

Annual Assessment Report
Biological and Chemical Sciences Major
Fall 2012

I. Executive Summary

In the past several years, the BCS major has made some very large changes. First, although we still meet as the faculty in Biological and Chemical Sciences we have split our major into 3 majors: Biology, Chemistry and Biochemistry and Molecular Biology. For this assessment report we will discuss our combined majors since the majority of our work has been on the shared senior level courses, but we realize that we will eventually need to split our majors and come up with separate mission statements, goals and objectives for each major. Because of this we will not include a detailed assessment plan in this report: we know we have the challenge of coming up with separate plans for each major in the future. This change brings us to the second point: Chemistry as a major no longer requires any Biology courses. This change will be documented in more detail below. Third, Biology changed its introductory sequence to 4 100-level introductory courses; this will also be discussed in more detail below. And finally, BCS changed its capstone sequence from requiring a written senior thesis to a junior year course that explores the scientific literature and a senior capstone seminar where the students delve deeper into a topic as well as learn more about “life after Wells.”

II. Changes outlined above

- 1. The Biological and Chemical Sciences major has split into 3 separate majors:** Biology, Chemistry, and Biochemistry and Molecular Biology. This change was made, in part, at the request of the Admissions Office. The three majors listed separately gives each more visibility and also minimizes the confusion among prospective students who didn't understand the one major three tracks concept (Biological and Chemical Sciences: Biology; Biological and Chemical Sciences: Chemistry; and Biological and Chemical Sciences: Biochemistry and Molecular Biology).
- 2. Changes to the Chemistry Track/Major:** Since the last assessment report the Chemistry track under the BCS Major was separated into its own distinct major, but still overseen by the Faculty in the Biological and Chemical Sciences Program. At the point that this separation occurred, changes were made to the requirements for the Chemistry major. The Chemistry track had had a 62-63 semester hour set of requirements (by far the largest number of any major at Wells), including 56 semester of hours of specific required courses, a choice of one of two 300-level courses in Physics (3 semester hours), and only one elective course in Chemistry (3-4 semester hours). In addition, because it required several courses in Biology, the Chemistry track was unlike Chemistry majors elsewhere and differed from the Biochemistry and Molecular Biology track by only a couple courses. The new chemistry major requires a total of 49-52 semester hours of courses (much more in line with the rest of campus), of which 40 semester hours are for specific required courses and 9-12 are from a set of electives.

Some of the advantages of these changes are that:

1. This configuration is more like a traditional Chemistry major and so would be more attractive to students looking for that option; this was a specific recommendation made by admissions.
2. There are fewer required courses (including electives), but depth in the subject has not been sacrificed.
3. Students are given a greater choice in electives (3 versus previous 1).
4. Students who are interested in the Chemistry/Biology interface can do Chemistry Major with a Biology Minor, or opt for the Biochemistry and Molecular Biology Major.
5. Students interested in the Chemistry/Physics interface could elect additional Physics courses as electives or do a Chemistry Major with a Physics Minor.
6. The fewer required courses (49-52 semester hours, versus the current 62-63), along with the flexibility of the electives, should make a Chemistry Major with an Education Minor easier to accomplish. This was a concern raised during the last review of the program in Education.
7. The set of required courses should, with some planning, leave at least one Junior- or Senior-year Fall Semester “open”, allowing students the opportunity to study off campus.
8. This change did not require any additional courses in the curriculum and so did not cause problems with staffing.

3. Changes to the Introductory Biology sequence: We changed our introductory course sequence to include 4 courses that can be taken in any order by both future majors and non-majors alike. We dropped BIOL 151 and BIOL 152 and replaced them with 4 100-level courses (Biol114L: Anatomy & Physiology 1; Biol119L: Ecology and Evolution; Biol126L: Genetics; and Biol130L: The Biology of Organisms).

Since the four 100-level biology courses are open to nonmajors and majors alike, they have helped remove the cultural perception that science is “hard” or “inaccessible”, or that only a select subgroup of students can do it. We see this as a very positive change. We also note that a mix of sophomores and freshmen, plus a smattering of upper division students in each of our 100 level biology courses is a healthy situation in terms of assisting freshmen, in particular, to adjust to the expectations of college life. Since the four courses can accommodate up to 96 students each semester (4 labs of 24 students per lab), we have fulfilled the college mandate to

accommodate a student body of 800 without additional teaching staff.

However, we remain understaffed in Biology as only three of our four regular biology faculty positions are filled. The empty fourth position encompasses teaching in the aquatic and invertebrate areas of biology and includes responsibility for the “Biology of Organisms” foundational (100 level) course, offered every spring.

To address this lack we continue to need the assistance of adjunct faculty every semester.

In the Fall 2012 we administered a questionnaire to the students in BCS 301 (the first class that took the 4-100 level Intro courses) and BCS 403 (some students that took the old introductory sequence). We asked:

Introductory Biology courses at Wells College: Assessment questionnaire

We are assessing our new program in introductory biology at Wells College, and we ask for your help.

