

THE MAJOR IN ECOLOGY & EVOLUTIONARY BIOLOGY

(E&EB)

IN YALE COLLEGE

2020-2021

## TABLE OF CONTENTS

Introduction .....	3
What does the E&EB Major do for me? .....	3
Courses for Students Majoring in Other Subjects .....	4
Overview of the E&EB Major.....	6
<i>BIOL</i> Introductory Courses .....	6
Placement Exam – Requirement .....	7
Prerequisites for the E&EB major.....	7
Research Opportunities.....	8
Research Courses .....	8
Summer Research .....	9
Studies Abroad .....	10
Where to get advice .....	12
The First Year .....	12
...and Beyond .....	12
E&EB Student Advisors .....	13
E&EB Peer Mentors.....	13
Yale Ecology and Evolutionary Biology Undergraduate Group (YEEBUG).....	13
E&EB Faculty and Research Interests.....	14
Primary Faculty .....	14
Affiliated Faculty .....	21
Recommendations for Premedical Students .....	24
Facilities.....	25
E&EB Courses 2020-2021 .....	28
Required Introductory Courses: .....	28
Courses and Laboratories with No Prerequisites: .....	29
Intermediate Courses:.....	29
Laboratories.....	31
Advanced Courses.....	32
E&EB Research and Tutorials .....	34
Graduate Courses and Labs.....	36
2020 Senior Symposium Tuesday, April 28 <sup>th</sup> , Zoom .....	38
Appendix I – Worksheets for E&EB.....	39
E&EB Major Worksheet B. A. Degree Track 1.....	40
E&EB Major Worksheet B. A. Degree Track 2.....	41
E&EB Major Worksheet B. S. Degree Track 1 .....	42
E&EB Major Worksheet B. S. Degree Track 2 .....	43
Appendix II – Forms for Tutorial & Research Courses .....	44
EEB 469 Underclass Tutorial Department of Ecology and Evolutionary Biology.....	45
EEB 470 Senior Tutorial.....	46
EEB 474 Underclass Research.....	48
EEB 475 and 476 Senior Research .....	49
EEB 495 and 496 Intensive Senior Research.....	50
Senior Essay .....	51

## Introduction

Teaching and research in biology at Yale occurs in the three biology departments on Science Hill – E&EB, MCDB, and MB&B – in the Yale School of Medicine, and in the Yale School of Public Health. The depth and breadth of expertise in this community make Yale a leading center for students and scientists.

The Department of Ecology and Evolutionary Biology (E&EB) offers broad education in the biological sciences. By helping us to understand the beauty and complexity of life, it richly supports our curiosity about nature. The subject matter ranges from molecules through cells, organs, organisms, populations, and communities to ecosystems and the ecological and evolutionary processes that have produced and continue to shape them. Biology is currently experiencing an explosion of discovery with important implications for the analysis and treatment of human disease, for the development of biotechnology, and for our capacity to recognize, understand, and deal with human impacts on the environment, including extinctions and global change. The E&EB major delivers some of the major conceptual tools needed to understand these important issues.

The department offers a B.A. or B.S. degree. The B.A. program is appropriate for students who are interested in ecology, evolution and organism diversity as part of a liberal education but do not intend to pursue graduate work in the discipline. The B.S. program is appropriate for students intending to attend medical or veterinary school or to pursue graduate study in ecology and evolutionary biology, other biological disciplines, or environmental sciences. The two programs share prerequisites but differ in core and senior requirements.

The prerequisites for the E&EB major provide basic scientific literacy. Beyond the prerequisites, either of two tracks will satisfy the E&EB major. Track 1 emphasizes courses appropriate for ecology, evolutionary biology, and environmental science careers; Track 2 emphasizes courses appropriate for pre-medical and pre-veterinary students. Pre-medical and pre-veterinary students may use courses required by medical schools but not by the major as electives.

College seminars do not count toward the requirements of the major.

The department offers several courses without prerequisites for non-majors. These include all 100-level offerings and the 200-level courses that deal with organism groups (e.g., plants, fishes, mammals, birds, insects, and invertebrates).

**Independent Research:** EEB majors can pursue independent research in both laboratory and field-based projects. With approval, independent research for credit can be conducted under the supervision of faculty members in any department at Yale.

**Studying Abroad:** Participation in study abroad programs is encouraged. Credit for courses taken abroad may apply to the major if approved in advance by the DUS, who will want to see a syllabus that describes content, workload, and methods of evaluating performance. You are strongly encouraged to consult with the DUS before studying abroad.

**Credit/D/Fail:** No course taken to fulfill distribution requirements, as a prerequisite of the E&EB major, or as a requirement of the E&EB major may be taken Credit/D/Fail. All such courses must be taken for a letter grade.

### **What does the E&EB Major do for me?**

The E&EB major provides excellent preparation for a wide range of careers in medicine, public health, the pharmaceutical industry, science writing, teaching, conservation, and research. E&EB undergraduates enjoy a high rate of acceptance at medical and graduate schools.

## Courses for Students Majoring in Other Subjects

E&EB offers several courses with no prerequisites for non-majors.

Courses in brackets are not being offered this year but remain on the books and may be offered in the future.

**E&EB 035, The Ecology of Food.** Food and ecology are linked, both in the production of food through agriculture and livestock and in the harvesting of wild plants and animals. The production and consumption of food has consequences for energy consumption, food waste, trophic interactions and the transportation of food around the globe. These topics link to many of the fundamental concepts of ecology, including population biology, the niche, trophic interactions, nitrogen cycling and the effects on biodiversity. This class explores these topics through a combination of lectures, readings and interactive field trips to near campus ecosystems, the Marsh Botanical Gardens, and the Yale Sustainable Farm.

**E&EB 075, Virus Discovery & Evolution.** An introduction to empirical research that combines lab exercises with mentored research on bacteriophage, the viruses that infect bacteria. This course helps students decide whether they want to continue with undergraduate research. It focuses on experimental design, hypothesis testing, data analysis, and presentation. Students practice these skills while conducting independent research projects, gaining basic experience with methods and principles from microbiology, genetics, ecology, and evolutionary biology.

**E&EB 106 / MCDB 106 / HLTH 155, Biology of Malaria, Lyme and Other Vector Borne Diseases.** This introduction to the biology of pathogen transmission from one organism to another by insects focuses on malaria and Lyme disease. Biology of the pathogens including modes of transmission, establishment of infection, host immune responses, and the associated challenges to prevention and treatments.

**E&EB 115, Conservation Biology.** Introduction to the ecological and evolutionary principles that inform efforts to conserve Earth's biodiversity by slowing the rapid increase in disappearance of both plants and animals. Discussion of sociological and economic issues.

**E&EB 125, History of Life.** Examination of fossil and geologic evidence pertaining to the origin, evolution, and history of life on Earth. Emphasis on major events in the history of life, on what the fossil record reveals about the evolutionary process, on the diversity of ancient and living organisms, and on the evolutionary impact of Earth's changing environment.

**E&EB 145, Plants & People.** The interaction of plants and people explored from biological, historical, anthropological, and artistic perspectives. Basic botany; plants in the context of agriculture; plants as instruments of trade and societal change; plants as inspiration; plants in the environment. Includes field trips to the greenhouses at Yale Marsh Botanical Garden, the Yale Peabody Museum and Herbarium, the Yale Farm, and the Yale Art Gallery.

**E&EB 210 / SD&S 101, Introduction to Statistics: Life Sciences.** Statistical and probabilistic analysis of biological issues presented with a unified foundation in basic statistical theory. Problems are drawn from genetics, ecology, epidemiology, and bioinformatics.

[E&EB 246, Plant Diversity & Evolution.]

**E&EB 250, Biology of Terrestrial Arthropods.** Evolutionary history and diversity of terrestrial arthropods (body plan, phylogenetic relationships, fossil record); physiology and functional morphology (water relations, thermoregulation, energetics of flying and singing); reproduction (biology of reproduction, life cycles, metamorphosis, parental care); behavior (migration,

communication, mating systems, evolution of sociality); ecology (parasitism, mutualism, predator-prey interactions, competition, plant-insect interactions).

[E&EB 264, Ichthyology.]

**E&EB 272, Ornithology.** An overview of avian biology and evolution, including the structure, function, behavior, and diversity of birds. The evolutionary origin of birds, avian phylogeny, anatomy, physiology, neurobiology, breeding systems, and biogeography

**E&EB 275 / EVST 400, Biological Oceanography.** Exploration of a range of coastal and pelagic ecosystems. Relationships between biological systems and the physical processes that control the movements of water and productivity of marine systems. Anthropogenic impacts on oceans, including the effects of fishing and climate change. Three Friday field trips.

**E&EB 290, Comparative Anatomy.** A survey of the structure, variation, and evolution of major vertebrate groups. Topics include the microanatomy of major organ systems, the embryology of the vertebrate body plan, and the structure and evolution of the major organ systems: the locomotory system, sensory organs, digestive tract, reproductive tract, and nervous system.

## Overview of the E&EB Major

### ***BIOL* Introductory Courses**

E&EB, MCDB and MB&B combine efforts to teach a yearlong Introductory Biology course consisting of four one-half credit modules. The completion of all these modules is a prerequisite for each of these majors and will probably also be necessary for any student contemplating a career in the health sciences regardless of the student's major.

#### **BIOL 101 Biochemistry and Biophysics, Michael Koelle (P), Anthony Koleske (P), Samantha Lin**

**M W 11:35 – 12:50, 1/2 Course credit**

Introduction to the study of life at the molecular level. Topics include the three-dimensional structures and function of large biological molecules, the human genome, and the design of antiviral drugs to treat HIV/AIDS. Prerequisite: The first of four modules in a yearlong introductory biology sequence; meets for the first half of the fall term.

#### **BIOL 102 Principles of Cell Biology and Membrane Physiology, Mark Mooseker (P), Valerie Horsley (P), Samantha Lin**

**M W 11:35 – 12:50, 1/2 Course credit**

Introduction to the study of cell biology and membrane physiology. Topics include organization and functional properties of biological membranes, membrane physiology and signaling, rough endoplasmic reticulum and synthesis of membrane/secretory membrane proteins, endocytosis, the cytoskeleton, and cell division. Prerequisite: The second of four modules in a yearlong introductory biology sequence; meets for the second half of the fall term.

#### **BIOL 103 Genes and Development, Vivian Irish (P), Weimin Zhong (P), Surjit Chandhoke (P), Amaleah Hartman**

**M W 11:35 – 12:50, 1/2 Course credit**

Introduction to genes, genetics, and developmental biology. How genes control development and disease; Mendel's rules; examples of organ physiology. Prerequisite: The third of four modules in a year-long introductory biology sequence; meets for the first half of the spring term.

#### **BIOL 104 Principles of Ecology and Evolutionary Biology, Erika Edwards (P), Thomas Near (P), Amaleah Hartman**

**M W 11:35 – 12:50, 1/2 Course credit**

Introduction to ecology, evolutionary biology, animal behavior, and the history of life. Evolutionary transitions and natural selection. Adaptation at genic, chromosomal, cellular, organismal, and supra-organismal levels. Distributional and social consequences of suites of organismal adaptations. Prerequisite: The fourth of four modules in a year-long introductory biology sequence; meets for the second half of the spring term.

## **Placement Exam – Requirement**

All students are required to take all four of the new introductory modules as prerequisites for the E&EB, MB&B and MCDB majors. Students with score of 5 on the AP Biology Exam or a score of 7 on the IB Biology exam are eligible to take a Yale-developed placement exam in the biological sciences available to incoming freshmen as an online exam beginning sometime in July. Based on performance on the placement exam, students may be exempted from some of the introductory modules.

Please note that many courses will require one or more of the introductory modules as prerequisites. Please check each course description carefully.

## **Prerequisites for the E&EB major**

The prerequisites for the major provide core scientific literacy in biology, chemistry, physics, and mathematics. In addition to the introductory biology sequence – BIOL 101, 102, 103, and 104 – the major requires a two-term lecture sequence in general chemistry – CHEM 161, 165 or CHEM 163, 167 – taken with associated laboratories, CHEM 134L and 136L; and one term of organic chemistry – CHEM 174 or 175, or CHEM 220 or 221, – with associated laboratories – CHEM 222L or 223L. Optionally, CHEM 174, 175, taken with CHEM 222L, 223L, satisfies both chemistry requirements. Two terms of lecture courses in physics are required – PHYS 170, 171 or higher – and one term of mathematics – MATH 115 or 116 – or one term of statistics & data science – S&DS 100 or 230. A different statistics course approved by the director of undergraduate studies (DUS) may be substituted for the mathematics prerequisite.

