Proposal to Academic Policies Committee

Department of Biology

Action Items:

Proposal I: Drop BIO215 (4) from the Biology B.A. and B.S. majors.

Proposal II: Add BIO211 (4) to replace BIO 215 (4) as a required course for the Biology B.A. and B.S. majors.

Proposal III: Add BIO305 (3) as a required course for the Biology B.A. and B.S. majors.

Proposal IV: Change BIO350 (3) from a required course to a Track II elective for the Biology B.A. and B.S. majors.

Proposal V: Add BIO211 (4) to replace BIO 215 (4) as a required course for the Biology-Chemistry major.

Proposal VI: Add BIO305 (3) as a required course for the Biology-Chemistry major.

Proposal VII: Change the upper-division requirements for the Biology-Chemistry major from "take three of" to "take two of": BIO300, BIO315, BIO350, BIO390, BIO400, BIO420.

Proposal VIII: Add BIO211 (4) to replace BIO 215 (4) as a required course for the Environmental Science major.

Proposal IX: Delete BIO105 (4) as an option for the Environmental Science major.

Proposal X: Add BIO305 (3) as a required course for the Environmental Science major.

Proposal XI: Change the other related electives for the Environmental Science major from "take any combination of courses from the two categories below" to "take one course from each category."

Proposal XII: Add BIO211 (4) to replace BIO 215 (4) as a required course for all of the Biology minors.

Proposal XIII: Delete BIO105 (4) as an option for the Environmental Biology minor.

Proposal XIV: Add BIO305 (3) as a requirement for the Organismal Biology and Environmental Biology minors.

Proposal XV: Change the upper-division electives for the Environmental Biology minor from 10 units to 7 units.

Total course additions: 2

Total course deletions: 1

Total unit additions: 7

Total unit deletions: 4

Staffing increase/decrease: 6

Rationale:

All of these proposals are based on the same rationale, so the general rational will be given first and then each proposal will be explained in detail. Since 2002, all Biology, Biology-Chemistry and Environmental Science majors have been assessed for their general knowledge of Biology by taking the ETS Major Field Test in Biology as part of a Senior Seminar course. We then obtain scores for each student as well as group scores in sub-categories of Biology. We are ranked against over 300 institutions whose students take this test, and the scores reported are both raw scores and percentile rankings. Our assessment goal is for each group of students (e.g. Biology-Chemistry majors or Biology majors) to be ranked at or above the 75th percentile for each sub-category of Biology. An analysis of these data shows that our scores in the sub-categories of Animal Biology and Plant Biology are declining – both in raw score (not shown) and percentile ranking (Figure 1, next page). Moreover, the Biology-Chemistry majors are particularly weak in these areas, as well as in the area of Ecology. In contrast, our majors are generally quite strong in the areas of Molecular Biology & Genetics, Cellular Structure & Function, and Population Genetics & Evolution (Figure 1).

In addition to these trends, an analysis of other institutions reveals that many require a sequence of at least three courses for their Biology majors: Cell Structure & Function, Ecology & Evolution, and Organismal Biology (Table I). We are currently introducing these three topics in just two freshmen courses: BIO210 (Cell Biology & Biochemistry) and BIO215 (Animal Biology). The topics of Evolution, Ecology, & Organismal Biology are all taught in BIO215, with each topic receiving minimal coverage. Fortunately, the Biology and Biology-Chemistry majors encounter evolutionary theory in many other courses, which likely explains their high scores in that sub-category. However, the Biology-Chemistry majors never again encounter Ecology or Organismal Biology, which likely explains their poor showing in these areas. Many of the Biology majors also specialize in our "Track II" option of a Cellular & Molecular emphasis, which may also explain our general decline in the areas of Plant & Animal Biology.