We would appreciate it if you could answer the following six questions about the introductory biology courses. Some of you will have taken only courses in the new sequence. These include:

Biol 114: Anatomy & Physiology 1

Biol 119: Ecology and Evolution

Biol 126: Genetics

Biol 130: Biology of Organisms

Some of you may have had one or more of the new courses as well as courses from the following list of our “old” offerings:

Biol 151: The Biology of Cells

Biol 152: The Biology of Organisms

Biol 213: Ecology and Evolution

Biol 226: Genetics

Please answer the following questions as well as you can, indicating as directed which courses you took and which courses you refer to specifically. Thank you for your help!

Questions:

- 1. Which courses did you take and in which order?*
- 2. Looking back, would you have chosen to take the courses in a different order? If so, why?*
- 3. Which courses duplicated topics, and what topics were duplicated? Did you find duplication of material to be helpful, or did you consider it unnecessarily redundant?*
- 4. Was there any topic not covered in one of your introductory courses that you wish you had studied before advancing to upper division courses? If so, what topic or topics?*
- 5. How well prepared were you for your upper division courses in biology, after finishing the introductory sequence?*
- 6. Is there anything else you would like to tell us about our introductory courses in biology?*

Interestingly, each group of students felt that their experience was the best. The students who took the new courses (the current BCS 301 students) were very positive about their experience. Most of those students took Biol 126 first (we have since changed Biol 126 to be a spring course) and felt that it was a good introduction to the biology courses (although one student felt Genetics was too hard for a 1st semester student). Some students wanted more cell biology, while others felt that subject was covered in too many of the courses. There was some mention of overlap between Biology of Organisms and Ecology and Evolution, but that student had actually taken the old Biol 152 and therefore got the same lectures on Evolution twice! The students who took the old distribution requirements (those in BCS 403 currently) also thought that their experience was very positive. They enjoyed the progressive nature of study and seemed to think that since they took 100-level and then 200-level courses they were “getting somewhere”. The biggest complaint was with the removal of the Biol 151: The Biology of Cells course – many students felt that was an important foundation course that was now missing. However, we have covered those topics in the other courses so those concepts are not now missing, as is the perception. Another complaint was the lack of consistency in the style of lab reports, which we have discussed and this problem is removed from the current 4 course intro sequence where lab reports all follow a consistent format. In conclusion, the new 4 100-level introductory courses are in active development, with collaboration among the faculty to ensure that students are getting exposure to all of the essential concepts we need them to learn at the introductory level. We will continue to evaluate these courses to make sure nothing is removed inadvertently in the future.

Course-by-course assessments:

Biology 114L: Anatomy & Physiology 1. Instead of offering a 100-level course in Cellular Biology, we designed a 100-level course in anatomy and physiology. The course is designed to accomplish many goals. It satisfies the laboratory distribution requirement for all students, it serves as a course in the Women’s and Gender Studies program, and it is a requirement for students interested in certain graduate programs in the health professions, such as nursing and physicians’ assistant programs, as well as strongly recommended for pathology assistant programs. Furthermore, it covers topics in introductory biology that are part of the fundamental knowledge base for biology majors. Training built into the course includes: reading and analysis of graphed data; acquiring a working knowledge of descriptive statistics; developing the ability to format and complete a science laboratory report; acquiring a basic understanding of the meaning and inherent limitations within a well-crafted hypothesis; acquiring the ability to use basic laboratory equipment such as graduated cylinders, scales, pipettes, pressure cuffs, stethoscopes, thermometers, and the like; and developing the ability to work productively with others. Topics cover basic cellular biology as well as human anatomy and physiology of selected body systems including sensory systems, reproduction, locomotion, nutrition, and metabolism. Student evaluations following the first two semesters of the course were positive. In particular, students valued the direct relevance to daily life they found in the course material. They also appreciated the “student-centered” course structure, which minimizes lecture time and maximizes student activities.

Biol114L is part one of a two-semester sequence in A&P. In the spring of 2012, the second course, Biol330L: Anatomy & Physiology 2, was offered for the first time since 114L was initiated. Biol330L builds upon skills acquired in the first course, and it covers the remaining major systems in A&P (such as the nervous system), while incorporating the academic rigor associated with a 300 level biology course. This fulfills our need to offer upper-division courses in Biology that develop the skills of our majors, but it also accommodates those who do not major in Biology yet wish to complete two semesters of A&P. This is possible because, although majors in Biology are required to complete all four 100 level courses, most 300 level biology courses (including A&P 2) do not require all four 100 levels.

Biology 119L: Ecology and Evolution: This course was formerly Biol 213 with the same course name. Major changes that have occurred are an increased emphasis on Evolution and some additional help with mathematical calculations for the lab reports. Also, this course has retained its focus on field based lab projects and has kept 2 lab write-ups.

