



THE BIOLOGY OF AGEING

How far has research advanced?

Major theoretical advances have been achieved in the biology of ageing over the past twenty years, with the introduction of a new concept: **the genetics of longevity**. Thanks to the ability of investigators to artificially extend the longevity of some invertebrate species, new scientific data based on study of the mutations and functions involved in these changes are now available. But research on the genetics of longevity is still in its infancy. Modern analytical techniques will probably enable rapid progress in understanding and the compilation of a full inventory of genes that are likely to modulate the duration of human life.

The 2009 World Congress of Gerontology and Geriatrics, held under the auspices of the IAGG (International Association of Gerontology and Geriatrics) will provide an opportunity to make an update on the **most recent advances of basic research in this area**.

Professor Jacques Tréton, a researcher and lecturer at the Université Paris-Descartes, will be discussing the major themes of research on the biology of ageing and the most important presentations during the congress.

The evolutionist approach to ageing

The causes of ageing

SA6044 – AGEING IS NO LONGER AN UNSOLVED BIOLOGICAL PROBLEM

Chairs: Leonard HAYFLICK (San Francisco, USA), Robin HOLLIDAY (Canberra, Australia)

Monday 2.00 p.m. -3.30 p.m. – Amphithéâtre Bordeaux

The speakers – leaders in the field of ageing – will **summarise knowledge on the causes of biological ageing**, a complex research field based on studying models of longevity in some mammals. Species evolution tells us that biological organisms have had to adapt their genomes and levels of reproduction to environmental variations. Threatened by extinction, species reproduce more rapidly and in larger numbers in order to survive. Inversely, in a favourable environment, species live longer and reproduce less. **Variations in reproduction would give rise to variations in longevity, which in turn would act indirectly on the rate of senescence.**

Steven AUSTAD, an American researcher from San Antonio, has studied the reasons why some animals age much more slowly than others. Why do bats live for between 10 and 20 years, while mice only live for two or three years? By means of mechanisms that are now clearly identified, bats have acquired the ability to fly in order to escape from their predators, and their lifespan has increased.

The evolution of human longevity

SA7107 EVOLUTION OF THE HUMAN LIFESPAN – Caleb E. FINCH (Los Angeles, USA)

Tuesday 10.30 a.m. -12.00 p.m. - Room 342 A

Major developments in the molecular biology of lower organisms have shown that **some genes are determinant to the ageing process**. The apolipoprotein gene ApoE is the gene whose influence on longevity is the most firmly established. Bearers of form 2, or allele 2 of ApoE generally live longer than those carrying ApoE 4, which is much rarer in centenarians.

Caleb FINCH will provide **an update on the genetic transformations induced by the evolution in human longevity**. He will explain how dietary changes in man's ancestors (from plants to animals) led to changes in size and longevity and in the appearance of form 4 of the ApoE gene in order to help the body deal with the excess of lipids induced by consuming animal meats. Under modern living conditions where food is abundant and disease is expressed because of lifespan extension, ApoE 4 has exhibited some late, harmful effects: initially beneficial, it now predisposes people to atherosclerosis and Alzheimer's disease.

The IGF-1 pathway

Two major theories have tried to explain ageing: the **oxidative theory**, according to which oxidants accumulate during lifetime and cause irreversible damage, and the more recent **endocrine theory** which gives insulin and **IGF-1** (*insulin-like growth factor*) a **role in longevity**.

IGF are peptide hormones with a chemical structure close to that of insulin. They may be responsible for orchestrating the genetic programmes involved in longevity. Their importance has been highlighted by several teams, including that of the immunologist Claudio Franceschi, which observed that the families of Sardinian centenarians displayed common specificities: a very low level of IGF-1 and a highly pertinent immune system.

SA8 231 HEALTHY AGEING: POPULATION STUDIES ON BIOLOGICAL, CLINICAL AND PSYCHOSOCIAL DETERMINANTS

Chairs: Tom KIRCKWOOD (Newcastle, UK), Jacobijn GUSSEKLOO (Leiden, Netherlands)

Wednesday 5.30 p.m. – 7.00 p.m. – Amphithéâtre Bordeaux

The works reported during this session by R. Westendorp's team are of considerable fundamental interest. They enabled to explain the role of IGF-1 in some senescence mechanisms. A cell that has accumulated oxidative stress in its genome has several options: it can die because it has made an error, or not die and conserve this error. The consequences are not the same. Under the first hypothesis, whenever there is an error, the body loses a cell; under the second, it keeps the cell but in the long term will develop a cancer. A third option consists in eliminating the error through the implementation of repair systems.

A continuous deficiency in these repair mechanisms exerts a direct action on this IGF-1 pathway and causes accelerated cell ageing. This mechanism is the cause of two conditions: progeria, which prematurely transforms young children into elderly people, and Werner's syndrome, which affects adults between the ages of 30 and 40 years who then develop multiple cancers.