An online program, ONEXYS for Physics, is offered in the summer by the Mathematics and Physics departments and by the Poorvu Center for Teaching and Learning to review math skills needed in preparation for introductory physics courses.

Acceleration credit awarded in chemistry, mathematics, and physics, or completion of advanced courses in those departments, may be accepted in place of the corresponding prerequisites for the E&EB major. Students who have mathematics preparation equivalent to MATH 115 or higher are encouraged to take a statistics course (usually S&DS 101–106) and/or additional mathematics or statistics courses such as MATH 120, 121, 222, or 225 and S&DS 220 or 230. Because chemistry courses are prerequisite to several E&EB courses, students are strongly urged to take general and organic chemistry in the first and sophomore years. Students who place out of general chemistry should take organic chemistry during their first year. Finishing the prerequisites early allows for a more flexible program in later years.

## Ecology and Evolutionary Biology

### Degrees Offered

BA Ecology and Evolutionary Biology (Track 1)	BA Ecology and Evolutionary Biology (Track 2)	BS Ecology and Evolutionary Biology
--	--	---

### Prerequisites for entering the major

<b>Intro Biology sequence</b> (BIOL 101, 102, 103, and 104)
<b>2 term lecture in General Chemistry</b> (CHEM 161, 165 or CHEM 163, 167) with labs (CHEM 134L, 136L)
<b>1 term Organic Chemistry</b> CHEM 174 or 175, or CHEM 220 or 221 with lab (CHEM 222L or 223L)
<b>2 terms Physics</b> (PHYS 170, 171, or higher)
<b>1 term Mathematics</b> MATH 115 or higher or S&SD 101-106

### Requirements for each degree

3.5 course credits (not incl senior req)	3.5 course credits (not incl senior req)	5.5 course credits (not incl senior req)
E&EB 220	E&EB 290 and E&EB 295 or BENG 350	BA requirements in either track
E&EB 225	and MCDB 300	2 elective courses, one must be lecture, other can be seminar or labs (>200 level)
1 course from E&EB 246-272, with lab	E&EB 291L	

### Senior Requirements

<b>1 term independent study</b> (E&EB 470) <b>or</b> <b>Senior Essay</b>	<b>2 terms original research</b> (E&EB 475-476, 495-496)
---	--

### Substitutions

Two upper-level courses in EPS (excluding paleobiology courses), MATH, CPSC, or ENAS for organic chem and lab. Second term of organic chem and lab and up to two terms of physics labs allowed as electives. Courses from other departments may also be suitable as electives. All substitutions require permission of the DUS



## Research Opportunities

Students interested in research can work on a broad spectrum of subjects in E&EB, MCDB, MB&B, G&G, Anthropology and in the Schools of Medicine, Public Health and Forestry & Environmental Studies. Those subjects include molecular biology, biochemistry, genetics, cell biology, neurobiology, physiology, environmental sciences, plant science, ecology, evolution, and behavior. Students may work in laboratories for academic credit or experience, and financial support may be available, but students being paid may not receive course credit.

The choice of a research laboratory should be made in consultation with faculty members and the director of undergraduate studies. Opportunities can be found on the following web sites: <https://eeb.yale.edu/> , <https://biology.yale.edu/> , <https://undergradresearch.yale.edu/> . and <https://database.yuraresearch.org/> . Descriptions of research programs in E&EB can be found below in the section titled *Faculty and Research Interest*.

The Co-DUS, Marta Wells, and the E&EB Peer mentors can advise students on how to choose a lab. Peer mentors are listed here: <https://eeb.yale.edu/academics/undergraduate-program/peer-mentoring>

### Research Courses

During the academic year, students with DUS approval may take E&EB 475 & 476 or E&EB 495 & 496. These courses are primarily for students who are doing independent research to fulfill the senior requirement. Students who wish to do research earlier in their course of study may take E&EB 469 or E&EB 474 before their senior year. Neither substitutes for other major requirements but does count towards the 36 credits required for the Yale College degree. For research courses, hours are typically arranged at the mutual convenience of the student and the faculty advisor. Students taking these courses are expected to spend an average of 10 hours per week. Approval from the Yale College Committee on Honors and Academic Standing is required to exceed certain limits. A student must petition that committee for permission to enroll in more than one research course in any one term before the senior year or for more than 2 course credits in research in any one term during the senior year. Permission is also required for a student to enroll in more than three such course credits in the first six terms of enrollment. In the petition sound academic reasons must be given for exceeding these limits.

Students taking E&EB 475 & 476 are expected to spend at least ten hours per week in the laboratory of a faculty member over two terms in senior year. Students must reapply each term to be enrolled, and at the completion of *each* term, a paper must be submitted to their professor. ***Please note that taking E&EB 475/476 or E&EB 495/496 does not satisfy the lab requirement or the elective requirement.***

## Summer Research

Yale students can also do full-time research with a faculty member over the summer. Summer research allows students to continue research begun during the previous academic year or to begin research that will be continued during the subsequent academic year. Some faculty members have grant funds that can support students during the summer. Other possibilities for financial support can be found at <http://www.yale.edu/yser/fellowships.html> . Interested students should consult a member of the Yale faculty or the director of undergraduate studies. Academic credit is not granted unless the student is registered in (and paying tuition to) the Yale summer school.

Summer research at other institutions is possible through several programs. Yale does not award academic credit for research done at other institutions, even if done in the context of a course.

Go to [studentgrants.yale.edu](http://studentgrants.yale.edu) to look for sources of money.

Go to Yale F&ES Career Development Office for internship opportunities.

USA Summer Programs in Field Stations

Biological Field Stations: <http://www.obfs.org/>

Duke University Marine Laboratory: <http://www.nicholas.duke.edu/marinelab/>

Institute of Ecosystems Studies: <http://www.ecostudies.org/about.html>

Marine Biological Laboratory – Woods Hole: <http://www.mbl.edu>

Mountain Lake Biological Station – University of Virginia: <http://www.mlbs.org>

The School for Field Studies: <http://www.fieldstudies.org>

Shoals Marine Laboratory: <http://www.sml.cornell.edu>

University of Michigan Biological Station: <http://www.lsa.umich.edu/umbs/>

University of Notre Dame Environmental Research Center:

<https://underc.nd.edu/education/applying-to-underc/>

## **Studies Abroad**

It is possible for E&EB majors to participate in programs that include study abroad. Programs approved for a full semester of credit by the Yale College Studies Abroad program include the Organization for Tropical Studies (OTS) in Costa Rica and School for Field Studies in several localities. More detailed information can be found on the web site:

<http://www.yale.edu/yalecollege/international/>

Application to both the programs and to the Studies Abroad Committee should be done early in the semester preceding the semester spent abroad. Summer programs also exist that may be used to fulfill some degree requirements, and, in some cases, credit can be transferred. How the credit in programs abroad might be applied to fulfilling the E&EB major requirements depends on the program chosen and should be discussed with the DUS early in planning in a conversation supported by the syllabus of the proposed course.

Here is some information on opportunities for study abroad in E&EB.

### **Organization for Tropical Studies – Costa Rica, South Africa**

Semester and summer (Costa Rica only) programs available. Study either tropical biology and environmental science in Costa Rica or savanna ecology and conservation in South Africa.

<https://tropicalstudies.org/>

### **Tropical Biology Association – Uganda, Tanzania, Madagascar**

Summer and four-month courses in tropical ecology and conservation. These course highlight up-to-date concepts and techniques in tropical ecology and conservation.

<http://www.tropical-biology.org>

**School for Field Studies (SFS) – Australia, Bhutan, Cambodia, Chile, Costa Rica, Kenya, Panama, Peru, Tanzania, and Turks and Caicos Islands.** Semester and summer programs available. SFS teaches students field research skills through cooperative work with local communities, conservation organizations, and government agencies. <http://www.fieldstudies.org>

### **Council on International Education Exchange – Africa, Australia, Latin America, Middle East**

Semester, academic year, and summer programs available. CIEE offers programs at universities and field stations. Students can choose from a variety of arts and science courses including: Biology, Ecology and Environmental Studies.

<http://www.ciee.org>

### **AustraLearn – Australia, New Zealand**

Semester, academic year, summer, and internship programs available. AustraLearn offers programs at universities in Australia and New Zealand. Students can choose from a variety of arts and science courses including: Animal Science, Biology, botany, Ecology, Environmental Science, Marine Biology, and Zoology.

<http://www.australearn.org>

### **Denmark International Study (DIS) – Copenhagen**

Semester, academic year, and summer programs available. Students can select from one of the biology disciplines: Marine Biology and Ecology, or Environmental Biology, or Molecular Biology

and Genetics, or Medical Practice and Policy. Students may also combine courses from the various disciplines.

<http://www.disp.dk/>

**Institute for Study Abroad (ISA) – Australia, New Zealand**

Semester or academic year program available. ISA offers programs at universities in Australia and New Zealand. Students can choose from a variety of arts and science courses including: Anatomy, Biology, Ecology, Entomology, Environmental Science, Forestry, Genetics, and Zoology. Internship programs are also available in Australia, Chile, England, Ireland, and New Zealand. <http://www.ifsa-butler.org/>

**Institute for Tropical Marine Ecology – West Indies**

Semester and summer programs available. Academic programs in marine ecology, research, and conservation.

<http://itme.org/>

**Institute for Tropical Ecology and Conservation ITEC – Panama**

Tropical field courses include lectures, field exercises, and individual research. <http://www.itec-edu.org/>

## Where to get advice

The advising system for students majoring in E&EB provides clear a information on programs of study through the students' four years at Yale. Each student has three formal advisors to guide academic choices but finding the right person for a specific issue can take student initiative.

### The First Year

Upon entering Yale, each student is assigned to one of the fourteen residential colleges on campus. With this initial assignment, the first-year student encounters a team of three important advisors who help to answer questions and direct the student's choice of classes.

First, each entering student is assigned a *first-year counselor (froco)*, who is a senior living with the first-year class. The froco gives the first years a "student's eye view" of the curriculum, courses and instructors. Valuable as this is, it should not substitute for the advice of a faculty advisor, which is particularly important for first-years who are considering a major in science. The second advisor, also a member of the student's residential college, is usually a faculty fellow of that student's college and sometimes a member of the E&EB department. The faculty advisor is responsible for advising the student about fulfilling distributional requirements in the first year. The third member of the first-year advising team is the student's residential dean. The dean has ultimate authority over the student's decisions for courses and programs of study. If the first-year faculty advisor is not a member of a science department in Yale College, the student is strongly advised to consult with the director of undergraduate studies in the field of the student's primary interest. Prospective science majors should arrange advising meetings before classes start in the fall.

***The most important issue for prospective E&EB majors is taking chemistry in the first year*** because many courses require two years of chemistry, sometimes followed by biochemistry. Starting this sequence early is essential. If a first-year student takes a second science course, it should be the introductory Biology sequence (BIOL 101 – 104). One can postpone the laboratory for chemistry until the year after the course is taken, but this is not recommended.

Math and physics can be taken later.

### ...and Beyond

After the first year, a student may continue with the faculty advisor assigned for the first year or choose a new faculty advisor for the sophomore year. E&EB majors should find an advisor in the program as soon as they decide on the major. A list of E&EB faculty and their affiliated colleges can be found in the next section. The sophomore year advisor usually remains a student's advisor for the next two years, but students may switch if they prefer another individual. Students may consult with the E&EB DUS to identify an appropriate faculty advisor. When you have identified a faculty advisor, please inform the E&EB Registrar.

The E&EB faculty advisor has four roles: (1) ensuring that the student fulfills the requirements for graduation; (2) ensuring that the student fulfills the requirements of the major; (3) giving guidance on the student's curriculum and future career plans; (4) writing letters of recommendation for the student when requested.

