GERONTOLOGY 310
PHYSIOLOGY OF AGING
Fall 2010

USC Course Catalog Description: GERO 310 Physiology of Aging (4, Fa) Effects of normative aging processes on homeostatic mechanisms and how these changes relate to development of disorder and disease in later life. Lecture and discussion. Prerequisite: BISC 220L or BISC 221L.

Classroom: Gero Smart Classroom, 2nd Floor Time: Mon./Wed. 10:00 a.m. - 11:50 a.m.

Instructors:
Kelvin J. A. Davies, Ph.D., D.Sc.
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Office Hours: by appointment

Christian J. Pike, Ph.D.
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Office Hours: by appointment

Joanna M. S. Davies, M.D.
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Office Hours by appointment

Course Description
Examination of human aging with major emphasis in the physiology of the later years and implications for health maintenance. The goal of the course will be to solidify biological concepts and theories that underlie the phenomena of human aging. Throughout the course special effort will be made to differentiate normal aging processes from age-related deterioration caused by disuse, misuse or abuse, and disease.

Course Objectives
By the conclusion of the course, students are expected to be able to:

1) Provide an informed opinion on key issues in biological gerontology relevant to health care practitioners, social service professionals, educators, administrators, and policy analysts.

2) Discuss the nature of biological aging as a composite of genetics and environment.

3) Clearly distinguish between normal aging processes and age-associated diseases.

4) Clearly distinguish between problems of disuse, misuse, abuse, and normal aging changes.
Textbook
The required text book for this course is *Human Aging: Biological Perspectives* (2nd Edition) by Augustine G. Digiovanna, and there will be additional assigned readings for some topics. Students are also expected to use a medical dictionary to assist them in understanding the text and the assigned readings.

Evaluation
This class is primarily a lecture course with audiovisual presentations, a textbook, and supplementary reading material. Evaluation in the course will be based on one midterm examination, a term-paper, and a final examination. The final examination will not be comprehensive. Examinations will consist of short essay questions designed to give you the opportunity to demonstrate what you have learned. An outline of the examination schedule is given below:

<table>
<thead>
<tr>
<th>Test</th>
<th>Date</th>
<th>Dates/Topics Covered</th>
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<tbody>
<tr>
<td>Midterm</td>
<td>October 18</td>
<td>Aug. 23 through Oct. 13</td>
</tr>
<tr>
<td>Final Examination</td>
<td>December 13 (from 8:00am to 10:00am)</td>
<td>Oct. 20 through Dec. 1</td>
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Students will be evaluated on the basis of:
1) Midterm Exam. (33%)
2) Final Exam. (33%)
3) Term Paper (34%)

The Term Paper is due on or before the last day of class on Wednesday, December 1

If you are going to miss an examination, you MUST CALL AHEAD of time and reschedule to take the make-up test within the next week. Anyone who does not call ahead of time to reschedule will receive an F' for that exam.

Students with Disabilities (the information below was provided by the office of the Provost)

“Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure that the letter is delivered to any of the Instructors as early in the semester as possible. DSP is located in on campus in STU 301, and is open from 8:30 a.m. - 5:00 p.m., Monday through Friday. The phone number for DSP is (213) 740-0776.”
All students are required to submit a term paper, representing their own original work that provides an in-depth review of an aspect of the Biology of Aging.

Students will be free to choose their own topics, subject to final approval by the course instructor.

Student papers must be printed (using a word processing program) and must be a minimum of ten (10) pages in length, using double-spaced type with a 12 point font. Leave a one-line space between each paragraph, use a one-inch all-around margin, and number each page consecutively. Be sure to give your term paper an appropriate title, and also make sure to put your own name on the paper.

Student papers must include at least ten (10) literature references, not including the course textbook. Students are encouraged to use the campus libraries and the internet to find appropriate background information and references. The references used should primarily be published journal articles from the bio-medical literature, rather than books, unpublished opinions from the internet, or popular magazines. Use numbers to quote your references directly in the text of your term paper; like this (1). Number each reference in the order it appears in the text.

Extensive direct quotations are not appropriate for this term paper, and copying without giving credit is never acceptable. If you really want to include a quote or two, it/they should be no longer than three (3) lines long, and should be set inside quotation marks. Remember to fully reference the source of any quote you use in your reference list.

All term papers will be due no later than the end of the last class. Term papers may also be given to the instructor at any time before this date.

