To provide a basic introduction to three major subfields in the dynamics of populations: Evolution, Ecology and Game Theory and in the connections between them.

1. Basic Evolutionary Theory

(a) Fitness and Landscapes, Mutations
(b) Moran and Wright-Fisher Models
(c) Stochastic Modelling - The Master Equation, Fokker-Planck Equation and Gillespie Algorithm
(d) Neutral Molecular Evolution and Genetic Drift
(e) The Small Mutation Limit and Clonal Interference
(f) Coalescence Theory

2. Basic Ecological Theory

(a) Neutral Theory
(b) McArthur-Wilson Theory
(c) Lotka-Volterra Systems and the May Limit
(d) Niche Theory
(e) Predator-Prey and Symbiosis
(f) Food Webs
(g) Spatial Ecology

3. Basic Game Theory

(a) Payoffs and the Two-Player Game
(b) Hawk-Dove and Prisoner's Dilemma
(c) Hamilton-May Model
(d) Adaptive Dynamics

1. Basic Programming Ability, either in Matlab or Python or C or equivalent.
2. Rudimentary knowledge of calculus and differential equations

Biweekly homework assignments and Final Project

60% Homework and 40% Final Project

Texts:
1. Nowak, M. A. Evolutionary Dynamics: Exploring the Equations of Life
2. J. Wakeley: Coalescent Theory

Evolution, Ecology and Game Theory