The regular faculty advisor can handle most routine issues, including signing schedules. Certain matters need the attention of the director or co-director of undergraduate studies. The E&EB DUS's names, phone numbers, and email addresses are on the inside cover of this booklet. They can also be reached through the E&EB Registrar.

## **E&EB Student Advisors**

### **Academic Year 2020-21, Academic Advisors:**

**Class of 2021** David Post, OML 426B, (203-432-3005)

**Class of 2022** Adalgisa Caccone, ESC 140, (203-432-5259)  
Richard Prum, ESC 164, (203-432-9423)

**Class of 2023** Marta Wells, OML 103B, (203-432-6294)  
Martha Munoz, OLM 103A, (203-432-9861)

**Class of 2024** Stephen Stearns, OML 560, (203-432-8452)

## **E&EB Peer Mentors**

The E&EB peer mentors are upperclass students who have been trained by the Yale Poorvu Center for Teaching and Learning to assist others in the major. They can provide a student's perspective on questions about what classes to take, whether you might want to do research, which types of research labs are best suited for you, how to balance your coursework with other activities, and a variety of other academic and extracurricular topics. They represent a range of different interests, and you can read about them at <https://eeb.yale.edu/academics/undergraduate-program/peer-mentoring>.

## **Yale Ecology and Evolutionary Biology Undergraduate Group (YEBUG)**

YEBUG is an undergraduate organization dedicated to building the E&EB community at Yale. YEBUG provides a diverse network of other students majoring in E&EB, all of whom are eager to help out whether you are a declared major, thinking about declaring the E&EB major, or are interested in any small aspect of E&EB. In the past, YEBUG has held social events, organized dinners with professors, led field trips, and more. This year, they will be focusing on curating opportunities and establishing virtual and socially distant events. If you would like to subscribe to the newsletter or get in touch, please email [yeebugboard@gmail.com](mailto:yeebugboard@gmail.com).

## E&EB Faculty and Research Interests

### Primary Faculty



**Adalgisa Caccone**

Lecturer in Ecology and Evolutionary Biology and Senior Research Scientist in Ecology & Evolutionary Biology, Forestry and Environmental Studies and Epidemiology (Microbial Diseases)

21 Sachem St, ESC 140, New Haven, CT 06511-8934

[adalgisa.caccone@yale.edu](mailto:adalgisa.caccone@yale.edu)

Phone: 203-432-5259  
[Saybrook College Fellow]

Research Interests: Molecular evolution and conservation genetics.



**Mary Beth Decker**

Research Scientist in Ecology and Evolutionary Biology; Lecturer School of Forestry & Environmental Studies

165 Prospect St, OML 316B, New Haven, CT 06511-8934

[marybeth.decker@yale.edu](mailto:marybeth.decker@yale.edu)

Phone: 203-432-6293

Research Interests: Biological oceanography, jellyfish blooms in changing coastal and estuarine ecosystems.



**Michael J. Donoghue**

Sterling Professor of Ecology and Evolutionary Biology; Director of the Yale Institute for Biospheric Studies; and Curator of Botany Peabody Museum of natural History

21 Sachem St, ESC 364, New Haven, CT 06511-8934

[michael.donoghue@yale.edu](mailto:michael.donoghue@yale.edu)

Phone: 203-432-2074

Research Interests: Plant evolution and systematics; phylogenetic biology.



**Casey Dunn**

Professor of Ecology and Evolutionary Biology

165 Prospect St, OML 326A, New Haven, CT 06511-8934

[casey.dunn@yale.edu](mailto:casey.dunn@yale.edu)

Phone: 203-432-3109

[Saybrook Fellow]

Research Interests: Comparative invertebrate zoology. We use phylogenetics to study evolution of genomes, genome function, morphology, and siphonophores.



**Erika Edwards**

Professor of Ecology and Evolutionary Biology; Curator of Botany Peabody Museum of Natural History; Director Marsh Botanical Gardens; and Director of Graduate Studies  
165 Prospect St, OML 326B, New Haven, CT 06511-8934  
[erika.edwards@yale.edu](mailto:erika.edwards@yale.edu)

Phone: 203-432-3869  
[Saybrook College Fellow]

Research Interests: Evolution; phylogenetics; plant structure and function; ecological adaptation.



**Walter Jetz**

Professor of Ecology Evolutionary Biology; Professor School of Forestry & Environmental Studies  
165 Prospect St, OML 401, New Haven, CT 06511-8934

Phone: 203-432-7540  
[Saybrook College Fellow]

Research Interests: Macroecology; community ecology; biogeography; global change biology; conservation; ecology and evolution of terrestrial vertebrates.



**Martha M. Muñoz**

Assistant Professor of Ecology and Evolutionary Biology  
165 Prospect St, OML 103, New Haven, CT 06511-8934  
[martha.munoz@yale.edu](mailto:martha.munoz@yale.edu)

Phone: 203-432-9861

Research Interests: The Ecology and Evolution of life in motion by integrating physiology, biochemistry, and behavior. We focus on reptiles and amphibians as model systems.



**Thomas Near**

Professor and Chair of Ecology and Evolutionary Biology; Bingham Oceanographic Curator of Ichthyology, Peabody Museum of Natural History, Head of College-Saybrook College  
21 Sachem St, ESC 370A, New Haven, CT 06511-8934.  
[Thomas.near@yale.edu](mailto:Thomas.near@yale.edu)

Phone: 203-432-3002  
[Head of Saybrook College]

Research Interests: Evolutionary biology of fishes – retracing how species and lineages are treated to one another, primarily using DNA sequence data to reconstruct the evolutionary relationships of species represented through branching diagrams and phylogenies.





**C. Brandon Ogbunu**  
Assistant Professor of Ecology and Evolutionary Biology; member of the Chemical  
Biology Institute, West Campus  
165 Prospect St., OML 253A, New Haven, CT 06511-8934  
[brandon.ogbunu@yale.edu](mailto:brandon.ogbunu@yale.edu)

Phone: 203-432-7805

Research Interests: systems biology, population genetics, epidemiology, disease  
ecology and evolution, science and society



**David M. Post**  
Professor of Ecology and Evolutionary Biology  
165 Prospect St, OML 426B, New Haven, CT 06511-8934.  
[david.post@yale.edu](mailto:david.post@yale.edu)

Phone: 203-432-3005  
[Timothy Dwight Fellow]

Research Interests: Aquatic ecology; food-web structure and dynamics. eco-evolutionary  
interactions, environmental change



**Jeffrey R. Powell**  
Professor of Ecology and Evolutionary Biology, Professor Environmental Health  
Sciences; School of Forestry & Environmental Studies and School Public Health  
21 Sachem St, ESC 172, New Haven, CT 06511-8934  
[jeffrey.powell@yale.edu](mailto:jeffrey.powell@yale.edu)

Phone: 203-432-3887  
[Grace Hopper Fellow]

Research Interests: Evolutionary genetics; molecular evolution and conservation genetics.



**Richard O. Prum**  
William Robertson Coe Professor of Ornithology of Ecology and Evolutionary Biology,  
Curator Vertebrate Zoology (Ornithology) Peabody Museum of Natural History  
21 Sachem St, ESC 164, New Haven, CT 06511-8934.  
[richard.prum@yale.edu](mailto:richard.prum@yale.edu)

Phone: 203-432-9423  
[Grace Hopper Fellow]

Research Interests: Evolutionary ornithology, including phylogenetics, behavior, feathers,  
structural color, evolution and development, sexual selection, and historical biogeography.



**Linda Puth**

Lecturer in Ecology and Evolutionary Biology  
165 Prospect St, OML 550, New Haven CT 06511-8934.  
[linda.puth@yale.edu](mailto:linda.puth@yale.edu)

Phone: 203-432-8099

[Timothy Dwight Fellow]

Research Interests: Community assembly and the consequences of diversity, primarily in freshwater algae.



**Alvaro Sanchez**

Assistant Professor of Ecology and Evolutionary Biology and Microbial Sciences  
Institute  
Yale West Campus, 300 Heffernan Dr., West Haven, CT 06516 and 165 Prospect St, OML  
327C, New Haven, CT 06511-8934

[alvaro.sanchez@yale.edu](mailto:alvaro.sanchez@yale.edu)

Phone: 203-737-6778

Research Interests: Ecology and evolution of microbial communities using systems  
biology approaches that tie in genetics, biochemistry and population biology.



**Carla A. Staver**

Associate-on Term Professor of Ecology and Evolutionary Biology and School of Forestry  
& Environmental Studies  
165 Prospect St, OML 404, New Haven, CT 0651-8934.

[carla.staver@yale.edu](mailto:carla.staver@yale.edu)

Phone: 203-436-9200 Fax: 203-432-5176

Research Interests: Landscape ecology of savannas and forest; fire and herbivore feedbacks;  
temporal and spatial variability as ecological driver; historical dependence in ecology.



**Stephen C. Stearns**

Edward P Bass Professor of Ecology and Evolutionary Biology; Director of Undergraduate  
Studies  
165 Prospect St, OML 560, New Haven, CT 06511-8934.

[stephen.stearns@yale.edu](mailto:stephen.stearns@yale.edu)

Phone: 203-432-8452  
[Saybrook College Fellow]

Research Interests: Life history evolution, evolution medicine, and evolutionary genetics  
and developing innovations in teaching that serve learning.



**Alison Sweeney**

Associate Professor of Physics and Ecology and Evolutionary Biology  
217 Prospect St, SCL 207, New Haven, CT 0651-8499  
[alison.sweeney@yale.edu](mailto:alison.sweeney@yale.edu)

Phone: 203-432-3650 Fax: 203-432-6175

Research Interests: Molecular evolution of self-assembling protein photonic structures in molluscs and optical characterization of the sophisticated roles they play in camouflage and photosynthetic symbiosis.



**Paul Turner**

Elihu Professor of Ecology and Evolutionary Biology  
165 Prospect St, OML 327B, New Haven, CT 06511-8934  
[paul.turner@yale.edu](mailto:paul.turner@yale.edu)

Phone: 203-432-5918  
[Trumbull College Fellow]

Research Interests: Virus evolutionary genetics and genomics, mostly in bacteriophages and arthropod-borne viruses. We use experimental evolution to test basic biology questions, and conduct applied research on virus-based therapies to treat disease.



**David Vasseur**

Associate-on Term Professor of Ecology and Evolutionary Biology  
165 Prospect St, OML 426A, New Haven, CT 06511-8934  
[david.vasseur@yale.edu](mailto:david.vasseur@yale.edu)

Phone: 203-432-2719  
[Saybrook College Fellow]

Research Interests: Theoretical ecology; biodiversity-ecosystem function; impacts of environmental variability on population, community, and ecosystem processes; spatial population synchrony.



**Günter Wagner**

Alison Richard Professor of Ecology and Evolutionary Biology; Department of Obstetrics, Gynecology and Reproductive Sciences – Yale University; and Adjunct Professor of Obstetrics and Gynecology – Wayne State University  
Yale West Campus, 300 Heffernan Dry #B31, West Haven, CT 06516  
[gunter.wagner@yale.edu](mailto:gunter.wagner@yale.edu)

Phone: 203-737-3091; 203-432-9998  
[Silliman College Fellow]

Research interests: Population genetics theory; evolutionary theory.



**Marta Lucia Martinez Wells**

Senior Lecturer in Ecology and Evolutionary Biology  
165 Prospect St, OML 103, New Haven, CT 06511-8934  
[marta.wells@yale.edu](mailto:marta.wells@yale.edu)

Phone: 203-432-6294  
[Trumbull College Fellow]

Research Interests: Insect behavior and evolution; mating signal and speciation in neuropteran insects.

