

Aging and big data: new trends in laboratory medicine



**VI CONGRESO LATINOAMERICANO
DE BIOQUIMICA CLÍNICA**

**CONGRESO INTERNACIONAL DEL
COLEGIO NACIONAL DE BACTERIOLOGÍA**

¡El riesgo es que te quieras quedar!

Cartagena, Colombia 3 al 6 OCTUBRE 2024

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Today I'll cover:

- **Innovation**
- **Big Data**
- **Diseases and bioinformatics**
- **Personalized medicine**
- **Aging**
- **Hallmarks of aging**
- **Geroscience**



Innovation in the laboratory

Technology

Biomarkers

Organizational



**Marketing /
Communication**

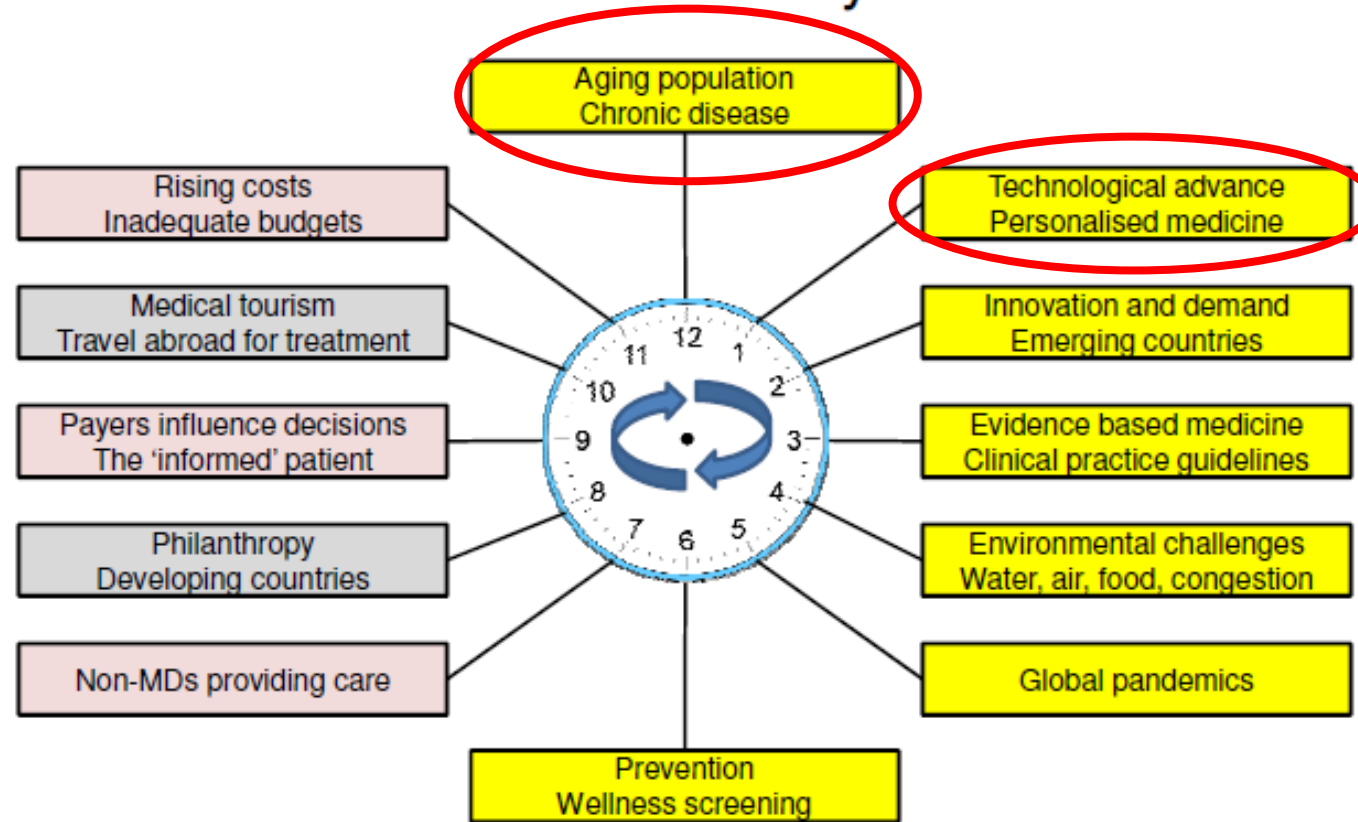
Process

Strategy

**Business /
funding**



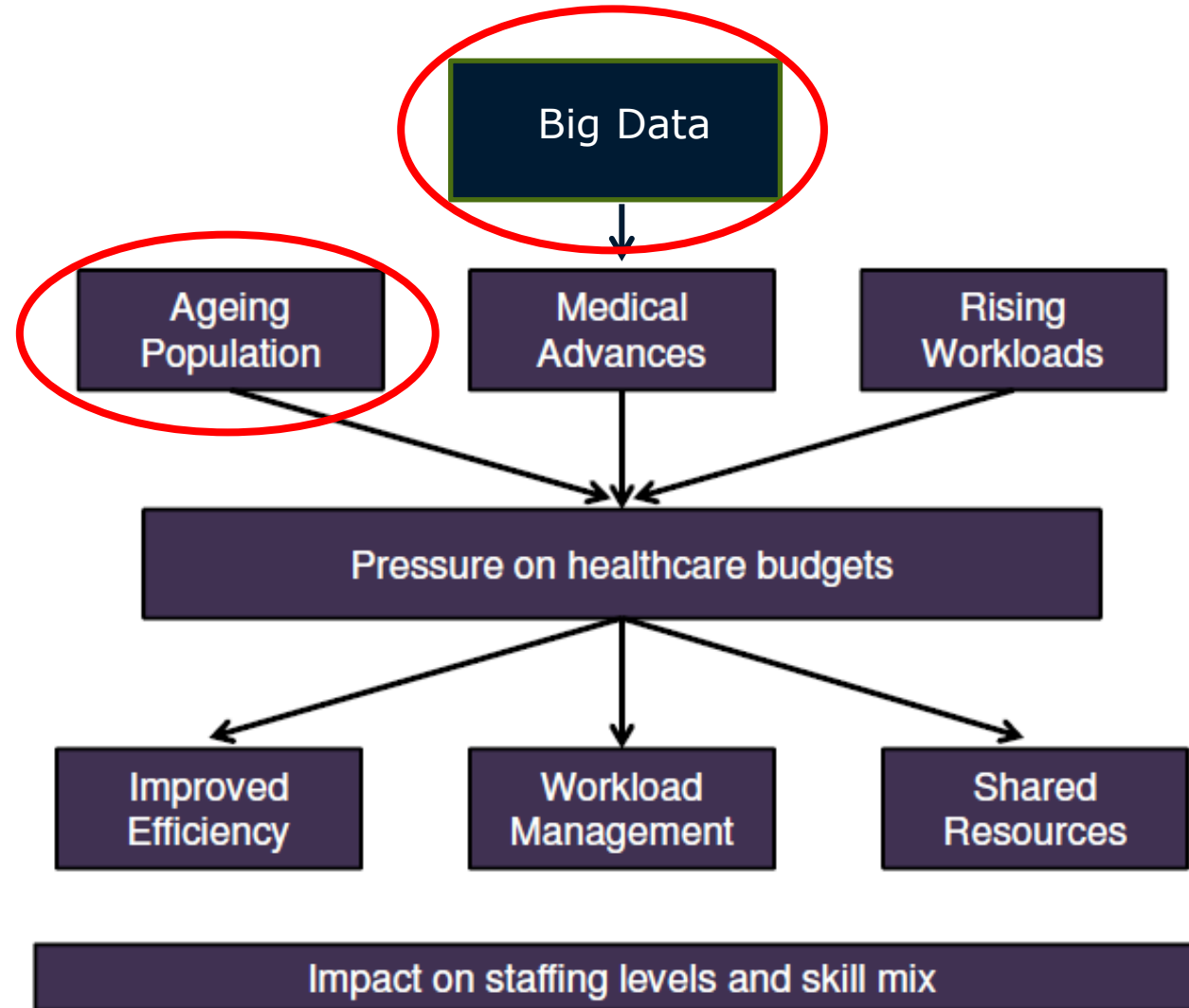
Mega-Trends in Healthcare: The Future? Influence on Laboratory Medicine?



Adapted from Harvard Business Report <http://hbr.org>



Smarter Working



“Big data” is the assessment of massive amounts of information from multiple electronic sources in unison, by sophisticated analytic tools to reveal otherwise unrecognized patterns.

We **also talk about “big data”** in the context of analyzing large, complex data sets such as those derived from omics experiments.

The important thing to recognize is that many of the same analytical approaches can be applied to **laboratory medicine** data regardless of the precise definition that we choose.

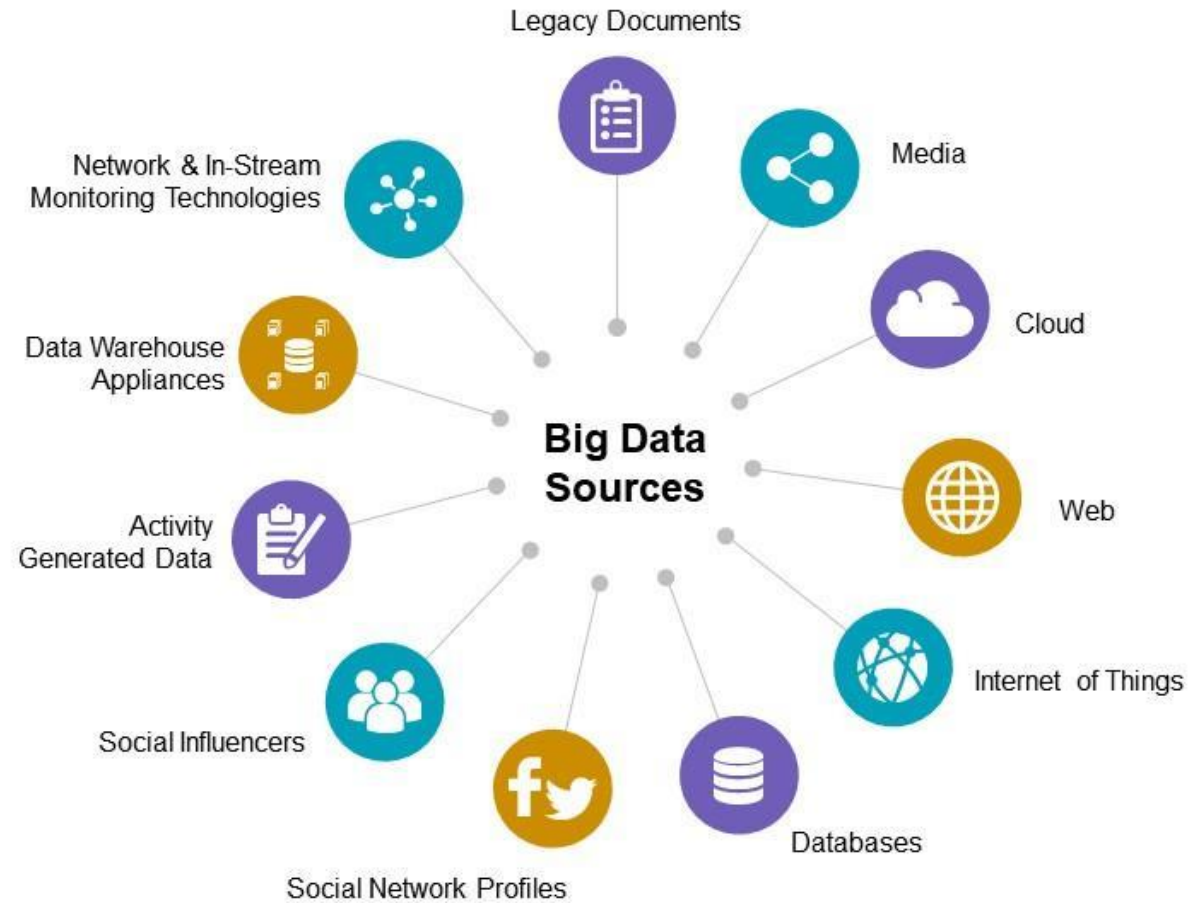
As a result, I think that **it’s appropriate to use “big data” to describe information that we get from our large numbers of patients, samples and analytes in the clinical laboratory.**



