

Biology Majors' *Handbook* *Version 7.0*

2011-2012
THE COLORADO COLLEGE

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INTRODUCTION

Welcome! We are so glad that you are considering a major in Biology. This handbook answers many questions biology majors have concerning requirements, suggested courses, research, meetings, and opportunities in the Biology Department, but the faculty welcome additional questions. For further information, meet with your advisor, watch the bulletin boards, attend the majors' meeting in the fall, attend seminars, **and check your Worner Center mailbox and e-mail frequently**. It is very important that you declare that your biology major no later than your sophomore year, so that you receive Biology Department announcements. Please advise the department administrative assistant of your Worner Center box number, phone number, e-mail address, any prolonged off-campus sojourn, and any change in your status at the College. **Ultimately, it is the responsibility of the student to know all departmental and college requirements and regulations.**

The handbook is arranged around themes. Whether you have just started your college career or are already in the middle of completing a Biology major, we urge you to read all of the sections in the handbook, and to review any questions you have with your advisor.

IMPORTANT DATES, EVENTS, AND ANNOUNCEMENTS

- **Students should declare the Biology major before the end of the sophomore year (but there are no restrictions on declaring earlier).** To declare the major, you need a faculty advisor in the Biology department with whom you confer before declaring. See checklist of important items, Appendix I.
- Each fall a **REQUIRED** meeting of all prospective and declared majors will be announced in Block 1 or 2. The senior class photograph is taken at this meeting. Topics will include:
 - Discussion of graduation requirements including the required seminar abstracts, senior exams, and optional graduation with distinction or senior thesis.
 - Discussion of graduate school applications and employment opportunities in biology.
 - Other important announcements.
- Students enrolled at CC prior to Fall 2011 may choose either the old Biology major or the new tracks in the Biology major.
- Students enrolling at CC in Block 1 of 2011-12 or later **MUST** choose the new Biology major with one of two tracks: Organisms, Ecology, and Evolution (OEE) or Molecular and Cellular Biology (MCB). The tracks have many courses in common, so first-year and sophomore students who have not decided on one track or the other should enroll in courses that count toward both tracks. Use the checklists in Appendix I to track your progress in the major. **Ultimately, it is your responsibility to know all departmental and college requirements and regulations.**
- Students who declared the Biology major prior to Block 1 of 2011-12 may complete the “old” Biology major rather than specializing in one track or the other. See checklist, Appendix I.
- Biology majors must complete senior capstone experiences. The senior capstone experiences have several components including attendance at departmental seminars, written abstracts describing seminars attended, and successfully passing the Biology ETS or GRE subject exam (see details in the “Senior Capstone Experience” section). The GRE exam must be taken in November or December, while the ETS exam is offered early in Blocks 3 and 6. Note that the senior capstone requirements apply to **All** Biology majors, not just those declaring the new tracked major.
- Biology majors have the option of writing a senior thesis and attempting to graduate with distinction (see details following). Read the handbook in detail to make sure that you complete all requirements on time if you are attempting to graduate with distinction. There are many assignments that students pursuing distinction must complete on time, such as registering for a senior thesis by the end of Block 2 of the senior year. Appendix VIII contains a checklist for those attempting to graduate with distinction.
- Majors should also attend Biology Day each spring (see Biology Day section).

THE BIOLOGY MAJOR: A SHORT GUIDE TO REQUIREMENTS

As of Block 1, 2011, there are two ways to complete the new Biology Major; students who enrolled prior to fall 2011 may still utilize the requirement for the former Biology major (Appendix VIII). All students enrolling at CC as of fall 2011 must follow the requirements for the new major and declare one of the two tracks. The first option is the Organisms, Ecology, and Evolution (OEE) track, and the second option is the Molecular and Cellular Biology (MCB) track. Both tracks are appropriate for students considering a variety of careers from education to medicine; talk to your advisor to sort out which track will work best for you. Some “old” courses will no longer be offered, however, and the new substitutes for those courses are clearly indicated in the appendix. For example, BY210 will no longer be offered, so students completing the old major must A) have completed BY210 with a C- or higher before the Fall of 2011 or B) earn a C- or higher in BY131. Similarly, BY361 has been replaced with BY231.

The two Biology Major tracks share many courses in common. A first-year student embarking upon a Biology major is advised to enroll in courses that are common to both tracks. Taking courses intended for entry-level students in both tracks will help you meet faculty and students who will help you decide which track is best for you.

	Required by OEE?	Required by MCB?
1 unit from BY101, BY105, 106 (108/109), 107	yes	yes
A second unit from BY101, BY105, 106 (108/109), 107	yes	no
BY131	yes	yes
BY231	yes (or BY280)	yes
BY208	yes	yes
CH107	yes	yes
CH108	yes	yes
CH250	yes	yes
CH251	no	yes
2 units of math	yes (must include 1 calculus and 1 statistics or mathematical modeling)	yes
Biology electives, some of which may be satisfied by courses outside Biology (see details for each track)	yes (five)	yes (six)

The Organisms, Ecology, and Evolution Track

I. Two of the following **introductory organismic biology** courses

- a. BY105
- b. BY106 (OR BY108 OR BY109)
- c. BY107

Talk to your advisor if you have AP/IB credit that might count toward this requirement (you will need to pass a bypass test if you wish to apply your credit to this requirement)

II. **Ecology**, BY208

III. Two units in **Molecular and Cellular Biology and in Genetics**

- a. BY131 (OR BY210) AND
- b. BY231 OR BY280 (OR BY361)

Talk to your advisor if you have AP/IB credit that might count toward the BY 131 requirement. See the handbook section explaining how we count AP or IB credits.

IV. Three units in **Chemistry**

- a. CH107
- b. CH108
- c. CH250

Talk to your advisor if you have AP/IB credit that might count toward the CH 107/108 requirement.

V. Two units in **mathematics**, one from calculus and one from statistics or modeling

- a. MA125-6 OR MA126 OR MA127 OR MA129 AND
- b. BY220 OR BY256/MA256

Talk to your advisor if you have AP/IB credit that might count toward the mathematics requirements.

VI. Five approved **biology electives**

- a. Three must be Biology (BY) courses at the 300 level or higher
- b. One unit of elective credit may be CH251, CH382, GY205, GY300, SC206, or SC301
- c. One unit must be an approved senior capstone course
- d. Any BY course except BY100 and BY104 may count as an elective
- e. BY101 (FYE) counts as one unit of lower-level elective
- f. It is possible to petition the department to ask for other courses to count as electives.

VII. **Senior capstone experiences**

- a. Complete attendance at five Biology seminars, and summarize each in an abstract, and submit each abstract to your advisor no later than the first Monday of the block following the block in which the seminar occurred. After declaring the Biology Major, students can turn in abstracts during their junior or senior years.
- b. Successfully pass a senior examination, either the Educational Testing Service (ETS) Biology Subject Test, or the Biology subject GRE exam. Passing levels are discussed in a separate section of the handbook, as well as the requirements for a makeup exam if a passing level is not achieved.

- c. Complete a senior capstone course in the last two semesters prior to graduation (options vary from year to year, but will always include BY499 Senior Thesis and multiple other courses)

Students interested in careers in health care or research should note that 2 units of organic chemistry, 1 unit of biochemistry, 2 units of calculus, and 2 units of physics may be required for admission to medical, dental, nursing, veterinary, and graduate schools. However, admission requirements are variable so students should check the programs to which they intend to apply. Students interested in K-12 classroom teaching, community education (wilderness education, camp counseling, etc.), or volunteering in an educational setting (Peace Corps, etc.) should meet with Professor Mike Taber in Education to discuss how to best prepare for those activities.

The Molecular and Cellular Biology track

- I. One of the following **introductory organismic biology** courses
 - a. BY105
 - b. BY106 (OR BY108 OR BY109)
 - c. BY107

Talk to your advisor if you have AP/IB credit that might count toward this requirement (you will also need to pass a bypass exam if you wish to apply your credit to this requirement).

- II. **Introduction to Molecular and Cellular Biology**, BY131 (OR BY210)

Talk to your advisor if you have AP/IB credit that might count toward the BY 131 requirement. See the section on AP/IB credit to understand how your credit might be applied.

- III. **Genetics**, BY231 (OR BY361)

- IV. Four units in **Chemistry**

- a. CH107
- b. CH108
- c. CH250
- d. CH251

- V. *Talk to your advisor if you have AP/IB credit that might count toward the CH107/108 requirement.*

- VI. Two of the following **mathematics** courses:

- a. MA125-6 (only counts as one unit toward the requirement)
- b. MA126
- c. MA127
- d. MA129
- e. BY220
- f. BY256/MA256
- g. EV228

Talk to your advisor if you have AP/IB credit that might count toward the mathematics requirements.

- VII. Six approved **biology electives**

- a. Three must be Biology (BY) courses with BY231 (OR BY361) as a pre-requisite
- b. One unit of elective credit may be CH241 or CH382
- c. One unit of elective credit may be GY300, PY299, or SC301
- d. One unit must be an approved senior capstone course
- e. Any BY course except BY100 and BY104 may count as an elective
- f. BY101 (FYE) counts as one unit of lower-level elective
- g. It is possible to petition the department to ask for other courses to count as electives.

- VIII. **Senior capstone experiences**

- a. Complete attendance at five Biology seminars, and summarize each in an abstract, and submit each abstract to your advisor no later than the first Monday of the block following the block in which the seminar occurred. After declaring the Biology Major, students can turn in abstracts during their junior or senior years.
- b. Successfully pass a senior examination, either the Educational Testing Service (ETS) Biology Subject Test, or the Biology subject GRE exam. Passing levels are discussed in a separate section of the handbook, as well as the requirements for a makeup exam if a passing level is not achieved. .
- c. Complete a senior capstone course in the last two semesters prior to graduation (options vary from year to year, but will always include BY499 Senior Thesis and multiple other courses).

Students interested in careers in health care or research should note that 2 units of organic chemistry, 1 unit of biochemistry, 2 units of calculus, and 2 units of physics may be required for admission to medical, dental, nursing, veterinary, and graduate schools. However, admission requirements are variable so students should check the programs to which they intend to apply. Students interested in K-12 classroom teaching, community education (wilderness education, camp counseling, etc.), or volunteering in an educational setting (Peace Corps, etc.) should meet with Professor Mike Taber in Education to discuss how to best prepare for those activities.

ADVICE ON SCHEDULING COURSES FOR A BIOLOGY MAJOR

The Biology Major requires that a student earn a C- or higher in 15 courses. Many of these courses must be taken in a prescribed order. For example, CH107 must be taken prior to BY131. Thus, it is very important to plan out your Biology major early in your career, and try to take at least 4 courses each year that apply to the major. Students who want to study abroad have to plan carefully, as many study abroad programs do not enable students to earn Biology credit while studying abroad. Study abroad is a valuable experience, so plan ahead: you may have to take more than 4 required courses in the year before or after your study abroad experience.

It is also important to consider what extracurricular activities you will pursue in order to move toward gaining entrance to a post-graduate degree program (such as a Master's in Teaching, N.P., Ph.D., or M.D.), or toward employment following graduation. In particular, you should work with the Career Center and your advisor to plan for summer activities that will enrich your academic experience and make you more eligible for post-graduate work or employment. Summer research experience is increasingly required for admission to graduate programs including medical school, and is essential to qualify for Ph.D. programs. Furthermore, students earning high enough grades to qualify to graduate with distinction should plan to do undergraduate research during the summer between their junior and senior years, because a thesis (BY 499) is required to graduate with distinction and extensive research and writing time is required to complete a thesis.

The following are suggestions for the scheduling of courses for the Biology major. Many variations on these suggestions are possible, but may not be optimal. Talk with your advisor about your planned course of study. Because many courses in the major must be taken in a particular sequence, and because these courses also are popular with many students outside the Biology major, we strongly advise AGAINST changing your entire schedule using drop-add opportunities without first consulting with your advisor. We have also made some suggestions for first-years and sophomores who are deciding between being a Biology major (MCB track) or a Biochemistry major, because those majors have many first-year and sophomore courses in common. The Environmental Science major is very different from the Biology major and has no first-year or sophomore-level courses in common with it; we refer interested students to the Environmental Science Department. The Neuroscience major has some overlap with the MCB track Biology major, but students majoring in Neuroscience must complete two two-block courses and PY100, all of which are often full, so we advise you to speak with a Neuroscience faculty member as soon as possible if you are thinking of majoring in Neuroscience.

