

# *Biology Majors'* *Handbook* *Version 6.2*

**2009-2010**  
**THE COLORADO COLLEGE**

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## **INTRODUCTION**

This handbook answers many questions biology majors have concerning requirements, suggested courses, research, meetings, and opportunities in the Biology Department. 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**. Please advise the department secretary 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 your responsibility to know all departmental and college requirements and regulations.**

Please read all sections of this handbook. You should use the checklist--Appendix I, and note changes in department requirements for the biology major.

## **IMPORTANT DATES, EVENTS AND ANNOUNCEMENTS**

- Students may declare the biology major at any time, but are strongly urged to speak with a biology faculty member about the major before declaring. Majors should be declared by the end of the sophomore year. 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.
- Biology majors must attend departmental seminars and submit **abstracts of 5 seminars** during their senior year (see seminar abstract section). Majors are highly encouraged to submit abstracts to their advisor as early as possible; abstracts may be submitted at any time following declaration of the major.
- Biology majors may write a senior thesis and attempt to graduate with distinction (see details following).
- Majors must take the ETS Biology Subject Test, offered by the Department twice a year.
- Majors should also attend Biology Day each spring (see Biology Day section).

## **THE BIOLOGY MAJOR: A SHORT GUIDE TO REQUIREMENTS**

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

### **I. 5 Core Courses\***<sup>1</sup>

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

<sup>1</sup> \*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.

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. 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, 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).**

## **REQUIREMENTS FOR THE BIOLOGY MAJOR: THE FULL GUIDE**

1. Two introductory units from:
  - BY 105 (Biology of Plants)
  - BY 107 (Biology of Microbes)
  - BY 108 (Biology of Invertebrates)
  - BY 109 (Biology of Vertebrates)
2. One field course. Those regularly taught:
  - BY 108 (Biology of Invertebrates, when taught by Prof. Hathaway)
  - BY 202 (Field Botany)
  - BY 203 (Field Zoology)
  - BY 208 (Ecology)
  - BY 410 (Ornithology)
  - BY 412 (Entomology)
  - Certain Special Topics courses or other courses taught on an occasional basis may also carry field credit.
3. BY 210 (Cell Biology) **and** BY 361 (Molecular and Classical Genetics)
4. Four electives (3 at the 300 or 400 level and 3 must have a BY number)
  - All Biology courses except BY 100, 102, 104, 210 and 361 & other courses designated “not for biology majors”.
  - Anthropology 201 (Human Evolution), 202 (Human Biological Variation) or 305 (Topics in Biological Anthropology)
  - Chemistry 382 (Biochemistry)
  - EV 422 (Biogeochemistry and Ecosystem Ecology)
  - Physics 151 (Biophysics)
  - Psychology 299 (Neuroscience) or 412 (Human Neuropsychology)
  - Sport Science 203 (Sports Medicine Seminar), 206 (Exercise Physiology), 300 (Investigations in Sport Science), 301 (Biomechanics) or 302 (Surgical Anatomy)

*A total of 9 units in Biology or 8 units in Biology plus 1 unit in another department.*

*Not more than a total of 2 units from BY 309, 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*

5. Three units in **Chemistry**

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

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

6. One unit of **Mathematics**

- BY 220 (Biostatistics and Experimental Design)
- MA 117 (Probability and Statistics) or MA 217 (Probability and Statistical Modeling)
- MA 125 (Pre-Calculus and Calculus) or MA 126 (Calculus I)

7. Two Supplemental Units **from one of these groups:**

Group 1: **Chemistry**      251 (Reactions of Organic Molecules) and one of the following:  
    351 (Synthesis of Organic Molecules)  
    382 (Biochemistry I)  
    345 Bioanalytical Chemistry

Group 2: **Geology**            130 (Introductory Geology) – a two-block course  
    140 (Physical Geology) plus any GY course requiring 140 as a prerequisite

Group 3: **Mathematics\***    128 (Calculus 2)  
    203 (Calculus 3)  
    217 (Probability and Statistical Modeling)  
    220 (Linear Algebra)  
    256 (Mathematical Biology)  
    315 (Differential Equations)  
    340 (Topics in Mathematics)  
    417 (Mathematical Statistics)

Group 4: **Computer Science\***

   121 (Computer Science I)  
    222 (Computer Science II)

Group 5: **Physics**            141 and 142 (Introductory Physics I and II).  
    241 and 242 (Introductory Classical Physics I and II)

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

Please remember that courses that appear in more than one category will NOT count for more than a single requirement. For example, a course may not count both as an elective and fulfill a field requirement.