The V's of big data



Big data sources



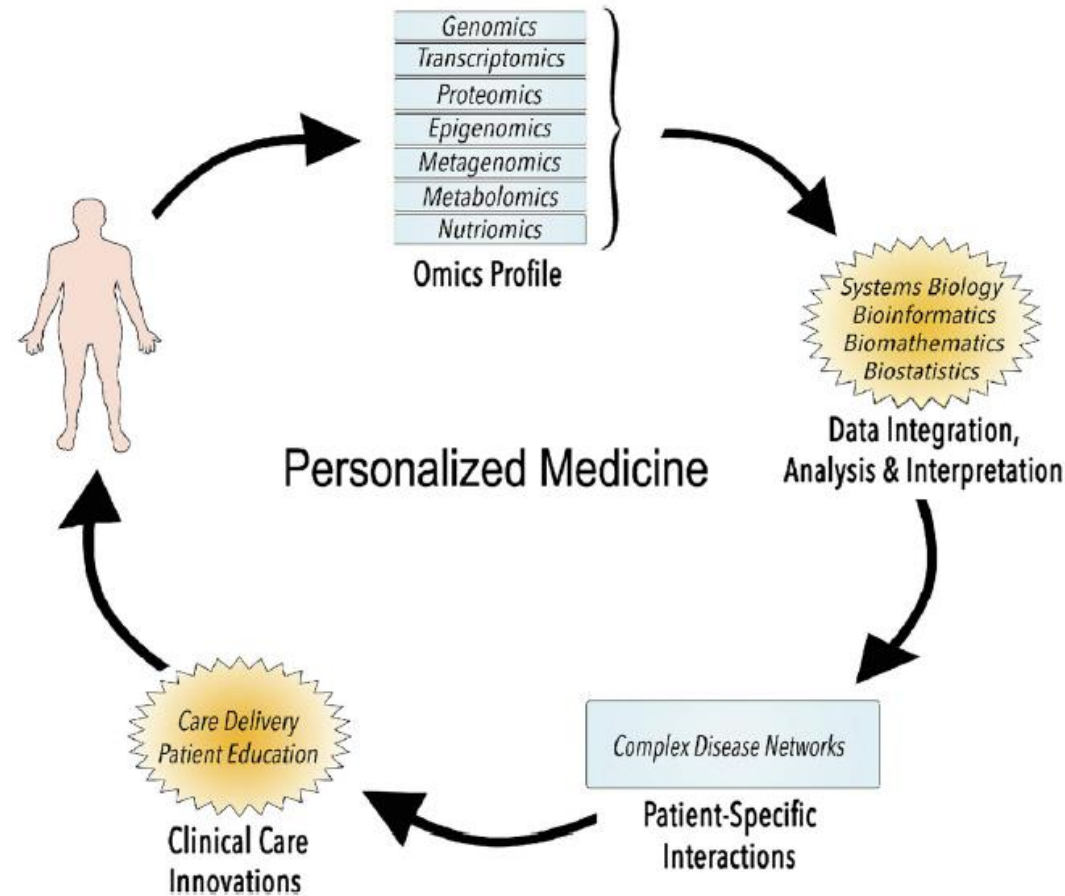
Big data require collection and analysis of data at an unprecedented scale and represents a paradigm shift in health care, offering :

- the capacity to generate new knowledge more quickly than traditional scientific approaches;
- unbiased collection and analysis of data; and
- a holistic understanding of biology and pathophysiology.

Big data promises more *personalized* and *precision* medicine for patients with improved accuracy and earlier diagnosis, and therapy tailored to an individual's unique combination of genetic, environmental risk, and precise disease phenotype.



A basic framework of personalized medicine.



The integration of omics profiles permit accurate modeling of complex diseases and opens windows of opportunities for innovative clinical applications to subsequently benefit the patient

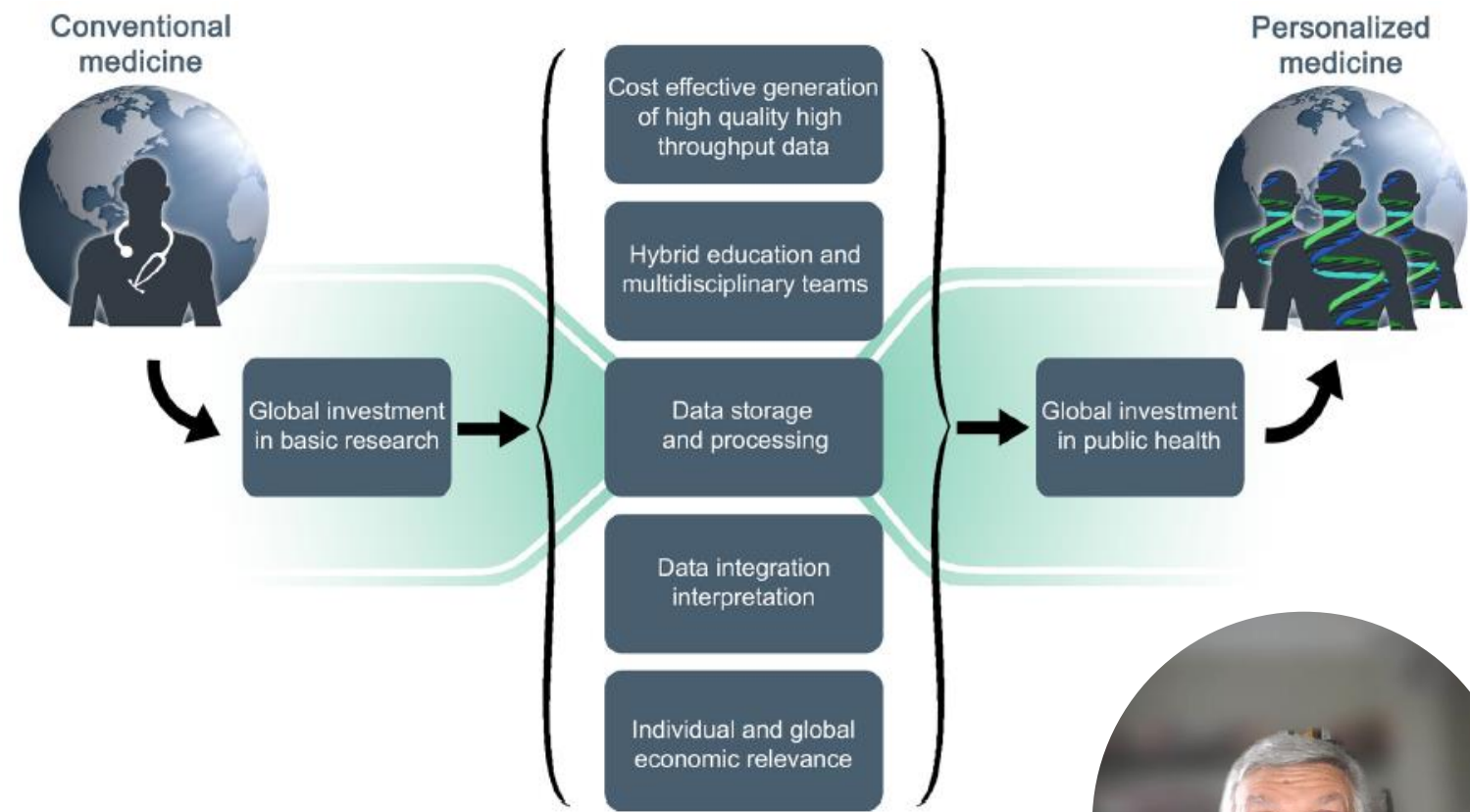


Bottleneck toward personalized medicine

The collective challenges to make the transition from conventional to personalized medicine include:

- i) generation of cost-effective high-throughput data;
- ii) hybrid education and multidisciplinary teams;
- iii) data storage and processing;
- iv) data integration and interpretation; and
- v) individual and global economic relevance.

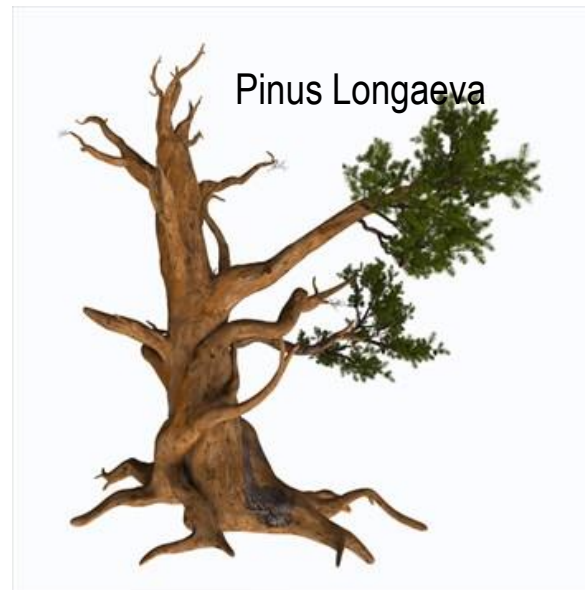
Massive global investment in basic research may precede global investment in public health for transformative medicine



