

Organismal Biology and Ecology

Majors' Handbook

COLORADO COLLEGE

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INTRODUCTION

Welcome! We are glad that you are considering a major in Organismal Biology and Ecology. This handbook answers many questions OBE majors have concerning requirements, study abroad, research and other opportunities in the OBE Department. For further information, meet with your advisor, watch the bulletin boards, attend the majors' meeting in the fall, and check your Worner Center mailbox and e-mail frequently. Advise the department administrative assistant of your Worner Center box number, phone number, e-mail address, any prolonged off-campus sojourn, and any change in your status at the College. **Ultimately, it is the responsibility of the student to know all departmental and college requirements and regulations.**

Whether you have just started your college career or are already in the middle of completing an OBE major, we urge you to read all of the sections in the handbook, and to review any questions you have with an OBE faculty member.

IMPORTANT DATES, EVENTS, AND ANNOUNCEMENTS

It is very important that you declare your OBE major no later than your sophomore year, so that you receive OBE Department announcements. To declare the major, you need a faculty advisor in the Department of Organismal Biology and Ecology with whom you confer before declaring. Appendix I contains the checklist of important items.

- Each fall a **REQUIRED** meeting of all prospective and declared majors will be announced. Topics include:
 - Introduction of new faculty and staff;
 - Discussion of graduation requirements including the capstone experience, 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.
- All OBE majors must complete the senior capstone experience (see details below).
- OBE majors have the option of writing a senior thesis and attempting to graduate with distinction (see details below). Appendix VIII contains a checklist for those attempting to graduate with distinction.
- Majors should also attend OBE Day each spring (see OBE Day section).

THE OBE MAJOR: A SHORT GUIDE TO REQUIREMENTS

- I. **Two** units in **Introductory Organismal Biology**: BY105 and/or BY106 and/or BY107
- II. **BY208 Ecology**
- III. **Two** units in **Molecular and Cellular Biology and in Genetics**: BY131, and BY280 or BY231
- IV. **Three** units in **Chemistry**: CH107 and CH108 and CH250
- V. **Two** units in **Mathematics**: one unit of calculus and one unit of statistics or mathematical modeling
- VI. **Five** approved **OBE Electives**
- VII. **Senior capstone experience** (of which the senior capstone course should count as one of the electives)

ADVICE ON SCHEDULING COURSES FOR A MAJOR IN ORGANISMAL BIOLOGY AND ECOLOGY

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

It is also important to consider what extracurricular activities you will pursue in order to move toward gaining entrance to a post-graduate degree program, or toward employment following graduation. In particular, you should work with the Career Center and your advisor to plan for summer activities that will enrich your academic experience and make you more eligible for post-graduate work or employment. **Summer research experience** is increasingly required for admission to graduate programs including medical school, and is essential to qualify for Ph.D. programs. Furthermore, students earning high enough grades to qualify to graduate with distinction should plan to do undergraduate research during the summer between their junior and senior years, because a senior thesis (BY499) is required to graduate with distinction and extensive research and writing time is required to complete a thesis.

The department strives to make all OBE 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 OBE courses. OBE majors must consult with the academic advisor to wisely allocate points during registration. By department policy, OBE 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 if you have problems enrolling in an OBE course.

FIRST YEAR:

At least 2-3 of the following courses:

BY105 Biology of Plants
 BY106 Biology of Animals
 BY107 Biology of Microbes

BY131 Intro to Molecular and Cellular Biology
 CH107 General Chemistry I
 CH108 General Chemistry II

SECOND YEAR:

At least 3-4 of the following:

BY105, BY106, or BY107 if both blocks have not
 already been completed
 Statistics requirement (recommended before BY208)
 BY208 Ecology

Calculus requirement
 BY131, if not already completed
 CH107, CH108 if not already completed
 CH250 Organic Chemistry

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

THIRD YEAR:

Finish your Calculus and Statistics requirements
 BY280 Population Genetics or BY231 Genetics

2-3 approved OBE electives

Talk with your advisor to find out if you might be eligible to graduate with distinction, so that you can complete those requirements.

FOURTH YEAR:

Complete the entire Senior Capstone Experience (includes seminars & abstracts; ETS or GRE exam, senior capstone course)
 2-3 approved OBE electives

REQUIREMENTS FOR THE OBE MAJOR: THE FULL GUIDE

I. Two units in Introductory Organismal Biology:

- BY105 Biology of Plants
- BY106 Biology of Animals
- BY107 Biology of Microbes

AP/IB credit may count towards a lower level elective or as credit for BY131 (see below), but cannot replace these organismal courses.

II. BY208 Ecology**III. Two units in Molecular and Cellular Biology and in Genetics:**

- BY131 Introduction to Molecular and Cellular Biology

A biology AP score of 5 or an IB-HL score of 5-7 fulfills this requirement (a biology AP score of 4 or an IB score of 4 count as a lower-level elective).

- BY280 Population Genetics OR BY231 Genetics

IV. Three units in Chemistry:

- CH107 General Chemistry I
- CH108 General Chemistry II

If you have Chemistry AP or IB credit on your transcript, you may take a bypass exam for CH107 or CH108 that is administered by the Chemistry Dept. Successful completion of the Chemistry bypass will exempt you from that course with respect to the OBE major. While some students are able to bypass CH107, skipping CH108 is rare and not recommended because the lab experience in CH108 helps greatly in future classes. Contact Ted Lindeman (tlindeman@coloradocollege.edu) in Chemistry for more information or to arrange to take a bypass exam.

- CH250 Structures of Organic Molecules

NOTE: Graduate schools in biology and health professions programs often require both CH250 AND CH251 Reactions of Organic Molecules.

