JEL 214 Functional and Comparative Zoology

Learning Objectives :

This course aims to provide an integrative view of animal morphological and functional diversity, employing the comparative approach. Students will learn about evolutionary history, function and comparative anatomy of animals, using phylogenies to interpret evolution and function. This course will also employ a basic biomechanics approach. By the end of this course, students will have a grasp of functional anatomy and the strategies animals have evolved to deal with the physical demands of their environment, and be able to map this back using phylogenies to understand how these traits and strategies evolved. In addition each sub-module listed below will give students a flavour of the research methodology used to address these questions, from micro-CT scanning and morphometrics to high-speed videography, computational models and even robotics. The course evaluation will be based on assignments, paper discussions and peer-review, and a project component involving an introduction to research proposal design in the field.

Reference Books :

Selected Readings:

Vertebrates: Comparative Anatomy, Evolution and Function by Kenneth Kardong

Comparative Anatomy of the Vetrebrates: GC Kent and KC Carr

Comparative Biomechanics: Vogel

Engineering Animals by Denny and MacFadZean

Principles of Animal Communication: Jack Bradbury and Sandra Vehrencamp

Bird Coloration: Mechanisms and Measurements by McGraw and Hill

Content :

Course Contents:

1. Introduction to phylogenetics/cladistics (1 lecture)
2. Brief overview of the evolutionary history and diversity of life on earth (3 lectures)
3. Basic biomechanics, allometry and scaling laws (1 lecture).
4. Comparative anatomy, the biomechanics and evolution of feeding, the cranium and the feeding apparatus in vertebrates and invertebrates. (4 lectures).
5. Comparative anatomy, evolution and the biomechanics of posture and support. (4 lectures).
6. The evolution of limbs, and biomechanics of locomotion in land, air and water. (4 lectures).
7. Control theory and control of locomotion. (1 lecture).
8. The production and propagation of biological sound (3 lectures).

9. Perception, form and function in hearing (1 lecture).
10. Bat echolocation and the bat-moth arms race (1 lecture).
11. Integument, the evolution and mechanisms of biological color. (3 lectures).
12. The evolution of form and function in eyes and the perception of color (1 lectures).
13. The mechanisms and function of color change, using cuttlefish and chameleons as examples (1 lecture).
14. Animal architecture: the physics of structures that animals build (1 lecture).
15. Paper discussions (9 lectures minimum, interspersed throughout).

Using recent advances in CT scanning and the open-source website MorphoSource, classes will also engage with three-dimensional skeletal anatomy of diverse animals (including extinct ones) using “virtual dissection”.

Remark :

Papers: Paper readings will be prescribed as part of the course, and regular discussions will feature as part of the syllabus.