

## 1. Program Description and Scope

The primary objective of the Biology Transfer Program is to provide students majoring in biology and related disciplines with the core science courses they will need for transfer to a four-year institution of higher education, and to impart to them the necessary scientific background for successful completion of a program of study leading to a Baccalaureate Degree. The Biology Transfer Program, therefore, offers a regimen of science courses equivalent in content and quality to the core science courses that need to be completed during the first two years of undergraduate study in biology programs at UC, CSU and other universities. This includes two semesters of inorganic chemistry (Chem 101A and Chem 101B), two semesters of organic chemistry (Chem 112A and Chem 112B), one semester of calculus (Math 101A), two semesters of physics (Phys 120 and Phys 121 or Phys 140, Phys 141, and Phys 142), and two semesters of biology (Biol 101A and Biol 101B).

To help insure that students in the Program are taking the correct courses for transfer, Ohlone College has developed the A.S. degree in Biology. Students completing this degree will have completed courses that fulfill lower division requirements for most biology programs at UC and CSU.

The majority of students taking courses in the Biology Transfer Program are biology and pre-medicine majors. Nonetheless, the program also serves the needs of students in other science disciplines such as biotechnology, bioengineering, public health, environmental science, and related areas. Students in these latter disciplines take one or several, but not the entire core, of program courses to satisfy transfer requirements. To a lesser extent, courses in the program are also taken for personal edification by non-degree seeking students or students in non-science disciplines.

The Biology Transfer Program has a strong organic connection to the College's Biotechnology Program. In fact, the Biotechnology Program grew out of curricula first offered in the Biology Department. Biol 100D, Ohlone's first biotechnology laboratory course, was offered in the spring 2000 semester. Although Biol 100D was not a core part of the Biology Transfer Program, the first several cohorts of students taking this class included a number of students also enrolled in the Biology Transfer Program. As the Biotechnology Program has expanded since 2000, becoming its own department in 2003, there has continued to be significant mutual influence in curriculum development between Biotechnology and the Biology Transfer Program. Courses in both programs are taught by some of the same full-time faculty.

Students in the Biology Transfer Program have benefited from Bridges to the Future Programs with area universities. These programs, funded by grants from the National Institutes of Health, provide academic support and molecular/biomedical/biotechnology research training for qualifying minority students seeking transfer from the community college to a four-year institution of higher education. The students are mentored by Ohlone College program coordinators, all of whom have been and are faculty in the Biology Transfer Program, as well as by scientists at the hosting university and scientists at participating research institutions. Ohlone College participated in a Bridges program with CSU-East Bay (then CSU-Hayward) until the program was discontinued in 2003. The CSU-EB program was specifically aimed at biology majors, and all students from Ohlone accepted into the program were from the Biology Transfer Program. In 2003 Ohlone College was invited to participate in a Bridges to the Future Program grant hosted by San Jose State University. The program officially started in 2005 and is now in its second year.

The Biology Transfer Program has partnered with Computer Applications and Occupational Technology to develop and implement COAT 147, Computer Applications in Biology. In Biol 101A and Biol 101B computers are routinely used in laboratory exercises to gather physiological, environmental, and chemical data and to monitor physiological processes. Additionally, data gathered from laboratory experiments are analyzed using appropriate statistical software, and analyses are presented in computer-generated graphical form. COAT 147 was designed with the needs of biology students in mind. Enrollment in COAT 147 is linked to enrollment in Biol 101A, and the two courses share common student assignments. A similar learning-community collaboration currently is being planned with ENGL 101.

During the Fall semester, 2006, key faculty from biology and chemistry formed the Biology-Chemistry Learning Community. The goals of this association is to examine and synchronize common course

content, to discuss and agree upon academic standards, to share ideas and visions, and to build more coordinated course content between the chemistry and biology courses in the program.

## 2. Relationship to Ohlone College Mission and Goals

*Goal 2: Develop across the curriculum the Learning College Model, utilizing methods and technologies that hold the most promise for improving student course and program completion success rates.*

Throughout the Biology Transfer Program a large variety of approaches to teaching are utilized: traditional lectures, laboratory exercises, student research projects, instructional cds, films, computer simulations, and more. Teaching laboratories are equipped with up-to-date scientific instrumentation and train students in relevant modern laboratory procedures and techniques that will be needed in future academic or industrial pursuits. More lab exercises have been added to train students in important molecular biological techniques such as PCR, southern blotting, restriction site mapping, and others. Lecture content has also increased the emphasis in understanding biological processes at the molecular level. This has been done without sacrificing more traditional approaches.

The core science courses are each supported by a one-unit discussion course (Biol 131D, Chem 131D, and Phys 131D) which are intended to increase student understanding and success in the science courses. In the 131D series, learning strategies are presented, more difficult concepts further dissected, examples of examination problems and how to approach them are discussed, test results are reviewed and suggestions for improvement are given.