V. Two units in Mathematics:

- **One** unit of calculus from:
 - MA126 Calculus I
 - MA127 Calculus I and II, accelerated
 - MA129 Calculus II

AP or IB credit recognized by the registrar counts towards this. Choose your calculus course carefully so that you avoid doing mostly review and do not take a course without adequate preparation. The Math Department recommends the following:

- *If you have Calculus AB credit on your transcript, take Calculus II and not Calculus I.*
- *If you have Calculus BC credit, do not take Calculus 2. If you want to take more math, take a Computer Science class or a higher level math class (ask your advisor for recommendations).*
- *If you have IB credit, talk to the Math Department.*
- *If you took Calculus in high school but do not have AP or IB credit, talk to the Math Department.*

- **One** unit of statistics or mathematical modeling from:

- BY220 Biostatistics and Experimental Design
- MA256/BY256 Mathematical Models in Biology
- MA117 Probability and Statistics
- MA217 Probability and Statistical Modeling
- EV228 Analysis of Environmental Data

*AP or IB credit recognized by the registrar in statistics. The **statistics/modeling requirement** is fulfilled by AP or IB credit in statistics. However, many students with this credit have benefitted a great deal by still taking BY220.*

VI. Five approved OBE Electives

- All BY courses except BY100 and BY104 may count as electives. BY101 (FYE) counts as one elective.
- The following Human Biology & Kinesiology courses may count as electives: HK204, HK304, and HK321.
- One unit of elective credit may be CH382, GY205, GY300, EV422, AN201, AN207, or AN306.
- **AP/IB** credit may count as one unit of lower level elective credit (ask your advisor).
- Three of the electives must be upper-level (numbered 300 or higher). Two of these must be OBE (BY) upper-level courses (one of these must be a capstone course taken during the last 8 blocks before graduation - see capstone options below). The remaining upper-level elective may be a non-BY class.
- Not more than a total of 2 research blocks (BY309, BY409 or BY499) may count towards the major.
- It is possible to petition the department to ask for other courses to count as electives.

VII. Senior capstone experience

During your junior and senior years, you must:

- Complete attendance at five OBE seminars, summarize each in an abstract, and submit each abstract electronically to both Donna Sison and your advisor no later than the first Monday of the block following the block in which the seminar occurred. Students are strongly advised to begin turning in abstracts before their senior year.
- Successfully pass the Biology ETS exam or the Biology GRE exam.
 - Register to take the **2-hour ETS Major Field Test in Biology early in Block 3 or early in Block 6**, the only two times OBE offers the exam. **It is best to take the ETS exam in Block 3 in case you do not pass the exam.** See the "Senior Capstone" section below on advice to prepare for this exam and links to sample questions.
 - Alternatively, you can take the Biology GRE in the fall, but we strongly recommend that you take the ETS exam instead. You must list Colorado College as a recipient of the GRE scores.
- Complete a senior capstone course (this also counts as one of your five electives) in the last two semesters prior to graduation), in one of the following ways:
 - BY499 Senior Thesis
 - BY409 Advanced Research in OBE (if it meets the requirements described in the section on "Senior Capstone" - ask the faculty member supervising your research).
 - Capstone course options vary from year to year. The current list of approved OBE capstone courses is: *BY308 Advanced Ecology, BY365 Plant Physiology, BY366 Comparative Animal Physiology, BY367 Animal Ecology, BY390 Ecology and Biogeography of Patagonia, BY410 Ornithology, BY412 Entomology, BY415 Evolution, BY421 Conservation Biology, BY442 Special Topics: Biology of Disease Vectors, BY475 Techniques in Molecular Ecology.*

SENIOR CAPSTONE EXPERIENCE

There are three parts of the required senior capstone experience:

1. Attend research seminars & turn in 5 abstracts
2. Successfully pass the Biology ETS exam or the Biology GRE exam
3. Complete a senior capstone course during the last 2 semesters prior to graduation

PART 1: BIOLOGY RESEARCH SEMINARS & ABSTRACTS

Majors must submit satisfactory abstracts from 5 Biology (OBE or MB) seminars. Attend acceptable seminars (see below), summarize 5, and email each abstract to both Donna Sison (dsison@ColoradoCollege.edu) and your advisor *by the first day of the block after the seminar*. Abstracts submitted after this day will generally not be accepted. You must declare an OBE major and be a junior or senior before abstracts can count. Declared majors receive e-mail notices of Biology seminars, which are also on the departmental web page.

ACCEPTABLE SEMINARS

- OBE Department seminars, including the keynote address at OBE Day
- Biology seminars at UCCS, CU, CSU, DU, CU medical school, and Penrose or Memorial Hospitals, but ask your academic advisor before attending.
- Selected seminars from other science departments at CC. In your abstract clearly link the seminar to biology. Again, ask your academic advisor before you attend non-OBE seminars.
- Not eligible: student presentations, including OBE Day talks.

FORMAT FOR ABSTRACTS-

- Limited to one printed page.
- Include 1) your name, 2) full seminar title, 3) complete name and academic affiliation of the presenter, 4) seminar date, 5) your abstract, and 6) the Honor Code and your commitment that you have followed it indicated by typing your name. Each abstract must be clear, concise, well-written, and complete to be accepted by your advisor and the department. See Appendix IV for an example.
- Follow the spirit of the CC Honor Code; this obviously includes attending the seminar and writing the abstract in your own words.

PART 2: PASS A SENIOR EXAMINATION

Successfully passing the senior examination is required of all students graduating with a major in Organismal Biology and Ecology.

The senior comprehensive exam is the Educational Testing Service (E.T.S.) Biology Subject Test, which is administered by the OBE 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. **Students are strongly advised to take the exam during Block 3**, in case they do not pass and need a second chance in Block 6. In the past, 20-25% of students failed the first attempt and needed a second round to pass the exam. 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 and Molecular Biology, Organismal Biology, and Population Biology, Evolution, and Ecology. The exam grade will be recorded permanently on the student transcript. Faculty use performance on the exam when writing letters of recommendation and when deciding how to distribute departmental research funds and other awards. A description of the ETS exam contents can be found at http://www.ets.org/s/mft/pdf/mft_testdesc_biology_4gmf.pdf, while practice questions can be found at http://www.ets.org/Media/Tests/MFT/pdf/mft_samp_questions_biology.pdf.

The Graduate Record Exam (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, students must list Colorado College as a recipient of the GRE scores. See Appendix XXX for advice on how to maximize your chances of passing the exam.

Criteria for Passing the Exam

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

What happens if you do not achieve a passing score?

Students who fail the exam in the fall must retake the ETS in Block 6 to attempt to raise their score to a passing level. Students who retake the ETS may receive a grade of Outstanding if their scores improve enough to reach that level.

