Molecular Genetics of Aging

Spring Semester, 2017

Course information

Course Title: Course Number: Course Date: Course Location: Instructor:

Molecular Genetics of Aging

BSC 4022 (3 credits)

Jan.ll - May 6, Tuesday and Thursday, 10:00am -11:20am

Boca Campus, Sanson Life Science Building, Rm. 119

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Office hours: Tuesday and Thursday, 1:OOpm- 4:00pm or by appointment

Course description

This course is open to upper level undergraduate students. In this course students will learn current theories of aging, molecular pathways modulating aging, major discoveries of aging in different model organisms including yeast, C. *elegans, Drosophila* and mouse, and in mammalian system. Additionally, students will learn how to read and criticize research articles.

Pre-requisite

BSC 1010 Minimum Grade of C- or BSC 1011 Minimum Grade of C-

Course objectives/student learning outcomes

Students are expected to: gain cunent knowledge and research methods of aging and learn how to design experiments to address aging-related scientific questions.

Instructional methods

Lectures, paper discussions and student presentations

Required texts/reading

Research papers and review articles, available in the Content folder at Blackboard.

Supplementary/recommended reading

Molecular Biology of Aging (2008). Edited by Leonard P. Guarente, Linda Partridge and Douglas C. Wallace. Cold Spring Harbor Laboratory Press. Cold Spring Harbor, New York

**Course topical outline (subject to change depending on course needs)**

**Weekl** (1) Course overview

(2) Theories of aging

Assigned reading: An integrated theory of ageing in the nematode *Caenorhabditis elegans*

**Week 2** (1) Longevity pathways in C. *elegans*

Assigned reading: The Plasticity of Aging: Insights from Long-Lived Mutants

(2) Dietary restriction in C. *elegans -* 1

Assigned reading: The genetics of caloric restriction in *Caenorhabditis elegans*

**Week** 3 (1) Dietary restriction in C. *elegans -* 2

Assigned reading: PHA-4/Foxa mediates diet-restriction induced longevity of C. *elegans*

(2) Dietary restriction in C. *elegans* - 3

Assigned reading: Pyruvate imbalance mediates metabolic reprogramming and mimics lifespan extension by dietary restriction in *Caenorhabditis elegans*

**Week 4** (1) Dietary restriction in yeast

Assigned reading: Regulation of Yeast Replicative Life Span by TOR and Sch9 in

Response to Nutrients

(2) Dietary restriction in fly

Assigned reading: Regulation of Lifespan in *Drosophila* by Modulation of Genes in the TOR Signaling Pathway

**Week 5 (1)** Dietary restriction in mouse

Assigned reading: Life-Span Extension in Mice by Preweaning Food Restriction and by Methionine Restriction in Middle Age

(2) Dietary Restriction in mammals

Assigned reading: Caloric Restriction Delays Disease Onset and Mortality in Rhesus

Monkeys

**Week6** (1) Mitochondria activity and aging- C. *elegans* (1)

Assigned reading: Mitochondrial Electron Transport Is a Key Detenninant of Life Span in *Caenorhabditis elegans.*

(2) Mitochondria activity and aging - C. *elegans* (2)

Assigned reading: Extension of Life-Span with Superoxide Dismutase/Catalase Mimetics

**Week?** (1) Mitochondria activity and aging- fly

Assigned reading: High-quality life extension by the enzyme peptide methionine sulfoxide reductase

(2) Mitochondria activity and aging- mouse

Assigned reading: Mitochondrial DNA Mutations, Oxidative Stress, and Apoptosis in

Mammalian Aging

**WeekS** (1) class review

**(2) Mid-term Exam**

**Week9 Spring Break (no class)**

**Week 10** (1) Discovery of the role oflGF signaling pathway in aging

Assigned reading: *daf-2 ,* an Insulin Receptor-Like Gene That Regulates Longevity and

Diapause in *Caenorhabditis elegans*

(2) Target genes of IGF signaling in C. *elegans*

Assigned reading: *daf-16* integrates developmental and environmental inputs to mediate aging in the nematode *Caenorhabditis elegans*

