# Study Abroad Application Proposal

## Essay

When I was 15, I spent three months in a tiny village in France on exchange. Immersed in a completely new culture and language, I was completely thrust out of my comfort zone – overwhelmed by the utterly foreign environment I had found myself in. Day by day, however, my head slowly lifted above the deluge of alien places, words, and people. I formed relationships that would last for years, partook in social situations I had never experienced before, learnt a whole other language, and came back with 101 unforgettable stories – of losing both poles, a ski, and a glove while (failing) to ski in the Pyrénées, of eating churros in the freezing cold of Lyon during the Fête des Lumières, of visiting the UN in Geneva and having a tour guide who spoke eight languages. I came back changed – more independent, more mature, and more ready to face anything the world could throw at me.

My experience in France taught me the innumerable benefits of immersing oneself in a different culture. I truly believe that experiencing different cultures and gaining worldly knowledge is as important as, if not more than, academic learning. Not only would studying in Edinburgh allow me to study subjects not offered at Caltech, I would also be thrown into an utterly unknown environment, with infinite opportunity for growth and self-learning. I believe that interacting with a completely new set of circumstances is a sure way to learn about oneself, to step outside of one's comfort zone and learn to adapt. It's a way to see more of the world's people and gain a greater respect for the diversity of humanity. Exchange in Edinburgh is a way to learn more about Scottish history and culture – something that greatly interests me as part of my family is Scottish – as well as experience college life in Europe, a vastly different experience to college life in the US, I imagine. I believe an exchange in Edinburgh would be an expansion upon my previous exchange experience, allowing me to expand myself personally and academically and become a wholly better, more rounded person.

## Proposed Fit

As an Engineering and Applied Sciences major concentrating in CNS, Ch41a, Bi/Ch110, and CS/CNS/EE 156a all fall under my option requirements. I propose to take Synthetic Organic Chemistry, Structures and Functions of Proteins 3, and introductory applied machine learning in Edinburgh as equivalent courses, respectively. Another area of study I am immensely interested in is Linguistics, of which there are no classes taught at Caltech. To study more in this area, I propose to take Linguistics and English Language 1A at Edinburgh. This last course will be taken towards the Institute Humanities and Social Sciences requirement.

**Proposed Course List**

1. **Introductory Applied Machine Learning (INFR10069)**
   College of Science and Engineering
   School of Informatics
   Department of Informatics
   Level 10
   Semester 1
   20 Credits
   9 Caltech Units
   Professor Adam Weirman
   Option Credit
   CS/CNS/EE 156a
   Introduction to Machine Learning and its Goals. Introduction to Data and Models. Memory based methods. Decision Trees. Error functions, Minimizing Error. Regression, Logistic Regression, Neural Networks. Margin Based Methods: Perceptron, Support Vector Machines. Naïve Bayes. Dimensionality Reduction. Clustering: K-means, Simple Gaussian Mixture Models, Hierarchical Clustering. Boosting Approaches. Model Averaging, Mixtures of Experts. Evaluation of Performance. [We will also use a modern machine learning programming environment]

2. **Synthetic Organic Chemistry (CHEM10024)**
   College of Science and Engineering
   School of Chemistry
   Department of Chemistry
   Level 10
   Semester 1
   20 Credits
   9 Caltech Units
   Professor Sarah E. Reisman
   Option Credit
   Ch41a
   A lecture course covering contemporary synthetic methods in organic chemistry, and their application to complex molecule synthesis. The course comprises individual lectures courses on: Template-directed Synthesis, Reagents for Organic Synthesis, Solid Phase Synthesis, Organometallics in Synthesis, Pericyclic Reactions and Asymmetric Base Catalysis. Either the Level 10 or Level 11 version of this course (as specified in the degree programme tables) is a compulsory requirement for Year 4/5 students on degrees in Chemistry or Medicinal and Biological Chemistry, but can be taken by Year 4/5 students on any Chemistry degree programme.

3. **Structures and Functions of Proteins 3 (BILG09015)**
College of Science and Engineering
School of Biological Sciences
Department of Biology
Level 9
Semester 1
20 Credits
9 Caltech Units
Professor Douglas C. Rees
Option Credit
Bi/Ch 110
How does protein structure and their dynamic properties work to produce the great range of physiological responses that we observe in cells? The course provides the basic groundwork necessary to equip a future Honours student in Biochemistry or Molecular Biology to answer this question. However, because of the rapid development of molecular studies and their growing importance in many areas of modern laboratory-based biology, the course is also designed to provide a strong background for students heading eventually for Biotechnology, Genetics, Immunology, Pharmacology or Physiology. The information in this course provides the basis for modern drug development strategies which are a key feature of Biotechnology Honours Programme and an underpinning the pharmaceutical industry. The emphasis is oriented towards development as a scientist and to making the transitions to Junior Honours. Experimental techniques and lectures are supplemented with workshops that reinforce this approach. An important feature of the in-course assessment is the Paper Analysis Exercise, designed to introduce students to the scientific literature, both in terms of how to read and how to appraise critically original papers.
Practicals provide hands-on experience of currently used laboratory techniques such as spectroscopy, electrophoresis, protein chromatography and protein/peptide mass spectrometry; development of skills in experimental design and in handling quantitative data are particularly important. Molecular graphics and modelling software is introduced to allow easy manipulation and examination of complex molecules, in order to supplement practical, lecture and workshop material.
There are four main themes in the lecture course:
(i) Students are introduced to the types of quaternary structure, and their symmetries, that are found in biological complexes.
(ii) Then there is an emphasis on how we find out about proteins: about how mass spectroscopy can be used to identity proteins, and to establish stoichiometry of complexes; about how X-ray crystallography, NMR, and cryo e-m are used to determine protein structures; and about how optical methods are used to follow dynamic properties, particularly those related to fluorescence, a major technique.
(iii) The principles established in the first two themes are explored by looking at molecular machines, particularly those that are drug targets: G-coupled Protein Receptors; the proteasome/ubiquitin system; gene machines utilising DNA or RNA; and ion channels, with an introduction to membrane structure.
(iv) The final theme is on quantitative analysis of the kinetics of protein:protein interactions and of reactions catalysed by proteins.

4. **Linguistics and English Language 1A (LASC08022)**
   College of Humanities and Social Sciences
   School of Philosophy, Psychology, and Language Sciences
   Department of Language Sciences
   Level 8
   Semester 1
   20 Credits
   9 Caltech Units
   Professor Colin F. Camerer
   Institute Credit (Social Sciences)
   No equivalent
   The course will introduce students to the study of the structure and use of language.
   Topics include:
   - Prescriptivism vs descriptivism
   - Language variation; Dialects and standard languages
   - Cross-linguistic variation; Unfamiliar languages
   - Sounds and sound systems
   - The structure of words and sentences
   - Language change
   - Language as a system for communication