Students who do not pass the senior examination must take a two-hour oral exam administered by two faculty members chosen by the department. Students will have to present a research paper during the exam, defend their interpretation of that research paper, and then answer questions covering the entire breadth of their Biology coursework. The faculty will know exactly which courses students took, so students should expect to review all of their notes from all of their Biology classes. The makeup exam must be scheduled in a timely fashion no later than block 7 in order to meet the graduation deadlines. *A passing grade must be achieved on the senior exam before graduation forms can be signed. Oral exams will only be given to students who have previously attempted the ETS or GRE exam. Students who do not take the ETS or GRE are **not eligible** for oral examination and will not be able to graduate with a*

degree in OBE until they have taken one of the tests. Students who take the oral exam only have the option of moving from Failing to Satisfactory. They may not receive Outstanding.

Cost of the exam is approximately \$30. Students must register and pay for the exam by the second Monday of Block 2 for the Block 3 test date. Students who fail the exam in Block 3 must register and pay for the spring exam by the second Monday of Block 5 for the Block 6 test date. Registration and payment should be done in the OBE Department office.

PART 3: PASS AN APPROVED SENIOR CAPSTONE COURSE

Students may fulfill the capstone course requirement by completing a senior thesis (BY499), completing a research block that requires a substantial written research report with literature background (e.g. BY409, if the supervising faculty member requires that the student meet the capstone course description and the department approves a petition – See Appendix VIII) or successfully completing a designated capstone course that draws upon a body of knowledge, perspectives, and experiences developed over the entire course of the OBE major. A capstone experience must be integrative across more than one level of biological organization, e.g. genome-metabolism-organism, genome-organism-evolution, or genome-physiology. Moreover, a capstone course must include at least two of the following elements: a critique of primary literature; a seminar-style discussion of primary literature; a written proposal, oral presentation, or paper that requires synthetic thinking; substantive opportunities designed to broaden student understanding of inquiry and research methods in OBE. A course may only fulfill the capstone requirement if taken during the last two semesters before graduating; the intent is for students to bring to a given course the full complement of their biology education at Colorado College.

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

- Critique primary literature, providing theoretical context for the literature discussed
- Analyze a body of research including primary literature, explain application and relevance of the findings, and describe potential future directions of the research topic
- Select appropriate primary literature papers relevant for a research project, seminar, or research proposal
- Organize information from multiple sources (primary literature, review articles, original research) into a cohesive oral presentation or written report or proposal. Presentations or reports may be of any length (as decided by the supervising faculty) but should provide evidence of synthesis of information across levels of biological organization

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

The current list of approved OBE capstone courses is: *BY308 Advanced Ecology, BY365 Plant Physiology, BY366 Comparative Animal Physiology, BY367 Animal Ecology, BY390 Ecology and Biogeography of Patagonia, BY410 Ornithology, BY412 Entomology, BY415 Evolution, BY421 Conservation Biology, BY442 Special topics: Biology of Disease Vectors, BY475 Techniques in Molecular Ecology.*

UNDERGRADUATE RESEARCH/TRAINING OPPORTUNITIES

- A. **Supervised Research Blocks in Organismal Biology and Ecology (BY309/409)** Students are encouraged to engage in supervised research through enrollment in BY309/409 and other programs. See section below for more details.
- B. **Senior Thesis (BY499)** 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 BY309 or 409 can be the basis of a thesis. Students may sign-up for one full block of BY499 or for an entire year of BY499 extended format (must be initiated by the beginning of block 1 for the senior year). See section on Senior Thesis for details.
- C. **Off-campus - Research Experience for Undergraduates (REU)** The National Science Foundation awards REU grants to universities and field stations, which in turn fund undergraduate research, mainly during summers. These typically provide room and board and a stipend for about 10 weeks. These are usually excellent quality programs, and a number of students have written senior theses based on REU experiences. Institutions award REU grants to students based on applications, which are due mostly in February and March with some as late as early May. Search the web (search for NSF REU programs), or sign up for the EV/BIO listserv and check the OBE department web pages. (**Note** that applications for these positions are usually due in January or February, so you should work on them during December.)
- E. There are many opportunities for summer work in ecology, field biology, and environmental science on the listserv **EVINTERNSHIPS**. These listings also include a number of laboratory jobs of various sorts, including molecular approaches to questions that relate to multiple aspects of biology, and are not limited to ecological opportunities only. Students with an interest in lab-based biology are also encouraged to participate in this listserv. If you have an email account at Colorado College, you may request to subscribe or unsubscribe from this list by accessing <http://listserv.coloradocollege.edu/archives/HTML/EVINTERNSHIPS.HTML>
- F. **Department Opportunities - Not for Academic Credit** The OBE Department offers a tutoring program. Junior and senior OBE

majors are available to assist students in all core classes in the department. Students wishing to participate in the program can obtain the names and phone numbers of tutors either from flyers posted in their classroom or from the OBE paraprofessionals. Those students needing to be tutored should keep in mind that finding an available tutor takes time and planning. The student must find a tutor who is available and the tutor must contact the paraprofessional in charge of the program before a tutoring session can be scheduled. Students who call a tutor the night before an exam should not expect to be tutored that evening. If you are worried about a particular class but are not positive that you will require the assistance of a tutor, call a few tutors to determine who will be available that block and will best fit your needs.

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

NOTE: All Students who work and receive wages from the OBE 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 OBE Department.

SUPERVISED RESEARCH BLOCKS

Research in OBE blocks (BY309 or BY409) allows students opportunities to pursue a lab or field research project under supervision of an experienced scientist. Projects are designed and supervised with the help of a faculty member whose expertise and interests are related to the project. Faculty specialties are shown in Appendix III. 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.] **Not more than a total of 2 units** from BY309, 409, 499 or independent study from off-campus programs can be used toward the OBE major, and only 1 unit of independent research from an off campus program may be applied to the major.

Begin talking with a faculty member in the area of your interest before you consider enrolling in BY309 or BY409. A faculty member must agree to work with you before you can register for BY309/409. If a faculty member agrees to supervise your research and is not scheduled for BY309 or BY409 Research in OBE that block, the Registrar will create a course for you. Talk with your faculty research advisor to find out if you should register for BY309 or BY409 (generally BY309 if you are a junior and BY409 if you are a senior). Also determine whether you need to petition the department to get a BY409 block recognized as a senior capstone course (see Appendix VII).