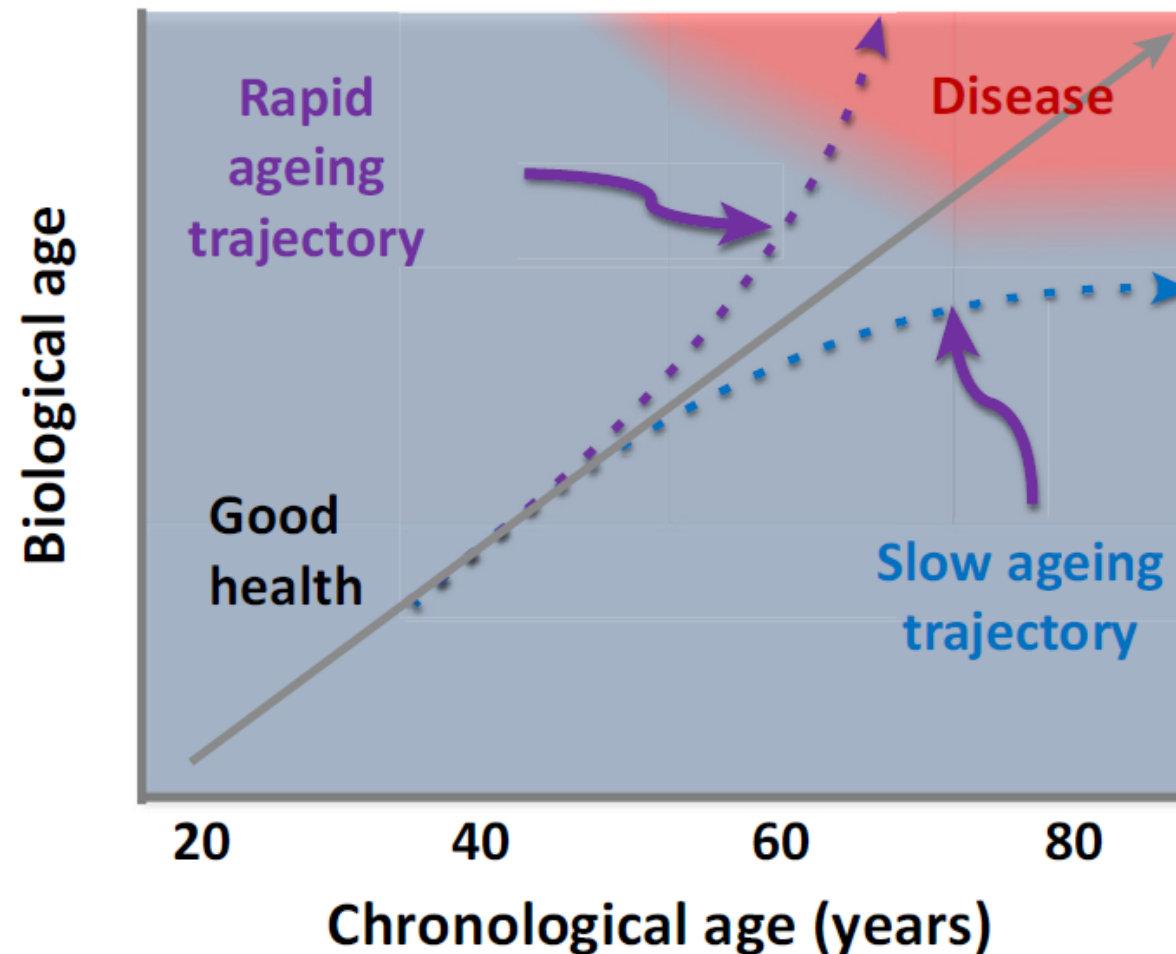
AGING

Aging is a process that accumulates changes in organisms over time.

Human aging process involves multidimensional changes on physical, psychological, cultural and social levels.

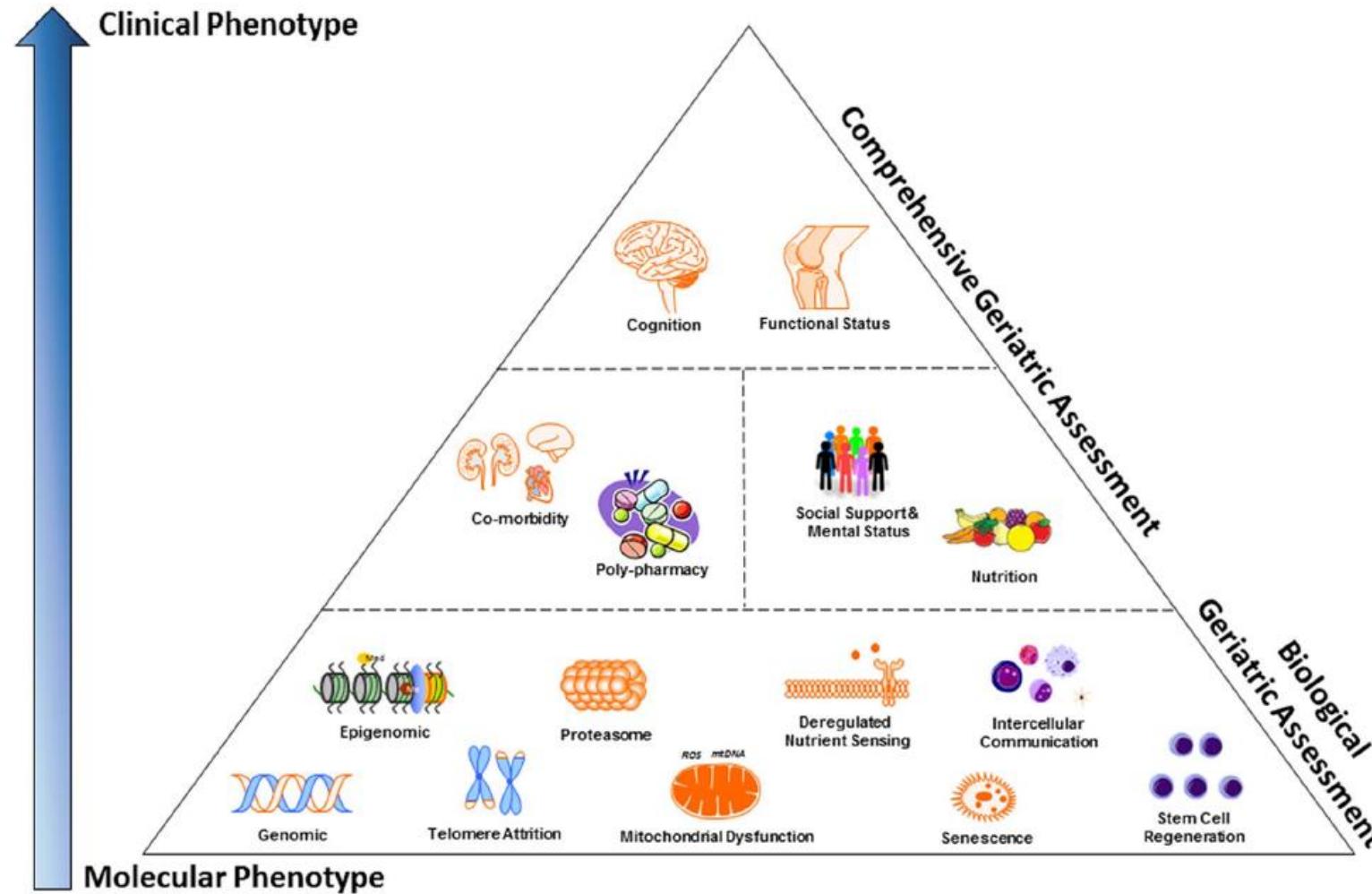


The Concept of Biological versus Chronological Age

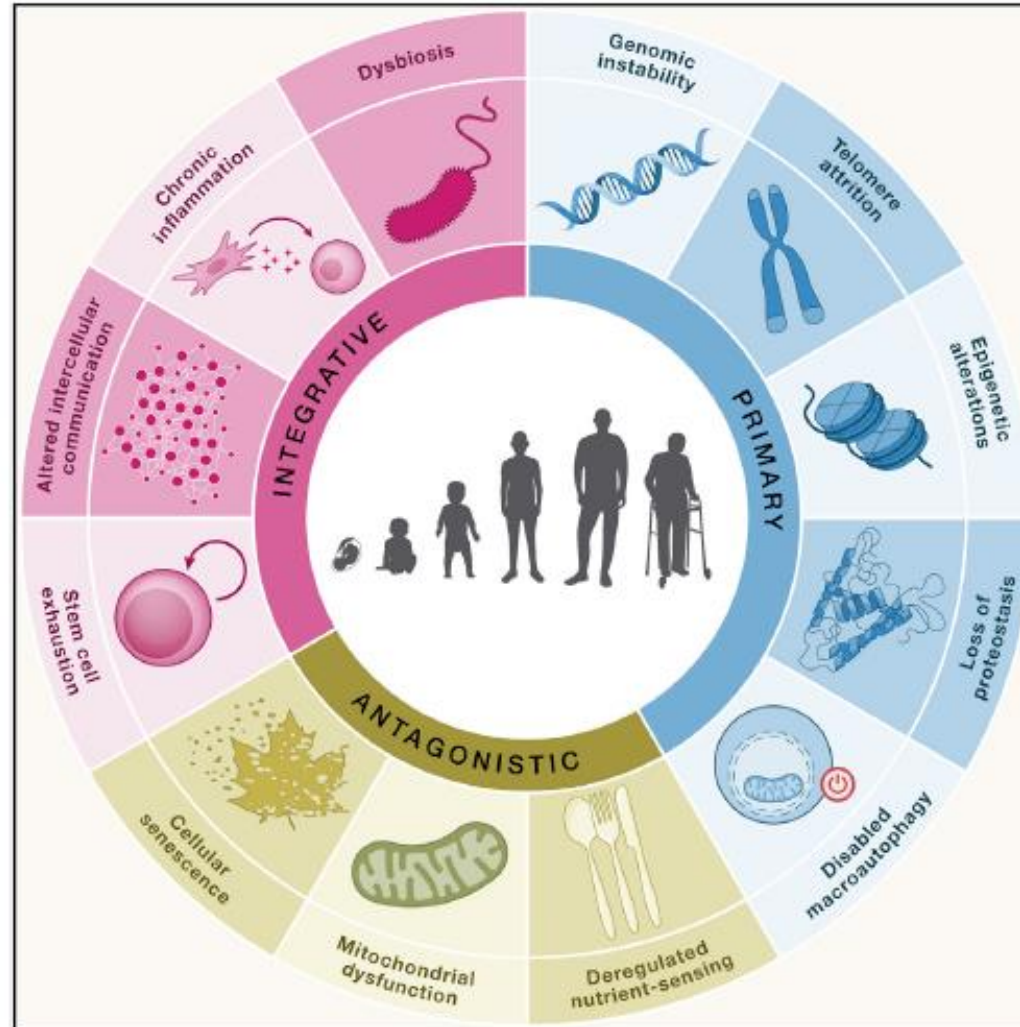


A Biological Geriatric Assessment (BGA) will enhance the Comprehensive Geriatric Assessment (CGA)

