

Geobiology 2017

1. **ESSAY:** Provide a brief personal narrative (up to a page single spaced) on the value of a term/semester abroad for you academically and personally. Be sure to include a rationale for going abroad. Note that members of the selection committee are not looking to be entertained. These should be thoughtful statements and students selected to study abroad will have their statement reviewed by host university faculty. **Note that all applicants selected by Caltech to study abroad must also be accepted by the host university/Cambridge college — this process happens after the Caltech selection process is completed.**

After the restless polymath Alexander von Humboldt set out on his rugged expeditions through South America, he claimed, "The most dangerous worldviews are the worldviews of those who have never viewed the world." Through his journeys over mountaintops and across seas, Humboldt upheld that nature is the best teacher, not only in the manner evolution crafts structures and ecology fosters harmony, but in the endless natural intricacies that satisfy inquisitive minds.

As a geobiologist, I must constantly stretch my mind to consider the interactions between life (ranging from molecular microbe metabolism, to megafauna mass extinctions) and the earth (ranging from the chemistry of a mineral, to global climate through geologic time). These topics are too diverse, and solutions are too complex, to approach them with only one perspective. To enhance my knowledge base, problem-solving skills, and general wisdom, it would greatly benefit me to study abroad.

My relationship with biology has developed since childhood: from raising tadpoles into bullfrogs, to characterizing the marine sponge microbiome at the Marine Biological Laboratory in Woods Hole last summer. Though these experiences range in technical level and conceptual understanding, they share a common theme: I feel most inspired by science when I immerse myself in nature and the outdoors. I view the living world as the ultimate scientific community — with evolution and geological processes as persistent experimenters, whose mechanisms hold many of the keys to sustainability and resourcefulness. Scientific concepts can be expanded by looking to nature, as demonstrated by my heroes: Humboldt and Cousteau, who balanced their hours in the lab with adventures in the field.

While Caltech offers me an unparalleled education in fundamental concepts and access to the most advanced tools, I maintain that there is deep scientific merit to a walk in the woods or a snorkel at the beach. Technical analytical understanding of natural processes can be inspired by broad-minded observations in the outdoors. More specifically, though Caltech biology has equipped me with understanding of molecular and microbial processes and techniques, there are limited possibilities offered to pursue my interests in field biology, ecosystem conservation, and marine biology at Caltech.

On a personal level, studying abroad would strengthen the moral aspects of my decision to be a scientist. I aim to research ways to preserve ecological networks and minimize anthropogenic destruction of the earth. Australia is one of the areas most affected by climate change in terms of loss of biodiversity. An opportunity to dive the Great Barrier Reef would present to me the most striking case of how anthropogenic carbon emissions disrupt earth's feedback systems, resulting in a shifted equilibrium that destroys some of evolution's most spectacular feats: coral reefs. Witnessing the human-caused devastation, that Cousteau and Humboldt warned us about, would motivate my studies and remind me of what I strive to protect.

3. **PROGRAM FIT:** Briefly describe how each program you are applying for fits in with your course of study at Caltech. If you are applying for several programs with a range of course types, provide this information in the order of your program preference with **#1 being your most preferred study abroad university.**

(In place of Core Course Checklist): I have taken all of my core course requirements except for Chemistry Lab. I am planning to take this next term (Spring 2017). If I am not able to take this next term, then I can take it during my junior or senior year. I plan to take my scientific writing requirement during my junior year. I plan to take my remaining 2 PE courses during my senior year.

The study abroad options I have assembled would not hinder my course track for the Geobiology option at Caltech. They represent courses from both the Geology and Biosciences departments, both of which satisfy my option requirements. The two courses I would be required to take for this fall term are Biochemistry and Sedimentology. I would take biochemistry and sedimentology abroad, which are two required courses for fall term.

In addition, I have chosen courses that would enhance the Geobiology option by including aspects of field biology and conservation ecology. These courses do not have Caltech equivalents, but would explore areas that are relevant to my interests in finding solutions for environmental health.

Enrolling in SCIE30001 Science Research Project would allow me to continue research abroad, while exploring subject areas not represented at Caltech. I have contacted several scientists to mentor my research project, including those working in the areas of marine ecology, herpetology, and mycology. I have been in contact with Dr. Devi Stuart-Fox about a possible project investigating infrared reflection in animal thermoregulation.

4. **PROPOSED COURSE LIST:** For each program, and in order of preference, list each of the courses you wish to take according to the directions below and in the handout **Proposed Course List Guidelines. You should consult the handout on each program to ensure that you fully understand the program requirements. NOTE THAT YOU MUST USE THE CURRENT YEAR'S COURSE LIST AT THE STUDY ABROAD UNIVERSITY, AS THE NEXT YEAR'S CLASS LIST IS NOT AVAILABLE UNTIL THE SUMMER MONTHS.** Students selected for study abroad sometimes have to make changes in their proposed class list, due to changes in the courses available, but will have help in doing so.