It is possible that you will need to apply for a Venture Grant to help fund a research project. Venture Grant applications also have a deadline (the 2nd Friday of each block), and typically the grants must be awarded before you begin the research. Check with your faculty research advisor to find out if you should write a Venture Grant. See link for details about Venture grants: <http://www.coloradocollege.edu/offices/dean/grants-for-students/internal-grants-for-students/venture-grants.dot>. Students who receive Venture Grant funding must present their work publicly, for example at OBE Day. **We strongly encourage all BY309 and BY409 students to present their research in the form of a poster on OBE Day.** Talk to your advisor about this opportunity. For information about **conducting research off-campus under supervision of a non-CC faculty member**, see Appendix VI. **A petition is required.** Not more than 1 unit of independent study from off-campus work can be used toward the OBE major.

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

Do not take equipment or supplies from any laboratory, prep room or classroom without communicating in writing or in person with the supervisor of the room: 1) who you are, 2) what equipment/supplies you wish to use, 3) where you wish to move these items, and 4) when you will return it. This will keep the OBE 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.

STUDY AT OTHER INSTITUTIONS

OFF CAMPUS STUDY: CREDIT TOWARD THE ORGANISMAL BIOLOGY AND ECOLOGY MAJOR

These guidelines are only for OBE majors and students who definitely intend to declare an OBE major. Students majoring in other departments or programs (e.g. Molecular Biology, Neuroscience, Biochemistry, or Environmental Program) should consult with their Department Chair or Program Director and with an OBE 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 universities. Field or laboratory research directly supervised by a member of the OBE Department does not require petitioned approval, nor does participation in an ACM program.

Students seeking credit for the OBE 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, 409, 499, or independent study from off-campus programs can be used toward the OBE major. Not more than **1** unit of independent study from off-campus work can be used toward the OBE major. With few exceptions, **no more than 2 units** from non-CC or ACM programs may be applied to the OBE major. Courses taken on off-campus programs prior to enrolling in college (for example, in a gap year or gap semester) do not count for the OBE 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 OBE advisor 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 OBE major. OBE majors need to consult with their academic advisor in OBE (or Professor Kelso) 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 OBE major requirements.

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

1. Courses at other institutions in traditional academic settings

Students are urged to take required courses for the major at Colorado College. However, in unusual cases, you may seek substitute credit for a required course taken elsewhere in a *formal* university setting such as summer session at accredited colleges and universities. Eligible required courses for the OBE major are BY105, 106, 107, 131, 231. The department requirement for electives may be met by an off campus course described in number 2 below. *Normally courses with Ecology in the title do not substitute for BY208 Ecology.* You may be asked to document the course content through syllabi, copies of exams, textbooks and through discussion with the Chair and/or a department 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 OBE major requirements, unless a case is exceptional (for example, transfer students from another college or university). Only courses that require at least 2 prerequisites in Biology may count as upper-level electives. They must be approved by the OBE faculty responsible for off campus credit.

Note: substituting required courses in other departments, such as Chemistry, requires written approval by that Department and approval by your academic advisor in the OBE Department or the Associate Chair, if your advisor is not a member of the OBE 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 OBE faculty members who teach the course for which equivalency is desired. The signature of the designated departmental representative, currently Professor Tass Kelso, is also required. It is best to provide evidence (syllabi, etc.) BEFORE taking the course that it is the equivalent of a OBE 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.
- 5) Note: While off campus credit can be applied to your major and to overall CC requirements, with the exception of ACM courses, the grades you receive in the classes do NOT count towards the GPA in your major or your overall CC GPA.

2. ACM Programs

No departmental paperwork is required for these programs, and the course work will transfer directly to your OBE 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 OBE 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.

- **ACM Tropical Research (Spring) Semester in Costa Rica.** Successful completion of the program provides two units toward the OBE major. One of these will be for BY309/409 Independent Study if the field project is on a biological topic (as determined by your advisor or Professor Snyder after you return). The second unit will count as an upper-level elective if the student has taken BY208 Ecology prior to the ACM program or as a lower-level elective if the student has not. Students also receive a third unit in Spanish, and a 4th unit of unspecified CC credit.
- **ACM Human Evolution & Ecology in Tanzania.** Students who successfully complete this program will receive two units of credit toward the major. One unit will count as a lower-level elective, and the second will count as an upper-level elective *if the research project is on a biological topic.*

Procedures for ACM programs

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

3. Non-ACM field programs

The college has limited CC credit to a select list of off campus programs (see the Registrar or International Programs Office for a current list of CC-Approved Programs). Students with strong preparation who feel they have completed a substantive project in a CC-approved program worthy of upper level credit may petition the department after they return; if granted, they would then receive 1 upper and 1 lower level credit, to a maximum of 2 elective units towards the major. The petition would include demonstration of coursework preparation (e.g. BY208 and 220) and submission of a completed project to a relevant faculty member who supports the petition (project must have adequate design, hypothesis, and data, and be done solo rather than in a group). *Normally courses with Ecology in the title do not substitute for BY208 Ecology.*

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

- **Boston University Tropical Ecology:** Participants in the program can receive *1 upper and 1 lower level elective* in OBE as per the current practice. Prereqs are: 1 year of intro Bio and a course in Ecology; 1 yr college Spanish.
- **Sea Semester Oceans and Climate** and **Marine Biodiversity:** These programs are advertised as targeting more advanced science students than the regular programs. Prerequisites: a minimum of 3 lab science courses, including 1 at the 300-level or higher, or consent of instructor. *Two CC units of credit toward the bio major will be given as follows: 2 upper level OBE electives (equivalent to independent study), if the student project is on a biological topic. See following section for credits for other Sea Semester Programs*
- **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 OBE elective and 2 upper level OBE electives for a total of 3 OBE 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 OBE faculty members who teach the course for which equivalency is desired. Signature of the department off-campus advisor is also required. It is best to provide evidence (syllabi, etc.) BEFORE taking the course that the proposed course is the equivalent of an OBE 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 OBE major.

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

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

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

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

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

Sea Education Association (SEA) programs (for *Oceans and Climate* and *Marine Biodiversity*: see above)

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

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

Other programs on the approved list typically receive 1-2 lower level electives. Please check with the designated department faculty member to see what these are for the program you are interested in. Students who take abroad programs prior to enrollment in college may not receive credit towards the OBE major, although they may receive CC credit overall. Courses taken prior to taking college level biology are treated as the equivalent of BY100's (Studies in Biology, for non-majors) and do not receive credit in the OBE 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 OBE office. This form requires verification by your off-campus supervisor that s/he will supervise you.
- 2) Obtain signature of a CC OBE 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 OBE major. Remember that only one off-campus research unit and a total of two units of research credit may count toward the major.

