

## **Biology Academic Learning Compact**

The biology program emphasizes content knowledge related to the various levels of biological organization (e.g., cellular and subcellular, organismal, and ecosystem and population levels), as well as critical thinking and communication skills. Therefore, while a concentration in Biology begins with course work in General Biology, a well-rounded biologist will build on basic concepts with study in core areas: ecology, cell and developmental biology, organismal biology and genetics. Course offerings supplemented by tutorials allow students to accomplish these goals. In the current curriculum, for example, Methods in Field Ecology, Plant-Insect Interactions, and Coral Reef Ecology allow study of ecological principles beyond General Biology. Cell and developmental biology begins with a foundation course (with lab) in cell biology. Advanced courses such as Plant Developmental Biology, lab tutorials, internships, and seminars give the student an opportunity to shape interests. Organismal biology is represented in several course offerings, including Organismic Biology, Botany, Fish Biology, Invertebrate Zoology, Plant Physiology, and Entomology. Genetics (with lab) introduces the field that can be explored at advanced levels through work in biochemistry and through seminars focused on various levels of genetics from molecular to organismal, as well as through tutorials and internships.

The curriculum is flexible to accommodate needs and interests of our students. It should be noted that most of the classes and other educational activities include activities to build content knowledge, critical thinking and communication skills. The sub-disciplines offered regularly by faculty include marine biology, neurobiology and environmental studies. Each assumes completion of general biology and the incorporation in an individual's curriculum of the core areas of study.

**Marine Biology** includes Coral Reef Ecology, Invertebrate Zoology, Fish Biology, Methods of Field Ecology, Animal Behavior, Aquatic Botany/Marine Plants, study at a marine field station, and selected tutorials. Students interested in this area typically work with faculty in educational activities at the Pritzker Marine Biology Research Center located at the Bayfront.

**Neurobiology** has two options: Option 1 - Neurobiology, Brain Behavior and Evolution, and Vertebrate Neuroanatomy with at least two of the labs associated with these courses; Option 2 - two of the above courses with labs and one of the Social Sciences offerings in neurobiology.

**Environmental Studies.** Many biology students also focus their work in Environmental Studies. Courses include Communities and Ecosystems, Conservation Biology - Rain Forest Case Studies, Conservation Biology - Global Perspectives, Plant Ecology - Introductory, Plant Ecology - Advanced, The Role of Women in Natural History, Coral Reef Ecology, Methods in Field Ecology, Tutorials and Senior Thesis Conferences. Students are encouraged to meet with Dr. Lowman, Professor of Biology and Director of Environmental Initiatives.

Subdisciplines such as genetics and entomology are designed individually, depending on specific areas of interest and academic goals. Students choosing one of the subdisciplines will undertake one or two ISP's in the subdiscipline and a senior thesis. Students fulfilling requirements for concentrations such as gender studies may be able to arrange with faculty to focus projects or tutorials on gender topics. Courses such as Women in Science and the Role of Women in Natural History may also be of interest.

Biology students should also complete the basic courses in physics, calculus and chemistry, and be able to use the computer as a research and presentation tool. Statistics and the command of a modern language other than English make important contributions to a biologist's education.

### **An Area of Concentration in Biology includes:**

1. Course work in General Biology (primary emphasis on content knowledge, but some critical thinking and communication in the forms of scientific writing and/or presentation are also emphasized).
2. Three semesters of laboratory experience (and appropriate accompanying lecture courses) beyond the level of general biology (emphasis on content knowledge, critical thinking and communication typically in the form of lab reports).

3. Two independent study projects, in which students typically design and execute their own studies, then present the work in paper and/or oral form (emphasis on content knowledge, critical thinking and communication).
4. A senior thesis and oral baccalaureate examination, in which the student is asked not only about her or his thesis research but also about concepts in biology in general (emphasis on content knowledge, critical thinking and communication).

\*\* A more detailed itemization of some available courses and their areas of emphasis with respect to content knowledge, critical thinking and communication is provided in the attached matrix.

### **Expected Outcomes**

Through work in courses, including seminars focused on scientific literature, individualized tutorials, as well as the thesis and baccalaureate experience, students should:

1. Acquire fundamental information in biology that spans recognized levels of organization which include: molecular biology (genetics)/ biochemistry; cell and tissue organization and function; organismal biology (some understanding of life cycles, physiology, behavior, etc.) of representatives of the "5" kingdoms, including human biology; and ecosystem and population biology for a variety of habitats.
2. Gain an appreciation of biodiversity, which should emerge from the above and experience in more advanced courses and research projects.
3. Acquire effective written and verbal communication skills, which will be gained from numerous opportunities to give formal and informal presentations in courses, informal seminars, as teaching assistants (lab lectures, etc.) and the baccalaureate exam.
4. Employ various mathematical, statistical and laboratory analytical principles and techniques to study exercises or research problems.
5. Complete problem-oriented laboratory exercises/projects, research projects of limited scope (usually as independent study projects) and a comprehensive experimentally or library-based senior research thesis are required.
6. Gain the ability to critically evaluate research designs, results and interpretations so as to assess the importance and "shortcomings" of secondary and primary research literature in areas of particular interest/specialization.
7. Use computers and multimedia information systems as educational and research tools. This can include; information retrieval, word processing, graphical and data base development, statistical analysis, and laboratory apparatus control and data input/analysis.
8. Acquire the ability to perform well on graduate/professional entry exams and interviews as appropriate to individual aspiration.