Suggestions for students who are uncertain whether to major in the OEE track or the MCB track

These suggestions are based on the principle that you should take courses that will count toward both majors and enable you to meet faculty and students who will help you decide which track is best for you. See pages 7-8 if you are certain that you will major in the OEE or MCB track, respectively

FIRST YEAR:

Two of the following introductory biology courses:

BY 105 (Biology of Plants)

BY 106 (Biology of Animals)

BY 107 (Biology of Microbes)

BY 131 (Introduction to Molecular and Cellular Biology)

and

CH 107 (General Chemistry I) **and** CH 108 (General Chemistry II)

Note: Taking MA 125-6 Pre-calculus and Calculus or MA 126 Calculus I could improve your grades in CH 107 and CH 108. MA 125-6 will satisfy one math course requirement for either track of the biology major.

SECOND YEAR:

BY 208 Ecology

BY 231 Genetics

CH 250 (Organic Chemistry)

MA125-6 OR MA126 OR MA127 OR MA129 OR BY220 OR BY256/MA256

By the end of your sophomore year, you should decide to commit either to the OEE track or the MCB track. **Talk to your Biology advisor and declare your major before the end of your sophomore year. While it is theoretically possible to declare later, planning your academic schedule and getting into courses may be challenging if you wait too long.**

Suggestions for students who are certain that they will choose the OEE track

FIRST YEAR:

Two of the following introductory biology courses:

BY 105 (Biology of Plants) OR

BY 106 (Biology of Animals) OR

BY 107 (Biology of Microbes) (no credit if taken after BY 101) AND

BY 131 (Introduction to Molecular and Cellular Biology)

and

CH 107 (General Chemistry I) & CH 108 (General Chemistry II)

Note: Taking MA 125-6 Pre-calculus and Calculus or MA 126 Calculus I could improve your grades in CH 107 and CH 108. MA 125-6 will satisfy one math course requirement for either track of the biology major.

SECOND YEAR:

Four of the following:

One more block of BY 105, BY 106, or BY 107 if both blocks have not already been completed (should be completed before the junior year).

BY 220 Biostatistics (recommended before taking BY 208)

BY 208 Ecology

BY 131 Introduction to Molecular and Cellular Biology (should be completed before the junior year)

CH 250 (Organic Chemistry)

MA125-6 OR MA126 OR MA127 OR MA129 or MA256/BY256

Note: Only 1 course in organic chemistry is required for the OEE track of the biology major, but many graduate courses and virtually all health-professions require 2 courses in organic chemistry (e.g. CH250 and CH251). Therefore, it may be advisable to also take CH 251 (Reactions of Organic Molecules). This second course in organic chemistry could be taken any time during the four years, but keep in mind that it is a prerequisite for Biochemistry.

Talk with your advisor and the Career Center about possible summer activities between your second and third years at the college. **Talk to your Biology advisor and declare your major before the end of your sophomore year.**

THIRD YEAR:

Finish your mathematics requirement.

BY 280 Population Genetics or BY 231 Genetics (if you have not already completed one of these courses)

Two-three approved Biology electives

Talk with your advisor and the Career Center about possible summer activities between your third and fourth years at the college. Talk with your advisor to find out if you might be eligible to graduate with distinction, so that you can complete the senior requirements for distinction.

FOURTH YEAR:

Complete a senior capstone course in the last two semesters prior to graduation (options vary from year to year, but will always include BY499, Senior Thesis) (list of eligible courses depends on the year; consult your advisor)

Complete the entire Senior Capstone Experience (includes seminars & abstracts; ETS or GRE exam)

Two or three approved biology electives (a total of 5 approved electives are required to complete the major, at least 3 of which must be at the 300 or 400 level)

Suggestions for students who are certain that they will choose the MCB track

FIRST YEAR:

One of the following introductory biology courses:

BY 105 Biology of Plants

BY 106 Biology of Animals

BY 107 Biology of Microbes (no credit if taken after BY 101)

CH 107 General Chemistry I

CH 108 General Chemistry II

BY 131 Introduction to Molecular and Cellular Biology

Note: Taking MA 125-6 Pre-calculus and Calculus or MA 126 Calculus I could improve your grades in CH 107 and CH 108. MA 125-6 will satisfy one math course requirement for either track of the biology major.

SECOND YEAR:

BY 231 Genetics

CH 250 Organic Chemistry I

CH 251 Organic Chemistry II

MA 125-6 OR MA 126 OR MA 127 OR MA 129 or MA 256/BY 256 or BY 220

Talk with your advisor and the Career Center about possible summer activities between your second and third years at the college. **Talk to your Biology advisor and declare your major before the end of your sophomore year.**

THIRD YEAR:

Finish your mathematics requirement.

Three approved Biology electives, including one or two with a BY 231 pre-requisite.

Talk with your advisor and the Career Center about possible summer activities between your third and fourth years at the college. Talk with your advisor to find out if you might be eligible to graduate with distinction, so that you can complete the senior requirements for distinction.

FOURTH YEAR:

Complete a senior capstone course in the last two semesters prior to graduation (options vary from year to year, but will always include BY499, Senior Thesis) (list of eligible courses depends on the year; consult your advisor)

Complete the entire Senior Capstone Experience (includes seminars & abstracts; ETS or GRE exam)

Two or three approved biology electives, including two or three with a BY 231 pre-requisite (a total of 6 approved electives are required to complete the major)

Suggestions for students who are uncertain whether to major in Biology (MCB track) or Biochemistry

The table below summarizes some of the differences between Biochemistry and Biology (MCB track).

	Required by Biochemistry?	Required by MCB?
1 unit from BY101, BY105, 106 (108/9), 107	yes	yes
BY131 Introduction to Molecular & Cellular Biology	yes	yes
BY231 Genetics	yes	yes
CH107 General Chemistry I	yes	yes
CH108 General Chemistry II	yes	yes
CH250 Organic Chemistry I	yes	yes
CH251 Organic Chemistry II	yes	yes
CH382 Biochemistry	yes	no; can count as an elective
Calculus I	yes	yes
Calculus II	yes	no; can count toward math requirement
1 unit of statistics or mathematical modeling	no	no; can count toward math requirement
Calc-based Physics I (PC241)	yes	no
Calc-based Physics II (PC242)	yes	no
Biology electives, three of which must have BY 231 Genetics as a pre-requisite	no	yes (five)
Upper level chemistry courses, such as physical chemistry	yes	no (CH382 can count as an elective)

The guiding principle for the advice below is to take first-year and sophomore-level courses that count toward both MCB Biology and Biochemistry, to buy yourself time to decide which major is best for you. *Note that the BY courses that are required by Biochemistry and/or allowed as electives for Biochemistry have not been finalized as of the printing of this Handbook, so it is best to check with a Biochemistry advisor.*

FIRST YEAR:

One of the following introductory biology courses (Only ONE of these courses counts toward the Biochemistry major.):

- BY 105 Biology of Plants
- BY 106 Biology of Animals
- BY 107 Biology of Microbes (no credit if taken after BY 101)
- CH 107 General Chemistry I
- CH 108 General Chemistry II
- BY 131 Introduction to Molecular and Cellular Biology

Note: Taking MA 125-6 Pre-calculus and Calculus or MA 126 Calculus I could improve your grades in CH 107 and CH 108. MA 125-6 will satisfy one math course requirement for either track of the biology major.

SECOND YEAR:

- BY 231 Genetics
 - CH 250 Organic Chemistry I
 - CH 251 Organic Chemistry II
 - MA 125-6 OR MA 126 OR MA 127 OR MA 129 or MA 256/BY 256 or BY 220
- The Biochemistry major strongly recommends completing MA128 and PC241 and PC242 before the end of the second year (but these courses are not required for the MCB Biology Major).

By the end of your sophomore year, you should decide to complete the MCB Biology Major or the Biochemistry Major.

Talk to your advisor and declare your major before the end of your sophomore year.

**REQUIREMENTS FOR THE BIOLOGY MAJOR: THE FULL GUIDE TO THE ORGANISMS, ECOLOGY AND EVOLUTION
(OEE) TRACK**

If you maintain a grade point average (GPA) of 3.0 in all your courses and a GPA of 3.5 in all BY courses taken to fulfill the biology major, you may be eligible to graduate with distinction. Graduating with distinction requires planning ahead as early as the sophomore year; please see section on “Senior Thesis and Graduation with Distinction in Biology.”

See the department website for descriptions of all Biology classes.

1. **Two** introductory units from:

- BY 105 (Biology of Plants)
- BY 106 (Biology of Animals); no credit after BY108 or BY109
- BY 107 (Biology of Microbes)
- BY 108 (Biology of Invertebrates)-no longer offered, but students who took the course prior to fall 2011 may count that unit.
- BY 109 (Biology of Vertebrates)-no longer offered, but students who took the course prior to fall 2011 may count that unit.

Check the AP/IB section of this handbook to determine if your AP or IB credit might fulfill the requirement for one of these courses. Application of AP or IB credit to a specific organismic course will require you to successfully pass a departmental bypass exam for that course; these are offered in blocks 1,3, and 5 only.

2. BY 208 (Ecology)

3. BY 131 (Introduction to Molecular and Cellular Biology)

Check the AP/IB section of this handbook to determine if your AP or IB credit might fulfill this requirement.

4. BY 280 (Population Genetics) OR BY 231 (Genetics)

5. **Five** approved Biology electives

- Three must be Biology (BY) courses at the 300 level or higher
- One unit of elective credit may be CH251, CH382, GY205, GY300, SC206, or SC301
- One unit must be an approved senior capstone course
- Any BY course except BY100 and BY104 may count as an elective
- BY101 (FYE) counts as one unit of lower-level elective
- It is possible to petition the department to ask for other courses to count as electives.

6. **Three** units in **Chemistry**

- CH 107 (General Chemistry)
- CH 108 (General Chemistry II)
- CH 250 (Structures of Organic Molecules)

Check with your advisor to find out if AP or IB credit can fulfill CH 107/108 requirement.

NOTE: Graduate schools often require BOTH CH 250 (Structure of Organic Molecules) AND CH 251 (Reactions of Organic Molecules).

7. **One** unit of calculus from:

- MA 125-6 (Pre-Calculus and Calculus)
- MA 126 (Calculus I)
- MA 127 (Calculus I and II, accelerated)
- MA 129 (Calculus II)

Check with your advisor to find out if AP or IB credit can fulfill the calculus requirement.

8. **One** unit of statistics or mathematical modeling from:

- BY 220 (Biostatistics and Experimental Design)
- MA 256/BY 256 (Mathematical modeling in Biology)

Check with your advisor to find out if AP or IB credit can fulfill the statistics requirement. Check with your advisor to find out if MA117 or MA217 can be used to fulfill the statistics requirement.

9. Senior Capstone Experiences...During your junior and senior years, you must

- Complete attendance at five Biology seminars, and summarize each in an abstract, and submit each abstract to your advisor no later than the first Monday of the block following the block in which the seminar occurred. After declaring the Biology Major, students can turn in abstracts during their junior or senior years.
- Successfully pass the Biology ETS exam or the Biology GRE exam.

- Register to take the ETS for Block 3 or early in Block 6, the only two times Biology offers the exam
- To take the Biology GRE in time to fulfill this requirement, you must take it in November or December and you must list Colorado College as a recipient of the GRE scores.
- Complete a senior capstone course in the last two semesters prior to graduation (options vary from year to year, but will always include BY499, Senior Thesis) in one of the following ways:
 - BY 499 (Senior Thesis; required to graduate with distinction)
 - BY 409 (Advanced Research in Biology)—IF it meets the requirements described in the section on “Senior Capstone, Part 3”)
 - An approved Senior Capstone course. The current list is: *BY308 Advanced Ecology*, *BY365 Plant Physiology*, *BY366 Comparative Animal Physiology*, *BY378 Laboratory Investigation in Molecular Microbiology*, *BY410 Ornithology*, *BY412 Entomology*, *BY415 Evolution*, *BY421 Conservation Biology*, *BY443 Techniques in Molecular Ecology*, *BY463 Senior Seminar in Bacterial Pathogenesis*, *BY466 Developmental Biology*, *BY450 Seminar in Molecular Biology*.

REQUIREMENTS FOR THE BIOLOGY MAJOR: THE FULL GUIDE TO THE MOLECULAR AND CELLULAR BIOLOGY (MCB) TRACK

If you maintain a grade point average (GPA) of 3.0 in all your courses and a GPA of 3.5 in all courses taken to fulfill the biology major, you may be eligible to graduate with distinction. Graduating with distinction requires planning ahead as early as the sophomore year; please see section on “Senior Thesis and Graduation with Distinction in Biology.”

See the department website for descriptions of Biology classes.