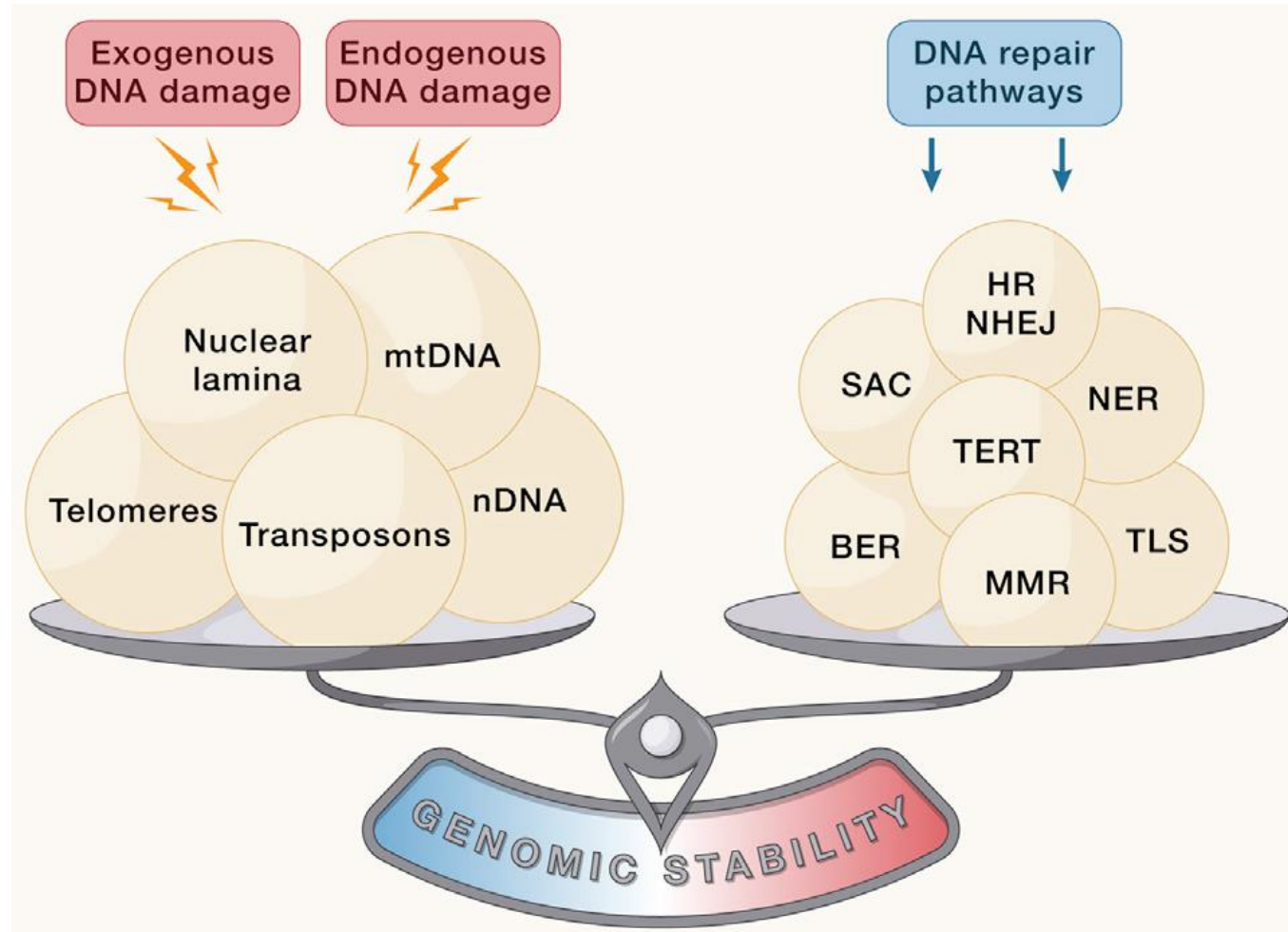
A BGA could isolate individuals at risk of accelerated aging and allow for earlier clinical intervention and reduce functional



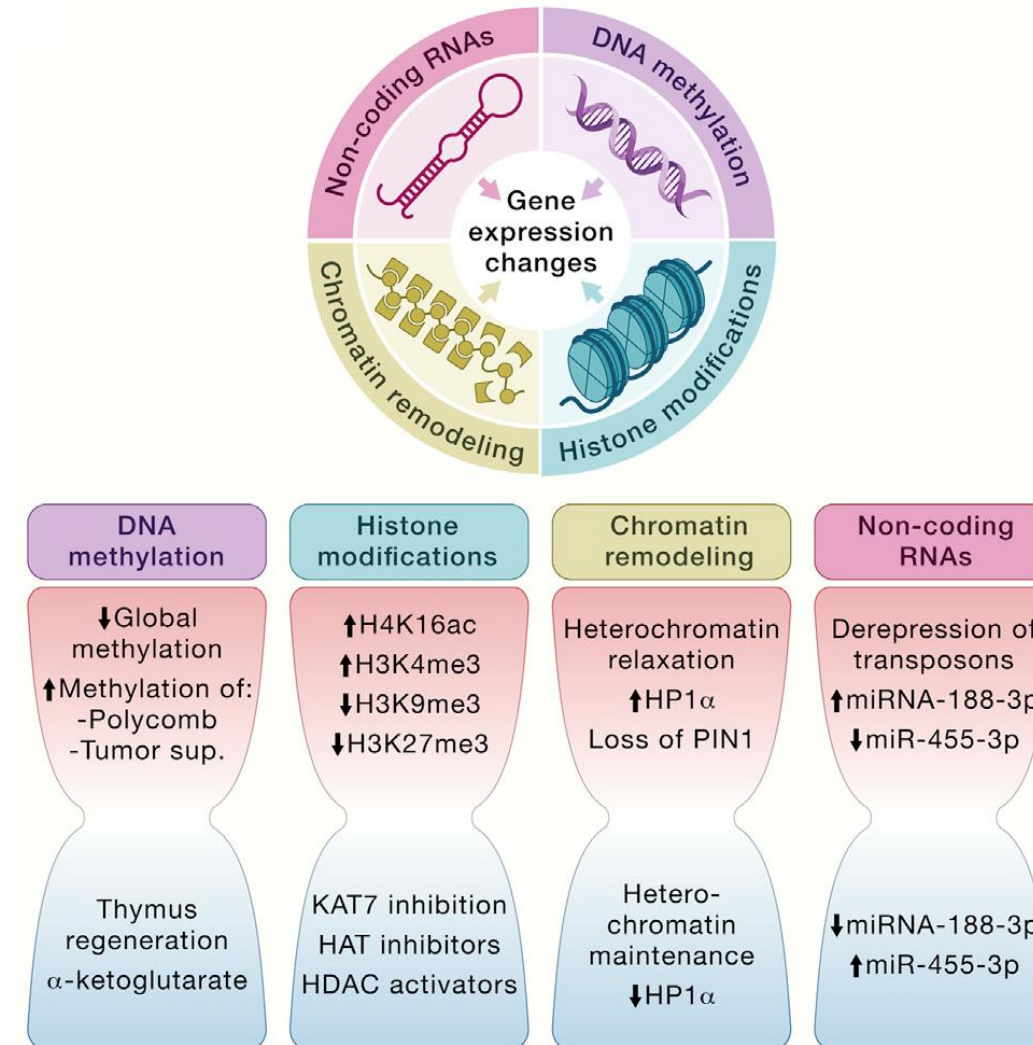
The hallmarks of aging



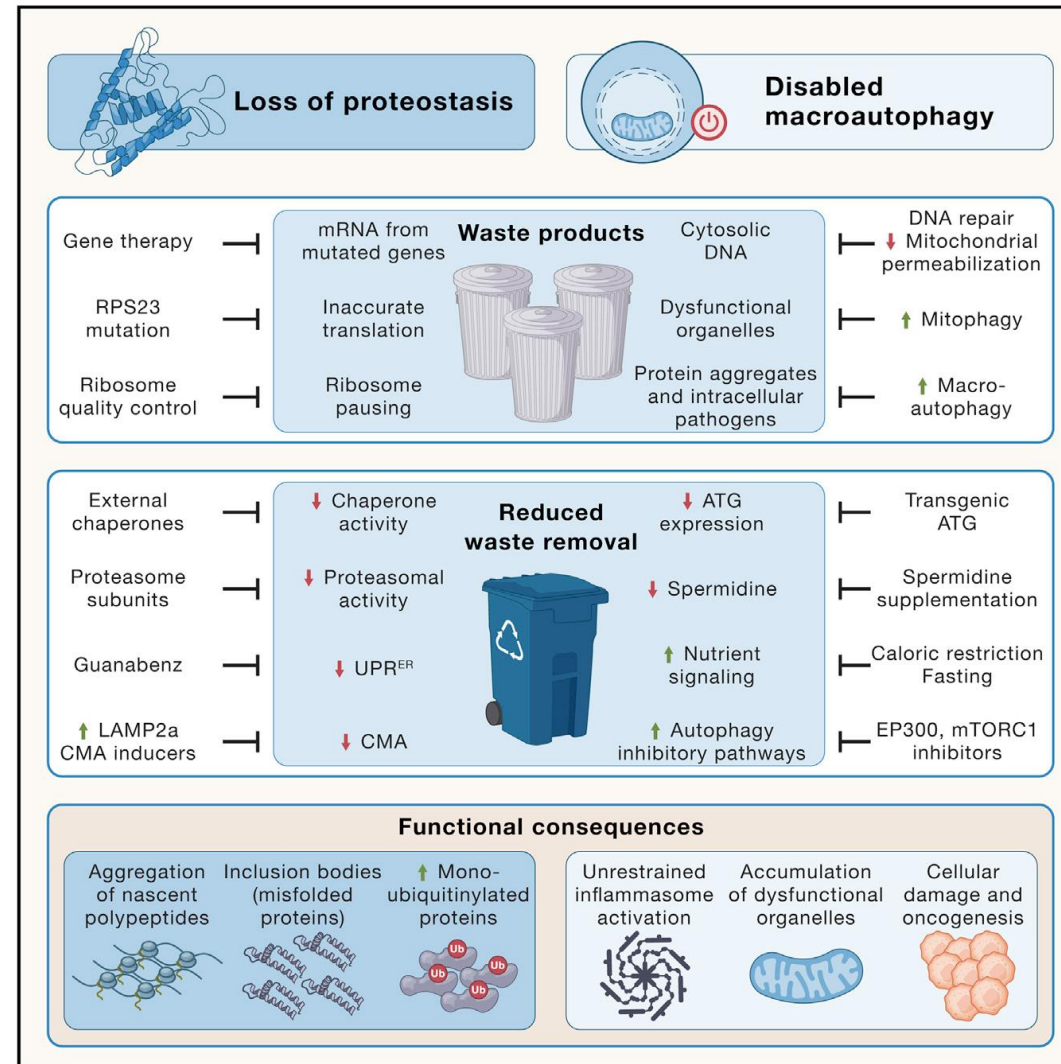
Loss of cellular integrity caused by genomic instability, telomere attrition, and epigenetic alterations