**IMPORTANT NOTES:**

- 1) Graduate or professional schools may require two courses in organic chemistry (CH250 and CH 251), Calculus II, Physics and/or the Graduate Record Examination (G.R.E.). You should talk with your advisor and check admission requirements.
- 2) Some science courses taught at other institutions, especially those on the quarter system, may NOT transfer as one entire unit of CC credit. Before taking science courses elsewhere, students are cautioned to check with their academic advisor, and the department Associate Chair concerning transfer credit toward the major.

**ADVICE ON SCHEDULING COURSES FOR A BIOLOGY MAJOR**

The following are suggestions for the scheduling of courses for the biology major. Many variations from these suggestions are possible, but may not be optimal.

**FIRST YEAR:**

**Two** of the following introductory biology courses:

- BY 105 (Biology of Plants)
- BY 107 (Biology of Microbes)
- BY 108 (Biology of Invertebrates)

BY 109 (Biology of Vertebrates)

**and**

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

**Note:** Students with a weak background in math might find it advisable to take MA 125 Pre-calculus and Calculus before taking CH 107 and CH 108. MA 125 will satisfy the one math course requirement for biology major.

### **SECOND YEAR:**

BY 210 Cell Biology

A field course in biology (there are several which will satisfy the biology field course requirement)

\*\*\* Students in field courses must all travel in the CC vehicle--you may not follow in private cars.

**Note:** Taking a statistics course before BY 208 Ecology is advisable. The statistics course will satisfy the biology math requirement.

CH 250 Structures of Organic Molecules

**Note:** Only 1 course in organic chemistry is required for the biology major, but many graduate courses and virtually all health-profession post-baccalaureate programs will 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, except that it is a prerequisite for Biochemistry.

**Students may declare the biology major at any time, but are strongly urged to speak with a biology faculty member about the major before declaring. Majors should be declared by the end of the sophomore year. See checklist of important items, Appendix I**

### **THIRD YEAR:**

BY 361 Molecular and Classical Genetics

2 biology electives

**Notes:** The best time to take the physics or geology requirement for the biology major is probably during the second or third years. If you choose the supplemental courses from chemistry or math, these may be taken any time after you have the prerequisites. The best time to take a semester abroad is during the third year. The best time to do research for a senior thesis is during the summer between the third and fourth years.

### **FOURTH YEAR:**

Two biology electives

#### ***BYPASS EXAMS FOR INTRODUCTORY BIOLOGY COURSES***

Students with strong backgrounds in biology may by-pass BY 105, 107, 108, 109 or 210 by examination. It is not necessary to have taken Advanced Placement (AP) Biology or the AP Exam to take a bypass exam.

A successful score on the bypass exam, determined by the faculty person in charge, exempts the student from the required course and satisfies the prerequisite for other courses; students who pass the BY210 exam are exempted from taking that course as a requirement. 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 secretary 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 Associate Chair concerning AP or IB credit toward the biology major.

#### **AP credit for courses within the Biology Department.**

The Biology Department may grant one unit of credit for an Advanced Placement score of 4 or 5. There are 2 possible outcomes of this credit:

The Biology Department accepts Advanced Placement (AP) and International Baccalaureate (IB) credits in Biology *if the Colorado College Registrar has given Colorado College credit based on the student's achievement on the AP or IB exam.* Normally 1 CC credit is given for a grade of 4 or 5 on the AP exam, and either 1 or 2 units of CC credit are awarded for a score of 4 or higher on the IB exam.

