Optimising healthspan using gerotherapeutic drugs in middle aged individuals

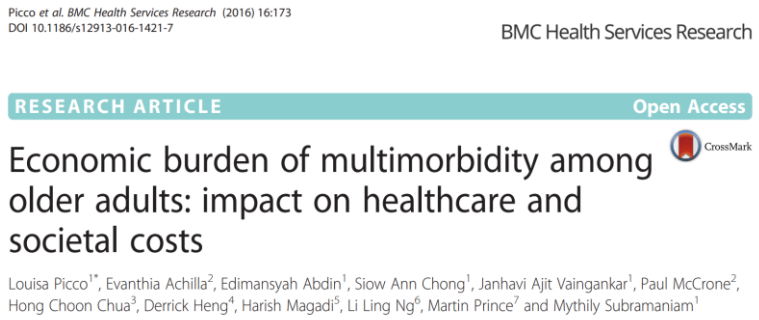
Andrea Maier

NUS National University of Singapore

NUHS Centre for Healthy Longevity

Longevity dividend: health and economic gains by slowing the biological processes of aging

costs



Picco et al. BMC Health Services Research (2016) 16:173
DOI 10.1186/s12913-016-1421-7

BMC Health Services Research

RESEARCH ARTICLE Open Access

Economic burden of multimorbidity among older adults: impact on healthcare and societal costs

Louisa Picco[1*], Evanthia Achilla[2], Edimansyah Abdin[1], Siow Ann Chong[1], Janhavi Ajit Vaingankar[1], Paul McCrone[2], Hong Choon Chua[3], Derrick Heng[4], Harish Magadi[5], Li Ling Ng[6], Martin Prince[7] and Mythily Subramaniam[1]

pp/a
no chronic condition: SGD$2,806
one chronic condition: SGD$5,610
multimorbidity: SGD$15,148

value

ANALYSIS
https://doi.org/10.1038/s43587-021-00080-0

nature aging

Check for updates

OPEN

The economic value of targeting aging

Andrew J. Scott[1], Martin Ellison[2] and David A. Sinclair[3]

Developments in life expectancy and the growing emphasis on biological and 'healthy' aging raise a number of important questions for health scientists and economists alike. Is it preferable to make lives healthier by compressing morbidity, or longer by extending life? What are the gains from targeting aging itself compared to efforts to eradicate specific diseases? Here we analyze existing data to evaluate the economic value of increases in life expectancy, improvements in health and treatments that target aging. We show that a compression of morbidity that improves health is more valuable than further increases in life expectancy, and that targeting aging offers potentially larger economic gains than eradicating individual diseases. We show that a slowdown in aging that increases life expectancy by 1 year is worth US$38 trillion, and by 10 years, US$367 trillion. Ultimately, the more progress that is made in improving how we age, the greater the value of further improvements.

slowdown in aging that increases life expectancy by 1 year is worth US$38 trillion

enabler

THE LANCET
Healthy Longevity

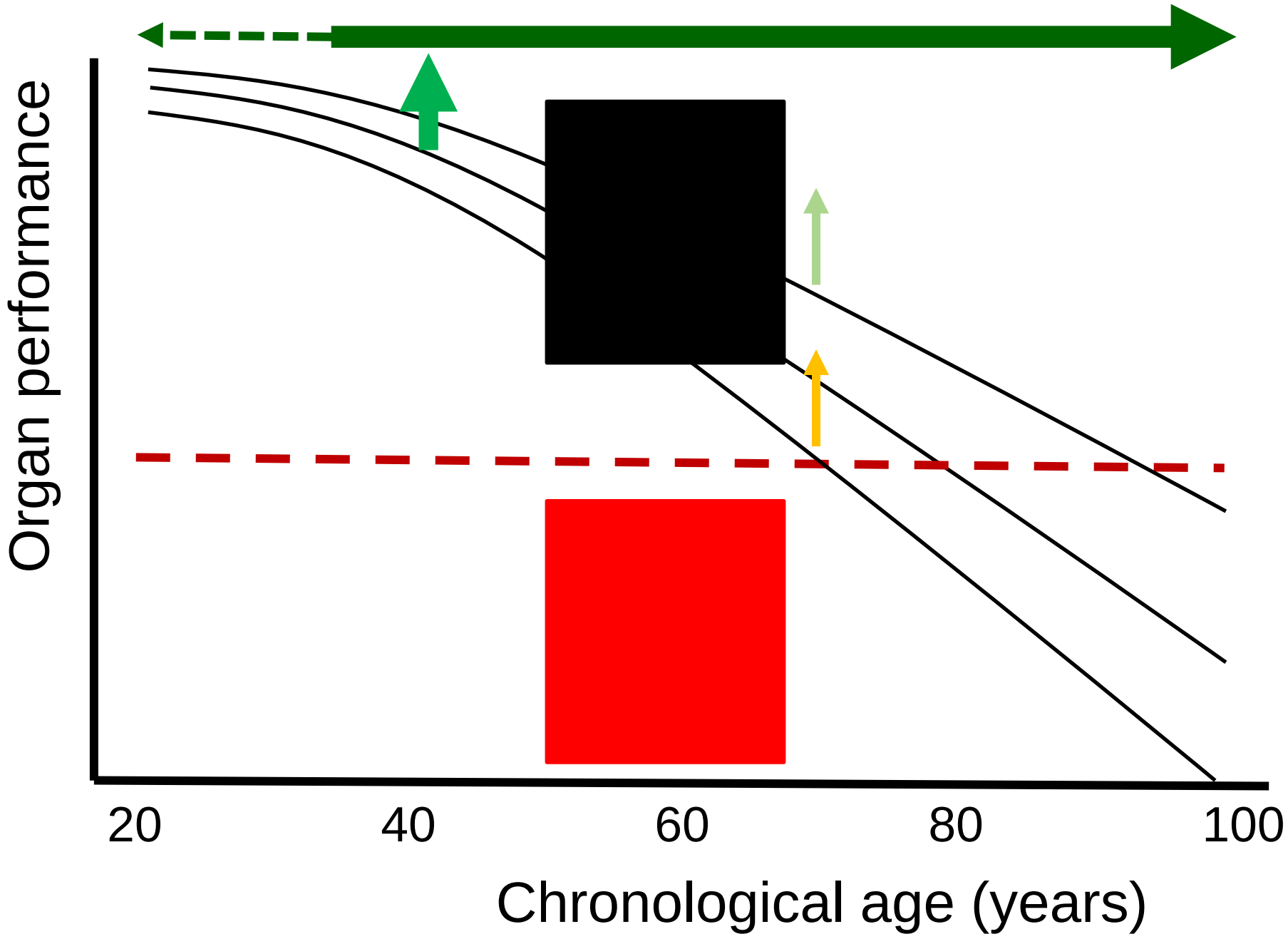
CORRESPONDENCE | VOLUME 3, ISSUE 1, E12, JANUARY 01, 2022