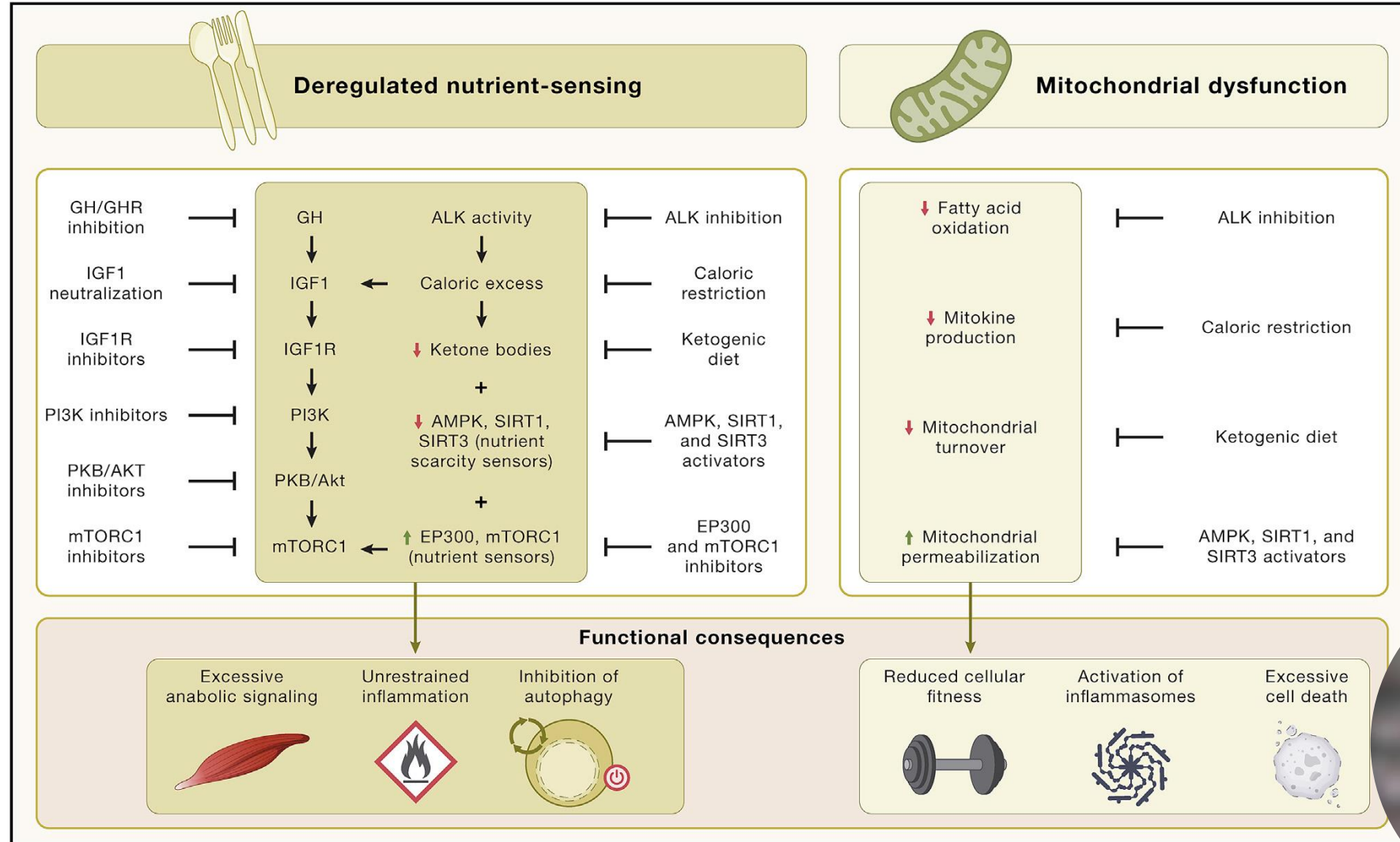
Loss of cellular integrity caused by epigenetic alterations