**Students with 1 AP or IB credit who desire to major in Biology are not required to take a bypass exam if they wish to apply these credits for one of the introductory Biology classes such as BY 105 or BY 109. They may now automatically apply this credit as one unit of unspecified introductory biology and will therefore be required to take only one other introductory class. Our introductory classes currently consist of BY 105 (Biology of Plants), BY 107 (Biology of Microbes), BY 108 (Biology of Invertebrates) and BY 109 (Biology of Vertebrates). For students receiving AP or IB credit in place of 1 introductory biology class, a minimum of eight (8) additional units are required.**

**Students with 2 IB credits in Biology who desire to major in Biology should discuss their individual program with the Department Chair.**

*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.

Students 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. Your Biology department faculty advisor can advise you about this.

#### **AP credit for courses outside the Biology Department.**

Students with AP or IB credits in chemistry, mathematics, or physics may be allowed to bypass an introductory level course in these areas 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**

Independent study allows more advanced students opportunities to pursue a lab or field research project under supervision of an experienced scientist. Note that prerequisites are enforced. A prerequisite may only be waived by formal petition to the biology faculty. The written petition must be submitted by the student with assistance and advice from the supervising biology professor for the research block. The petition will be considered by the biology faculty at a regular department meeting, the third Friday of each block. NOTE: 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.

Begin talking with a faculty member in the area of your interest several months before your independent study block. If a faculty member agrees to supervise your research and is not scheduled for BY 309 or BY 409 Independent Study that block, the Registrar will create a course for you. Register for a BY 309 if you hold Junior standing, and for BY 409 if you have Senior standing.

**For information about conducting research off-campus under supervision of a non-CC faculty member, see Appendix VII. A petition is required.**

#### **GENERAL RULES:**

**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 to the supervisor of the room: 1) who you are, 2) what you have taken, 3) where you have taken it, 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) and GROWTH CHAMBERS (Room 514)

Many of the research problems involving plants require the use of these rooms. Please check with the supervisor 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 to her and she can inform you as to what is and what is not possible.

#### 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 secretaries 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.

### **SENIOR EXAMINATIONS AND SEMINAR ABSTRACTS**

**A 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. There is no minimum score necessary for graduation, but the test results will be treated in the following way:

**Outstanding:** Overall Achievement at the 90<sup>th</sup> percentile or above

**Satisfactory:** Overall Achievement at the 60<sup>th</sup> - 89<sup>th</sup> percentile, or in at least 2 of the 4 subscores.

**Poor:** Overall Achievement below the 60<sup>th</sup> percentile or in more than 2 of the subscores.

These results will be officially recorded on the student's transcript as a Senior Comprehensive grade.

Cost of the exam is approximately \$26. 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.

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.

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. They frequently have not been able to reconstruct the main ideas of the seminar from notes taken several months earlier. 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-

- **abstracts of FIVE acceptable biology seminars** must be submitted to your academic advisor in the biology department by noon the first Monday after Biology Day, usually the last Monday of block 7, or by noon the third Friday of block 4 for December graduates. Majors with an advisor in another department must notify the secretary in the biology department office of this fact by the end of block 2, and then submit the five abstracts by the same block 4 or 7 deadline above to the biology department Chair or Associate Chair. *These deadlines will be enforced.* Students may submit abstracts at anytime after they declare their major.

#### 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 this 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.*

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.* 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 if their advisor is not in the Biology Dept.) 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 correct 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, 108, 109, 210, or 361. The department requirement for a field course (BY 118, 202, 203, 208, 218, 410, 412, 450) may be met by an off campus course described in number 2 described below. 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 three units toward the Biology major. Up to two 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 third 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 fourth unit in Spanish.

- 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 field course or lower-level elective, and the second will count as an upper-level elective.

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). *Effective beginning in the summer of 2007*, changes have been made in the credit the Biology Department awards for most **CC-accepted programs** (exceptions listed below), **to 2 lower level electives [OR 1 field and 1 lower level elective], rather than the 1 lower level and 1 upper level elective credit that had been the previous practice.** 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 (as it currently stands). 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 to the new rule apply. These are the programs for which upper level elective credit will continue to be awarded, and no petition is required:

- **ACM Costa Rica** (3 Biology credits, up to 2 credits at the upper level with adequate preparation-no change). See the CC ACM Costa Rica advisor.
- **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.
- **Woods Hole 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. *Three CC units of credit toward the bio major will be given as follows:* 1) one unit of geology that can be paired with GY140 to satisfy the geology option for the biology major; 2) one unit of lower level elective biology credit; 3) an upper level biology elective (equivalent to independent study), if the student project is on a biological topic.  
*Note: Woods Hole 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 chair or Professor Capen 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.