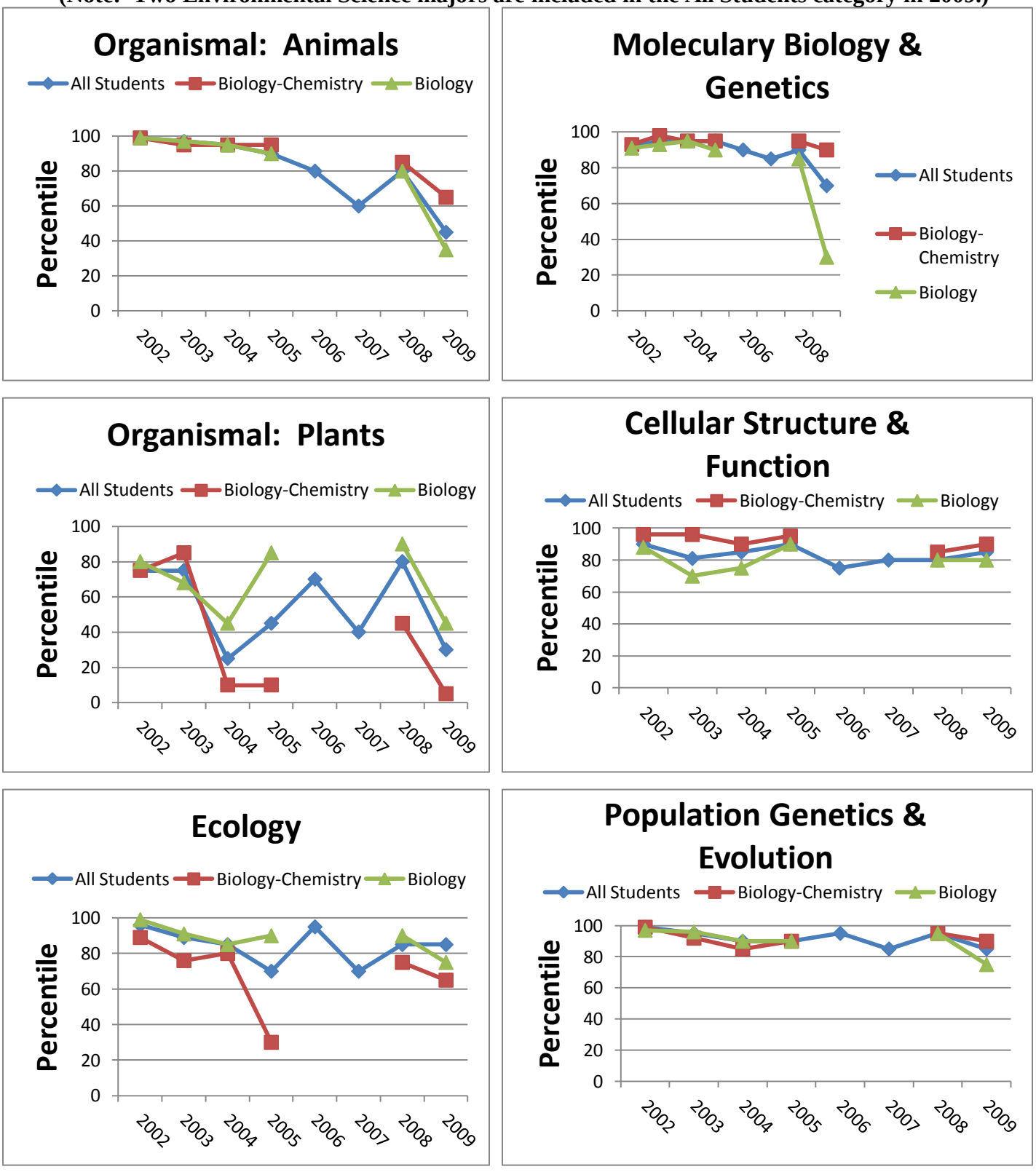
Table I: Required Introductory Biology Courses at Similar Institutions*

Institution	**Required Introductory Courses**
Occidental College	3: General Zoology; General Ecology; Intro. to Cell & Molecular Biochemistry
Hope College	3: Organismal Biology; Ecology & Evolutionary Biology; Cells & Genetics
Harvey Mudd	4: Structure & Function; Ecology & Environmental Biology; Evolutionary Biology; Molecular Biology
Calvin College	3: Living World; Cellular & Genetic Systems; Ecological & Evolutionary Systems
Gordon College	3: Cells & Genetics; Animal Biology; Plants, Ecology & Evolution
Wheaton College	3: Genetics & Cell Biology; Intro. to Zoology & Botany; Ecology & Evolution
Seattle Pacific University	3: Genetics & Molecular Biology; Animal Biology; Plants, Evolution & Ecology
Westmont College	2: Cells & Genetics; Animal Biology, Ecology, & Evolution

*Similar institutions were chosen by Christian emphasis, size, and/or receipt of an HHMI Science Education award.

To rectify these short-comings in our students' education, we propose to split BIO215 into two courses: BIO211 (Ecological & Evolutionary Systems) and BIO305 (Organismal Biology). We propose that both of these courses be required of all of our majors. **In order to accomplish this course addition, we have rearranged the requirements for each major so that there is no increase in units to any of these majors. These changes along with the specific rationale pertaining to each major are detailed below.**

Figure 1. Data from the ETS Major Field Test in Biology from 2002 – 2009 by Sub-Category. (Note: Two Environmental Science majors are included in the All Students category in 2009.)



Catalog Revisions for Course Descriptions:

Current Catalog Description:

BIO 215 (4) ANIMAL BIOLOGY-GE
Principles of animal structure, function, and diversity. Lecture and lab. Offered every year.
Prerequisite: Biology 210.
(Mistake in catalog; BIO215 is offered every semester.)