Journal References should look like this:


Reference to a chapter in a book should look like this:

<table>
<thead>
<tr>
<th>Month</th>
<th>Date</th>
<th>Day</th>
<th>Topic</th>
<th>Instructor</th>
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<tbody>
<tr>
<td>Aug.</td>
<td>23</td>
<td>Mon.</td>
<td>Introduction to class and structure/evaluation</td>
<td>Christian Pike</td>
</tr>
<tr>
<td>Aug.</td>
<td>25</td>
<td>Wed.</td>
<td>Aging and disease – an overview</td>
<td>Joanna Davies</td>
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<tr>
<td>Aug.</td>
<td>30</td>
<td>Mon.</td>
<td>Endocrine system in aging I</td>
<td>Christian Pike</td>
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<tr>
<td>Sept.</td>
<td>1</td>
<td>Wed.</td>
<td>Endocrine system in aging II</td>
<td>Christian Pike</td>
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<tr>
<td>Sept.</td>
<td>6</td>
<td>Mon.</td>
<td>LABOR DAY HOLIDAY – NO CLASS</td>
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<tr>
<td>Sept.</td>
<td>8</td>
<td>Wed.</td>
<td>Neurobiology of aging I</td>
<td>Christian Pike</td>
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<tr>
<td>Sept.</td>
<td>13</td>
<td>Mon.</td>
<td>Neurobiology of aging II</td>
<td>Christian Pike</td>
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<tr>
<td>Sept.</td>
<td>15</td>
<td>Wed.</td>
<td>Neurobiology of aging III</td>
<td>Christian Pike</td>
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<tr>
<td>Sept.</td>
<td>20</td>
<td>Mon.</td>
<td>Neurobiology of aging IV</td>
<td>Christian Pike</td>
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<tr>
<td>Sept.</td>
<td>22</td>
<td>Wed.</td>
<td>Principles of Gerontology</td>
<td>Kelvin Davies</td>
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<tr>
<td>Sept.</td>
<td>27</td>
<td>Mon.</td>
<td>Theories of biological aging</td>
<td>Kelvin Davies</td>
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<tr>
<td>Sept.</td>
<td>29</td>
<td>Wed.</td>
<td>Free Radical Theory of aging</td>
<td>Kelvin Davies</td>
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<td>Oct.</td>
<td>4</td>
<td>Mon.</td>
<td>Integument I</td>
<td>Kelvin Davies</td>
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<td>Oct.</td>
<td>6</td>
<td>Wed.</td>
<td>Integument II</td>
<td>Kelvin Davies</td>
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<td>Oct.</td>
<td>11</td>
<td>Mon.</td>
<td>Skeletal system in aging</td>
<td>Kelvin Davies</td>
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<td>Oct.</td>
<td>13</td>
<td>Wed.</td>
<td>Muscular system in aging</td>
<td>Kelvin Davies</td>
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<tr>
<td>Oct.</td>
<td>18</td>
<td>Mon.</td>
<td>MID-TERM EXAMINATION</td>
<td>Kelvin Davies</td>
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<tr>
<td>Oct.</td>
<td>20</td>
<td>Wed.</td>
<td>Sensory systems in aging I</td>
<td>Christian Pike</td>
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<tr>
<td>Oct.</td>
<td>25</td>
<td>Mon.</td>
<td>Sensory systems in aging II</td>
<td>Christian Pike</td>
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<tr>
<td>Oct.</td>
<td>27</td>
<td>Wed.</td>
<td>Reproductive system in aging I</td>
<td>Christian Pike</td>
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<tr>
<td>Nov.</td>
<td>1</td>
<td>Mon.</td>
<td>Reproductive system in aging II</td>
<td>Christian Pike</td>
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<tr>
<td>Nov.</td>
<td>3</td>
<td>Wed.</td>
<td>Urinary system in aging</td>
<td>Christian Pike</td>
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<tr>
<td>Nov.</td>
<td>8</td>
<td>Mon.</td>
<td>Immune system in aging I</td>
<td>Christian Pike</td>
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<td>Nov.</td>
<td>10</td>
<td>Wed.</td>
<td>Immune system in aging II</td>
<td>Christian Pike</td>
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<td>Nov.</td>
<td>15</td>
<td>Mon.</td>
<td>Digestive system in aging</td>
<td>Kelvin Davies</td>
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<tr>
<td>Nov.</td>
<td>17</td>
<td>Wed.</td>
<td>Nutrition in aging</td>
<td>Valter Longo</td>
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<tr>
<td>Nov.</td>
<td>22</td>
<td>Mon.</td>
<td>Caloric Restriction &amp; Aging</td>
<td>Valter Longo</td>
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<tr>
<td>Nov.</td>
<td>24</td>
<td>Wed.</td>
<td>Heart and circulatory system in aging</td>
<td>Kelvin Davies</td>
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<tr>
<td>Nov.</td>
<td>29</td>
<td>Mon.</td>
<td>Respiratory systems in aging</td>
<td>Kelvin Davies</td>
</tr>
<tr>
<td>Dec.</td>
<td>1</td>
<td>Wed.</td>
<td>Coordination &amp; Integration of the Cardiovascular system</td>
<td>Kelvin Davies</td>
</tr>
<tr>
<td>Dec.</td>
<td>13</td>
<td>Mon.</td>
<td>FINAL EXAMINATION  8 a.m. to 10 a.m.</td>
<td>Kelvin Davies</td>
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</table>
Gero. 310 – Fall 2010 DESCRIPTION OF CLASS TOPICS