Advanced pathological ageing should be represented in the ICD

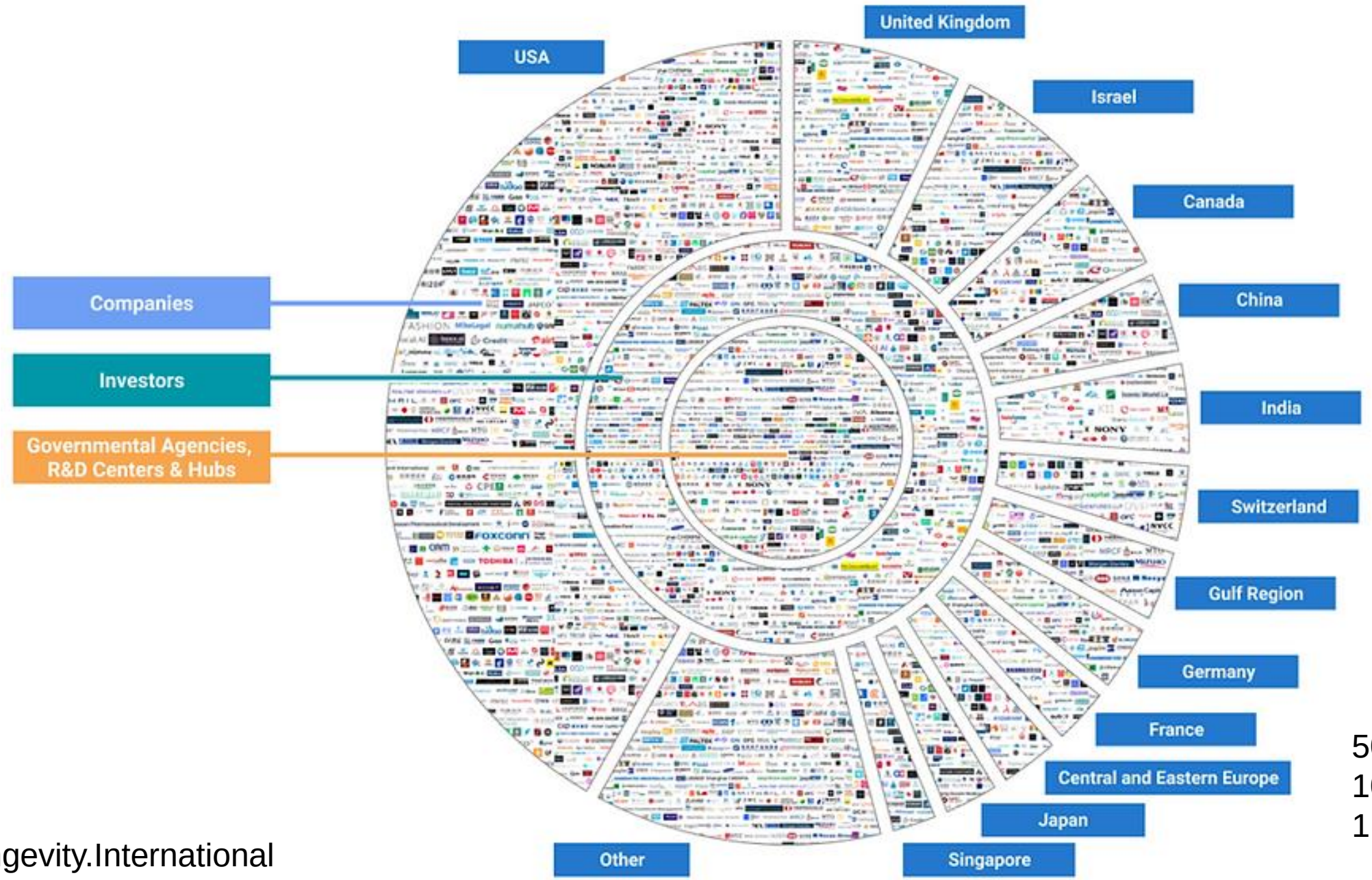
Evelyne Bischof • Andrea B Maier • Kai-Fu Lee • Alex Zhavoronkov • David Sinclair

Open Access • Published: January, 2022 • DOI: https://doi.org/10.1016/S2666-7568(21)00303-2

XT9T


Organ performance
20
40
60
80
100
Chronological age (years)

