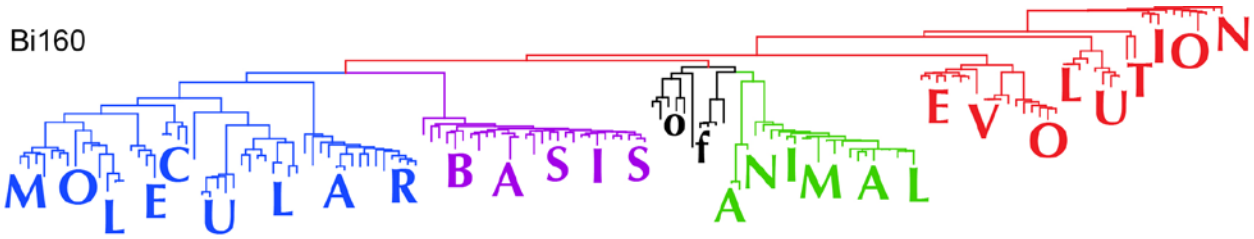
Course Syllabus



Instructor:
Joe Parker, Ph.D. **(Assistant Professor, Caltech, BBE)**
Email: joep@caltech.edu
Tel: 626-395-8729
Office Hours: By email

Teaching Assistants:
David Miller drmiller@caltech.edu
Yuriko Kishi ykishi@caltech.edu

Course Structure:
9 units (3-3-3)
Lectures (3 units) and Journal Discussion (3 units): Monday, 8:00AM – 11:00PM via Zoom
Final written assignment (3 units)

Learning Outcomes:
By the end of this course, you should be proficient in molecular evolutionary biology. By attending lectures and completing weekly journal article assignments, at the end of Spring Term **you should leave this course with a detailed knowledge of:**

- *the early evolution of animals, evolutionary theory, population genetics and principles of phylogenetic analysis.*
- *the molecular and cellular processes by which animal genomes, anatomy and behavior evolve and give rise to differences between species and higher taxonomic groupings.*
- *the phenomenon of speciation (one species splitting into two), and the role of the genome in this process.*
- *the concepts of convergence and parallel genetic change.*
- *how genes and molecules influence social, coevolutionary and symbiotic relationships, as well as chemical interactions between species.*

In addition, you will produce a written review-style journal article that demonstrates your familiarity with a specific area of molecular evolutionary biology.

PLEASE NOTE! This is a new course at Caltech. Any feedback is welcomed to help improve it. What are we not covering? What are we covering too much? How could a specific concept be better explained? Please feel encouraged to communicate your suggestions to me (or the class TAs).

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Content and Schedule:

4/6 Lecture: *The Metazoa*

4/13 Lecture: *Molecular Evolutionary Processes*

4/20 Lecture: *Transposons and Genome Evolution*

4/27 Lecture: *Body Plan Evolution*

5/04 Lecture: *The Metazoan Innovation: Growth and Size Control*

5/11 Lecture: *Evolutionary Neuroscience*

5/18 Lecture: *Phenotypic Convergence and Molecular Parallelism*

5/25 MEMORIAL DAY

6/01 Lecture: *Evolution of chemical communication* (Adrian Brückner)

Grading:

This is a pass-fail course.

1) **45% of this grade comes from a weekly journal club discussion.** Following each lecture, TAs will provide a recent paper, which you must read before the following Monday lecture date. The first hour of the Monday session is a journal club where the paper is discussed. Questions that may be asked about the paper during the discussion include: *What does it achieve? How does it advance the field? How does it challenge prior dogma? What novel techniques does it implement? How does it change our view of the subject in question, and what questions does it raise for future research?* Always have in mind that some papers are more challenging than others, and you should expect to encounter difficulties! As your read the paper, you may reach out to the TAs beforehand to help you grasp something, or alternatively bring it up during the discussion. **Participation in the discussion is essential. Students who cannot attend an online journal discussion in person are expected to submit a written summary and impression of the paper (~500 words).**

2) **45% of this grade comes from writing your own review article on a topic of your choosing, in the general area of molecular evolution.** Students must consult the primary literature and produce an up-to-date analysis of current knowledge of a specific problem. This project will be written up in the following format: Title, Abstract (~200 words), main text, split into sections with subheadings (~2500-4000 words total), References (no limit) and figures (up to three). Use the "*Trends*" or "*Current Opinion*" journal series as models for how to write your article. Students are encouraged to pick a topic from the lectures. Some ideas for your review article might be:

Current understanding of the Ediacaran-Cambrian transition (informed by the latest palaeontological and geobiological insights)

The emergence of multicellular animals from single celled protists (informed by the latest genomic insights)

Phylogenomic controversies in the animal tree of life and their bearing on the evolution of body plan/cell type/nervous system complexity

Evolution of developmental processes controlling animal phenotypes

Molecular evolution of metazoan transcriptional mechanisms

Evolution of behavior through changes in the sensory periphery or central brain circuitry

Does convergence at the phenotypic level arise from parallel changes in the genome?

The final project must be submitted by June 7th.

3) **10% for Attendance and Participation.** Students are expected to either attend the seminars/journal clubs, or watch the online videos of the seminars and submit journal club summaries as described in **2)** above.

Honor Code

"No member of the Caltech community shall take unfair advantage of any other member of the Caltech community."

Students with Documented Disabilities

Students who may need an academic accommodation based on the impact of a disability must initiate the request with Caltech Accessibility Services for Students (CASS). Professional staff will evaluate the request with required documentation, recommend reasonable accommodations, and prepare an Accommodation Letter for faculty dated in the current quarter in which the request is being made. Students should contact CASS as soon as possible, since timely notice is needed to coordinate accommodations. http://cass.caltech.edu/. Undergraduate students should contact Dr. Lesley Nye, Associate Dean of Undergraduate Students (administrative contact: Beth Larranaga) and graduate students should contact Dr. Kate McAnulty, Associate Dean of Graduate Studies (administrative contact: Angelica Medina-Cuevas).