SENIOR THESIS AND GRADUATION WITH DISTINCTION IN ORGANISMAL BIOLOGY AND ECOLOGY

OVERVIEW OF PROGRAM

The OBE Department faculty recognizes the educational benefits for any student doing original research and presenting it in writing and orally. Therefore, any senior OBE major may elect to undertake a senior thesis. A senior OBE major who completes a high quality senior thesis, presents it orally at OBE 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 BY499 Senior Thesis.

CHECKLIST to graduate with distinction in Organismal Biology and Ecology

1. Complete an OBE senior thesis with a grade of A- or above and
2. From the courses taken for the OBE major, achieve a GPA of at least 3.7 for the 10 courses with the highest grades. If a student does not have seven or more grade track courses, e.g. is a transfer student or a student taking the MBL Semester in Ecosystem Science, a faculty member may nominate the student for consideration for distinction by a departmental vote.

SENIOR THESIS

The option of undertaking a senior thesis must be initiated by the student and approved by an OBE 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 OBE 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 OBE 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 V) 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 an OBE 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.

ENROLLING IN BY499 SENIOR THESIS

Also by the end of block 2 students planning to do a senior thesis should be enrolled in BY499 Senior Thesis through the Registrar's Office. Enrolling in BY499 and completing the OBE Department's requirements for a senior thesis will provide an official record of the senior thesis on the student's transcript. There is an option of enrolling in BY499 as a regular block course, or enrolling in BY499 as a FULL YEAR extended format course. Students may enroll in one extended format course per semester for ½ CC unit at no extra tuition cost. The instructor for BY499 should be the primary thesis advisor.

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 OBE Day in Block 7. The presentation is prepared under the supervision of at least one OBE 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 OBE 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 ensure that the presentation will meet the OBE Department's standards of quality.

The student must inform the faculty coordinator of OBE Day of his or her intention to give an oral presentation at OBE Day and must submit an abstract of the presentation for the OBE Day program. The OBE Day coordinator will 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 BY309/409) at the OBE Department's annual OBE Day. Because of time limitations for oral presentations of students attempting to qualify for Graduation with Distinction, however, other student presentations at OBE Day will usually be in the form of a poster. The coordinator of OBE Day will make the final decision about the format of research presentations at OBE Day.

Students attempting to graduate with distinction in December must discuss their situation with their advisor and the Department Chair to arrange for fulfilling the oral presentation requirement outside of OBE 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 OBE office. By signing, the thesis advisors have judged that the written thesis meets the standards of quality necessary for Graduation With Distinction. The copy will be kept on file by the Department and should be presented in a folder with a typed label (title, student's name), or as a formally bound copy. It is customary to give each advisor a copy of the thesis.

The thesis must also be submitted to the library, which strongly prefers an electronic copy. The student should use their last name and tiger number to log in to the following website: <http://discovery.coloradocollege.edu/etd/>. After logging in, they will be prompted with instructions on how to complete the submission.

For a detailed overview of the thesis submission process, covering everything from how to get departmental and personal bound copies to submitting a thesis electronically, see <http://coloradocollege.libguides.com/content.php?pid=345211>.

OBE DAY

Each spring the department faculty, staff and students meet for a day-long series of presentations, including those given by OBE majors seeking Graduation with Distinction. OBE Day is in March (block 6). All OBE majors are encouraged to attend, and others are welcome. Abstracts required for graduation may be written on the keynote speaker's talk but not student presentations.

DEPARTMENTAL AWARDS TO STUDENTS (shared between OBE and MB)

The Mary Alice Hamilton Award

Each year the OBE and MB Department faculty selects one or two outstanding senior biology majors as the winner of the Mary Alice Hamilton Award. Among other things, grades, research, and potential to become a professional biologist are considered in making the award to the outstanding biology major(s). Winners will be announced at 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 OBE and MB 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 decline of birds of prey and in particular the peregrine falcon. He was first to breed the temperate North American peregrine in captivity, a line used extensively in restoration of the western population. He served on several recovery teams and working groups for endangered species. At Colorado College he inspired students through independent projects to pursue careers from botany to ornithology, in the lab and in the field. In keeping with his scholarship and breadth as a biologist, the Enderson Award will honor a junior or senior Biology major whom, in the opinion of the faculty, has shown commitment and productivity in an original research project in conservation biology. Candidates are eligible if their work has conservation implications, whether the focus was molecular, organismic, or ecosystem, lab or field.

The Laboratory Biology Award

This award is made to a senior OBE and MB 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 OBE and MB 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 OBE / MB Departments award the Alberts Prize to support student research in biochemistry and molecular biology.

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. **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.
- B. **Departmental Budget. LIMITED FUNDS** are available to assist students in conducting BY309/409 research.
- C. **Robert M. Stabler Award.** This 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 OBE major for summer study at a marine Biology station. The amount of money awarded depends on the cost of the program and financial need. 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. See the department office for application procedures and details.
- 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. **Mary Ella Gilmore Magnusson and Prof. Ralph Gilmore Family Fund.** The earnings from this fund are used to provide summer stipends for Colorado College students to engage in research in natural sciences during their undergraduate years. The research may occur in conjunction with a CC faculty member on campus or in the field. The stipend may be used for research expenses, including but not limited to supplies, chemicals, transportation costs, etc. Contact the professor with whom you would like to work.

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.

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 Organismal Biology and Ecology 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 that 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 OBE courses and faculty.

1. You will receive an email asking you to complete a course evaluation at the end of the block. These evaluations are anonymous, but you must complete your course evaluation before being able to access your grade for the course. Evaluations offer important insight to the instructors, allowing them to look for trends and suggestions in order 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.
2. You will receive requests 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, as your comments are important and taken seriously in the review process. Please participate, even if your evaluation is brief.