Longevity ecosystem



50 000+ Companies
10 000+ Investors
1 000+ R&D Centers

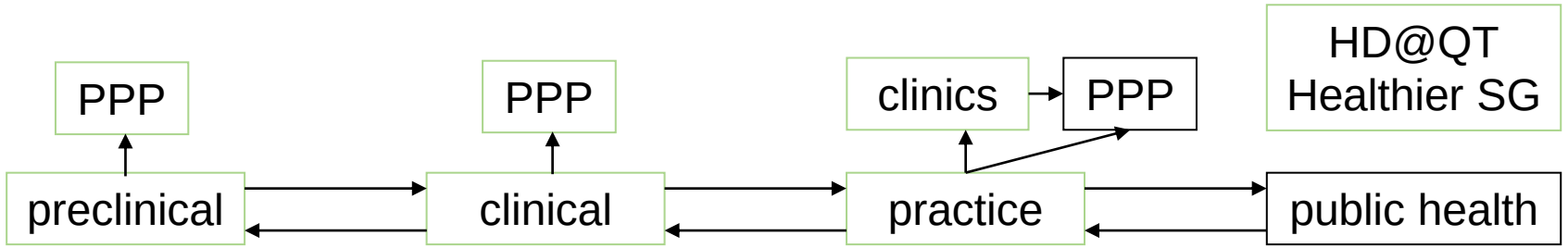
Increasing healthspan of SG by …

building the ecosystem

at least 3 year in 10 years

Healthy Longevity Medicine Society

Healthy Longevity Academy: executive, master, incubator

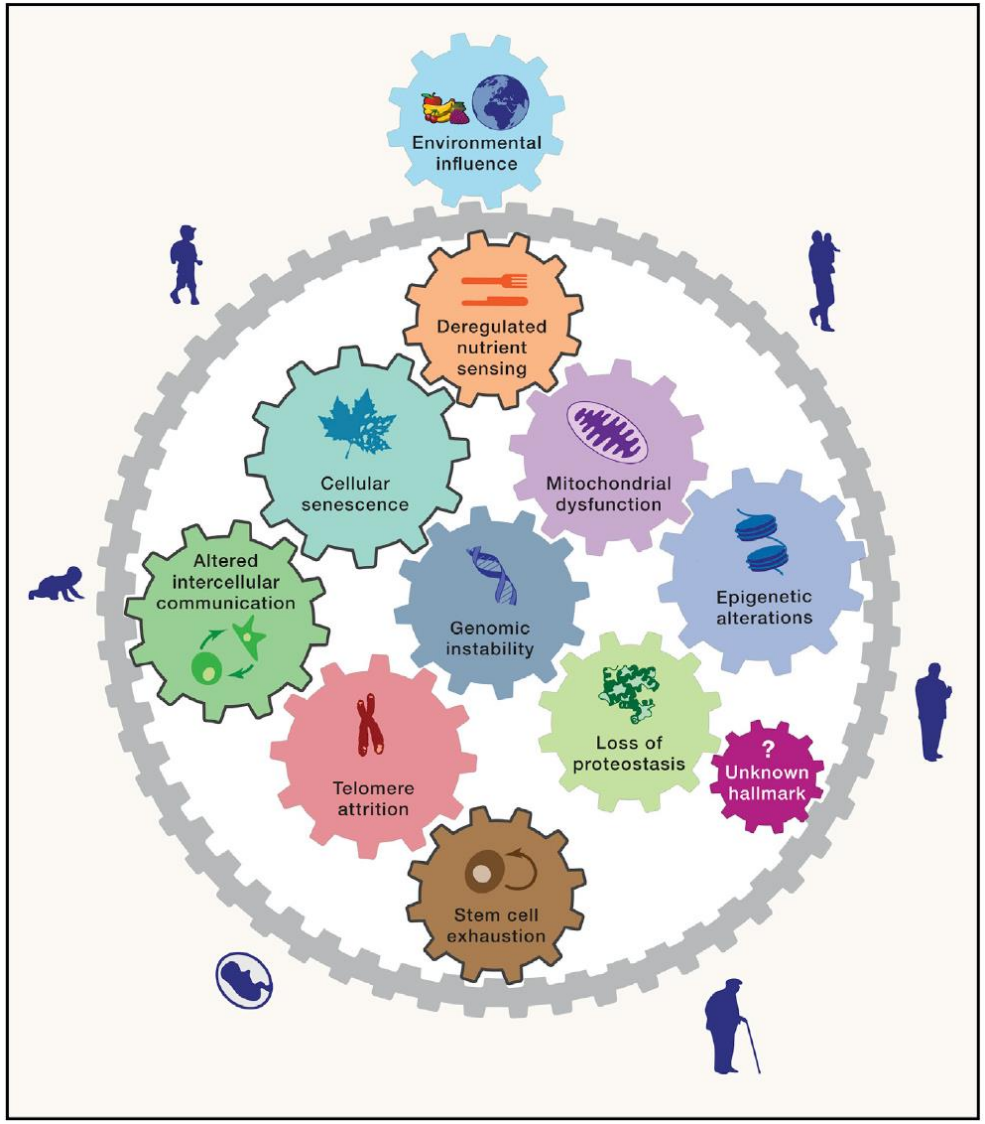


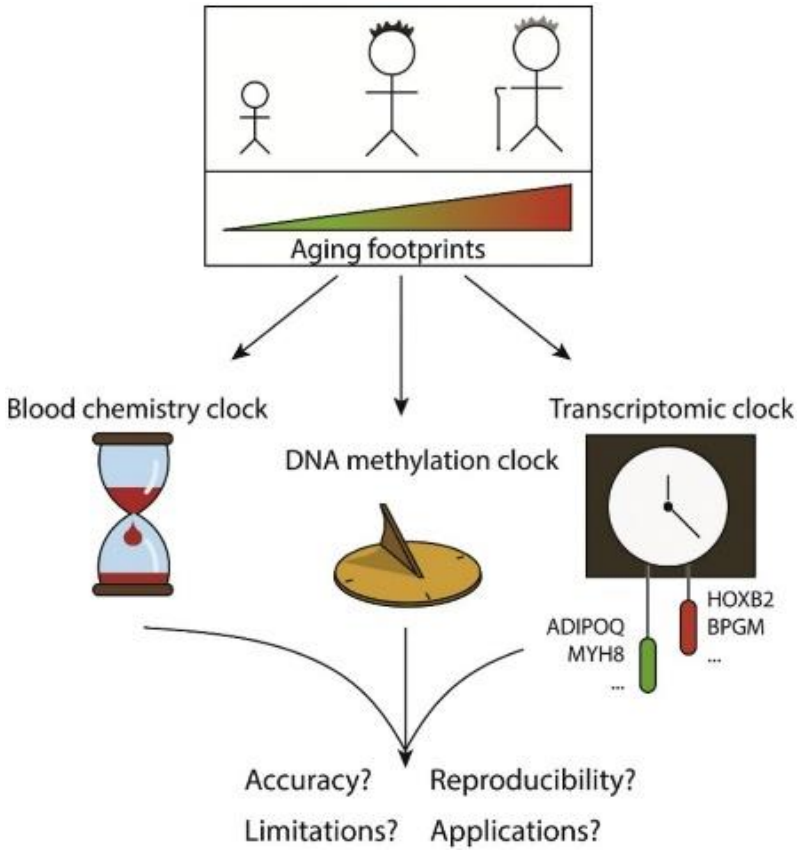
diagnostics: core measuring biological age

interventions: core 'treating' biological age

NUHS Centre for Healthy Longevity

Diagnostics





Tuttle et al., Exp Gerontol 2018; Singh et al., Cell 2019; Shahmirzadi et al., Cell Metabolism 2020; Galkin et al., Ageing Res Rev 2020; Tuttle et al., Aging Cell 2020

Biomarker of Ageing Consortium

2023 Executive Committee

Mahdi Moqri, PhD, MBA
STANFORD & HARVARD UNIVERSITIES

Dr. Moqri is a Research Fellow in Aging Research at Stanford School of Medicine and a Visiting Scholar at Harvard Medical School.

Relevant expertise:
Biomarkers of aging and rejuvenation and their assessments.

Jesse Poganik, PhD
HARVARD UNIVERSITY

Dr. Poganik is Research Fellow at Brigham and Women's Hospital and Harvard Medical School.

Relevant expertise:
Epigenetic clocks of aging in human and model animals.

Allison Duettman
FORESIGHT INSTITUTE

Allison Duettmann is the President and CEO of Foresight Institute.

Relevant expertise:
Advanced biotech, nanotech, computing for the long-term benefit of life.

Dane Gobel
METHUSELAH FOUNDATION

Dane Gobel is the Co-Founder and Program Director for the Methuselah Foundation.

Relevant expertise:
Non-profit management, business development, deep tech open innovation, dealflow.

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HARVARD UNIVERSITY

Dr. Gladyshev is a Professor of Medicine at Harvard Medical School and Director of Redox Medicine at Brigham & Women's Hospital.

Relevant expertise:
Aging clocks and other biomarkers of biological age.

Michael Snyder, PhD
STANFORD UNIVERSITY

Dr. Snyder is the Chair of the Department of Genetics at Stanford School of Medicine and the Director of the Center for Genomics and Personalized Medicine.

Relevant expertise:
Longitudinal biomarkers of aging and Multiomic Ageotyping.

Vittorio Sebastiano, PhD
STANFORD UNIVERSITY

Dr. Sebastiano is an Associate Professor in the Department of Obstetrics & Gynecology at Stanford School of Medicine and the Co-Founder of Turn Biotechnologies.

Relevant expertise:
Biomarkers of cellular rejuvenation.

Andrea Maier, MD
NATIONAL UNIVERSITY OF SINGAPORE

Dr. Maier is a Professor in Medicine and Healthy Ageing and the Co-Director of Center for Healthy Longevity at the National University of Singapore and a Fellow of the Royal Australasian College of Physicians.

Relevant expertise:
Healthy aging and longevity biomarkers.

