HAMILTON COLLEGE DEPARTMENTAL VISIONS

These departmental mission statements were prepared as part of the planning process for new science facilities at Hamilton College.

Hamilton College

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Adapted from planning documents for Hamilton's new science facility.

See also Hamilton College's vision statement: http://www.pkal.org/documents/HamiltonVision.cfm.

Archaeology

Archaeology explores the material record of human behavior in all times and places in order to understand how the diversity of cultures evolves. Study in archaeology has twin objectives: to trace the record of the human past as reconstructed by archaeologists and to learn through the development and application of investigative methods what artifactual remains can reveal about the record of human behavioral events. From their first introduction to the field, students should come to:

Recognize the dependence of observation and interpretation on theory. Understand the special nature of historical inference and the roles of experimental and comparative approaches in inference. View culture, like nature, as systematically organized and that it changes according to specifiable social, ecologic, and evolutionary principles. Understand how new theories and technologies have advanced the study of our past. Appreciate the extraordinary diversity of cultural solutions to adaptive and social challenges faced by human populations over the last 2.5 million years, since humans first used tools.

Archaeology lies at the boundary of the natural and social sciences, with strong connections to the other anthropological disciplines and to the earth and biological sciences. In teaching about archaeology, we endeavor to show how archaeological interpretation builds out of collaborative efforts across many scientific fields. Thus, we encourage broad academic training, but also advise deep commitment to study in allied sciences since archaeology today draws increasingly on technical scientific information. One example of interdisciplinary study is the geoarchaeology concentration, in which geologic principles and methods are explored as a means of enhancing archaeological interpretation.

At every step in their study of archaeology, students should learn about the factual record of the human past, about the historical connections between the world's cultures past and present. Equally important, however, is the challenge of evaluating that record, to ask whether an interpretation is correct or incorrect, to develop analytic skills, to learn why some questions are preeminent and others are not. These goals, we feel are best reached through participation in archaeological research under the close guidance of faculty. Thus, from their first exposure to archaeology, students wil1 examine first hand ancient technologies and other physical remains and will perform a range of archaeological analyses. For the more interested students, participation in the archaeological field program leads to a deeper understanding of archaeological questions and the methods used to produce answers. The final step that a student may take is collaborative study with a faculty member. The active research programs of the archaeology faculty ensure opportunities for significant student research.

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Biology

Biology is the science of life, and study of it gives a deeper understanding of ourselves and our world. The Department of Biology at Hamilton welcomes all students who desire to learn more about living organisms. The goals of our program are these:

- To provide all students an understanding of fundamental principles and observations within the life sciences.
- To offer a curriculum that covers the breadth of the life sciences, including the structure, function, and evolution of life at molecular, cellular, organismal, and populational levels.
- To give all students hands on experience in studying living materials and in using current instrumentation and research methods.
- To help all students understand the nature of science, including the ethical principles of scientific conduct.
- To foster research collaborations between students and a faculty actively engaged in research.
- To guide students who choose to concentrate in Biology toward becoming skilled and confident independent investigators.
- To promote teaching and learning that cross the boundaries of traditional disciplines.
- To develop in all our students the skills of intelligent reading, analytic thinking, and clear oral and written expression.

Biology at Hamilton is presented in the context of the liberal arts. We provide students a firm foundation in the life sciences by beginning with an introductory three course survey that ranges across the breadth of the discipline. After the introductory core, students then choose from a range of intermediate and upper level courses that provide depth in subdisciplines of biology through classes that are characteristically small, allowing for extensive classroom interactions.

We believe that the best education in science includes a hands on component, so all these courses, except for several senior seminars, have a required laboratory or field component. The third level of our curriculum is the senior program.. We believe that students learn biology best when they act and think like biologists; thus, during the senior year, all concentrators become actively engaged in research with one or more of the faculty.

The culmination of the undergraduate study of biology at Hamilton, therefore, is collaborative research with a faculty member, sometimes resulting in joint presentations to regional and national meetings. In the senior program, students develop as independent and skilled problem solvers. Trained with an emphasis on communication skills, they also present their research to the Department in written theses and in oral presentations.

To support the best possible learning throughout the curriculum, the Department maintains a range of modern instrumentation for collaborative student faculty research; we are comrnitted to making modern equipment and facilities of the highest quality available to all our students.

The Department also contributes to interdisciplinary programs in biochemistry, psychobiology, and environmental studies. Our overall goal is for students to be able to do whatever they want to do when they leave Hamilton to be thoroughly prepared to reach their goals.