**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, including 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 only two units of Independent Study 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 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.

#### **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, participation in the department 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 who, 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.

### 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 an 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. Unless a senior wants to take some other extended format course, s/he should sign up for BY 499 as an extended format course for each of the two semesters of the senior year.

## 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.

At Biology Day the Biology Department faculty will evaluate the presentation (see the sample evaluation form, Appendix II) and will give the completed forms to the student's oral presentation advisor, who will discuss the evaluations with the student. After discussing the evaluations with the student, the advisor will report the results of the evaluation forms to the Senior Thesis/Distinction coordinator.

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 Senior Thesis/Distinction coordinator. 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.

## GRADUATION WITH DISTINCTION

To recognize those students who complete the senior thesis requirements explained above **and** have a superior academic record in regular courses, the Biology Department will award **Graduation With Distinction in Biology**. To receive Graduation with Distinction in Biology a student must complete a high quality senior thesis based on original research and present the results orally at Biology Day in the spring. In addition, a student must: 1) have at least a 3.0 GPA in all course work at CC, and 2) have at least a 3.5 GPA overall in CC **biology** courses. All biology majors successfully completing a senior thesis and an oral presentation of it at Biology Day will be awarded Graduation With Distinction in Biology if they also meet the GPA criteria stated in this paragraph.

## UNDERGRADUATE OPPORTUNITIES

A. **ACM Programs** are sponsored by Colorado College and biology credit may be received without petitioning the Department. Other departments may offer credit for ACM Programs. Students interested in ecological programs should take BY 220 Biostatistics and Experimental Design before going to one of these programs.

1. ACM Semester in Costa Rica. See Professor Snyder for information **BEFORE** you enroll. See the off-campus study guidelines for additional information on the program.

**Elective credit.** Students who successfully complete the semester in Costa Rica may receive one CC unit of elective credit toward a biology major. This unit will not be counted as independent study (BY 309/409). If a student has taken a field biology course before going to Costa Rica (which will usually be the case), this elective credit can be applied at the 300 level.

**Independent study.** In addition to the one elective unit above, students who successfully complete the semester program including a project in biology in Costa Rica may receive up to two CC units of credit equivalent to BY 309/409. No more than two units of independent study may be used as electives toward a

biology major, but more than two such units can be used toward the total number for graduation). The independent study courses offered by the Biology Department are Research Projects in Biology (BY 309 or BY 409), and Senior Thesis (BY 499).

**NOTE:** *A student may take more than 14 units in Biology only if 18 units outside of Biology will be earned for graduation.* Credits received from the ACM Costa Rica program beyond the three units in Biology may be used toward the total units necessary for graduation, but not toward a Biology Major.

2. Oak Ridge Science Semester - Fall semester for junior and seniors at the Oak Ridge National Laboratory.
  3. Tanzania Program: Fall Semester, currently 2 credits in Biology. See the Associate Chair for information.
- B. **Research Projects in Biology (BY 309/409)** Students are encouraged to engage in independent research through enrollment in BY 309/409 and other programs. Projects are designed 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.
- C. **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 block of BY499 or for BY499 extended format for one-half unit of credit.] See section on Senior Thesis for details.
- D. **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 or may not transfer to Colorado College.

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

- E. **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 of \$2500 to \$3000 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. Students interested in ecology REUs should e-mail Professor Ebersole who can forward electronic notifications. Please go to the Biology web pages for more information on REU opportunities. (**Note** that applications for these positions are usually due in February.)

