Undergraduate Handbook
Integrative Biology

University of California, Berkeley

http://ib.berkeley.edu/undergrad/

INTEGRATIVE BIOLOGY

Undergraduate Affairs Office

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WELCOME and INTRODUCTION

Welcome to Integrative Biology (IB) at UC Berkeley

Congratulations on exploring Integrative Biology as your prospective major! This is an exciting time in biology on the Cal campus, as much of the groundbreaking and innovative research is being done in our department. Before choosing this major, you will have many opportunities to get involved and really become part of the IB community. We hope that you find this handbook a useful guide for the major. Please know that if you have any questions not covered in our handbook, we welcome you to stop by the office and talk with the IB peer and staff advisors. We are always here to help! Again, welcome to IB and we are looking forward to working with you!

The Department of Integrative Biology offers a program of instruction that emphasizes how structure, function, and process integrate to influence the biology, ecology, and evolution of organisms. It investigates integration at all levels of organization from molecules to the biosphere, and across all branches of the tree of life: plants, animals, fungi and microbes.

IB draws from many traditional and emerging fields, and levels of biological organization in forging new research directions and answering traditional questions in new ways. The faculty has strengths in the disciplines of functional morphology, organismal physiology, animal behavior, biomechanics, ecology, systematic biology, paleo-biology, population genetics, and evolution.

Students who major in Integrative Biology will gain both broad and deep knowledge in the biological sciences, which provides an excellent foundation for those interested in the biology of organisms, populations, and communities, particularly students who might wish to pursue graduate studies in any of the sub-disciplines listed above or related emerging research areas. It also provides superb training for students interested in health-related professions (medicine, dentistry, veterinary medicine, physical therapy, optometry, etc.) or allied careers in human biology (e.g., psychology, sociology, demography, political science, environmental and resource management, law, etc.).

Through laboratory and/or field courses, independent research projects, or involvement in faculty or graduate student research, students will gain an understanding of scientific logic and methods, through experimental or comparative approaches, including the investigation of historical patterns and processes.

All IB students receive a Bachelor of Arts degree in Integrative Biology upon graduation. The first two years of coursework are similar for all IB majors. Juniors and seniors are then expected to take the courses specified for their particular track. It is critical that students contact a staff advisor or faculty advisor early in the decision-making process. These advisors are here to help, are your advocates, and can provide essential information and guidance.

IB Major Descriptions

TRACK 1: ECOLOGY, EVOLUTION AND ORGANISMAL BIOLOGY

Organismal diversity is the centerpiece of modern biology; efforts to characterize, understand, and protect this diversity underlie the research programs of many faculty in Integrative Biology. This diversity encompasses not just different taxonomic groups but also levels of organization, thereby providing the foundation for a comprehensive understanding of biology. The Ecology, Evolution and Organismal Biology track in the IB major will provide students with the broad expertise in biology needed to pursue graduate study and employment in this field while at the same time allowing students considerable opportunity to explore those aspects of biology that most capture their individual interests. We believe that undergraduates from our major, particularly those who have pursued honors research, should be exceptionally well prepared and highly competitive for admission to graduate study in their chosen area of biology.

TRACK 2: HUMAN BIOLOGY AND HEALTH SCIENCES

Health sciences in the 21st century will increasingly require a broad and integrated understanding of humans—their origins, diversity and interactions with their environment. IB is uniquely positioned to provide this perspective on human biology for students pursuing health-related careers. The creation of a Human Biology and Health Sciences track recognizes that IB is actively engaged in meeting the educational needs of students interested in the health sciences. Students also fulfill some major requirements by studying non-human organisms. We believe that this structure will address the intellectual desires of students in health sciences and make them very strong candidates for medical school and related career choices.

Advising and Student Services

IB has three levels of undergraduate advising: staff advising, faculty advising and peer advising.

UNDERGRADUATE STUDENT SERVICES OFFICE & STAFF ADVISORS

Staff advisors are trained to support students and assist them in successfully completing their IB major. They are excellent resources for questions concerning administration and academics, or finding out about other available services. Students should see a staff advisor to

- ask questions about major requirements,
- ask for advice about schedule planning,
- begin the process of declaring the IB major,
- discuss research opportunities, graduate & professional schools, career opportunities, scholarships and internships,
- get their Advisor Code (AC) to access Tele-BEARS registration,
- get information and course control numbers for independent research,
- request general assistance, advice or information, and
- find out about upcoming events and programs.
- ask questions about eligibility and requirements for IB honors program.

Go here for open hours during fall, spring, and summer in 3060 Valley Life Sciences Building.

FACULTY ADVISORS

Students are welcome to talk to an IB Faculty for advising.

- Your advisor can assist with questions about coursework to fulfill requirements and career goals.
- He/She can be a good mentor for your present and future goals.
- Share your future goals with your faculty advisor, even if they might change, including what has inspired you to establish such goals.
- Discuss potential research ideas.
- Seek Research Sponsorship for IB research courses.
- Request course substitution request.

We also encourage you to meet and talk to other IB faculty, particularly those conducting research in areas that interest you.

PEER ADVISORS

The Peer Advising Program provides an excellent service to IB students and the department. Our IB peer advisors

- advise undeclared students,
- share firsthand knowledge of course demands,
- make suggestions on course combinations,
- provide general information about applying to medical, pre-health professional, professional careers, and graduate schools, and
- are a great resource for information about many other student experiences.

Go here for open hours (fall and spring only) in 3060 Valley Life Sciences Building.

Major Course Requirements

Requirement Area	Track 1: Ecology, Evolution & Organismal Biology	Track 2: Human Biology & Health Sciences
Group A: Evolution & Genetics	1 course	1 course
Group B: Ecology, Behavior & Diversity	2 courses	1 course
Group C: Structure, Function & Human Health	1 course	2 courses: Either IB 131 or IB 132 and one additional course
Lab / Field Lab	2 courses: 1 lab and 1 field lab, or 2 field labs	2 courses: Chosen from list of labs and field labs.
Elective(s)	Additional approved electives to total upper-division units to 24	Additional approved electives to bring your total upper-division units to 24

REQUIREMENT GROUP A: EVOLUTION & GENETICS

Course Number	Units	Title	Semester Expected
IB 141	3	Human Genetics	Each summer
IB 160	4	Evolution	Each fall
IB 161	4	Population & Evolutionary Genetics	Spring – Odd years
IB 162	4	Ecological Genetics	Fall – Even years
IB 163	4	Molecular Evolution	Not currently offered
IB 164	4	Human Genetics & Genomics	Fall & Summer
IB 167	4	From Fossils to Genes	Spring- Even years
IB 169	4	Evolutionary Medicine	Each spring

REQUIREMENT GROUP B: ECOLOGY, BEHAVIOR & DIVERSITY

Course Number	Units	Title	Semester Expected
IB 102LF++	4	California Plants	Spring – odd years
IB 103LF++	5	Invertebrate Zoology	Spring – even years
IB 104LF++	5	Natural History of Vertebrates	Each spring
IB C107L ++	4	Principles of Plant Morphology	Each fall
IB C110L	4	Biology of Fungi	Fall – even years
IB 113L	4	Paleobiology: Ecology & Evolution	Each spring
IB C144	4	Animal Behavior	Each fall
IB 146LF++	5	Behavioral Ecology	Spring – odd years
IB 151	4	Plant Physiological Ecology	Spring – odd years
IB 152	4	Environmental Toxicology	Not currently offered

IB 153	3	Ecology	Each fall
IB 154	3	Plant Population & Community Ecology	Fall – odd years
IB C155	3	Holocene Paleoecology	Spring – even years
IB C156	4	Conservation Biology	Each fall
IB 157LF++	4	Ecosystems of California	Each fall
IB C158LF ++	13	Biology & Geomorphology of Tropical Islands	Each fall
IB 159	3	The Living Planet: Impact of Biosphere	Each fall – odd years
IB 162	4	Ecological Genetics	Fall – even years
IB 166	4	Evolutionary Biogeography	Spring – even years
IB 167	4	From Fossils to Genes	Spring – even years
IB 168L	4	Systematics of Vascular Plants	Spring – even years
IB 170LF	3	Community Ecology Lab	Spring – odd years
IB 173LF++	5	Mammalogy	Fall – even years
IB 174LF++	4	Ornithology	Spring – odd years
IB 175LF++	4	Herpetology	Spring – odd years
IB C176L++	3	Fish Ecology	Each spring
IB 181L++	3	Paleobotany	Spring – even years
IB 183L++	4	Evolution of Vertebrates	Spring – odd years
IB C185L++	5	Human Paleontology	Spring – odd years
IB C187	3	Human Biogeography of the Pacific	Not currently offered

LF = Acceptable for Field Lab requirement for Track 1
++ = Satisfies TWO requirements within IB. OK for Requirement Group B and Lab or Field Lab.

REQUIREMENT GROUP C: STRUCTURE, FUNCTION & HUMAN HEALTH

Course Number	Units	Title	Semester Expected
IB 115	4	Intro to Systems in Biology & Medicine	Not currently offered
IB 116L++	4	Medical Parasitology	Each summer
IB 117	2	Medical Ethnobotany	Each fall & summer
IB 118	4	Host-Pathogen Interactions: Transdiscipline	Each fall
IB 123AL++	5	Exercise Physiology (reqs IB 132)	Each fall
IB C125L++	4	Intro to Biomechanics & Human Movement	Each fall
IB 127L++	3	Motor Control (reqs IB 132)	Not currently offered
IB 128	3	Sports Medicine	Each summer
IB C129L++	3	Physiology Assessment	Each spring
IB 131	3	Human Anatomy	Each fall & summer
IB 132	3	Human/Mammalian Physiology	Each spring & summer
IB 135	4	Mechanics of Organisms	Spring - even years
IB 137	4	General Endocrinology	Each fall
IB 138	4	Comparative Endocrinology	Each spring
IB 139	3	The Biology of Stress	Each fall
IB 140	4	Human Reproduction	Each spring
IB C142L++	6	Human Osteology	Spring – even years

IB C143A	3	Biological Clocks	Not currently offered
IB C143B	3	Hormones & Behavior	Each spring
IB 148	3	Comparative Animal Physiology	Fall – even years
IB 150	3	Evolutionary Environmental Physiology	Each spring
IB 151	3	Plant Physiological Ecology	Spring – odd years
IB 184L++	4	Morphology of Vertebrate Skeleton	Spring – odd years

++ = SATISFIES TWO REQUIREMENTS WITHIN IB. OK FOR REQUIREMENT GROUP C AND LAB.

