Introduction

This report presents a summary of the UF Biology Major (major) and establishes a baseline to which future evaluations of the major may be compared. This report does not replace guidance or policy promulgated by the Office of the University Registrar. Information about the major has been collated and made available to the university, prospective students and the general public via a university-hosted website1. The curriculum content of this report is based upon the 2013-2014 Undergraduate Catalog2. Footnotes with hyperlinks to referenced items are provided to facilitate online reading of the report. Footnotes with the term “action item” indicate tasks that will be addressed during the 2014-2015 academic year.

The major began spring semester 2007 and is offered through a collaboration of the College of Agricultural and Life Sciences (CALS) and the College of Liberal Arts and Sciences (CLAS). The office receives many phone calls and personal visits from prospective students and parents inquiring about the major. A large number of inquirers are surprised that a biology degree is offered through CALS. However, once they learn that CALS has 17 life science departments3, not including six off-campus locations4 that offer selected life science courses, understanding quickly follows.

The major in CALS is indicated as BLY and has four tracks including Pre-professional (PRO), Applied Biology (APB), Biotechnology (BTC), and Natural Science (NS). The major in CLAS is indicated as BIO and has three tracks including Pre-professional (PRO), Integrated Biology (INT), and Biology Secondary Education (BSE). Specific reference to a track is by the major abbreviation followed by the track abbreviation. For example, the Pre-professional track in CALS is indicated by BLYPRO (Table 1).

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1 http://major.biology.ufl.edu/
2 https://catalog.ufl.edu/ugrad/current/Pages/majors.aspx#b
3 http://cals.ufl.edu/students/undergraduate-majors-contacts.php
4 http://cals.ufl.edu/distance-ed/statewide/index.php
Description of the Tracks

Detailed descriptions of the tracks may be found in the 2013-2014 catalog. The Applied Biology track (BLYAPL) is designed for students who are interested in learning how fundamental biology is applied to solving natural resources problems. The Biotechnology track (BLYBTC) is designed for students preparing for a career where knowledge of molecular biology and genetic engineering techniques are important. The Natural Science track (BLYNS) is designed for students interested in descriptive and interpretive biology, with an emphasis on natural science as practiced in the environment. The Biology Secondary Education (BIOSEC) track prepares students to teach life science in secondary schools. The Integrative Biology (BIOINT) track is designed for students seeking an academic program providing broad and flexible coverage of the life sciences. This track emphasizes courses in genetics, taxonomic diversity, structural biology, ecology, evolution and physiology. The Pre-professional tracks (BLYPRO and BIOPRO) are designed for students seeking entrance into a professional school in medicine, veterinary medicine, dentistry and pharmacy. This track emphasizes courses in genetics, physiology, microbiology, and cell biology.

Administration of the Major and the Biology Major Office

The major is administered by the Biology Major Executive Committee (BMEC) with faculty representation from both colleges. Associate Deans from both colleges also serve in an ex officio capacity. Committee members from CALS may come from any of its life science departments, while those from CLAS come from the Biology Department (department). The college from which the BMEC committee Chair (who also functions as the Director of the Biology Major) rotates between CALS and CLAS on a one-year cycle. The founding Chair, David Julian (CLAS), was succeeded by Gary Peters (CALS) in the summer of 2013. The by-laws and minutes of the BMEC meetings can be accessed from the major website.

References:

2. BIO. https://catalog.ufl.edu/ugrad/current/liberalarts/majors/biology.aspx
8. http://major.biology.ufl.edu/about/administration-of-the-major/
The Biology Major Office (office) was established May 2012 and is located in 214 Bartram Hall. The Assistant Director together with the Program Assistant provides the day-to-day management of the major. The Assistant Director is appointed as a Lecturer and the Program Assistant is a staff member in the department. The major does not have faculty or staff lines and is distinct from the department in that the major is administered by the BMEC.