These cell maintenance and repair functions, critical to sustaining their longevity, are the subject of considerable research, including that being carried out by the team led by Bertrand FRIGUET in Paris, who will be speaking during symposium SA8 233 on the ROLE OF CELLULAR SENESCENCE AND OXYDATIVE STRESS IN TISSUE AGEING during session 233-2 entitled ROLE OF THE METHIONINE SULFOXIDE REDUCTASE SYSTEM IN PROTEIN REPAIR DURING AGEING.

Cardiovascular ageing

Role of telomeres in cardiovascular ageing

SA6046 - TELOMERE DYNAMICS AND CARDIOVASCULAR AGEING

Chair: Athanase BENETOS (Nancy, France)

Monday 2:00 p.m. - 3:30 p.m. – Room 342 B

Telomeres, located at the tip of chromosomes, are now known to play a key role in ageing. Scientists have observed that they become shorter as the cell divides. The shorter they become, the less the cell can divide. This very interesting mechanism protects cells from age- or disease-related mutations. The clinical, cardiovascular implications of these telomere dynamics will be presented during this symposium.

Genetic bases of vascular ageing

SA8217 VASCULAR AGEING AND CONSEQUENCES

Note should also be made of the symposium on vascular ageing, during which works on the genetic bases of vascular hardening will be presented by the French team led by Stéphane Laurent. Identification of the genes involved in this vascular ageing phenomenon would enable better prevention in individuals with such a genetic predisposition.

The role of nutrition in longevity

SA6057 - NUTRITION AND BRAIN AGEING: PRIMING THE BRAIN AGAINST THE RAVAGES OF TIME - Chairs: James JOSEPH (Boston, USA)

Monday 3:45 p.m. - 5:15 p.m. – Room 252 AB

James JOSEPH's team from Boston has studied the **impact** of nutrition, and particularly that of **consuming fruits and vegetables on brain ageing**. Those who regularly consume sufficient quantities of fruits and vegetables have 40% less risk of developing Alzheimer's disease.

Sufficiently solid scientific data are now available to scientists to affirm that polyphenol-containing compounds (cranberries, strawberries, hazelnuts, black grapes, etc.) protect the body against an acceleration of cognitive deficit by acting on the pathways of IGF-1, an insulin-like growth factor that reduces inflammatory stress. An antioxidant-rich diet combined with physical exercise and social activities, restricts the deposition of beta-amyloid plaques in individuals receiving this diet.

Nutrition and calorie restriction

Diet restrictions play an important role in model animals on slowing and preventing a whole range of age-related pathologies, including cardiovascular disease, cancer, some neurodegenerative disorders and diabetes. There will be some excellent presentations on this research, including those by Donald INGRAM and Valter D.LONGO.

Diet restriction induces physiological changes, in particular greater insulin sensitivity and stress resistance. Until now, almost nothing was known about the organs involved in the increase of longevity due to diet restriction. Several recent studies have established that the nervous system is an important regulator of invertebrate longevity.

SA6057-4 - DIET RESTRICTION *VERSUS* DIET SELECTION: CONVERGING CONCEPTS

Donald INGRAM has shown that diet restriction allows the body to rest for a certain time to allow for the set-up of maintenance functions. Information transmitted to the brain via the hypothalamic-pituitary axis and the IGF-1 insulin pathway will trigger genetic programmes that differ depending on whether food is abundant or not, exerting a direct effect on longevity.

SA7 107 – THE GENETIC COMPONENT OF AGING AND LONGEVITY: A REAPPRAISAL?

During one of the presentations of this important symposium, Valter D.LONGO from Los Angeles will provide an update on the role of certain compounds in longevity regulation, and particularly polyphenols. These compounds may act like sirtuins (SIR, silent information regulator) which silence some genes and induce the programming of different body functions related to the modulation of calorie intake and longevity.

The role of self-medication

SA7108 – MELATONINE, BIORHYTHMS AND AGEING

Chair: Vladimir ANISIMOV (S^T Petersburg, Russia)

Tuesday 10.30 p.m. – 12.00 p.m. – Room 342 B

An entire symposium will be devoted to melatonin and the regulation of biorhythms. The elderly are often desynchronised, particularly regarding sleep: they sleep badly at night and tend to be drowsy during the day. An intake of melatonin resynchronises the body. It is also given to populations such as those who work at night, or flight attendants who develop specific conditions related to jet lag. One of the presentations will be **an update on the role of melatonin in preventing the risk of breast cancer.**

SA7152 - ESSENTIAL TRACE ELEMENT (ZN, CR, SE) DEFICIENCIES IN ELDERLY: WHICH POLICY OF SUPPLEMENTATION? SYMPOSIUM ORGANISED BY SFERETE (FRENCH SOCIETY FOR TRACE ELEMENT RESEARCH) AND TEU (TRACE ELEMENT INSTITUTE FOR UNESCO/LYON)

Chair(s): Monique FERRY (Valence, France), Guy CHAZOT (Lyon, France)

Tuesday 5.30 p.m. – 7.00 p.m. - Room 342 A

This symposium will deal with the issue of trace element supplementation for the elderly, and will be an update on the **benefits of chromium**, the value of which had not hitherto been demonstrated.