COURSES ACCEPTABLE FOR IB LAB OR FIELD LAB (LF) REQUIREMENT

Course Number	Units	Title	Semester Expected
IB 102LF++	4	California Plants	Spring – odd years
IB 103LF++	5	Invertebrate Zoology	Spring – even years
IB 104LF++	5	Natural History of Vertebrates	Each spring
IB C107L++	4	Principles of Plant Morphology	TBA
IB 113L++	4	Paleobiology: Ecology & Evolution	Each spring
IB 116L++	4	Medical Parasitology	Each summer
IB 117LF++	2	Medical Ethnobotany Lab	Each fall & summer
IB 123AL++	2	Exercise Physiology	Each fall
IB C125L++	4	Intro to Biomechanics & Human Movement	Each fall
IB 127L++	1	Motor Control	No longer offered
IB C129L++	3	Physiology Assessment	Each spring
IB 131L	2	Human Anatomy	Each fall, summer
IB 132L	2	Human/Mammalian Physiology	Each spring, summer
IB C135L++	3	Mechanics of Organisms	Not currently being offered
IB C142L++	6	Human Osteology	Spring – even years
IB 146LF++	5	Behavioral Ecology	Spring – odd years
IB 151L	2	Plant Physiological Ecology	Spring – odd years
IB 154L	2	Plant Population & Community Ecology	Fall – odd years
IB 157LF++	4	Ecosystems of California	Each fall
IB C158 LF++	13	Biology & Geomorphology of Tropical Islands	Each fall
IB 168L++	4	Systematics of Vascular Plants	Spring – even years
IB 173LF++	5	Mammalogy	Spring – even years
IB 174LF++	4	Ornithology	Spring – odd years
IB 175LF++	4	Herpetology	Spring – odd years
IB C176L++	3	Fish Ecology	Spring – odd years
IB 181L++	4	Paleobotany	Fall – even years
IB 183L++	4	Evolution of Vertebrates	Spring – odd years
IB 184L++	4	Morphology of Vertebrate Skeleton	Spring – odd years
IB C185L++	5	Human Paleontology	Spring – odd years

LF = Acceptable for the Field Lab requirement for Track 1

++ = Satisfies TWO requirements within IB. OK for Group Requirement and Lab.

Courses "Pre-approved" for IB Upper Division Electives

No more than TWO upper-division courses from other departments may be taken as electives toward the minimum 24 upper-division unit requirements.

- The courses listed below have been approved by the IB faculty, and may be taken as electives without further approval from an IB Faculty Advisor.
- Students are responsible for determining that they have adequate prerequisites and background when enrolling in courses in other departments. If used for the major as an elective, such courses MUST be completed for a letter grade.
- The courses on this list may NOT be taken to satisfy Requirement Groups A, B, or C, or the IB lab requirement.

Course Number	TITLE	UNITS	Semester Expected
Bioengineering			
BioE 102	Biomechanics	4	Fall & Spring
BioE 110	Biomedical Physiology for Engineers	4	Spring
BioE C119/ME C176	Orthopaedic Biomechanics	4	Fall
Chemistry			
Chem 135	Chemical Biology	3	Fall
Environmental Science, Policy and Management			
ESPM 111	Ecosystem Ecology	4	Spring
ESPM 114	Wildlife Ecology	3	Spring
ESPM 132	Spider Biology	4	Spring
ESPM 144	Insect Physiology	3	Spring
ESPM 173	Introduction to Analysis of Ecological Data	3	Spring
***ESPM 174**	Design and Analysis of Ecological Research	4	Fall
*** = Advanced Course**			
Geography			
GEOG 148	Biogeography	4	Fall
Letters & Science			
Letters & Science 121	Origins in Science & Religion	4	Not currently offered
Integrative Biology			
IB C216 (ESPM C216)	Freshwater Ecology		Spring
Molecular and Cell Biology			
MCB C100A	Biophysical Chemistry	4	Fall
MCB 102	Biochemistry	4	Fall, Spring, Summer
MCB 104	Genetics, Genomics and Cell Biology	4	Fall, Spring
MCB C112/PMB C112	General Microbiology	4	Fall
MCB 135A	Molecular Endocrinology	3	Every other Fall
***MCB 136**	Advanced Physiology	4	Fall
***Students who take IB132 cannot also receive elective credit towards the major for MCB136.**			
MCB 140	General Genetics	4	Fall
MCB 150	Molecular Immunology	4	Fall, Spring
MCB 160	Cellular and Molecular Neurobiology	4	Fall
Plant & Microbial Biology			
PMB C112/MCB C112	General Microbiology	4	Fall
Psychology			
PSYCH 110	Biological Psychology	3	Spring, Summer
Psych 121	Animal Cognition	3	Spring
Public Health			
PH 162A	Public Health Microbiology	3	Fall, Summer

EAP Pre-approved courses for the IB Major

Australia University (Australia)

Course Number	Units	Title	Major Requirement
Biol 130	4	Animal Physiology	Group C
Env Sci 117	4	Revegetation & Land Restoration	Group B
Biol 134	4	Ecology	Group B

Marine Bio and Terrestrial Ecology Program, University of Queensland (Australia)

Course Number	Units	Title	Major Requirement
Biol 160	8.7	Marine Biology	Group B and Field Lab
Biol 106	5.7	Human and Terrestrial Ecology	Group B and Field Lab

Bordeaux University (France)

Course Number	Units	Title	Major Requirement
Biol 106	4	Animal Physiology	Group C
Bio C 100	4.3	Molecular and Functional Genetics	Group A
ENV S 109	4	Ecology and Planning	Group B
Biol 111	5.7	Cellular Biology and Development	Group C and Lab

University of Cape Town (South Africa)

Course Number	Units	Title	Major Requirement
Biol 111	8	Applied Physiology	Group C and Lab
Biol 108	8	Macro Evolution	Group A
Biol 102	4	Principles of Evolution	Group A
Biol 115	8	Global Change Ecology	Group B
ENV S 139	8	Ecosystem Ecology	Group B and Lab

Tropical Biology and Conservation, Monteverde University (Costa Rica)

Course Number	Units	Title	Major Requirement
Biol 101	2.7	Tropical Diversity	Group B

Biol 102	2.7	Tropical Community Ecology	Group B with Field Lab
Biol 188	2.7	Tropical Research Practicum	Group B with Field Lab

University of Copenhagen (Denmark)

Course Number	Units	Title	Major Requirement
Biol 125	4	Microbial Ecology	Lab Requirement
Biol 131	4	Archea Biology	Elective

University of Bologna (Italy)

Course Number	Units	Title	Major Requirement
Biol 177	3	Anthropological Genetics	Group A

Lund University (Sweden)

Course Number	Units	Title	Major Requirement
Biol 145	8	Molecular Genetics	Group A
Biol 150	8	Advanced Ecology	Group B and Field Lab

Summer Programs

National University of Singapore

Course Number	Units	Title	Major Requirement
BioSci 180 S	5.3	Field Studies in Biodiversity	Group B and Field Lab

Cambridge University, Pembroke/King's College (United Kingdom)

Course Number	Units	Title	Major Requirement
Biol Scis 100S	3	Behavioural Ecology	Group B
Biol Scis 105S	3	Issues in Neuroscience	Elective
Biol Scis 115S	3	Principles of Cell Signaling	Elective

Physics Summer Programs

International Summer School, University of Sussex (United Kingdom)

Course Number	Units	Major Requirement
Physics I & II	8	IB Physics Requirement

Science Summer School, University of Glasgow (United Kingdom)

Course Number	Units	Major Requirement
Physics I & II	8	IB Physics Requirement

Science & Engineering Summer School, University College Dublin (Ireland)

Course Number	Units	Major Requirement
Physics for Life Sciences I & II	8	IB Physics Requirement

Declaring the Major

ELIGIBILITY TO DECLARE

In order to declare IB as a major, students must have completed

- The math series: For students who enter Cal as freshmen in fall 2012, this means either Math 1A/1B or Math 10A/10B. For students who were admitted to Cal as freshman in fall 2015, Math 10A and Math 10B are the requirement.
- Chem 1A/1AL - General Chemistry
- Chem 3A - Organic Chemistry
- Either Biology 1A/1AL or Biology 1B
- At the time of declaration, you must be enrolled in or have completed Chem 3B OR the 2nd biology course, and must have scored an average or better on the course midterm exam.
- The average GPA in courses for the major must be > or equal to 2.0.

Transfer Students:

It is recommended that lower division courses be completed before arriving at Berkeley. This is recommended for two main reasons:

- The College of Letters & Science sets a limit to the number of semesters or units you may accrue after transferring.
- You MUST declare a major by the time you have completed 90 units (including those in progress). This means that transfers, by definition, must declare during their second semester.

Transfers should also:

- have completed one semester at Cal with an average of 2.0 in all courses taken for the IB major, and
- have completed all lower-division courses, excluding the physics series, having earned a GPA of 2.0 or above in those courses.

DECLARATION PROCESS

1. Create a plan:
   - Decide on a major track.
   - Review all of the major requirements.
   - Complete the IB Major Planning Checksheet.
   - Contact the USSO for more information.
2. **Click Here to begin the declaration process. Come by the Undergraduate Student Services Office (USSO), no earlier than the next day.
   - We need time to review your plan.
   - We recommend you complete this during weeks 1-8 of fall or spring.
3. Discuss your past coursework and future academic plan with a staff advisor in the USSO.
4. Meet with your Faculty Advisor, review the completed paperwork, obtain advice, and signature*
5. Return the signed form to the Intake Advisor in 3060 VLSB, who will then officially declare in the student systems.*
6. You will appear officially declared approximately a week subsequent to that submission.

*Required only for students declaring with <2.5 GPA in lower-division, upper-division or major gpa. Optional for students with 2.5 GPA or higher.

IB MAJOR PROBATION POLICY

An IB major must maintain a 2.0 grade point average (GPA) in the complete set of all major and upper-division courses taken for the major. Students for whom either GPA calculation falls below 2.0 will be placed on departmental probation for the following semester. If placed on probation, the student has one semester to raise both GPAs to the required 2.0, and will be subject to dismissal from the major if this is not achieved. The decision to dismiss will be made by the Undergraduate Achievement & Adviser Committee and communicated to the student before the following semester begins. If dismissed from the major, students must work with an L&S advisor in order to pursue another major.

Questions concerning the IB probation and dismissal policy may be directed to the staff advisors in the IB Undergraduate Student Services Office.