Loss of protein and organelle turnover

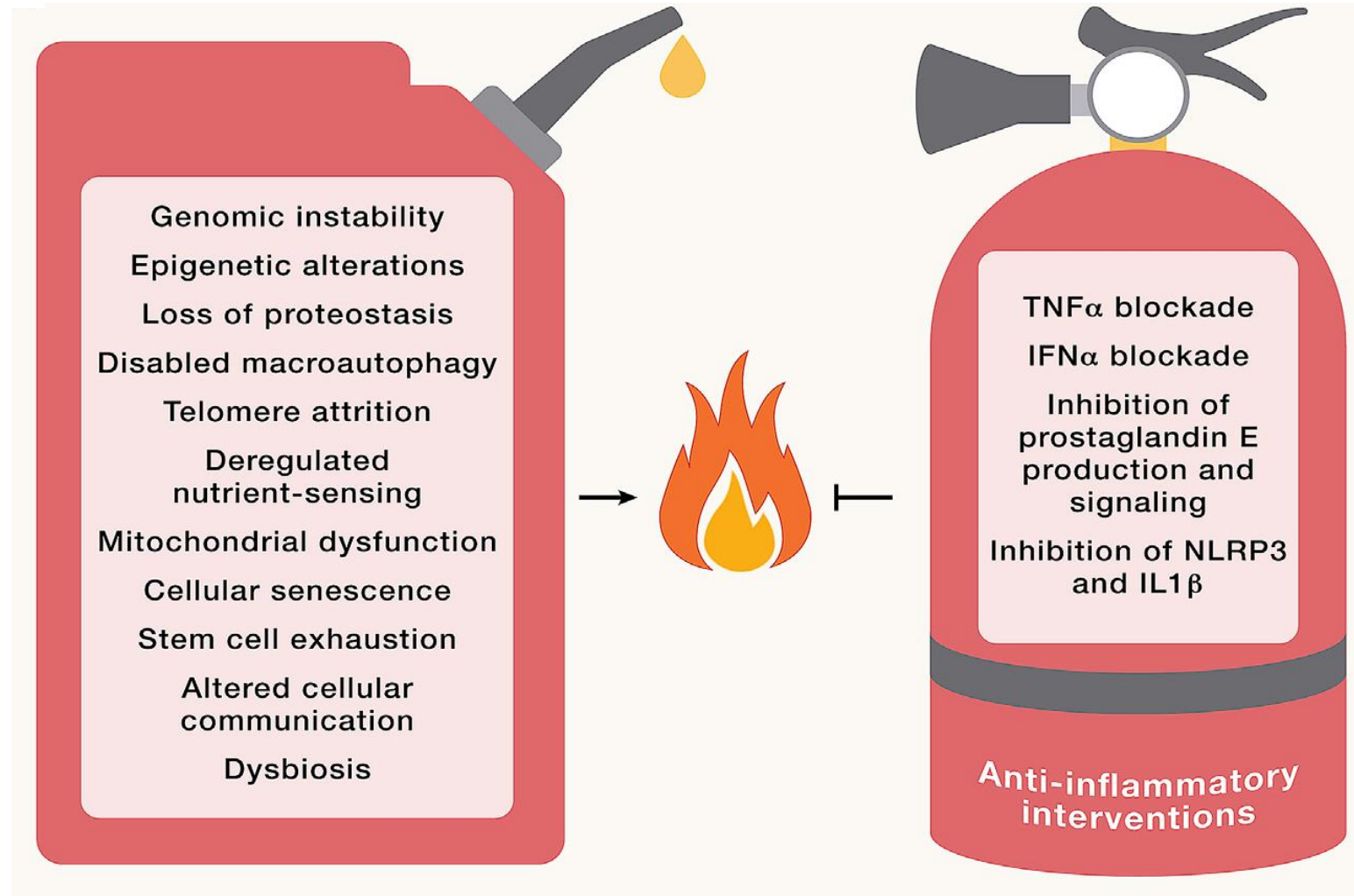


Metabolic alterations

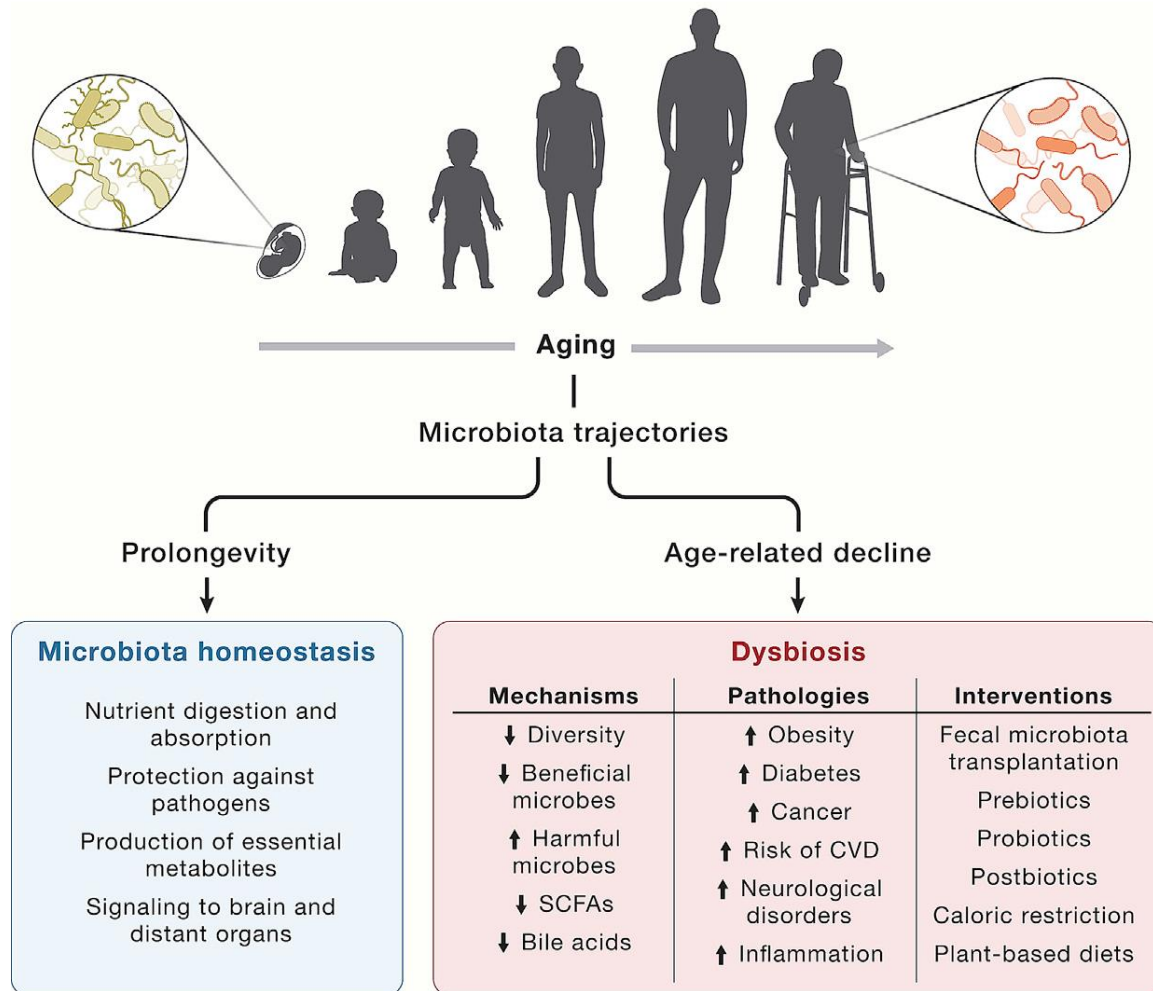


Derangement of supracellular functions

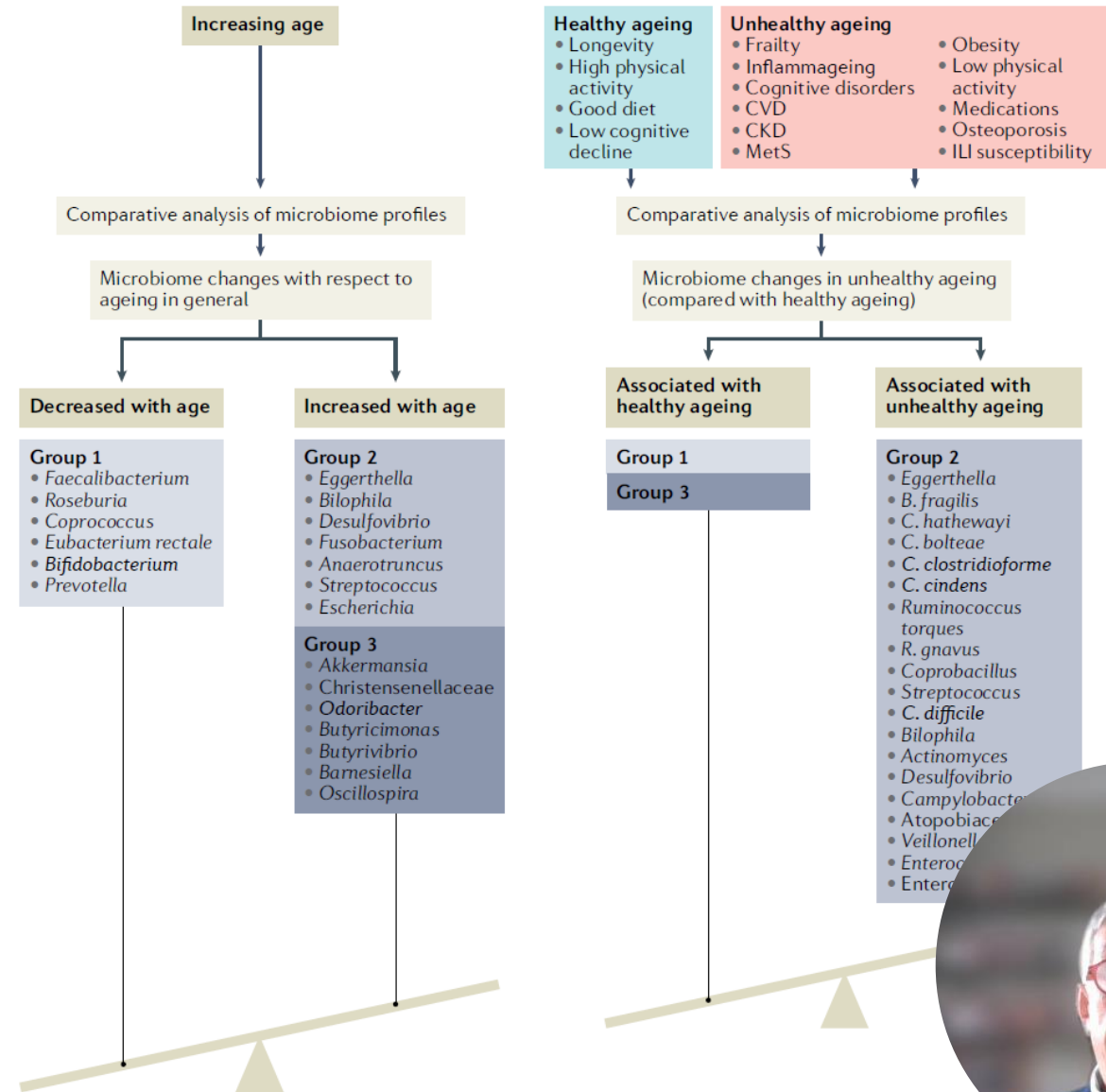
Chronic inflammation



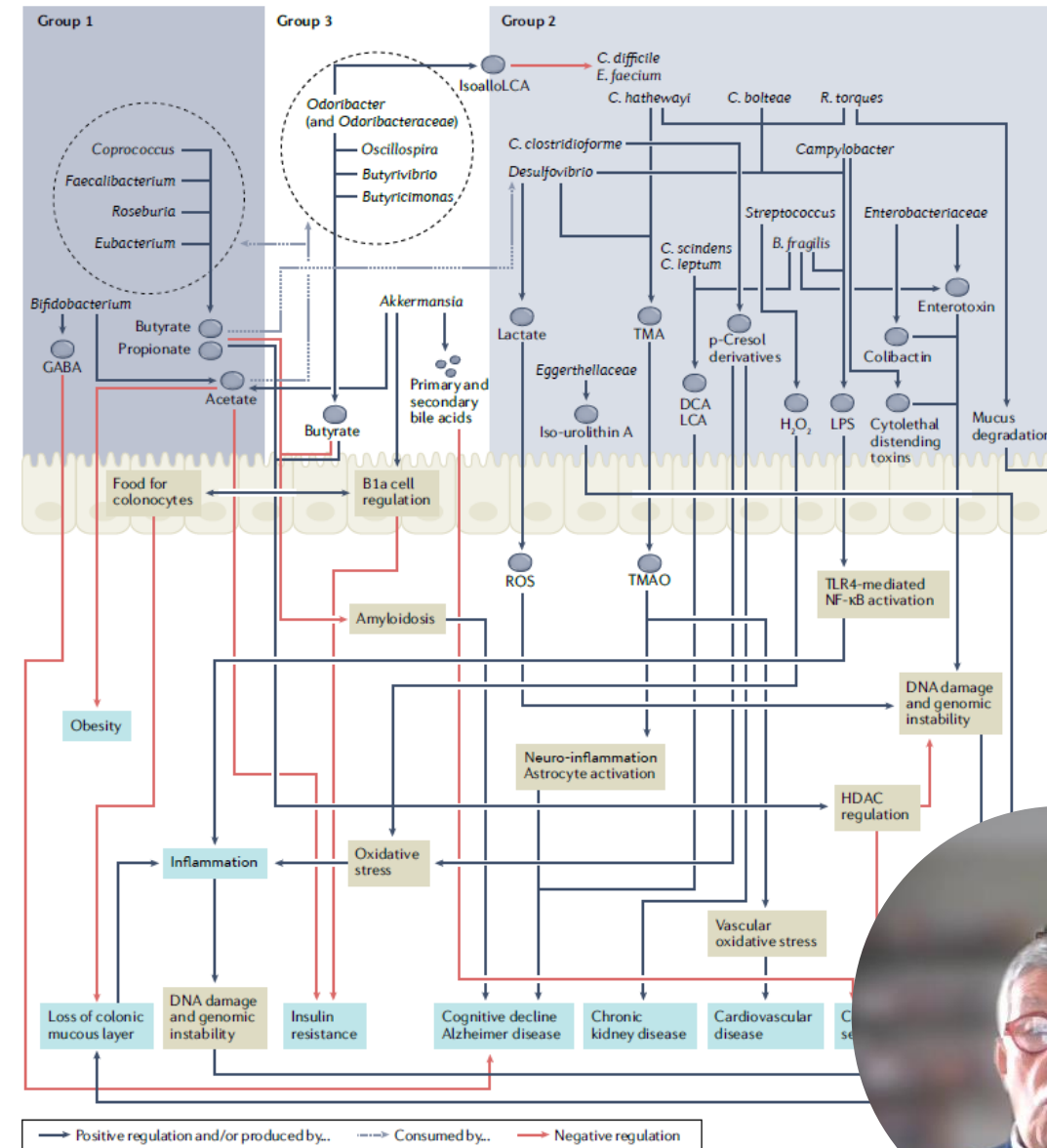
Derangement of supracellular functions Dysbiosis



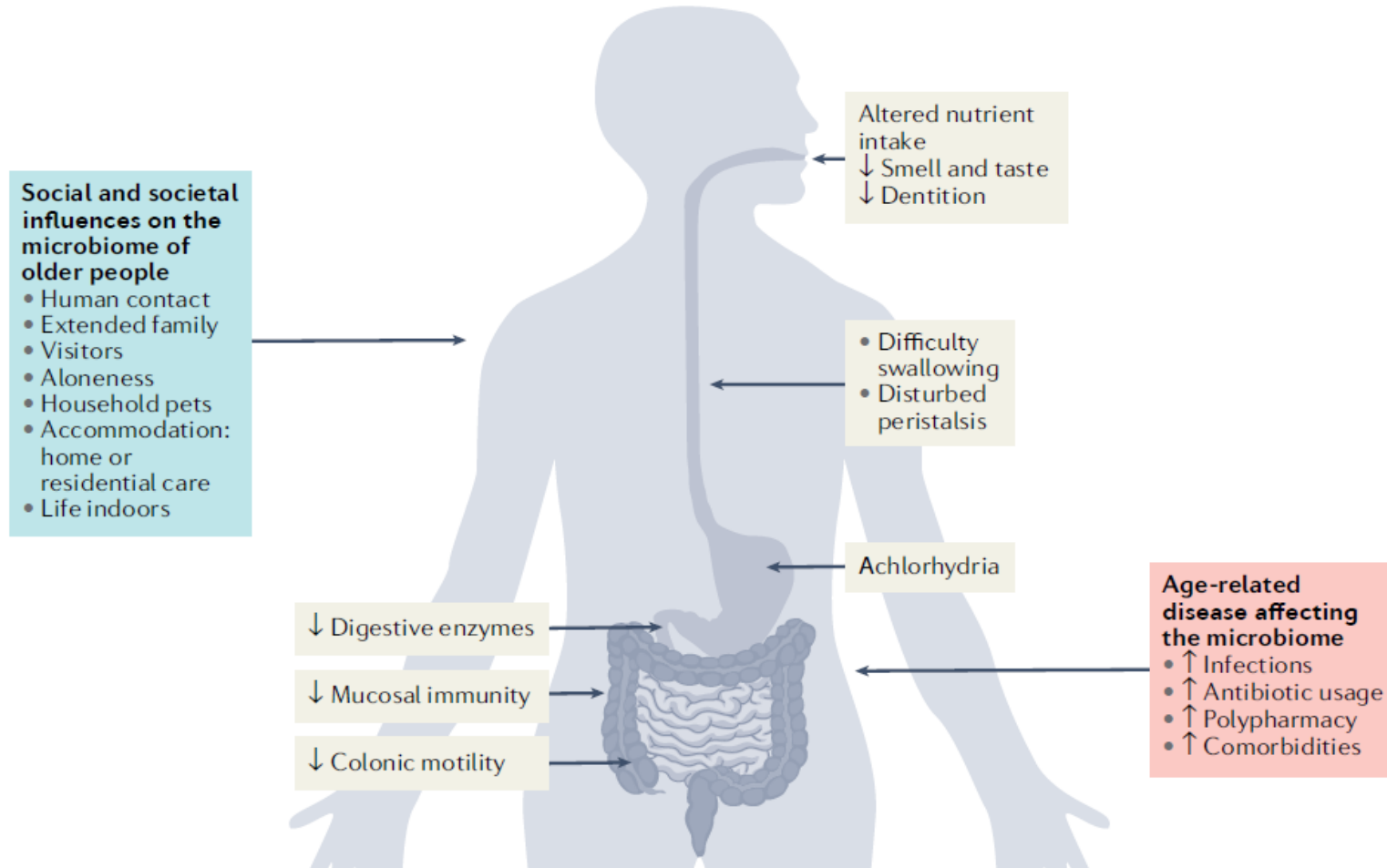
Microbiome alterations in ageing (and unhealthy ageing)