Melbourne Proposed Course List

Total: 50 ECTS Credits (36 CIT Units)

Biochemistry and Molecular Biology BCMB20002

- Level 2
- School of Biomedical Sciences
- 12.5 Credit Points
- 9 Caltech Units
- Caltech Evaluator: Judith Campbell, Carl Parker
- Type of Caltech Credit: option requirement
- Equivalent Course: Bi/Ch 110. Introduction to Biochemistry

- Description: This subject is an introduction to the core of biochemistry, building on chemical principles and relating structure to function. The subject is an approved biochemistry prerequisite for entry to graduate medicine (and kindred vocational study) at the University of Melbourne. The molecular basis of life as discussed in this subject is essential for the understanding of any biological system and is at the core of all degrees in life science that use molecular techniques. The content includes an introduction to the molecular architecture of cells and the structure of biological building blocks (amino acids, nucleic acids, carbohydrates, lipids). The coverage includes the structure and function of proteins, including the properties of enzymes, their regulation and kinetic behavior. How nucleic acids replicate information and serve as a template for the synthesis of RNAs and proteins (i.e. molecular biology). The structure of lipids is examined to show their major biological roles, particularly as components of cell membranes. Metabolic pathways (glycolysis, gluconeogenesis, glycogen metabolism, TCA cycle and oxidative phosphorylation) will complete this core coverage of essential biochemistry. The subject is designed to complement the laboratory experiences in the subject BCMB20005.

Biology of Australian Flora & Fauna BIOL10001

- Level 1
- School of Biosciences
- 12.5 Credit Points
- 9 Caltech Units
- Caltech Evaluator: Rob Phillips
- Type of Caltech Credit: option elective
- Equivalent Course: N/A
- Description: This subject will include the natural history of Australia from the Cretaceous to the present, and the influence of Australian Aborigines and Europeans; Australian environments, climatic zones, major biomes; terrestrial biota: diversity, endemism and biology of Australian plants, relictual rainforests, sclerophylly, adaptation to fire, diversity, endemism and biology of unique habitats, low nutrients and aridity; diversity, endemism and biology of vertebrate fauna including amphibians and marsupials; marine environments, algae, invertebrates, reefs, mangrove communities, inland waterbodies; and ecology, conservation, and management of Australian ecosystems.

Science Research Project SCIE30001

- Level 3
- School of Biosciences
- 12.5 Credit Points
- 9 Caltech Units
- Caltech Evaluator: Elizabeth Bertani
- Type of Caltech Credit: Geobiology option laboratory requirements
- Equivalent Course: Bi 10

- Description: An individual program of supervised research in which the student designs a research project, in consultation with the supervisor, carries out and presents the results of the project. Detailed requirements are to be negotiated with the supervisor and the Science Research Project Coordinator(s). Each student will receive feedback on their progress through ongoing consultation with their supervisor.

Sedimentary Geology GEOL30003

- Level 3
- School of Earth Sciences
- 12.5 Credit Points
- 9 Caltech Units
- Caltech Evaluator: John Grotzinger
- Type of Caltech Credit: option requirement
- Equivalent Course: Ge 112 Sedimentology and Stratigraphy
- Description: Topics covered include facies analysis and petrology of carbonate, terrigenous and chemical sediments; techniques used in stratigraphic analysis and sequence stratigraphy; sedimentary geochemistry and its applications; principles and applications of palaeontology with respect to stratigraphy; post-depositional processes, including diagenesis and weathering, that alter rocks after their formation; chemical interactions between minerals and groundwater in weathered rocks and weathering products; the processes involved in hydrocarbon generation and organic maturation; and application of sedimentary geology to understanding sediment-hosted ore deposits.

Additional Two Courses:

Field Biology of Australian Wildlife ZOOL30009

- Level 3
- School of Biosciences
- 12.5 Credit Points
- 9 Caltech Units
- Caltech Evaluator: Rob Phillips
- Type of Caltech Credit: Geobiology option elective
- Equivalent Course: N/A
- Description: This field work subject provides an overall perspective on the biology of Australian terrestrial vertebrates: marsupials, monotremes, eutherians, birds, reptiles and amphibians. A key aim is for students to gain experience in designing and conducting a research project on wild animal populations and then preparing a journal style manuscript reporting their findings. Thus they should develop skills in analysing, interpreting and evaluating data and integrating their findings with existing literature and knowledge. Students should also develop skills in detection, population survey, capture, handling, collection of standard morphometric data and identification of wildlife, and assessment of behaviour,

reproductive status etc. They will apply these research methods to animals in the wild, and integrate this with knowledge of the biology of these taxa.

Comparative Animal Physiology ZOOL20006

- Level 2
- School of Biosciences
- 12.5 Credit Points
- 9 Caltech Units
- Caltech Evaluator: Chace Tydell
- Type of Caltech Credit: Geobiology option elective
- Equivalent Course: Bi 145 a. Tissue and Organ Physiology
- Description: This lecture and laboratory based subject aims to give students a solid foundation in basic physiological processes in animals, with a focus on the different ways in which animals adapt to their environments. Particular emphasis will be placed on marine and desert animals, and the integrative mechanisms involved in the regulation of important organ systems. Topics include endocrine feedback, neural integration, water and salt balance; cardiovascular systems, thermoregulation; metabolism and reproduction.

Aboriginalities MULT10001

- Level 1
- School of Culture and Communication
- 12.5 Credit Points
- 9 Caltech Units
- Caltech Evaluator: Jean Ensminger
- Type of Caltech Credit: Introductory Social Science Requirement
- Equivalent Course: An 22. Introduction to Sociocultural Anthropology.
- Description: This subject will provide students with an introduction to the complexity, challenges and richness of Australian Indigenous life and cultures. Drawing on a wide range of diverse and dynamic guest lecturers, this subject gives students an opportunity to encounter Australian Indigenous knowledges, histories and experiences through interdisciplinary perspectives. Across three thematic blocks - Indigenous Knowledges, Social and Political Contexts and Representation/Self-Representation - this subject engages contemporary cultural and intellectual debate. Social and political contexts will be considered through engagement with specific issues and a focus on Indigenous cultural forms, which may include literature, music, fine arts, museum exhibitions and performance, will allow students to consider self-representation as a means by which to disrupt and expand perceptions of Aboriginality.