The Curriculum

Differences in College Requirements

Important differences exist in the college-level requirements for the BLY and BIO majors. BLY tracks require that students complete Technical Writing, Public Speaking, and Economics\(^\text{16}\), which are not required for BIO students. BIO tracks require that students demonstrate a proficiency in a foreign language\(^\text{17}\), which is not required of BLY students. Anecdotal information suggests that prospective students use these differences when selecting a college. For example, students proficient in a second language may prefer the BIO major because they have satisfied the CLAS foreign language requirement. Students who lack proficiency in a second language and those who recognize the benefits of taking courses in Public Speaking, Technical Writing, and Economics may prefer the BLY major.

Foundation Courses

All BLY and BIO tracks require similar foundation courses (Tables 2 and 3) including General Chemistry 1 and 2 with labs, Analytical Geometry & Calculus 1, and either Analytical Geometry & Calculus 2 or Introduction to Statistics. All tracks require two courses in physics; however, the level varies with the track. For example, BLYAPB, BLYBTC, BIOSEC, and BIOINT require Applied Physics 1 and 2, whereas BLYPRO and BIOPRO require at least Physics (without calculus) 1 & 2. With the exception of the BLYNS and BIOSEC tracks that only require CHM 2200 and lab, the other tracks require two courses (CHM 2210 and CHM 2211 and lab) in organic chemistry.

Core Courses

Large differences exist in the core courses required by the different tracks (Tables 4 and 5). It is probably not useful to describe in detail the differences in core course requirements, but rather indicate the similarities. All tracks require a course in genetics and a senior capstone course, five of the seven tracks require microbiology, five require physiology, four require biochemistry and four require

\(^{16}\) See page 26 in http://cals.ufl.edu/faculty-staff/docs/policies/policymanual10-19-12.pdf

\(^{17}\) http://www.advising.ufl.edu/student/foreignlang.html
evolution. None of the BLY tracks require courses in ecology, animal diversity, plant diversity, or structural biology. None of the BIO tracks require analytical chemistry or molecular genetics.

**Pre-professional Track**

The Pre-professional track is the only track common to both BLY and BIO and both have identical foundation and core courses. The tracks differ slightly in the electives approved to satisfy the 12-credit life science electives requirement\(^\text{18}\). The office spends considerable time explaining the similarities and differences between the Pre-professional tracks to prospective students and their parents.

**Admissions, Enrollment and Changes of Major**

**Requirements for Admission into the Major**

Students are admitted into the major as freshmen or transfer students with Associate of Arts degrees. Although admission requirements for freshmen are the same for both BLY and BIO, there are differences in transfer requirements (Table 6). The required overall GPA and minimum grades in prerequisite courses are higher for transfer admission into BIO compared to BLY. BIO students must also receive at least B’s in their first attempts including W’s.

**Admissions Data**

Figures 1 through 3 present the total number of students who applied, the percent rejected, and the percent of students who declined, although offered admission into BLY and BIO\(^\text{19}\). Over two-fold more students applied for admission into BIO compared to BLY for academic year 2007-2008 (Figure 1). Within two years the number of applicants who applied to BLY exceeded those who applied to BIO; however by 2012-2013 a similar number of students applied to both BLY and BIO. In 2007-2008 BIO rejected almost 75% of the students who applied while BLY rejected about 56%. Within one year the rejection rate for BLY increased to match that for BIO and remained similar until 2012-2013 when the rejection rate for BLY exceeded that for BIO (Figure 2). The percent of students who declined, although offered admission, ranged from approximately 12% to 31% and were similar for both BLY and BIO until 2012-2013 when the approximately two-fold more students declined admission into BIO than into BLY (Figure 3).

**Enrollment Patterns**

\(^{18}\) http://major.biology.ufl.edu/advising/als/

\(^{19}\) Thanks to Tim Young CLAS-AAC for providing data.
As of fall 2012 there were 1,852 students enrolled in the major, of which 601 are in BLY and 1251 in BIO (Figure 4). Enrollment tripled over the first three years before leveling off in 2010. Anecdotal information suggests that students prefer BIO over BLY and suggests that greater emphasis could be placed upon informing inquiring students and parents of the opportunities in life sciences that exist in BLY\textsuperscript{20}.

