Learning objectives

- To study the significance of organism size and scaling
- To begin an analysis of the controls of animal locomotion ability (frog & toad jumping)
- To consider the evolutionary origins of organism form and function

Reading

“Scaling” reading
Background on the following topics from reserve reading or personal biology textbooks
Key words and phrases
- (animal) locomotion, musculoskeletal systems, natural selection, analogy and homology

Activities

Tuesday 9-9:50
- Introductions
- Pre-test, information sheets, handouts → distribute experimental design Monday
- Course pre-view

Tuesday 1:15-4:05
- Biomechanics investigation – part I (scaling) and experimental design for next week

Thursday 8-8:50
- Movement, scaling, and organismal design lecture/discussion

Thursday 9:9:50
- Biomechanics and scaling exercises
Learning objectives

- To continue your analysis of animal locomotion ability
- To begin your study of natural selection, evolutionary history, ecology, and the “design” of organisms
- To consider the composition of scientific articles

Reading


Key words and phrases
- e.g., Campbell & Reece 2002, chapter 22 (descent with modification)

Activities

Tuesday 9-9:50
- Lecture on principles of natural selection and adaptation

Tuesday 1:15-4:05
- Biomechanics investigation – part II (independent projects)

Thursday 8-8:50
- Discussion of Irschick and Losos (1998)

Thursday 9-9:50
- Exercise on writing and reviewing scientific papers
Learning objectives

- To continue your study of natural selection, evolutionary history, ecology, and the design of organisms
- To consider some of the challenges organisms face because of variation in temperature and water availability in the environment
- To understand the distinctions between adaptation, acclimation, and phenotypic plasticity.

Reading

Molles (2002) chapters 1, 4, and 5

Activities

Tuesday 9-9:50
- Lecture on
  - Principles of adaptation and physiological ecology
  - Temperature relations

Tuesday 1:15-4:05
- Acclimation exercise

Thursday 8:00-8:50
- Lecture on water relations

Thursday 9-9:50
- Water relations case studies

**Biomechanics papers are due Friday the 6th.**
Week IV - Causes and consequences of variation in plant growth and competitive ability

Learning objectives

- To consider the determinants of plant growth rate (e.g., plant morphology, and the uptake and allocation of energy and materials)
- To understand the concept of relative growth rate
- To demonstrate your understanding of the first 3+ weeks' course material

Reading

Molles (2002) chapters 6 and 13 (in the latter chapter, focus on the sections about plants)

Background on the following topics from reserve reading or personal biology textbooks

Key words and phrases

- Flowering plant morphology, growth, photosynthesis

Activities

Tuesday 9-9:50
- Lecture on
  - Plant structure and growth; carbon dynamics

Tuesday 1:15-4:05
- Examine Bio 251 plant carbon dynamics findings
- First harvest, relative growth rate exercise
- Start thinking about plant competition experiments

Thursday 8-9:50
- Quiz (scaling, locomotion, natural selection, analogy and homology, adaptation; temperature, water, and energy relations)

Friday – Monday: Weigh plants from first relative growth rate harvest.
Learning objectives

- To begin long-term experiments that evaluate links between leaf-level performance, whole plant growth performance, and responses to competition between plant species (tallgrass prairie plants)
- To understand the mechanisms and consequences of sexual reproduction

Reading

Tuesday AM: Molles (2002) – Review chapters 6 and 13 as necessary
Tuesday PM: Goldberg and Landa (1991)

Thursday: Background on the following topics from reserve reading or personal biology textbooks

Key words and phrases
- Reproduction, sexual reproduction
- e.g., Campbell & Reece (6th ed.) chapter 13

Activities

Tuesday 9-9:50
- Discuss Goldberg and Landa (1991)

Tuesday 1:15-4:05
- Second harvest, relative growth rate exercise
- Finalize designs of plant competition experiments

Thursday 8-9:50
- Lecture and exercises on sexual reproduction

Thursday – Monday: Set up competition experiments.
Week VI - Transmission Genetics & Population Genetics

Learning objectives

- To understand basic principles of transmission genetics, including segregation, independent assortment, crossing over, interactions within and between loci, and quantitative inheritance
- To understand basic principles of population genetics

Reading

Molles (2002) – chapter 8 (especially relevant in week 7)
Background on the following topics from reserve reading or personal biology textbooks
  Key words and phrases
  - Mendelian genetics, transmission genetics, classical genetics, quantitative genetics, natural selection, simple population genetics (e.g., Campbell & Reece chapters 14, 15, 23; chapter 23 is especially relevant in week 7)

Activities

Tuesday 9-9:50
  - Transmission genetics

Tuesday 1:15-4:05
  - Transmission genetics exercises

Thursday 8-9:50
  - Introduction to population genetics
Learning objectives

- To understand basic principles of microevolution, including the effects of natural selection, genetic drift, gene flow, and mutation on evolutionary change in populations and sets of populations
- To consider a case study of recent, rapid adaptive evolution of quantitative traits
- To consider the concept of speciation, and the relationship between microevolution and macroevolution