## Affiliated Faculty



**Craig Brodersen**

Professor, School of Forestry and Environmental Studies; Ecology and Evolutionary Biology

195 Prospect St, New Haven, CT 06510.

[craig.brodersen@yale.edu](mailto:craig.brodersen@yale.edu)

Phone: 203-436-5145



**Nicholas Christakis**

Sol Goldman Family Professor of Sociology and Professor of Internal Medicine General; Ecology & Evolutionary Biology

17 Hillhouse Ave, 17HLH, New Haven, CT 06511.

[nicholas.christakis@yale.edu](mailto:nicholas.christakis@yale.edu)

Phone: 203-436-4747



**Liza Comita**

Assistant Professor of Forestry and Environmental Studies; Ecology & Evolutionary Biology

195 Prospect St, New Haven, CT 06511.

[liza.comita@yale.edu](mailto:liza.comita@yale.edu)

Phone: 203-436-5783



**Forrest Crawford**

Assistant Professor, School of Public Health, Ecology and Evolutionary Biology

300 George St, New Haven, CT 06511

[forrest.crawford@yale.edu](mailto:forrest.crawford@yale.edu)

Phone: 203-785-6125



**Vivian F. Irish**

Professor of Molecular, Cellular and Developmental Biology; Professor of Ecology and Evolutionary Biology

165 Prospect St, New Haven, CT 06511.

[Vivian.irish@yale.edu](mailto:Vivian.irish@yale.edu)

Phone: 203-432-5572

[Davenport College Fellow]



**James Noonan**

Associate Professor Genetics and Ecology and Evolutionary Biology  
333 Cedar Street, New Haven, CT 06510

[james.noonan@yale.edu](mailto:james.noonan@yale.edu)

Phone: 203-737-1922



**Eric J. Sargis**

Professor of Anthropology; Curator Peabody Museum; Professor of Ecology and Evolutionary Biology

10 Sachem St, New Haven, CT 06511.

[eric.sargis@yale.edu](mailto:eric.sargis@yale.edu)

Phone: 203-432-6140

[Trumbull College Fellow]



**Oswald J. Schmitz**

Oastler Professor of Population and Community Ecology of School of Forestry And Environmental Studies; Professor of Ecology & Evolutionary Biology

195 Prospect St, New Haven, CT 06511.

[oswald.schmitz@yale.edu](mailto:oswald.schmitz@yale.edu)

Phone: 203-436-5276

[Ezra Stiles College Fellow]



**David K. Skelly**

Oastler Professor of Ecology of School of Forestry and Environmental Studies; Director of Peabody Museum of Natural History; Professor of Ecology & Evolutionary

Biology; Curator of Peabody Museum; Dir of Peabody Museum

170 Whitney Ave, RM 112, New Haven, CT 06511

[david.skelly@yale.edu](mailto:david.skelly@yale.edu)

Phone: 203-432-3752



**Jeffrey Townsend**

Elihu Professor of Biostatistics YSPH; Ecology and Evolutionary Biology

Director of Bioinformatics; Yale Center for Analytical Sciences

135 College St, New Haven, CT 06510.

[jeffrey.townsend@yale.edu](mailto:jeffrey.townsend@yale.edu)

Phone: 203-737-7042



**J. Rims Vaisnys**

Professor of Electrical Engineering; Ecology and Evolutionary Biology  
10 Hillhouse St, New Haven, CT 06511

[juozas.vaisnys@yale.edu](mailto:juozas.vaisnys@yale.edu)

Phone: 203-432-4253

[Jonathan Edwards College Fellow]



## **Recommendations for Premedical Students**

Most medical schools require:

One year of Biology plus one year of laboratories (University of Texas medical schools require two years of biology)

Two years of Chemistry plus two years of laboratories

One year of Physics plus laboratories (Note: The E&EB major does not require physics laboratories)

At least one term of calculus; some require a full year of math

Biochemistry plus laboratory is often recommended by medical schools for pre-medical students and is listed by them under the Chemistry requirements, not Biology.

Many medical schools require two terms of English; some require 2-3 terms.

Increasingly, medical schools are recommending/requiring courses in statistics, psychology, and other social sciences.

Medical schools require that all courses used to fulfill the basic pre-medical requirements be taken for a letter grade, not Credit/D/Fail. In addition, only grades of C or higher are accepted. C- or lower grades are not acceptable.

Students who expect to apply to medical school should consult the Health Professions Advisory Board (HPAB) at Undergraduate Career Services (UCS) located at 55 Whitney Avenue (203- 432-0818), preferably during their first term at Yale. Catalogues for every American and most Canadian medical schools are available on the Internet.

Some state-supported medical schools and a few private medical schools have additional course requirements in the humanities and social sciences. All pre-medical students should check the requirements of their state-supported medical schools, for more than 70% of applicant's matriculate in such schools. Individual medical school course requirements for American and Canadian applicants can be found in the AAMC publication, *Medical School Admission Requirements*, available in the Health Professions Department at the Office of Undergraduate Career Services Also see <https://students-residents.aamc.org/>

The HPAB publishes an informational bulleting with general information, *Preparing to Become a Health Care Professional*, plus specific information for those about to apply for admission to medical school (primarily junior and seniors), *Applying to Medical School*.

Students who are interested in applying as MD/PhD applicants should obtain a copy of the UCS publication, *General Information about MD/PhD Programs*. All are available on the UCS website at [www.yale.edu/career/students/gradprof/medschool](http://www.yale.edu/career/students/gradprof/medschool) or at the UCS office.



## Facilities

The offices and laboratories of the primary faculty members in EEB are in two buildings on science hill – Osborn Memorial Laboratories (OML) and the Environmental Sciences Center (ESC) – and on West Campus (YWC). Joint appointees are housed in their home departments. Other laboratories are in the buildings listed below.

**Libraries:** The several science libraries collectively constitute one of the greatest collections of biological literature in the world. The Marx Science and Social Science Library (formerly CSSSI), Peabody Museum (ornithology and entomology), Kline Geology Library (paleobiology), School of Forestry & Environmental Studies (forestry and environmental

biology), Engineering Library and Medical Library (biomedical sciences) together represent a collection of approximately one million volumes.

The Marx Library is in the concourse level of the Kline Biology Tower. It houses both the literature of sciences and social sciences and supports computing and analysis with its StatLab. Please visit their web site for additional information. <https://marx.library.yale.edu>

**Computer Facilities:** Yale Information and Technology Services (ITS) provides both mainframe and microcomputer resources to the student community. A software library is available for download. Biomedical Computer Facilities, located at the Medical School and accessed through remote or local terminals, are available for DNA and protein sequence analysis. The residential colleges are fully networked for access to Yale computing facilities and the Internet.

**Peabody Museum of Natural History:** With collections dating to 1825 and now numbering over 2,000,000 units, Yale's Peabody Museum is a major resource for research and teaching in the biological sciences. Of interest to those studying the history and diversity of life are its world-famous holdings of fossil vertebrates, including dinosaurs (150,000 units), fossil invertebrates (275,000 units), and fossil plants (100,000 units), as well as its collections of modern birds (100,000 units), insects (1,250,000 units), other animals (300,000 units), and plants (250,000 units). Students may do research and work with any of the scientific staff members of the Museum.

**Genomics and Molecular Biology Facilities:** University services for all aspects of molecular biological research are available in various Yale facilities. These include oligonucleotide synthesis, DNA sequencing, monoclonal and polyclonal antibody preparation, peptide synthesis, cell sorting, and amino acid analysis. In addition, facilities are available for mass spectrometry and X-ray crystallography. Equipment to generate and analyze DNA chips and protein microarrays are located both at the Yale Medical School and in the Department of Molecular, Cellular, and Developmental Biology (MCDB). Mass spectrometry, high throughput chemical genomic screening, and next generation genomic DNA sequencing including Roche/454 and Illumina/Solexa are available in the MCDB Department. In addition, the laboratories for teaching and faculty research are equipped with state-of-the-art instrumentation and equipment for specific projects.

**Imaging Facilities:** MCDB operates a modern light microscope imaging facility supervised by Dr. Joseph Wolenski. These microscopes are available to the Yale scientific community at competitive hourly rates. Equipment includes two Zeiss LSM 510 confocal inverted microscopes, one with near-infrared two-photon imaging capabilities and a temperature-controlled stage. MCDB also houses a spinning disk confocal microscope and a Nikon wide field microscope equipped with a color camera for histological slides and a sensitive CCD camera for fluorescence imaging.

**Structural Analysis/Electron Microscopy Facilities:** MCDB operates a Structural Analysis Laboratory that includes both scanning and transmission electron microscopes and related equipment for processing, sectioning, and imaging support. These facilities are used in both teaching and research and are core resources also available to members of E&EB and other Science Hill departments.

**DNA Analysis Facility on Science Hill (DAFSH)** is a non-profit academic Core Facility for DNA Sequencing and Fragment Analysis located on the first floor of the ESC within the YIBS-MSCG Center (see below). Its services are used by over 600 scientists from Yale as well as other academic institutions and private companies from across the United States and around the world. Yale users have priority over external customers and get reduced rates. Training and job opportunities for Yale students are available during both academic and summer months. Please visit its web site for additional information <https://dna-analysis.yale.edu/>

**Yale Institute for Biospheric Studies (YIBS)** located on the first floor of the Environmental Science Center, is the umbrella environmental science center on campus. We support and inspire the environmental community at Yale through research and training, grants and fellowships, and weekly seminars and events. We use a collaborative and cross-disciplinary approach to study the entire biosphere: from molecules to landscapes, and everything in between. For additional information please visit: <https://yibs.yale.edu/>

**Yale Center for Earth Observation (YCEO)** is a centralized source of remote sensing hardware, software, and expertise for the Yale community. Assistance is available to help users in the selection, procurement and analysis of satellite images for their research. This research and teaching lab is one of the [Yale Institute of Biospheric Studies \(YIBS\)](#) research centers, and is co-sponsored by the Yale [School of Forestry and Environmental Studies](#).

**Plant and Animal Husbandry:** Numerous controlled environment growth chambers, constant temperature rooms, green houses and plant tissue culture facilities are available for environmentally controlled growth of plant materials. The major animal care facility for small mammals for the Arts and Sciences campus is also located on Science Hill.

**Herbarium:** The Yale Herbarium (currently housed in the Peabody Museum) consists of 350,000 systematically arranged plant specimens from the algae to vascular plants. The collection includes significant type specimens in the mosses and ferns with a representation of most families and important genera of the flowering plants.

**Marsh Botanical Garden:** The University's botanic garden and arboretum is located north of OML on the grounds of Marsh Hall at Prospect Street and Hillside Terrace. The garden features a diverse collection of native and exotic trees, shrubs, and perennials highlighting plant communities and environmental change. The greenhouses feature plants from tropical regions and arid climates as well as economically important crops. Erika Edwards (Professor of Ecology and Evolutionary Biology) is the Director of the Marsh Botanical Gardens. Kunso Kim is the Associate Director. Garden Staff includes Chris Bolick, Plant Research Facilities Manager, David Garinger, Curator of Greenhouse Plant Collections, Robert Rak, Research Aide and Christine Ventura, Horticulturist. <https://marshbotanicalgarden.yale.edu/>.

**Yale's West Campus:** The Core Facilities on Yale's West Campus currently include: Yale Center for Molecular Discovery, Yale Center for Genome Analysis, High Performance Computing Center, West Campus Analytical Chemistry Core, West Campus Imaging Core, and

West Campus Materials Characterization Core. The Krios cryo-electron microscope, a technology that is enabling scientists to visualize the molecules of biological life in atomic detail, was unveiled at Yale in 2017. Please visit their web site for more information: <http://westcampus.yale.edu/research/scientific-core-facilities>.

**Yale Nature Preserve:** This tract in the Westville section of New Haven adjoins the Yale Golf Course. It is heavily wooded and has a central pond. Many groups of terrestrial and freshwater organisms are well represented in natural communities.

**Yale Forests:** There are more than 10,000 acres of Yale Forests managed as working forest by the School of Forestry & Environmental Studies. They are also available by arrangement for research and instruction. Largest and closest is the 7,800-acre Yale-Meyers Forest in northeastern Connecticut. It has some lakes and a diversity of fauna, flora, and natural habitats

## E&EB Courses 2020-2021

### **Required Introductory Courses:**

**BIOL 101, Biochemistry and Biophysics, Michael Koelle (P), Anthony Koleske (P), Samantha Lin**

**M W 11:35 – 12:50, 1/2 Course credit**

Introduction to the study of life at the molecular level. Topics include the three-dimensional structures and function of large biological molecules, the human genome, and the design of antiviral drugs to treat HIV/AIDS. Prerequisite: The first of four modules in a yearlong introductory biology sequence; meets for the first half of the fall term.