Enrollment in the Pre-professional tracks in both colleges is higher than in the other tracks (Figures 5 and 6) and may reflect student bias towards medical compared to the other vocational fields in life science (e.g., research, teaching, natural resources, biotechnology). A goal of the office is to expand the vocational vision of students to include those that extend beyond medicine by providing appropriate information on the major website and during workshops\textsuperscript{21}. The import of this effort may be gathered from UF data showing that less than 50\% of combined BLY and BIO students that apply to medical school will matriculate into medical school (Figure 7). The office intends to devise a procedure to track vocational or graduate school choices of students who do not matriculate into professional schools\textsuperscript{22}.

\textit{Changes of Major and Effect on Enrollment}

Although large numbers of students initially select either BLY or BIO as their major, there is evidence that students’ preference for a major changes. The dynamics of student movement into and out of the major was analyzed over the period of spring 2007 through summer 2012\textsuperscript{23}.

Approximately 77\% of students who transferred out of BLY enrolled in a different college (CALS) (Figure 8), with 41\% of those entering CLAS. In contrast, only 39\% of the students who transferred out of BIO left their college (CLAS), and only 12\% entered CALS (Figure 9). This suggests that additional effort may be needed to retain leaving BLY students within CALS and informing leaving BIO students of the opportunities that exist within the BLY tracks\textsuperscript{24}.

The most popular major for students transferring out of BLY was BIO (Figure 10) while that for students transferring out of BIO was PSY\textsuperscript{25} (Figure 11). Of the 594 students who transferred out of BLY, approximately 14\% entered BIO. Of the 1,849 students who transferred out of BIO, approximately 5\%....

\textsuperscript{20} This is an action item.
\textsuperscript{21} The office conducts several workshops throughout the year in collaboration with the Academic Advising Center.
\textsuperscript{22} This is an action item.
\textsuperscript{23} Thanks to Tim Young CLAS-AAC for providing the data.
\textsuperscript{24} This is an action item.
\textsuperscript{25} See page 3 for the key to abbreviations. http://major.biology.ufl.edu/files/2013/02/Change_of_Major_Data.pdf
entered BLY. This suggests that greater effort may need to be placed on informing students leaving BIO of the opportunities that exist in BLY26.

A similar comparison can be made regarding the majors from which new BIO and BLY transfers originated. Of the 561 students who transferred into BLY, approximately 16% originated from MCY and 15% from BIO (Figure 12). Anecdotal information suggests that a large portion of this movement is due to MCB and BIO students encountering difficulties with tracking issues. Of the 1,360 students who transferred into BIO, approximately 14% originated from USE and 13% from CY (Figure 13.)

**Student Learning Outcomes and Assessment of the Major**

Assessment of the major is conducted by evaluating how well students within the major have met specific benchmarks regarding Student Learning Outcomes27 (SLOs) contained within the UF Biology Academic Assessment Plan28. The assessment is administered in the senior capstone course, BSC 4936 Critical Analysis of Biological Research. The course is offered online fall, spring, and summer C semesters and includes an online Biology Major Field Test29 (MFT), an ethics-in-research module, and a scientific literacy paper.

The current version of the MFT has been administered to 18,270 students nationwide at 393 colleges and universities. None of UF’s peer institutions are among those that administers the test. Since spring 2011 the MFT has been administered during the senior year in the last week of each semester when BSC 4936 is offered. Currently, students are required to be on campus, but the office is seeking alternatives that will allow for administration of the test off-site so that students can take the test at an institution near their residence30. A total of 125 BLY and BIO students have taken the test (Figure 14). Participation will increase as students who entered the major during the 2013-2014 academic year become seniors. The data have not been statistically analyzed and are presented as averages for the academic years 2010-2011, 2011-2012, and 2012-2013. The MFT was not administered during the fall 2010 semester; therefore, the 2010-2011 academic year only includes data from the spring and summer semesters.

