

# Organismal and Systems Biology

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From the NJIT Department of Biology, the Graduate Certificate in Organismal and Systems Biology is an exciting program with courses spanning multiple levels of biological organization. Students will gain a mechanistic understanding of biological processes at the cellular, organismal, and population levels that give rise to complex phenomena and system behavior. They will learn the value of comparative and quantitative approaches to the discovery of generalizable principles, using an integrated framework of physiology, evolution and ecology.

## Who would be suited to take this program?

The program is well suited to students with a background in biology or related life sciences.

## What are the Required Courses?

Code	Title	Credits
<b>Core Courses</b>		
Select four (4) of the following:		12
BIOL 610	Comparative Vertebrate Anatomy	3
BIOL 612	Comparative Animal Physiology	3
BIOL 621	Ecology	3
BIOL 641	Systems Neuroscience	3
BIOL 668	Evolutionary Medicine	3
BIOL 672	Computational Systems Biology	3
EVSC 627	Environmental Microbiology	3

## What will I learn?

- **Comparative Vertebrate Anatomy** - Explores the anatomical evolution of vertebrates within the context of the functional interrelationships of organs and the changing environments to which vertebrates have adapted. An ideal entry point into the ways living creatures interact with their immediate physical world, we examine how the forms and activities of animals reflect the materials available to nature and consider rules for structural design under environmental forces.
- **Comparative Animal Physiology** - Explores how animals, from invertebrates to vertebrates, function from the cellular to the organism level. The study of the structure and function of the various organs provides insight into how animals survive extreme environments and how they respond to changes in their environment. The comparative approach shows that the underlying physiological principles that govern life are common to all animals and yet animals have evolved unique and sometimes startling physiological solutions to problems posed by their particular environments.
- **Ecology** - Introduces graduate students to ecology at multiple conceptual and geographic scales. Ecological patterns and processes shape global biodiversity. From the community of microbes under your fingernail to entire continents and the planet, the field of ecology seeks to understand complex interactions among biological species and the environment. These themes are increasingly important; humans are reliant on functioning ecosystems even as anthropogenic factors alter our planet in profound ways.
- **Systems Neuroscience** - Neurophysical phenomena from a systems perspective. Basic concepts of cellular neuroscience, such as excitability, impulse conduction, and integration of activity at the cellular, before focusing on network level physiology of the nervous system and its role in the generation of behavior. The basic knowledge to understand neurobiological processes at all levels of complexity.
- **Evolutionary Medicine** - Addresses the evolutionary principles and processes underlying many types of disease (both infectious and hereditary/genetic). Covers biology, epidemiological models, and some aspects of human behavior.
- **Computational Systems Biology** - Introduction to the mathematical and computational modeling of biological systems. The required knowledge of biology and numerical tools for the solution of differential equations will be introduced as needed.
- **Environmental Microbiology** – Addresses basic microbiology (biochemical principles, cell structure organization, microbial nutrition and growth), important microbes involved in environmental microbiology and the environments where they are found, how they are detected and monitored, and their effects on humans, and the environment.

## Why study Organismal and Systems Biology at NJIT?

Biology is a broad and diverse discipline with an ever-increasing specialization into sub-disciplines, sometimes at the cost of losing sight of coherent conceptual frameworks that tie together biological principles from cells to communities of organisms. The faculty at NJIT's Department of Biological Sciences (and other academic units it interfaces with) is uniquely committed to explore and teach biology as an integrative discipline, bridging levels of organization and scientific approaches.

## **Into what industries might holders of this program find employment?**

Education, Environmental Science, Conservation

## **Prerequisites**

Applicants should have a bachelor's degree in biology or a related life sciences discipline.

## **Related Degree Programs**

All courses in this program related entirely to the NJIT MS in Biology (<https://www.njit.edu/academics/degree/ms-biology/>)