

SYLLABUS
BIOLOGY 395 – EXTREME PHYSIOLOGY
INTERSESSION, JANUARY 2019

COURSE: Biology 395 – Extreme Physiology Travel Course
Credit value: 3.0 (Combined Lecture and Laboratory)
Biology Curriculum Course Group Satisfied: Organismal
Prerequisites: General Physiology (Biology 245/245L)
For more information visit: <http://sites.scranton.edu/extremephysiology/>

LOCATION: Tucson and Flagstaff, AZ, and other locations in Arizona

TEXTS and other INSTRUCTIONAL MATERIALS:

- 1) Assigned readings and journal articles (sample Bibliography attached)
- 2) Instructor-provided PowerPoint presentations
- 3) Quantitative Circulatory Physiology (QCP) Modeling Software (copyright Robert Hester, Biological Simulators, Inc. Jackson MS 39236)

INSTRUCTORS: Dr. Terrence Sweeney; LSC 275; phone: 941-7623; terrence.sweeney@scranton.edu
with Prof. Tara Fay; LSC 254; phone: 941-4395; tara.fay@scranton.edu

COURSE DESCRIPTION:

This travel course will expose the student, serving as both subject and investigator, to the stunning and diverse environments of Arizona, as she/he assesses cardiovascular and respiratory conditioning and tracks his/her improvement through a 25-day period of extreme environmental and physical challenges. Accompanying instruction will explore the ongoing physiological adaptation.

STUDENT LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

- record and analyze quantitative measures of human cardiovascular and respiratory performance;
- demonstrate and document the improvements in personal cardiovascular and respiratory performance that are attainable through a sustained period of aerobic and environmental challenges;
- describe the synergism of nutrition and training in the enhancement of human performance;
- identify the mechanisms of physiological adaptation to the environmental challenges posed by an arid environment or high altitude;
- describe the adaptive mechanisms employed by species native to arid and high altitude environments that allow these species to survive extreme environmental challenges; and
- cogently present information and ideas published in the primary literature.

COURSE POLICIES:**Course Enrollment cap:** 10 students**The grading scale used is as follows:**

| | | | |
|--------------------------|--------------------------|--------------------------|--------------|
| A = 94 – 100 | B = 84 – 86 | C = 74 – 76 | D = 60 – 64 |
| A ⁻ = 90 – 93 | B ⁻ = 80 – 83 | C ⁻ = 70 – 73 | F = below 60 |
| B ⁺ = 87 – 89 | C ⁺ = 77 – 79 | D ⁺ = 65 – 69 | |

Student grade will be determined from performance on tasks and deliverables described below.

Final Grade Breakdown:

| Description | Contribution to Final Letter Grade (%) |
|--|--|
| Presentation of Human Performance Data | 15 |
| Presentation of Primary Literature Synopsis | 20 |
| Human Performance Equipment Operation | 15 |
| Final Exam | 30 |
| Personal Performance Journal | 10 |
| Participation/Cooperation in Household Functions | 10 |

TENTATIVE SCHEDULE:**Date:**

- 1/1 Students arrive in Tucson, AZ
- 1/2 Course officially begins
Introductory Lecture
Resting Parameters, HR, BP, RR, RMV, SO₂, body weight
Endurance: 1.5-mile timed run
- 1/3 Completion of Initial Human Performance Testing
Recording of Initial Pre-training Cardiovascular and Respiratory Conditioning
VO₂max; Wingate Test Anaerobic Performance Assessment
- 1/4 - 1/12 Training & class instruction in Tucson (Dept. of Physiology, UA)
Training Schedule
Each student is to keep a daily log of exercise regimen and nutritional intake
Part I: Mandatory Group Exercise Regimen
Varied daily schedule of defined exercise (e.g., cycling, hiking, running, swimming)
Part II: Individualized Exercise Regimen
Optional additional exercise (logged and perhaps in smaller groups)
- Tentative Lecture Schedule / Topics
Cooking for Nutrition I
Exercise Physiology
Exercise and its Impact on Immune Function
Nutritional Demands of Prolonged Exercise
Comparative Physiology of Desert Animals
Comparative Physiology of Desert Flora