Chemistry

Chemistry has been referred to as the "central science" for its broad focus on matter—its structure, dynamics and interactions. Knowledge of chemical principles is important in studying a diverse set of fields, including biology, psychology, materials science, geology, physics, and environmental science. Awareness of chemical phenomena is also critical to understanding of a broad range of political and social issues such as pollution, waste disposal, water quality, recycling and energy sources.

The chemistry program assures the depth and breadth required to fulfill the curricular goals and offers maximum flexibility for students to achieve them. The objectives are to provide students with a strong background in chemistry for graduate work in the sciences, to give students an adequate background in chemistry to enter a science oriented profession like medicine or dentistry, and to offer opportunities to learn about chemistry and its impact on the everyday world.

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These goals are best accomplished by close student faculty interaction. Classes and laboratories are kept small to foster a mentor/mentee relationship and to facilitate learning on many levels.

The curriculum begins with a one semester introduction to the field, and is followed by two semesters of organic chemistry. For the fourth semester students choose from among several courses, including analytical chemistry, inorganic chemistry or biophysical chemistry, depending upon their goals and interests. In the third year students take classical physical chemistry and/or quantum chemistry, along with an integrated laboratory course that serves as an introduction to research. Upper level courses for juniors and seniors are offered in inorganic chemistry, organic chemistry or biophysical chemistry.

The cornerstone of the major is the required Senior Project, whereby students conduct research under the direction of a faculty mentor. This experience is critical to the accomplishment of the pedagogical aims of the concentration, which include understanding model and using them to make predictions, developing problem solving skills, and instilling confidence in students' own capabilities to do science.

To address the needs of the non science major the department also offers more broadly based courses that tend to stress the impact of chemistry on daily life more than chemical principles. These courses vary somewhat in content and emphasis, but recent titles include "Our Chemical Environment," "Miracles, Disasters and Everyday Chemistry," and "Environment, Technology and Chemistry."

In 1987 the Chemistry and Biology departments established a joint concentration in Biochemistry/ Molecular Biology, a field which has blossomed in the last twenty years and forms the basis of genetic engineering, biotechnology and most of modern medical research. Probing the chemical processes that occur in living organisms with the tools of biochemistry and molecular biology reveals the hitherto unknown details of how cells function and how they cope with diseases. The major is administered by representatives of the Chemistry and Biology Departments. Numbers of students in the program have grown substantially since its inception and the major has provided students with a broadly based background that has led to graduate school in biochemistry and/or molecular biology, to medical school or to employment in a technical field.

Computer Science

Computer Science is the study of how to represent and manipulate information. It addresses the abstract properties of algorithms and data structures, their mechanical and linguistic realizations, and their applications. The fundamental question underlying all of computer science is "what can be automated?".

In designing a computer science concentration at Hamilton, we have been guided by our belief in the importance of a liberal arts education, and so have designed a program which emphasizes formal principles (at the expense of technical content), while fostering the development of excellent oral and written communication skills, a sense of historical, ethical, and cultural perspective, and a breadth of theoretical background.

We teach the principles of computer science, if for no other reason than the rapid advance of computer science renders current practices obsolete in a very short time. Indeed, the observation in computer science folklore that the working knowledge of a computer scientist has a half life of five years demands that our students must be prepared to adapt to change, rather than relying on an unchanging body of facts. In short, we seek to provide our students with the facility to learn any topic which may not happen to be included in the curriculum.

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With this principle of adaptability in mind, we have developed a curriculum that has been nationally recognized as innovative not only for its liberal arts orientation, but also for its content and approach to teaching and learning. The Department considers computer science a "contact sport," best suited to a hands on, experiential learning environment. So, many courses, particularly the introductory ones, are laboratory based. The introductory sequence has been completely overhauled within the past three years to include a lab based survey of the discipline (which includes sections on history, ethics, and the social consequences of computing, as well as more interactive treatments of hardware and software), and a three semester introduction to object¬ oriented programming. Texts and lab materials for these courses were written by department faculty and published expressly for these courses. The curriculum progresses through courses in algorithms, computer architecture, system software, parallel programming, artificial intelligence, and theory of computation, and culminates with a senior seminar in which students work on live research projects for faculty from departments all around carnpus.

