GERO 498: Nutrition, genes, longevity and diseases

Maymester Spring/Summer 2021
4 Units

Time: 2:00pm - 4:50pm California time OR 9-12 AM California time (See specific classes)

Room: All Lectures will be held online using the Zoom application

Course Instructors:

Valter D. Longo, Ph.D.
Phone: (213) 740-6212 Fax: (213)740-5714 E-mail: vlongo@usc.edu
Office Hours: By appointment

Raffaella Ghittoni, Ph.D
Email: rghitton@usc.edu
Office hour: by appointment on Zoom (please schedule a meeting by email)

Please note that E-mail is the best way to be sure to contact the instructor

Course Description

This course is intended to teach students about the important role of nutrition and genes and the impact each has on longevity and diseases, particularly diseases related to aging. This course is unique in that it approaches these subjects through a traditional didactic approach as well as a “on location” approach to learning. This is accomplished by allowing students to have the opportunity to learn in an environment that has proven to be conducive to healthy aging. Students will be encouraged to observe and compare the lifestyle choices people make through their activities of daily living and dietary choices. Students will also be strongly encouraged to live as much as possible the Mediterranean lifestyle with emphasis on the Mediterranean diet and an active lifestyle. In particular the class will try to emphasize the Mediterranean diet and life style of 50-100 years ago, which is still adopted by the older population but often not by younger individuals. For many students, this month-long immersion in the Mediterranean life style, could have a life-long impact.

In the classroom students will examine the effect of nutrition and genes modulated by nutrients on aging and life span in simple organisms and humans. The course will provide an introduction to the biology of aging and to the mechanisms for the extension of the healthy life span and the prevention of age-related diseases. The course will also describe the effect of common but also extreme diets and of diets adopted by very long-lived populations from around the world on aging and diseases. Specific populations with unusually long life spans will be examined as part of the course. Finally the course will discuss the role of diets, dietary restriction and fasting in the treatment of diseases with emphasis on cancer, diabetes, cardiovascular and neurodegenerative diseases. Students will be given actual case reports from doctors and/or clinical trials describing the translation of
these approaches to disease prevention and treatment. For example, they will learn about the effects of fasting on the side effects caused by chemotherapy and they will see the effects of dietary restriction on hypertension and diabetes. Students will be responsible for more in-depth study of selected topics through assigned readings.

**Prerequisite**

It is recommended that students have had 1 prior undergraduate-level courses in biology. However, students without this background, can still perform well in the class with the appropriate effort.

**Course Objectives**

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

1) Understand the fundamental biology underlying aging and age-related diseases.
2) Understand the role of different dietary components on gene expression, cell function and protection, aging and diseases.
3) Describe the type of diets that can extend the healthy life span and why.
4) Understand how biogerontology can be applied to disease treatment and its role in medicine.
5) Have a general understanding of the role of different types of exercise on physiology, aging and diseases.
6) Understand how to apply evolutionary and comparative biology approaches to the optimization of health, disease prevention and treatment.
7) Understand the differences in the diet and lifestyle of people from Genoa Italy and Americans. Students should be able to identify the differences that are known to affect aging and diseases.

**Online Course Materials:**

Course materials and announcements will be posted on the Blackboard website. Your USC e-mail username and password will allow you to access the secure site: https://blackboard.usc.edu (if you have trouble with Blackboard, please contact blackboard@usc.edu)

Students are responsible for checking additional postings and announcements on Blackboard website on a daily basis.

**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.”
**Statement on Academic Integrity**
USC seeks to maintain an optimal learning environment. General principles of academic honesty include the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by an instructor, and the obligations both to protect one’s own academic work from misuse by others as well as to avoid using another’s work as one’s own. All students are expected to understand and abide by these principles. Scampus, the Student Guidebook, contains the Student Conduct Code in Section 11.00, while the recommended sanctions are located in Appendix A: [http://www.usc.edu/dept/publications/SCAMPUS/gov/](http://www.usc.edu/dept/publications/SCAMPUS/gov/). Students will be referred to the Office of Student Judicial Affairs and Community Standards for further review, should there be any suspicion of academic dishonesty. The Review process can be found at: [http://www.usc.edu/student-affairs/SJACS/](http://www.usc.edu/student-affairs/SJACS/).

**Textbook**
None. Articles will be used instead of the textbook and distributed at the beginning of the class. Students will have to become familiar with pubmed searches and with identifying and downloading articles.

**Full text journals**
Many full text journals are available to free to USC students at: [http://www.usc.edu/e_resources/hsl/lists/journal_A.php](http://www.usc.edu/e_resources/hsl/lists/journal_A.php)

If signing in from outside USC, the USC username and password used for emails will be required.