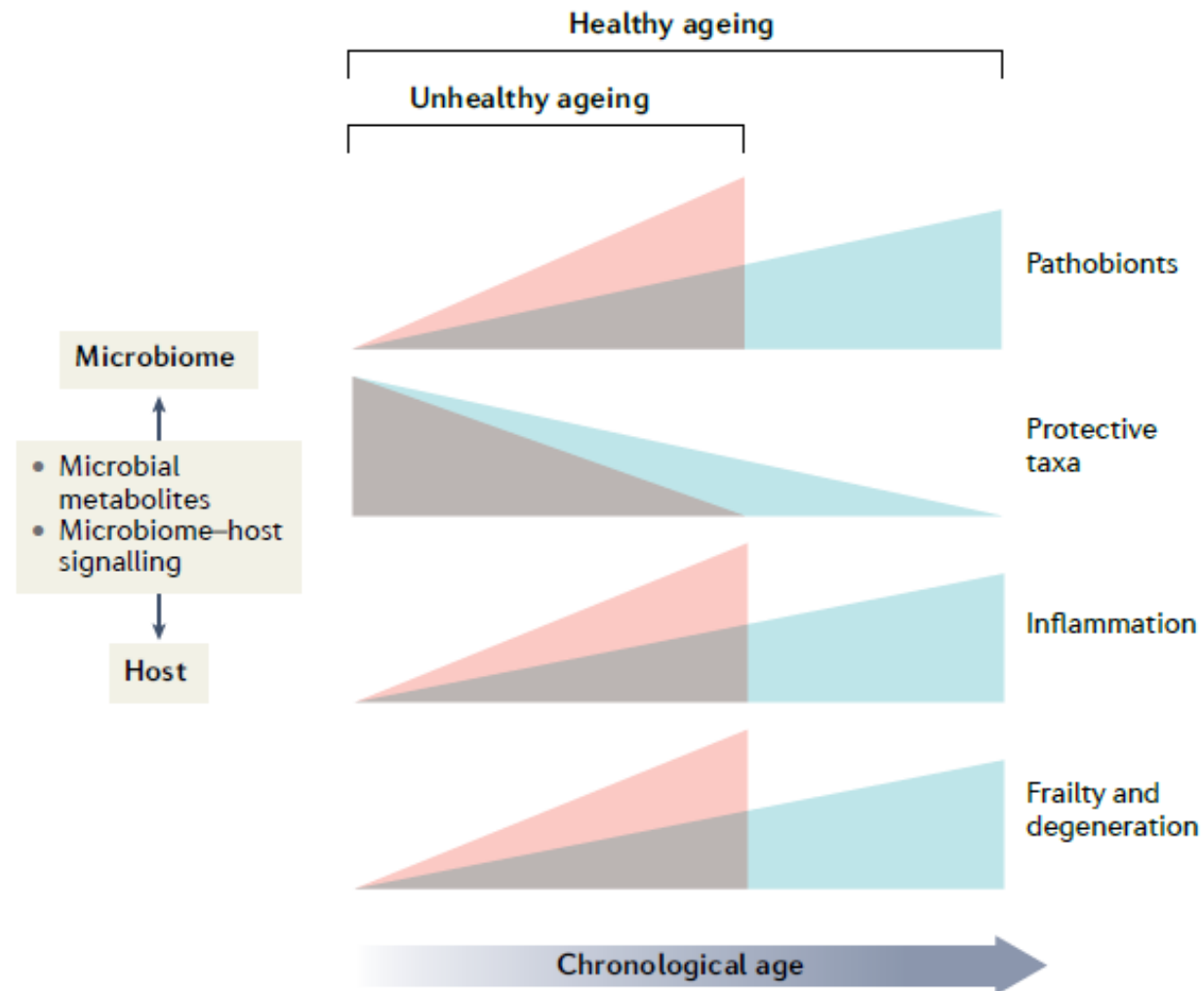
Functional implications of microbiome alterations on host physiology in ageing



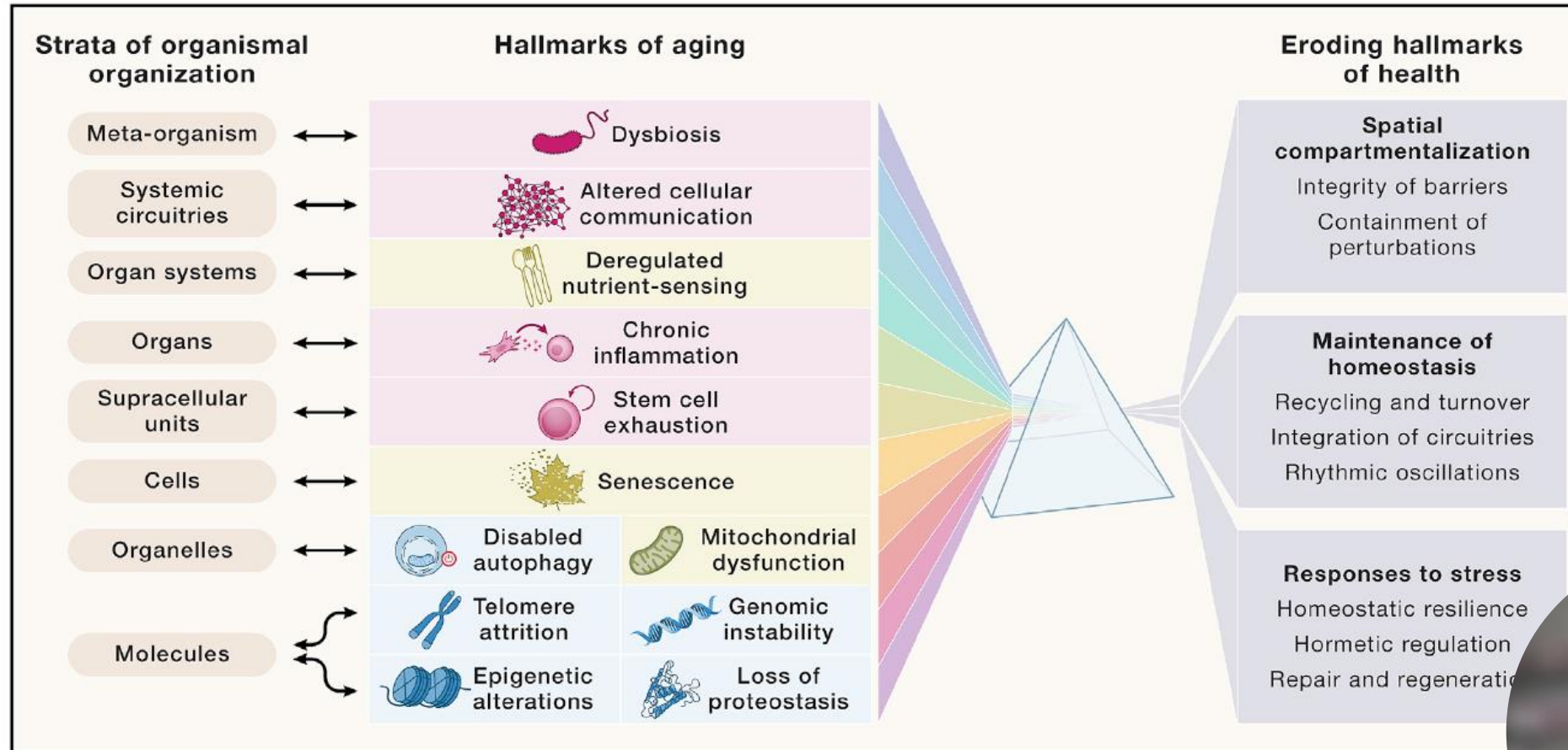
Physiological, social and disease-related influences on the microbiome of older people



Microorganism–host signalling as a contributor to healthy or unhealthy ageing



Integration of hallmarks

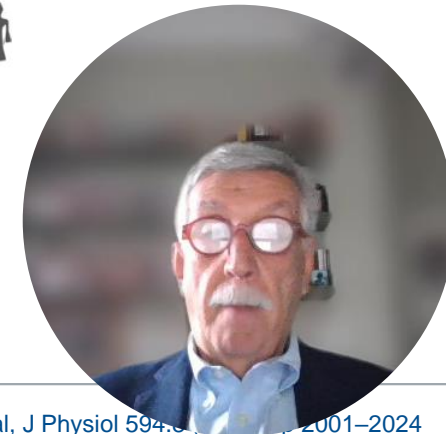
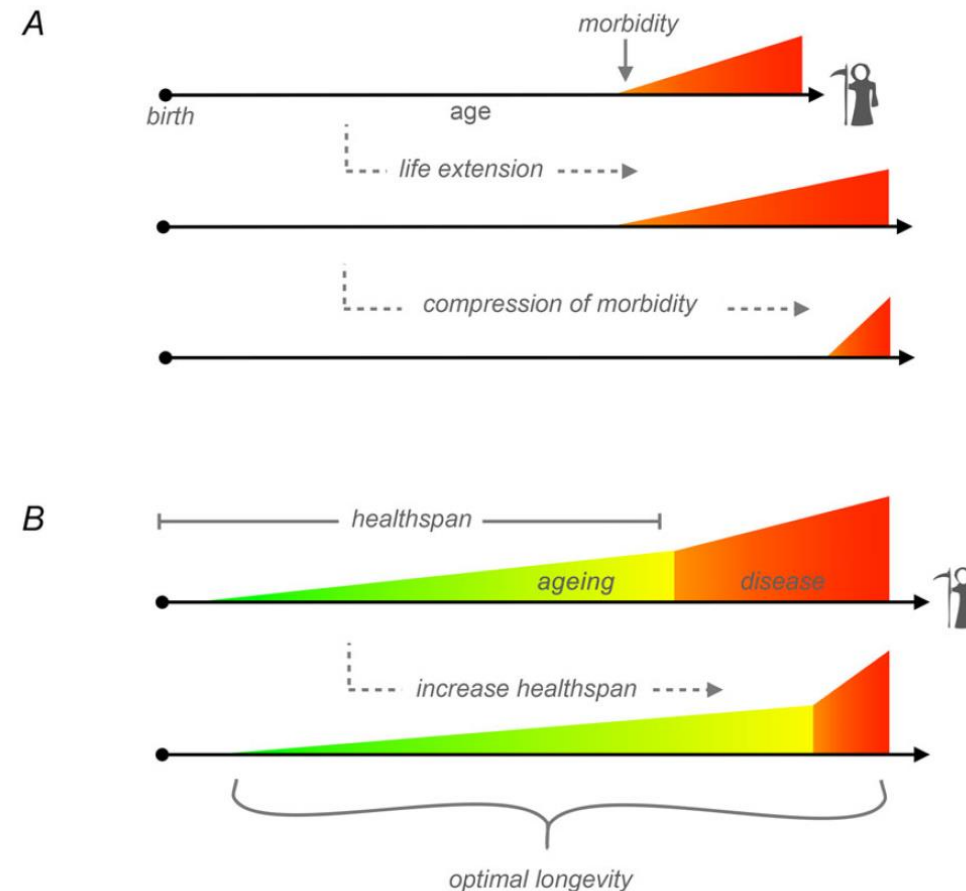