Some students had also voiced concerns that Biol 119 and Envr 101 were very similar courses. We have worked with ENVR to make sure that topics were no longer duplicated.

Biology 126L: Genetics: This course includes many of the topics formerly covered in Biol 151L and also includes material from Biol 226L (Genetics). One of the reasons this course was developed was to get rid of the duplication of the material from Biol 151L and Biol 226L. This course focuses on the major principles of genetics ranging from molecules through populations, with an emphasis on human genetics.

Topics include Mendelian genetics, non-Mendelian inheritance patterns, genetic linkage, epigenetics, cell division (mitosis and meiosis), DNA and chromatin structure, transcription, translation, protein function, regulation of gene expression, recombinant DNA technology, and population genetics. Care has been taken so that the presentation of population genetics does not overlap with this topic in Biol 119L. Here, the underlying genetics and predictive models are considered in more detail.

The laboratory covers the genetics of various organisms, theory and practice of standard techniques, and consideration of the promise and potential ethical dilemmas accompanying new genetic technologies and genomic analyses. Laboratories also include a 5 part series where students design and conduct their own experiments, collect and analyze their data, write up their results in a report, and present their findings to the class. Emphasis is placed on the proper formatting and presentation of data figures.

Biology 130L: Biology of Organisms: This course will in the future be taught by the invertebrate/aquatic systems biologist that we need to round out our faculty in biology. In the interim, the course emphasizes protists and invertebrates, and it also focuses on respiration and photosynthesis. We hope that these subjects will be strengthened and refined when we acquire the necessary new colleague to teach this subject. Other changes include adding sections on

cell biology and removing major sections that dealt with the anatomy and physiology of animals (now included in Biol 114) and evolution (included in Biol 119). This course is now based on the phylogeny of organisms from bacteria and archaea to plants and animals. It includes field-based inquiry into the ways in which living systems work within their environments. Of particular interest are new laboratories designed to examine the anatomy and physiology of early spring blooming plants, and a field project on phylogeny that helps students relate the diversity of the living world to the everyday environment they see outdoors.

4. Changes to the Senior Capstone sequence:

BCS 301: Changes in 301 included a new focus on information literacy and critical evaluation of oral, written, and web-based information sources. Students prepared an original hypothesis/thesis statement, an annotated bibliography, developed a paper outline, and wrote a short paper. The course continues to evolve this year (F '12), as each student is developing a web page (instead of a paper) containing all of the above elements, plus their *curriculum vita*. Feedback from F'11 indicates that students find critiquing each other's hypotheses very valuable. They believe that they have improved overall in understanding oral presentations now that they have completed written evaluations of one semester's worth of science colloquiums. Finally, they liked a course exercise in which the class "graded" representative Wells student science papers, saying that this gave them a better understanding of how their paper grades are calculated.

BCS 403: This is now a senior seminar type capstone that focuses on the effective communication of scientific results. Students read, evaluate, summarize, and present information from the primary literature. Emphasis is placed on writing and presenting scientific data in an engaging and informative way. As part of this, students critically evaluate our science colloquium speakers each week. The difference in presenting to a general audience versus a scientific audience is covered. Students write 3 summaries of primary literature papers for the general public. Students then read and critically evaluate each other's work, and summaries are revised based on this feedback. Each student also presents a primary literature paper to a scientific audience, and receives feedback on this presentation. The presentation is then revised and presented a second time.

This course also discusses "Life After Wells". Students develop (or revise) their resumes and *curriculum vita*. We discuss the post-graduation plans of each student and possible career or graduate school options. A session on how to apply to graduate and professional is also covered for those interested. This portion is still being developed and we are working with Eric Vaughn on this, as well as from feedback from students. We are interested in (1) having people from different science careers come in and speak to what their jobs are, what they entail on a daily basis, how they got their position and answer any questions. Possible speakers could be MDs, physician's assistants, patent lawyers, public policy makers, primary researchers (PhDs from a variety of fields), forestry agents, scientific writers/editors, and business positions (industry); (2) having a career counselor come in and discuss options (or have individual meetings with a career counselor); (3) having former Wells students currently in graduate or professional school come in and speak to what they are experiencing (ie what grad school is all about?).

Student feedback from Fall 2011 indicated that students enjoyed the practice of doing multiple oral presentations, learning to read and interpret information in the primary literature, and appreciating the importance of communication in science. Also important was interacting with their peers in a joint senior capstone experience. Students did not enjoy the repetitive nature of the course (reading, presenting, evaluating and in some cases, redoing the same presentation as earlier). The lack of primary literature papers from Chemistry was also reported as a major short-coming of the course since it is a BCS course. Students also thought the course was too much work on top of their other courses and were hoping for more about the career opportunities for life after Wells.

Update for 2012 (from 2011 feedback)- more chemistry papers were added to the mix, and students were encouraged to actually choose their own paper to present.