Proposed Catalog Descriptions:

BIO211 (4) ECOLOGICAL AND EVOLUTIONARY SYSTEMS
An introduction to the principles of ecology, evolutionary biology and sustainability. Lecture and lab. Offered every semester.

BIO305 (3) ORGANISMAL BIOLOGY Principles of animal and plant structure, function, and diversity. Lecture and lab. Offered every year. *Prerequisite: Biology 211.*

Complete course descriptions and learning outcomes are attached at the end of this proposal.
Proposals I-IV are related so they will be considered together:

Proposal I: Drop BIO215 (4) from the Biology B.A. and B.S. majors.

Proposal II: Add BIO211 (4) to replace BIO 215 (4) as a required course for the Biology B.A. and B.S. majors.

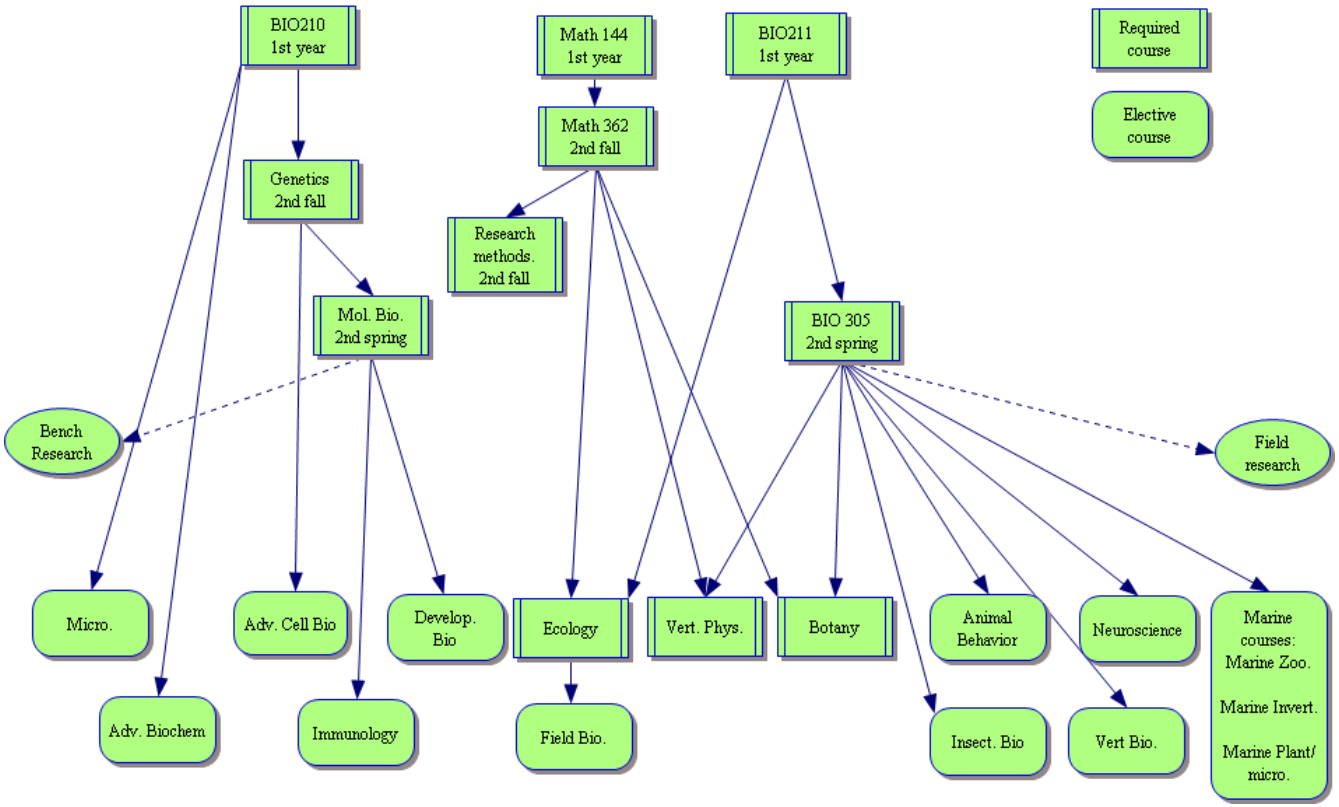
Proposal III: Add BIO305 (3) as a required course for the Biology B.A. and B.S. majors.

Proposal IV: Change BIO350 (3) from a required course to a Track II elective for the Biology B.A. and B.S. majors.