APPENDIX I

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

1. Spring of Sophomore Year
 - A. Obtained an advisor in OBE.....[]
 - B. Applied for Major in OBE.....[]
 - C. If pre-health, have a file in pre-health advising office []
 - D. If pre-K-12 education, have contacted Education Department chair[]

2. Fall of Each Year
 - OBE Major Meeting..... [] [] [] []

3. Spring of Each Year
 - Attend OBE Day..... [] [] [] [] []

4. Preregistration of Junior Year
 - Check graduation requirements before scheduling for senior year..... []

5. Spring of Junior Year
 - Make plans for senior thesis, Graduation with Distinction, if desired[]
 - If considering graduate school, find 5-6 appropriate programs and learn their admissions requirements and application deadlines.....[]

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

7. Senior Year Capstone Experience
 - A. ETS exam OR Biology GRE exam[]
 - B. Seminars and abstracts[]
 - C. Senior capstone course[]
 - D. Students who are attempting to graduate with distinction (honors) in OBE
 - Register for senior thesis by the end of Block 2[]
 - Sign up for BY499 by the end of Block 2[]
 - Sign up to present at OBE Day[]
 - Turn in beautiful final, signed copy of thesis.....[]

8. Fall of Senior Year if planning to go to graduate school at some time:
 - A. Register for GRE Biology Subject Test and GRE General tests[]
 - B. Secure letters of recommendation
 - C. Finish applications, most of which are due December – March..... []

9. General Education (All-College) Requirements
 - A. Social Inequality (1 unit).....[]
 - B. Global Cultures (1 unit).....[]
 - C. Scientific Investigation (2 units, includes 1 block with lab/field component)..... []
 - D. West in Time (2-block course, 2 units).....[]
 - E. Quantitative Reasoning (1 unit)[]
 - F. Language (2 blocks or equivalent).....[]

Students must fulfill this requirement by one of the following options: 1) 2 units in any of the languages offered at CC (unless permitted otherwise by disability services), 2) an acceptable language program at any accredited college or university, in any non-English language, equivalent to two units of language at Colorado College, if approved by the registrar's office

 - G. Writing proficiency (acceptable writing portfolio or additional writing course).....[]

CHECKLIST to complete the **OBE** major.

1. **Two** introductory Organismal units: [] []
 - List courses taken to fulfill this requirement here:

2. BY208 (Ecology) []

3. Two units in Molecular and Cellular Biology and in Genetics
 - BY131 (Introduction to Molecular and Cellular Biology) []
 - BY280 (Population Genetics) OR BY231 (Genetics) []
 - List course taken to fulfill this requirement here:

4. **Three** units in **Chemistry**
 - CH107 (General Chemistry I) []
 - CH108 (General Chemistry II) []
 - CH250 (Structures of Organic Molecules) []

5. Two units of Mathematics including:
 - One** unit of calculus: []
 - List course taken to fulfill this requirement here:
 - One** unit of statistics or mathematical modeling: []
 - List course taken to fulfill this requirement here:

6. **Five** approved OBE electives [] [] [] [] []
 - Three must be Biology (BY) courses at the 300 level or higher [] [] []
 - One unit must be an approved senior capstone course []
 - List courses taken to fulfill this requirement here:

7. Senior Capstone Experience
 - **Five** seminar abstracts [] [] [] [] []
 - Pass the Biology ETS exam or the Biology GRE exam []
 - Complete an approved Senior Capstone Course []
 - List course taken to fulfill this requirement here:

CHECKLIST to complete undergraduate courses required by most M.D. programs

(check the specific programs to which you plan to apply!)

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

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

- BY105 Biology of Plants
- BY106 Biology of Animals
- BY107 Biology of Microbes
- BY131 Introduction to Molecular and Cellular Biology

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

2. CH107, CH108, CH250, and CH251[] [] [] []

Summer versions of general chemistry and organic chemistry also fulfill the requirements but may have slightly different course numbers. Some students find CH382 useful before taking the MCAT. Pre-health students from high schools that did not offer AP or IB calculus should probably complete MA125-6 before enrolling in CH107.

3. Calculus I MA125-6 or MA126 or MA127 and Calculus II MA129[] []

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

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

- PC141 and 142, Physics for the Life Sciences

OR

- PC241 and 242, for students who enjoyed calculus, took it in college, and earned an "A."

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

- One unit of English literature

AND

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

6. A course in **Sociology** or **Psychology** (strongly recommended, sometimes required) []

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

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

Other health professions schools, including Veterinary Medicine, Nursing, Podiatry, Physical Therapy, Optometry, Pharmacy, and Physician Assistant programs, are likely to have other specific course requirements and are not as standardized as Medical and Dental school requirements. It is important to consult information from specific schools before completing plans for an academic program.

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

APPENDIX II

SAMPLE FORM

"TITLE OF THESIS"

A Senior Thesis Presented to
The Faculty of the Department of Organismal Biology and Ecology,

Colorado College

By

"Your Name"

_____ day of May, _____

Approved by:

Primary Thesis Advisor

Secondary Thesis Advisor

APPENDIX III

FACULTY RESEARCH INTERESTS

OBE majors should consider a research project or thesis during the junior and senior years. Many graduate schools prefer 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.

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 – Animal Eco-physiology

- 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

Tass Kelso - Plant Systematics and Evolution

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

Brian Linkhart - Ornithology

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

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 science faculty at Colorado College. See the department 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 chair for information.

APPENDIX IV--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

APPENDIX V

REGISTRATION FOR SENIOR THESIS

Return this form to the Senior Thesis/Distinction Coordinator by the end of Block 2.

Student's name (print or type) _____ Planned Date of Graduation (Month/Year) _____

Local phone number _____ Local address _____

I plan to complete the requirements for senior thesis in Organismal Biology and Ecology. These requirements are: 1) writing a high quality thesis based on original research and presenting the thesis orally at the OBE Department's annual OBE Day in the spring semester. I have read the sections in the OBE Majors' Handbook on Senior Thesis and Graduation With Distinction, and by filing this form, I understand that the requirements for Senior Thesis must be completed according to the schedule given in the OBE Majors' Handbook. I understand that coordination, scheduling, and completion of the thesis and oral presentation are the student's responsibilities.

I further understand that if I qualify for a senior thesis and I meet the minimum grade point average criteria as given in the OBE Majors' Handbook, I will awarded Graduation with Distinction in Organismal Biology and Ecology.

I certify that I have enrolled in BY 499 Senior Thesis as a regular block course or as an extended format course during my senior year.

Signature

My research will be (was) done at _____

under the supervision of _____.

