

# Aging and associated diseases

## Organization and coordination

**Gemma Marfany** (Departament de Genètica)

**Maria Soley** (Departament de Bioquímica i Biologia Molecular)

## Teachers involved:

Gemma Marfany

Mary Soley

Lisardo Boscá

Coral Santfeliu

Concepció Soler

Susanna Balcells

Ignasi Ramírez

Mercè Pallàs

Daniel Grimberg

## Objective

Like any multicellular organism of sexual reproduction, individuals of the human species are born, grow, can reproduce and die. If death does not occur prematurely by a traumatic accident or an infection, we reach old age when the aging process is shown. In each organ, tissue and many cells there is a, time-dependent, loss of structure and function, and the cellular biochemistry slows down because of the accumulated damage. Lesions at the molecular level reveal the most significant consequences of aging: failure in DNA repair, oxidative damage to numerous structures and organelles, deterioration of proteins ...

In the last century, one of the most important achievements of humanity has been the huge increase in life expectation. Thus, the proportion of people over 65 has increased considerably in societies of industrialized world. This creates a strong social pressure to better understand the process of aging and the diseases associated with this biological phenomenon.

In this context our objective is that the students learn about aging, in an active way. It means, making and answering questions and participating in discussions. We expect to arouse students' interest in this subject and and promote the work focused on aging.

## **Program**

### **Theme 1 - Aging and Disease**

Aging and human longevity. Genetic factors and environmental factors. Presenile diseases and progeria. Animal models. Hormones and aging. Theories on aging

### **Theme 2 - Cellular senescence and cell death**

Cellular senescence. Replicative senescence. Shortening of telomeres. Senescent phenotype. Programmed cell death. Consequences of cellular senescence and cell death. Relationship between aging and cancer. Progeria, nuclear lamina and mechanisms for maintenance of DNA

### **Theme 3 - Oxidants and antioxidants in aging**

Oxidants. Antioxidants. Oxidants and antioxidants in cells and organelles. Molecular consequences of oxidative stress: damage and repair. Oxidative stress and aging.

### **Theme 4 - Aging of organs and systems**

Biochemical changes associated with aging. The immune system. Aging and inflammatory response. Immunosenescence: clinical implications and therapeutic strategies. The skeleton and aging: osteoporosis. Skeletal muscle and heart: cardiac hypertrophy. Cardiovascular diseases and aging. Neurodegenerative diseases in aging.

### **Theme 5 - Biological Bases of healthy in aging**

Nutrition. Caloric restriction, immobilization and atrophy. Exercise.

## **Evaluation**

For the evaluation we will take into account the following criteria:

- Oral presentation (group work)- **4 points**
- Written comment of 2-4 pages (individually work)- **4 points**
- Forum comments- **2 points**

The oral presentation is the result of the collective work of a group (2 to 4 students). Each student has to choose an article/s assigned to a particular group and enrol in the Campus virtual. Students should read the article/s, prepare, in group, the oral presentation (10 min) and the discussion in answer to the other students' questions.

In the written comment, every one has to write a general comment of 2-4 pages, about the paper that was prepared in group. It is very important to draw comparisons with the general content of the course.

It also should include a general comment on the course, as a means for us to gauge its success and its contents. Is it necessary to improve? What aspect in particular?

In the forum comments every one must participate in the forum (debating on aging from a biological/molecular point of view), at least once but no more than five times.

## **Bibliography**

Arking, R., (2006) *The Biology of Aging. Observations and Principles*, 3rd edition, Oxford University Press.

Everitt, A.V., Rattan, S.I.S., Le Couteur, D.G. and de Cabo, R., (2010) *Calorie Restriction, Aging and Longevity*, Springer.

Masoro, E.J. and Austad, S.N., (2006) *Handbook of the Biology of Aging*, 6th edition, Academic Press.

Mobbs, C.V. and Hof, P.R., (2010) *Interdisciplinary Topics in Gerontology, Vol 37 Body Composition and Aging*, Karger.

Park, S.Ch., Hwang, E.S., Kim, H-S. and Park, W-Y., (2001) *Healthy Aging for Functional Longevity. Molecular and Cellular Interactions in Senescence*, Annals of the New York Academy of Sciences, Vol. 928.

Timiras, P.S., (2007) *Physiological Basis of Aging and Geriatrics*, 4th edition., Informa Healthcare.

## Web sites

SAGE KE ( Science of Aging Knowledge environment),  
<http://sageke.sciencemag.org//>

<http://www.rtve.es/mediateca/videos/20101014/imprescindibles-camino-a-inmortalidad-14-10-10/9029>

<http://thesciencenetwork.org/tags/Aging>

<http://www.senescence.info/>