August 23  ORIENTATION AND INTRODUCTION TO THE STUDY OF AGING  
Instructor: Dr. Christian Pike  
- Class structure and evaluation, Course Objectives

Students are expected to have a background in basic cell biology, molecular biology, and biochemistry. Those whose background is not strong in these areas should undertake serious self-study of the following topics in Chapter 2 of the course textbook: *Human Aging: Biological Perspectives* (2nd Edition) by Augustine G. Digiovanna

- Basic organization of cells, tissues, and organs  
- The genome  
- The information chain: transcription & translation  
- Cancer ‘the uncontrolled cell’  
- Mendelian genetics and disease inheritance  
- DNA repair  
- RNA and protein synthesis  
- Proliferation potential of cells in vitro

August 25  AGING AND DISEASE  
Instructor: Dr. Joanna Davies  
- Giant Cell (Temporal) Arteritis and Polymyalgia Rheumatica  
- Diseases of the Integument  
- Cardiovascular Diseases  
- Respiratory Diseases  
- Digestive Diseases  
- Genitourinary Diseases  
- Diseases of Muscle & Bone – Muscle Fatigue, Sarcopenia, Rheumatoid Arthritis, Osteoarthritis, Osteoporosis, Lumbar stenosis, Gout, Pseudogout (CPPD) Paget’s Disease, Giant Cell (Temporal) Arteritis and Polymyalgia Rheumatica, Dermatomyositis.

August 30  THE ENDOCRINE SYSTEM I  
Instructor: Dr. Christian Pike  
- The endocrine glands and associated hormones  
- Hormone functions  
- Mechanism of hormone action  

Text: Chapter 14

Sept. 1  THE ENDOCRINE SYSTEM II  
Instructor: Dr. Christian Pike  
- Age changes in endocrine system and hormone levels  
- Diabetes, insulin insensitivity and glucose regulation  
- GH, IGF-1 and longevity regulation  

Text: Chapter 14

Sept. 6  LABOR DAY – NO CLASS
Sept. 8  THE NERVOUS SYSTEM I  
Instructor: Dr. Christian Pike  
- Basic anatomy and organization of the nervous system  
- Neural cell types and functions  
- The synapse: target of drug therapy and drug abuse  
- Neural transmission: how neurons communicate  
Text: Chapter 6

Sept. 13  AGE-RELATED CHANGES OF THE NERVOUS SYSTEM II  
Instructor: Dr. Christian Pike  
- Normal age-related changes in the nervous system  
- Age changes in neural structure and integrity  
- Age changes in neural function and cognitive abilities  
- Effects of aging on neural plasticity  
Text: Chapter 6

Sept. 15  AGE-RELATED DISEASES OF THE NERVOUS SYSTEM III  
Instructor: Dr. Christian Pike  
- Stroke  
- Parkinson’s disease  
Text: Chapter 6

Sept. 20  AGE-RELATED DISEASES OF THE NERVOUS SYSTEM IV  
Instructor: Dr. Christian Pike  
- Dementias  
- Alzheimer’s disease  
Text: Chapter 6

Sept. 22  Principles of Gerontology  
Instructor: Dr. Kelvin Davies  
- Why the study of aging is important to your future  
- Human life expectancy  
- Demography of aging  
- The role of aging in disease  
- The importance of scientific method in natural science research  
  a. type of studies in aging research  
  b. role of statistical analyses  
- Criteria for age-related changes  
- Single vs multi-dimensional model of biological aging  
Text: Chapter 1

Sept. 27  BIOLOGICAL AGING THEORIES  
Instructor: Dr. Kelvin Davies  
- Classes of aging theories - Programmed, Stochastic, Network  
- Evolutionary theories of aging  
- Disposable soma (body) theory  
- Antagonistic pleiotropy theory  
- Accumulation of late-acting error theory  
- Physiological theories of aging  
  - Genetic theories - genetic timers, genetic clock theory, death gene theory, telomere theory, heterochromatin loss theory, limited gene usage somatic mutation theory,
faulty DNA repair theory
- Non-genetic theories - error catastrophe, rate of living, free radical theory of aging, mitochondrial theory, mitochondrial DNA theory, clinker theories, cross-linkage, hormonal theories, calcium theories, immune system theories, wear and tear theory
- Network theories of aging