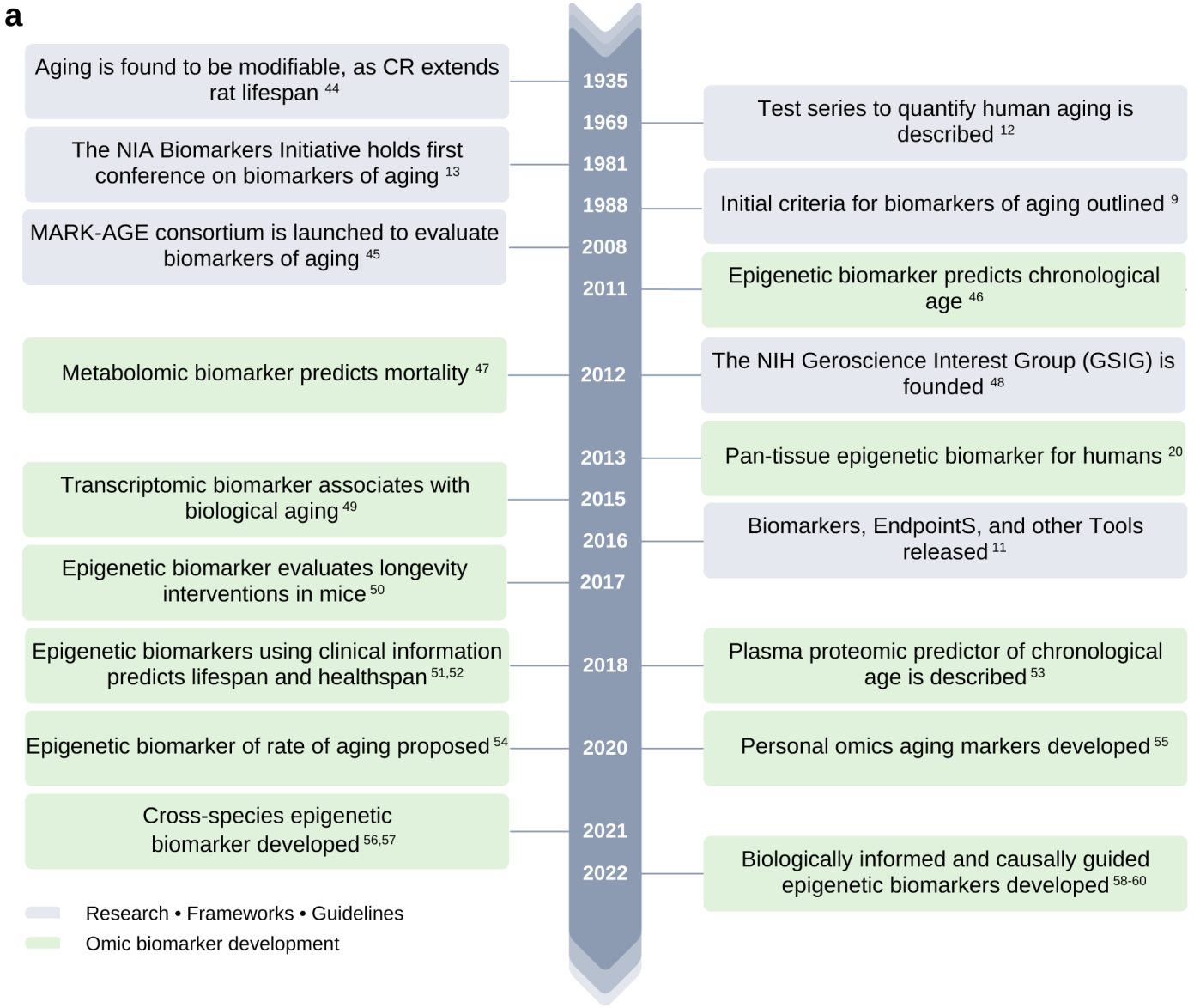
Eric Verdin, MD
BUCK INSTITUTE FOR RESEARCH ON AGING

Dr. Verdin is President and Chief Executive Officer of the Buck Institute for Research on Aging, as well as Professor of Medicine at University of California, San Francisco.

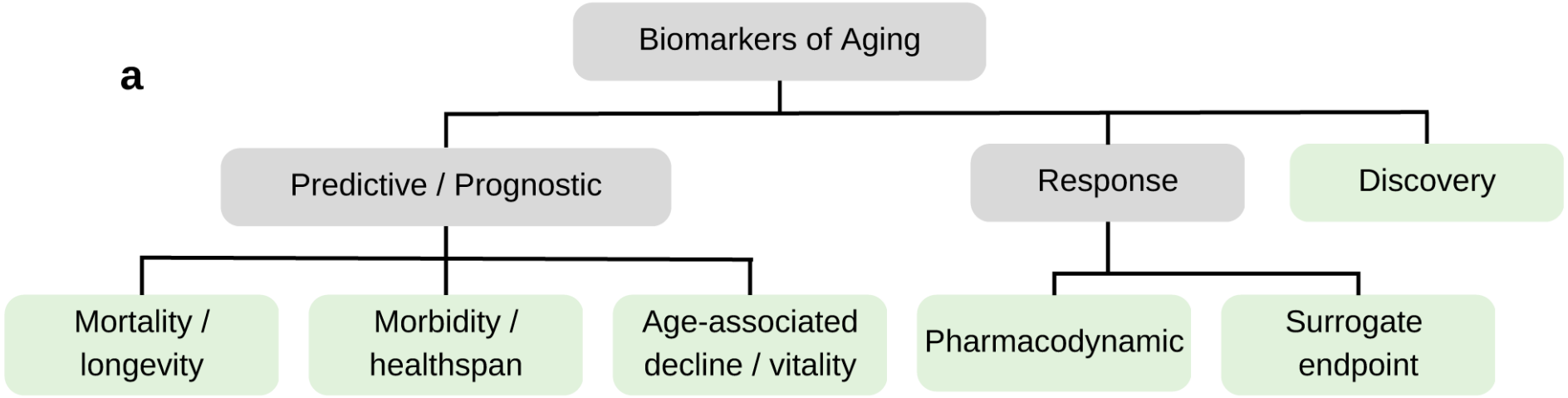
Relevant expertise:
Biomarkers of immune aging.

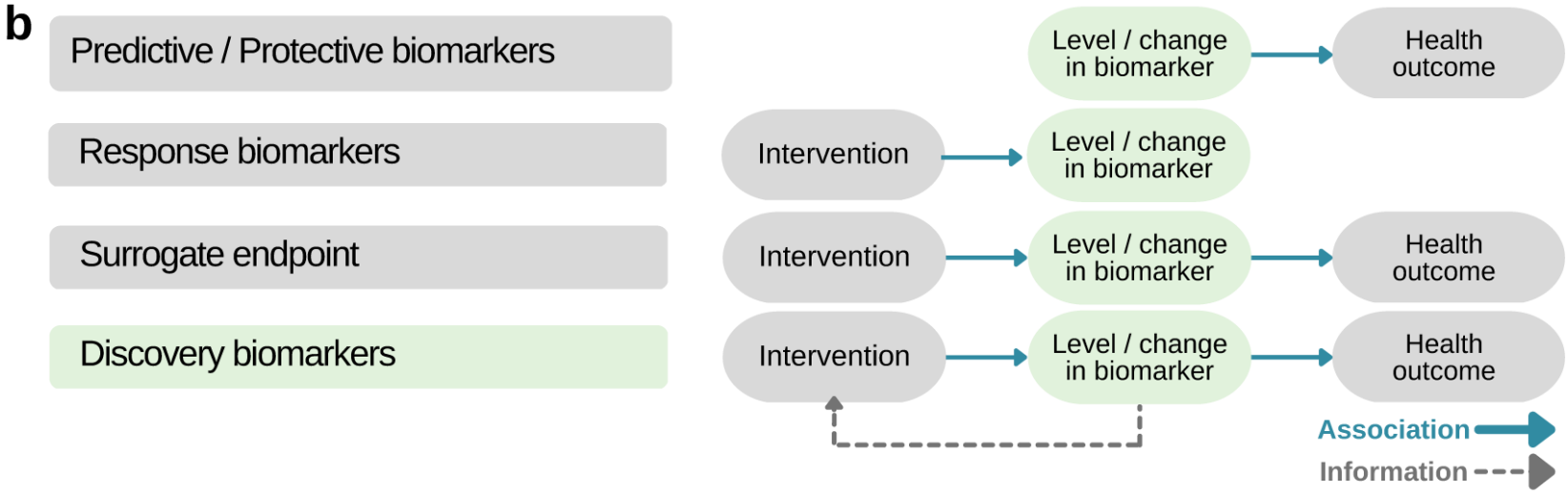
Facilitate communication, collaboration, and sharing of data, tools, and information to establish reliable biomarkers of aging, particularly for the identification and evaluation of longevity interventions.