**BIOL 102, Principles of Cell Biology and Membrane Physiology, Mark Mooseker (P), Valerie Horsley (P), Samantha Lin**

**M W 11:35 – 12:50, 1/2 Course credit**

Introduction to the study of cell biology and membrane physiology. Topics include organization and functional properties of biological membranes, membrane physiology and signaling, rough endoplasmic reticulum and synthesis of membrane/secretory membrane proteins, endocytosis, the cytoskeleton, and cell division. Prerequisite: The second of four modules in a yearlong introductory biology sequence; meets for the second half of the fall term.

**BIOL 103, Genes and Development, Vivian Irish (P), Weimin Zhong (P), Surjit Chandhoke (P), Amaleah Hartman**

**M W 11:35 – 12:50, 1/2 Course credit**

Introduction to genes, genetics, and developmental biology. How genes control development and disease; Mendel's rules; examples of organ physiology. Prerequisite: The third of four modules in a year-long introductory biology sequence; meets for the first half of the spring term.

**BIOL 104, Principles of Ecology and Evolutionary Biology, Richard Prum (P), Thomas Near (P), Surjit Chandhoke (P), Amaleah Hartman**

**M W 11:35 – 12:50, 1/2 Course credit**

Introduction to ecology, evolutionary biology, animal behavior, and the history of life. Evolutionary transitions and natural selection. Adaptation at genic, chromosomal, cellular, organismal, and supra-organismal levels. Distributional and social consequences of suites of organismal adaptations. Prerequisite: The fourth of four modules in a year-long introductory biology sequence; meets for the second half of the spring term.

## **Courses and Laboratories with No Prerequisites:**

### **E&EB 035. The Ecology of Food. Linda Puth**

M 1:30 – 2:20 W 1:30 – 3:20

Food and ecology are linked both in the production of domesticated food through agriculture and livestock and in the harvesting of wild plants and animals. The production and consumption of food has downstream consequences through energy consumption, food waste, trophic interactions and the transportation of food around the globe.

### **E&EB 106 / MCDB 106 / HLTH 155. Malaria, Lyme & Vector Borne Disease. Alexia Belperron**

M W 1:00 – 2:15

Introduces the biology of pathogen transmission from one organism to another by insects with a focus on malaria, dengue, and Lyme disease. Biology of the pathogens including modes of transmission, establishment of infection, and host immune responses; the challenges associated with vector control, prevention, development of vaccines, and treatments.

### **E&EB 115<sup>G</sup> / EEB 515 / F&ES 315. Conservation Biology. Linda Puth**

M W 10:30 – 11:20, 1 HTBA

Introduces the ecological and evolutionary principles underpinning efforts to conserve Earth's biodiversity and the efforts to slow the disappearance of both plants and animals. Discussion of sociological and economic issues.

### **E&EB 125 / G&G 125. History of Life. Derek Briggs**

T Th 11:35 – 12:50

Examination of fossil and geologic evidence pertaining to the origin, evolution, and history of life on Earth. Emphasis on major events in the history of life, on what the fossil record reveals about the evolutionary process, on the diversity of ancient and living organisms, and on the evolutionary impact of Earth's changing environment.

### **E&EB 145. Plants and People. Linda Puth**

M W F 10:30 – 11:20

The interactions of plants and people explored from biological, historical, anthropological, and artistic perspectives. Basic botany; plants in the context of agriculture; plants as symbols; plants in the environment. Includes visits to the Peabody Museum, the Marsh Botanical Garden, and the Yale Art Gallery.

## **Intermediate Courses:**

Note: Prerequisites for all E&EB courses numbered 200 and above are BIOL 101, 102, 103 and 104, or permission of the instructor.

### **E&EB 210<sup>G</sup> / E&EB 510 / S&DS 101 / S&DS 501<sup>G</sup>. Intro to Statistics: Life Sciences.**

**Jonathan Reuning- Scherer & Walter Jetz**

T Th 1:00 – 2:15

Statistical and probabilistic analysis of biological problems presented with a unified foundation in basic statistical theory. Problems are drawn from genetics, ecology, epidemiology, and bioinformatics.

**E&EB 220<sup>G</sup> / E&EB 520a / EVST 223. General Ecology.** David Vasseur & David Post

M W F 10:30 – 11:20

The theory and practice of ecology, including the ecology of individuals, population dynamics and regulation, community structure, ecosystem function, and ecological interactions at broad spatial and temporal scales. Topics such as climate change, fisheries management, and infectious disease are placed in an ecological context. *Prerequisite: MATH 112 or equivalent.*

**E&EB 225<sup>G</sup> / E&EB 525. Evolutionary Biology.** Paul Turner

T Th 10:30 – 11:20

An overview of evolutionary biology as the discipline uniting all the life sciences. Reading and discussion of scientific papers to explore the dynamic aspects of evolutionary biology. Principles of population genetics, paleontology, and systematics; application of evolutionary thinking in disciplines such as developmental biology, ecology, microbiology, molecular biology, and human medicine.

**[E&EB 228<sup>G</sup> / E&EB 528. Ecology and Evolution of Infectious Diseases].**

**[E&EB 230<sup>G</sup> / E&EB 530 / EVST 221 / F&ES 221. Field Ecology].**

**[E&EB 246<sup>G</sup> / E&EB 546. Plant Diversity and Evolution].**

**E&EB 250<sup>G</sup> / E&EB 550. Biology of Terrestrial Arthropods.** Marta M. Wells

T Th 11:35 – 12:50

Evolutionary history and diversity of terrestrial arthropods (body plan, phylogenetic relationships, fossil record); physiology and functional morphology (water relations, thermoregulation, energetics of flying and singing); reproduction (biology of reproduction, life cycles, metamorphosis, parental care); behavior (migration, communication, mating systems, evolution of sociality); ecology (parasitism, mutualism, predator-prey interactions, competition, plant-insect interactions). *To be taken concurrently with EEB 251L.*

**[E&EB 255<sup>G</sup> / E&EB 555. Invertebrates I]. [E&EB 264<sup>G</sup> / E&EB 564. Ichthyology].**

**[E&EB 272<sup>G</sup> / E&EB 672. Ornithology].**

MWF 9:25 - 10:15

An overview of avian biology and evolution, including the structure, function, behavior, and diversity of birds. The evolutionary origin of birds, avian phylogeny, anatomy, physiology, neurobiology, breeding systems, and biogeography.

**E&EB 275<sup>G</sup> / E&EB 575b / EVST 400b. Biological Oceanography.** Marybeth Decker

T Th 11:35 – 12:50

Exploration of a range of coastal and pelagic ecosystems. Relationships between biological systems and the physical processes that control the movements of water and productivity of marine systems. Anthropogenic impacts on oceans, such as the effects of fishing and Climate change. Includes three Friday field trips.

**[E&EB 280 / ANTH 310. Mammalogy].**

**E&EB 290. Comparative Anatomy of Vertebrates. Günter Wagner**

M W F 11:35 – 12:25

A survey of the structure, variation, and evolution of major vertebrate groups. Topics include the microanatomy of major organ systems, the embryology of the vertebrate body plan, and the structure and evolution of the major organ systems such as the locomotory system, sensory organs, digestive tract, reproductive tract, and nervous system. To be taken concurrently with EEB 291L.

**E&EB 295. Life in Motion: Ecological and Evolutionary Physiology. Martha Munoz**

M W 10:35 – 11:20

Physiology studies the functions that organisms perform and how they use those functions to interact with the environment. To survive, grow, and reproduce, all organisms must acquire energy and avoid conditions that exceed their physiological limits. These interactions all involve motion—ions travel across membranes, muscle fibers twitch, organisms breathe and move. In this course, we view physiological processes both “bottom up” and “top down”, then integrate to extract general physiological rules of life. These insights are linked to the broader context of global change to whether and how organisms can physiologically respond to contemporary selective pressures. While the course focuses heavily on animal physiology, plants, fungi, and microbes are also discussed.

### **Laboratories**

**E&EB 075L. Laboratory for Virus Discovery and Evolution. Alita Burmeister**

Th 1:00 – 5:00

An introduction to empirical research with a hybrid between lab exercises and mentored research on bacteriophage, which are viruses that infect bacteria. A general goal of this course is for each student to decide whether they want to continue with undergraduate research.

Specific learning objectives and assessments focus on experimental design, hypothesis testing, data analysis, and presentation. Students will practice these skills and conduct independent research projects. Students will gain basic experience with methods and principles from microbiology, genetics, ecology, and evolutionary biology. SC 1 Course credit

**E&EB 223L<sup>G</sup> / E&EB 523L. Laboratory for Principles of Ecology, Evolutionary Biology, and the Tree of Life. Marta Wells.**

T W Th 1:30 - 4:30

Study of evolutionary novelties, their functional, and their role in the diversity of life. Introduction to techniques used for studying the diversity of animal body plans. Evolutionary innovations that have allowed groups of organisms to increase their diversity. SC ½ Course credit

**[E&EB 327L<sup>G</sup> / E&EB 627L. Laboratory for Plant Structure and Function].**

**[E&EB 247L<sup>G</sup> / E&EB 547L. Laboratory for Plant Diversity and Evolution].**

**E&EB 251L<sup>G</sup> / E&EB 551L. Laboratory for Biology of Terrestrial Arthropods. Marta Wells**

W 1:30 – 4:30

Comparative anatomy, dissections, identification, and classification of terrestrial arthropods; specimen collection; field trips. SC ½ Course credit

**[E&EB 256L<sup>G</sup> / E&EB 556L. Laboratory for Invertebrates I]. [E&EB 265L<sup>G</sup> / E&EB 565L. Laboratory for Ichthyology].**

**E&EB 273L<sup>G</sup> / E&EB 673L. Laboratory for Ornithology. Richard Prum**

T 1:30 – 4:30

Laboratory and field studies of avian morphology, diversity, phylogeny, classification, identification, and behavior. SC ½ Course credit

**E&EB 291L. Comparative Anatomy of Vertebrates Laboratory. Staff**

Th F 1:30 – 4:30

Microscopic examination of histological and embryological preparations. Dissection of selected vertebrate species including shark, bony fish, frog, lizard, and rat. To be taken with EEB 290. SC ½ Course credit

### **Advanced Courses**

**[E&EB 305. Plant Ecology]. [E&EB 320. Advanced Ecology].**

**[E&EB 321. Philosophy of Biology]. [E&EB 325 G / E&EB 625. Limnology]. [E&EB 326. Plant Structure and Function].**

**E&EB 335G / E&EB 635 / HLTH 250. Evolution and Medicine. Stephen Stearns**

T Th 11:35 – 12:50

Introduction to the ways in which evolutionary science informs medical research and clinical practice. Diseases of civilization and their relations to humans' evolutionary past; the evolution of human defense mechanisms; antibiotic resistance and virulence in pathogens; cancer as an evolutionary process. Students view course lectures on line; class time focuses on discussion of lecture topics and research papers.

**[E&EB 336 / HUMS 336 / HSHM 453. Culture and Human Evolution].**

**E&EB 342. Primate Diversity and Evolution. Eric Sargis**

TTh 2:30 - 3:45

The diversity and evolutionary history of living and extinct primates. Focus on major controversies in primate systematics and evolution, including the origins and relationships of several groups. Consideration of both morphological and molecular studies. Morphological diversity and adaptations explored through museum specimens and fossil casts.

**E&EB 352. Evolutionary Theory. Alvaro Sanchez**

MW 1:00 - 2:15



This course introduces students to the theory behind evolutionary biology. The aim of the course is for the student to understand how evolution works, focusing on the quantitative and predictive theory that is the backbone of modern evolutionary thinking. The course covers three main areas: An introduction to population genetics, an introduction to quantitative genetics and the genotype-phenotype map, and an introduction to life-history evolution. To master this material and to put the concepts studied in class into practice, students work on weekly problem sets. Through the completion of the course assignments, students gain valuable quantitative and mathematical modeling skills.

**E&EB 354. Phylogenetic Biology. Casey Dunn**

TTh 11:35 - 12:50

Phylogenetic Biology is the study of the evolutionary relationships between organisms, and the use of evolutionary relationships to understand other aspects of organism biology. This course surveys phylogenetic methods, providing a detailed picture of the statistical, mathematical, and computational tools for building phylogenies and using them to study evolution. We also examine the application of these tools to particular problems in the literature and emerging areas of study.