1. **One** introductory unit from:

- BY 105 (Biology of Plants)
- BY 106 (Biology of Animals); no credit after BY108 or BY109
- BY 107 (Biology of Microbes)
- BY 108 (Biology of Invertebrates)-no longer offered, but students who took the course prior to fall 2011 may count that unit.
- BY 109 (Biology of Vertebrates)-no longer offered, but students who took the course prior to fall 2011 may count that unit.

Check the AP/IB section of this handbook to determine if your AP or IB credit might fulfill the requirement for one of these courses. Application of AP or IB credit to a specific organismic course will require you to successfully pass a departmental bypass exam for that course; these are offered in blocks 1,3, and 5 only.

2. BY 131 (Introduction to Molecular and Cellular Biology)

Check the AP/IB section of this handbook to determine if your AP or IB credit might fulfill this requirement.

3. BY 231 (Genetics)

4. **Six** approved Biology electives

- Three must be Biology (BY) courses with BY231 (OR BY361) as a pre-requisite
- One unit of elective credit may be CH241 or CH382
- One unit of elective credit may be GY300, PY299, or SC301
- One unit must be an approved senior capstone course
- Any BY course except BY100 and BY104 may count as an elective
- BY101 (FYE) counts as one unit of lower-level elective
- It is possible to petition the department to ask for other courses to count as electives.

5. **Four** units in **Chemistry**

- CH 107 (General Chemistry)
- CH 108 (General Chemistry II)
- CH 250 (Structures of Organic Molecules)
- CH 251 (Reactions of Organic Molecules)

Check with your advisor to find out if AP or IB credit can fulfill the CH 107/108 requirement.

6. **Two** units of math from:

- MA 125-6 (Pre-Calculus and Calculus)
- MA 126 (Calculus I)
- MA 127 (Calculus I and II, Accelerated)
- MA 129 (Calculus II)
- BY 220 (Biostatistics and Experimental Design)
- MA 256/BY 256 (Mathematical Modeling in Biology)
- EV 228 (Analysis of Environmental Data)

Check with your advisor to find out if AP or IB credit can fulfill the mathematics requirement.

8. Senior Capstone Experience...During your last two semesters, you must

- Complete attendance at five Biology seminars, and summarize each in an abstract, and submit each abstract to your advisor no later than the first Monday of the block following the block in which the seminar occurred. After declaring the Biology Major, students can turn in abstracts during their junior or senior years.
- Successfully pass the Biology ETS exam or the Biology GRE exam.
 - Register to take the ETS offered in Block 3 or early in Block 6, the only two times Biology offers the exam
 - To take the Biology GRE in time to fulfill this requirement, you must take it in November or December and you must list Colorado College as a recipient of the GRE scores.
- Complete an approved Senior Capstone Course as one of your electives (requirement #5 above) during the last two semesters, in **one** of the following ways:
 - BY 499 (Senior Thesis; required to graduate with distinction)
 - BY 409 (Advanced Research in Biology)—IF it meets the requirements described in the section on “Senior Capstone, Part 3”
 - An approved Senior Capstone course. The current list is: *BY308 Advanced Ecology*, *BY365 Plant Physiology*, *BY366 Comparative Animal Physiology*, *BY378 Laboratory Investigation in Molecular Microbiology*, *BY410 Ornithology*, *BY412 Entomology*, *BY415 Evolution*, *BY421 Conservation Biology*, *BY443 Techniques in Molecular Ecology*, *BY463 Senior Seminar in Bacterial Pathogenesis*, *BY466 Developmental Biology*, *BY450 Seminar in Molecular Biology*.

BYPASS EXAMS FOR INTRODUCTORY BIOLOGY COURSES

Students with strong backgrounds in biology may by-pass BY 105, 106, 107 or 131 by examination. It is not necessary to have taken Advanced Placement (AP) Biology or the AP Exam to take a bypass exam. Bypass exams are offered in blocks 1, 3 and 5 each year.

A successful score on the bypass exam, determined by the faculty member in charge, exempts the student from the required course and satisfies the prerequisite for other courses. *However, students should note that successful completion of one or more bypass exams means that a minimum of 9 other courses in Biology must still be completed.* Any approved elective may be substituted for the course bypassed via an exam (for the exception, see policy on AP/IB credit). The department administrative assistant has a list of faculty in charge of bypass exams.

ADVANCED PLACEMENT/IB CREDIT FOR BIOLOGY MAJORS

Students should consult with their academic advisor in biology or with the Chair concerning AP or IB credit toward the Biology major.

AP and IB credit

The CC registrar must have previously awarded CC units of credit on your transcript before the Biology Dept can assess AP or IB units appropriately. Please make sure your scores have been sent to the college.

AP credit	
Score 4	Credit for one lower-level elective (or specific course—105, 106, 107, 131--IF bypass test is passed)
Score 5	Credit for BY131; placed into BY231
IB-HL (higher level)	
Score 4	Credit for one lower-level elective (or specific course—105, 106, 107, 131—IF bypass test is passed)
Score 5	Credit for BY131; placed into BY231
Score 6, 7	1) Credit for BY131 and 2) Credit for one lower-level elective (or an organismic course—105, 106, 107--IF bypass test is passed)
IB-SL (standard level)	
Score 5	Credit for one lower-level elective (or specific course—105, 106, 107, 131--if bypass test is passed)

Bypass exams for 105, 106, 107, and 131 will be given 3 times per year, during the first week of blocks 1, 3, and 5. Students should arrange this in advance with the department supervisor of the relevant exam. Students must take a bypass exam at least one block before the course s/he wishes to bypass.

Important Notes: Students choosing this option are reminded that our intermediate and upper level courses often have specified introductory courses as prerequisites and that the AP/IB credit will **not** automatically bypass these prerequisites. Talk to the professor who teaches that elective to find out if AP/IB credit will enable you to enroll in the elective.

Students majoring in the Organisms, Ecology, and Evolution track who have AP or IB credit in Biology may not have strong preparation across the scope of organismic biology (for example, they may not have been exposed to significant amounts of botany or invertebrate zoology) and should consider taking one or more introductory courses as electives. Talk to your Biology advisor about this

situation.

AP credit for courses outside the Biology Department.

Students with AP or IB credits in chemistry or mathematics may be allowed to bypass an introductory level course that is required for the biology major. Students wishing to consider this option should consult with the department chairs in Biology and the relevant other department to assess how the AP or IB credit may be applied.

INDEPENDENT STUDY/SUPERVISED RESEARCH BLOCKS

Research in Biology blocks (BY 309 or BY 409) allow students opportunities to pursue a lab or field research project under supervision of an experienced scientist. **Note that prerequisites are enforced**. Not more than a total of 2 units from BY309, 409, 499, CH 403, or independent study from off-campus programs can be used toward the biology major, and only 1 unit of independent research from an off campus program may be applied to the major.

Begin talking with a faculty member in the area of your interest several months before your research block. If a faculty member agrees to supervise your research and is not scheduled for BY 309 or BY 409 Research in Biology that block, the Registrar will create a course for you. Talk with your faculty research advisor to find out if you should register for BY 309 or BY 409 (generally BY309 if you are a junior and BY409 if you are a senior).

It is possible that you will need to apply for Venture Grant funding to purchase supplies needed for an independent study project. Venture Grant applications also have a deadline (the 2nd Friday of each block), and typically the grants must be awarded before you begin the research. Check with your faculty research advisor to find out if you should write a Venture Grant and learn about that process, its deadlines, etc. See <http://www.coloradocollege.edu/resources/dean/VentureGrants/> for details about Venture Grants. Students who receive Venture Grant funding must present their work publicly, for example at Biology Day.

We strongly encourage all BY 309 and BY 409 students to present their research in the form of a poster on Biology Day. Talk to your advisor about this opportunity.

For information about **conducting research off-campus under supervision of a non-CC faculty member**, see Appendix VII. **A petition is required.** Not more than 1 unit of independent study from off-campus work can be used toward the biology major.

GENERAL RULES for students doing research with a CC faculty member:

Please do not take any equipment or supplies from the Biology preparatory room (Room 525), the botany preparatory room (Room 419), the greenhouse (Room 514) or any classroom without communicating in writing or in person with the supervisor of the room: 1) who you are, 2) what equipment/supplies you wish to use, 3) where you wish to move these items, and 4) when you will return it. This will keep the biology faculty and staff aware of equipment whereabouts when they are preparing for classes.

- * If a piece of equipment gets broken or misplaced, **immediately inform** the professor with whom you are working.
- * Before using any chemicals or instruments, make sure the professor with whom you are working explains to you how to properly use them. It is your responsibility to ask if you are uncomfortable with something.
- * Upon completion of your research, please clean and return all the equipment and supplies that you have used.

The following rooms and people will be valuable resources in helping you obtain your research goal. Please become familiar with them:

BIOLOGY-PREPARATORY ROOM (Rm. 525)

In this room you will find glassware, commonly used chemicals, field equipment, etc. It is a good idea to introduce yourself to the supervisor of the preparatory room and familiarize her with your research. This way, she will let you know what kind of supplies are available which will save you large amounts of time. If you use the last of something or need to order new supplies, please let your supervisor know.

GREENHOUSE (Room 509), BOTANY PREPARATORY ROOM (Room 419), HERBARIUM (Room 411) and GROWTH CHAMBERS (Room 514)

Many of the research problems involving plants require the use of these rooms. Please check with the supervisors of these areas as to the availability of these rooms before planning your research. Again, if you anticipate using any of these rooms, introduce yourself and learn what is or is not possible. The HERBARIUM is only available to students who have taken BY 202 Field Botany, and is used only with explicit permission of Professor Tass Kelso.

BIOLOGY OFFICE

The office (Olin 458) and room across the hall (Olin 465) contain a photocopier, a fax machine, a paper cutter and a variety of office supplies. Please consult with the department administrative assistant before using any office equipment or taking office supplies.

RESEARCH PROFESSORS

Work out with the cooperating professor exactly what your project will entail. Make sure you understand when everything is due. Please respect deadlines and be on time for meetings with any professors with whom you work.

BIOLOGY PARAPROFESSIONALS

The paraprofessionals are available to help in a wide variety of ways. Most often, the paraprofessional has done extensive research and knows what kinds of questions and problems that you are bound to encounter. Feel free to ask them for help. Each block, though, the paraprofessionals are assigned to assist with a class, which must be their first priority. Please be considerate of their time.

SCANNING/TRANSMISSION ELECTRON MICROSCOPE USE

Only individuals who have taken the necessary preparatory classes (BY 344 and BY 345) can use these microscopes for their research. Please see Professor Ron Hathaway if you wish to use these microscopes.

LICOR/PRESSURE BOMB USE

Before taking either of these instruments, please check with either Professor Jim Ebersole or the professor with whom you are working to make sure the instrument is available.

DEPARTMENTAL SEMINARS

As an important part of your professional education, Biology majors are expected to routinely attend department seminars. Note that abstracts of five seminars are required. Biology seminars are scientific presentations given by faculty or guest speakers. See the professor in charge of seminar scheduling for arrangements if you have suggestions for speakers. You will be notified by email of upcoming seminars on campus that are relevant for Biology majors, and if they count for your abstracts.

SENIOR CAPSTONE

There are three parts of the required senior capstone experience.

1. Research seminars & abstracts
2. ETS or GRE examination
3. Senior capstone course

PART 1: BIOLOGY SEMINARS

Complete attendance at five Biology seminars, and summarize each in an abstract, and submit each abstract to your advisor no later than the first Monday of the block following the block in which the seminar occurred. After declaring the Biology Major, students can turn in abstracts during their junior or senior years.

Students who will graduate with a Biology major are required to submit abstracts of FIVE biology seminars. NONE of these abstracts may come from student seminars although the keynote address from BioDay may be used. Students from past years recommend you write abstracts within several days of the seminar. If you are a declared major, you will receive e-mail notices of Biology seminars, which are also listed on the departmental web page under Seminars.

Please follow these guidelines for seminar abstracts:

DEADLINES-

- Submit each abstract to your advisor no later than the first Monday of the block following the block in which the seminar occurred. After declaring the Biology Major, students can turn in abstracts during their junior or senior years.

ACCEPTABLE SEMINARS-

- abstracts of seminars sponsored by the Biology Department will be accepted, but student seminars presented at Bio Day are NOT acceptable
- abstracts from biology seminars at UCCS, CU, CSU, DU, CU medical school and at Penrose or Memorial Hospital will normally be accepted (if in doubt ask your academic advisor for approval before you attend the seminar).
- abstracts of seminars from other science departments at CC may be eligible but abstracts must include a paragraph that clearly explains the link of the topic to biology (again, if in doubt ask your academic advisor for approval before you attend the seminar).