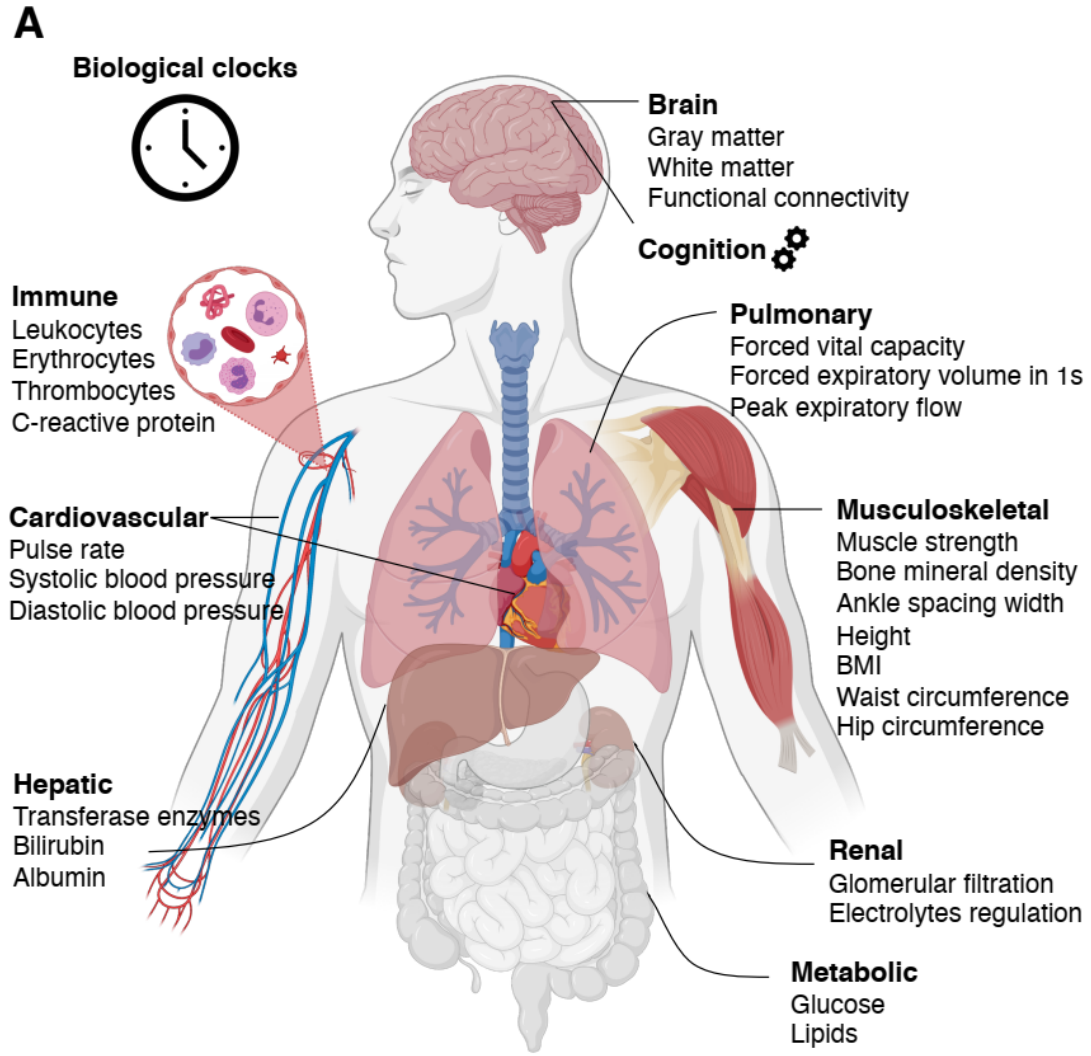
Timeline - biomarkers of aging

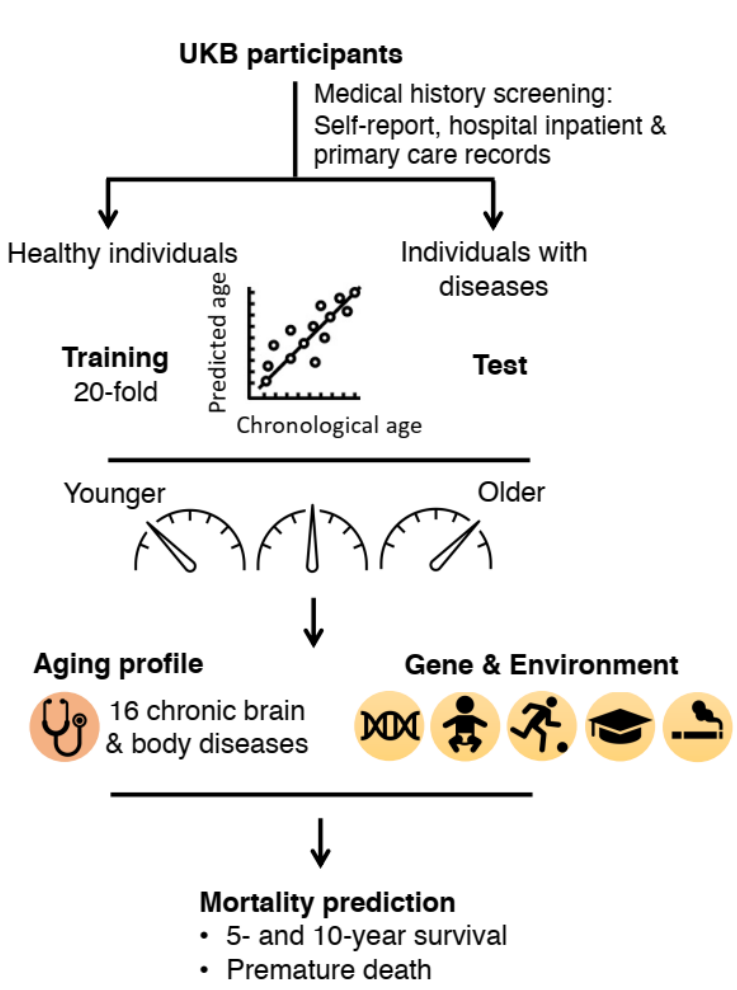


Categories of biomarkers of ageing







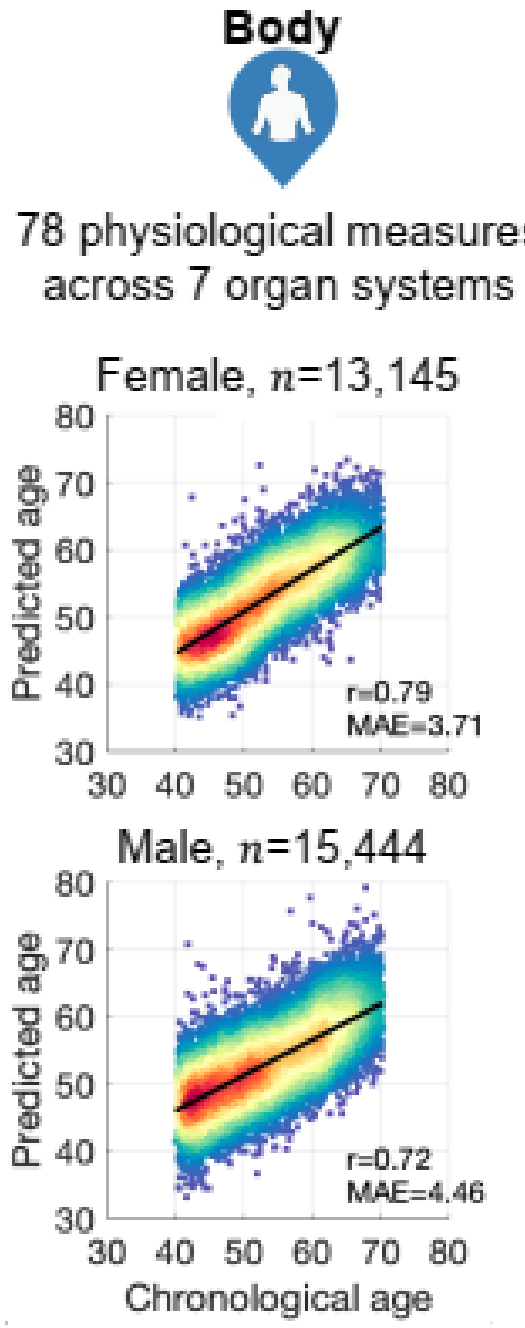


143,423 individuals (age range 39-73 years, mean 56.7±8.2, 79,980 males)