**Student Learning Outcomes**

26 This is an action item.
28 http://assessment.aa.ufl.edu/undergraduate-academic-assessment-plans
29 http://www.ets.org/mft/about/content/biology
30 This is an action item.
The SLOs emphasize content, critical thinking, and communication related to the major and are introduced, reinforced and assessed in specified courses within the major (Tables 7 and 8). The benchmarks for each SLO are included after the description.

**Content**

SLO 1. Students identify, describe and explain the basic terminology, concepts, methodologies and theories used within the biological sciences. **Benchmark:** UF median score above the 50th percentile for the content areas of the MFT including Total Score, and Sub-Scores in Cell Biology: Molecular Biology and Genetics; Organismal Biology; and Population Biology, Evolution, and Ecology.

**Critical Thinking**

SLO 2. Students analyze biological information and develop reasoned solutions to problems using the processes and applications of scientific inquiry. **Benchmark:** UF median score above the 70th percentile for the Analytical Skills Assessment Indicator portion of the MFT.

SLO 3. Students discriminate ethical behavior from unethical behavior in scientific research. **Benchmark:** Median score above 70% on the Ethics in Research Module Quiz.

**Communication**

SLO 4. Students communicate knowledge, ideas and reasoning clearly and effectively in written or oral forms appropriate to the biological sciences. **Benchmark:** Median score above 70% according to the department rubric on the Scientific Literacy Paper. This SLO will be assessed beginning fall 2013.

**Evaluation of Student Learning Outcomes**

SLO 1 is assessed using MFT that evaluates students’ in Total Score and the four biology subgroups. The overall UF Total Score average (all academic years) placed UF in the top 18% of U.S. institutions participating in the MFT. The overall UF averages for the sub-areas including Cell Biology, Molecular Biology and Genetics, Organismal Biology, and Population Biology, Evolution, and Ecology were in the top 19%, 14%, 22%, and 21% of institutions for the four sub-scores, respectively (Figure 15). All of these scores are well above the 50th percentile benchmark.
SLO 2 is assessed using the results from the Analytical Skills Assessment Indicator of the MFT. The overall UF average for this indicator was in the top 20% of institutions that participated in the MFT. This score is above the 70th percentile benchmark (Figure 16).

SLO 3 is assessed using an online interactive research ethics role-play video31 in the Ethics Module of BSC 4936. Assessment for this SLO began spring 2013 and includes summer 2013 results. Students complete a research-in-ethics quiz during the first week of classes (pre), and again later in the semester (post) after they have completed and discussed the Ethics Module. The overall UF average percent score on the quiz before completing the module was 45.5%, while after completing the module the score was 73.2% (Table 9). The percent score after completion of the module was above the 70% benchmark score. The average percent post-module score increased 62% over the pre-module score. It appears that the ethics-in-research module has been effective in bringing the issue of ethics-in-research to the awareness of BLY and BIO students. Appendix A includes selected extracts from the discussion among the students on this topic.

SLO 4 will be assessed in the 2014-2015 Annual Report.

There appears to be an increase in percent below scores each of the three years in which the test was administered. By the 2012-2013 academic year UF was in the top 10% of Total Score and three of the four Sub-Score areas (Figure 17). Similarly, by 2012-2013 UF was in the top 10% in four, and the top 20% in three, and the top 38% for one of the Assessment Indicators (Figure 18). The longitudinal data have not been statistically analyzed.