FORMAT-

- abstracts are limited to one page and must be printed and not handwritten.
- each abstract must include the following: 1) complete title of the seminar, 2) complete name and academic affiliation of the presenter, 3) date of the seminar, 4) a complete description (abstract) of the seminar where you summarize the major points of the presentation, and 5) the student's name with the honor code signed. Each abstract must be clear, concise, well-written and complete to be accepted by your advisor and the department. See the back of the Biology Handbook for an example format.
- *abstracts must include the honor code. The letter and spirit of the CC honor code must be strictly followed. For example, each abstract must be your own original description, written by you in your own words, and you must have actually attended the seminar in person.*

PART 2: TAKE A SENIOR EXAMINATION

Successfully passing the senior examination will be required of all students graduating with a major in Biology. The senior comprehensive exam will be the Educational Testing Service (E.T.S.) Biology Subject Test, which will be administered by the Biology Department twice during the year: early in Block 3 (students wishing to graduate in December **must** take the exam then) and early in block 6. The ETS Biology Exam is a 2-hour multiple choice test covering diverse fields of biology and is a nationally administered exam. Scores are recorded as percentiles ranked across multi-year performance of Biology majors at undergraduate institutions across the country. Scores are given for Overall Percentile, and in 4 subareas: Cell Biology, Genetics, Organismic Biology, and Ecology and Evolution. The exam grade will be recorded permanently on the student transcript. The Graduate Record Exams (GRE) Subject Test in Biology may be substituted for the ETS only if it is taken on the November or December test dates. The Spring GRE results come back too late for graduation deadlines. To substitute the ETS, student must list Colorado College as a recipient of the GRE scores.

Criteria for Passing the Exam

1. ETS. A grade of Outstanding will be given for achieving the 85th percentile overall or in at least 2 of the 4 subcategories. A grade of Satisfactory will be given for achieving the 60th percentile overall, or the 65th percentile in at least 2 subcategories.
2. GRE. A grade of Outstanding will be given for achieving the 80th percentile overall or in at least 2 subcategories. A grade of Satisfactory will be given for achieving the 50th percentile overall or the 60th percentile in at least 2 subcategories.

What happens if you do not achieve a passing score?

Students who take the ETS or GRE in the fall have the option of retaking the ETS (not the GRE) in block 6 to see if they can raise their score to a passing level. Students who take the oral exam makeup (described below) for a failing ETS grade have only the option of moving to Satisfactory from Failing. They may not receive Outstanding. Students who retake the ETS might have the option of receiving Outstanding if their scores improved to reach that level.

For students who take the ETS in the winter and do not pass, they must successfully pass an oral make up exam with 2 faculty members chosen by the department. They will be asked to read an appropriate research paper chosen by faculty, and meet with 2 faculty members to orally discuss the concepts and implications of that research paper, as well as respond to questions from the faculty. The makeup exam must be schedule in a timely fashion no later than block 7 in order to meet the graduation deadlines. *A passing grade must be achieved on the senior exam before graduation forms can be signed. Oral exams will only be given to students who have previously attempted the ETS or GRE exam . Students who do not take the ETS or GRE are not eligible for oral examination and will not be able to graduate with a degree in Biology until they have taken one of the tests.*

Cost of the exam is approximately \$30. Students must register and pay for the exam by the second Monday of block 2 for the block 3 test date and by the second Monday of block 5 for the block 6 test date. Registration and payment should be done in the Biology Department office. This test is a **requirement** for completion of the biology major.

PART 3: TAKE AN APPROVED SENIOR CAPSTONE COURSE

Students may fulfill the capstone requirement by completing a senior thesis (BY 499), completing a research block that requires a substantial written research report with literature background (e.g. BY 409, if the supervising faculty member requires that the student meet the capstone course description) or successfully completing a designated capstone course that draws upon a body of knowledge, perspectives, and experiences developed over the entire course of the Biology major. A capstone experience must be integrative across more than one level of biological organization, e.g. genome-metabolism-organism, genome-organism-evolution, or genome-physiology. Moreover, a capstone course must include at least two of the following elements: a critique of primary literature; a seminar-style discussion of primary literature; a written proposal, oral presentation, or paper that requires synthetic thinking; substantive opportunities designed to broaden student understanding of inquiry and research methods in biology.

A course may only fulfill the capstone requirement if taken during the last two semesters before graduating; the intent is for students to bring to a given course the full complement of their biology education at Colorado College. The current list of eligible courses for capstone experiences is: BY308 Advanced Ecology, BY365 Plant Physiology, BY366 Comparative Animal Physiology, BY378 Laboratory Investigation in Molecular Microbiology, BY410 Ornithology, BY412 Entomology, BY415 Evolution, BY421 Conservation Biology, BY443 Techniques in Molecular Ecology, BY463 Senior Seminar in Bacterial Pathogenesis, BY466 Developmental Biology, BY450 Seminar in Molecular Biology.

Students who complete the senior capstone course will be better able to

- Critique primary literature, providing theoretical context for the literature discussed.
- Analyze a body of research including primary literature, explain application and relevance of the findings, and describe potential future directions of the research topic.

- Select appropriate primary literature papers relevant for a research project, seminar, or research proposal.
- Organize information from multiple sources (primary literature, review articles, original research) into a cohesive oral presentation or written report or proposal. Presentations or reports may be of any length (as decided by the supervising faculty) but should provide evidence of synthesis of information across levels of biological organization.

If you have questions concerning these requirements, see your academic advisor in the Biology Department

STUDY AT OTHER INSTITUTIONS:

OFF CAMPUS STUDY: CREDIT TOWARD THE BIOLOGY MAJOR

These guidelines are only for Biology majors and students who definitely intend to declare a Biology major. Students majoring in other departments or programs (e.g. Neuroscience, Biochemistry, or Environmental Science) should consult with their Department Chair or Program Director and with a Biology faculty member associated with that program or major. Off-campus study may be a Colorado College sponsored program such as the Associated Colleges of the Midwest Tropical Field Research Semester in Costa Rica, courses and programs such as the School for Field Studies, and research at established institutions such as government laboratories or the University of Colorado Health Sciences Center. Field or laboratory research directly supervised by a member of the Biology Department faculty does not require petitioned approval, nor does participation in an ACM program.

Students seeking credit for the Biology major through participation in other off-campus programs or for doing research with a non CC supervisor must be aware of the following guidelines and credit limits.

- Not more than a total of 2 units from BY309, 403, 409, 499, or independent study from off-campus programs can be used toward the Biology major. Not more than 1 unit of independent study from off-campus work can be used toward the Biology major. With few exceptions, no more than 2 units from nonCC or ACM programs may be applied to the Biology major. Courses taken on off campus programs prior to enrolling in college (for example, in a gap year or gap semester) do not count for the Biology major. Units over these limits may still count toward the 32 units required for a CC degree.
- Courses of study in off-campus programs must first be accepted for potential CC credit by the Registrar's Office. You will be asked to fill out a credit approval form; this form requires you to consult with your academic advisor about how this course of study will affect your progress towards a CC degree and your major. The College's International Programs Office can also assist you, but early consultation with your Biology advisor, the Associate Chair, or the departmental faculty member (currently Professor Tass Kelso) who deals with off-campus credit is essential.
- If your proposed course of study program is given approval for CC credit by the Registrar, you may next seek credit toward the Biology major. Biology majors need to consult with their academic advisor in Biology (or Professor Kelso or Associate Chair) and fill out, then file the departmental off-campus study form **in advance**. This form is used to gain departmental acceptance of your participation in the program.
- Students are cautioned that a course must receive 4 semester hours to count as 1 full CC unit. Courses of only 3 semester hours will count as only 0.75 units of CC credit and may not fulfill Biology major requirements.

Requests for off-campus credit fall into one of the four categories below. Choose the applicable category and then follow the procedures for that category.

1. Courses at other institutions in traditional academic settings

Students are urged to take required courses for the major at Colorado College. However, in unusual cases, you may seek substitute credit for a required course taken elsewhere in a *formal* university setting such as summer session at accredited colleges and universities. Eligible required courses for the biology major are BY 105, 107, 106, 131, 231. The department requirement for electives may be met by an off campus course described in number 2 described below. *Normally courses with Ecology in the title do not substitute for BY208 Ecology.* You may be asked to document the course content through syllabi, copies of exams, textbooks and through discussion with the Chair and/or a dept member who teaches the course for which you want to substitute one elsewhere. Some of this material may not be available until after your course but we urge you to seek preliminary advice about whether the course can be counted as a substitute. Documentation of equivalency is the responsibility of the student. Again, at most only 2 courses may be used to meet the Biology major requirements, unless a case is exceptional (for example, transfer students from another college or university). If courses require at least 2 prerequisites, they may count as upper-level electives.

Note: substituting required courses in other departments, such as Chemistry, requires written approval by that Department and approval by your academic advisor in the Biology Department or the Associate Chair, if your advisor is not a member of the Biology faculty. Courses taught in nontraditional formats will not be considered as substitutes for any **required** course.

Procedures for courses from traditional academic institutions

- 1) Consult with your advisor about suitability of the course(s) for you.
- 2) Confirm with the Registrar that credit from your proposed study will successfully transfer. Fill out the Registrar's Off-Campus Study form.
- 3) Obtain your advisor's signature to verify which requirements the proposed courses might fulfill. The advisor may need to consult with the CC Biology faculty members who teach the course for which equivalency is desired. The signature of the associate chair or designated departmental representative, currently Professor Tass Kelso, is also required. It is best to provide evidence (syllabi, etc.) BEFORE taking the course that the proposed course is the equivalent of a Biology major requirement. If not, it will be noted on the form that adequate evidence must be supplied after the course (this is risky for the student).
- 4) When you return to CC, it is your responsibility to confirm that the Registrar has received the official transcript from the other institution and that the coursework appears on your transcript. You must receive a grade of C or higher in order to receive credit.

2. ACM Programs

No departmental paperwork is required for these programs, and the course work will transfer directly to your Biology major. However, well in advance of your program you should consult with the college ACM advisor, currently Professor Marc Snyder, about entrance requirements and deadlines and with your Biology advisor about the suitability of these programs for your educational goals. We strongly recommend taking BY208 Ecology AND BY220 Biostatistics before attending either of these programs; you will benefit much more from the experience with the background obtained in these courses.

- a) **ACM Tropical Research (Spring) Semester in Costa Rica.** Successful completion of the program provides two units toward the Biology major. One of these will be for BY309/409 Independent Study if the field project is on a biological topic (as determined by your advisor or Professor Snyder after you return). The second unit will count as an upper-level elective if the student has taken a field course prior to the ACM program or as a field course or lower-level elective if the student has not had a field course prior to the program. Students also receive a third unit in Spanish, and a 4th unit of unspecified CC credit.
- b) **ACM Human Evolution & Ecology in Tanzania.** Students who successfully complete this program will receive two units of credit toward the major. One unit will count as a lower-level elective, and the second will count as an upper-level elective if the research project is on a biological topic.

Procedures for ACM programs

- 1) Consult with your advisor about suitability of program for your goals.
- 2) Consult with CC advisor of the program about suitability of the program for you and about application procedure, etc.
- 3) Upon return, get confirmation of that your field project topic was biological and merits credit toward the Biology major.

3. Non-ACM field programs The college has limited CC credit to a select list of off campus programs (see the Registrar or International Programs Office for a current list of CC-Approved Programs). Students with strong preparation who feel they have completed a substantive project in a CC-approved program worthy of upper level credit may petition the department after they return; if granted, they would then receive 1 upper and 1 lower level credit, to a maximum of 2 elective units towards the major. The petition would include demonstration of coursework preparation (e.g. BY208 and 220) and submission of a completed project to a relevant faculty member who supports the petition (project must have adequate design, hypothesis, and data, and be done solo rather than in a group).

Some exceptions apply. These are the programs for which upper level elective credit will continue to be awarded, and no petition is required:

- ***Boston University Tropical Ecology*** Participants in the program can receive *1 upper and 1 lower level elective* in Biology as per the current practice. Prereqs are: 1 year of intro Bio and a course in Ecology; 1 yr college Spanish.
- ***Sea Semester Oceans and Climate*** (for advanced students) This program is advertised as targeting more advanced science students than the regular program. Prerequisites: A minimum of 3 lab science courses, including 1 at the 300-level or higher, or consent of instructor. *Two CC units of credit toward the bio major will be given as follows: one upper level biology elective (equivalent to independent study), if the student project is on a biological topic.*
Note: Regular Sea Semester Program receives 1 lower level Biology elective and 1 geology unit (can be paired with GY140 to satisfy the Geology option for the major) OR 2 lower level biology electives OR 1 lower level elective and 1 field course unit in Biology. (No change from previous Biology Department policy)
- ***CC/Woods Hole Environmental Science Semester (at Woods Hole)*** Prerequisites are 1 year biology, 1 year chemistry, 1 year calculus (1 year typically equals 2 blocks). *This program will receive 1 lower level Biology elective and 2 upper level Biology electives for a total of 3 Biology units.*

Procedures for non-ACM field programs

- 1) Consult with your advisor about suitability of the course(s) for you.
- 2) Consult with the International Programs Office, which can help you choose strong programs and advise you on the process of

obtaining credit.