The Biology-Chemistry Tutorial Center, housed in building 8, hires student peer tutors, many of whom are students who have successfully completed coursework in the Biology Transfer Program. The tutorial center has been an important resource for students in the program to receive help and support from peer mentors. Additionally, the center houses a number of computer stations where students have internet access and have access to instructional software and cds relevant to program coursework.

*Goal 3: Develop strategies to increase the proportion of full-time students including learning communities, cohort groups, enhanced facilities, and improved course availability.*

Faculty teaching core science courses in the Program work together to provide course scheduling with minimum or no overlap so that students in the program can enroll in Program courses without encountering scheduling conflicts, thereby allowing students to more easily carry full-time loads.

As discussed above, chemistry and biology faculty who teach courses in the Biology Transfer Program have formed the Biology-Chemistry Learning Community.

## 3. Program Student Learning Outcomes

1. Students will demonstrate the correct operating procedures in the use of common lab equipment such as compound microscopes, spectrophotometer, pH meter, electrophoresis gel apparatus, micropipetters, and centrifuges.

**BACKGROUND:** Students in the Biology Transfer Program will be using certain laboratory equipment multiple times throughout their studies at Ohlone. In some cases, the lab equipment will be encountered in one particular lab class. For example, microscopes will be used often in biology labs, but never in physics or chemistry labs. In other cases, the same lab equipment will be used, for example, in both chemistry and biology (spectrophotometer). At the end of the program, a student will need to demonstrate the ability to correctly use a commonly encountered lab instrument.

**ASSESSMENT.** Questions requiring the demonstration of the correct use of equipment will be included on laboratory practical exams. Practical exams in Chemistry 101A will test a student's ability to

use pH meters and spectrophotometers. The student's ability to use pH meters and spectrophotometers will again be tested in Biology 101A and/or Biology 101B. The ability to correctly use equipment that is limited to Biology, such as microscopes and electrophoresis gel apparatuses, will be assessed by questions on lab practical exams in Biology 101A and Biology 101B, once near the time the instrument was introduced, and then again at the end of Biology 101B. Student success are scored as follows:

4. Student can correctly use instrument, completing all of the required steps in it use in the proper order.
3. Student performs most of the steps in the proper order, but omits one or two minor, non-critical steps.
2. Student omits many steps, including critical ones, or performs them out of order.
1. Student cannot operate instrument.

2. Students will construct, for analytical purposes, appropriate graphs from raw experimental data.

**BACKGROUND:** Students in the program perform investigative experiments in all science classes (physics, chemistry, and biology) that constitute the core of the program. It is essential that students can collect, analyze, and graphically present the results of scientific investigations.

**ASSESSMENT.** One lab exercise involving graphing will be selected for evaluation in all Chem 101A sections. Since Chem 101A is a prerequisite for Biol 101A and Chem 112A, this will provide the baseline data for initial graphing skills. To measure improvement in graphing skills, one graphing exercise will be selected for evaluation in all sections of each of Biol 101B, Chem 112B, and Phys 121. These last three courses are taken by students near the end of the program. Each selected graphing exercise will be given a score of 10 points. Comparisons between and among results will be based on raw scores.

3. Student will list common laboratory safety guidelines.

**BACKGROUND:** Science courses in the Program are heavily laboratory based. Many laboratory safety procedures and guidelines are equally applicable to biology, chemistry, or physics laboratory settings.

**ASSESSMENT.** Instruction in laboratory safety is introduced in Chem 101A and reinforced in all subsequent laboratory classes. Retention of common laboratory safety guidelines at the end of the Program is expected. Biol 101B and/or Chem 112B are the last core science courses taken in the Program. To assess student retention of lab safety guidelines, a questionnaire will be filled out by students near the end of Biol 101B asking students to list eight of the most important laboratory safety guidelines/practices. The responses will be compared to a ranked list of laboratory safety practices compiled and agreed upon beforehand by faculty. Student responses are scored by number of practices listed that are on the faculty's list, giving scores between 0 to 8.

4. Student will list and briefly explain the main concepts of modern evolutionary theory.

**BACKGROUND:** All of modern biology is informed by evolutionary theory. Even in the realm of biomedical research, theoretical and practical considerations in problem solving cannot ignore the evolutionary history of the organisms, genes or proteins under consideration, nor the factors governing evolutionary change. There are a number of persistent and widespread misconceptions about biological evolution circulating in American society in general. It is important that students completing the Biology Transfer Program know the correct version of evolutionary theory accepted by biologists.

**ASSESSMENT.** Biological evolution is not a topic extensively discussed in chemistry, physics, or math. Thus, this particular student learning objective can be assessed only in Biol 101A and Biol

101B. Students enrolled in Biol 101A currently take a diagnostic test to assess their retention of chemistry and their initial knowledge of biology. Questions regarding biological evolution will be added to this test to assess students' initial knowledge of biological evolution. The same questions will be asked again as part of the final exam in Biol 101B.