Research in the Major

UC Berkeley is a world-renowned research institution, with many opportunities for undergraduates. You are not limited to research in an IB lab—explore your options and spend your time doing research that you find interesting and fulfilling. Start looking for a research position early! There are a number of resources available to help you determine whether or not research is for you and if so, how you'd go about setting it up.

RESOURCES FOR FINDING RESEARCH POSITIONS

1. Online Resources;
    - Undergraduate research: http://research.berkeley.edu.
    - Search for faculty by keywords: http://vcresearch.berkeley.edu/faculty-expertise
2. Talk to people who are involved in research
    - Peer advisors. Learn how they found their research positions and hear about their experiences.
    - IB Professors & Faculty Advisors.
        - Check out the IB Faculty Research webpage, http://ib.berkeley.edu/research/interests/ and determine which labs you are interested in.
        - Before contacting a professor, **review some of the latest publications** that have come out of his/her lab. You are not expected to understand the articles completely, but if you read some articles and try to understand the professors' research, they will be more convinced of the seriousness and depth of your interest.
        - **Set up appointments to meet with the professors you have selected.** When calling or emailing professors, it is more effective to express interest in their particular field of research and what you would like to discuss with them than simply asking, "Do you have space in your lab?" Once you make an appointment, keep the appointment and be on time! Otherwise, faculty may be less willing to make other appointments with you.
        - **Bring a resume, contact information, and your most recent UC Berkeley transcript** (an unofficial copy is fine) to your appointment with a professor. Professors often find this information useful so having it on hand is a good idea.
        - During your appointment, **ask the professor if he/she would have available space to accept you into his/her group to do an independent research project.** Professors want students who are genuinely interested in their research, not students who are primarily interested in improving their resume. Be prepared to discuss the professor's work intelligently. Since there is so much competition for IB positions, it is wise to approach your search for a lab position with the same degree of professionalism with which you would approach any job search.
        - **Clearly indicate whether you are seeking a paid position or seeking work for academic credit.** In almost all cases, professors only offer unit credit during the academic year. Some professors will pay summer salaries to you if you continue into the summer after already working in the lab for the fall and spring. Discuss whether you would like to take IB 199 or, if you are eligible, H196A/B (honor research credit – see section on Honors). Be sure to find out how many hours a week the professor expects you to work. If you're going to earn units, 3 hours/week = 1 unit, during a 15 week semester.
    - Check out this additional IB research website for more guidelines and tips http://ib.berkeley.edu/undergrad/research.php
    - GSIs. Ask them about their research experiences (undergraduate and graduate) and find out how they got started.
3. Attend a research workshop sponsored by the Haas Scholar's Program. See http://research.berkeley.edu/resources.php for specific dates and times.
    - Workshop A – Getting started in undergraduate research.
    - Workshop B – How to write a research proposal.
4. Apply to Structured Research Programs, such as the Undergraduate Research Apprenticeship Program (URAP), at http://research.berkeley.edu/urap,
5. Visit here for a list of summer research programs and opportunities.
6. Sign up for research mailing lists.
    - Research listserv (Office of Undergraduate Research @ Berkeley), http://research.berkeley.edu/listserve.php
    - Health & Pre-Med Career Mail (Career Center), http://callisto.berkeley.edu.
7. Diversify your interests. Look in places outside of the IB department.
    - Non-IB departments. Anthropology, Chemistry, Environmental Science, Policy and Management, Molecular and Cellular

Biology, Nutritional Sciences and Toxicology, Plant and Microbial Biology, Psychology-Biopsychology Group, and Public Health, just to name a few.

- Off-campus sites. Lawrence Berkeley National Laboratories (LBNL), Children's Hospital Research Institute (CHORI), and University of California, San Francisco (UCSF) are three examples and the most popular choices.

EARNING IB CREDIT FOR RESEARCH

A large percentage of IB majors gain valuable experience in scientific research under the guidance of a faculty sponsor and may receive academic credit for their work by enrolling in an independent study course such as IB 99, IB 199, IB 191 or IB H196A & H196B (the honors program)

IB 99 and IB 199 are courses that are open to students with adequate backgrounds and have arranged to work in a laboratory under the supervision of a UCB faculty member. (Research is not restricted to IB labs.) IB 191 is intended for advanced undergraduates wishing to pursue independent research projects under the mentorship of an IB faculty member.

IB 99 – Supervised Independent Study, variable units (1-4) – For students with freshman or sophomore standing (up to 60 units completed). You must have a minimum UCB GPA of 3.4.

IB 199 – Supervised Independent Study, variable units (1-4) – For students with junior or senior standing (60 or more units completed). You must have a minimum UCB GPA of 2.0.

IB 191 – Directed Undergraduate, 3 units – For declared IB students with 2.0 GPA in all major coursework.

General Information about IB 99/199

- Courses must be taken on a P/NP basis.
- 1 unit of credit equals 3 hours/week worked in the lab (or 45 hours/semester).
- You cannot aggregate more than 4 units of credit for independent studies or group studies in a single semester (courses numbered 98, 198, 99, or 199).
- You cannot earn credit for research for which you are getting paid.

To receive IB 99 or 199 credit for research, you must:

- Find a UCB faculty member to sponsor your research,
- Submit a completed IB 99 or 199 application (an application must be submitted each semester for which you wish to receive IB 199 credit) to an advisor in the Undergraduate Affairs Office before the add/drop deadline, in order to obtain the course control number to add on Tele-BEARS, and
- Submit a written report on the research project to your UCB sponsor at the end of each semester for which you receive IB 199 credit. Be sure to clarify these guidelines with your PI and/or faculty sponsor at the beginning of the semester.

General Information about IB 191

- Course must be taken on a letter grade basis for 3 units.
- You cannot earn credit for research for which you are getting paid.

To receive IB 191 credit for research, you must:

- Find an IB faculty member to sponsor your research,
- Submit a completed IB 191 application (an application must be submitted each semester for which you wish to receive IB 191 credit for a maximum of two semesters) to an advisor in the Undergraduate Affairs Office before the add/drop deadline, in order to obtain the course control number to add on Tele-BEARS, and
- Submit a final project to your UCB sponsor at the end of each semester for which you receive IB 191 credit. Be sure to clarify these guidelines with your PI and/or faculty sponsor at the beginning of the semester.

See next page for info about H196.

Departmental Honors

The honors program in Integrative Biology provides an exciting opportunity to gain valuable professional experience by working closely with a faculty Principal Investigator (PI) and/or IB faculty sponsor to complete an original research project. It is also a great way to receive recognition for your outstanding academic achievements. Students who fulfill all IB Honors criteria receive a notation on their transcript and diploma.

ELIGIBILITY TO PARTICIPATE IN HONORS

You must

- secure a research position in a lab and have an IB faculty research sponsor, and
- currently have (and maintain) a 3.3 GPA overall AND in the IB major
- enroll in IB H196A/B by submitting a completed application each semester

REQUIREMENTS TO GRADUATE WITH HONORS

You must

- write an honors thesis approved by your faculty sponsor to be turned in to the sponsor by the last day of instruction.
- present a poster describing their findings at Cal Day (a public event held each April), and to participate in several social events aimed at sharing their findings with the IB community,
- complete at least two semesters of research including 3 units each of IB H196A/B,
- have a cumulative UCB GPA of at least 3.3 or higher in all work completed at UCB, and
- have an IB major GPA of 3.3 or higher.

CALCULATING THE HONORS GPA

- We will not round any GPA. For example 3.295 does not equal a 3.3 and therefore is not eligible for honors.
- We will calculate Honors GPA based on grades earned in LD and UD courses for the major requirements.
- Your GPA calculation will be based upon the grades in the courses you have taken to date, including electives for the major.
- The grade earned in H196A will be included in GPA calculation for GPA eligibility of 3.3 or higher to enroll in H196B.
- The grade earned in H196B will be included in GPA calculation for GPA eligibility of 3.3 or higher to *graduate* with IB Honors.

Additional information on H196 and receiving honors is available in the UAO.

HONORS COURSES H196A/H196B

General Information

- H196A and H196B are 3 units each
- Both courses must be taken for a letter grade

Signing up for H196A/H196B

- If your PI is not a UCB faculty member, you need to have a UCB faculty member sponsor your research and assign a grade,
- Pick up an application from the UAO, 3060 VLSB,
- Write up a description of your project and take the form to your PI for his/her signature (UCB faculty sponsor if PI is not in IB department), and submit your completed IB H196A/H196B application to an advisor in the UAO by the end of the 5th week.

Beyond the B.A. in IB

MEDICAL SCHOOL & OTHER HEALTH SCHOOLS

There are numerous resources for students interested in a health-related career. Most importantly, the Career Center has counselors who are trained to work with pre-health students (this includes pre-med). You can make appointments with them through their website and also gain access to a wealth of information about timing, planning, special programs, recommendations for courses, MCAT preparation, and the application process. Here are some valuable web resources:

- The Career Center, http://career.berkeley.edu/health/health.stm, for appointments with pre-health counselors, numerous resources and peer advising (https://career.berkeley.edu/Peers/Peers.stm).
- Cal Biology / Pre-Health Clubs: https://career.berkeley.edu/Health/CalClubs.stm
- Career Services One Stop Access: http://callisto.berkeley.edu, a student portal, of sorts, for Career Services.
- Medical School Admissions Requirements (MSAR): https://www.aamc.org/students/applying/ or come in to the IB USSO to view a previous version of the most recent book. The Career Center also has the current MSAR available for viewing.

GRAD SCHOOL IN BIOLOGICAL SCIENCE

Many of you will want to go on to graduate school in order to pursue careers as research scientists, teachers or professors. In addition to excellent academic achievement in appropriate courses and on entrance exams, such as the GRE, laboratory experience is generally required for pursuing graduate study in a biological science. Be sure to talk to your faculty advisors about your interest in graduate school. The Career Center has many resources to draw from, such as workshops, a letter service, individual counseling, graduate school fairs, and more:

- http://career.berkeley.edu/grad/grad.stm

CAREER OPTIONS WITH A B.A. IN IB

Students with undergraduate degrees in IB have many different career options. Here are some examples:

Laboratory technicians at universities, biotech companies, pharmaceutical companies, and research institutes • animal behavior/training • ecologist • environmental biologist and consultant • paleontology • medicine • pharmacy • dentistry • optometry • public health • public policy • education • science editing, writing, and illustration • museum scientist and curator • forest ranger • zoology

For more information about career opportunities, make an appointment with a career counselor at the Career Center.

