidacy exam for Biology, thus providing formal preparation for that exam.Faculty: James Marden

Prerequisite: Departmentally controlled

BIOL 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, that are supervised on and individual basis and which fall outside the scope of formal courses.

BIOL 597: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently.

BIOL 598: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or semester.

BIOL 598B: **SPECIAL TOPICS**

1-3 Credits

BIOL 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

BIOL 601: Ph.D. Dissertation Full-Time

0 Credits/Maximum of 999

No description.

BIOL 602: Supervised Experience in College Teaching

1-3 Credits/Maximum of 3

Supervised experience in teaching and orientation to other selected aspects of the profession at The Pennsylvania State University.

BIOL 610: Thesis Research Off Campus

1-15 Credits/Maximum of 999

No description.

BIOL 611: Ph.D. Dissertation Part-Time

0 Credits/Maximum of 999

No description.

BIOL 893: Experiential Teaching in Biology

2 Credits

The course provides a broad exploration of the science of learning as well as how to effectively develop curricula and pedagogy to support effective learning in undergraduate biology laboratory courses. Additionally, this course will prepare graduate students for future roles as educators. In particular, this course will focus on the cognitive principles of how people learn most effectively as well as provide students the skills involved in developing curricula and pedagogy to support active learning and a learner-centered environment in undergraduate biology laboratory courses. The major topics to be covered include the science of learning, the need for curricular reform in the sciences, how to create a student-centered learning environment, and the ethical and professional foundations of teaching. After successfully completing this course, students will be able to use evidence to discuss the value of learner-centered classrooms in the sciences, identify elements of a learner-centered biology classroom, identify major classroom challenges and methods of approaching them, write effective assessment questions and provide effective feedback to students, lead productive and effective class discussions, and demonstrate understanding of how people learn and apply learner-centered teaching approaches to developing effective lesson plans.