**Student Evaluation**
Students will be evaluated on the basis of:
1) Midterm  (45%)
2) Final    (45%)
3) Attendance and participation  (10%)
Gero 498  CLASS SCHEDULE

WEEK 1

**Tuesday, May 18:** Remotely. 2-4:50 pm. Introduction to the class.
Valter Longo, Introduction to Aging


Readings:
[http://www.sciencemag.org/content/328/5976/321/suppl/DC2](http://www.sciencemag.org/content/328/5976/321/suppl/DC2)
(a slide show introduction to aging by *Science* magazine)


**Wednesday, May 19** Aging and pollution. Remotely. 2-4:50 pm. Caleb Finch
Guest lecturer

Readings:
Finch CE, Crimmins EM. *Constant molecular aging rates vs. the exponential acceleration of mortality.*

Trumble BC, Finch CE. *THE EXPOSOME IN HUMAN EVOLUTION: FROM DUST TO DIESEL.*


Longo VD, Finch CE. *Evolutionary medicine: from dwarf model systems to healthy centenarians?*


Finch CE. Organisms with negligible senescence. MolBiolAging 2015


Thursday, May 20. Sugar, obesity and diseases. Remotely, 2-4:50 pm. Michael Goran

“Role of Dietary Sugars in Obesity and Related Metabolic Diseases”
Michael Goran is a Professor of Preventive Medicine, Physiology and Biophysics. He is the founding Director of the USC Childhood Obesity Research Center and holds the Dr Robert C and Veronica Atkins Endowed Chair in Childhood Obesity and Diabetes.

Dietary consumption patterns have shifted during the course of prior generations towards greater consumption of sugars, sugary beverages and fructose and an earlier introduction of these sugars to infants. These changes have important implications in the development of obesity and risk of metabolic diseases including type 2 diabetes, cardiovascular disease and non alcoholic fatty liver disease (NAFLD). These dietary shifts are also likely to have a greater impact during infancy and childhood because infants and children are also undergoing growth and development. Furthermore, increased dietary sugars have a greater impact on obesity and metabolic risk in certain segments of the population including Hispanics, those who are already obese, and in the case of NAFLD, those carrying the PNPLA3 genotype. In this lecture, I will review emerging studies indicating that consumptions of sugars and sugar sweetened beverages is beginning to occur early in life and this early life exposure is associated with increased risk of obesity by early childhood. In addition, I will review the evidence linking dietary intakes of sugars, especially fructose with altered metabolism and early obesity in animal models and limited human studies. I will review the evidence suggesting that high fructose exposure during critical periods of development of the fetus, neonate and infant can act as an obesogen by affecting lifelong neuroendocrine function,
appetite control, feeding behaviour, adipogenesis, fat distribution and metabolic systems. These changes ultimately favour the long-term development of obesity and associated metabolic risk. This lecture will be presented by Dr Michael I Goran from the Keck School of Medicine. Dr Goran is Professor of Preventive Medicine, Co-Director of the USC Diabetes and Obesity Research Institute and the holder of the Atkins Endowed Chair in Childhood Obesity and Diabetes.

Suggested Reading


Readings

The Amyloid Hypothesis of Alzheimer's Disease: Progress and Problems on the Road to Therapeutics
John Hardy and Dennis J. Selkoe
Science 297, 353 (2002);
DOI: 10.1126/science.1072994

When neurogenesis encounters aging and disease

Monday, May 24:

1) Introduction to the biology of aging (continued), theories and aging mechanisms at the molecular, and cellular level. Valter Longo. Remotely, 2-4:50 pm.

Aging in microorganisms. Valter Longo

Readings:

http://www.sciencemag.org/content/328/5976/321/suppl/DC2
(a slide show introduction to aging by Science magazine)


Tuesday, May 25.

Genetics of Aging in mice and humans. Valter Longo. Remotely, 2-4:50 pm.


**Wednesday, May 26:**
**Cancer and aging:** from the mechanisms of tumorigenesis, to standard treatment to anti-aging approaches for its prevention and treatment. Valter Longo. Remotely, 2-4:50 pm.

**Readings:**


**Thursday May 27**

**Dietary restriction, Exercise in aging and cardiovascular risk factor/diseases.** Valter Longo. Remotely, 2-4:50 pm.

**Readings:**


Biological Mechanisms of Physical Activity in Preventing Cognitive Decline.