- 3) Confirm with the Registrar that credit from your proposed study will successfully transfer. Fill out the Registrar's Off-Campus Study form.
- 4) Obtain your advisor's signature to verify which requirements the proposed courses might fulfill. The advisor may need to consult with the CC Biology faculty members who teach the course for which equivalency is desired. Signature of the department off-campus advisor is also required. It is best to provide evidence (syllabi, etc.) BEFORE taking the course that the proposed course is the equivalent of a Biology major requirement. If not, it will be noted on the form that adequate evidence must be supplied after the course (this is risky for the student).
- 5) Upon return, get confirmation that the topic of your field project was biological and merits credit toward the Biology major.

Summary Guide of credits towards the Biology major from popular CC-approved programs

ACM-Costa Rica: See Prof. Snyder for details. One unit will count as a lower-level elective, and the second will count as an upper-level elective if the research project is on a biological topic.

ACM-Tanzania: Receives 2 units towards the Biology major: one credit is the equivalent of BY309/409 (if project is a biological topic and student has had appropriate prior preparation in biology courses) and 1 is a lower level elective.

Boston University Tropical Ecology (this program has prerequisites). Student receives 1 *upper level elective* and 1 *lower level elective*.

Boston University Europe (Grenoble or Dresden): Prerequisite is BY131 or equivalent. Students receive 1 *lower level elective* for the cell biology component (no credit after BY131 or 210) and 1 unit of Organic Chemistry.

OTS/Duke Tropical Medicine and Public Health (Costa Rica): Student receives 2 *lower level electives*.

Sea Education Association (SEA) programs:

Oceans and Climate: students receive 2 *upper level electives*

Ocean Exploration: students receive 2 *lower level electives*

Documenting Change in the Caribbean, Sustainability in Polynesian Island Cultures, and Energy and the Ocean Environment: students receive 1 *lower level elective*

Woods Hole Environmental Science Semester (this program has prerequisites). Students receive 2 *upper level elective credits* and 1 *lower level elective*.

Other programs on the approved list typically receive 1-2 lower level electives. Please check with the designated department faculty member to see what these are for the program you are interested in. Students who take abroad programs prior to enrollment in college may not receive credit towards the biology major, although they may receive CC credit overall. Courses taken prior to taking college level biology are treated as the equivalent of BY100's (Studies in Biology, for nonmajors) and do not receive credit in the Biology major.

4. Independent Study with an off-campus supervisor

You must submit a petition to the department in order to obtain credit for independent research conducted in a setting that does not award credit. Examples of this include research at CU's Health Sciences Center and similar institutions. Off-campus research under supervision of a CC faculty member does not require departmental approval.

Procedures for independent study with an off-campus supervisor

- 1) Obtain the form *Petition for Off-campus Research Credit*, which is available in the Biology office. This form requires verification by your off-campus supervisor that s/he will supervise you.
- 2) Obtain signature of a CC Biology faculty member. This signifies that that person will participate in your project and evaluation.
- 3) Submit the petition at least one block prior to the study so the department can discuss it at a departmental meeting. Late petitions, included those submitted during the summer, cannot be considered.
- 4) After completing your research, obtain verification from the supervising CC faculty member that your research merits credit toward the Biology major. Remember that only one off-campus research unit and a total of two units of research credit may count toward the major.

BIOLOGY DAY

Each spring the department faculty, staff and students meet for a day-long series of presentations, including those given by biology majors seeking Graduation with Distinction. Biology Day is usually in April (block 7). All students are encouraged to attend. Abstracts required for graduation may be written on the keynote speaker's talk but not student presentations.

DEPARTMENTAL AWARDS TO STUDENTS

The Mary Alice Hamilton Award

Each year the Biology Department faculty selects one or two outstanding senior biology majors as the winner of the Mary Alice Hamilton Award. Among other things, grades, research, and potential to become a professional biologist are considered in making the award to the outstanding biology major(s). Winners will be announced at the Honors Convocation each spring. The award is usually a book appropriate to the professional interest of the recipient.

The Richard and Reba Beidleman Award

Each spring the Biology Department faculty selects a student recipient for the Richard and Reba Beidleman Award. The student must have demonstrated through courses, fieldwork, or other activities, outstanding potential for becoming a professional ecologist and/or field biologist. The award recipient, who may be in any year of study, will be announced at the annual Honors Convocation.

The James Enderson Award in Conservation Biology

The Enderson Award in Conservation Biology honors Professor Jim Enderson, who joined the Biology Department in 1962, long before it was fashionable to call oneself a “conservation biologist.” Throughout his career, his research centered on the precipitous declines of birds of prey, especially the peregrine falcon. He was first to breed the temperate North American peregrine in captivity, a line used extensively in restoration of the western population. He served on several recovery teams and working groups for endangered species. At Colorado College he inspired students through independent projects to pursue careers from botany to ornithology, in the lab and in the field. In keeping with his scholarship and breadth as a biologist, the Enderson Award will honor a junior or senior Biology major whom, in the opinion of the faculty, has shown commitment and productivity in an original research project in conservation biology. Candidates are eligible if their work has conservation implications, whether the focus was molecular, organismic, or ecosystem, lab or field.

The Laboratory Biology Award

This award is made to a senior biology major whose interests and course work are mainly in the area of laboratory-based biology. The criteria for selecting a recipient for this award are: grades in biology courses with a laboratory component, engagement in lab-based research, preferably for a senior thesis, and plans for post-graduate work or study.

The Jason Wilkes Memorial Prize

Each spring the biology faculty may select a minority student who is a declared biology major to receive this award. The recipient, like Jason, must have a strong interest in biology.

The Alfred Alberts Prize

In alternate years the Chemistry and Biology Departments award the Alberts Prize to support student research in biochemistry and molecular biology.

SENIOR THESIS AND GRADUATION WITH DISTINCTION IN BIOLOGY

OVERVIEW OF PROGRAM

The Biology Department faculty recognizes the educational benefits for any student doing original research and presenting it in writing and orally. Therefore, any senior biology major may elect to undertake a senior thesis. A senior biology major who completes a high quality senior thesis, presents it orally at Biology Day, **and has a high grade point average** (for details of the GPA requirement see the section on *Graduation With Distinction* below) will receive **Graduation With Distinction**. This honor will be recorded on the student’s official transcript and noted on the commencement program at graduation. On the other hand, if a student meets the senior thesis and presentation requirements, but does not have a high enough grade point average, s/he will **not** receive Graduation With Distinction, but the successful completion of the senior thesis requirements will become part of the student’s official transcript under BY 499 Senior Thesis.

CHECKLIST to graduate with distinction in Biology

1. Overall GPA is 3.0 or higher.
2. GPA in all BY courses taken to fulfill the Biology major is 3.5 or higher.
3. Has completed hypothesis-driven research that can be used as the basis of a thesis.
*Note: if a student wishes to use research done off-campus, under the supervision of a non-CC faculty scientist, that student must get approval to use that research for a senior thesis PRIOR to doing the research. **PLAN AHEAD!***
4. Registered for BY 499 before the end of Block 2 of the Senior year.
5. Completed the “Registration for Senior Thesis” form (Appendix VI) and turned it in to the faculty Senior Thesis/Distinction coordinator (currently Prof. Bertrand; check with Biology administrative assistant)
Note: Step 5 requires both a primary thesis advisor and a secondary reader.
6. Informed the Biology Day coordinator (a faculty member) of their intention to present their thesis on Biology Day (consult

Biology administrative assistant to find out who the Biology Day coordinator is)

7. Presented thesis in an oral seminar at Biology Day.

SENIOR THESIS

The option of undertaking a senior thesis must be initiated by the student and approved by a Biology Department faculty member (primary research advisor), who will supervise the student's research and senior thesis. In addition, another faculty member (who may be in another CC department if the area of research falls under the other faculty member's area of expertise) must agree to act as a secondary advisor. (Faculty members may decline to be thesis advisors because of other commitments.) The primary and secondary research advisors comprise the thesis committee. The thesis committee will establish the format and requirements of the research and thesis, read and suggest revisions in the thesis, and determine whether the thesis is of sufficient quality to qualify for Graduation With Distinction.

Ideally, the decision to write a senior thesis should be made in the fall of the junior year so that the spring may be devoted to a survey of the literature and planning for the research. The research itself should begin by the following summer. Work on the writing of the research must begin by the fall of the senior year.

The senior thesis is based on original research done by the student. A literature review, although a necessary part of a senior thesis, is not in itself considered to be a thesis.

OFF-CAMPUS RESEARCH

Off-campus research projects done in such programs as the Oak Ridge Semester, the ACM Tropical Field Research Program in Costa Rica, research at another institution, or other approved research experience at a laboratory or field station may be used for the research on which a senior thesis is based. Students should be aware, however, that sometimes research supervision in these programs is not very good, and that they could end their off-campus program without having obtained suitable data for a senior thesis. A student should approach a CC biology faculty member about being the student's primary research advisor **before the student undertakes the off-campus research**. When the student returns to CC after finishing the off-campus research, the primary thesis advisor will judge whether the results of the student's off-campus research project is worthy of a senior thesis. **Students are additionally cautioned that the actual writing of the senior thesis based on off-campus research must be done by working closely with the CC Biology Department faculty member who has agreed to be the student's primary research advisor.** In this case the primary thesis advisor supervises the data analysis and writing of the thesis, rather than supervising the actual research.

REGISTRATION FOR SENIOR THESIS

Students undertaking a senior thesis must return a completed form (Appendix VI) entitled, *Registration for Senior Thesis*, by **the end of block 2 of the senior year**, to the coordinator of the Senior Thesis/Distinction program. Students must arrange for a thesis committee consisting of a primary research advisor, who must be a Biology Department faculty member, and a secondary advisor, who may be in another academic department. An oral presentation advisor, normally the primary research advisor, is also necessary. These advisors must sign the registration form before it is turned in to the Senior Thesis/Distinction coordinator.

SIGNING UP FOR BY 499 SENIOR THESIS

Also by the end of block 2 students planning to do a senior thesis should be signed up for BY 499 Senior Thesis through the Registrar's Office. Enrolling in BY 499 and completing the Biology Department's requirements for a senior thesis (a high quality written senior thesis and an oral presentation at Biology Day) will provide an official record of the senior thesis on the student's transcript. There is an option of signing up for BY 499 as a regular block course, or if a student does not want to use a regular block for this course, s/he may enroll in BY 499 as a FULL YEAR extended format course. Students may enroll in one extended format course per semester for ½ CC unit at no extra tuition cost. The instructor for BY 499 should be the primary thesis advisor. BY499 may only be taken as a full year extended format course in both semesters.

ORAL PRESENTATION OF THESIS

In addition to the written senior thesis, a student must make a high quality oral presentation of the thesis research and results. Ordinarily, this presentation will be at the annual spring Biology Day in block 7. The presentation is prepared under the supervision of at least one biology faculty member who is also part of the thesis committee. Normally the oral presentation advisor is also the primary research advisor for the senior thesis, unless circumstances dictate otherwise. The student's oral presentation advisor will help the student fit the presentation into the time available at Biology Day, make suggestions about organization and the preparation of slides, and help set the level of the talk appropriate for the CC audience. The talk must be a well-planned, rehearsed, understandable, and professional presentation of scholarly work. **Students who do off-campus research as a basis for their senior thesis are cautioned that they must work closely with their CC presentation advisor to prepare their talk, even if they have orally presented the results previously as part of their off-campus research experience.** This will help insure that the presentation will meet the Biology Department's standards of quality.

The student must inform the faculty coordinator of Biology Day of his or her intention to give an oral presentation at Biology Day and must submit an abstract on the presentation for the Biology Day program. The Biology Day coordinator will attempt to send instructions for the abstract via campus mail or e-mail to all those students who have submitted a form declaring their intention to write a senior thesis (see section on Registration for Senior Thesis); however, it is the student's responsibility to check his/her Worner box and e-mail regularly and make certain that his/her abstract is submitted in a timely manner.