- Group discussions of student conditioning data
- Faculty mentoring of students on relevant journal articles/reviews
- Trips / Sites (most likely incorporated into daily mandatory exercise)
 - Saguaro National Monument
 - Arizona Sonoran Desert Museum
 - Chiricahua Mountains
 - Sabino Canyon Recreational Area
 - Mount Lemon
- 1/12 Pre-High Altitude Update of Conditioning
 - Resting Parameters, HR, BP, RR, RMV, SO₂, hematocrit
 - Endurance: 1.5-mile run time
- 1/13 Relocation to Flagstaff, AZ
- 1/14 Recording of Initial Changes with relocation to high altitude
 - Resting HR, BP, RR, RMV, SO₂
 - Endurance: 1.5-mile run time
 - Survey for Acute Mountain Sickness
- 1/14 - 1/19 Training & class instruction in Flagstaff (Northern Arizona University)
 - Training Schedule
 - Each student is to keep a daily log of exercise regimen
 - Part I: Mandatory Group Exercise Regimen
 - Varied daily schedule of defined distance cycling, hiking, X-C skiing, etc.
 - Part II: Individualized Exercise Regimen
 - Optional additional exercise (logged and perhaps in smaller groups)
 - Lecture Schedule / Topics
 - Cardiovascular Physiology, examined using *QCP* Modeling Software
 - Respiratory Physiology
 - Cooking for Nutrition II
 - Physiological Adaptations to High Altitude
 - Comparative Physiology of High Altitude Animals
 - Group discussions of student conditioning data
 - Student presentations of relevant journal articles/reviews
 - Trips / Sites (most likely incorporated into daily mandatory exercise)
 - Grand Canyon Hike - overnight stay at Phantom Ranch (1/17 - 1/18)
 - Snowbowl Ski Resort
 - Sedona / Oak Creek Canyon
 - Sunset Crater National Monument/ Walnut Canyon / Wapatke Ruins
 - Museum of Northern Arizona
- 1/19 Update of Conditioning after week in Flagstaff
 - Resting Parameters, HR, BP, RR, RMV, SO₂, hematocrit
- 1/20 Return to Tucson, AZ
- 1/21 Recording of Initial Changes with relocation to low altitude
 - HR, BP, RR, RMV, SO₂, hematocrit

1/22 - 1/23 Final Update of Conditioning

Resting Parameters, HR, BP, RR, RMV, SO₂, body weight, VO₂max

Endurance: 1.5-mile run time

1/23 - 1/24 Course Lecture Wrap-up, Exam, Student Presentation of Human Performance Data

1/25 Return to Pennsylvania

SAMPLE BIBLIOGRAPHY OF PRIMARY LITERATURE ASSIGNMENTS:

Carter, R. III, D. E. Watenpaugh, and M. L. Smith. Genome and Hormones: Gender Differences in Physiology Selected Contribution: Gender differences in cardiovascular regulation during recovery from exercise. *J Appl Physiol.* **91**: 1902 – 1907, 2001.

Fu, Q., A. Arbab-Zadeh, M. A. Perhonen, R. Zhang, J. H. Zuckerman, and B. D. Levine. Hemodynamics of orthostatic intolerance: implications for gender differences. *Am. J. Physiol. Heart Circ. Physiol.* **286**: H449–H457, 2004.

Gottshalk, C. W. and M. Mylle. Micropuncture study of the mammalian urinary concentrating mechanism: evidence for the countercurrent hypothesis. *Am. J. Physiol.* **196 (4)**: 927-936, 1959.

Sun, D., A.N. Huang, A. Koller and G. Kaley. Decreased Arteriolar Sensitivity to Shear Stress in Adult Rats is Reversed by Chronic Exercise Activity. *Microcirculation* **9**: 91–97, 2002.

Tuan, T-C, T-G Hsu, M-C Fong, C-F Hsu, K K C Tsai, C-Y Lee and C-W Kong. Deleterious effects of short-term, high-intensity exercise on immune function: evidence from leucocyte mitochondrial alterations and apoptosis. *Br. J. Sports Med.* **42**: 11-15, 2008.