F. There are many opportunities for summer work in ecology, field biology, and environmental science on the listserv **EVINTERNSHIPS**. Most of these are forwarded by Professor Ebersole from the off-campus listserv Ecolog. 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>

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

1. Laboratory Assistant\* - Professors teaching lab courses may select a student to assist in lab for that block. Assistants are paid the standard Colorado College student wage. Interested students should contact the professor for details and guidelines.
2. Occasionally a professor may have a research project under way for which he or she needs student help. This is an extremely desirable opportunity to gain the experience of participating in a research program.
3. There are a few routine jobs\* such as greenhouse or animal room technician which pay the College wage for students. This employment includes the responsibility of work carried out properly under supervision.
4. The Biology Department offers a tutoring program. Junior and senior biology majors are available to assist students in all core classes in the department (BY 105, 107, 108, 109, 208, 210, 301, 361, and 360). 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, or 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** (up to \$200.00) 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. Work/Study Programs. Dishwashing, animal care, greenhouse care come under this program, which is directed by the Financial Aid Office.
- F. Laboratory Assistants.
- G. 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 independent 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.

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 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 physics.** It is also very helpful to show evidence of ability to conduct research; for example, a senior thesis, a 309 or 409 project, or a summer activity. 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. **Employment.** Recent graduates of this department have continued their education in a variety of professions, in technical schools, and in areas of specialized employment such as those listed below.

Biotechnology	Bureau of Land Management
Cytogenetics Laboratory	Curator of Museum
Environmental Protection Agency	Food Service Management
Forestry	Game Management
Genetic Counseling	Greenhouse Management
Herbarium Director	Horticulture Management
Industrial Research	Medical Research
Optometry	Park Service
Peace Corps	Podiatry
Scientific Illustrator	Scientific Journalism
Scientific Librarian	Space Technology
Variety of Civil Service Jobs	Veterinary Medicine

- E. **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 secretary for more information.

***SUGGESTED ELECTIVES FOR VARIOUS FIELDS OF BIOLOGY (--beyond required courses)***

**Animal Behavior (Ethology)**

Biology of Vertebrates  
Biostatistics & Experimental Design  
Field Zoology  
Ecology  
Animal Behavior  
Ornithology  
Entomology

**Botany**

Field Botany  
Ecology  
Plant Conservation & Diversity  
Entomology  
Advanced Ecology  
Seminar in Evolutionary Biology  
Biostatistics  
Biology of Plants

**Ecology**

Field Botany  
Field Zoology  
Advanced Ecology  
Biostatistics and Experimental Design  
Seminar in Evolutionary Biology  
Biology of Plants

**Cellular and Molecular Biology**

Biostatistics  
Biology of Microbes  
Biochemistry  
Molecular Biology  
Scanning Electron Microscopy  
Transmission Electron Microscopy  
Virology  
Bacteriology

**High School Teaching**

Molecular Biology  
Field Zoology/Botany  
Ecology  
Animal Behavior

**Vertebrate Physiology**

Ornithology  
Entomology  
Human Physiology  
Animal Cell Physiology  
Immunology

**Research Problems in Biology**

BY309/409/499

**Health Sciences**

Biostatistics & Experimental Design  
Parasitic Protozoa  
Parasitic Helminths  
Animal Behavior  
Bacterial Physiology  
Animal Cell Physiology  
Biology of Microbes  
Immunology

**Medical Technology or Nursing**

Biostatistics & Experimental Design  
Parasitic Protozoa  
Parasitic Helminths  
Human Physiology  
Virology  
Bacteriology

**Zoology**

Animal Behavior  
Biology of Invertebrates  
Field Zoology  
Biostatistics & Experimental Design  
Ecology  
Parasitic Protozoa  
Parasitic Helminths

**Genetics**

Molecular Biology  
Biochemistry  
Animal Behavior  
Biostatistics & Experimental Design  
Seminar in Evolutionary Biology

***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.

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.** During the fall of your senior year, you should begin to apply for admission. 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 may 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.

### ***ADVICE IN SELECTING A BIOLOGY OR ENVIRONMENTAL SCIENCE (EV) MAJOR***

Should I major in  
BIOLOGY and emphasize ecology and field courses?  
or in  
ENVIRONMENTAL SCIENCE (EV)?

