Animal Physiology

Biology 228, Fall, 2005

Syllabus

- **professor**: John Long, x7305; **email**: jolong **office**: Olmsted 317
- **required text**: Hill, Wyse, Anderson (HWA, below), *Animal Physiolog*y, 2004, Sinauer.
- **lecture** TR: 9:00 - 10:15 a.m., OH 201; • **lab** T: 1:30 - 5:30 p.m. OH 314
- **office hours**: M 9:30 - 10:30 a.m., F 10:00 - 11:00 a.m.

September	Lecture	Reading	Laboratory
1 R	Locomotion: mechanism and evolution	HWA, Chs 1, 2	
6 T	Locomotion: lift & flight	Pennycuick '96	Flight I: Theory
8 R	Locomotion: body size & shape	Vogel, Ch 3	
13 T	Flight: how-possibly adaptation models	—	Flight II: Field Measurements
15 R	Flight: energetics & metabolism	HWA, chs 5, 6	
20 T	Flight: migration & navigation	HWA, Ch 16	Flight III: Field Measurements
22 R	Locomotion: integrated models	Dickinson '00	
27 T	Examination I: Locomotion	—	Flight IV: Analysis & Testing
29 R	Nervous systems & motor control	HWA, Ch 18	
October			
4 T	Neurons: excitable cells	HWA, Ch 11	Neuromuscular I: Action Potentials
6 R	Muscles: cross-bridge theory	HWA, Ch 17	
11 T	Muscles: kinetics & mechanical limits	HWA, Ch 17	Neuromuscular II: Skeletal Muscle
13 R	Muscles, motors, & motility	Vogel, Ch 22	
	Fall Break		
25 T	Evolution of vertebrate muscle types	Schachet	Neuromuscular III: Smooth Muscle
27 R	Muscle disease	HWA, Ch 19	
November			
1 T	Examination II: Nerves & Muscles	—	Neuromuscular IV: Independent Research
3 R	Environments: water & salt	HWA, Chs 3, 25	
8 T	Osmoregulation: kidneys	HWA, Ch 27	Circulation I: Osmoregulation
10 R	Environments: oxygen & carbon dioxide	HWA, Ch 20	
15 T	Oxygen transport: hemoglobin	HWA, Ch 22	Circulation II: Hemoglobin
17 R	Circulation	HWA, Ch 23	
22 T	Pumps, pipes and bulk flow	Vogel, Ch 9	Circulation III: Vertebrate Heart
	Thanksgiving Break		
29 T	Respiratory systems	HWA, Ch 21	Circulation IV: Independent Research
December			
1 R	Examination III: Circulatory Systems	—	
6 T	Extreme Physiology: Diving Adaptation	HWA, Ch 24	Symposium
8 R	Extreme Phyisology: Desert Adapations	HWA, Ch 28	

Assignments	% of total	due date
Problem set I: Dimensional analysis	5	13 September
Problem set II: Action potentials	5	11 October
Scientific manuscript I: Flight	15	4 October
Scientific manuscript II: Neuromuscular	15	8 November
Scientific manuscript III: Circulation	15	8 December
Examination I: Locomotion	10	27 September
Examination II: Nerves & Muscles	10	1 November
Examination III: Circulatory Systems	10	1 December
Oral presentation	10	6 December
Participation, attendance	5	
Total	100	

Attendance: mandatory for laboratories.
Without excuse from the Dean of Studies office (Class Advisor), loss of Participation credit.

Late penalty: 2% of possible grade for each day; note that all assignments must be completed to pass course.

Academic accommodations are available for students with disabilities who are registered with the Office of Disability and Support Services. Students in need of disability accommodations should schedule an appointment with me early in the semester to discuss any accommodations for this course which have been approved by the Office of Disability and Support Services, as indicated in your DSS accommodation letter.

Skills-based goals:

1. Uncertainty in measurement, analysis, and interpretation.

2. Experimental techniques:
   a. transduce physical phenomena
   b. calibrate instruments
   c. record analog and digital data
   d. handle animals with care
   e. prepare live tissues

3. Statistics:
   a. design coherent experiments
   b. test hypotheses
   c. fit non-linear functions

4. Presentation:
   a. discuss and present orally
   b. write in the scientific style
   c. produce clear graphics

5. Scientific literature:
   a. search and access primary literature
   b. read and understand primary literature
   c. critique primary literature

Knowledge-based goals:

Mechanistic physiology:

1. muscles & movement: contractile proteins, sarcomeres, excitation-contraction coupling, force-length & force-power curves, work loops, neural control.

2. kidneys & osmoregulation: nephrons, counter-current multiplier, hormonal regulation, filtration-resorption, filtration pressure, Donnan equilibrium.

3. hearts & circulation: cardiac muscle, pacemaker cells, cardiac output, circulation, principle of continuity, Hagen-Pouseuille equation, pressure-volume pumps.

4. lungs & respiration: physical chemistry of air & water, diffusion, Fick's equation, partial pressures, hemoglobin, myoglobin, oxygen loading and unloading.

5. jaws & energy metabolism: prey processing, digestion, glucolysis, aerobic metabolism, protein metabolism, oxygen consumption.

Evolutionary physiology:

6. historical analysis: pitfalls and possibilities, phylogenetic reconstruction.

7. how-possibly adaptation models.

8. population-level approaches with living systems.