

Molecular Genetics of Aging

Spring Semester, 2017

Course information

Course Title: Molecular Genetics of Aging
Course Number: BSC 4022 (3 credits)
Course Date: Jan.11 – May 6, Tuesday and Thursday, 10:00am –11:20am
Course Location: Boca Campus, Sanson Life Science Building, Rm. 119
Instructor: Kailiang Jia, M.D., Ph.D.
Associate Professor
Department of Biological Sciences
Sanson Life Science Building, Rm. 261
Email: kjia@fau.edu, Phone: (561) 297-0512
Office hours: Tuesday and Thursday, 1:00pm – 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 current 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)

- Week 1** (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 Prewaning 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

- Week 6** (1) Mitochondria activity and aging - *C. elegans* (1)

Assigned reading: Mitochondrial Electron Transport Is a Key Determinant 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 7** (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

Week 8 (1) class review
(2) **Mid-term Exam**

Week 9 **Spring Break (no class)**

Week 10 (1) Discovery of the role of IGF 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 of NAD 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 worms 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%	B ⁻
77 – 79%	C ⁺
73 – 76%	C
70 – 72%	C ⁻
67 – 69%	D ⁺
63 – 66%	D
60 – 62%	D ⁻
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 performances, and debate activities. These students will be allowed to make up missed work without any reduction in the student's final 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 special accommodation due to a disability to properly execute coursework must register with the Office for Students with Disabilities (OSD) in Boca Raton, SU 133 (561-297-3880); in Davie, MOD 1 (954-236-1222); in Jupiter, SR 117 (561-799-8585); or at the Treasure Coast, CO 128 (772-873-3305) and follow all OSD procedures.

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