Think about what you want to do after leaving CC. In general, a biology major will usually be better for those who want to work as field biologists, do biological research of any kind, or go to graduate school in biology. An EV major will likely be better if after you leave CC you want to work on environmental questions and have some biological background to bring to those questions. For example, an EV background would be one appropriate option for those considering environmental law or public policy as a career.

However, note that even if you are a biology major, you can take many of the non-science courses important in understanding environmental problems as part of the all-college distribution requirement, e.g. Economics, Environmental Economics, and Public Policymaking. Conversely, you can do an EV major and obtain enough biology to go to graduate school or be qualified for field assistant jobs by taking more biology courses than those required. If you want to go to graduate school, be sure to take Cell Biology and Genetics. And for either entering graduate school or becoming qualified for entry-level field jobs, take more than the required field courses. These should include at least one organismic identification course, such as Field Botany, Field Zoology, or Ornithology, and some upper-level courses such as Advanced Ecology, Conservation Biology, or Plant Ecology.

### ***REQUIREMENTS FOR REGULAR BIOCHEMISTRY MAJOR***

**(and Suggested Year for Completion)**

**(17.25 Requirements)**

**First Year:** CH 107, 108 General Chemistry I & II; MA 126, 128 Calculus I & II; Foreign Language or APA. If you already have AP credit or are placed out of the above, it is recommended that you take CH 250 and 251.

**Second Year:** CH 250, 251, Organic Chemistry I & II; PC 241, 242 Classical Physics I & II; BY 210 Cell biology and its pre-req. In BY. Foreign Language or APA.

**Third Year:** Ch 345 Bioanalytical Chemistry; CH 366 Physical Chemistry I; CH 382 Biochemistry I; BY 361 Classical Genetics. All College Requirements - finish APB. Summer of research or 1 unit of research.

**Fourth Year:** CH or BY 403 (or summer research); CH 490 (1/4 credit) Senior Seminar. Finish All-College Requirements. Two electives from below:

**Biology and Chemistry Electives:** BY 301, 364 & 401 Various Physiologies; By 360, 450 Microbiology; BY 304 Immunology; BY 465 Molecular Biology; CH 342 Instrumental Methods; CH 383 Biochemistry II; CH 367 Physical Chemistry II; CH 301, 401 Investigations in Chemistry; CH 351 or 352 Organic Chemistry III.

## **REQUIREMENTS FOR ACS CERTIFIED BIOCHEMISTRY MAJOR**

(And Suggested Year for Completion)

(17.25 Requirements)

**First Year:** CH 107, 108 General Chemistry I & II; MA 126, 128 Calculus I & II; Foreign Language or APA. If you already have AP credit or are placed out of the above, it is recommended that you take CH 250 or 251.

**Second Year:** CH 250, 251 Organic Chemistry I & II; PC 241, 242 Classical Physics I & II; BY 210 Cell Biology and its pre-req. Foreign Language or APA.

**Third Year:** CH 345 Bioanalytical Chemistry; CH 366 Physical Chemistry I; CH 382 Biochemistry I; BY 361 Classical Genetics. All-College Electives: Finish APB. Summer of research or CH 403 and a substantial written research paper.

**Fourth Year:** CH 342 Instrumental Methods - if summer research is used for research requirement. CH 490 (1/4 credit) Senior Seminar. CH 383 Biochemistry II; CH 475 Inorg. Chemistry or 367 Phys. Chemistry II.

**Biology/Chemistry Electives (optional):** BY 301, 364 & 401 Various Physiologies; BY 360, 450 Microbiology; BY 304 Immunology; BY 465 Molecular Biology; CH 301, 401 Investigations in Chemistry; CH 351 or 352 Organic Chemistry III.

### ***Should I Major in Biology, Chemistry or Biochemistry?***

Though all three majors will potentially allow a student to pursue a graduate degree in biochemistry, *none* will satisfy the entrance requirements of *all* biochemistry graduate schools. If a student is interested in a career in molecular biology or biochemistry research, the biochemistry major may be the best compromise, but our best advice is to look at the graduate school catalogs for the programs that you are most interested in.