- http://callisto.berkeley.edu

For more information about what kind of careers, graduate schools, and other opportunities are IB alumni have:

- https://career.berkeley.edu/Survey/Survey

You may want to begin gathering preliminary information about career choices by visiting the Career and Educational Guidance Library. It's housed in the small building directly in front of the Tang center. They offer resources to help you assess where you may want to head in the future:

- http://www.uhs.berkeley.edu/Students/careerlibrary/index.shtml

Appendix 1: Course descriptions

LOWER-DIVISION REQUIREMENTS FOR THE IB MAJOR

Mathematics 10A: Methods of Mathematics: Calculus, Statistics, and Combinatorics (4 Units)

Students will receive 2 units for 10A after taking 1A. 3 hours of lecture and 3 hours of discussion per week. *Prerequisites: Three and one-half years of high school math, including trigonometry and analytic geometry. Consult the mathematics department for details.* This sequence is intended for majors in the life sciences. Introduction to differential and integral calculus of functions of one variable. Representation of data, elementary probability theory, statistical models, and testing.

Mathematics 10B: Methods of Mathematics: Calculus, Statistics, and Combinatorics (4 Units)

Students will receive 2 units for 10B after taking 55. 3 hours of lecture and 3 hours of discussion per week. *Prerequisites: Continuation of 10A. Consult the mathematics department for details.* This sequence is intended for majors in the life sciences. Elementary combinatorics and discrete probability theory. Introduction to graphs, matrix algebra, linear equations, difference equations, and differential equations.

Chemistry 1A: General Chemistry (3 units)

Prerequisites: High school chemistry recommended. Credit option: Students will receive no credit for 1A after taking 4A. Description: Stoichiometry of chemical reactions, quantum mechanical description of atoms, the elements and periodic table, chemical bonding, real and ideal gases, thermochemistry, introduction to thermodynamics and equilibrium, acid-base and solubility equilibria, introduction to oxidation-reduction reactions.

Chemistry 1AL: General Chemistry Laboratory (1 unit)

Students will receive no credit for 1AL after taking 4A. One hour of lecture and three hours of laboratory per week. *Prerequisites: 1A (may be taken concurrently).* An experimental approach to chemical sciences with emphasis on developing fundamental, reproducible laboratory technique and a goal of understanding and achieving precision and accuracy in laboratory experiments. Proper use of laboratory equipment and standard wet chemical methods are practiced. Areas of investigations include chemical equilibria, spectroscopy, nanotechnology, green chemistry, and thermochemistry. Concurrent enrollment in 1A is recommended.

Chemistry 3A: Chemical Structure and Reactivity (3 units)

112A will restrict credit if completed before 3A. Three hours of lecture per week. *Prerequisites: 1A with a grade of C- or higher, or a score of 4 or 5 on the Chemistry AP test.* Introduction to organic chemical structures, bonding, and chemical reactivity. The organic chemistry of alkanes, alkyl halides, alcohols, alkenes, alkynes, and organometallics.

Chemistry 3AL: Organic Chemistry Laboratory (2 units)

Students will receive no credit for 3AL after taking 112A. One hour of lecture and four hours of laboratory per week. Prerequisites: 1A and 1AL or equivalent with a grade of C- or higher, or a score of 4 or 5 on Chemistry AP test; 3A (may be taken concurrently). Introduction to the theory and practice of methods used in the organic chemistry laboratory. An emphasis is placed on the separation and purification of organic compounds. Techniques covered will include extraction, distillation, sublimation, recrystalization, and chromatography. Detailed discussions and applications of infrared and nuclear magnetic resonance spectroscopy will be included.

Chemistry 3B: Chemical Structure and Reactivity (3 units)

Students will receive no credit for 3B after taking 112B. Three hours of lecture per week. *Prerequisites: 3A with a grade of C- or higher.* Conjugation, aromatic chemistry, carbonyl compounds, carbohydrates, amines, carboxylic acids, amino acids, peptides, proteins, and nucleic acid chemistry. Ultraviolet spectroscopy and mass spectrometry will be introduced.

Chemistry 3BL: Organic Chemistry Laboratory (2 units)

Students will receive no credit for 3BL after taking 112B. One hour of lecture and four hours of laboratory per week. *Prerequisites: 3AL; 3B (may be taken concurrently).* The synthesis and purification of organic compounds will be explored. Natural product chemistry will be introduced. Advanced spectroscopic methods including infrared, ultraviolet, and nuclear magnetic resonance spectroscopy and mass spectrometry will be used to analyze products prepared and/or isolated. Qualitative analysis of organic compounds will be covered.

Biology 1A: General Biology Lecture (3 units)

Prerequisites: A grade of C- or better in Chemistry 3A/3AL or 112A. General introduction to cell structure and function, molecular and organism genetics, animal development, form and function. Intended for biological sciences majors, but open to all qualified students. Sponsored by MCB.

Biology 1AL: General Biology Laboratory (2 units)

Laboratory that accompanies Bio 1A lecture course. Intended for biological science majors, but open to all qualified students. Must be taken concurrently with Bio 1A, unless exempt by major. Sponsored by MCB.

Biology 1B: General Biology (4 units)

Description: General introduction to plant development, form, and function; population genetics, ecology, and evolution. Intended for students majoring in the biological sciences, but open to all qualified students. Students must take both Biology 1A and 1B to complete the sequence. Sponsored by Integrative Biology.

Physics 8A: Introductory Physics (4 units)

Prerequisites: Mathematics 16A or equivalent or consent of instructor. Credit option: Students with credit for 7A will not receive credit for 8A. Description: Introduction to forces, kinetics, equilibria, fluids, waves, and heat. This course presents concepts and methodologies for understanding physical phenomena, and is particularly useful preparation for upper-division study in biology and architecture.

Physics 8B: Introductory Physics (4 units)

Prerequisites: 8A or equivalent. Credit option: Students with credit for 7B or 7C will not receive credit for Physics 8B. Description: Introduction to electricity, magnetism, electromagnetic waves, optics, and modern physics. The course presents concepts and methodologies for understanding physical phenomena, and is particularly useful preparation for upper-division study in biology and architecture.

LOWER-DIVISION IB DEPARTMENTAL COURSES (NOT REQUIRED FOR THE MAJOR)

IB 31: Animal Biology: A Behavioral View (3 units)

Students will receive no credit for 31 after taking C144 or Psychology C115B. Two hours of lecture, one hour of film/demonstration and one hour of discussion per week. *Prerequisites: Open to all students; designed for those not specializing in biology.* Principles of evolution biology as they relate to animal behavior and behavioral ecology with broad coverage of animal groups. Special attention will be paid to the emerging discipline of behavioral ecology. (SP) *Caldwell*

IB 32: Bioinspired Design (3 units)

Students will receive no credit for 31 after taking C144 or Psychology C115B. 2 hours of lecture and 1 hour of discussion per week. *Prerequisites: Open to all students.* Bioinspired design views the process of how we learn from Nature as an innovation strategy translating principles of function, performance and aesthetics from biology to human technology. The creative design process is driven by interdisciplinary exchange among engineering, biology, art, architecture and business. Diverse teams of students will collaborate on, create, and present original bioinspired design projects. Lectures discuss biomimicry, challenges of extracting principles from Nature, scaling, robustness, and entrepreneurship through case studies highlighting robots that run, fly, and swim, materials like gecko-inspired adhesives, artificial muscles, medical prosthetic devices, and translation to start-ups.

IB 35AC: Human Biological Variation (3 units)

Three hours of lecture per week. This course addresses modern human biological variation from historical, comparative, evolutionary, biomedical, and cultural perspectives. It is designed to introduce students to the fundamentals of comparative biology, evolutionary theory, and genetics. This course satisfies the American cultures requirement. (F) *Hlusko*

IB C82: Introduction to Oceans (2 units)

Two hours of lecture per week. *Prerequisites: One of the following courses at high school level: physics, chemistry, or biology is recommended.* The geology, physics, chemistry, and biology of the world oceans. The application of oceanographic sciences to human problems will be explored through special topics such as energy from the sea, marine pollution, food from the sea, and climate change. Also listed as Geography C82 and Earth and Planetary Science C82. (F) *Bishop, Rhew*

IB C96: Studying the Biological Sciences (BSP) (1 unit)

Two hours of lecture per week. Must be taken on a *passed/not passed* basis. *Prerequisites: Consent of instructor.* Freshmen will be introduced to the "culture" of the biological sciences, along with an in-depth orientation to the academic life and the culture of the university as they relate to majoring in biology. Students will learn concepts, skills, and information that they can use in their major course, and as future science professionals. Restricted to freshmen in the biology scholars program. Also listed as Plant and Microbial Biology C96 and Molecular and Cell Biology C96. (F) *Matsui*

IB 98: Directed Group Study (1-4 units)

1-4 hours of directed group study per week. Must be taken on a *passed/not passed* basis. Course may be repeated for credit. Course may be repeated for credit when topic changes. *Prerequisites:* Freshmen and sophomores only, *Consent of instructor*. Lectures and small group discussions focusing on topics of interest, varying from semester to semester.

IB 198: Supervised Group Study and Research By Upper Division Students (1-4 units)

1-4 hours of directed group study per week. Must be taken on a *passed/not passed* basis. *Prerequisites: Consent of instructor.* Undergraduate research by small groups

UPPER-DIVISION IB DEPARTMENTAL COURSES

102LF. Introduction to California Plant Life with Laboratory (4)

Two hours of lecture and six hours of laboratory per week. Prerequisites: Biology 1B or consent of instructor. Formerly 102L. The relationship of the main plant groups and the plant communities of California to climate, soils, vegetation, geological and recent history and conservation. Laboratory will also include at least two Saturday field trips and focus on main plant groups and major plant families in California, and use of keys to identify introduced and especially native pteridophytes, conifers, and flowering plants of the state. Offered alternate years.

103LF. Invertebrate Zoology with Laboratory (5)

Three hours of lecture and six hours of laboratory per week, plus several weekend field trips. Prerequisites: Biology 1A-1B. Formerly 103L. Introductory survey of the biology of invertebrates, stressing comparative functional morphology, phylogeny, natural history, and aspects of physiology and development. Laboratory study of invertebrate diversity and functional morphology, and field study of the natural history of local marine invertebrates.

