Assessment Plan
for the
Hendrix College
Biology Department

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Educational Philosophy of the Biology Department

Biology education at Hendrix College contains the following components: a rigorous sequence of integrated core courses to provide breadth in the discipline, a wide selection of challenging advanced courses, investigational laboratories associated with both core and upper level courses, and the opportunity to be involved in genuine research. We believe that a curriculum designed with these guidelines will provide our students with an excellent understanding of biology and the best opportunity for continued success as they proceed on to graduate or professional schools, or move directly into the work force.

At the center of our educational philosophy is a strong belief that every student benefits by taking course work in all major areas of biological science. Thus we require that all students take six core courses that cover the entire breadth of modern biology. These courses are designed to be rigorous within the individual discipline while still highlighting the connections between the various aspects of biological science and between biology and society as a whole. These courses should be supported by a coordinated, relevant, general education curriculum, a highlight of which is allowing all students to participate in the scientific process integral to life sciences and to the formation of an informed world view. In addition, majors take at least four upper level biology courses of their choice, giving them the opportunity to either focus on a particular discipline or take a more diverse package of courses across the whole spectrum of biology. Providing excellence in education across this broad discipline requires a sufficient number of high-quality biologists who are student-oriented teachers with the time to spend with individual students and the resources to make effective use of that time.

Laboratory experiences are crucial to the success of these courses and to the best education of the students. These laboratory experiences need to be as investigational as time and resources will allow while also encouraging the students to participate in a group learning experience. Time in the laboratory should engender in students an enthusiasm for the research process in addition to teaching the skills necessary to conduct a successful project. This requires a physically comfortable and emotionally positive learning environment which is accessible to and conducive to collaborative learning. In order to make both the lectures and laboratories work well, we require extensive support services (audio-visual, library, technical training, computers, animal care, secretarial) to make the physical tasks possible.

Regardless of how it is constructed, no classroom or directed laboratory experience can provide the student a completely realistic research experience. We therefore strongly encourage students to participate in undergraduate research. Several options for research are available to students and will be discussed in more detail later. There is more to research than experiments in
the laboratory, however, and for the experience to be most valuable students need the opportunity to present their data and conclusions in a formal academic setting. We therefore require students to prepare written reports of their research and, if they were able to accumulate sufficient data, to present their research at a scientific conference and prepare their results for publication.

**Pedagogy**

All Biology faculty at Hendrix are very student oriented and feel that advising is much more than dealing with curricular concerns. We share the idea that the life sciences are an integral part of a liberal arts tradition and thus consider advisers to function as mentors “unto the whole person”. This personal mentoring is expressed both in our approach to the classroom, where discussion and other forms of student involvement are encouraged and expected, and in the laboratory. We are all dedicated to providing high quality laboratory experiences for our students and thus feel that having good laboratory equipment, a safe and comfortable setting, and a pleasant laboratory atmosphere are vital to our teaching and highly conducive to student learning. With the large numbers of majors compared to the number of faculty, we will continue to rely on lecture, discussion and cooperative learning interactions as important components of our teaching. We all see the merit of moving, when appropriate to the material and the available resources, to a more discovery-based, highly interactive teaching methodology, and will use more of this teaching style as the resources become available.

In the life sciences, as in all sciences, the greater the comprehension of the current paradigms driving the field of endeavor, the greater the familiarity with the technology used, and the better the mastery of the process of science, the more independent the learner becomes. Thus, we see a progression (although not a linear one) during which students move from assimilation of facts to become contributing participants in the scientific process. To aid in this progression, all classes, even the most basic, should offer opportunities for students to utilize resource material, formulate scientific questions, analyze data, and critically evaluate conclusions. The ultimate experience is for the student to formulate a unique scientific question, perform the research to find an unequivocal answer that raises further questions of genuine scientific significance, make oral presentations of the findings, and publish this work in the specialized literature of the field. While not all students are capable of that quality work, many are and the others benefit by being a part of the peer group in this type of environment.
Aims of the Biology Department

The aims of the Biology Department listed below reflect our educational philosophy and indicate the areas where we hope to improve in the future.

1. Create a safe and positive learning environment for all participants.
2. Effect a personal engagement in biological awareness that affords the most positive long-term impact on the student's intellectual, moral, and professional development.
3. Provide the appropriate undergraduate investigative skills and conceptual knowledge in biology to promote admission into national caliber professional and graduate schools and continued success once there.
4. Increase our retention rate in the biological sciences and our success as measured by national rankings in the number of majors obtaining professional and Ph.D. degrees.
5. Raise the level of appreciation and understanding for the processes of nature and our natural history in all Hendrix students, faculty and alumni.
6. Optimal implementation of aims 2 through 5 demands that we offer laboratory experience in all of our courses. We currently can not offer laboratory sections for Cell Biology or for most of the Natural Science courses. Fulfilling this aim will require considerable expansion of our resources. Because of staffing limitations and the space constraints imposed by Buhler Hall, laboratory sections for Cell Biology must await construction of the new Life Sciences building and the hiring of a laboratory coordinator. Laboratory sections for the Natural Science courses will not begin until the Cell Biology laboratories are in place and an additional faculty member hired.
7. Obtain continued outside funding and national recognition for undergraduate research performed in the biological sciences at Hendrix College.
8. Enhance and expand our Summer Opportunities Program for undergraduate student internships and research programs.
9. Play an outreach role in the reform of science education by example, and by cooperative interaction with local, state, and federal agencies.
Curriculum

The biology major at Hendrix College requires that students:

• take six core courses that cover the breadth of biological science. These courses are
  2. General Botany.
  5. General Physiology.