### ***What if I am a pre-medical student?***

Any degree on campus is potentially an excellent preparation for medical school as long as you enroll in the required core classes. You should get advising through the pre-medical office as early in your career as possible! Students with degrees in history and music have fared equally well as chemistry, biology and biochemistry majors for admission into pre-medical programs. None of the three degrees should be viewed as the preferred entrance to a medical career unless a combined MD-PhD is in your future.

### ***What are the major differences between the programs?***

The **Biology** degree will give the student a very strong foundation in the biological sciences, but it would typically be deficient in physical chemistry, inorganic chemistry, analytical chemistry and enough biochemistry. Of course, such classes can be taken as electives, though each requires some prerequisites. A student who is interested primarily in graduate study in field biology with an understanding of some biochemistry would best be served by a biology major.

Although a **Chemistry** degree provides a very strong background in chemistry, it does not require any classes in biochemistry or biology. The only biologically relevant classes that may be accepted as electives for the chemistry degree are Biochemistry I & II. However, students enrolled in a chemistry degree program will often take classes in Biology of Vertebrates, Cell Biology, and Genetics. This course of study would give the student the equivalent of a biochemistry degree, but at the expense of three additional classes beyond the 15 classes required for the chemistry major. Such a degree with the extra classes could be a reasonable entry for studying biochemistry or molecular biology, though additional classes in molecular biology and microbiology would be useful.

The **Biochemistry** major provides for a middle ground between the biology and chemistry majors. The flexibility of the upper division electives allows a student some leeway in choosing to emphasize a more biological or more chemical route for the degree. The student can take as few as three biology classes or as many as six (including research) to complete the major. Of course, additional classes in either department can also be taken up to the college limits. For a research career in biochemistry, we recommended that a student enroll in molecular biology, biochemistry II and microbiology as upper division electives. Additional classes in physical or inorganic chemistry may also be required by some graduate programs.

### **American Chemical Society (ACS) Certification**

The Chemistry Department is reviewing the possibility of ACS certification for the biochemistry degree. The certification has a few additional merits, but they are not very substantial. The first merit is that prospective biochemistry majors would be eligible to apply for the Otis Barnes Chemistry Scholarship rather than the Margaret Barnes Natural Science Scholarship. The second merit is that students would earn a degree recognized by some in the (more chemical) field as providing a minimal number of classes in chemistry. Of course, anyone reading a student's transcript would realize that a substantial amount of chemistry and biology was required for the uncertified degree as well.

### **(Possibly) Helpful Information for Biochemistry Advisors**

Students preparing for pre-medical careers have usually enrolled in BY 301 (Animal Cell Physiology) or BY 464 or 465 (Molecular Biology) or CH 383 (Biochem II).

Students preparing for careers in molecular biology have usually enrolled in BY 464 or 465, BY 360 and CH 383 as electives.

Students preparing for careers in biochemistry have usually enrolled in CH 383, BY 464 or 465 and CH 351 or BY 360.

Students planning on graduate work in molecular biology and/or biochemistry are encouraged to take additional electives and research

depending on interest.

### *APPENDIX I*

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

1. Spring of Sophomore Year

A. Finished

1. 4 Units of Biology ..... [ ] [ ] [ ] [ ]

2. 3 Units of Chemistry ..... [ ] [ ] [ ] [ ]

3. 1 Unit of Mathematics ..... [ ]

B. Obtained an advisor in biology ..... [ ]

C. Applied for Major in Biology ..... [ ]

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 ..... [ ]

6. Departmental Seminars: Attend department seminars, write abstracts of five presentations to be turned in during the senior year ..... [ ]

7. Senior Year

ETS exam ..... [ ]