Note: Any student may request to present research based on independent study (such as for BY 309/409) at the Biology Department's annual Biology Day. Because of time limitations for oral presentations of students attempting to qualify for Graduation with Distinction, however, other student presentations at Biology Day will usually be in the form of a poster. The coordinator of Biology Day will make the final decision about the format of research presentations at Biology Day.

TURNING IN THE FINAL COPY OF THE SENIOR THESIS

By the first Friday of Block 8, a final, clean, and professional-looking original of the thesis, signed by the thesis committee (on a title page as shown in Appendix III of this handbook) must be turned in to the Biology office. By signing, the thesis advisors have judged that the written thesis meets the standards of quality necessary for Graduation With Distinction. The copy will be kept on file by the Department and should be presented in a folder with a typed label (title, student's name). It is customary to give each advisor a copy of the thesis.

ADDITIONAL UNDERGRADUATE OPPORTUNITIES

- A. **Research Projects in Biology (BY 309/409)** Students are encouraged to engage in supervised research through enrollment in BY 309/409 and other programs. Projects are designed and supervised with the help of a faculty member whose expertise and interests are related to the project. Faculty specialties are shown in Appendix IV. Students must have completed three Biology courses to be eligible for BY 309/409. Projects may be done at any time, but credit is awarded in a single block. [Students may also sign-up for BY309 or 409 extended format for one-half unit of credit.] Students should consult their academic advisor for guidance.
- B. **Senior Thesis (BY 499)** - Students planning professional careers requiring research experience are encouraged to complete a senior thesis. Select an area of concentration in the sophomore or junior year. Research performed in BY 309 or 409 can be the basis of a thesis. Students may sign-up for one full block of BY499 or for an entire year of BY499 extended format (must be initiated by the beginning of block 1 for the senior year). See section on Senior Thesis for details.
- C. **Field Stations** - The faculty encourages field-oriented majors to attend a field station. Many offer undergraduate courses, while others offer research experience. Programs are offered in the academic year or during the summer. Field station information may be found in the biology seminar room, on department bulletin boards and below. Some financial aid may be available through the Stabler Award. Note, however, that credit may not transfer to Colorado College.

Cedar Point Biological Station University of Nebraska School of Life Sciences Lincoln, Nebraska 68588 www.unl.edu/cedarpt/	Lake Itasca Forestry and Biological Station Bell Museum of Natural History University of Minnesota www.cbs.umn.edu/itasca/
Malheur Field Station Princeton, Oregon 97721 www.geol.pdx.edu/mfs/	Bodega Marine Laboratory Bodega Bay, California 94923 www.bml.ucdavis.edu
Marine Biological Laboratory Woods Hole, Massachusetts 02543 www.mbl.edu	Duke University Marine Laboratory Beaufort, North Carolina 94923 www.env.duke.edu/marinelab/
Hatfield Marine Science Center New Port, Oregon 97365 www.hmsc.orst.edu	University of Michigan Biological Station Ann Arbor, MI 48104 www.umich.edu/~umbs
Mountain Research Station University of Colorado Nederland, Colorado 80466 www.colorado.edu/mrs	Friday Harbor Marine Labs University of Washington Friday Harbor, Washington 98250 http://depts.washington.edu/fhl/
Rocky Mountain Biological Laboratory Crested Butte, Colorado 81224 www.rmbll.org	

- D. **Research Experience for Undergraduates (REU).** The National Science Foundation awards REU grants to universities and field stations, which in turn fund undergraduate research, mainly during summers. These typically provide room and board and a stipend for about 10 weeks. These are usually excellent quality programs, and a number of students have written senior

theses based on REU experiences. Institutions award REU grants to students based on applications, which are due mostly in February and March with some as late as early May. Search the web for these opportunities, or sign up for the EV/BIO listserv. Please go to the Biology web pages for more information on REU opportunities. (**Note** that applications for these positions are usually due in February.)

E. There are many opportunities for summer work in ecology, field biology, and environmental science on the listserv **EVINTERNSHIPS**. These listings also include a number of laboratory jobs of various sorts and are not limited to ecological opportunities only. Students with an interest in lab based biology are also encouraged to participate in this list serve. If you have an email account at Colorado College, you may request to subscribe or unsubscribe from this list by accessing <http://listserv.coloradocollege.edu/archives/HTML/EVINTERNSHIPS.HTML>

F. **Department Opportunities - Not for Academic Credit:**

1. The Biology Department offers a tutoring program. Junior and senior biology majors are available to assist students in all core classes in the department. Students wishing to participate in the program can obtain the names and phone numbers of tutors either from flyers posted in their classroom or from the biology paraprofessionals.

Those students needing to be tutored should keep in mind that finding an available tutor takes time and planning. The student must find a tutor who is available and the tutor must contact the paraprofessional in charge of the program before a tutoring session can be scheduled. Students who call a tutor the night before an exam should not expect to be tutored that evening. If you are worried about a particular class but are not positive that you will require the assistance of a tutor, call a few tutors to determine who will be available that block and will best fit your needs.

Students interested in earning some extra money, and who are interested in a teaching career or graduate school are encouraged to become a department tutor. For information on becoming a tutor please contact one of the biology paraprofessionals.

NOTE: *All Students who work and receive wages from the Biology Department budget must fill out the proper form in the Financial Aid Office before they can be hired. Final selection of students for department jobs will be made by the Biology Department.

FUNDING FOR UNDERGRADUATE WORK AND RESEARCH OPPORTUNITIES

Aside from The Colorado College student aid program, there are other available funds for financial assistance in this department.

- A. Departmental Budget (BY 309, 409). **LIMITED FUNDS** are available to assist students in conducting investigations.
- B. Venture Grants. The Venture Grant Committee awards funds for research projects under the guidance of a professor. Funds may also be granted to permit students and faculty to attend scientific meetings and conferences. Application forms and further information are available in the Dean's office.
- C. Robert M. Stabler Award. A permanently endowed fund was established to honor Dr. Stabler who was chair of Biology for many years. It is awarded annually, preferably to a junior biology major for summer study at a marine Biology station. See the section of this handbook under "Awards" for more information. Some of the money may also be requested, on a financial-need basis, to partially offset extra costs of international field programs, e.g. courses in Patagonia and Belize. Contact the instructors of those courses for more information.
- D. Research Assistants. Faculty members may have research grants to hire students to assist in specific research projects. See individual faculty for further information.
- E. The Mary Ella Gilmore Magnusson and Prof. Ralph Gilmore Family Fund. The earnings from this fund are used to provide summer stipends for Colorado College students to engage in research in natural sciences during their undergraduate years. The research may occur in conjunction with a CC faculty member on campus or in the field. The stipend may be used for research expenses, including but not limited to supplies, chemicals, transportation costs, etc. Contact the professor with whom you would like to work.
- F. The Stabler Award - The Biology Department grants these monies to assist students studying at field stations. First priority is given to junior biology majors to take courses, including independent study, at marine biology field stations during the summer. Second priorities include assistance to students taking academic year courses at marine stations, supporting student attendance in courses at terrestrial field stations, and providing monies to support student research at terrestrial field stations. The amount of money awarded depends on the cost of the program and financial need. Announcement is made after spring break each year. See the department secretary for application procedures and details.

Please note that reimbursements for students doing independent or class research has been approved at 10 cents per mile after the first 100 miles per block. No reimbursement will be given for anything under 100 miles.

OPPORTUNITIES AS A GRADUATE

Biology is a diverse science and provides a wide variety of opportunities at all levels of training and experience. There are three principal professional paths often followed by students with majors in biology: (I) graduate school for advanced degrees (MA, MS, or PhD) in one area of biology or in an interdisciplinary program; (II) health professional programs, including training to become a

physician, nurse, dentist, medical technologist, radiologist, veterinarian, and other related health care programs; and (III) teaching in elementary or secondary schools.

See your advisor or an appropriate professor in the Department concerning these options. Some programs require specific admissions procedures, but sometimes personal contact through a professor is helpful. It is wise to gather as much information as possible during the sophomore year because entry requirements may have to be fulfilled in the junior or senior year.

- A. **Graduate School.** Information about many types of programs at many universities can be found in the seminar room and on department bulletin boards. Catalogues are filed in the seminar room, and in the library. Applications are usually accepted during the winter of the senior year; the GRE scores should be available at this time. Admission is usually determined by excellence in undergraduate research GPA, science grades, by Advanced Biology and Aptitude Test GRE scores, and by letters of recommendation. Many graduate programs require two courses in organic chemistry, a second course in calculus, and two physics courses with lab. It is necessary to show evidence of ability to conduct research; for example, a senior thesis, more than one block of BY 309 / 409, or a summer research project that culminated in public presentation of your work (e.g. a poster presentation at Biology Day, or, preferably, off-campus). A well-written report is an excellent selling point. A graduate school is more likely to accept a person who shows a definite direction in a particular field rather than one who is only interested in biology in general. High levels of motivation and ability to think independently, demonstrated by meaningful research experience, are perhaps the most desirable characteristics. Admission to graduate school usually means that financial help is available in the form of a research assistantship, teaching assistantship, scholarship, or fellowship.
- B. **Teaching in Elementary or Secondary Schools.** A student must plan well in advance of graduation for certification for teaching in public schools. This can be done at Colorado College by planning with the Education Department for the required courses and for practice teaching. Teaching in certain private schools does not require a certificate, but the courses and the practice teaching are very helpful. If the scheduling of classes is arranged in the sophomore year, and careful planning begins in the freshman year, it is possible to major in biology and be certified within the four years.
- C. **Health Sciences.** By the end of the sophomore year, you should be aware of course requirements and admission tests for the particular schools to which you expect to apply. Be sure to go to the meetings called by the Health Professions Advisor, and direct questions to this person.
- D. **Biology Paraprofessional.** This position in the Biology Department involves assisting and teaching in the laboratory, field and classroom, equipment care and other duties. Applications from graduating Colorado College biology majors or other qualified applicants are accepted by the Biology Department during the second semester of each school year. Contact the department for more information.

APPLICATION TO GRADUATE SCHOOLS

A. **Getting Started.** During your sophomore and junior years you should seriously consider your interests. In what areas of biology would you prefer to specialize? How committed are you, or will you be, to biology, research, or teaching? Your motivation is as important as the area of study. The job market is far from ideal, but there is always a need for qualified, motivated people. Many graduate schools prefer applicants who have worked as interns, or in postgraduate jobs, prior to applying to grad school. Consider taking a year or more to enhance your resume, your skills, and your research experience in order to be a competitive applicant.

Browse through the graduate school catalogues in the seminar room and the library. Talk with your advisor and the faculty member most knowledgeable in the field in which you are interested. Get to know them and let them get to know you (see section on Letters of Recommendation). Ask about schools in which you are interested. The critical factor in selecting a graduate school is its faculty. Review the current literature to identify people doing research in your areas of interest and where they are. The principal investigators in your field will have established graduate programs, unless they are associated with pure research institutions.

B. **Application Procedures.** When you have narrowed the choice of schools, carefully prepare the applications. They are a reflection of you. You should correspond with the graduate advisors of the departments in which you are interested. Ask them questions about their program, selection procedures, availability of funding, etc. Correspond with the individual faculty members with whom you are interested in working. If at all possible, visit the schools and professors, perhaps during the summer before your senior year. Talk with graduate students in that department. Attendance at regional or national scientific meetings frequently affords a student an opportunity to meet with various leaders in your selected discipline.

C. **Graduate Record Exam.** The exam should be taken in the fall of your senior year. The scores may then be sent with applications. You may need to take both parts of the GRE. Besides the Advanced Biology Section, most graduate departments also require the Aptitude Test.

FUNDING FOR GRADUATE WORK AND OTHER POST-CC OPPORTUNITIES

- A. Competition for national fellowships is very intense, but Colorado College students have been successful in past years in obtaining the following fellowships. Watch for announcements for applications and interviews during the fall of senior year.
1. Thomas J. Watson Fellowship. For a year of independent study and travel abroad. The proposal should consist of a

unique, creative idea which requires travel and independence. No formal academic association is expected.

2. Woodrow Wilson Fellowship. For graduate study with the ultimate goal of teaching at the college level.
3. National Science Foundation Fellowship. For graduate study with prime emphasis on research.
4. Hughes Graduate Student Grants.
5. S. Fulbright – Post-baccalaureate Fellowships. For international study and research following graduation.

All of the above offer complete support for a year and some are renewable. There are other programs, such as Marshall Fund and the Rotary Fellowship.