In order to add BIO305 to the Biology B.A. and B.S. majors without increasing the size of the major, we propose to change BIO350 (Advanced Cell Biology) from a required course to a Track II elective. Of all the required courses, we chose Advanced Cell Biology to become an elective for several reasons. First, many of the other required courses are essential for a broad perspective of modern biology, e.g. Molecular Biology, Vertebrate Physiology, Ecology, and Bioinformatics. Second, our students are clearly testing very well in the area of Cellular Structure & Function. Hopefully their scores will not decline by not requiring Advanced Cell Biology; if we see a decline in this area, then we will reconsider this choice in the future. Third, we are currently forced into offering two lab sections of BIO350 because it is a required course. We would prefer to keep our junior and senior courses at an enrollment of 20-24 in order to give the students the appropriate attention for an upper-division course. Changing BIO350 to an elective will allow us to offer one less section and have a smaller lecture size. The proposed sequence of math and science courses for freshmen and sophomore Biology majors would then be:

Freshman, Fall	**Freshman, Spring**	**Sophomore, Fall**	**Sophomore, Spring**
BIO210 or BIO211	BIO210 or BIO211	BIO345	BIO380
	MTH144	MTH362/BIO300	BIO305
CHE 152	CHE 153	CHE 295	

PLNU Biology Curriculum Map
(11-9-09 Version)



This sequence would also prepare students for both types of summer research offered by our department: lab research and field research. Most lab research requires a molecular biology background (BIO380), whereas field research requires an organismal background (BIO305). Thus, our students would be able to participate in either research program by the summer of their sophomore year (see Curriculum Map).

More robust Ecology & Evolution and Organismal Biology courses will also have a positive impact on our upper-division courses (see Curriculum Map, previous page). The new BIO211 course will comprise a thorough introduction to both Ecology and Sustainability, a major concern in the area of our stewardship of God's creation. There was no room for sustainability issues to even be introduced in BIO215 (Animal Biology). Introducing Sustainability in BIO211 will allow our upper-division Ecology course (BIO360) to go into much more depth in both Ecology and Sustainability. A thorough introduction to Organismal Biology will impact several upper-division courses in the same fashion; BIO305 will be a prerequisite for all of these courses (see Curriculum Map).

We also considered the students who leave Biology for other majors after their freshman year. We considered what we would like them to know for their future lives, and we decided that a thorough knowledge of evolutionary theory and of creation-care are the most essential issues, and also the ones we focus on for our General Education courses. The new BIO211 course would allow us to give these students a solid foundation in both.

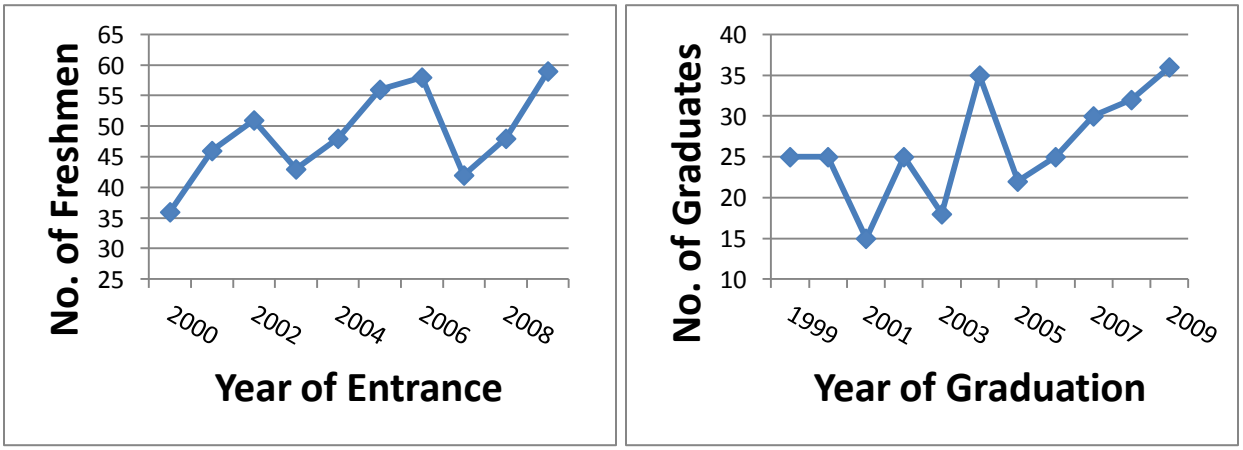


Figure 3. Biology, Biology-Chemistry, and Environmental Science majors are increasing at both the freshman and senior levels.

6 units of additional staffing are proposed with these changes. BIO305 is proposed as a 3 unit course with 3 laboratory sections, resulting in a staffing increase of 8 units. Since we would offer only one lab section of BIO350, the total staffing increase would be 6 units.