8. Fall of Senior Year

A. If planning to go to graduate school at some time:

1. Register for GRE Biology Subject Test and Aptitude tests ..... [ ]

2. Begin writing applications to the schools of your choice. Check deadlines with individual schools ..... [ ]

9. List of Minimal Courses for Biology Major (Nine units total)

A. Two from the following: (See Section on AP and IB Biology on p. 5) BY 105, BY 107, BY 108, BY 109 [ ] [ ]

B. Approved field course ..... [ ]

C. BY 210 ..... [ ]

D. BY 361 ..... [ ]

**APPENDIX I (continued)**

- E. Four electives in addition to the requirements listed above (3 at the 300 or 400 level):
  - BY \_\_, ..... [ ]
  - BY \_\_, ..... [ ]
  - BY \_\_, ..... [ ]
  - BY \_\_, ..... [ ]
  - OTHER \_\_ ..... [ ]
  
- F. CH 107 ..... [ ]
  - and,**
  - CH 108 ..... [ ]
  - and,**
  - CH 250 ..... [ ]
  
- G. MA 125 **or** 126 **or** MA 117 **or** BY 220..... [ ]
  
- H. Two units from one of the following groups:
  - Chemistry 251, 351, 382, 383, 345
  - Geology 130 or 140 plus any Geology course requiring GY 140 as a prerequisite
  - Mathematics 128, 203, 217, 220, 240, 256, 315, 340, 417
  - Computer Science 121, 222
  - Physics 141 and 142 OR 241 and 242.....[ ][ ]

**APPENDIX II**

**BIOLOGY DEPARTMENT  
EVALUATION FORM FOR ORAL PRESENTATION OF SENIOR THESIS**

Student's name: \_\_\_\_\_ Advisor: \_\_\_\_\_  
Thesis Title: \_\_\_\_\_

Evaluator's name \_\_\_\_\_ Date: \_\_\_\_\_  
E=Excellent, G=Good, S=Satisfactory, F=Fair, P=Poor

<b>Organization:</b>	<b>E(5)</b>	<b>G(4)</b>	<b>S(3)</b>	<b>F(2)</b>	<b>P(1)</b>	<b>Comments</b>
<b>1. Introduction</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>2. Hypothesis or question asked</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>3. Methods</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>4. Results</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>5. Summary/Conclusions</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>6. Length of presentation</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>7. OVERALL QUALITY OF ORGANIZATION</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

<b>Oral presentation:</b>	<b>E(5)</b>	<b>G(4)</b>	<b>S(3)</b>	<b>F(2)</b>	<b>P(1)</b>	<b>Comments</b>
<b>1. Pace</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>2. Loudness</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>3. Clarity</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>4. OVERALL QUALITY OF ORAL PRESENTATION</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

<b>Visual Presentation:</b>	<b>E(5)</b>	<b>G(4)</b>	<b>S(3)</b>	<b>F(2)</b>	<b>P(1)</b>	<b>Comments</b>
<b>1. Photographic quality of slides</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>2. Size of text &amp; symbols</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>3. Amount of material on slides</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>4. OVERALL QUALITY OF VISUAL PRESENTATION</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

Comments on scientific aspects of thesis research (e.g., use of controls, statistics, experimental design, appropriateness of techniques, adequacy of data, etc.)

Letter Grade on Presentation (optional) \_\_\_\_\_

Was the presentation of high enough quality to merit **Graduation With Distinction**?

Yes  No

**Instructions for evaluators:**

After completing this form, return to the research advisor named at the top of the evaluation form. Try to do this by the end of the first day of classes after Biology Day.

**Instructions for research advisors:**

As soon as possible after Biology Day, collect all of the evaluation forms for your senior thesis student(s) and discuss the results with him/her (them). You may show the forms to the student(s). As soon as possible report the results of the evaluations for your senior thesis students to the Senior Thesis/Distinction coordinator. Only the results of the final question on the form (Was the presentation of high enough quality to merit **Graduation With Distinction**?) need be reported to the Distinction coordinator.

*APPENDIX III*

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

*APPENDIX IV*

***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.
- Geology and Ecology.
- Biogeography of the arctic/alpine flora.
- Conservation of rare plants.

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 nesting cavities

*Appendix IV – continued*

Phoebe Lostroh - Microbiology

- Genomics of *Vibrio fischeri*
- Biofilm formation in *Vibrato 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.

*APPENDIX V--sample seminar abstract*

TITLE OF THE SEMINAR

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 hierarchical 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 VII  
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: \_\_\_\_\_