Geology

- To educate all students and to present the geosciences as relevant to everyone, not just geoscientists.
- To prepare students who will pursue careers in the geosciences with adequate and broad backgrounds in the major subdisciplines of geology.
- To emphasize active, rather than passive, learning environments in the classroom, to offer discovery and inquiry based courses that are content and concept rich, and to place emphasis on concepts, processes of science, posing researchable questions, thinking like a scientist, etc., rather than solely on mastery of a body of facts.
- To infuse the excitement of research into all courses and to incorporate new knowledge into lower division courses.
- To give students experience in analytical techniques appropriately integrated into solving problems in particular disciplines.
- To offer students field experiences both as activities appropriately integrated into courses and as separate field courses.
- To emphasize development of critical thinking skills, lifelong learning skills, teamwork, quantitative skills, and oral and written communication skills.
- To stress interdisciplinary connections and multi disciplinary perspectives.
- To increase effective use of technology.

One of our principal aims is to offer a flexible Geology curriculum that is appropriate for those who will ultimately pursue careers in geology, that is attractive and relevant to those who choose a major in Geology as part of a liberal arts education, and that is illuminating and mind-broadening for those who will take only a single course in Geology.

We are committed to effective and innovative teaching and believe deeply that the best way for students to learn and to develop lifelong learning skills is for them to be actively engaged in their own education. Faculty in the Department use a variety of strategies for achieving that goal, including hands on experiences in the classroom, lab, and field, discussions, projects emphasizing analysis and critical thinking, research and research like experiences integrated into courses, group work and oral presentations, and independent research with a faculty mentor.

The Department is also committed to interdisciplinary connections between geology and other disciplines. The Department is a major contributor to the interdisciplinary minor in Environmental Studies, we offer cross listed, interdisciplinary courses with the Archaeology, Biology, and Africana Studies Departments, and we are one of a very few schools to offer a Geoarchaeology major.

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Mathematics

Mathematics is the language of science and of social science, of business and of commerce. The study of mathematics requires the ability to abstract and organize information, to reason and argue logically, to employ effective problem solving strategies, and to communicate one's ideas and discoveries in a well organized and precise fashion. To attain these lofty sounding goals, we in the Mathematics deparunent work closely with our students in a variety of course formats ranging from fairly formal lectures to intimate seminars. In each, we address the two fold goal of improving the student's competence in the subject matter while at the same time providing skills useful in the wider arenas of the college and that dreaded place "the real world".

Mathematics students graduate from Hamilton with all these abilities, as well as strong communications skills, in addition to a demonstrated ability to deal with quantitative problems. They go on to careers in banking, communication, education, the securities, insurance and computer industries, as well as government. Others enter graduate programs in medicine, law and business, or pursue graduate work in mathematics, applied mathematics, statistics, computer science, economics, and engineering.

The majority of our students choose mathematics because they find it interesting in its own right rather than because they need it for some other goal. Given that fact, it is of note that we average 20 25 majors per year. These students are equally divided between men and women and include a cross section of the community at large.

As technological advances broaden the variety of tools available for the investigation of mathematical questions, we have responded by including more such technology in our courses. We see this as a major area of change over the next decade.

The Mathematics curriculum begins with a two semester calculus sequence and culminates in the Senior Seminar, taken by all majors in the fall of their senior year. These small seminars focus on different areas of mathematics and are primarily presentations by students of their own work. The following spring, students may elect to write a thesis, working independently under faculty guidance.

Physics

Physics is the study of how the universe works. It is a quest for the simple rules that underlie all the wonderful complexity we see around us, from why water runs down hill to why the stars shine. The study of physics benefits the imagination and the intellect and promotes the ability to function with confidence in our technological society.

Our educational concerns have centered on two kinds of students who, taken together, we believe, make up a large part of our student body. The first, and smaller, segment is made up of those students who want to be majors in physics at a liberal arts college. Some of these will also want to go on to graduate school in physics or to professional school in engineering after their time here and it is thus incumbent on us to provide them with that basis in physics which will stand them in good stead at that professional leveL The second segment is made up of those students who wish to study physics at the college level but who have compelling interests and talents in other disciplines. While they wish to gain substantive, coherent knowledge of our field, other curricular plans impose limits on the time they can spend with us. For these students we offer courses that avoid the highly ordered and mathematical structure of our concentration while still providing education in the theories and methods of physics. To sum up, these courses must be understandable at the college entry level, stimulating for beginning students, but mathematically less threatening than most of those we offer to our majors.

For the first group of students we can claim that we have been successful because our physics majors have gone on to the best engineering and physics programs in the country,e.g. M.I.T., Cornell, Princeton, Chicago, Yale, Columbia In addition, close student faculty collaboration is an essential part of our program. Each physics major has a research experience before graduation: each does a senior project with a faculty member.