Geroscience: life to years not years to life

Compression of morbidity, healthspan and optimal longevity

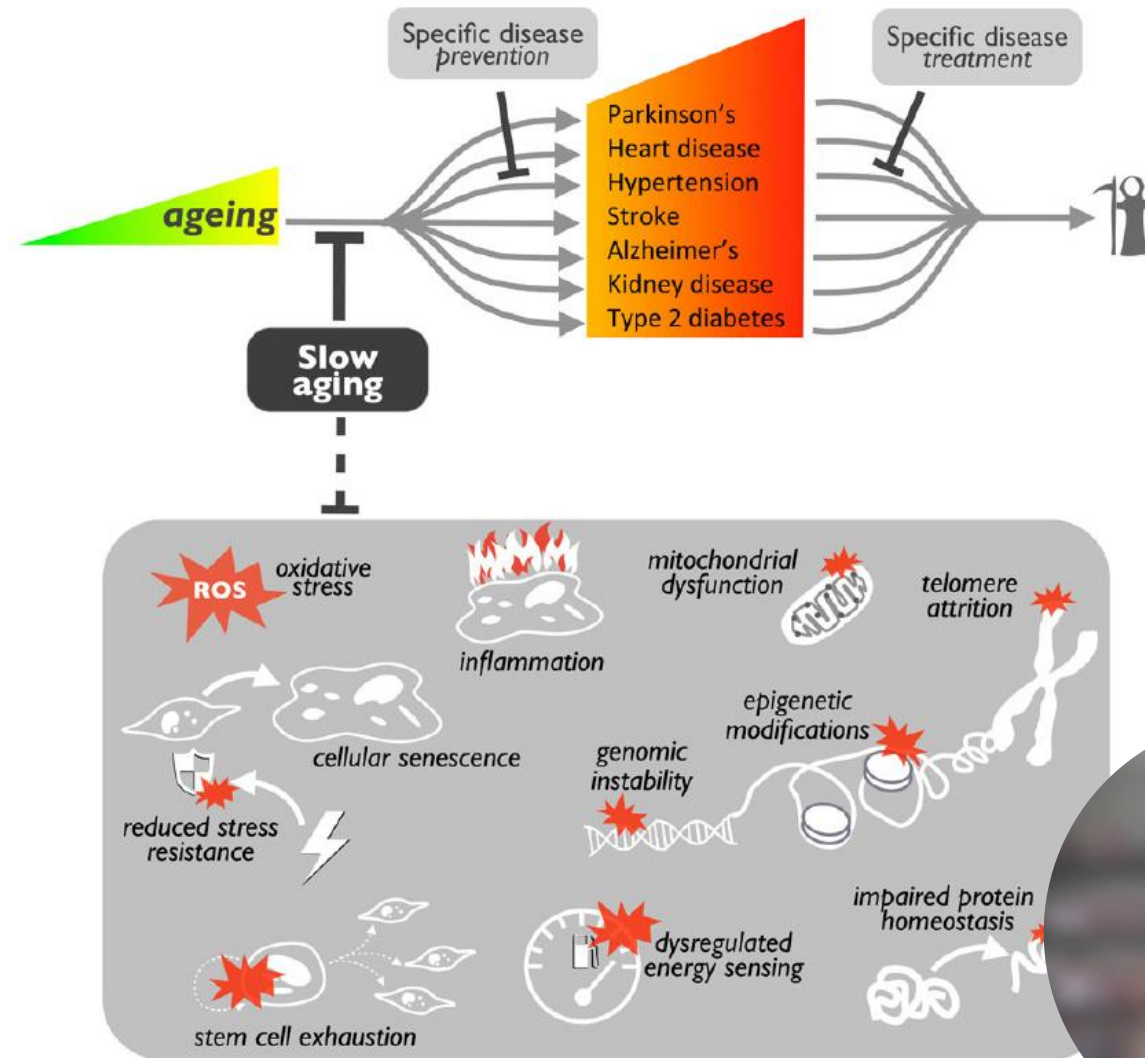
A, delaying the age of onset of chronic diseases and disability (**morbidity**) longer than any associated increase in lifespan results in 'compression' of the overall morbidity incurred in a lifetime.

B, **healthspan** is a period of healthy ageing with a modestly increasing ('subclinical') chronic disease burden, followed by a period of age-related clinical disease. To achieve optimal longevity (living long, but primarily in wellness) in the future, healthspan must be significantly extended.



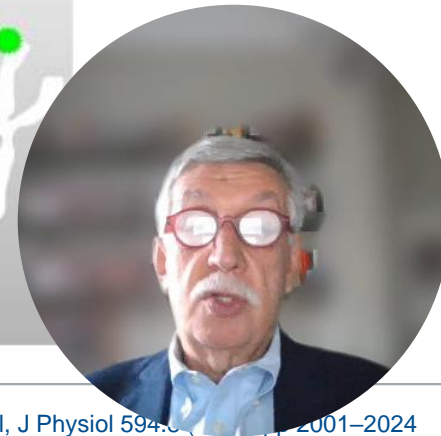
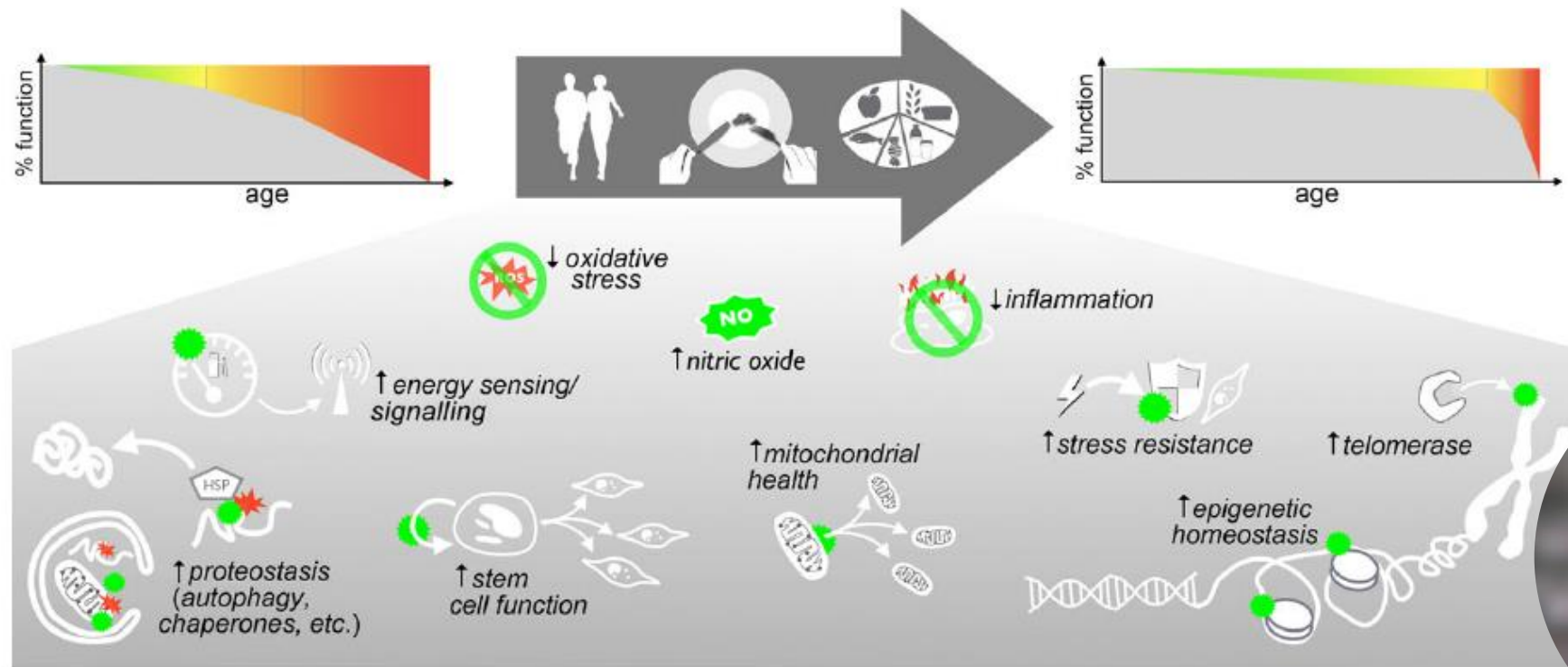
Slowing processes of ageing as a strategy for increasing healthspan

Delaying age-related disorders as a group may be a more effective way to increase healthspan than preventing or treating individual chronic diseases. The former would involve inhibiting the basic mechanisms of ageing.



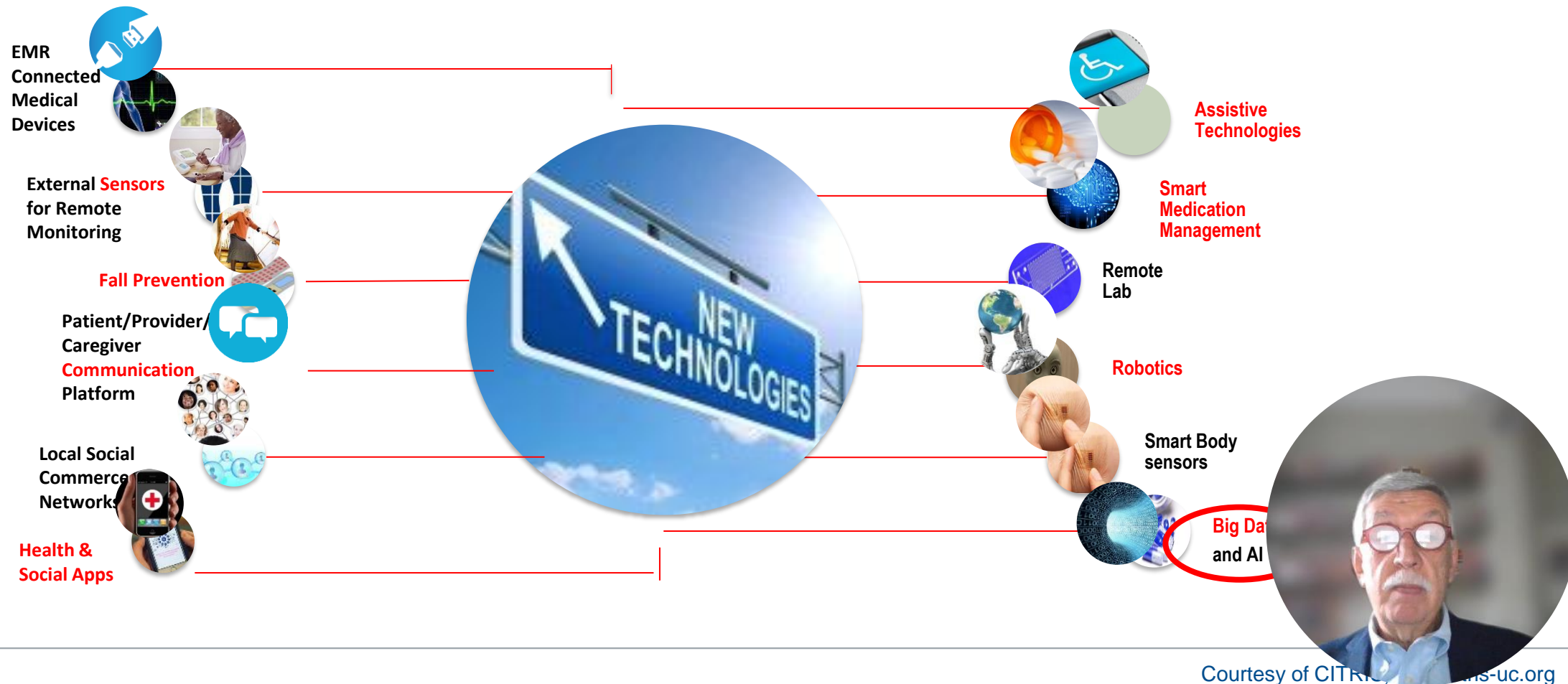
Lifestyle-behavioural strategies that increase function and potential underlying mechanisms

Regular physical activity, restricted energy intake and healthy diet composition enhance physiological function and healthspan, promoting optimal longevity. The molecular/biological mechanisms underlying these benefits may involve inhibiting or reversing several fundamental processes of ageing.



Emerging Technology: The Future (is here)

Aging Technology Innovations



Take Home Messages



- **Innovation is mandatory in Laboratory Medicine**
- **Big data are ready to enter in diagnostics**
- **Sources of big data are gigantic**
- **New biomarkers and omics are mandatory**
- **Hallmarks of aging are well defined**
- **Geroscience is reality**





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Thank you for your attention