JUSTIFICATON FOR STAFFING INCREASE

Besides the very significant hole that we have identified in our curriculum through the program review process, the biology department has experienced considerable growth in numbers which is putting tremendous pressure on our class sizes. In the last eight years we have

gone from a mean of 22 graduates (1999-2001) to a mean of 33 graduates (2007-09) - a 50 percent increase. Given the record number of freshman majors this year, there is no sign that this huge growth spurt is going to level off. Students are frequently unable to get into courses required for the major and we have had to grant exceptions to our curricular requirements in order to allow students to graduate on time. (Size of lab sections is limited by seating capacity.) Indeed it is possible these exceptions might play a role in our declining scores in certain areas. Students frequently need to delay courses they would like to take as juniors because they can't get into them until their senior year. Except for our courses in field biology, almost all of junior/senior level classes are filled to room capacity every year. By adding one new course to the curriculum and by concurrently moving another required course to elective status (Advanced Cell Biology), we will be able to better spread out the enrollment. The pressure on the other courses will be significantly reduced and the frequency with which students get closed out of other courses will be decreased.

In addition, we considered several other options for trying to cut 6 units of staffing from our majors. We considered decreasing the teaching units and/or time spent in lab for the freshman courses, which have many sections. However, we believe that this solution would be detrimental to our students' education, as all of the Biology curriculum reform literature proposes more laboratory time and research experiences for freshmen, not less. We considered cutting courses from our curriculum, however, this is risky. It seems highly likely that this would involve creating a new hole in our curriculum. It doesn't, in our opinion, make sense to plug one hole, by creating a new one elsewhere. So we decided that cutting other content areas would be detrimental. We considered cutting our low enrollment courses: Neuroscience, Marine Invertebrates, and Marine Plants & Microbes. These courses, however, are every other year courses. Now that we are not requiring Advanced Cell Biology, we believe that enrollment may rise in these courses. Furthermore we are about to hire a marine biologist. Given our location on the coast and given the expected summer research opportunities, we expect that this very exciting portion of our program will soon be in high demand. We also have two neuroscientists in the department (Drs. Elson and Flietstra) and a rather new and stimulating neuroscience research program led by Dr. Elson, so it did not make sense to cut that course either. In short, we could not arrive at any way to remove 6 units from our curriculum without potential detrimental effects on our majors.

Proposed Catalog Descriptions for the Biology B. A. (Changes are in bold and strikethrough fonts.):

LOWER-DIVISION REQUIREMENTS

BIOLOGY:

COURSE	TITLE	UNITS
BIO 210	CELL BIOLOGY AND BIOCHEMISTRY	4
~~BIO 215~~	~~ANIMAL BIOLOGY~~	~~4~~
BIO 211	**ECOLOGY AND EVOLUTION**	**4**

UPPER-DIVISION REQUIREMENTS

COURSE	TITLE	UNITS
MTH 362	CALCULUS BASED STATISTICS	2
BIO 300*	BIOINFORMATICS	2
BIO 305	**ORGANISMAL BIOLOGY**	**3**
BIO 310	GENERAL BOTANY	3
BIO 345*	GENETICS	4
~~BIO 350~~	~~ADVANCED CELL BIOLOGY~~	~~3~~
BIO 360	ECOLOGY	3
BIO 380	MOLECULAR BIOLOGY	3
BIO 420	VERTEBRATE PHYSIOLOGY	3
BIO 497*	BIOLOGY SEMINAR	1

TRACK II ELECTIVES

COURSE	TITLE	UNITS
BIO 315	MICROBIOLOGY	2
BIO 350	**ADVANCED CELL BIOLOGY**	**3**
BIO 390	IMMUNOLOGY	3
BIO 400	DEVELOPMENTAL BIOLOGY	4
BIO 450	ADVANCED BIOCHEMISTRY	3
BIO 470	NEUROSCIENCE	3

Proposed Catalog Descriptions for the Biology B. S. (Changes are in bold and strikethrough fonts.):

LOWER-DIVISION REQUIREMENTS

COURSE	TITLE	UNITS
BIO 210	CELL BIOLOGY AND BIOCHEMISTRY	4
~~BIO 215~~	~~ANIMAL BIOLOGY~~	~~4~~
BIO 211	**ECOLOGY AND EVOLUTION**	**4**

UPPER-DIVISION REQUIREMENTS

COURSE	TITLE	UNITS
MTH 362	CALCULUS BASED STATISTICS	2
BIO 300*	BIOINFORMATICS	2
BIO 305	**ORGANISMAL BIOLOGY**	**3**
BIO 310	GENERAL BOTANY	3
BIO 345*	GENETICS	4
~~BIO 350~~	~~ADVANCED CELL BIOLOGY~~	~~3~~
BIO 360	ECOLOGY	3
BIO 380	MOLECULAR BIOLOGY	3

BIO 420	VERTEBRATE PHYSIOLOGY	3
BIO 497*	BIOLOGY SEMINAR	1

TRACK II ELECTIVES

COURSE	TITLE	UNITS
BIO 315	MICROBIOLOGY	2
BIO 350	**ADVANCED CELL BIOLOGY**	**3**
BIO 390	IMMUNOLOGY	3
BIO 400	DEVELOPMENTAL BIOLOGY	4
BIO 450	ADVANCED BIOCHEMISTRY	3
BIO 470	NEUROSCIENCE	3
	APPROVED OFF-CAMPUS+	1-4

Proposals V-VII are related so they will be considered together:

Proposal V: Add BIO211 (4) to replace BIO 215 (4) as a required course for the Biology-Chemistry major.

