Undergraduate and Graduate Curricula for the 21st Century

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Modern undergraduate and graduate degree programs are critical elements of a successful geoscience program. Over the last decade at Penn State University, we have designed several new programs that train students for a competitive and changing job market. In addition, programs at the boundaries of disciplines help us attract students who would not consider our traditional Geoscience BS degree. A rigorous Earth Sciences BS degree program tailored to students with interests in education and environmental law has maintained steady numbers of majors over its six year history. The degree incorporates course work from Geosciences, Geography and Meteorology, and requires completion of an interdisciplinary minor (e.g., Climatology, Marine Sciences, Global Business Strategies). Here we describe five new undergraduate and graduate degree programs that have recently received University approval. A new Geobiology BS program will attract majors with interests at the intersection of the earth and life sciences. The curriculum includes both paleontological and biogeochemical course work, and is also tailored to accommodate pre-med students. Research is a fundamental component of every student's degree program. We require a capstone independent thesis as well as a field program and encourage students to pursue research as early as the freshman year. A new 5-year combined BS-MS program will enable outstanding students to carry their undergraduate research further before pursuing employment or doctoral programs. New Astrobiology undergraduate minor and dual title graduate degree programs have been designed to educate students in this emerging field. Finally, a minor in Science, Society and the Environment of Africa focuses on the interplay between science, policy and society and will help recruit students from underrepresented groups

Geobiology Bachelor of Science

Geobiology is the interdisciplinary study of the Earth and its biosphere. It embraces the history of life and its interactions with the earth over geologic time; it also includes study of interactions between living organisms and physical and chemical processes in the modern environment on Earth, and possibly elsewhere in the universe. Thus, geobiology encompasses the fields of paleobiology and paleontology, biogeochemistry, geomicrobiology and astrobiology. The degree program provides students with a strong background in general science and especially in Geosciences and Biology. Students gain practical field experience in the study of the physical environment and ecological properties. Students will be well prepared for advanced studies in this emerging discipline, and for careers in the environmental sciences. Geobiology is critical to the study of environmental quality, global change and environmental-human health interactions, all of which have profound importance in legal, economic and policy arenas.

Science, Society and the Environment of Africa Minor

The continent of Africa has the greatest accumulation of natural resource wealth of any region of the world, yet its people and societies are among the poorest and least integrated with the global economy. This interdisciplinary minor enables students to integrate fundamental aspects of the social, physical and technical sciences that have contributed to this paradox. It provides a complement to elective and required coursework in both the humanities and the sciences, including degree programs in Political Sciences, Earth Sciences, Environmental Resource Management, Engineering, and/or African and African-American Studies. Students in this program will learn to apply fundamental concepts from diverse disciplines towards an integrated understanding of African resource management. This minor provides excellent preparation for students planning careers in development, law, international relations, international business, resource management, engineering and the physical sciences. Learning objectives for the minor include excellence in written and oral expression, the ability to collect and interpret data from a diversity of dynamic natural systems, and rigor in scientific thought.

Integrated BS/MS Degree Program

The objective of the integrated BS/MS degree in Geosciences is to provide the academically best prepared undergraduate students an opportunity to complete the degree requirements for a MS degree within one year of additional academic work, past a four year BS degree program. The BS degree requirements in Geosciences include the completion of a Senior Thesis, which is based on field, analytical or experimental work. Each year there are cases in which, with additional effort, the Senior Thesis work could readily be expanded into MS thesis level research. The Integrated BS/MS program is intended for these students. In addition, some of our undergraduate students elect to take more 400 level Geosciences classes than the minimum requirement, and some obtain permission to register for 500-level instruction. In essence these undergraduates are starting to work for a more advanced degree. The creation of the new program will strengthen the present MS degree in Geosciences through a wider participation of students. The program will benefit students by allowing them to achieve a higher level of education efficiently, by formally recognizing the more advanced studies they have started, by making them eligible for industrial internships which are restricted to MS students, and increasing their employment opportunities. The curriculum is similar to our MS and Ph.D. degree course requirements.

Astrobiology Minor and Dual Title Graduate Degree

Astrobiology is devoted to the scientific study of life in the universe - its origin, evolution, distribution, and future. This multidisciplinary field brings together the physical and biological sciences to address some of the most fundamental questions of the natural world: How do living systems emerge? How do habitable worlds form and how do they evolve? Does life exist on worlds other than Earth? How could terrestrial life potentially survive and adapt beyond our home planet?

Minor

The Astrobiology Minor is designed to educate students in this interdisciplinary field covering the varied scientific disciplines that contribute to our general understanding of life, the origin of life, the past history of life on Earth, possible futures for life on Earth, and the possible existence of life on other planetary environments. The principle goal of the minor is to develop student's literacy in astrobiology so that they can critically evaluate claims related to this field that they encounter well after their college education has ended. To qualify for the Minor students are required to take 18 course credits from the list below, with at least six credits at the 400-level.

Dual Title Graduate Degree

The Astrobiology dual-title degree program is administered by the Department of Geosciences for the participating graduate programs. A program committee with representatives from each participating department maintains program definition, defines the nature of the candidacy examination and assigns the examining committee, identifies courses appropriate to the program, and recommends policy and procedures for the program's operation. The dual-title degree program is offered through participating programs in the College of Earth and Mineral Sciences and the Eberly College of Science and, where appropriate, other graduate programs in the University. The program enables students from several graduate programs to gain the perspectives, techniques, and methodologies of Astrobiology, while maintaining a close association with major program areas of application.