104LF. Natural History of the Verterates with Laboratory (5)

Three hours of lecture, three hours of laboratory, and a four hour field trip per week, plus special field projects. Prerequisites: Biology 1A-1B. Formerly 104L. Biology of the vertebrates, exclusive of fish. Laboratory and field study of local vertebrates exclusive of fish.

C107L. Principles of Plant Morphology (5)

Two hours of lecture, one hour of discussion, and six hours of laboratory per week. Prerequisites: Biology 1A-1B; must be taken concurrently with 107. An analysis of the structural diversity of multicellular plants, especially the higher forms, with emphasis on the developmental mechanisms responsible for this variation in form and the significance of this diversity in relation to the environments in which plants grow. Also listed as Plant and Microbial Biology C107LF.

C110L. Biology of Fungi with Laboratory (4)

2 hours of lecture and 6 hours of laboratory per week. Prerequisites: Biology 1B. Selected aspects of fungi: their structure, reproduction, physiology, ecology, genetics and evolution; their role in plant disease, human welfare, and industry. Also listed as: PLANTBI C110L.

113L. Paleobiological Perspectives on Ecology and Evolution (4)

Three hours of lecture and three hours of laboratory per week. Prerequisites: Prior biology experience, or consent of instructor. No paleontological or geological background required. Formerly 108. This course will center around answering the following questions: What do the fossil and geologic records have to tell us about the nature of ecological and evolutionary processes? What do they teach us that cannot be learned from the living world alone? In answering these questions, the course will provide an introduction to the analysis of key problems in paleobiology, with an emphasis on how evolutionary and ecological processes operate on geologic timescales.

115. Introduction to Systems in Biology and Medicine (4)

Two hours of lecture and two hours of computer laboratory per week. Prerequisites: Biology 1A, Mathematics 1A or 16B. This course is aimed at students wishing to understand the general principles of how biological systems operate. Topics include feedback regulation; competition and cooperation; genetic switches and circuits; random processes; chaos; mechanisms for error correction; and the properties of networks. Examples are selected from many fields including medicine, physiology, ecology, biochemistry, cell biology, and genetics. Students will learn to conceptualize and quantify interactions within biological systems using simple mathematical models and computer programs. No previous experience in programming is required.

116L. Medical Parasitology (4)

6 hours of lecture and 6 hours of laboratory per week. Prerequisites: Biology 1A, Biology 1B or equivalent. This course includes the biology, epidemiology, pathogenesis, treatment, and prevention of various medically important parasitic infections. Life cycles of parasitic helminths and protozoa, the biological aspects of the host-parasite relationship, the epidemiology of the infection, and the interplay of social, economical, and ecological factors which contribute to the disease will be covered in both lectures and videos.

117. Medical Ethnobotany (2)

Two hours of lecture per week. Biological diversity and ethno-linguistic diversity sustain traditional botanical medicine systems of the world. Major topics covered in this course include cultural origins of medicinal plant knowledge on plant-derived pharmaceuticals and phytomedicines; field research methods in ethnobotany and ethnopharmacology; examples of how traditional botanical medicines provide safe, effective, affordable, and sustainable primary health care to tropical countries; human physiology, human diseases, and mechanisms of action of plant-derived drugs.

117LF. Medical Ethnobotany Laboratory (2)

Six hours of laboratory per week. Formerly 117L. Laboratory will focus on studying medicinal plants from the major ecosystems and geographical regions of the world. Students will learn common names, scientific names, plant families, field identification, habitats, and ethnomedical uses of medicinal plants. How the medicinal plant is prepared, administered, and used as a phytomedicine will also be discussed. There will be reference to the phylogenetic relationships between the plant families and genera represented by the medicinal plants.

118. Host-Pathogen Interactions: A Trans-Discipline Outlook (4)

3 hours of lecture and 1 hour of discussion per week. Prerequisites: Biology 1A-1B. The second half of the 20th century is marked by great strides in the battle against infectious diseases. However, the forces that drive pathogen evolution continue to pose new challenges for science and medicine. In this course we will cover various aspects relating to host-pathogen interactions, focusing on animals and their bacterial pathogens. We will address the ecology of host-pathogen interactions, their shaping by co-evolution, examine prominent molecular mechanisms taking part in this warfare and learn how ancient mechanisms are used and reused through millions of years of evolution. The course will examine how better understanding of host-pathogen interactions can suggest new strategies for fighting infectious diseases.

123AL. Exercise Physiology Laboratory (5)

3 hours of lecture and 3 hours of laboratory per week. Prerequisites: Biology 1A, Chemistry 3B and Integrative Biology 132 or Molecular and Cell Biology 136. Discussion of how chemical energy is captured within cells and how potential chemical energy is converted to muscular work. Energetics, direct and indirect calorimetry, pathways of carbon flow in exercise, ventilation, circulation, skeletal muscle fiber types. Laboratory component of the course is to obtain practical experience in the measurement of physiological parameters and to be able to compile, compare, contrast, and interpret physiological data. Laboratory demonstrations and exercises will explain lecture content.

C125L. Introduction to the Biomechanical Analysis of Human Movement (4)

Three hours of lecture and three hours of laboratory per week. Prerequisites: Physical Education 9 and Integrative Biology 131 and 131L. Formerly C165. Basic biomechanical and anatomical concepts of human movement and their application to fundamental movement patterns, exercise, and sport skills. Also listed as Physical Education C165.

127L. Motor Control with Laboratory (3)

Two hours of lecture and two hours of laboratory per week. Prerequisites: 132 or Molecular and Cell Biology 136. Neural control of movement in humans and other animals. Lectures introduce basic theories of information and control, analyze motor control at the spinal level, survey anatomy and physiology of motor systems of the brain, and synthesize theory and physiology to understand control systems that regulate posture, locomotion, and voluntary movements. In laboratories, students learn theory and motor physiology hands-on, and design and perform independent investigations.

128. Sports Medicine (3)

Two hours of lecture and one hour of discussion per week. Prerequisites: Background in anatomy, physiology, or exercise physiology recommended. Survey course of sports medicine including topics of athletic injury (cause, evaluation, and treatment options), exercise physiology, exercise and health, fitness testing, issues specific to female athletes, drug abuse in sports, environmental issues (heat, altitude, sun exposure), nutrition, careers in sports medicine, introduction to clinical research.

C129L. Human Physiological Assessment (3)

Two hours of lecture and three hours of laboratory per week. Prerequisites: 123A, 123AL (may be taken concurrently). Formerly C129. Principles and theories of human physiological assessment in relation to physical activity and conditioning. Performance of laboratory procedures in the measurement and interpretation of physiological fitness (cardiorespiratory endurance, body composition, musculoskeletal fitness). Also listed as Physical Education C129.

130. Human Fertility—The Big History of our Species' Reproductive Journey (4)

2 hours of lecture and 2 hours of laboratory per week. This course explores human reproduction through the lenses of evolutionary biology, population statistics, and culture. Throughout, we organize the course in terms of major transitions and the question of choice. How do evolved biology and inherited culture make some choices more accessible and others less so? What happened to human fertility—and to the possibility of making choices about fertility—at such moments of change as the emergence of pair bonding in hominids, the advent of agriculture, the industrial revolution, and the development of both contraceptive and proceptive technologies in the 20th consequences do these histories on different time-scales have for young people today contemplating their own reproductive choices?

131. General Human Anatomy (3)

Three hours of lecture per week. Prerequisites: Biology 1A-1B or Chemistry 1A. The functional anatomy of the human body as revealed by gross and microscopic examination. Designed to be taken concurrently with 131L.

131A. Applied Anatomy (1)

Course may be repeated once for credit. One hour of lecture per week. Must be taken on a passed/not passed basis. A series of 15 lectures by former students of 131 who have become successful physicians and surgeons. The purpose is to provide the practical applications of anatomy, e.g., plastic surgeons, neurosurgeons, vascular surgeons, pathologists, etc.

131L. General Human Anatomy Laboratory (2)

Four hours of laboratory per week. Prerequisites: Biology 1A-1B or Chemistry 1A. 131 (may be taken concurrently). Prepared human dissections, models, and microscopic slides.

132. Survey of Human Physiology (3)

Students will receive no credit for 132 after taking Physiology 100 or 101 or Molecular and Cell Biology 32, 136. Three hours of lecture per week. Prerequisites: 131, Biology 1A. Mechanisms by which key physiological priorities are maintained in healthy humans. From a basis in elementary theories of information and control, we develop an understanding of homeostasis of cellular composition, structure, and energy metabolism. We then study neural and endocrine signaling in humans, and develop the key concepts of control and homeostasis in all the major organ and multi-organ systems, including cardiovascular, respiratory, renal, metabolic, reproductive, and immune systems, growth and development, and sensory and motor systems.

132L. Mammalian Physiology Laboratory (2)

Students will receive no credit for 132L after taking Molecular and Cell Biology 32L or 136L, or if currently enrolled in similar courses. Three hours of laboratory per week. Prerequisites: Previous or concurrent enrollment in 132 or equivalent, or consent of instructor. In the laboratory component of Integrative Biology 132, students gain hands-on experience measuring physiological parameters, interpreting physiological data, designing experiments, and communicating ideas in writing and orally. Guided investigations include measurements of membrane potentials, responses of skeletal muscle to electrical stimulation, electromyography, pulmonary and cardiovascular measurements in humans, contractility and regulation of the frog heart, human electrocardiography, and renal control of body fluids. In two independent investigations, students identify their own questions, develop hypotheses, design and perform experiments, and present

their studies in symposia. Background in elementary statistics, data analysis and oral presentation are also provided.

135. The Mechanics of Organisms (4)

Three hours of lecture and one hour of discussion per week. Prerequisites: Introductory physics and biology recommended. Organism design in terms of mechanical principles; basics of fluid and solid mechanics with examples of their biological implications, stressing the dependence of mechanical behavior and locomotion on the structure of molecules, tissues, structural elements, whole organisms, and habitats. Offered alternate years.

C135L. Laboratory in the Mechanics of Organisms (3)

Students will receive no credit for C135L after taking 135L. Six hours of laboratory and one hour of discussion per week, plus one field trip. Prerequisites: Integrative Biology 135 or consent of instructor; for Electrical Engineering and Computer Science students, Electrical Engineering 105, 120 or Computer Science 184. Formerly Integrative Biology 135L. Introduction to laboratory and field study of the biomechanics of animals and plants using fundamental biomechanical techniques and equipment. Course has a series of rotations involving students in experiments demonstrating how solid and fluid mechanics can be used to discover the way in which diverse organisms move and interact with their physical environment. The laboratories emphasize sampling methodology, experimental design, and statistical interpretation of results. Latter third of course devoted to independent research projects. Written reports and class presentation of project results are required. Also listed as Electrical Engineering C145O and Bioengineering C136L.