- Support vector machines (SVMs) were trained to predict chr age
- 20-fold cross-validation
- Variables standardized by weighted column mean and standard deviation

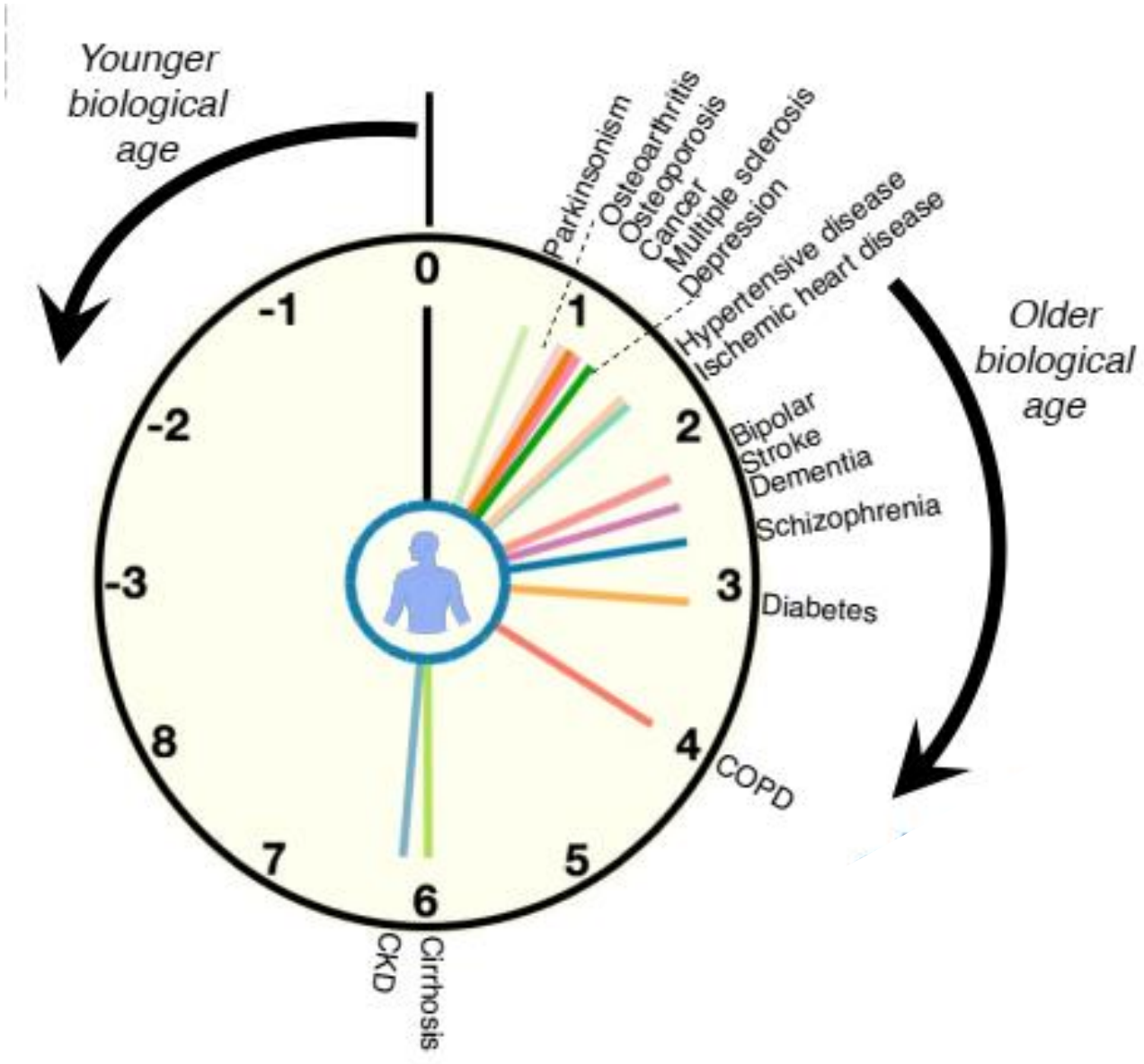
Yi Tian et al., Nature Medicine 2023

Body clock



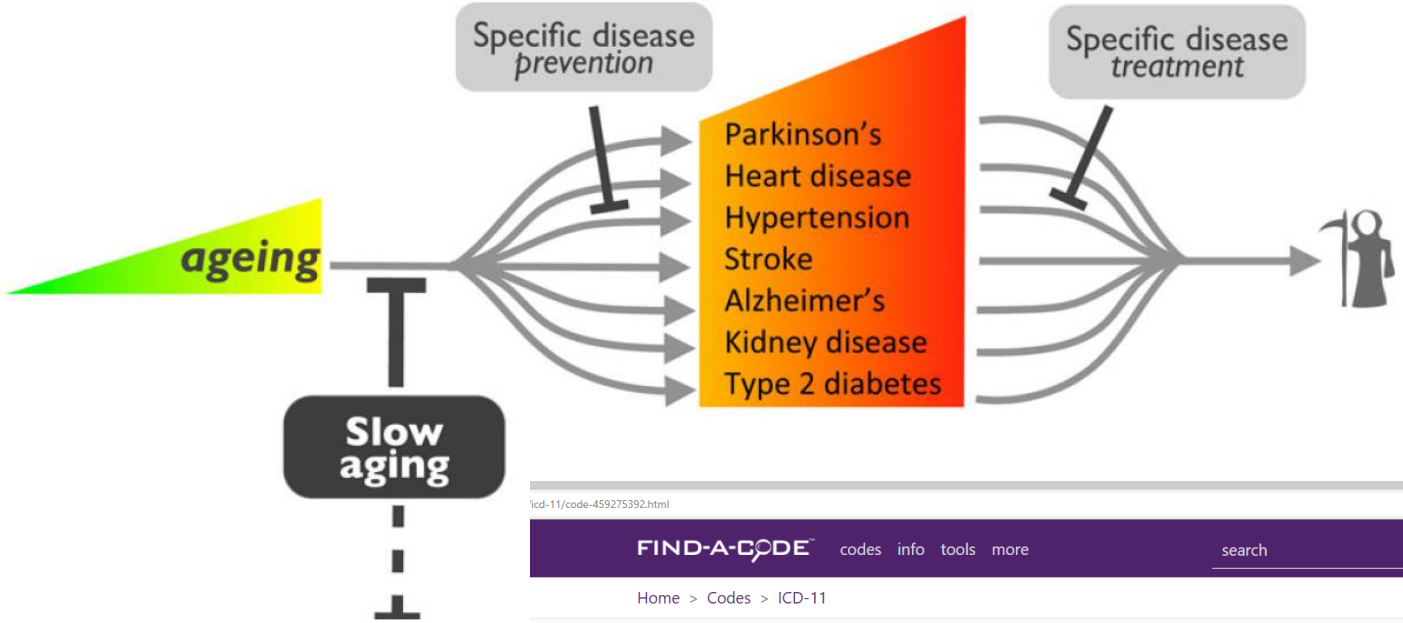