B. Institutional Funding. Graduate schools expect to give partial support to incoming students. Some are scholarships (or fellowships) and some are part-time employment as research assistants or teaching assistants. This type of employment is really a paid internship while taking course work and doing research; it may be required as part of the degree program in some schools.

C. Professional Health Science Schools. Student aid is available. There are some fellowships and scholarships available, primarily through the institution; others are available through some private agencies. Contact the Health Sciences Advisor for further information.

LETTERS OF RECOMMENDATION

Graduate schools, summer programs, scholarship applications and prospective employers often ask applicants to submit letters from former professors. Use the following guidelines as a matter of courtesy: (students are strongly urged to develop a file at the Career Center).

1. Try to choose professors you have had for more than one course or with whom you have done independent work so that the letters can be authoritative.
2. Provide a written and signed request with a list of the persons to whom the letters are to be sent, all proper forms, and the deadline dates for the letters. Include a statement of the position sought and how you match the requirements.
3. Make your request at least two weeks prior to the date on which the recommendation is due.
4. Ask the professor if you should provide them with addressed, stamped envelopes.

DEPARTMENT ALCOHOL AND DRUG POLICY

The Department of Biology strongly supports Colorado College's Drug and Alcohol policies while on field trips based on the following considerations:

- 1) A field trip is a concentrated learning experience. Anything that distracts from that experience or reduces the ability to learn and think is contrary to the purpose of the experience.
- 2) Faculty members and students represent the College when on a field trip. Behavior, therefore, should be in accordance with the highest standards of the College.
- 3) While the laws concerning the consumption or use of alcohol and other psychoactive drugs differ among the states which may be visited during a field trip, these laws must be obeyed. Neither the College nor the faculty can, will, or should shield students from these laws and their consequences if students choose to violate them during a field trip.

Whenever an instructor has probable cause to believe that a student or students have violated this policy, the instructor has the authority to sever the students involved from the class and order them to return immediately to the campus by their own means of transportation. Such action does not preempt further action by appropriate authorities.

COURSE EVALUATIONS

The department seeks your participation in two forms of evaluation of Biology courses and faculty.

First, instructors in most Biology courses will ask you to complete a course evaluation at the end of the block. Instructors look for trends and suggestions in these evaluations to improve the course the next time it is offered. The evaluations may also become part of the files used by the department to consider promotion and tenure for the instructor.

Second, you will receive a request in the mail for an evaluation of a specific professor under review, or being considered for tenure or promotion. Your honest candid evaluations are very important to the department and College's review process. Please take the time to respond thoughtfully to this request. We very much wish to increase the number of responses we receive and your comments are important and greatly appreciated. Please participate, even if your evaluation is brief.

POINTS AND GETTING INTO BIOLOGY COURSES

The department strives to make all Biology courses accessible to all CC students and to offer sufficient sections of all courses to meet the needs and desires of our students; however, there is high demand for most Biology courses. Biology majors must consult with the academic advisor to wisely allocate points during registration. By department policy, Biology faculty generally hold to course

limits. If you are on the wait list for a course you need/want, show up the first day of class and you may get in. Faculty are not obliged to overload any course, and you should not expect that to happen. See your academic advisor in biology if you have problems enrolling in a Biology course.

APPENDIX I

CHECK LIST OF IMPORTANT ITEMS AND EVENTS: Use this checklist to track your progress through the requirements for the major and graduation

1. Spring of Sophomore Year
 - A. Finished
 1. 2-4 Units of Biology [] [] [] []
 2. 2-4 Units of Chemistry [] [] [] []
 3. 1 Unit of Mathematics [] [] [] []
 - B. Obtained an advisor in biology [] [] [] []
 - C. Applied for Major in Biology [] [] [] []
 - D. If pre-health, have a file in pre-health advising office [] [] [] []
 - E. If pre-K-12 education, have contacted Education Department chair [] [] [] []
2. Fall of Each Year
 - Biology Major Meeting [] [] [] []
3. Spring of Each Year
 - Attend Biology Day [] [] [] [] [] []
4. Preregistration of Junior Year
 - Check for graduation requirements before scheduling for senior year [] [] [] []
5. Spring of Junior Year
 - Make plans for senior thesis, Graduation with Distinction, if desired [] [] [] []
 - If considering graduate school, find 5-6 appropriate programs and learn their admissions requirements and application deadlines [] [] [] []
6. Departmental Seminars: Attend department seminars, write abstracts of five presentations to be turned in during the senior year [] [] [] []
7. Senior Year Capstone Experience
 - ETS exam OR Biology GRE exam [] [] [] []
 - Seminars and abstracts [] [] [] []
 - Senior capstone course [] [] [] []
 - Students who are attempting to graduate with distinction (honors) in Biology
 - Register for senior thesis by the end of Block 2 [] [] [] []
 - Sign up for BY 499 by the end of Block 2 [] [] [] []
 - Sign up to present at Biology Day [] [] [] []
 - Turn in beautiful final, signed copy of thesis [] [] [] []
8. Fall of Senior Year if planning to go to graduate school at some time:
 1. Register for GRE Biology Subject Test and GRE General tests [] [] [] []
 2. Secure letters of recommendation
 3. Finish applications, most of which are due December – March [] [] [] []
9. General Education (All-College) Requirements
 - A. Language [] [] [] []

Students must fulfill this requirement by one of the following options: 1) 4 years of the same language in high school, 2) IB or AP Placement credit, 3) placement exam credit through a language dept at CC, 4) 2 credits at CC in a language course, 5) transfer credits from an accredited institution, 6) approved foreign study, or 7) native speakers of a non-English language.
 - B. West in Time [] [] [] []
 - C. Diverse Cultures and Critiques [] [] [] []
 - D. Scientific Inquiry [] [] [] []

One must have a lab or field component. Most 100- and 200-level biology courses fulfill this requirement.

CHECKLIST to complete the **Organisms, Ecology, and Evolution** track of the Biology major.1. **Two** introductory units from: [] []

- BY 105 (Biology of Plants)
- BY 106 (Biology of Animals) (no credit if taken after BY108 or BY109)
- BY 107 (Biology of Microbes) (no credit if taken after BY101)
- BY 108
- BY 109 (Biology of Vertebrates)
- List courses taken to fulfill this requirement here:

Check with your advisor to find out if AP or IB credit can fulfill one of these requirements.

...2. BY 208 (Ecology) []

3. BY 131 (Introduction to Molecular and Cellular Biology) []

Check with your advisor to find out if AP or IB credit can fulfill this requirement.

4. BY 280 (Population Genetics) OR BY 231 (Genetics)

- List course taken to fulfill this requirement here:

5. **Five** approved Biology electives [] [] [] [] []

- Three must be Biology (BY) courses at the 300 level or higher [] [] []
- One unit of elective credit may be CH251, CH382, GY205, GY300, SC206, or SC301
- One unit must be an approved senior capstone course []
- Any BY course except BY100 and BY104 may count as an elective
- BY101 (FYE) counts as one unit of lower-level elective
- It is possible to petition the department to ask for other courses to count as electives.
- List courses taken to fulfill this requirement here:

6. **Three** units in **Chemistry**

- CH 107 (General Chemistry I) []
- CH 108 (General Chemistry II) []
- CH 250 (Structures of Organic Molecules) []

*Check with your advisor to find out if AP or IB credit can fulfill CH 107/108 requirement.**NOTE: Graduate schools often require BOTH CH 250 (Structure of Organic Molecules) AND CH 251 (Reactions of Organic Molecules).*7. **One** unit of calculus from: []

- MA 125-6 (Pre-Calculus and Calculus I)
- MA 126 (Calculus I)
- MA 127 (Calculus I and II Accelerated)
- MA 129 (Calculus II)
- List course taken to fulfill this requirement here

*Check with your advisor to find out if AP or IB credit can fulfill the calculus requirement.*8. **One** unit of statistics or mathematical modeling from: []

- BY 220 (Biostatistics and Experimental Design)
- MA 256/BY 256 (Mathematical modeling in Biology)
- List course taken to fulfill this requirement here:

Check with your advisor to find out if AP or IB credit can fulfill the statistics requirement. Check with your advisor to find out if MA117 or MA217 can be used to fulfill the statistics requirement.

9. Senior Capstone Experience...During your senior year, you must

- Attend five approved biology research seminars
- Write abstracts summarizing those seminars and submit them to your advisor on or before the Monday following Biology Day.
- Take the Biology ETS exam or the Biology GRE exam.
 - Register to take the ETS early in Block 3 or early in Block 6, the only two times Biology offers the exam
 - To take the Biology GRE in time to fulfill this requirement, you must take it in November or December and you must list Colorado College as a recipient of the GRE scores.
 - Check with your advisor to find out if the Molecular Biology and Biochemistry GRE exam can fulfill this requirement.
- Complete an approved Senior Capstone Course as one of your electives (requirement #5 above), in **one** of the following ways:

- BY 499 (Senior Thesis; required to graduate with distinction)
- BY 409 (Advanced Research in Biology)
- An approved Senior Capstone course. The current list is: BY308 Advanced Ecology, BY365 Plant Physiology, BY366 Comparative Animal Physiology, BY378 Laboratory Investigation in Molecular Microbiology, BY410 Ornithology, BY412 Entomology, BY415 Evolution, BY421 Conservation Biology, BY443 Techniques in Molecular Ecology, BY463 Senior Seminar in Bacterial Pathogenesis, BY466 Developmental Biology, BY450 Seminar in Molecular Biology.

CHECKLIST to complete the **Molecular and Cellular Biology** track of the Biology major.

1. **One** introductory unit from:[]
 - BY 105 (Biology of Plants)
 - BY 106 (Biology of Animals); no credit if taken after BY 108 or BY 109.
 - BY 107 (Biology of Microbes); no credit if taken after BY101
 - BY108 (Biology Invertebrates)
 - BY109 (Biology of Vertebrates)

2. BY 131 (Introduction to Molecular and Cellular Biology)[]
Check with your advisor to find out if AP or IB credit can fulfill this requirement.

3. BY 231 (Genetics)[]

4. **Six** approved Biology electives[] [] [] [] [] [] [] []
 - Three must be Biology (BY) courses with BY231 (OR BY361) as a pre-requisite
 - One unit of elective credit may be CH241 or CH382
 - One unit of elective credit may be GY300, PY299, or SC301
 - One unit must be an approved senior capstone course
 - Any BY course except BY100 and BY104 may count as an elective
 - BY101 (FYE) counts as one unit of lower-level elective
 - It is possible to petition the department to ask for other courses to count as electives.

List courses taken to fulfill this requirement here:

5. **Four** units in **Chemistry**.....[] [] [] [] []
 - CH 107 (General Chemistry)
 - CH 108 (General Chemistry II)
 - CH 250 (Structures of Organic Molecules)
 - CH 251 (Reactions of Organic Molecules)

Check with your advisor to find out if AP or IB credit can fulfill the CH 107 requirement.

6. **Two** units of mathematics from:[]
 - MA 125-6 (Pre-Calculus and Calculus)
 - MA 126 (Calculus I)
 - MA 127 (Calculus I and II Accelerated)
 - MA 129 (Calculus II)
 - BY 220 (Biostatistics and Experimental Design)
 - MA 256/BY 256 (Mathematical Modeling in Biology)
 - EV 228 (Analysis of Environmental Data)

Check with your advisor to find out if AP or IB credit can fulfill the mathematics requirement.
Check with your advisor to find out if MA117 or MA217 can fulfill the statistics requirement.

7. Senior Capstone Experience...During your senior year, you must.....[] [] [] []
 - Attend five approved biology research seminars
 - Write abstracts summarizing those seminars and submit them to your advisor on or before the Monday following Biology Day.
 - Take the Biology ETS exam or the Biology GRE exam.
 - Register to take the ETS early in Block 3 or early in Block 6, the only two times Biology offers the exam
 - To take the Biology GRE in time to fulfill this requirement, you must take it in November or December and you must list Colorado College as a recipient of the GRE scores.
 - Check with your advisor to find out if the Molecular Biology and Biochemistry GRE exam can fulfill this requirement.
 - Complete an approved Senior Capstone Course as one of your electives (requirement #5 above), in **one** of the following ways:
 - BY 499 (Senior Thesis; required to graduate with distinction)
 - BY 409 (Advanced Research in Biology)
 - An approved Senior Capstone course. The current list is: BY308 Advanced Ecology, BY365 Plant Physiology, BY366 Comparative Animal Physiology, BY378 Laboratory Investigation in Molecular Microbiology, BY410 Ornithology, BY412 Entomology, BY415 Evolution, BY421 Conservation Biology, BY443 Techniques in Molecular Ecology, BY463 Senior Seminar in Bacterial Pathogenesis, BY466 Developmental Biology, BY450 Seminar in Molecular Biology.