136. The Biology of Sex (4)

3 hours of lecture and 2 hours of discussion per week. Prerequisites: Biology 1B; introductory genetics. The ability to reproduce is a defining characteristic of life, and of great interest to biologists as well as humanity in general. What is sex, and why did it develop? Why do we have sexual reproduction, whereas some animals do not? This course will provide a comprehensive overview on the biology of sex from an evolutionary perspective with an emphasis on humans in comparison to other species. The course will consist of two lectures each week, and a lab where we discuss a paper, watch videos, or have discussion sections on specific topics that were covered in class.

137. Human Endocrinology (4)

Three hours of lecture and one hour of discussion per week. Prerequisites: Biology 1A-1B; human physiology (132) strongly recommended. Course will address the role of hormones in physiology with a focus on humans. Regulation of hormone secretion and mechanisms of hormone action will be discussed. Physiological processes to be addressed include reproduction, metabolism, water balance, growth, fetal development. Experimental and clinical aspects will be addressed.

138. Comparative Endocrinology (4)

Three hours of lecture and one hour of discussion per week. Prerequisites: Biology 1A-1B. Organic Chemistry recommended. The primary goal of this course is to provide students with a broad understanding of the evolution of hormonal systems. A comparative approach allows us to envisage how the complex mammalian endocrine system presumably evolved from that of more primitive vertebrates. Students will learn about endocrine pathways and endocrine-based behaviors of jawless fishes, fishes, amphibia, reptiles, birds, and mammals. In addition, students will gain an understanding of the experimental methods used in endocrine research. The class teaches students how to read and interpret the primary scientific literature; thus it encourages the critical thinking that is a fundamental skill for any scientist.

139. The Neurology of Stress (4)

3 hours of lecture and 1 hour of discussion per week. Prerequisites: Biology 1A or Psychology 110. This course is designed to be an interdisciplinary course. It will adopt a broad-based approach to explore the concepts of stress, health, and disease, with a particular focus on current primary literature. The course will cover multiple dimensions in the study of stress, which employ genetic, epigenetic, molecular, cellular, physiological, and cognitive approaches, especially in the context of endocrine and neuroscience research. We will analyze the individual response to stress, how genetic and environmental factors play a role in it, how it translates to physiological and mental health and well-being vs. pathological conditions, and put that in a public health perspective.

140. Human Reproduction (4)

Three hours of lecture and one hour of discussion per week. Prerequisites: A course in physiology (e.g., 132, Molecular and Cell Biology 32, or consent of instructor). Evaluation of human reproduction, social problems and demographics, anatomy and physiology of reproductive organs, endocrinology of the menstrual cycle; puberty, psycho-physiology of copulation and orgasm; fertilization and implantation infertility and sexual dysfunction; conception and contraception; pregnancy and abortion; birth and lactation; sexual differentiation of brain and reproductive organs; homosexuality and transexualism.

141. Human Genetics (3)

Principles of inheritance, especially as applied to human traits, including molecular aspects of genetics, the genetic constitutions of populations, and questions of heredity/environment.

C142L. Introduction to Human Osteology (6)

Six hours of lecture and fourteen hours of laboratory per week. Prerequisites: Anthropology 1, Biology 1B. Formerly C142. An intensive

study of the human skeleton, reconstruction of individual and population characteristics, emphasizing methodology and analysis of human populations from archaeological and paleontological contexts, taphonomy, and paleopathology. Also listed as Anthropology C103.

C143A. Biological Clocks: Physiology and Behavior (3)

Two hours of lecture and one hour of discussion per week. Prerequisites: Completion of biological prerequisites for the major and one of the following: Psychology 110 or a course in animal organismal physiology (Integrative Biology 132, 140, 148, or Molecular and Cell Biology 160). A consideration of the biological clocks that generate daily, lunar, seasonal and annual rhythms in various animals including people. Emphasis on neuroendocrine substrates, development and adaptive significance of estrous cycles, feeding rhythms, sleep-wakefulness cycles, reproductive and hibernation cycles, body weight and migratory cycles. Also listed as Psychology C113.

C143B. Hormones and Behavior (3)

Two hours of lecture and one hour of discussion per week. Prerequisites: Completion of biological prerequisites for the major and consent of instructor; a course in mammalian physiology recommended. This course provides a comprehensive overview of behavorial endocrinology beginning with hormone production and actions on target issues and continuing with an exploration of a variety of behaviors and their hormonal regulation/consequences. The course uses a comparative approach to examine the reciprocal interactions between the neuroendocrine system and behavior, considering the effects of hormone on development and adult behavior in addition to how behavior regulates endocrine physiology. While much of the course focuses on non-human vertebrate species, the relevance to humans is explored where appropriate. Topics include sexual differentiation and sex differences in behavior, reproductive, parental, and aggressive behaviors, and hormonal and behavioral homeostatic regulation. Also listed as Psychology C116.

C144. Animal Behavior (4)

Students will receive no credit for 144 after taking C144, 145, 146LF, or Psychology C115B. Three hours of lecture and one hour of discussion/demonstration per week. Prerequisites: Biology 1A, 1B, or Environmental Science, Policy, and Management 140. Molecular and Cell Biology 140 and C160 recommended. An introduction to comparative animal behavior and behavioral physiology in an evolutionary context, including but not limited to analysis of behavior, genetics and development, learning, aggression, reproduction, adaptiveness, and physiological substrates. Also listed as: ESPM C126.

146LF. Behavioral Ecology with Laboratory (5)

Two hours of lecture, one hour of discussion, and three hours of laboratory per week, plus one weekend field trip. Prerequisites: 144 or C144 or consent of instructor. Formerly 146L. An in-depth examination of the ecological and evolutionary bases for behavioral diversity. Topics covered include behavior as an adaptive response, sexual selection, animal mating systems, group living, and cooperative and competitive interactions. Current conceptual approaches to these topics are explored, with an emphasis upon rigorous testing of hypotheses drawn from primary literature. Hands-on laboratory training in the methods of experimental design, data collection, and data analysis.

148. Comparative Animal Physiology (3)

Students will receive no credit for 148 after taking 100A. Three hours of lecture and one hour of discussion per week. Prerequisites: Biology 1A-1B. Comparative study of physiological systems among animal phyla. General physiological principles will be illustrated by examining variation in neural, muscular, endocrine, cardiovascular, respiratory, digestive, and osmoregulatory systems. Students will read original literature and give a group presentation in a symposium.

150. Evolutionary Environmental Physiology (3)

3 hours of lecture and 1 hour of discussion per week. Prerequisites: Biology 1A-1B or equivalent. Evolutionary physiology studies how physiological traits arise and are modified during adaptation to the environment. An integrative understanding of the origin and maintenance of physiological traits, encompassing levels of biological hierarchy from molecular to ecological and biogeographic, is essential for improving human health and stewarding the natural world through the current era of rapid environmental change. This course consists of three parts: 1) big questions in evolutionary physiology and how they are addressed; 2) a student-led exploration of how environmental factors have shaped physiological evolution; and 3) predicting responses to global change using evolutionary physiology.

151. Plant Physiological Ecology Laboratory (4)

3 hours of lecture and 1 hour of discussion per week. Prerequisites: Biology 1A-1B or equivalent. This course focuses on a survey of physiological approaches to understanding plant-environment interactions from the functional perspective. Lectures cover physiological adaptation; limiting factors; resources acquisition/allocation; photosynthesis, carbon, energy balance; water use and relations; nutrient relations; linking physiology; stable isotope applications in ecophysiology; stress physiology; life history and physiology; evolution of physiological performance; physiology population, community, and ecosystem levels.

151L. Plant Physiological Ecology Laboratory (2)

Three hours of lecture per week. Prerequisites: Concurrent enrollment in 151. The laboratory is focused on instructing you on observational and experimental approaches and methods used in plant physiological ecology. Students are introduced to a wide range of techniques and will make measurements on different plant species growing in the field or greenhouse (weeks 1-7). A group research project is required (weeks 9-12).

152. Environmental Toxicology (4)

Three hours of lecture and one hour of discussion per week. Prerequisites: Background in biology or chemistry is recommended. The environmental fate and effect of toxic substances from human activities, with emphasis on aquatic systems, including their biological effects from the molecular to the community level. Course will review pollutant types, principal sources, impacts on aquatic organisms, monitoring approaches, and regulatory issues.

153. Ecology (3)

Three hours of lecture and one hour of discussion per week. Prerequisites: Biology 1B or consent of instructor. Principles of microbial, animal, and plant population ecology, illustrated with examples from marine, freshwater, and terrestrial habitats. Consideration of the roles of physical and biological processes in structuring natural communities. Observational, experimental, and theoretical approaches to population and community ecology will be discussed. Topics will include quantitative approaches relying on algebra, graph analysis, and elementary calculus. Discussion section will review recent literature in ecology.

154. Plant Population and Community Ecology (3)

Three hours of lecture/discussion per week. Prerequisites: Biology 1B. Enrollment in accompanying lab course 154L is encouraged but not required. An introduction to ecology of plants, covering individuals, populations, communities, and global processes. Topics include: form and function, population ecology, life histories, community structure and dynamics, disturbance and succession, diversity and global change.

154L. Plant Ecology Laboratory (2)

4 hours of laboratory per week. Prerequisites: Biology 1B. Field and laboratory class in plant ecology. Laboratory exercises covering plant functional morphology, dispersal ecology, spatial dispersion in plant populations, environmental gradients and plant distributions, population dynamics simulations, and restoration ecology. Small-group independents projects, with write-ups and presentations. Concurrent enrollment in Integrative Biology 154 is required.

C155. Holocene Paleoecology: How Humans Changed the Earth (3)

Students will receive no credit for C155 after taking 155 and/or Anthropology 129D. Deficient grade in 155 and/or 129D may be removed by taking C129D. Three hours of lecture per week. Prerequisites: Either Anthropology 2 or Biology 1A. Since the end of the Pleistocene and especially with the development of agriculturally based societies humans have had cumulative and often irreversible impacts on natural landscapes and biotic resources worldwide. Thus "global change" and the biodiversity crisis are not exclusively developments of the industrial and post-industrial world. This course uses a multi-disciplinary approach, drawing upon methods and data from archaeology, palynology, geomorphology, paleontology, and historical ecology to unravel the broad trends of human ecodynamics over the past 10,000 years. Also listed as Anthropology C129D.