Sept. 29  FREE RADICAL THEORY OF AGING
Instructor: Dr. Kelvin Davies
- Oxygen and Oxidative stress
- Protein, lipid, DNA, RNA oxidation
- Antioxidants – Compounds, Enzymes
- Repair systems
- Inducible defense and repair

Text: Chapter 2 + class handouts

Oct. 4  THE INTEGUMENT SYSTEM I
Instructor: Dr. Kelvin Davies
- Main functions for homeostasis
- The epidermis, age changes in the epidermis
- Epidermal accessory structures

Text: Chapter 3

Oct. 6  THE INTEGUMENT SYSTEM II
Instructor: Dr. Kelvin Davies
- The dermis
- Boundary between epidermis and dermis
- Vitamin D production
- Subcutaneous layer
- Cosmetic age changes, abnormal changes

Text: Chapter 3

Oct. 11  THE SKELETAL SYSTEM
Instructor: Dr. Kelvin Davies
- Contraction and movement
- Age-related changes in muscles
- Age-related changes in activity and physical performance

Text: Chapter 8

Oct. 13  THE MUSCLE SYSTEM
Instructor: Dr. Kelvin Davies
- Anatomy and physiology of bone
- Age-related changes in bone

Text: Chapter 9

Oct. 18  MID-TERM EXAMINATION
Oct. 20  SENSORY SYSTEMS IN AGING I  
Instructor: Dr. Christian Pike  
- Olfaction and the effects of age  
- The auditory system: basics of normal functioning and the effects of age  
- Age-related diseases of the auditory system  
Text: Chapter 7

Oct. 25  SENSORY SYSTEMS IN AGING II  
Instructor: Dr. Christian Pike  
- The visual system: basics of normal functioning and the effects of age  
- Age-related diseases of the visual system  
- Gustation and the effects of age  
Text: Chapter 7

Oct. 27  REPRODUCTIVE SYSTEM I  
Instructor: Dr. Christian Pike  
- Anatomy and functioning of the female reproductive system  
- The ovarian cycle and menopause  
- Normal age changes and age-related disorders in the female reproductive system  
- Hormone therapies in postmenopausal women  
Text: Chapter 13

Nov. 1  REPRODUCTIVE SYSTEM II  
Instructor: Dr. Christian Pike  
- Anatomy and functioning of the male reproductive system  
- Normal age changes in the male reproductive system  
- Erectile dysfunction, prostate cancer and other age-related diseases  
Text: Chapter 13

Nov. 3  URINARY SYSTEM  
Instructor: Dr. Christian Pike  
- Anatomy and physiology of the kidney and urinary system  
- Structural and functional age-related changes in the urinary system  
- Incontinence, end stage renal insufficiency, and other age-related disorders  
- Alterations of drug metabolism in the elderly  
Text: Chapter 12

Nov. 8  THE IMMUNE SYSTEM I  
Instructor: Dr. Christian Pike  
- Basic components of the immune system  
- Key cell types and functions  
- Innate and acquired immune responses  
Text: Chapter 15

Nov. 10  THE IMMUNE SYSTEM II  
Instructor: Dr. Christian Pike  
- Age-related changes in the immune system  
- Thymic involution  
- Vaccination and aging  
Text: Chapter 15
Nov. 15  THE DIGESTIVE SYSTEM
Instructor: Dr. Kelvin Davies
- Breakdown of foods
- Passage of foods through GI system
- Absorption of food elements
Text: Chapter 10

Nov. 17  NUTRITION IN AGING
Instructor: Dr. Valter Longo
- Guidelines for healthy eating
- Current recommendations for persons over 55
- Current research on nutrition in the elderly
Text: Chapter 11

Nov. 22  CALORIC RESTRICTION & AGING
Instructor: Dr. Valter Longo
Text: Chapter 11 + class handouts

Nov. 24  THE HEART & CIRCULATION
Instructor: Dr. Kelvin Davies
- Anatomy and physiology of the cardiovascular system
- Hypertension, atherosclerosis, arteriosclerosis
Text: Chapter 4

Nov. 29  RESPIRATION
Instructor: Dr. Kelvin Davies
- Anatomy and physiology of the respiratory system
- Age-related disorders of the respiratory system
Text: Chapter 5

Dec. 1  COORDINATION & INTEGRATION OF THE CARDIOVASCULAR SYSTEM
Instructor: Dr. Kelvin Davies
- How circulation and respiration combine to deliver oxygen to tissues, remove carbon dioxide and metabolic wastes, and maintain pH
- Normal age-related changes, and abnormal disease states
Text: Chapters 4 and 5

Dec. 13  FINAL EXAMINATION  8am – 10am