**Friday, May 28:** Hanno Pijl, MD,PhD. University of Leiden, Holland  
**AM California Time**

Dr Hanno Pijl, MD, PhD is an endocrinologist and a professor of Diabetology at the Department of Internal Medicine of the Leiden University Medical Centre in Leiden, The Netherlands. He is
also a member of the Dutch Health Council ("Gezondheidsraad"), Standing Committee on ‘Nutrition’.

First part

**Nutrition and chronic disease: an evolutionary perspective**

The first part of my lecture will cover the changes our food intake went through over millions of years, the mismatch between what we eat and our physiology and its impact on the pathogenesis of chronic disease.

Second part

**Calorie restriction and the management of (type 2) diabetes mellitus**

In the second part of my lecture I will discuss the pathophysiology of the metabolic syndrome and type 2 diabetes.

Readings


b) Intermittent fasting vs daily calorie restriction for type 2 diabetes prevention: a review of human findings ADRIENNE R. BARNOSKY et. al Translational Research Volume 164, Number 4


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**Monday, May 31:** MEMORIAL DAY (NO CLASS)

**Tuesday June 1**

**Nutrition, dietary restriction, aging and diseases: Parts 1 and 2.** From the fundamental role of various nutrients on aging in model organisms and mammals, to the Mediterranean diet to the diets of long-lived and short-lived populations from around the world and their effect on life span and diseases. Valter Longo. Remotely, 2-4:50 pm.

Readings:


Extending the Healthy Life span: from yeast to humans. Fontana, L, Partridge, L., Longo VD. Science, April 16, 328, 321-6


Olive Oil and Cardiovascular Health Mar’ia-Isabel Covas. Cardiovasc Pharmacol Volume 54, Number 6, December 2009


Wednesday, June 2.

MIDTERM COVERS UP TO TUESDAY MAY 25 LECTURE ON GENETICS OF AGING IN MICE AND HUMANS

Week 4 Class Meets online


Friday June 4:


Readings:


**Monday, June 7:**

CLASS AT 9-12 AM California Time

**Romina Cervigni, PhD.** The use of the longevity diet and fasting in the prevention and treatment of diseases of aging

**Tuesday, June 8**

**Intermittent Fasting, Therapeutic Fasting, and Ketogenic Diets.** Raffaella Ghittoni, PhD. Remotely, 2-4:50 pm.

An introduction to: 1) The different and most popular intermittent fasting practices including alternate day fasting, 16:8, 5:2 and alternate day fasting, 2) Therapeutic fasting, as practiced by in patient clinics, 3) Ketogenic diets


**Wednesday June 9**

**Final.** Remotely, 2-4:50 pm.
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<thead>
<tr>
<th>Weeks</th>
<th>Date</th>
<th>Time</th>
<th>Topics Covered</th>
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<tr>
<td>Week 1</td>
<td>M 05/17</td>
<td>NO CLASS</td>
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<tr>
<td></td>
<td>Tu 05/18</td>
<td>2-4:50pm PDT</td>
<td>Valter Longo - Course Overview - Introduction to Aging</td>
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<td>W 05/19</td>
<td>2-4:50pm PDT</td>
<td>Caleb Finch - Aging and pollution</td>
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<td>Th 05/20</td>
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<td>Michael Goran - Sugar, obesity and diseases.</td>
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<td>Christian Pike - Aging and Alzheimer’s Disease</td>
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<td>M 05/24</td>
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<td>Valter Longo - Introduction to the biology of aging (continued), theories and aging mechanisms at the molecular, and cellular level. Aging in microorganisms</td>
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<td>Tu 05/25</td>
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<td>Valter Longo - Genetics of Aging in mice and humans.</td>
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<td>W 05/26</td>
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<td>Valter Longo - Dietary restriction, Exercise in aging and cardiovascular risk factor/diseases</td>
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<td>F 05/28</td>
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<td>Hanno Pijl - Nutrition and chronic disease: an evolutionary perspective.</td>
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<td>Calorie restriction and the management of (type 2) diabetes mellitus</td>
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<td>Week 2</td>
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<td>Valter Longo- Nutrition, dietary restriction, aging and diseases: Parts 1.</td>
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<td>MIDTERM - Exam material covers up to Tuesday May 25 lecture on Genetic of aging in mice and humans included</td>
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<td>F 06/04</td>
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<td>Valter Longo- Nutrition, Fasting Mimicking Diets Stem cells and Regeneration in the treatment and prevention of diseases</td>
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<td>Week 3</td>
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<td>Romina Cervigni - The use of the longevity diet and fasting in the prevention and treatment of diseases of aging</td>
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<td>Tu 06/08</td>
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