C156. Principles of Conservation Biology (4)

Three hours of lecture and one and one-half hours of discussion per week. Prerequisites: Biology 1A-1B or equivalent. A survey of the principles and practices of conservation biology. Factors that affect the creation, destruction, and distribution of biological diversity at the level of the gene, species, and ecosystem are examined. Tools and management options derived from ecology and evolutionary biology that can recover or prevent the loss of biological diversity are explored. Also listed as Environ Sci, Policy, and Management C103.

157LF. Ecosystems of California (4)

Six hours of fieldwork per week. Prerequisites: Biology 1B or consent of instructor. Formerly 157L. The ecosystems of California are studied from both an ecological and historical biogeographical perspective with a focus on terrestrial plant communities. Students learn how to identify about 150 species of native plants (mostly trees, but also other dominant plants from the non-forest biomes). Field trips occur each Friday and over several weekends. Students conduct group projects that involve plant inventories and data collection as well as how to collect plant specimens and use the Herbarium.

C158LF. Biology and Geomorphology of Tropical Islands (13)

Nine hours of lecture for 6 weeks; field projects for 6 weeks; three hours of lecture for 3 weeks. Formerly C158. Natural history and evolutionary biology of island terrestrial and freshwater organisms, and of marine organisms in the coral reef and lagoon systems will be studied, and the geomorphology of volcanic islands, coral reefs, and reef islands will be discussed. Features of island biogeography will be illustrated with topics linked to subsequent field studies on the island of Moorea (French Polynesia). Also listed as Environ Sci, Policy, and Management C107.

159. The Living Planet: Impact of the Biosphere on the Earth System (3)

Students will receive two units of credit after taking Earth and Planetary Science 8, Earth and Planetary Science C141/Geography C141, or Geography 40. Two hours of lecture and two hours of discussion per week. Prerequisites: Biology 1B or consent of instructor. Earth is a complex dynamic system. Interplay between its components (solid earth, oceans, and atmosphere) governs conditions on the planet's outside that we and other biota inhabit. In turn, life asserts a vast influence on the abiotic components; in fact, the biosphere itself is a crucial system component. We will explore the effect that 3.5 billion years of evolving biosphere had on System Earth and vice versa (e.g., in terms of climate), including the recent human impact on the system.

160. Evolution (4)

Three hours of lecture and one hour of discussion per week. Prerequisites: Biology 1B. An analysis of the patterns and processes of organic evolution. History and philosophy of evolutionary thought; the different lines of evidence and fields of inquiry that bear on the understanding of evolution. The major features and processes of evolution through geologic times; the generation of new forms and new lineages; extinction; population processes of selection, adaptation, and other forces; genetics, genomics, and the molecular basis of evolution; evolutionary developmental biology; sexual selection; behavorial evolution; applications of evolutionary biology to medical, agricultural, conservational, and anthropological research.

161. Population and Evolutionary Genetics (4)

Course may be repeated for credit. Three hours of lecture and two hours of computer and/or discussion per week. Prerequisites: Biology 1B and Mathematics 16A or equivalent. Population genetics provides the theoretical foundation for modern evolutionary thinking. It also provides a basis for understanding genetic variation within populations. We will study population genetic theory and use it to illuminate a number of different topics, including the existence of sex, altruism and cooperation, genome evolution speciation, and human genetic variation and evolution.

162. Ecological Genetics (4)

Three hours of lecture and one hour of discussion per week. Prerequisites: Biology 1B. This course integrates ecology, genetics, and evolutionary biology. It presents contemporary approaches to studying evolution in natural populations, including analyzing heritability of ecologically important traits, using molecular techniques to decompose genotypes, documenting and measuring the magnitude of selection in natural systems, and using models to predict evolution in natural populations. Case studies are used to examine evolutionary effects of ecological interactions among organisms, the importance of population size and structure, and interactions among populations through migration and dispersal.

163. Molecular and Genomic Evolution (3)

Three hours of lecture per week. Prerequisites: Biology 1A-1B. This course will introduce undergraduates to the study of evolution using molecular and genomic methods. Topics included will be rates of evolution, evolution of sex chromosomes, insertions and deletions of DNA sequences, evolution of regulatory genetic elements, methods of phylogenetic inference, gene duplication, multigene families, transposons, genome organization, gene transfer, and DNA polymorphism within species.

164. Human Genetics and Genomics (4)

Three hours of lecture and two hours of computer laboratory per week. Prerequisites: Biology 1A, 1B, and Math 16A, or equivalent. This course will introduce students to basic principles of genetics, including transmissions genetics, gene regulation, pedigree analysis, genetic mapping, population genetics, and the principles of molecular evolution. The course will also introduce students to recent developments in genomics as applied to problems in human genetic diseases, human history, and the relationship between humans and their closest relatives.

166. Evolutionary Biogeography (4)

Three hours of lecture and one hour of discussion per week. Prerequisites: Biology 1B, 11, Geography 148 or Earth and Planetary Science 50. The goals of the course are to (a) examine how geographically-linked characteristics of species influence their potential for evolution and extinction; and (b) provide an overview of the analytical techniques and applications for studying the interplay between geographic ranges, environment, evolution, and extinction. Accordingly, the course begins by examining what geographic ranges of species are and what controls them. We then will explore how geographic-range characteristics influence and interact with speciation and extinction processes. With that foundation, we will examine how species assemble into communities and how ecological processes govern distributions at the community and landscape levels, touching on such topics as community energetics, scaling issues, and the influences of humans on "natural" ecosystems. The last third of the course will be devoted to an overview of quantitative analytical techniques that commonly are used to study interactions between biogeogeographic ranges, evolutionary processes, extinction, and environmental change.

167. Evolution and Earth History: From Genes to Fossils (4)

3 hours of lecture and 1 hour of discussion per week. Prerequisites: Biology 1A. The diversity of life is the product of evolutionary changes. This course will integrate fossil and molecular data to consider some of the outstanding questions in the study of evolution. Major topics covered include the origin and early evolution of life, the expansion of the biosphere through time, the generation of variation and the mechanisms of natural selection, genetics and developmental evolution, and the relationships between microevolution and macroevolution.

168L. Systematics of Vascular Plants with Laboratory (4)

Two hours of lecture and six hours of laboratory per week. Prerequisites: Biology 1A-1B. A discussion of the philosophy, principles, techniques, and history of botanical systemics. An outline of the major group of vascular plant and their evolution. Laboratory course devoted to a survey on a world-wide basis of the diversity of vascular plant families.

169. Evolutionary Medicine (4)

Three hours of lecture and one hour of discussion per week. Prerequisites: Biology 1B, or equivalent. Formerly 163. This course explores the ways that evolutionary theory can illuminate our understanding of human health and disease. The integration of evolutionary concepts into health sciences can deepen our understanding of the origins of diseases and how human populations evolve in response to these

ailments. The course begins with an introduction to evolutionary medicine (two hours of lecture) followed by an overview of human genetic variation and natural selection (six hours of lecture). With this foundation, we study the evolution of human diet and the evolution of human ecological relationships with the environment (six hours of lecture). We then explore the fascinating topic of infectious disease ecology from the perspective of both microbial and human evolutionary responses (nine hours of lecture). Next, we evaluate the fields of reproductive biology, gynecology, and infant/child health through an evolutionary lens (twelve hours of lecture). Finally, we examine evolutionary concepts in chronic metabolic and degenerative diseases associated with aging and lifestyle (ten hours of lecture).

170LF. Community Ecology Laboratory (3)

8 hours of laboratory per week. Prerequisites: Integrative Biology 153 or comparable upper-division course in ecology from Integrative Biology or Environmental Science Policy and Management course lists (or by consent of instructor); introductory course in statistics strongly recommended. This course is a hands-on introduction to common research methods in population and community ecology. Each method and its application are first presented in a lecture session, illustrated with published examples. The method is then practiced in a subsequent group field exercise, conducted in a local terrestrial, aquatic, or marine habitat. The course focuses on sampling methods, experimental designs, and statistical analyses used to investigate patterns of species distribution and abundance, interspecific associations, and local species diversity. Graded assignments include write-ups of field exercise results, and an in-depth review paper and oral in-class presentation on an ecological method of particular interest to the student.

173LF. Mammalogy with Laboratory (5)

Two hours of lecture and six hours of laboratory per week, plus two weekend field trips. Prerequisites: 104LF. Formerly 173L. An advanced course in the biology of mammals. Topics covered include elements of modern mammalian biology such as morphology, physiology, ecology, and behavior. For all topics, the traits that define mammals are emphasized, as is the variation on these themes evident within modern mammalian lineages. Laboratory and field explore the biology of modern mammals. Laboratories use the extensive collections of the Museum of Vertebrate Zoology to introduce students to mammalian diversity in a phylogenetic context.

174LF. Ornithology with Laboratory (4)

Two hours of lecture and six hours of laboratory per week, plus one weekend field trip. Prerequisites: 104L or consent of instructor. Formerly 174L. An advanced course in the biology of birds. Laboratory: an introduction to the diversity, morphology, and general ecology of birds of the world.

175LF. Herpetology with Laboratory (4)

Two hours of lecture and four hours of laboratory per week, plus two field trips. Prerequisites: 104LF. Formerly 175L. Lectures will introduce students to the diversity of amphibians and reptiles on a world-wide basis, with an emphasis on systematics, ecology, morphology, and life history. Laboratories will teach students the diagnostic characteristics and some functional attributes of amphibians and reptiles on a world-wide basis. Field trips will acquaint students with techniques for collecting, preserving, identifying, and studying amphibians and reptiles.

C176L. Fish Ecology (3)

2 hours of lecture and 3 hours of laboratory per week. Prerequisites: Introductory course in biological science; upper division or graduate standing. Introduction to fish ecology, with particular emphasis on the identification and ecology of California's inland fishes. This course will expose students to the diversity of fishes found in California, emphasizing the physical (e.g., temperature, flow), biotic (e.g., predation, competition), and human-related (e.g., dams, fisheries) factors that affect the distribution, diversity, and abundance of these fishes.

181L. Paleobotany —The 500-Million Year History of a Greening Planet (3)

3 hours of lecture and 3 hours of laboratory per week. Prerequisites: Courses in botany and geology are recommended. Introduction to the evolution of plants and terrestrial ecosystems through time. From the invasion of land to the present, we will follow the evolution of major plant groups through important moments of the Phanerozoic eon (the past 540 million years). By studying fossilized plant assemblages, we will interpret how major environmental changes unfolded across landscapes in the past and how plants have influenced the shaping of our planet. Lectures will be complemented by an interactive laboratory covering paleobotanical research techniques, study of fossil and living plant form and function in the lab and field, and analysis of peer-reviewed literature.