Yi Tian et al., Nature Medicine 2023

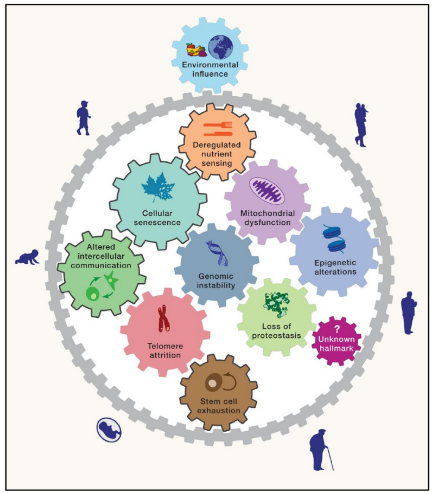
Body clock – healthy → diseased



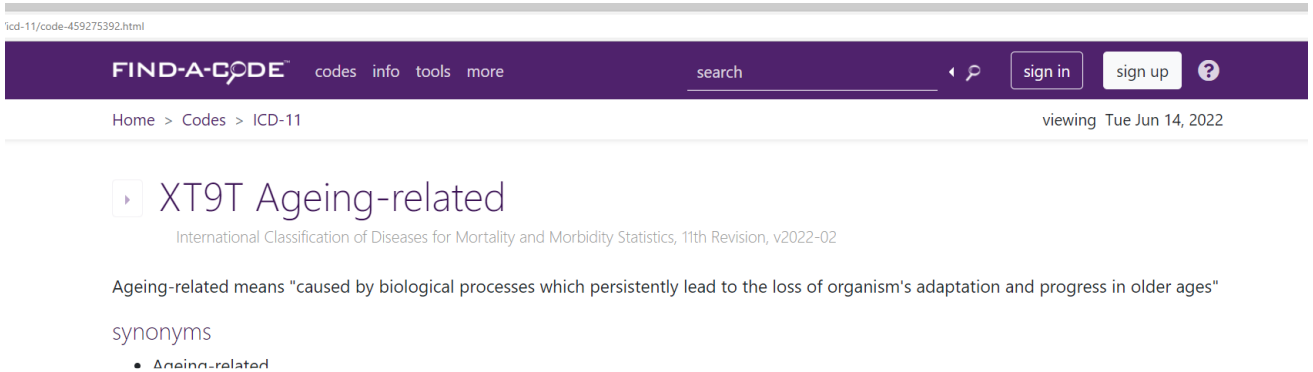
Yi Tian et al., Nature Medicine 2023

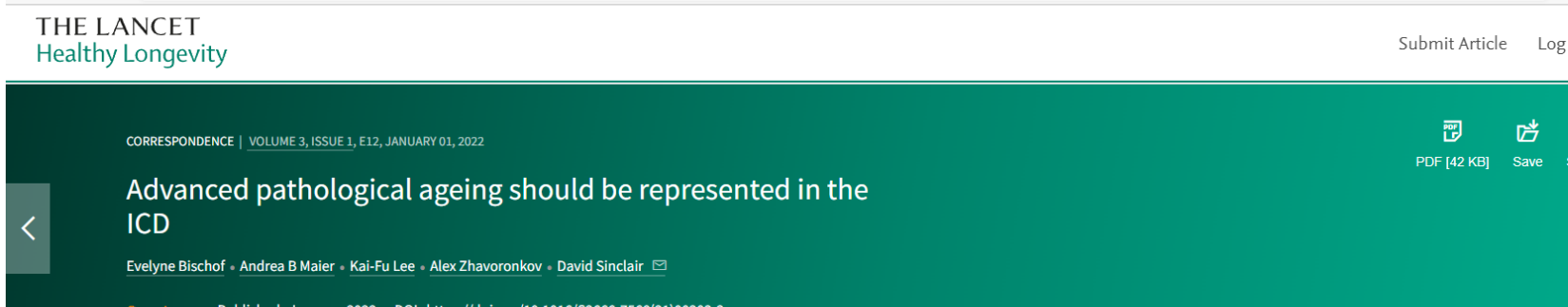
Interventions