Proposal VI: Add BIO305 (3) as a required course for the Biology-Chemistry major.

Proposal VII: Change the upper-division requirements for the Biology-Chemistry major from "take three of" to "take two of": BIO300, BIO315, BIO350, BIO390, BIO400, BIO420.

In order to make these same changes to the Biology-Chemistry major without increasing the number of units in a large major, we are changing the upper-division electives for Biology to two courses instead of three. As discussed above, we believe that these students already receive an excellent education in the Cellular and Molecular aspects of Biology. We wish them to have a better grasp of Organismal Biology and Ecology, which we predict will be accomplished by the new BIO211 and 305 courses. Since the Biology-Chemistry major is a joint major with the Chemistry Department, we have discussed these changes with them and they support our proposal. The proposed sequence of math and science courses for Biology-Chemistry majors would then be:

Freshman, Fall	**Freshman, Spring**	**Sophomore, Fall**	**Sophomore, Spring**	**Junior, Spring**
BIO210 or BIO211	BIO210 or BIO211	BIO345	BIO380 or BIO305	BIO380 or BIO305
	MTH144	PHY141	PHY142	
CHE152	CHE153	CHE295	CHE300	

If a Biology-Chemistry student was planning to do lab research, (s)he would take BIO380 sophomore year and BIO305 junior year. On the other hand, if a Biology-Chemistry student was planning to do field research, (s)he would take BIO305 sophomore year and BIO380 junior year. (see Curriculum Map). Since neither BIO305 nor BIO380 are pre-requisites for any of the

Biology-Chemistry electives, this scenario would not delay progression through the major. The most important consideration here is what type of research the student is planning on pursuing.

Proposed Catalog Descriptions for the Biology-Chemistry B. S. (Changes are in bold and strikethrough fonts.):

LOWER-DIVISION REQUIREMENTS

COURSE	TITLE	UNITS
BIO 210	CELL BIOLOGY AND BIOCHEMISTRY	4
~~BIO 215~~	~~ANIMAL BIOLOGY~~	~~4~~
BIO 211	**ECOLOGY AND EVOLUTION**	**4**

UPPER-DIVISION REQUIREMENTS

COURSE	TITLE	UNITS
BIO305	**ORGANSIMAL BIOLOGY**	**3**
BIO 345	GENETICS	4
BIO 380	MOLECULAR BIOLOGY	3
BIO 497	BIOLOGY SEMINAR	1
CHE 300	ORGANIC CHEMISTRY II	2
CHE 325	PHYSICAL CHEMISTRY I	5
CHE 351	ORGANIC QUALITATIVE ANALYSIS	2
CHE 466	ADVANCED INORGANIC CHEMISTRY	2
CHE 326	PHYSICAL CHEMISTRY II	2
	OR	
CHE370	INSTRUMENTAL ANALYSIS	(2)
	OR	
CHE 453	ADVANCED ORGANIC CHEMISTRY	(2)
BIO450	ADVANCED BIOCHEMISTRY	4
	OR	
CHE 450	ADVANCED BIOCHEMISTRY	(4)

~~THREE~~ **TWO** COURSES FROM:

COURSE	TITLE	UNITS
BIO 300	BIOMATHEMATICS & BIOINFORMATICS	2
BIO 315	MICROBIOLOGY	2
BIO 350	ADVANCED CELL BIOLOGY	3
BIO 390	IMMUNOLOGY	3
BIO 400	DEVELOPMENTAL BIOLOGY	4
BIO 450	ADVANCED BIOCHEMISTRY	3

Proposals VIII – XI are related so they will be considered together:

Proposal VIII: Add BIO211 (4) to replace BIO 215 (4) as a required course for the Environmental Science major.

Proposal IX: Delete BIO105 (4) as an option for the Environmental Science major.

Proposal X: Add BIO305 (3) as a required course for the Environmental Science major.

Proposal XI: Change the other related electives for the Environmental Science major from "take any combination of courses from the two categories below" to "take one course from each category."

The Environmental Science major is in a similar position as the Biology-Chemistry major in that it is both a joint major with Chemistry and a large major. In order to make these same changes to the Environmental Science major without increasing the number of units, we are changing the other related electives to two instead of three. Thus, one elective would be from the Methodology category (which could affect Chemistry) and the other elective would be from the Public Policy category (which could affect History & Political Science and Theology & Christian Ministry). Since we have fewer than 20 Environmental Science majors, the potential effects on other departments are minor, and the Chemistry, History & Political Science, and Theology & Christian Ministry Departments support these changes.

