BIO-2100: BIOLOGY OF AGING

Cuyahoga Community College

Viewing: BIO-2100 : Biology of Aging

Board of Trustees:
January 2021

Academic Term:
Fall 2021

Subject Code
BIO - Biology

Course Number:
2100

Title:
Biology of Aging

Catalog Description:
Exploration of current biological theories of aging with emphasis on humans. Fundamental concepts of cell biology and physiology will be used to study extrinsic and intrinsic factors of aging. Topics will include normal age-related changes and pathology in body systems, senescence, genetics, life expectancy, and improving longevity.

Credit Hour(s):
3

Lecture Hour(s):
3

Lab Hour(s):
0

Other Hour(s):
0

Requisites

Prerequisite and Corequisite
BIO-1040 The Cell and DNA, or BIO-1050 Human Biology, or BIO-1500 Principles of Biology I, or BIO-2331 Anatomy and Physiology I.

Outcomes

Course Outcome(s):
Define the term aging and explain how aging is measured.

Objective(s):
1. Compare definitions of biological aging and the distinction of aging from disease.
2. Describe factors that cause or influence the process of aging.
3. Identify models used to study aging and how aging is measured.
4. Explain how demographic data is used in the study of aging.
5. List and describe different theories of aging.

Course Outcome(s):
Explain the cellular and molecular mechanisms of aging.

Objective(s):
1. Compare and contrast longevity studies in various organisms (yeast, roundworms, fruit flies, mice and humans).
2. Describe the phases of the eukaryotic cell cycle and explain how it is regulated.
3. Describe the characteristics of senescent cells grown in culture.
4. Compare oxidative stress and telomere shortening theories of aging.
5. Describe how genes are expressed through the transcription of DNA and translation of RNA into an amino acid sequence.

Course Outcome(s):

Understand the age-related changes in animal physiological systems.

Objective(s):

1. Describe how changes in body composition and energy metabolism affect aging.
2. Identify mechanisms and the resulting changes associated with normal aging and age related pathology in the skin and the nervous, sensory, digestive, urinary, immune, reproductive, cardiovascular, endocrine, and musculoskeletal systems.

Course Outcome(s):

Explain how aging and longevity can be modulated.

Objective(s):

1. Describe how calorie restriction affects life span.
2. Describe how increased function or maintenance of function results from regular physical activity.

Methods of Evaluation:

1. Quizzes
2. Exams
3. Written reports
4. Research papers
5. Projects (individual or group)
6. Presentations (individual or group)
7. Article discussions/reviews/summaries
8. Discussion boards
9. Homework assignments
10. Case studies

Course Content Outline:

1. CONCEPTS
   a. Biogerontology
   b. Longevity
   c. Life span
   d. Development, maturity, and senescence
   e. Homeostasis
   f. Intrinsic rate of aging
   g. Extrinsic rate of aging
   h. Genotype
   i. Phenotype
   j. Epigenome
   k. Cross-sectional vs. longitudinal studies
   l. Life expectancy
   m. Mortality rate
   n. Age-dependent and age-independent mortality
   o. Life table
   p. Survival curves
   q. Cell cycle
   r. Cell cycle regulation
   s. Mitosis
   t. Replicative senescence
   u. Oxidative stress
   v. Reactive oxygen species
   w. Telomeres
   x. Gene expression, including transcription, RNA processing, and translation
   y. Levels of gene expression in eukaryotes, including chromatin structure, transcription factors, RNAi, and epigenetics
   z. Total energy expenditure

aa. Resting energy expenditure
bb. Diet-induced thermogenesis
cc. Normal age-related changes in body systems
dd. Age-related disorders by body systems
ee. Morbidity

2. SKILLS
   a. Interpreting graphs and tables
   b. Evaluating published literature
3. ISSUES
   a. Senescence
   b. Longevity
   c. Health and wellness related to aging

Resources

Bilder, G. E . *Human Biological Aging*. 1st. Hoboken: New Jersey, 2016.

McDonald, R.B. *Biology of Aging*. 2nd. Boca Raton: Taylor & Francis, 2019.

Musi, N. and P. Hornsby. *Handbook of the Biology of Aging*. 8th. San Diego: Academic Press, 2015.

Lodish et. al. *Molecular Cell Biology*. 8th. New York: Macmillan Higher Education, 2016.

Pierce, B.A. *Genetic Essentials: Concepts and Connections*. 4th. New York: Macmillan Higher Education, 2018.

Marieb, E.N. and K.N. Hoehn. *Human Anatomy and Physiology*. 11th. New York: Pearson, 2019.

Resources Other

1. Books:
   a. Arking, R. *The Biology of Aging: Observations and Principles*. 3rd ed. New York: Oxford University Press, Inc., 2006.
   b. Austad, S. *Why We Age*. New York: John Wiley and Sons, Inc., 1997.
   c. Butler, R. *The Longevity Revolution: The Benefits and Challenges of Living a Long Life*. New York: Public Affairs, 2008.
   d. Cristofalo, V.J., R.C. Adelman, K.W. Schaie (Ed). *Focus on Modern Topics in the Biology of Aging*. New York: Springer, 2002.
   e. Digiovanna, A.G. *Human Aging: Biological Perspectives.* 2nd ed. New York: McGraw-Hill, 2000.
   f. Finch, Caleb E., *The Biology of Human Longevity: Inflammation, Nutrition, and Aging in the Evolution of Lifespans.* 1st ed. Burlington, MA: Elsevier, Inc., 2007.
   g. Guarente et al., *Molecular Biology of Aging*. Cold Spring Harbor Monograph Series 51. Long Island, New York: Cold Spring Harbor Laboratory Press, 2008.
   h. Infeld, D.L (Ed). *Biology of Aging*. New York: Routledge, 2002.
   i. National Institute on Aging. *Aging Under the Microscope: A Biological Quest*. Bethesda, MD: National Institutes of Health, 2002.
   j. Schulz, R. and T. Salthouse. *Adult Development and Aging; Myths and emerging realities*. 3rd Ed. Upper Saddle River, NJ: Prentice Hall, 1999.
2. Websites:
   a. Alzheimer's Association www.alz.org
   b. American Heart Association www.americanheart.org
   c. Centers for Disease Control and Prevention www.cdc.gov
   d. National Institute on Aging. Website for the federal effort on aging research at the U.S. National Institutes of Health www.nia.nih.gov

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