Thesis committee (signatures required below):

Primary advisor (must be in the CC OBE Dept.)

Secondary advisor (may be in another dept.)

Oral presentation advisor (usually the same person as the primary advisor)

STUDENTS: DO NOT WRITE BELOW THIS LINE

Date form filed:

Date of Thesis completion:

Thesis meets standards senior thesis? yes no

Date of oral presentation:

Oral presentation meets standards for senior thesis? yes no

Overall GPA: _____ GPA in OBE courses:

Graduation With Distinction in OBE granted? yes no

APPENDIX VI
DEPARTMENT OF ORGANISMAL BIOLOGY AND ECOLOGY
PETITION FOR OFF-CAMPUS RESEARCH CREDIT
BY309 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 OBE, 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 OBE faculty does not require this departmental petition. See the OBE 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 OBE 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 BY309 or 409.

Name of Applicant _____ Date _____

Local Address _____ Phone _____

Credit desired: BY309 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 OBE Major? _____

Courses (numbers) completed toward the OBE 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: _____

TO BE COMPLETED BY PERSON SUPERVISING THE RESEARCH OFF CAMPUS

☐ Are you willing to sponsor, supervise and evaluate the student research project proposed above? _____

☐ Are you willing to submit a written evaluation of the student’s research project after its completion? _____

Please explain the nature of your intended evaluation:

☐ Are adequate research facilities, supplies and support available for the student to undertake the project? _____

Explain briefly, as necessary:

☐ Additional comments (please attach a letter if needed):

Off-campus supervisor signature

Date

TO BE COMPLETED BY THE STUDENT

I understand and agree to the OBE Department guidelines for off-campus research and to the requirements and evaluation methods set by the CC OBE Department and my on-campus advisor:

Student signature

Date

TO BE COMPLETED BY THE CC FACULTY SPONSOR AFTER ABOVE IS COMPLETED

As this student’s on-campus advisor, I have evaluated this student’s proposal and am willing to administer the study for the department. I agree to evaluate the research and submit a grade for the BY309 or 409 credit to the registrar. The student will enroll in the BY309 or 409 under my name.

CC OBE Faculty supervisor signature

Date

TO BE COMPLETED AFTER THE STUDY, BY THE CC OBE FACULTY SPONSOR

I certify the student has successfully completed all requirements and should receive a unit of credit for the study.

Credit received: BY309 or BY409 (circle one)

CC OBE Faculty supervisor signature

Date

FOR DEPARTMENT USE ONLY--DO NOT WRITE BELOW THIS LINE

Date Application Filed: _____ Request for: _____

Application: Approved Denied

Comments:

Unit of BY309 or BY409 credit granted: _____

APPENDIX VII
DEPARTMENT OF ORGANISMAL BIOLOGY AND ECOLOGY
PETITION FOR BY409 TO COUNT AS A SENIOR CAPSTONE COURSE

Instructions: This petition requesting that a BY409 course be counted as a Senior Capstone Course is to be completed in full and handed to the Chair or Associate Chair of the Department, BY THE BEGINNING OF THE ACADEMIC BLOCK PRIOR TO THE INTENDED STARTING DATE OF THE BY309/409 course. This deadline is enforced. Please do not ask for an exception!

Name of Applicant _____ Date _____

Phone _____

A course may only fulfill the capstone requirement if taken during the last two semesters before graduating.

When will you graduate? _____

When will you take the BY409 that you want to have serve as a senior capstone experience?

School Year (e.g. 2014-15) _____ Block _____

What is your research question for BY409?

How will your BY409 course require you to integrate across more than one level of biological organization (e.g. genome-metabolism-organism, genome-organism-evolution, genome-physiology-population-ecosystem, etc.)?

Mark all of the following elements that will be included in the BY409 course. A minimum of two are required for the course to count as a senior capstone.

a critique of primary literature

a seminar-style discussion of primary literature

a written proposal, oral presentation, or paper that requires synthetic thinking

substantive opportunities designed to broaden student understanding of inquiry and research methods in biology.

We strongly advise you to arrange to present your BY309/409 research at OBE Day. Discuss this possibility with your BY309/409 research mentor.

Name and signature of CC faculty member who will supervise this BY309/409 project. Signature indicates that the faculty member agrees that the BY309/409 will meet the requirements for a Senior Capstone.

Name & Signature: _____

Block & Date: _____

APPENDIX VIII

THE BIOLOGY MAJOR through 2013-14 ("old" Biology major)

Students declaring after July 1, 2014 will automatically be OBE majors. Those who declared prior to July 1, 2014 can be transferred to the new OBE major. There are practically NO differences between major requirements of the old Biology major OEE track and the new OBE major. If you are concerned or confused as this transition occurs, please speak with your advisor. Below is a reminder of what the "old" Biology major OEE track looks like, FYI.

In the "old" Biology major, two tracks existed: the first option was the Organisms, Ecology, and Evolution (OEE) track (very similar to the new OBE major), and the second option was the Molecular and Cellular Biology (MCB) track (very similar to the new MB major).

| | Required by OEE? | Required by MCB? |
|---|---|------------------|
| 1 unit from BY101, BY105, 106 (108/109), 107 | yes | yes |
| A second unit from BY101, BY105, 106 (108/109), 107 | yes | no |
| BY131 | yes | yes |
| BY231 | either BY280 or BY231 | yes |
| BY208 | yes | no |
| CH107 | yes | yes |
| CH108 | yes | yes |
| CH250 | yes | yes |
| CH251 | no | yes |
| 2 units of math | yes (1 calc & 1 stats or math modeling) | yes |

The Organisms, Ecology, and Evolution Track

- I. **Two** units in **Introductory Organismal Biology** among: BY105, BY106, BY107
- II. **BY208 Ecology**
- III. **Two** units in **Molecular and Cellular Biology and in Genetics**: BY131 + either BY231 or BY280
- IV. **Three** units in **Chemistry**: CH107 + CH108 + CH250
- V. **Two** units in **Mathematics**: MA125-6 or MA126 or MA127 or MA129 + BY220 or BY256/MA256 or MA117 or MA217
- VI. **Five** approved **Biology Electives**
- VII. **Senior capstone experience**

The Molecular and Cellular Biology track

- I. **One** unit in **Introductory Organismal Biology** among: BY105, BY106, BY107
- II. **BY131 Introduction to Molecular and Cellular Biology**
- III. **BY231 Genetics**
- IV. **Four** units in **Chemistry**: CH107 + CH108 + CH250 + CH251
- V. **Two** of the following **Mathematics** courses: MA117, MA126, MA127, MA129, MA217, BY220, BY256/MA256, EV228
- VI. **Six** approved **Biology Electives**
- VII. **Senior capstone experience**

APPENDIX IX
ADVICE FOR PASSING THE SENIOR EXAMINATION

During your last two semesters, you must pass a senior examination. You can satisfy this requirement by passing either the ETS Major Field Test in Biology or the Biology GRE. Most students choose to attempt to pass the ETS Major Field Test in Biology, so this appendix contains advice for doing well on that exam. Many of our students find the ETS Biology exam challenging, and 20-25% of past students have failed the exam at least once. We faculty would very much like each and every one of you seniors to pass the exam, so please take this advice to heart.