**Week 11** (1) IGF signaling in fly

Assigned reading: Extension of Life-Span by Loss of CHICO, a *Drosophila* Insulin

Receptor Substrate Protein

(2) IGF signaling in mouse

Assigned reading: Extended Longevity in Mice Lacking the Insulin Receptor in Adipose

Tissue

**Week 12** (1) NAD-dependent deacetylase (SIRT) in yeast

Assigned reading: Requirement ofNAD and SIR2 for Life-Span Extension by

Calorie Restriction in *Saccharomyces cerevisiae*

(2) SIRT in C. *elegans*

Assigned reading: Increased dosage of a sir-2 gene extends lifespan in *Caenorhabditis elegans*

**Week 13 (1)** SIRT in fly

Assigned reading: Sir2 mediates longevity in the fly through a pathway related to calorie restriction

(2) SIRT in mouse

Assigned reading: The sirtuin SIRT6 regulates lifespan in male mice

**Week 14** (1) Autophagy and aging

Assigned reading: Longevity pathways converge on autophagy genes to regulate life span in *Caenorhabditis elegans*

(2) Telomere and aging

Assigned reading: Long lifespan in wonns with long telomeric DNA

Week 15 (1) Aging research in humans

Assigned reading: Positional Cloning of the Werner's Syndrome Gene

(2) class review

Week 16 (1) An inter-disciplinary theory of aging

(2) Final Exam

Week 17 Final Exam Week (no class)

Assessment

Two written exams 70% Four Quizzes 20% Attendance 10%

Assignment of Grades

Percentage Grade

93 - 100% A

90 - 92% A-

87 - 89% B+

83 - 86% B

80- 82% s-

77 - 79% c+

73 - 76% c

70 - 72% c-

67 - 69% D+

63 - 66% D

60 - 62% n-

59% or less F

Policy on absences, makeup tests, late work, and incompletes

Absences for which a medical or court excuse is provided (professional letterhead required) will be recorded but not figured in the attendance grade. Likewise, one absence for which advance notice is given by phone or in person will not be figured in the attendance grade. Any significant tardy or early departure from class will be figured as one absence. Three absences will result in grade F. Students will not be penalized for absences due to participation in University-approved activities, including athletic or scholastics teams, musical and theatrical perf01mances, and debate activities. These students will be allowed to make up missed work without any reduction in the student's fmal course grade.

Also, note that grades of Incomplete ("I") are reserved for students who are passing a course but have not completed all the required work because of exceptional circumstances. A grade of "I" will only be given under certain conditions and in accordance with the academic policies and regulations put forward in FAU's University Catalog. The student must show exceptional circumstances why requirements cannot be met. A request for an incomplete grade has to be made in writing with supporting documentation, where appropriate.

If a student cannot attend an exam or hand in a homework project on time due to circumstances beyond their control then the instructor may assign appropriate make-up work.

**Classroom etiquette policy**

University policy on the use of electronic devices states: "In order to enhance and maintain a productive atmosphere for education, personal communication devices, such as cellular telephones and pagers, are to be disabled in class sessions."

**Disability policy statement**

In compliance with the Americans with Disabilities Act (ADA), students who require reasonable accommodations due to a disability to properly execute coursework must register with the Office of Student Accessibility Services (SAS) and follow all SAS procedures. SAS has offices across three of FAU's campuses- Boca Raton, Davie, and Jupiter, however, disability services are available for students on all campuse*s.*

**Religious Accommodations**

Students who wish to be excused from course work, class activities or examinations must notify the instructor in advance of their intention to participate in religious observation and request an excused absence.

**Code of Academic Integrity Statement**

Students at Florida Atlantic University are expected to maintain the highest ethical standards. Academic dishonesty, including cheating and plagiarism, is considered a serious breach of these ethical standards, because it interferes with the University mission to provide a high quality education in which no student enjoys an unfair advantage over any other. Academic dishonesty is also destructive of the University community, which is grounded in a system of mutual trust and places high value on personal integrity and individual responsibility. Harsh penalties are associated with academic dishonesty. For more information, see University Regulation 4.001 at<http://www.fau.edu/ctl/4.001_Code_of_Academic_Integrity.pdf>