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As a result of this research, and as further evidence of our success, in the last decade our seniors have been three times among the four to six finalists chosen each year for the Apker Award, given for the best undergraduate research done in the U.S. during that year by the American Physical Society. Two of our seniors since 1984 have won Watson Fellowships in a national contest and finally, and most important, all of our majors have gone on to satisfying careers in science, in engineering, in law, in medicine, in computer science, in biotech, in business, in architecture, in teaching, in banking, in music, in the theater, etc.

With regard to our majors it should also be noted that since the middle 80's our average number of majors has grown while nationally the trend has been steadily down. At present there are less than 4300 physics majors graduated annually from the roughly 900 schools that offer such a major. Since our average number of majors per year over the last decade is 6 we are at or above the national average, which, by the way, among the 900, is generated by a plurality of schools much bigger than us. Thus, here too our curriculum seems to be working well.

For the second group we can also claim success but for different reasons. Here the test of success is how well we do in attracting enrollees to our less mathematical courses. These courses include: Physics of Architecture, Light and the Laser, The Physicist's View of Nature, Introduction to Astronomy, Energy and the Environment, The Physics of Musical Sound and Electronics and Computers. Altogether these courses reach out to 200 students or more who otherwise would probably have taken no physics. The variety of offerings is, we believe, important in attracting such a large pool of students as there are incentives here for those also interested in the social sciences, in the arts, as well as those in the humanities and elsewhere who believe that they should understand something of physics in order to better understand our modern world.

Of course physics has ties to other disciplines which are indicated by the above list. We contribute to the Environmental Science Program, to the Music offerings, and to the Computer Science Major. We offer courses to majors in computer science, chemistry, biology, geology, mathematics and psychology and we prepare students for engineering school. Our curriculum is predicated on the interdisciplinary nature of physics.

Physics fits perfectly into the liberal arts curriculum. Our courses stimulate analytic thinking, intelligent reading, organized writing and clear speaking. An important part of our program is the kind of hands on experience which, at its best, is found in the laboratory. All of this lends itself to educating students to think and act for themselves. Our students' satisfaction, their sense of achievement and pleasure in studying physics, as well as the success of our graduates, whether majors or not, whatever their endeavors, are the best, and most satisfying, measures of our physics curriculum.

Our mission is to continue along these same paths: enhancing our research interests by acquiring and using modern equipment as it becomes available; providing dedicated space for these student faculty projects that have been so successful; making available classrooms, labs and staff that will allow us to continue to develop our interdisciplinary courses and, finally, by means of our good facilities, a strong curriculum and an excellent record being able to attract good students and faculty to Hamilton.

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Psychology

Hamilton courses in psychology are designed to examine the discoveries that have been made about behavior, the theories that have been proposed to account for behavior, and the methods by which behavior is studied. It is our goal to teach the use of the scientific method with the broad aim of having our students acquire critical and analytic skills and the more specific aim of teaching them the use of this approach for describing and understanding psychological phenomena Class and laboratory work focus on the particular methods of observation and theory construction used by psychologists as well as on the results produced by these methods. It is our hope that students in psychology will develop an appreciation of the strengths and limitations of these methods and thereby acquire an understanding of the similarities and differences between varying approaches for interpreting behavior and mental activity.

The program is intended to cover the major areas of psychology for the liberal arts student. In addition, the department sponsors two concentrations to provide specific preparation for professional study in psychology and related fields. The program in General Psychology is designed to educate students in the major areas of psychology, whereas the program in Psychobiology is designed to provide students with an interdisciplinary foundation in psychology, biology, and chemistry, with more advanced work related to neuroscience.

This mission is accomplished by providing students with a curriculum that is based in courses with strong laboratory experiences at every level. Introductory Psychology is taught in small (40 student maximum) sections, and includes exercises that allow students to collect data and write scientific reports. At the 200 level, students take Research Methods in Psychology, which focuses on single subject, experimental, and correlational approaches to the study of behavior.

Statistics in Psychological Research provides students with an understanding of the principles behind the commonly used statistical techniques in psychological research and experience in using computer software to conduct analyses. At the 300 level, the Department offers eight courses on topics that span the discipline; each of these courses contains an in depth laboratory component in which students gain experience with the methods in specific areas of psychology. All students complete senior projects, almost all of which are empirical research studies, and they write a final thesis and make an oral presentation of their work. ■