**E&EB 362. Tropical Field Biology. Linda Puth**

M 1:30 - 4:30

Firsthand experience of a region can inspire great insights and understanding of ecology and evolutionary biology. This course immerses students in the communities and ecosystems of a single tropical region each year, but locations rotate among a small group of sites. We spend the first half of the semester learning about the geology, history, biomes and organisms of the region. The spring 2021 class will travel to 1-2 tropical forest research stations in Costa Rica.

**[E&EB 380<sup>G</sup> / E&EB 680. Life History Evolution]**

**E&EB 428 / AMTH 428 / G&G 428<sup>G</sup> / PHYS 428 / G&G 528. Science of Complex Systems. Jun Korenaga**

M W F 10:30 – 11:20

Introduction to the quantitative analysis of systems with many degrees of freedom. Fundamental components in the science of complex systems, including how to simulate complex systems, how to analyze model behaviors, and how to validate models using observations. Topics include cellular automata, bifurcation theory, deterministic chaos, self-organized criticality, renormalization, and inverse theory. Prerequisite: PHYS 301, MATH 247, or equivalent.

**[E&EB 460G / E&EB 960. Studies in Evolutionary Medicine I].**

**[E&EB 461<sup>G</sup> / E&EB 961. Studies in Evolutionary Medicine II].**

**E&EB 464 / ANTH 464<sup>G</sup> / ANTH 864/ ARCG 464 / ARCG 864 Human Osteology. Eric Sargis**  
TTh 11:35 - 12:50

A lecture and laboratory course focusing on the characteristics of the human skeleton and its use in studies of functional morphology, paleo demography, and paleopathology. Laboratories familiarize students with skeletal parts; lectures focus on the nature of bone tissue, its biomechanical modification, sexing, aging, and interpretation of lesions.

## **E&EB Research and Tutorials**

### **E&EB 469. Tutorial.** Marta Wells HTBA

Individual or small-group study for qualified students who wish to investigate an area of ecology or evolutionary biology not presently covered by regular courses. A student must be sponsored by a faculty member who sets requirements and meets weekly or biweekly with the student. One or more written examinations and/or a term paper are required. To register, the student must submit a written plan of study approved by the faculty instructor or the director of undergraduate studies. Students are encouraged to apply during the term preceding the tutorial. Proposals must be submitted no later than the first day of the second week of the term in which the student enrolls in the tutorial. The final paper is due in the hands of the director of undergraduate studies by the last day of the reading period in the term of enrollment. In special cases, with approval of the director of undergraduate studies, this course may be elected for more than one term.

Normally, faculty sponsors must be members of the E&EB department.

### **E&EB 470. Senior Tutorial.** Marta Wells HTBA

Tutorial for seniors in the B.A. degree program who elect a term of independent study to complete the senior requirement. A student must be sponsored by a faculty member who sets requirements and meets weekly with the student. One or more written examinations and/or a term paper are required. To register, the student must submit a written plan of study approved by the faculty instructor to the director of undergraduate studies. Students are encouraged to apply during the term preceding the tutorial. Proposals must be submitted no later than the first day of the second week of the term in which the student enrolls in the tutorial. The final paper is due in the hands of the director of undergraduate studies by the last day of reading period in term of enrollment. Normally, faculty sponsors must be members of EEB department. Enrollment limited to seniors. Fulfill the senior requirement for B.A. degree.

### **E&EB 474. Research.** Marta Wells HTBA

One term of original research in an area relevant to ecology or evolutionary biology. This may involve, for example, laboratory work, fieldwork, or mathematical or computer modeling.

Students may also work in areas related to environmental biology such as policy, economics, or ethics. The research project may not be a review of relevant literature but must be original. In all cases students must have a faculty sponsor who oversees the research and is responsible for the rigor of the project. Students are expected to spend ten hours per week on their research projects. Using the form available from the office of undergraduate studies or from the Classes server, students must submit a research proposal that has been approved by the faculty sponsor to the director of undergraduate studies, preferably during the term preceding the research.

Proposals are due no later than the first day of the second week of the term in which the student enrolls in the course. The final research paper is due in the hands of the director of undergraduate studies by the last day of reading period in the term of enrollment.

### **E&EB 475/476. Senior Research.** Marta Wells HTBA

Two term of original research in an area relevant to ecology or evolutionary biology. This may involve, for example, laboratory work, fieldwork, or mathematical or computer modeling.

Students may also work in areas related to environmental biology such as policy, economics, or ethics. The research project may not be a review of relevant literature but must be original. In all

cases students must have a faculty sponsor who oversees the research and is responsible for the rigor of the project. Students are expected to spend ten hours per week on their research projects. Using the form available from the office of undergraduate studies or from the Classes server, students must submit a research proposal that has been approved by the faculty sponsor to the director of undergraduate studies, preferably during the term preceding the research.

Proposals are due no later than the first day of the second week of the term in which the student enrolls in the course. The final research paper is due in the hands of the director of undergraduate studies by the last day of reading period in the term of enrollment. Enrollment is limited to seniors. Fulfills a portion of the senior requirement for the B.S. degree. Must be taken in the senior year. **The senior research requirement for the BS is one or two semesters of research for the class of 2021 and two semesters for classes starting with 2022.**

**E&EB 495/496. Intensive Senior Research.** Marta Wells HTBA

Two term of intensive original research during the senior year under the sponsorship of a Yale faculty member. Like other research courses except that a more substantial portion of a student's time and effort should be spent on the research project (a minimum average of twenty hours per week). A research proposal approved by the sponsoring faculty member must be submitted to the director of undergraduate studies; forms are available from the office of undergraduate studies. For research in the fall term, approval is encouraging during the spring term of the junior year.

Proposals are due no later than the first day of the second week of the term in which the student enrolls in the course. The final research paper is due in the hands of the director of undergraduate studies by the last day of reading period in the term of enrollment. Fulfills a portion of the senior requirement for the B.S. degree. Must be taken in the senior year. **The senior research requirement for the BS is one or two semesters of research for the class of 2021 and two semesters for classes starting with 2022.** 2 course credits.

## Graduate Courses and Labs

With permission of the instructor, advanced undergraduates may take graduate courses for credit. If you are interested in one of these consult the instructor. You will need to fill out a special form available in Yale Degree Audit. For current course descriptions and other information, please use <https://courses.yale.edu/> .

**E&EB 500 & 501. Advanced Topics in Ecology & Evolutionary Biology. DGS**

**E&EB 510. Introduction to Statistics: Life Sciences. Walter Jetz & Jonathan Reuning-Scherer**

**E&EB 515. Conservation Biology. Linda Puth**

**E&EB 520. General Ecology. David Vasseur & David Post**

**E&EB 523L. Laboratory for Principles of Evolution, Ecology & Behavior. Marta Wells**

**[E&EB 528. Ecology & Evolution of Infectious Diseases].**

**E&EB 525. Evolutionary Biology. Paul Turner**

**[E&EB 530. Field Ecology].**

**E&EB 535. Evolution and Medicine. Stephen Stearns**

**E&EB 546. Plant Diversity and Evolution. Erika Edwards**

**E&EB 547L. Laboratory for Plant Diversity and Evolution. Erika Edwards**

**E&EB 550. Biology of Terrestrial Arthropods. Marta Wells**

**E&EB 551L. Laboratory for Biology of Terrestrial Arthropods. Marta Wells**

**[E&EB 555. Invertebrates I].**

**[E&EB 556L. Laboratory for Invertebrates I]. [E&EB 557. Invertebrates II].**

**[E&EB 558L. Laboratory for Invertebrates II].**

**E&EB 545. Responsible Conduct of Research. Jeffrey Powell**

**[E&EB 564. Ichthyology].**

**E&EB 575. Biological Oceanography. Marybeth Decker**

**[E&EB 621. Philosophy of Biology]. [E&EB 625. Limnology].**

**E&EB 635. Evolution and Medicine Stephen Stearns**

**E&EB 636. Biosocial Science. Nicholas Christakis**

**E&EB 652. Evolutionary Theory. Alvaro Sanchez & Brandon Ogbunu**

**E&EB 654. Phylogenetic Biology. Casey Dunn E&EB 672. Ornithology. Richard Prum E&EB 673L. Ornithology. Richard Prum**

**E&EB 678. Mathematical Models and Quantitative Methods in Evolution and Ecology. Alvaro Sanchez**

**[E&EB 680. Life History Evolution. ]**

**[E&EB 725. Scientific Writing for Ecology & Evolutionary Biology].**

**[E&EB 729. Microbial Ecology & Evolution].**

**[E&EB 800. Seminar in Molecular Evolution].**

**E&EB 821. Advanced Topics in Philosophy of Biology. Casey Dunn & Gunter Wagner**

**E&EB 901/902. Research Rotation I and II. DGS**

**E&EB 842. Primate Diversity and Evolution. Eric Sargis**

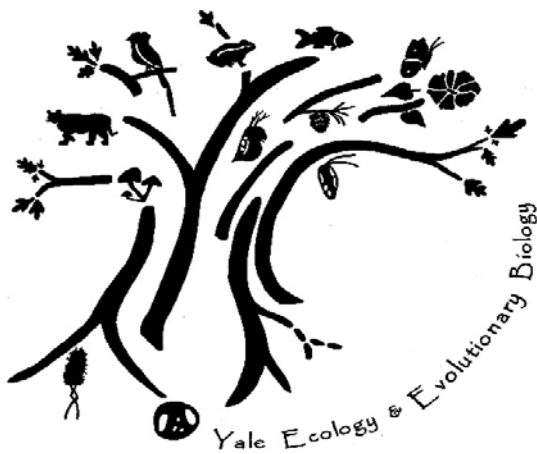
**[E&EB 930. Seminar in Systematics].**

## 2020 Senior Symposium Tuesday, April 28<sup>th</sup>, Zoom

Time	Presenter and Title	Faculty Advisor
1:30 – 1:45	<b>Emma Phelps</b> The influence of alewives on zooplankton heterogeneity in Connecticut lakes	David Post
1:50 – 2:05	<b>Simon Doss-Gollin</b> Resistance to bacteriophages T6 and U115 confers antibiotic resistance to Albicidin in <i>E. coli</i>	Paul Turner
2:10 – 2:25	<b>Anusha Bishop</b> Integrating genetic and environmental data to create connectivity and habitat maps for tsetse flies ( <i>Glossina pallidipes</i> ) in Kenya	Adalgisa Caccone
2:30 – 2:45	<b>Matt Hack</b> Species limits and population genetics of the Tepui Vireo ( <i>Vireo sclateri</i> )	Richard Prum
2:50 – 3:05	<b>Josie Wilson</b> Investigating the mechanisms underlying PD-1 blockade resistance in KrasLKB1 mutant lung adenocarcinoma	Nik Joshi
3:15 – 3:30	<b>Kaija Gahm</b> The Tadpole Olympics: Temperature-mediated tradeoff between development and performance in larval wood frogs ( <i>Rana sylvatica</i> )	David Skelly
3:35 – 3:50	<b>Caroline Borden</b> The legacy of fire: Persistence of changes to the New England landscape	Mark Ashton
3:55 – 4:10	<b>Maya Levin</b> Isolation and characterization of bacteriophage of <i>Salmonella enterica</i> for use in an antibiotic therapy for diarrheal diseases	Paul Turner
4:15 – 4:30	<b>Josh Perez-Cruet</b> Benthic macroinvertebrate survey of Canyon Creek	Marta Wells
4:35 – 4:50	<b>Maddie Bender</b> Rewirability and optimality in microbial metabolic decision-making (or, Bacteria: What do they know? Do they know things? Let's find out!)	Alvaro Sanchez
4:55 – 5:10	<b>Roxy Barahman</b> Tackling antibiotic resistance through bacteriophage/antibiotic evolutionary tradeoff	Alita Burmeister & Paul Turner

## **Appendix I – Worksheets for E&EB**

The following pages are worksheets that aid the potential major in planning a course of study.