### **Measures to track student progress:**

1. Faculty advisors will verify and certify that the student is meeting these goals on the Provisional Area of Concentration and Thesis Prospectus forms.
2. Students interested in post-graduate study in the areas of medical school, veterinary school, or in allied health will go through a checklist of their requirements with the Pre-med Advisor.

### **Examples of Measures to demonstrate each graduate's competencies:**

1. Evaluation of senior thesis and baccalaureate examination.
2. Evaluation of independent study projects.
3. Biology (and related field) Graduate Record Examinations; critical thinking, analytical writing, and verbal reasoning sections of the standard GRE and related tests can be used to assess written communication skills and critical thinking skills.
4. MCAT and VMCAT exams.
5. Electronic portfolios.

6. Acceptance into graduate and professional programs and awarding of fellowships (e.g., Fulbright, NSF, etc.).
7. Employment data can be used to assess various skills, depending on the type of job involved. All jobs would involve communication skills & critical thinking, but some jobs would also require biology content knowledge. This might be a way to assess students who do not go to graduate school. We may send surveys to employers (developed by institutional research), but a list of successful job placements would be useful in beginning the assessment.

## Course Matrix

	<b>Content Knowledge*</b>	<b>Critical Thinking</b>	<b>Communication</b>
Any of the general biology courses	Strong focus on content		Presentations given
Introduction to botany	Strong focus on content		Presentations given
Introduction to plant ecology	Lecture: focus on content Field labs: focus on experimental design	Use primary literature to learn themes	Class discussion and presentations
Plant-insect interactions	Strong focus on content	Read and analyze primary literature	Presentations given; class discussions
Plant developmental biology	Strong focus on content	Read and analyze primary literature; write review style paper	Class discussions and presentations; write review style paper
Entomology	Strong focus on content		Class discussion and presentation
Advanced Plant ecology-forest canopies	Lecture: content focus Lab: focus on field methods	Lecture: Use primary literature to learn themes Lab: design short experiments and collect data	Oral presentations and reviews
Cell biology and lab	Lecture: strong focus on content Lab: strong focus on content and skill development	Lecture: read and analyze primary literature; write review style paper Lab: create independent lab project	Lecture: Presentations and class discussions; write review style paper Lab: comprehensive lab notebook; formal journal style lab report
Introduction to genetics and lab	Lecture: strong focus on content Lab: strong focus on content	Lecture: read and analyze primary literature Lab: open-ended experiments	Lecture: create portfolio online, class discussions, presentations Lab: comprehensive notebook and formal lab reports
Coral reef ecology	Strong focus on content	Read and analyze primary literature	Presentations given
Invertebrate zoology lecture and lab	Lecture: strong focus on content Lab: strong focus on content	Lecture: use primary literature to examine current topics	Lecture: presentations given Lab: comprehensive lab notebook

	<b>Content Knowledge*</b>	<b>Critical Thinking</b>	<b>Communication</b>
Fish Biology lecture and lab	Lecture: strong focus on content Lab: strong focus on content	Students read and analyze primary literature	Lab: comprehensive lab notebook Student projects and presentations.
Methods of field ecology	Strong focus on content	Students read and analyze primary literature	Comprehensive field project with oral presentation
Organismic biology lecture and lab	Lecture and lab have content focus	Lecture: students synthesize information across topics; readings assigned from primary literature and arguments analyzed Lab: Lab notebook includes discussion questions as well as lab material	Lecture: Written essays and presentations Lab: comprehensive notebook
Brain behavior and evolution	Strong focus on content	Read and analyze primary literature	Class discussions
Vertebrate neuroanatomy	Strong focus on content	Read and analyze primary literature	Class presentations and discussions
Communities and ecosystems	Strong focus on content	Read and analyze primary literature	Class presentations and discussions
Conservation biology- Rainforest case studies	Strong focus on content	Read and analyze primary literature	Class presentations and discussions
Conservation biology- global perspectives	Strong focus on content	Read and analyze primary literature	Class presentations and discussions

\* This is not a comprehensive list of the course offerings but represents information about activities that are primary to the major. Other offerings, such as internships, seminars and tutorials, include content knowledge, critical thinking and communication.