We also propose to delete BIO105 (Ecology & Conservation) as an option for the Environmental Science major as it will be redundant with the new BIO211 course. The proposed sequence of math and science courses for Environmental Science majors would then be:

Freshman, Fall	**Freshman, Spring**	**Sophomore, Fall**	**Sophomore, Spring**
BIO210 or BIO211	BIO210 or BIO211	BIO345	BIO305
	MTH144	MTH362	
CHE 152	CHE 153	CHE 295	

Proposed Catalog Descriptions for the Environmental Science B. S. (Changes are in bold and strikethrough fonts.):

LOWER-DIVISION REQUIREMENTS

COURSE	TITLE	UNITS
BIOLOGY:		
BIO 102	ENVIRONMENT AND PEOPLE	4
	~~OR~~	
~~BIO 105~~	~~ECOLOGY AND CONSERVATION~~	~~(4)~~
BIO 210	CELL BIOLOGY AND BIOCHEMISTRY	4
~~BIO 215~~	~~ANIMAL BIOLOGY~~	~~4~~
BIO 211	**ECOLOGY AND EVOLUTION**	**4**

UPPER-DIVISION REQUIREMENTS

COURSE	TITLE	UNITS
BIO305	**ORGANISMAL BIOLOGY**	**3**
BIO 345	GENETICS	4
BIO 360	ECOLOGY	3
BIO 497	BIOLOGY SEMINAR	1
CHE 370	INSTRUMENTAL ANALYSIS	2
MTH 362	CALCULUS BASED STATISTICS	2
	TOTAL	~~12~~ **15**

Other Related Electives (~~9~~ **6** units minimum) Students can customize their degree by taking ~~any combination of courses from~~ **one course from each of** the two categories below. One or more approved off-campus environmental course(s) may fulfill part or all of this requirement.

METHODOLOGY:

COURSE	TITLE	UNITS
CHE 490	INTERNSHIP IN CHEMISTRY	1-3
CHE 499	RESEARCH IN CHEMISTRY	1-3
BIO 490	INTERNSHIP IN BIOLOGY	1-3
BIO 499	RESEARCH IN BIOLOGY	1-3

PUBLIC POLICY AND STEWARDSHIP:

COURSE	TITLE	UNITS
POL 230	INTRODUCTION TO INTERNATIONAL RELATIONS	4
POL 394	GOVERNMENTS AND POLITICS OF THE GLOBAL SOUTH	4
POL 441	ISSUES IN PUBLIC POLICY	4
PHL 451	RELIGION AND SCIENCE	3
	UPPER-DIVISION ELECTIVE TOTAL	~~25-29~~ **22-26**

Proposals XII-XV are related so they will be considered together:

Proposal XII: Add BIO211 (4) to replace BIO 215 (4) as a required course for all of the Biology minors.

Proposal XIII: Delete BIO105 (4) as an option for the Environmental Biology minor.

Proposal XIV: Add BIO305 (3) as a requirement for the Organismal Biology and Environmental Biology minors.

Proposal XV: Change the upper-division electives for the Environmental Biology minor from 10 units to 7 units.

In all of the Biology minors, the new BIO211 course in Ecology and Evolution will replace BIO215. Depending on the minor, we then proposed different options for BIO305 (Organismal Biology). For the Cell & Molecular Biology Minor, we did not add this course because this subject is not the focus of this minor, nor is it a pre-requisite for any of the other electives. For the Environmental Biology and Organismal Biology minors, we added BIO305 as a required course since it is a pre-requisite for most of the electives in these minors. This resulted in an increase of 3 units to the Organismal Biology minor, which actually brings it in line with the other minors at 23 units total. For the Environmental Biology minor, which is already 25-26 units, we decreased the elective requirement by 3 units.

We also propose to delete BIO105 (Ecology & Conservation) as an option for the Environmental Biology minor as it will be redundant with the new BIO211 course.

Proposed Catalog Descriptions for the Biology minors (Changes are in bold and strikethrough fonts.):

CELL AND MOLECULAR BIOLOGY MINOR

REQUIRED

COURSE	TITLE	UNITS
BIO 210	CELL BIOLOGY AND BIOCHEMISTRY	4
~~BIO 215~~	~~ANIMAL BIOLOGY~~	~~4~~
BIO 211	**ECOLOGY AND EVOLUTION**	**4**

ORGANISMAL BIOLOGY MINOR

REQUIRED

COURSE	TITLE	UNITS
BIO 210	CELL BIOLOGY AND BIOCHEMISTRY	4
~~BIO 215~~	~~ANIMAL BIOLOGY~~	~~4~~
BIO 211	**ECOLOGY AND EVOLUTION**	**4**
BIO305	**ORGANISMAL BIOLOGY**	**3**
BIO360	ECOLOGY	3

9 units from the following electives:

BIO 310	GENERAL BOTANY	3
BIO 315	MICROBIOLOGY	3
BIO320	MARINE VERTEBRATE BIOLOGY	3
BIO 325	INSECT BIOLOGY	3
BIO 330	MARINE INVERTEBRATE BIOLOGY	2
BIO 340	FIELD BIOLOGY	2

BIO 370	NEUROSCIENCE	3
BIO 410	VERTEBRATE BIOLOGY	3
BIO 430	ANIMAL BEHAVIOR	3
	TOTAL	~~20~~ **23**

ENVIRONMENTAL BIOLOGY MINOR (Note that we reformatted the catalog copy below so that it looks the same as the other minors.)