The ETS Major Field Test in Biology is a two-hour test with four subcategories: cell biology, molecular biology & genetics, organismal biology, and population biology, evolution, & ecology. To pass the exam, you must earn at least the 65th percentile in at least two of the four subcategories, or a 60th percentile as your average for all four subcategories. If you do not receive a passing score in Block 3, you must re-take the exam in Block 6. If you fail the exam in Block 6, you must pass an onerous two-hour oral exam, administered by two Biology faculty, during Blocks 7 or 8.

The exam is multiple choice. Because we don't often use multiple choice testing in our Biology courses, you may need to practice taking multiple choice tests. Look at the ETS as an opportunity to practice for other graduate exams, such as the MCAT or GRE. While a whole booklet of old ETS biology exams is not available, you could get some great practice by working with "Cracking the GRE Biology Subject Test" or "Kaplan GRE Biology illustrated guide." You could also go to the following web sites to read a description of the test and get some practice questions:

<http://www.ets.org/mft/about/content/biology> and

http://www.ets.org/Media/Tests/MFT/pdf/mft_testdesc_biology_4bmf.pdf and

http://www.ets.org/Media/Tests/MFT/pdf/mft_samp_questions_biology.pdf.

If you cannot score above the "passing" 65th percentile on two of subcategories, it is unlikely that you will somehow pass the exam by scoring above the 60th percentile when all four subcategories are averaged. So my advice would be to play to your strengths and review the course material relevant for the two subsections that you know the best, probably because you took several courses in those areas and did well in the relevant introductory level (100- or 200-level) courses. Here is a list of the subcategory, with corresponding courses that would help you prepare for that subcategory of the exam.

- Cell Biology: Introduction to molecular & cellular biology (131); Biology of microbes (107); FYE Biology of microbes (101); Bacterial genetics & physiology (359); Virology (363); Advanced cell biology (380); Stem cell biology (440); Cell signaling (440) Developmental Biology (466); Biochemistry (CH382); Seminar in bacterial pathogenesis (463); any other occasional electives focused on cells. Most of the exam questions are about eukaryotic cells.
- Organismal Biology: Biology of plants (105); Biology of animals (106); Field botany (202); Human evolution (205); Human anatomy (207); Human physiology (321); Parasitic helminthes (331), Plant physiology (365); Comparative animal physiology (366); Ornithology (410), Entomology (412). Biology of microbes (107 or 101) and Parasitology (330) might also be helpful but the exam questions are mostly about animal and plant biology.
- Genetics & Molecular Biology: Introduction to molecular and cellular biology (131), Genetics (231), Population genetics (280), Advanced genetic analysis (350); Bacterial genetics & physiology (359), Virology (363); Laboratory investigation in molecular microbiology (378), Stem Cell Biology (440), Cell signaling (440), Seminar in molecular biology (450), Seminar in bacterial pathogenesis (463), Developmental biology (466), Techniques in molecular ecology & systematics (475).
- Population biology, Evolution, & Ecology: Biology of plants (105); Biology of animals (106); Field botany (202); Human evolution (205); Ecology (208); Population genetics (280); Plant physiology (365); Comparative animal physiology (366); Advanced ecology (308); Animal behavior (332); Plant ecology (362); Animal ecology (367); Tropical forest and coral reef ecology (370), Ecology and biogeography of Patagonia (390); Ornithology (410); Entomology (412); Conservation biology (421); Techniques in molecular ecology & systematics (475). Most of the exam questions are about animals and plants (rather than microbes).
- Note that analytical skills are an important component of the exam, integrated throughout the four subject areas outlined above. Biostatistics (220), mathematical modeling in biology (256), and all coursework that emphasized experimental design and analysis, or required analysis of primary literature, would be useful in preparing for this part of the exam.

You should spend part of your summer and Blocks 1 and 2 of your senior year reviewing your notes, exams, and other materials from the relevant courses, and taking practice Biology GRE exams. Ideally, you should form a study group that meets regularly. You really need to avoid blowing this test off, which is why juniors have been included in this e-mail. Plan ahead. The oral exam for people who fail the ETS is rigorous, covers every course you took to complete the Biology major, and takes a lot more time and effort to prepare for than the ETS exam.

You might want to know why we require you to take the test. We require it because it is an objective test of your knowledge and it allows us to compare our graduates to graduates from many other institutions. Even though the Block Plan has been around for so long, we still encounter skeptics who think that “you can’t learn biology in 3.5 weeks.” Your average and individual scores on the ETS give us the data we need to respond to this criticism: we can show by direct comparison that our students do just as well as students on a variety of other calendars (semesters or trimesters, for example). Your degree from Colorado College means more because we can demonstrate our students’ knowledge of biology in this objective way. We also use your scores on the exam to critique our teaching and our curriculum, to try to improve them. For example, if students often score poorly on a specific subcategory, we faculty try to figure out how we could strengthen courses in that area. We really appreciate that you put your full effort into the exam, so that we can get an accurate picture of what our curriculum does well, and where we could do better. **Finally, remember that we take the exam results into account when making competitive departmental awards that look great on your resume, when selecting paraprofessionals, learning assistants, and tutors for the following year, and when writing letters of recommendation, so it is worth the effort to earn an “Outstanding” (85th percentile in at least two sub-categories).**

Please contact the OBE Office or the paraprofessionals to learn how to register for the ETS exam in Block 3, and to learn the exact date and time of the exam.