183L. Evolution of the Vertebrates with Laboratory (4)

Three hours of lecture and two hours of laboratory per week. Prerequisites: Biology 1B; introductory courses in earth history and zoology are recommended. Introduction to vertebrate paleontology, focusing on the history and phylogeny of vertebrates ranging from fishes to humans. Emphasis: evolution, taxonomy, functional morphology, faunas through time, problems in vertebrate history, including diversity through time and extinction. Laboratory: vertebrate fossils, focusing on demonstration and study of problems related to taxonomy, evolution, functional morphology, structures, preservation of fossil vertebrates, and their faunas through time.

184L. Morphology of the Vertebrate Skeleton with Laboratory (4)

Two hours of lecture, six hours of laboratory, and one hour of discussion per week. Prerequisites: Anthropology 1 and Biology 1B. Lectures on comparative osteology of vertebrates, with emphasis on selected groups of terrestrial vertebrates considered in paleoecological, paleoclimatological, and biostratigraphic analyses. Laboratory: comparative osteology of vertebrates, with emphasis on selected groups of vertebrates. Structure, anatomy, morphology, function, and development of the vertebrate skeleton.

C185L. Human Paleontology (5)

Three hours of lecture and three hours of laboratory per week. Prerequisites: Anthropology 1, Biology 1A-1B. Formerly C185. Origin and relationships of the extinct forms of mankind. Also listed as Anthropology C100.

C187. Human Biogeography of the Pacific (3)

Students will receive no credit for C187 after taking 187. A deficient grade in 187 maybe removed by taking C187 and/or Anthropology C124C. Three hours of lecture per week. Prerequisites: Anthropology 1 or Biology 1B or consent of instructor. This course examines the history of human dispersal across Oceania from the perspectives of biogeography and evolutionary ecology. H. sapiens faced problems of dispersal, colonization, and extinction, and adapted in a variety of ways to the diversity of insular ecosystems. A dual evolutionary model takes into account cultural evolution and transmission, as well as biological evolution of human populations. This course also explores the impacts of human populations on isolated and fragile insular ecosystems, and the reciprocal effects of anthropogenic change on human cultures. Also listed as Anthropology C124C.

Appendix 2: Sample curriculum plans

TRACK 1 — ECOLOGY, EVOLUTION & ORGANISMAL BIOLOGY

FOR UCB STUDENTS ADMITTED AS FRESHMEN

Fall ____	Units	Spring ____	Units	Summer ____	Units
Chem 1A/L	3/1	Chem 3A/L	3/2		
Math 10A	4	Math 10B	4		
Total Units		**Total Units**		**Total Units**	
Fall ____	**Units**	**Spring ____**	**Units**	**Summer ____**	**Units**
Chem3B/L	3/2	Bio 1A/L	3/2		
Bio 1B	4	Physics 8A	4		
Total Units		**Total Units**		**Total Units**	
Fall ____	**Units**	**Spring ____**	**Units**	**Summer ____**	**Units**
Physics 8B	4	IB Group B w/ Lab	3-5		
IB Group A or B	3-4	IB Group C	3-4		
		IB Research (optional)	1-4		
Total Units		**Total Units**		**Total Units**	
Fall ____	**Units**	**Spring ____**	**Units**	**Summer ____**	**Units**
IB Group A (if not already completed)	2-4	IB Group B w/ Field Lab	4-5		
IB Elective	3-4	IB Elective	2-4		
IB Research/Honors (optional)	3	IB Research/Honors (optional)	3		

TRACK 2 —HUMAN BIOLOGY & HEALTH SCIENCES

FOR UCB STUDENTS ADMITTED AS FRESHMEN

Fall ____	Units	Spring ____	Units	Summer ____	Units
Chem 1A/L	3/1	Chem 3A/L	3/2		
Math 10A	4	Math 10B	4		
Total Units		**Total Units**		**Total Units**	
Fall ____	**Units**	**Spring ____**	**Units**	**Summer ____**	**Units**
Chem3B/L	3/2	Bio 1A/L	3/2		
Bio 1B	4	Physics 8A	4		
Total Units		**Total Units**		**Total Units**	
Fall ____	**Units**	**Spring ____**	**Units**	**Summer ____**	**Units**
Physics 8B	4	IB Group C	4-5	IB Elective or Lab (optional)	
IB Group C	3-5	IB Group B	4-5		
		IB Research (optional)	1-4		
Total Units		**Total Units**		**Total Units**	
Fall ____	**Units**	**Spring ____**	**Units**	**Summer ____**	**Units**
IB Group A	4	IB 2nd Lab	2-4		
IB Lab	2-4	IB Elective	2-4		
IB Research/Honors (optional)	3	IB Research/Honors (optional)	3		
Total Units		**Total Units**		**Total Units**	

TRANSFER STUDENTS

TRACK 1 — ECOLOGY, EVOLUTION & ORGANISMAL BIOLOGY

SAMPLE PLAN FOR THOSE WHO HAVE COMPLETED ALL PRE-REQUISITES

Fall ____	Units	Spring ____	Units	Summer ____	Units
IB Group B w/Lab	3-4	IB Group B w/ Field Lab	4-5		
IB Group C	2-4	IB Elective	3-4		
		IB Research (optional)	1-4		
Total Units		**Total Units**		**Total Units**	
Fall ____	**Units**	**Spring ____**	**Units**	**Summer ____**	**Units**
IB Group A	4	IB Elective	4-5		
IB Elective	3-4				
IB Research/Honors (optional)	3	IB Research/Honors (optional)	3		
Total Units		**Total Units**		**Total Units**	

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SAMPLE PLAN FOR THOSE LACKING PRE-REQUISITES

Fall ____	Units	Spring ____	Units	Summer ____	Units
Physics 8B	4	IB Group B w/ Lab	4-5		
IB Group B or C	3-4	IB Group C or Elective	3-4		
		IB Research (optional)	1-4		
Total Units		**Total Units**		**Total Units**	
Fall ____	**Units**	**Spring ____**	**Units**	**Summer ____**	**Units**
IB Group A	4	IB Group B w/ Field Lab	4-5		
IB Elective	1-4	IB Elective	3-4		
IB Research/Honors (optional)	3-4				

TRANSFER STUDENTS

TRACK 2 — HUMAN BIOLOGY & HEALTH SCIENCES

SAMPLE PLAN FOR THOSE WHO HAVE COMPLETED ALL PRE-REQUISITES

Fall ____	Units	Spring ____	Units	Summer ____	Units
IB Group A or B	4	IB Group C	4-5		
IB Group C	4-5	IB Group B or Elective	2-4		
		IB Research (optional)	1-4		
Total Units		**Total Units**		**Total Units**	
Fall ____	**Units**	**Spring ____**	**Units**	**Summer ____**	**Units**
IB Group A	4	IB 2nd Lab or Group B	4		
IB 2nd Lab	2-4	IB Elective	4		
	3		3		
Total Units		**Total Units**		**Total Units**	

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SAMPLE PLAN FOR THOSE LACKING PRE-REQUISITES

Fall ____	Units	Spring ____	Units	Summer ____	Units
Physics 8B	4	IB Group B	4	IB Elective or Group C	
IB Group C	3-4	IB Group	4		
		IB Research (optional)	1-4		
Total Units		**Total Units**		**Total Units**	
Fall ____	**Units**	**Spring ____**	**Units**	**Summer ____**	**Units**
IB Group A	4	IB 2nd Lab			
IB Lab Course	1-4	IB Elective			
Total Units		**Total Units**		**Total Units**	

Appendix 3: 2015-2016 Academic calendar

FALL SEMESTER 2015	
FALL SEMESTER BEGINS	Wednesday, August 19, 2015
Convocation	Monday, August 24, 2015
Instruction begins	Wednesday, August 26, 2015
Early drop **DEADLINE**	Friday, September 4, 2015
Labor Day Holiday	Monday, September 7, 2015
DEADLINE to add/drop classes	Friday, September 25, 2015
DEADLINE to withdraw without semester-out rule imposed	Friday, October 16, 2015
Tele-BEARS for spring 2016 registration begins	Monday, October 19, 2015
DEADLINE to change grading option from letter grade to P/NP or P/NP to letter grade.	Friday, October 30, 2015
DEADLINE to apply for readmission for spring 2016	Tuesday, November 3, 2015
Veteran's Day Holiday	Wednesday, November 11, 2015
Thanksgiving Holiday	Thursday, November 26 - Friday, November 27, 2015
RRR Week	December 5-9, 2011
Last day of instruction; **DEADLINE** to withdraw (semester-out rule imposed)	Friday, December 9, 2011
Final examinations	Monday, December 7 - Friday, December 11, 2015
FALL SEMESTER ENDS	Friday, December 16, 2015
Winter Holiday	Monday, December 26 – Tuesday, December 27, 2011
New Year's Holiday	Thursday, December 31 – Friday, January 1, 2016

SPRING SEMESTER 2016	
SPRING SEMESTER BEGINS	Tuesday, January 12, 2016
MLK, Jr. Holiday	Monday, January 18, 2016
Instruction begins	Tuesday, January 19, 2016
Early drop **DEADLINE**	Friday, January 29, 2016
DEADLINE to add/drop classes	Friday, February 19, 2016
President's Day Holiday	Monday, February 15, 2016
DEADLINE to withdraw without semester-out rule imposed	Friday, March 11, 2016
Spring Recess	Monday, March 21 - Friday, March 25, 2016
DEADLINE to change grading option from letter grade to P/NP or P/NP to letter grade.	Friday, April 1, 2016
Cesar Chavez Holiday	Friday, March 25, 2016
Tele-BEARS for fall 2016 begins	Monday, April 18, 2015
Cal Day	Saturday, April 16, 2015
RRR week	May 2-6, 2016
Last day of instruction; **DEADLINE** to withdraw (semester-out rule imposed)	Friday, May 6, 2016
Final examinations	Monday, May 9 - Friday, May 13, 2016
SPRING SEMESTER ENDS	Friday, May 13, 2016
IB Undergraduate Commencement	May 14, 2016
Memorial Day Holiday	Monday, May 30, 2016
DEADLINE to apply for readmission for Fall 2012	Friday, June 3, 2016