REQUIRED

~~LOWER-DIVISION REQUIREMENTS~~

COURSE	TITLE	UNITS
BIO 102	ENVIRONMENT AND PEOPLE	4
	~~OR~~	
~~BIO 105~~	~~ECOLOGY AND CONSERVATION~~	~~(4)~~
~~BIO 215~~	~~ANIMAL BIOLOGY~~	~~4~~
BIO 211	**ECOLOGICAL AND EVOLUTIONARY SYSTEMS**	**4**
CHE101	CHEMISTRY AND SOCIETY*	4
	OR	
CHE151	GENERAL CHEMISTRY TUTORIAL	(1)
	AND	
CHE 152	GENERAL CHEMISTRY ~~II~~ I	(4)
	~~TOTAL~~	~~12-13~~

~~UPPER-DIVISON REQUIREMENTS~~

BIO 305	**ORGANISMAL BIOLOGY**	**3**
BIO360	ECOLOGY	3
	TOTAL	**18-19**

UPPER-DIVISON ELECTIVES

	APPROVED ELECTIVES**	~~6~~ **3**
	ONE APPROVED OFF-CAMPUS FIELD IMMERSION COURSE	4
	TOTAL	~~10~~ **7**

Library Impacts: None

Technological Impacts: There is sufficient lab space for the proposed changes and no new software is required.

Recorded Department Vote: Unanimous with all full-time faculty present and voting.

Biology 211: Ecological and Evolutionary Systems
Point Loma Nazarene University

The earth is the Lord's and everything in it.
Psalms 24:1

Course objectives:

This course provides an introduction to two major areas of study in biology: evolution and ecology. Evolution is the unifying theme for all of biology; it encompasses all sub-disciplines, from development to medicine to conservation biology. Ecology, on the other hand, helps us to understand and sustain the delicate balance between the living and nonliving world.

The introduction to the study of evolutionary processes will include the basic mechanisms for evolution, the theory of natural selection, the basis of heredity and variation, population structure and genetics, and mechanisms of speciation. Along with these topics we will explore the ways that questions about evolution are answered, and how some Christians reconcile their faith with their acceptance of evolution.

The introduction to the study of ecological systems will include an examination of both biotic (living) and abiotic (non-living) elements of the environment that influence the distribution and abundance of organisms. Population, community, and ecosystem level ecology are addressed, especially in light of man's influence on nature and nature's influence on man. We will then discuss how we can apply ecological principles to improve conservation of species and consider our responsibility to care for God's creation through sustainability.

My hope is that you develop an appreciation for the complexity and beauty of living systems, and develop awe and respect for the Creator through study of His creation.

Student Outcomes

- To assess the status of modern evidence for the theory of biological evolution as an explanation for the diversity, commonalities, and ancestry of living organisms.
- To articulate the relationship between scientific understandings of evolution and Christian concepts of creation.
- To understand interactions between organisms and their environment, and how this delicate balance is a call for action from Christians
- To articulate and act on our call to stewardship; caring for God's creation.

Biology 305: Organismal Biology
Point Loma Nazarene University

The course builds upon the basis of molecular, cellular, evolutionary, and ecological biology that students receive in the first year of the Biology program. It introduces two fundamental approaches to the study of the complexity of life on Earth:

(1) Biodiversity and phylogeny, including
- The web of life: molecular phylogeny.
- The diversity of life, both prokaryotic and eukaryotic: the distinctions between bacteria, archaeans, protists, plants, fungi, and animals.
- Evolution and development of body plans. The role of extinctions in the history of life.

(2) Interdependence of structure and function: the physiology of plants and animals with reference to
- Reproductive strategies
- Nutrition and excretion
- Circulation and respiration
- Endocrine and nervous systems.

Learning outcomes. Students will be able to:

1. Understand the diversity, unity, and organization of life on Earth in terms of common descent and the elaboration of body plans.
2. Analyze the common and divergent ways that animals and plants are built using tissues, organs, and organ systems, and how they solve the physiological tasks common to all living things.
3. Relate the structure and function of organisms to their evolutionary success.
4. Interpret evidence critically and integrate ideas from diverse fields of biology.