• take four upper level biology courses to provide depth in one or more subdisciplines.

• take at least two chemistry courses (although taking four is strongly recommended, as are two
  physics and two mathematics courses).

• participate in one term of Senior Seminar during which students make formal scientific
  presentations of their research, or a presentation based on a recent paper from a leading
  scientific journal.

• make a passing score on the Senior Comprehensive exam. This score is based on two
  components, the score on a national standardized exam and delivery of the Senior Seminar.

  All students are strongly encouraged to participate in a research or internship program.

They have a variety of options for gaining this experience including:

• an Independent Study project in which they develop their own hypotheses and then, with the
  help of a faculty mentors, design appropriate experiments to test their ideas.

• Internship programs developed with the assistance of the Office of Student Development and
  Biology faculty mentors.

• participation in an ongoing research program developed by one of the Biology Department
  faculty.

• participation though our Summer Opportunities Program in which we help students identify
  and apply to a wide range of programs hosted at research institutions across the country.

• various summer courses for which students pay tuition to participate in research and lecture
  settings.

  Students who participate in the research programs described above are strongly encouraged
  to present their findings during our Senior Seminar, and, when appropriate, at local and national
  scientific conferences such as the Arkansas Academy of Science and the National Conference on
  Undergraduate Research.
Fulfilling the Aims of the College

As a classic, liberal arts oriented department, we feel that our aims and goals match very well with those of the college. In particular, we feel that our program most successfully addresses the following aims described in the College’s Statement of Purpose:

- **Critical examination of intellectual traditions shaping the contemporary world.** Our courses are designed to trace the historical development of many crucial paradigms in biology so that students can understand the intellectual process involved in the development of scientific theories. Many of these paradigms strongly effect our day to day life and the decision making processes that will shape our world in the near future.

- **Development of skill and effectiveness in the use of language, the analysis of information, and the communication of knowledge.** Most courses in the biology curriculum require students to read and critically analyze scientific data and research papers, and to be able to summarize their understanding of the research orally, on exams, or in written summaries. The development of these skills culminates in Senior Seminar presentations and in participation at scientific conferences.

- **Exploration of connections between the humanities, natural sciences and social sciences.** It is impossible to accurately discuss scientific advances without putting them into their proper historical and social context. In particular, as we look at the social and ethical issues facing us today (AIDS and other diseases, overpopulation, environmental degradation), a solid grasp of biology is crucial for making educated decisions about many crucial problems.

- **Participation in depth in a specific field of study.** Our curricula with its six core courses and four elective upper level courses insures that students experience both breadth and depth in the biological sciences. Our emphasis on research both in the course laboratories and as independent research projects is the best possible way to illustrate how new knowledge in the field is discovered. Finally, we try to emphasize in all our courses the implications of new scientific knowledge to society as a whole.

- **Enduring intellectual curiosity and love of knowledge.** In our courses, we constantly endeavor to convey the excitement of scientific discovery. We utilize the newest scientific breakthroughs to generate discussion and contemplation on how science is done and how it effects society. Furthermore, illustrations of how the scientific method was used in the development of these breakthroughs provides students a rigorous method for testing the validity of ideas that is applicable to all areas of knowledge. Finally, participation in a research project is the best possible tool for generating and demonstrating intellectual curiosity.
• **Discernment of the social, spiritual and ecological needs of our times.** The study of biology leads students into a deep understanding of many important current issues and what steps are being taken to address these problems. Several Biology faculty have been participants in the Sustainability and Global Education initiative and we anticipate that members of the department will continue to make contributions to this important new program.

• **A sense of responsibility for leadership and service.** Most of our majors will go on to professional or graduate schools. Upon completion of these advanced degrees, they will assume leadership roles in providing health care, discovering new medical treatments, increasing our understanding of medicine, improving our understanding of the natural world and developing solutions for ecological problems. The Biology curriculum is designed to enhance understanding of these issues and to prepare our students to make educated decisions.

**Assessment**

The Biology Department uses several assessment tools to gauge how well we meet the aims of the Department and the College, and to identify areas where we need further work. Some of our tools give solid numbers while others are more subjective in nature.