CHECKLIST to complete undergraduate courses required by most M.D. programs (check the specific programs to which you plan to apply!)

See <http://www.coloradocollege.edu/healthprofessions/academicrequirements.htm> . A GPA of at least 3.5 is the minimum goal for competitive application to most U.S. allopathic medical schools, so major in something that keeps your GPA as high as possible. If certain science subjects are difficult for you on the block plan, you would be wise to take them in the summer time or after graduation, in order to keep your GPA high yet complete the minimum requirements.

1. **Two** units from:[][]

- BY 105 (Biology of Plants)
- BY 106 (Biology of Animals)
- BY 107 (Biology of Microbes)
- BY 131 (Introduction to Molecular and Cellular Biology)

This is a bare minimum; additional coursework in Biology is STRONGLY recommended.

2. CH 107, CH 108, CH 250, and CH 251.[][][][]

Summer versions of general chemistry and organic chemistry also fulfill the requirements but may have slightly different course numbers. Some students find CH 382 useful before taking the MCAT.

3. Calculus I (MA125-6 or MA 126) and Calculus II (MA 127).[][]

Check with pre-health advising if you have AP or IB credit in math.

Pre-health students from high schools that did not offer several sections of AP or IB calculus should complete MA 125-6 before enrolling in CH 107.

4. **Two** units of physics with laboratory[][]

- PC 141 and 142, recommended for students who did not enjoy calculus.

OR

- PC 241 and 242, recommended for students who enjoyed calculus.

5. Two units of **English**[][]

- One unit of English literature

AND

- One unit of a “Writing Intensive” course (which does not have to be an “English” (EN) course.

A course in behavioral science (for example Psychology or Sociology) is recommended, and required at some schools.

Advanced coursework in Biology and Chemistry will always help in preparation for qualifying exams.

Veterinary schools may emphasize a science major requirement or favor graduates with a science degree. It is worth examining the admissions policy of any veterinary schools of interest.

Other health professions schools, including Veterinary Medicine, Nursing, Podiatry, Physical Therapy, Optometry, Pharmacy, and Physician Assistant programs, are likely to have other specific course requirements and are not as standardized as Medical and Dental school requirements. It is important to consult brochures or catalogues from specific schools before completing plans for an academic program. Students who are interested in [PHYSICAL THERAPY and PHYSICIAN ASSISTANT program](#) should contact [Bruce Kola](#), the Physical Therapy and PA advisor in the Sports Science and Physical Education department in El Pomar Sports Center at CC.

To determine the specific course requirements for a particular medical school or dental school, consult reference books are available in the Health Professions Advising Office. The MCAT, DAT and GRE tests cover basic science, so the above courses should be completed before taking any exams.

Students today are often waiting a year or more after graduation before applying to a health professions school. This does not put the applicant at a disadvantage; many medical schools look favorably upon applicants who have taken an extra year or two to mature, gain work experience, and thus make a better decision regarding a career in health professions.

APPENDIX II

SAMPLE FORM

"TITLE OF THESIS"

A Senior Thesis
submitted to the
Department of Biology,
The Colorado College

by

"Your Name"

Date _____

Approved by:

Primary Thesis Advisor

Secondary Thesis Advisor

FACULTY RESEARCH INTERESTS

Biology majors should consider a research project or thesis during the junior and senior years. Many graduate schools desire students who have had some experience in research during their undergraduate years. Listed below are some research interests of the faculty which may provide ideas for possible projects.

Ralph L. Bertrand – Human Genetics

- Genetic variation between human populations using STR and ALU polymorphic loci
- Migration patterns in South East Asia and Indonesia
- Use of STR's for human identification and power of discrimination

James J. Ebersole - Plant Ecology

- Recovery of vegetation following natural or human disturbances.
- Restoration of alpine vegetation.
- Seed production in Gambel oak: patterns and causes of yearly variation

Emilie Gray

- Physiological ecology of animals, particular how animals adapt to their environment
- Evolutionary adaptations to extreme environments
- Gas exchange and water balance in arthropods
- Mosquito biology (all things mosquito)

Ronald P. Hathaway - Parasitology

- Histology and histological procedures including histochemistry.
- Reproductive physiology of trematodes and cestodes (parasitic flatworms).
- Scanning and transmission electron microscopy.

Shane Heschel – Plant Physiology

- Physiological ecology of plant populations, particularly in stressful environments
- Local adaptation via physiological mechanisms
- Factors driving the local extinction of plant populations
- Population genetics and inbreeding depression theory

Nancy Huang – Developmental Biology

- Embryonic development of the nematode *C. elegans*
- Translational regulation of maternally provided mRNAs
- RNA inhibition (RNAi)

Tass Kelso - Plant Systematics and Evolution

- Plant Systematics and Taxonomy.
- Evolution.
- Biology of the Primrose family.
- Biodiversity of the Pikes Peak Region.
- Conservation biology.

Darrell Killian – Molecular, Cellular, and Developmental Biology

- Sex determination in the nematode *C. elegans*
- Molecular control of the cell cycle
- Regulation of programmed cell death
- Germline development

Brian Linkhart - Ornithology

- Conservation Biology.
- Habitat relationships of birds, particularly forest raptors.
- Population ecology of animals.
- Ecology of cavity-nesting bird communities.
- Long-term dynamics of snags and trees with cavities

Phoebe Lostroh - Microbiology

- Genomics of *Vibrio fischeri*
- Biofilm formation in *Vibrio fischeri*
- Regulation of virulence genes in *Salmonella*
- Molecular genetic analysis of transcription in *Salmonella* and *E. coli*

Marc Snyder - Ecology

- Animal ecology
- Plant/animal interactions
- Animal evolution and plant/animal co-evolution

Mark Wilson – Plant and Microbial Molecular Biology

- Molecular systematics of neotropical orchids
- Molecular plant-microbe interactions
- Molecular ecology

NOTE: Students may also collaborate with other members of the biology and science faculty at Colorado College. See the department associate chair for information. There are also opportunities to do research away from campus, as described below and elsewhere in this handbook. See your advisor and the associate chair for information.

Date of the seminar

Name and title of presenter

Location of the seminar

ABSTRACT BODY--precise and concise, but complete, summary of the presentation. Focus on the main points and conclusion(s)

EXAMPLE:

"Stress, Social Rank and Personality: Studies of Wild Baboons"

December 11, 1991

Dr. Robert Sapolsky

Department of Physiology, Stanford University

The olive baboons of the Serengeti in East Africa were chosen for this study for a number of reasons, one being that it was possible to study these baboons in the wild. Furthermore, these baboons have an organized system of socialization both behavioral and psychological, including a hierarchial ranking system similar to human beings. The initial purpose of this study was to explore the mechanisms that enable bodies to deal with stress. The original question was to determine if the baboon's health and stress levels were connected to their social rank.

Glucocorticoids are hormones that in abundance cause diabetes, hypertension and ulcers in humans, as well as increase the opportunities for other diseases. The amount of glucocorticoids in the baboons was measured by taking blood samples. The results indicated that lower ranking baboons had increases in the levels of glucocorticoids in their bloodstreams. In addition, they were sluggish in turning these compounds on and off. In contrast, the higher-ranking baboons in a troop had lower levels of glucocorticoids and were able to turn them on and off faster. Therefore, it might follow that the lower ranking baboons had a higher level of stress due to increased levels of glucocorticoids in the bloodstream.

However, another aspect of this study involved identifying different personality types among the baboons. Knowing when or when not to fight, knowing when you have won or lost a fight, being successful at making allies, having friends and displacing aggression are categories which all deal with the individual personalities of the baboons. Even while a baboon may be at the top of his troop, life could still be extremely stressful. For example, if a troop is unstable and constantly fighting within themselves to obtain a rank, surely this is more stressful than a troop that is relatively stable and peaceful. Therefore, the study concluded that personality precedes rank in determining a baboon's ability to deal with stress and thus, remain healthy.

(Actual student abstract, submitted 1991-1992.)

Your name (typed)

Honor code upheld
Your signature

APPENDIX VI
DEPARTMENT OF BIOLOGY
PETITION FOR OFF-CAMPUS RESEARCH CREDIT
BY 309 OR 409

Instructions: This petition requesting Off-Campus credit for a BY309/409 research project is to be completed in full and handed to the Chair or Associate Chair of the Department of Biology, BY THE BEGINNING OF THE ACADEMIC BLOCK PRIOR TO THE INTENDED STARTING DATE OF THE PROJECT. This deadline is enforced. Please do not ask for an exception!

Research directly supervised by a member of the CC Biology faculty does not require this departmental petition. See the Biology Majors' Handbook for guidelines on off-campus studies, research and transfer credit. Print or type the information below. Only one unit of off-campus research credit (BY309 or 409) may be counted for the biology major. Except for the ACM program, a maximum of two off-campus units may be counted toward the major, only one of these may be BY 309 or 409.

Name of Applicant _____ Date _____

Local Address _____ Phone _____

Credit desired: BY 309 or 409 (circle one)

Do you have (or have you requested) other off-campus credit for the major? _____ If yes, explain below:

Class standing of applicant: _____ Name of your academic advisor: _____

Is this course needed for graduation? _____ For the Biology Major? _____

Courses (numbers) completed toward the biology major: (attach a COPY of your transcript) _____

Has the registrar approved all-college credit for this study? _____

Explain:

Attach a concise and comprehensive description of the off-campus study to be done (you should type your answer on a separate page and attach to this form - one page maximum).

Method of summarizing the results of the off-campus study (see major's handbook). You may answer below or on a separate page as above.

Location of off-campus research _____ Dates of research _____

Name, title, address, and telephone number of person at that institution who will supervise and evaluate your research (see back also):

Name & Title: _____

Address: _____

Telephone: _____ Fax: _____

APPENDIX VII
THE BIOLOGY MAJOR through 2010-11 (“old” biology major)

Biology majors must complete the following requirements from each of the following categories:

I. 5 Core Courses*¹

1. Two introductory units from BY 105, 107, 108, and 109
2. One of the following field courses: BY 108 (only the course taught by Prof. Hathaway) 202, 203, 208, 410, or 412 courses taught on a regular basis) OR certain other courses taught on an occasional basis, such as some Special Topics courses.
3. BY 210 (Cell Biology)
4. BY 361 (Molecular and Classical Genetics)

II. 4 Elective Courses

3 of the units must be at the 300 or 400 level and 3 units must have a “BY” designation

Anthropology: AN 201, 202, 305

Biology: All Biology courses including those listed above except BY 100, 102, 104, 210 and BY 361

Chemistry: CH 382

Environmental Science: EV 422

Physics: PC 151

Psychology: PY 312, 412

Sport Science: SS 203, 206, 300, 301, 302

A total of 9 units in Biology must be taken (or 8 units in Biology and 1 elective in another department).

Not more than a total of 2 units from BY309, 403, 409, 499, or independent study from off-campus programs can be used toward the biology major. Not more than 1 unit of independent study from off-campus work can be used toward the biology major.

III. 3 units in Chemistry

Normally these would be Chemistry 107, 108, and 250. Students testing out of one or more of the introductory units would take CH 251 or CH 210. This decision would be made in consultation with the Advisor and Dept. Chair.

IV. 1 unit of Mathematics

One of the following: BY 220, MA 117 or 217, MA 125, or 126 **or 127**. Students who take both BY 220 and Calculus (MA 125 or 126) may count BY 220 as a lower level elective. We strongly urge Biology majors to take BY220 as the most appropriate statistics course for the major.

V. 2 Supplemental Units

Two units from one of the following groups:

Group 1: Chemistry 251, and one of 345, 351, or 382,

Group 2: Geology 130, or 140 and any Geology course requiring 140 as a prerequisite

Group 3*: Mathematics: **MA 128, MA 129** 203, 217, 220, 256, 315, 340, 417

Group 4*: Computer Science 121, 222

Group 5: Physics 141 and 142 OR 241 and 242

*Students may combine one course from Group 3 and one course from Group 4.

Courses that appear in one or more categories will not count for more than a single requirement (e.g. a course may not count both as an elective and to fulfill a field requirement).

¹ *Students entering with a CC unit from AP or IB credit may count this as one of their introductory units. This means you will need only 1 more introductory unit. Students with two units of IB credit should discuss their situation with the Biology Chair.

Even if you do not have AP or IB credit, you may take a bypass exam for BY 105, BY 107, BY 108, BY 109 or BY 210 if you have a strong high school biology background. Passing this exam excuses you from that requirement, but you will still need 9 Biology credits if you do not have AP or IB credit.