# E&EB Major Worksheet      B. A. Degree      Track 1

Name: \_\_\_\_\_

Date: \_\_\_\_\_

Class: \_\_\_\_\_

College: \_\_\_\_\_

Advisor: \_\_\_\_\_

EMAIL: \_\_\_\_\_

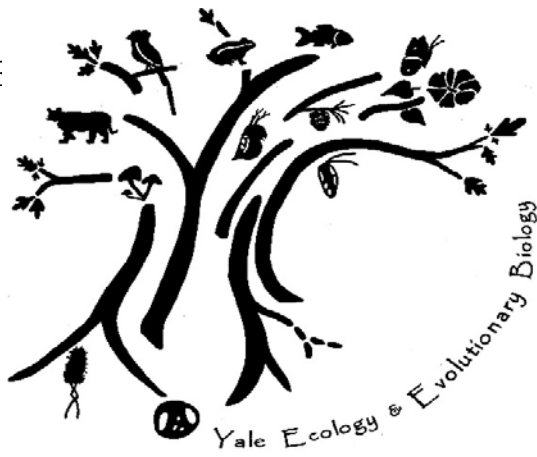
	<u>Course</u>	<u>Semester</u>	<u>Grade</u>	<u>Place Out</u>
<b>Prerequisites</b>				
Biology Introductory Courses				
BIOL 101      Biochemistry & Biophysics				
BIOL 102      Principles of Cell Biology & Membrane Physiology				
BIOL 103      Genes & Development				
BIOL 104      Principles of Ecology & Evolutionary Biology				
<b>2 Terms of General Chemistry</b>				
CHEM 161, 165; or CHEM 163, 167				
<b>2 Terms of General Chemistry Labs</b>				
CHEM 134L CHEM 136L				
<b>1 Term of Organic Chemistry</b>				
CHEM 174, 175; or CHEM 220, 221				
<b>1 Term of Organic Chemistry Lab</b>				
CHEM 222L				
<b>2 Terms of Physics</b>				
PHYS 170    (or higher) PHYS 171    (or higher)				
<b>1 Term of Math or Statistics &amp; Data Science</b>				
MATH 115, 116 or S&DS 100 or 230				
<b>2 Terms of Math or Geology</b>				
May be taken in lieu of the organic chemistry requirement, at the discretion of the DUS, not include MATH 190, GEO or Paleobiology courses at 100- level offerings.				
<b>Required Core Courses: Track I</b>				
General Ecology      E&EB 220				
Evolutionary Biology      E&EB 225				
Organismal Diversity Course      E&EB 2xx -OR- 3xx				
Organismal Diversity Lab      E&EB 2xxL -OR- 3xxL				
<b>Independent Research for Underclassman (Pass/Fail) Optional, but recommended</b>				
Tutorial      E&EB 469				
Research      E&EB 474				
<b>B.A. Senior Requirement - Choose one: Must be taken in senior year</b>				
Senior Tutorial (1 credit)      E&EB 470				
Senior Essay (no credit)				

**NOTES:** \_\_\_\_\_



I

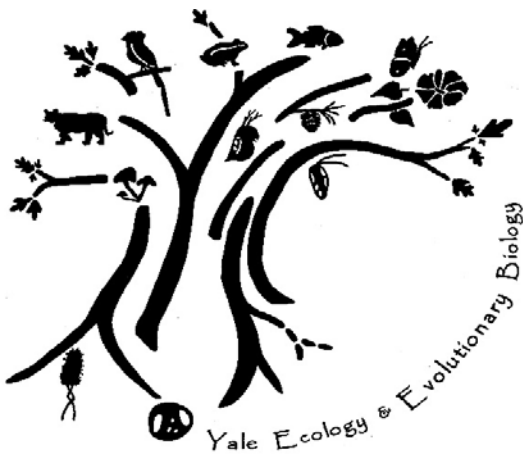
**B. A. Degree Track 2**



Name: \_\_\_\_\_  
 Date: \_\_\_\_\_  
 Class: \_\_\_\_\_  
 College: \_\_\_\_\_  
 Advisor: \_\_\_\_\_  
 EMAIL: \_\_\_\_\_

Prerequisites	Course	Semester	Grade	Place Out
<b>Biology Introductory Courses</b>				
BIOL 101 Biochemistry & Biophysics				
BIOL 102 Principles of Cell Biology & Membrane Physiology				
BIOL 103 Genes & Development				
BIOL 104 Principles of Ecology & Evolutionary Biology				
<b>2 Terms of General Chemistry</b>				
CHEM 161, 165; or CHEM 163, 167				
<b>2 Terms of General Chemistry Labs</b>				
CHEM 134L CHEM 136L				
<b>1 Term of Organic Chemistry</b>				
CHEM 174, 175; or CHEM 220, 221				
<b>1 Term of Organic Chemistry Lab</b>				
CHEM 222L				
<b>2 Terms of Physics</b>				
PHYS 170 (or higher) PHYS 171 (or higher)				
<b>1 Term of Math or Statistics &amp; Data Science</b>				
MATH 115, 116 or S&DS 100 or 230				
<b>2 Terms of Math or Geology</b>				
May be taken in lieu of the organic chemistry requirement, at the discretion of the DUS, not include MATH 190, GEO or Paleobiology courses at 100- level offerings.				
<b>Required Core Courses: Track II</b>				
Biochemistry MCDB 300 or MB&B 300				
Comparative Physiology -OR- Physiological Systems E&EB 295 or BENG 350				
Comparative Anatomy E&EB 290				
Comparative Anatomy Lab E&EB 291L				
<b>Independent Research for Underclassman (Pass/Fail) Optional, but recommended</b>				
Tutorial E&EB 469				
Research E&EB 474				
<b>B.A. Senior Requirement - Choose one: Must be taken in senior year</b>				
Senior Tutorial (1 credit) E&EB 470				
Senior Essay (no credit)				

NOTES:



# E&EB Major Worksheet      B. S. Degree      Track 1

Name: \_\_\_\_\_

Date: \_\_\_\_\_

Class: \_\_\_\_\_

College: \_\_\_\_\_

Advisor: \_\_\_\_\_

EMAIL: \_\_\_\_\_

	<u>Course</u>	<u>Semester</u>	<u>Grade</u>	<u>Place Out</u>
<b>Prerequisites</b>				
<b>Biology Introductory Courses</b>				
BIOL 101      Biochemistry & Biophysics				
BIOL 102      Principles of Cell Biology & Membrane Physiology				
BIOL 103      Genes & Development				
BIOL 104      Principles of Ecology & Evolutionary Biology				
	<u>Course</u>	<u>Semester</u>	<u>Grade</u>	<u>Place Out</u>
2 Terms of General Chemistry CHEM 161, 165; or CHEM 163, 167				
	<u>Course</u>	<u>Semester</u>	<u>Grade</u>	<u>Place Out</u>
2 Terms of General Chemistry Labs CHEM 134L CHEM 136L				
	<u>Course</u>	<u>Semester</u>	<u>Grade</u>	<u>Place Out</u>
1 Term of Organic Chemistry CHEM 174, 175; or CHEM 220, 221				
	<u>Course</u>	<u>Semester</u>	<u>Grade</u>	<u>Place Out</u>
1 Term of Organic Chemistry Lab CHEM 222L				
	<u>Course</u>	<u>Semester</u>	<u>Grade</u>	<u>Place Out</u>
2 Terms of Physics PHYS 170 (or higher) PHYS 171 (or higher)				
	<u>Course</u>	<u>Semester</u>	<u>Grade</u>	<u>Place Out</u>
1 Term of Math or Statistics & Data Science MATH 115, 116 or S&DS 100 or 230				
	<u>Course</u>	<u>Semester</u>	<u>Grade</u>	
2 Terms of Math or Geology  May be taken in lieu of the organic chemistry requirement, at the discretion of the DUS, not include MATH 190, GEO or Paleobiology courses at 100- level offerings.				
	<u>Course</u>	<u>Semester</u>	<u>Grade</u>	
<b>Required Core Courses: Track I</b>				
General Ecology      E&EB 220				
Evolutionary Biology      E&EB 225				
Organismal Diversity Course      E&EB 2xx -OR- 3xx				
Organismal Diversity Lab      E&EB 2xxL -OR- 3xxL				
<b>Required Electives: Track I</b>				
2 Terms of Science Electives  either 200+ level lecture courses in E&EB, MCDB, MB&B or from other dept. w/ prior DUS approval or 200+ level science laboratories				
<b>Independent Research for Underclassman (Pass/Fail)Optional, but recommended</b>	<u>Course</u>	<u>Semester</u>	<u>Grade</u>	<u>Advisor</u>
Tutorial      E&EB 469				
Research      E&EB 474				
<b>B.S. Senior Requirement</b>	<u>Course</u>	<u>Semester</u>	<u>Grade</u>	<u>Advisor</u>
2 terms required; must be taken in senior year, for letter grade				
E&EB 475 and 476 (Senior Research)				
E&EB 495 and 496 (Intensive Senior Research)				

**NOTES:** \_\_\_\_\_

I

**B. S. Degree Track 2**



Name: \_\_\_\_\_

Date: \_\_\_\_\_

Class: \_\_\_\_\_

College: \_\_\_\_\_

Advisor: \_\_\_\_\_

EMAIL: \_\_\_\_\_

Prerequisites	Course	Semester	Grade	Place Out
<b>Biology Introductory Courses</b>				
BIOL 101 Biochemistry & Biophysics				
BIOL 102 Principles of Cell Biology & Membrane Physiology				
BIOL 103 Genes & Development				
BIOL 104 Principles of Ecology & Evolutionary Biology				
<b>2 Terms of General Chemistry</b> CHEM 161, 165; or CHEM 163, 167				
<b>2 Terms of General Chemistry Labs</b> CHEM 134L CHEM 136L				
<b>1 Term of Organic Chemistry</b> CHEM 174, 175; or CHEM 220, 221				
<b>1 Term of Organic Chemistry Lab</b> CHEM 222L				
<b>2 Terms of Physics</b> PHYS 170 (or higher) PHYS 171 (or higher)				
<b>1 Term of Math or Statistics &amp; Data Science</b> MATH 115, 116 or S&DS 100 or 230				
<b>2 Terms of Math or Geology</b> May be taken in lieu of the organic chemistry requirement, at the discretion of the DUS, not include MATH 190, GEO or Paleobiology courses at 100- level offerings.				
<b>Required Core Courses: Track II</b>	<u>Course</u>	<u>Semester</u>	<u>Grade</u>	
Biochemistry MCDB 300 or MB&B 300				
Comparative Physiology -OR- Physiological Systems E&EB 295 or BENG 350				
Comparative Anatomy E&EB 290				
Comparative Anatomy Lab E&EB 291L				
<b>Required Electives: Track II</b>	<u>Course</u>	<u>Semester</u>	<u>Grade</u>	
<b>2 Terms of Science Electives</b> either 200+ level lecture courses in E&EB, MCDB, MB&B or from other dept. w/ prior DUS approval or 200+ level science laboratories				
<b>Independent Research for Underclassman (Pass/Fail) Optional, but recommended</b>	<u>Course</u>	<u>Semester</u>	<u>Grade</u>	<u>Advisor</u>
Tutorial E&EB 469				
Research E&EB 474				
<b>B.S. Senior Requirement</b>	<u>Course</u>	<u>Semester</u>	<u>Grade</u>	<u>Advisor</u>
2 terms required; must be taken in senior year, for letter grade				
E&EB 475 and 476 (Senior Research)				
E&EB 495 and 496 (Intensive Senior Research)				

**NOTES:**

## **Appendix II – Forms for Tutorial & Research Courses**

E&EB 469	Underclass Tutorial
E&EB 470	Senior Tutorial
E&EB 474	Research
E&EB 475 & 476	Senior Research
E&EB 495 & 496	Senior Intensive Research
	Senior Essay