**Assessing the overall success of the biology program.** The most important gauge of our teaching success, and unfortunately one of the most difficult to quantify, is the degree of success our alumni experience as they continue their education and begin their careers. In other words, have we prepared our students for "lives of fulfillment in their communities and the world"? To this end, we track current students and keep in contact with recent graduates to obtain the following information:

• the number of biology majors in each graduating class. If these numbers remain high, it indicates that our students find a biology major to be very useful in their career plans.

• the acceptance rates into medical school (including which medical schools) and subsequent graduation rates.

• the acceptance rates into other professional schools (Veterinary Medicine, Pharmacy, Physical Therapy, Dental, etc.) and subsequent graduation rates.

• the acceptance rates into graduate school, publication of papers while in graduate school, and completion of degrees. We will supplement this data with externally compiled reports which detail the number of Ph.D's awarded to students from undergraduate institutions. For example, the "National Science Foundation/SRS, Survey of Earned Doctorates" compiles statistics for all
colleges and universities while Franklin & Marshall compile a report entitled “Baccalaureate Origins of Doctoral Recipients” which focuses on graduates of 4-year private institutions.

• success at obtaining immediate employment for those who choose not to continue their academic education.

• relative level of preparation. Although impossible to accurately quantify, we also try to ascertain whether our alumni feel well prepared when they start their advanced academic programs, especially with regard to how they perform in comparison to students from other programs. As a new assessment tool starting with the end of the 1998 academic year, a survey form will be sent to alumni who have been in advanced programs for two or more years asking them to assess their level of undergraduate preparation in comparison to their peers. This form will also ask students what elements of the curriculum were most or least helpful and what changes might be made to enhance the preparation of future students.

• student assessment of the Biology curriculum. We collect a survey each year of our graduating seniors, asking them to identify strengths and weaknesses of our program.

Assessing understanding of content and paradigms in Biological Science. Our major quantitative tool for assessing the depth and breadth of student knowledge comes from the Major Field Assessment Test (MFT). This test, prepared by the Educational Testing Service, is administered at several hundred colleges nationwide. It tests the basic material that we cover in the six core courses so students should be well prepared regardless of what upper level courses they take. The scores from the MFT allow us to compare (1) how our students performed in comparison to each other, (2) how they performed in comparison to students around the country and (3) how they performed in each of three subset categories. We can match up these subset categories fairly closely with particular core courses. We use the individual overall scores and subset scores to assess the breadth and depth of each student’s understanding of the basics of Biological Science. We use the group data (how Hendrix students performed compared to all students taking the test), especially group subset scores, to identify any weak areas in our teaching where we need to enhance coverage. To make taking the test a more worthwhile experience for the students, we use the overall score on the test as 75% of their Senior Comprehensive grade.

Many of our students take the MCAT exam as part of their applications to medical school. Furthermore, some of our students take the Graduate Record Examination, the entrance exam for veterinary school, and other specialized exams. We will collect and summarize their results to assess how well we are doing as a department to prepare students for these exams.
Assessing critical analysis and communication skills. The remaining 25% of the Comprehensive Grade comes from the Senior Seminar presentation. In addition, the seminar presentation provides an important assessment tool as we observe formal demonstrations of the critical analysis and oral communication skills students have gained throughout their education. The seminars are carefully evaluated for these and other criteria (preparation of background material, use of visual aids, etc.) with both a written and verbal analysis of their performance returned to the presenter.

Assessing student involvement in research. We continue to work diligently to maintain high levels of student participation in research projects. The success of these efforts are measured in:

- the number of students who undertake Independent Study projects within the Department.
- the number and quality of research papers written by students. Copies of these written reports are maintained in the Departmental office.
- the number of applications and acceptances to the National Conference on Undergraduate Research and the Arkansas Academy of Sciences annual meetings.
- the number of students accepted to summer research positions through the Summer Opportunities Program.
- The number of research papers accepted for publication in scientific journals. Reprints of these articles are maintained in the Departmental office.

Outside Consultants. We also make use of outside consultants. In 1992, Kipp Kruse and Gary Reiness provided us with an excellent consultation that served as the basis for a tremendous amount of discussion and re-evaluation of our program. We plan to invite another consultant to examine our program during the 1998-1999 academic year. We are eager to see how well the recommendations of our 92 consultation have been met and to get new ideas on how to proceed in our ongoing efforts to maintain an excellent teaching program.
Table 1.

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<th>Year</th>
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<th>97-98</th>
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<td>% of Biology Graduates</td>
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<td>21</td>
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<td>7</td>
<td>6</td>
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<td>6</td>
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<td>2</td>
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* Some students have been involved in more than one research project.
** Research projects done for course credit

Table 2

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<th>Major Field Test</th>
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<th>95-96</th>
<th>96-97</th>
<th>97-98</th>
<th>98-99</th>
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<td>94%</td>
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<td>Subscores Cell Biology</td>
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<td>99%</td>
<td>99%</td>
<td>97%</td>
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<td>93%</td>
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<tr>
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<td>99%</td>
<td>93%</td>
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<td>90%</td>
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<td>Pop. Biol./Evol./Ecology</td>
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<td>98%</td>
<td>98%</td>
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