#### 4. Assessment of Student Success in Reaching Program Outcomes

This section of our report cannot be adequately completed until the next program review. Beginning with the academic year 2007-2008, the above methods of assessing student success are being put into place. Data for evaluating the success of the program using the criteria discussed above have yet to be fully gathered and analyzed.

Nonetheless, some statements can be made regarding past methods of evaluation and recognizable trends. Past means of evaluating the Program's success depended on tabulating the numbers of students in the Program who had completed degrees, or certificates, or merely completed courses in the Program's curricula. It has only been recently since the College has had an AS degree in Biology. Even now, some students in the Program transfer without applying for or receiving an AS degree in Biology. These students have successfully transferred from the Biology Transfer Program at Ohlone, but do not show up in statistics based on numbers of degrees awarded. Furthermore, many other students, lacking one or more of the core courses required for the AS degree in Biology, apply for a more general degree such as the AS degree in Natural Sciences. But this degree also includes students majoring in Chemistry, Physics, and other related disciplines, not just those who pass through the Biology Transfer Program. As a result of this, counting the number of degrees awarded in Biology underestimates the number of students who have been benefited by the Program.

Perhaps a better measure of past trends is the number of students completing Biology 101B with a C or better. Although this measure concentrates on completion of only one course in the Biology Transfer Program, students who have completed this course have also completed Biology 101A and Chemistry 101A (both with a C or better), and have likely completed other core courses as well. The following table shows by academic year the number of students since 2000 who have completed Biology 101B with a C or better.

Academic Year	Number of Students Completing Bio. 101 B
1999/2000	21
2000/2001	25
2001/2002	24
2002/2003	32
2003/2004	25
2004/2005	36
2005/2006	41
2006/2007	18

As can be seen in the table, the number of students completing Biology 101B has fluctuated from year to year, the overall trend up to 2006, however, has been toward a slight increase in the number of students completing Biology 101B. The increase in students completing the course in 2004/2005 and 2005/2006 may be due to the fact that Biology 101A and Biology 101B were both offered in the Spring 2005, Fall 2005, and Spring 2006 semesters. Traditionally Biology 101A is offered only in the fall and Biology 101B only in the spring. The drop in numbers for 2006/2007 needs more examination. This might be merely a one-time random decrease. The numbers over the next two years will determine whether or not this drop is part of a trend.

#### 5. Assessment of Program through Review of the Teaching Learning Process

We have just begun to gather data using the student learning objectives presented in section 3. Data will need to be obtained and analyzed before a comprehensive review of the success and effectiveness of the Program in achieving these SLO. This review will be assessed in the next program review cycle.

Nonetheless, we have come to appreciate the need for closer communication and collaboration between the diverse faculty who teach courses that are a part of the Biology Transfer Program. There are inherent and vital interrelationships between topical materials presented in chemistry, physics, mathematics and biology. So often students do not appear to fully appreciate the connection between what they learn in chemistry, math, or physics and its relevance to biology until much later when they find themselves in their first biology class. If students were more aware of the organic connectivity between these disciplines, it could well impact retention of subject matter acquired in chemistry, math and physics. This is one of the reasons for developing the Biology Chemistry Learning Community (BCLC) (see section 1). Over the past two semesters the BCLC have been discussing ways to improve student awareness of these interdisciplinary connections, particularly those between chemistry and biology. We will be introducing into the chemistry classes more biology-related examples for problem solving. Aspects of chemistry with important applications in biology will receive more emphasis in our chemistry classes. Finally, we are discussing ways to team teach portions of our classes, reinforcing to students the interdisciplinary connection between chemistry and biology. The work of the Biology Chemistry Learning Community is intended to promote an on-going review and assessment of our programs over the next several years.

Laboratory instruction is a central component of courses in the Biology Transfer Program. It is in laboratory exercises that students encounter visual and dynamic demonstrations of concepts presented in lecture. It is also in the laboratory that students learn vital data recording, analysis, and critical thinking skills important for their later success and advancement after transfer. Therefore it is essential that the laboratories in the program are up to date regarding techniques and equipment.

## **6. Assessment of Program Improvement since Previous Program Review**

This section will be developed in the next cycle of the program review.

## **7. Describe Review and Dissemination Team Involvement**

The following individuals have participated in this program review.

The Division Dean, Dr. Ron Quinta

Faculty members in the Program: Dr. James E. Baxter (Biology), Dr. Anu Ganguly (Chemistry), and Dr. Maru Grant (Chemistry).

Faculty member outside the program: Dr. Paul Belasky (Geology/Paleontology)

Members of the Biology Chemistry Learning Community: Dr. James E. Baxter (Biology), Dr. Anu Ganguly (Chemistry), Dr. Maru Grant (Chemistry), Yvette Niccolls (Math, Science, and Technology Coordinator), and Dr. Ron Quinta (Dean, Math, Science, and Technology).