## EEB 469 Underclass Tutorial Department of Ecology and Evolutionary Biology

Submission Date:	Semester:	
<b>STUDENT INFORMATION</b>		
Student's Last Name:	First:	Middle:
Email Address:		
Class:	Student ID:	Cell Phone:
Title for Tutorial:		
Are you an EEB major?		
Student's Signature:		
Date:		
<b>DESCRIPTION OF UNDERCLASSMAN TUTORIAL REQUIREMENTS</b>		
<p>Individual or small-group of underclassmen who wish to investigate an area of ecology or evolutionary biology not presently covered by regular courses. A student must be sponsored by a faculty member who sets requirements and meets with the student. One or more written examinations and/or a term paper are required. To register, the student must submit a written plan of study approved by the faculty instructor EEB faculty in charge. Students are encouraged to apply during the term preceding the tutorial. Proposals must be submitted no later than the first day of the second week of the term in which the student enrolls in the tutorial. The final paper is due in the hands of the EEB faculty in charge by the last day of reading period in the term of enrollment. In special cases, with the approval of the director of undergraduate studies, this course may be elected for more than one term. Please attach this form to your proposal and return to the DUS Office. Underclassmen will receive one credit and a grade of P/F.</p>		
<b>TO THE TUTORIAL MENTOR</b>		
<p>By signing this form, you agree to supervise the student's project. You also agree to grade the final paper and report a grade to the EEB DUS based on exam(s) or term paper. This should be reported no later than the last day of the final examination period. Notification by email is acceptable and preferred to the EEB faculty in charge: <a href="mailto:marta.wells@yale.edu">marta.wells@yale.edu</a> (or the assistant, EEB Registrar: <a href="mailto:deanna.brunson@yale.edu">deanna.brunson@yale.edu</a> ).</p>		
<b>MENTOR'S INFORMATION</b>		
Mentor's Name:		
Mentor's Email:		
Mentor's Phone:		
Mentor's Signature:		
Date:		
<b>FACULTY APPROVAL</b>		
EEB Faculty in Charge Signature:		
Date:		

## EEB 470 Senior Tutorial

Submission Date:	Semester:	
<b>STUDENT INFORMATION</b>		
Student's Last Name:	First:	Middle:
Email Address:		
Class:	Student ID:	Cell Phone:
Title for Tutorial:		
B.A. Senior Requirement:	YES	NO
Student's Signature:		
Date:		
<b>DESCRIPTION OF SENIOR TUTORIAL REQUIREMENTS</b>		
<p>Individual or small-group study for qualified students who wish to investigate an area of ecology or evolutionary biology not presently covered by regular courses. A student must be sponsored by a faculty member who sets requirements and meets weekly with the student. One or more written examinations and/or a term paper are required. To register, a student must submit a written plan of study approved by the faculty instructor to the EEB faculty in charge. Students are encouraged to apply during the term preceding the tutorial. Proposals must be submitted no later than the first day of the second week of the term in which the student enrolls in the tutorial. The final paper is due in the hands of the EEB faculty in charge by the last day of reading period in the term of enrollment. Normally, faculty sponsors must be members of the EEB department. Enrollment limited to seniors. Fulfills the senior requirement for the B.A. degree.</p>		
<b>TO THE TUTORIAL MENTOR</b>		
<p>By signing this form, you agree to supervise the student's project. You also agree to grade the final paper and report a grade to the EEB DUS based on exam(s) or term paper. This should be reported no later than the last day of the final examination period. Notification by email is acceptable and preferred to the EEB faculty in charge: <a href="mailto:marta.wells@yale.edu">marta.wells@yale.edu</a> (or the assistant, EEB Registrar: <a href="mailto:deanna.brunson@yale.edu">deanna.brunson@yale.edu</a> ).</p>		
<b>MENTOR'S INFORMATION</b>		
Mentor's Name:		
Mentor's Email:		
Mentor's Phone:		
Mentor's Signature:		
Date:		
<b>FACULTY APPROVAL</b>		
EEB Faculty in Charge Signature:		

Date:

## EEB 474 Underclass Research

Submission Date:	Semester:	
<b>STUDENT INFORMATION</b>		
Student's Last Name:	First:	Middle:
Email Address:		
Class:	Student ID:	Cell Phone:
Project Title:		
Are you an EEB major?		
Student's Signature:		
Date:		
<b>DESCRIPTION OF UNDERCLASSMAN RESEARCH REQUIREMENTS</b>		
<p>One term of original research in an area relevant to ecology or evolutionary biology. This may involve, for example, laboratory work, fieldwork, or mathematical or computer modeling. Students may also work in areas related to environmental biology such as policy, economics, or ethics. The research project may not be a review of relevant literature but must be original. In all cases students must have a faculty sponsor who oversees the research and is responsible for the rigor of the project. Students are expected to spend ten hours per week on their research projects. Using the form available from the EEB faculty in charge or from the Canvas site, students must submit a research proposal that has been approved by the faculty sponsor to the EEB faculty in charge, preferably during the term preceding the research. Proposals are due no later than the first day of the second week of the term in which the student enrolls. The final research paper is due in the hands of the EEB faculty in charge by the last day of reading period in the term of enrollment. Underclassmen will receive one credit and a grade of P/F.</p>		
<b>TO THE TUTORIAL MENTOR</b>		
<p>By signing this form, you agree to supervise the student's project. You also agree to grade the final paper and report a grade to the EEB DUS based on exam(s) or term paper. This should be reported no later than the last day of the final examination period. Notification by email is acceptable and preferred to the EEB faculty in charge: <a href="mailto:marta.wells@yale.edu">marta.wells@yale.edu</a> (or the assistant, EEB Registrar: <a href="mailto:deanna.brunson@yale.edu">deanna.brunson@yale.edu</a> ).</p>		
<b>MENTOR'S INFORMATION</b>		
Mentor's Name:		
Mentor's Email:		
Mentor's Phone:		
Mentor's Signature:		
Date:		
<b>FACULTY APPROVAL</b>		
EEB Faculty in Charge Signature:		
Date:		



## EEB 475 and 476 Senior Research

Submission Date:	Semester:	
<b>STUDENT INFORMATION</b>		
Student's Last Name:	First:	Middle:
Email Address:		
Class:	Student ID:	Cell Phone:
Title for Research:		
B.S. Senior Requirement:	YES	NO
Student's Signature:		
Date:		
<b>DESCRIPTION OF SENIOR RESEARCH REQUIREMENTS</b>		
<p>One term of original research in an area relevant to ecology or evolutionary biology. This may involve, for example, laboratory work, fieldwork, or mathematical or computer modeling. Students may also work in areas related to environmental biology such as policy, economics, or ethics. The research project may not be a review of relevant literature but must be original. In all cases students must have a faculty sponsor who oversees the research and is responsible for the rigor of the project. Students are expected to spend ten hours per week on their research projects. Using the form available from the office of EEB faculty in charge or from the Canvas site, students must submit a research proposal that has been approved by the faculty sponsor to the EEB faculty in charge, preferably during the term preceding the research. Proposals are due no later than the first day of the second week of the term in which the student enrolls. The final research paper is due in the hands of the EEB faculty in charge by the last day of reading period in the term of enrollment. Enrollment limited to seniors. Fulfills the senior requirement for the B.S. degree.</p>		
<b>TO THE TUTORIAL MENTOR</b>		
<p>By signing this form, you agree to supervise the student's project. You also agree to grade the final paper and report a grade to the EEB DUS based on exam(s) or term paper. This should be reported no later than the last day of the final examination period. Notification by email is acceptable and preferred to the EEB faculty in charge: <a href="mailto:marta.wells@yale.edu">marta.wells@yale.edu</a> (or the assistant, EEB Registrar: <a href="mailto:deanna.brunson@yale.edu">deanna.brunson@yale.edu</a> ).</p>		
<b>MENTOR'S INFORMATION</b>		
Mentor's Name:		
Mentor's Email:		
Mentor's Phone:		
Mentor's Signature:		
Date:		
<b>FACULTY APPROVAL</b>		
EEB Faculty in Charge Signature:		
Date:		

## EEB 495 and 496 Intensive Senior Research

Submission Date:	Semester:	
<b>STUDENT INFORMATION</b>		
Student's Last Name:	First:	Middle:
Email Address:		
Class:	Student ID:	Cell Phone:
Title for Research:		
B.S. Senior Requirement:	YES	NO
Student's Signature:		
Date:		
<b>DESCRIPTION OF INTENSIVE SENIOR RESEARCH REQUIREMENTS</b>		
<p>One term of intensive original research during the senior year under the sponsorship of a Yale faculty member. Similar to other research courses except that a more substantial portion of a student's time and effort should be spent on the research project (a minimum of twenty hours per week). To register, the student must submit a written plan of study approved by the faculty instructor to the EEB faculty in charge. Students should attach a two-page proposal of the planned research. This should include an introduction covering why this research is interesting and important and an outline of the research methodology to be used. Students are encouraged to apply during the preceding term. Proposals must be submitted no later than the first day of the second week in the term in which the student enrolls in the Intensive Senior Research. The final paper is due in the hands of the EEB faculty in charge by the last day of reading period in the term of enrollment. Please attach this form to your proposal and return to the EEB faculty in charge office. One term of intensive research fulfills a portion of the senior requirement for the B.S. degree.</p>		
<b>TO THE RESEARCH MENTOR</b>		
<p>By signing this form, you agree to supervise the student's project. You also agree to grade the final paper and report a grade to the EEB DUS based on exam(s) or term paper. This should be reported no later than the last day of the final examination period. Notification by email is acceptable and preferred to the EEB faculty in charge: <a href="mailto:marta.wells@yale.edu">marta.wells@yale.edu</a> (or the assistant, EEB Registrar: <a href="mailto:deanna.brunson@yale.edu">deanna.brunson@yale.edu</a> ).</p>		
<b>MENTOR'S INFORMATION</b>		
Mentor's Name:		
Mentor's Email:		
Mentor's Phone:		
Mentor's Signature:		
Date:		
<b>FACULTY APPROVAL</b>		
EEB Faculty in Charge Signature:		
Date:		

# Senior Essay

## Department of Ecology and Evolutionary Biology

Submission Date:	Semester:	
<b>STUDENT INFORMATION</b>		
Student's Last Name:	First:	Middle:
Email Address:		
Class:	Student ID:	Cell Phone:
Topic for Senior Paper:		
B.A. Senior Requirement:	YES	NO
Student's Signature:		
Date:		
<b>DESCRIPTION OF SENIOR ESSAY REQUIREMENTS</b>		
<p>The senior essay is graded, but it carries no course credit. The senior essay should be a critical evaluation of some portion of the current, primary biological literature. The topic may be anything within the realm of biology or it may explore the relationships of biology to other fields. Each student must obtain approval of the paper topic from a member of the EEB department to assure that the subject is a promising one. The paper is to be 20 double-spaced pages, not including bibliography. The faculty in charge of senior projects will ask a faculty advisor to read and grade each paper. Students may suggest readers if they wish. Papers are to be submitted to the student's senior essay advisor and a copy to the faculty in charge of the senior projects. Normally, a letter grade is reported to the registrar by the faculty in charge. If the essay is "Unsatisfactory", the student may make arrangements with the DUS to submit another paper. Papers received late may not be processed before Commencement.</p> <p>Hints for finding a faculty member to advise on senior essay: First decide on the general area you would like to explore in your senior essay. Then try to find which faculty member might have an interest or expertise in that area. The best sources are the faculty member's own website, and the EEB department booklet, available from the office of the faculty in charge (OML 103), on "Faculty Research Interests." Second, if a faculty member discussed the topic in a course, he/she would be a good choice. Otherwise, look through the Yale College Program of Study to see which faculty member teaches a course that includes your prospective topic. Approach the faculty member identified above. If he/she is not the best person to advise you on your topic, the faculty member should know who would be more knowledgeable in your area. Your senior essay advisor will often not be the same advisor that signs your course listings. In discussion with the essay advisor, narrow your area of interest to a focused topic on which you can write in depth; a superficial review of a broad field is not appropriate. The advisor may also suggest a few references to start off your reading in the field.</p>		
<b>TO THE SENIOR ESSAY MENTOR</b>		
<p>By signing this form, you agree to supervise the student's senior essay project and provide the necessary support. You also agree to grade the final paper and report a grade to the EEB DUS. This should be reported no later than the last day of the final examination period. Notification by email is acceptable and preferred to the EEB faculty in charge: <a href="mailto:marta.wells@yale.edu">marta.wells@yale.edu</a> (or the assistant, EEB Registrar: <a href="mailto:deanna.brunson@yale.edu">deanna.brunson@yale.edu</a> ).</p>		
<b>MENTOR'S INFORMATION</b>		
Mentor's Name:		
Mentor's Email:		
Mentor's Phone:		
Mentor's Signature:		
Date:		
<b>FACULTY APPROVAL</b>		
EEB Faculty in Charge Signature:		