39th World Congress of ISMH x 79th BCPM

BALNEOTHERAPY AND NEW NATURAL REMEDIES FOR HEALTHY AGEING

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COI Disclosure

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COI Related to this presentation

1. Employment / leadership positions / advisory roles: No
2. Stock Ownships / Profits: None
3. Patent royalties / licensing fees: None
4. Daily allowances: None
5. Honoraria: None
6. Research fundings: Yes – UEFISCDI
7. Donations: None
8. Travel expenses or gifts: None
9. Endowed chairs: None
10. Others: None
Maximum human longevity

“To be forever young doesn’t mean to be 20. It means to be an optimist, to feel good, to have an ideal to fight for and to achieve it.”

Ageing refers to the time sequential deterioration that occurs in most animals including weakness, increasing susceptibility to disease and adverse environment conditions, loss of mobility and agility, and age-related physiological changes.

Mme Jeanne Calment, died 1998, aged 122
AGING ……..

• Aging is a degenerative process, extensively studied for which many theories have been formulated;

• Aging is the major biomedical challenge of our society, considered as a progressive and irreversible set of structural and functional changes for a living organism, in relation with both genes and environmental factors;

• The percentage of elderly people, the demographic imbalanced pyramids and the incidence of age related diseases such as cardio-vascular diseases, cancer and neurodegenerative diseases are main concerns for many scientists;

• Discovering the biological basis of ageing is one of the greatest remaining challenge for science. Findings from model organisms have revealed that ageing is a surprisingly modifiable process that can be manipulated by both genetic and environmental factors.
10 questions about ageing

1) Comparative biology: How does ageing and longevity vary between species? Are there non ageing organisms?

2) Evolutionary biology: How / why does ageing evolve? How does it contribute to fitness?

3) Genetics: Are ageing and longevity controlled by the genome, and if so how?

4) Model organisms: Can ageing be suppressed and lifespan increased?

5) Molecular biology: What is the basis of ageing and longevity?

6) Cell biology: How does cellular senescence contribute to ageing and cancer? How are telomeres important?

7) Gerontology: How does ageing give rise to ageing-related disease?

8) Immunology: Why does the immune system fail in ageing? How does this impact health in later life?

9) Pharmacology: What are the prospects for treatments for ageing?

10) What should the aims of ageing research be? Is ageing a disease?
Darwin’s theory - survival and reproductive capacity as factors driving evolution. Populations of all organisms were controlled entirely by external “checks”: predators, food supply, disease, and environmental conditions.

Richard Dawkins: genes are actually competing and struggling for survival. Animals and humans are “survival machines” whose purpose is to propagate their genes.

While populations of simple organisms may in fact be controlled exclusively by external checks, would it not make sense for more complex animals to evolve some internal methods for controlling population to avoid these consequences.
Mutation accumulation theory

Even in a population free of ageing, death will none the less occur, from extrinsic hazards such as disease, predators and accidents.
• Suppose there are mutations that are beneficial in youth, but at the price of a higher rate of ageing
• More individuals will survive to express the early benefit than will survive to suffer the higher rate of ageing
• Mutations like this can therefore be incorporated by natural selection

Ageing evolves as a side-effect of natural selection in favour of mutations that cause a benefit during youth
“...the duration of life varies inversely as the rate of energy expenditure ... the length of life depends on the rate of living”

Loeb and Northrop (1916, 1917): increasing temperature reduces *Drosophila* lifespan

Coefficient relating lifespan to ambient temperature = 2-3, like that of chemical reactions

**The Rate-of-Living Theory (1928)**
Development and Ageing

- Genetics
- Evolution theory
- Bioethics
- Ageing-related disease
  - cardiovascular disease
  - Alzheimer’s
cancer, diabetes, etc
- Biochemistry
- Regenerative medicine
  - stem cells
- Cell biology
- Endocrinology
- Comparative biology
- Demography
Cellular Theories

The Hayflick Limit (1961)

Pre-1961: “All metazoan cells are potentially immortal. Ageing not cell autonomous”

Fibroblasts: connective tissue cells, e.g. from skin

Leonard Hayflick

Hayflick and Moorhead (1961)

- Isolate cells from human tissue, place in culture vessel with nutrient medium
- Cells divide and form confluent layer on vessel surface
- Discard half the cells, allow remainder to grow to confluency = one passage
- Continue to passage the cells
- Cell replication slows and stops after 50 ± 10 passages: cells have reached the Hayflick limit and undergone replicative senescence

Is replicative senescence the cause of ageing?
Research on healthy ageing interventions has evolved along the main theories of ageing. Pharmacological intervention to decelerate ageing and age-related diseases is highly attractive because it would target all the population during many years. If successful, healthy ageing therapy will be more efficient in reducing mortality than to fight separately each age-related disease. The potential for further advances in this field is immense; hundreds of genes in several pathways have recently emerged as regulators of ageing and caloric restriction. Some of these genes, such as IGF1R and FOXO3, have also been associated with human longevity in genetic association studies.
Caloric restriction

Reduced insulin/IGF-1 signalling

**Caenorhabditis elegans**

- Genotype: +/-
  - Median lifespan: ~16 days
- Genotype: daf-2/daf-2
  - Median lifespan: ~35 days

**Drosophila melanogaster**

- Genotype: +/-
  - Median lifespan: ~44 days
- Genotype: chico/chico
  - Median lifespan: ~65 days

**Mus musculus**

- Genotype: +/-
  - Median lifespan: ~10.7 months
- Genotype: igf1r+/-
  - Median lifespan: ~24.9 months
Change Of Hormones As We Age

- Estrogen
- Progesterone
- Testosterone
- Growth Hormone
- Thyroid
- Insulin
- Cortisol

20 years, 30 years, 40 years, 50 years, 60 years, 70 years

testosterone

insulin, IGF-1

glucose

Amino acids

Fatty acids

Growth Hyper-function

Aging Diseases of aging

Life time

calorie restriction metformin

Body fat, insulin other

Estrogens FSH, LH other

Puberty (reproductive function)

Menopause (ovarian failure)

Life time
The free radical theory of ageing

Denham Harman (1956)
“A free radical is any species capable of independent existence (hence the term ‘free’) that contains one or more unpaired electron”

Barry Halliwell & John Gutteridge

\[ Y + e^{-} \rightarrow Y^{.-} \]
\[ X \rightarrow e^{-} + X^{+} \]
\[ O_{2} + e^{-} \rightarrow O_{2}^{-} \]

Superoxide
Natural resources for healthy ageing
Balneo resources for healthy ageing therapies
In the context of the complex picture of early diagnosis, treatment and prevention of diseases associated with age, picture containing many unquantifiable and independent variables, difficult to analyze, appears to be necessary the analysis, mathematical modeling and simulation of bio-medical relations of laboratory parameters.
THANK YOU!

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