**Demographic Data**

Several questions regarding student demographics and future plans were included as part of the MFT. The results are included in Figures 19 through 29. There were 10 questions in the 2010-2011 academic year version and 12 questions in the following academic years. All of the data is self-reported and presented as percent of respondents including those that did not give a response. Since not all students responded the results may not accurately reflect the population of students that took the MFT. Approximately 59% of the students self-reported themselves as female, 48% white, and 72% having English as their most fluent language. Sixty-three percent began the major as freshmen, 76% were enrolled full-time, and 79% were seniors when they took the test. Approximately 70% of the students.

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31 http://ori.hhs.gov/thelab
reported that their overall and major GPA was greater than or equal to 3.0. Over 70% indicated that they took General Biology 1 and 2 at UF. Over 70% indicated that the percent of major courses taken as distance learning was less than 40%. Eleven and 50 percent indicated the intention to pursue either a masters or doctorate degree after graduation.
Appendix A

Selected Student Discussion from the Ethics-in-Research Module included in
BSC 4936 Critical Analysis of Biological Research

1. “This module/augmented reality has to be one of the most enticing, yet informative modules I have ever utilized. The ability to move through moral and immoral decisions and witnessing the resulting outcome was very interesting. Initially, I chose options that I would choose if I was in Kim's position then went back to learn what could have happened if I was dishonest or negligent. I did not realize how detrimental it could be to co-authors if one of the authors was dishonest in their results. Surely, I knew that the individual responsible for lying would be in trouble but I did not realize that the other's reputations would be put in jeopardy. This explains how important it is to read everything that is presented before you. One thing I believe was somewhat unusual was the reaction the PI had when choosing to speak to him. While I could understand that Greg's reputation in the lab was "impeccable", I believe that if a concern and some evidence is provided that he should have been more open to Kim's observation. It was unfortunate to see the backlash that some of the graduate students had when Kim was doing the right thing and it is nice to know how the university and RIO can be involved to protect the complainant. “

2. “I really enjoyed this activity. Although it seemed a bit tedious at first going through each character's perspective and playing through many variations of their decisions, it's interesting to gain insight on how many happenings hinge off of one person's decision to cut corners. Having worked in a lab for two years, I've been in Aaron's position before where it seemed like cutting corners in an insignificant way would have been much more effective, but it has to be recognized that falsifying data is a huge thing. Additionally, while going through the scenarios, I had tried to choose the avenues I thought were the "right" ones, and was surprised when some of them were incorrect. For one, when I was acting as Kim and reporting Aaron's falsifications, instead of going to the research interrogation officer, I went to talk to Aaron directly which then gave him the time to cover his tracks. I always thought it was best to go to the direct person, but it makes sense to go to an official first because their hand of authority can hold a bigger weight.”

3. “This case study involving research misconduct was relevant to any person who is a student in the science field or who has made a career out of research. I think that is especially relevant to us, as students, because many of us participate in research everyday. I have not heard of any misconduct cases that have occurred at the University of Florida, but I'm sure there have been instances. I have seen people falsify information in undergraduate labs, like chemistry or biology labs. Even though their work was never published, they were still manipulating their results to match what was expected so that they could achieve the grade that they wanted. This sets up a possibility for future ethical situations that could happen later in their research careers. ”

4. “As someone heavily involved with research this case study is very relevant to me. From the perspective of the grad student I don't know if I would have made the right decisions to preserve my career. I want to say that I would immediately expose the falsified information to my PI but in reality would I have the confidence to boldly accuse my post-doc of misconduct? It's a daunting task to question the integrity of someone so high up and especially someone with a history of work with the PI. While the responsibility is on me to take care of the situation it would definitely not be easy to take care of it. After the ethics committee cannot prove misconduct, how could I?”

5. “I think it's great that this resource was made available to use for a simulation. Although falsifying data could be tempting in order to make a paper look good or speed things up, people should understand the risks involved and what repercussions could occur when people act unethically. Certain types of research can affect other peoples lives, especially if the results were used to support safety claims. Acting on data which was falsified to look good could lead to serious problems. The lab could also lose respect and careers could be ruined if the lab was exposed for acting unethically.