Reading

- Molles (2002) – chapter 8
- Carroll and Boyd (1992)
- Rice and Salt (1988)

Background on the following topics from reserve reading or personal biology textbooks
- Natural selection, gene flow, mutation, quantitative genetics, speciation

Activities

Tuesday 9-9:50
- Evolutionary forces

Tuesday 1:15-4:05
- Evolutionary forces exercises

Thursday 8:00-9:50
- Carroll and Boyd (1992)
- Rice and Salt (1988)
Learning objectives

- To understand basic principles of natural selection and evolution of quantitative traits
- To participate in a long-term study of natural selection (and write scientific articles based on that participation)
- To consider a case study of recent, rapid adaptive evolution of quantitative traits
- To think about speciation

Reading

Abrahamson article
Molles (2002) – chs. 8, 14
Background on the following topics from reserve reading or personal biology textbooks
Key words and phrases
- Natural selection, herbivory, parasitism

Activities

Tuesday 9-9:50
- The Solidago-Eurosta system

Tuesday 1:15-4:05
- Natural selection on goldenrod gallflies (Eurosta solidaginis); field sampling

Thursday 8-9:50
- Quiz
Learning objectives

- To understand basic principles of population ecology, including population dynamics and demography
- To perform a quantitative analysis of natural selection on goldenrod gallfly gall size

Reading

Molles (2002) – chapters 9-10

Activities

Tuesday 9-9:50
  - Introduction to population ecology (consider the wasp data)

Tuesday 1:15-4:05
  - Gallfly data collection

Thursday 8:00-9:50
  - Discussion of gall selection data
  - Population ecology exercises
Learning objectives

- To develop understanding of demography, population growth, and life-history, including exponential and density-dependent population growth, density-dependent natural selection, and the evolution of senescence

Reading

Molles (2002) chs. 11-12

Activities

Tuesday 9-9:50
- Lecture population growth data and models

Tuesday 1:15-4:05
- Population dynamics lab (computer exercises)

Thursday 8:00-8:50
- Lecture on life-history evolution.
Thursday 9:00-9:50
- Discussion of George Williams' article on the evolution of senescence

*Gallfly natural selection papers are due Friday the 9th.*
Week XIII – Species Interactions

Learning objectives

- To learn principles of species interactions in biological communities, especially the population dynamics and distribution consequences of interspecific competition
- To harvest the plant competition experiments and discuss the relationships found in class data on lower-level carbon dynamics (i.e., leaf-level gas exchange and the growth and allocation of individuals)

Reading


Activities

Tuesday 9-9:50
- Lecture and exercise on species interactions and interspecific competition

Tuesday 1:15-4:05
- Harvest competition experiments

Thursday 8:00-8:50
- Distribution and discussion of carbon dynamics data (gas exchange through RGR and root fraction)

Thursday 9:00-9:50
- Data collection for competition experiments (as needed)
Learning objectives

- To learn principles of ecosystem and community dynamics, especially (1) the nature and controls of energy flow and carbon cycling and (2) the dynamics of networks of feeding relationships (food webs)

Reading

Molles (2002) – chapters 18, 19 (Tuesday) and chapters 15, 17 (Thursday)

Activities

Tuesday 9-9:50
- Lecture on energy flow and carbon cycling in terrestrial environments

Tuesday 1:15-4:05
- Carbon dynamics data collection at CERA

Thursday 8:00-8:50
- Lecture on enemy-victim interactions and food webs

Thursday 9:00-9:50
- Discussion of Power (1990)

**Competition papers are due Friday the 23rd.**
Learning objectives

- To continue to synthesize data on the effects of fire regime on system-level carbon dynamics in reconstructed tallgrass prairie at the Conard Environmental Research Area
- To analyze the writing style of science journalism articles

Reading

- Molles (2002) ch. 20
- Selected science journalism articles

Activities

Tuesday 9-9:50
- Quiz 3 (demography, life history, species interactions, some ecosystem dynamics)

Tuesday 1:15-4:05
- Carbon dynamics sample and data collection at CERA and/or sample processing and data collection in the lab.

Thursday 8:00-8:50
- Discussion of carbon dynamics data -- Briggs and Knapp

Thursday 9:00-9:50
- Discussion of science journalism article design
Learning objectives

- To synthesize data on the effects of fire regime on system-level carbon dynamics in reconstructed tallgrass prairie at the Conard Environmental Research Area
- To reconsider issues related to the "big-picture" of the course and to evaluate the course

Reading

- Whatever you need for your articles
- Scott Gilbert's recent paper on "Developmental Ecology" (Gilbert2001.pdf)

Activities

Tuesday 9-9:50
- Final discussion of ecosystem carbon dynamics findings and of the conservation and restoration issues those findings raise

Tuesday 1:15-4:05
- Carbon dynamics article peer review session

Thursday 8:00-9:50
- Lecture/discussion on the "big picture" (Organisms, Evolution, and Ecology)
- Article discussion
- End-of-course evaluations

Science journalism essays are due Friday the 7th.