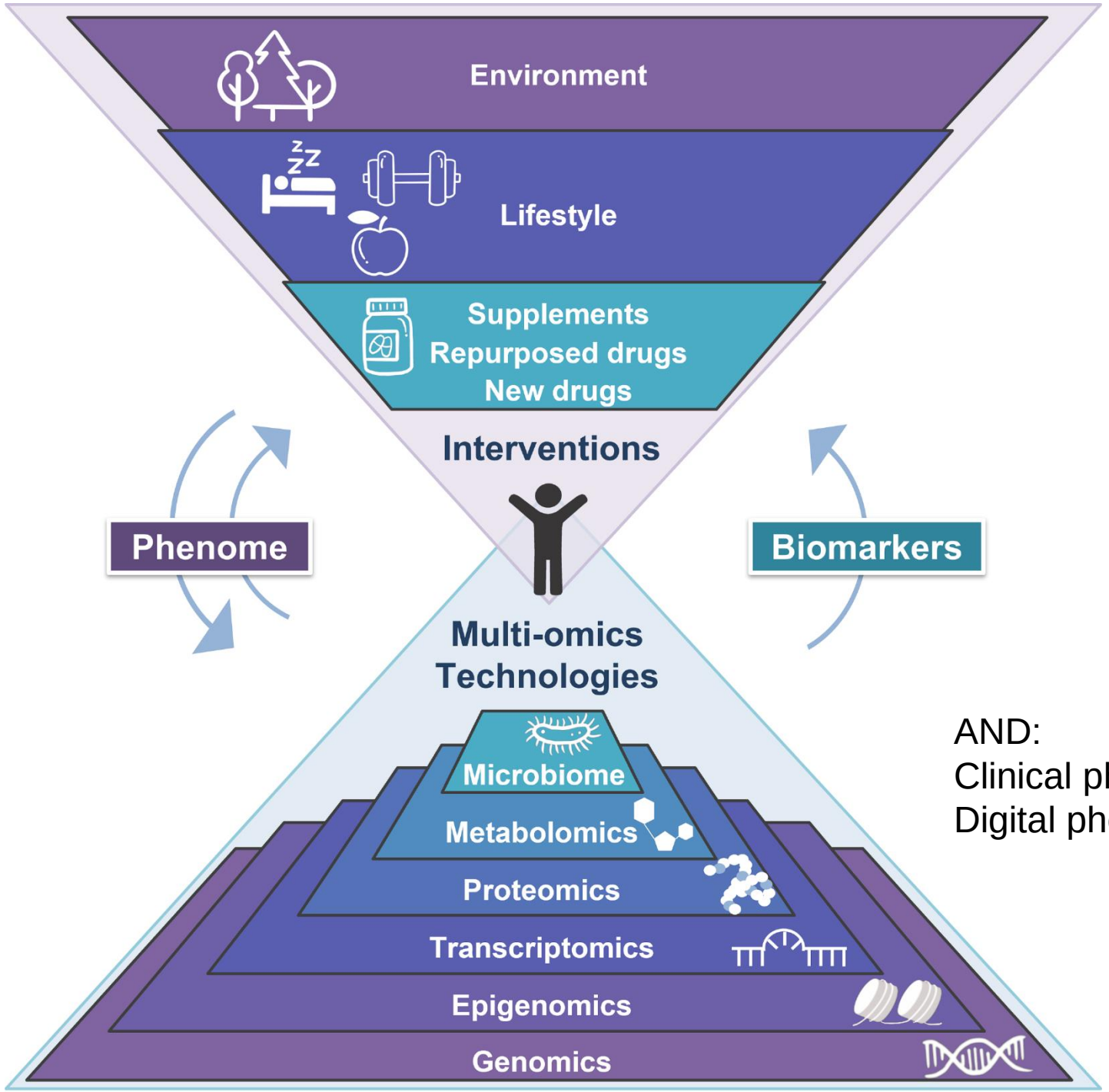




Seals et al., J Physiol 2015

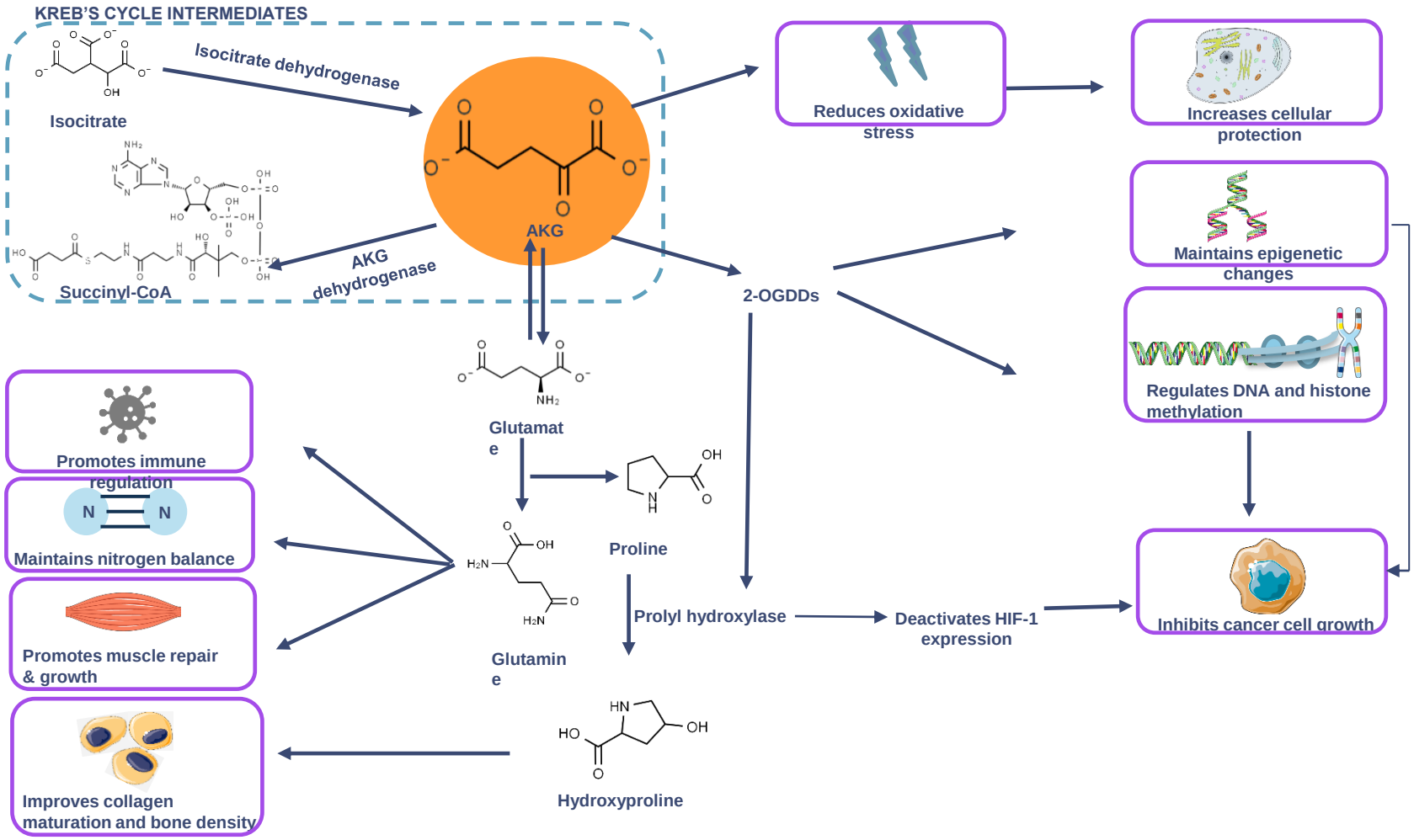






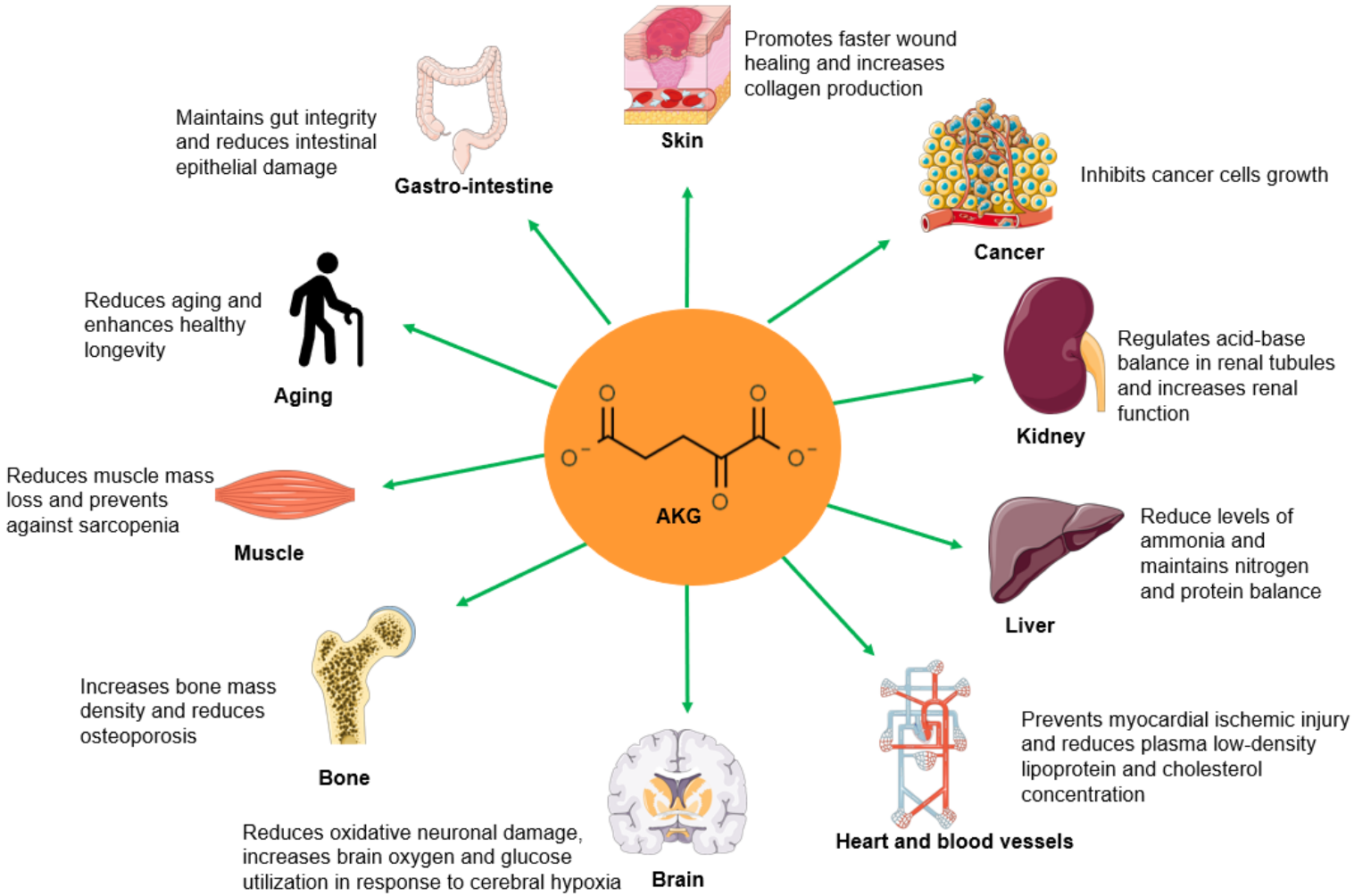
AND:
Clinical phenotyping
Digital phenotyping

Alpha-ketoglutarate



Gyanwali et al., Trends Endocrinology Metabolism 2022

Alpha-ketoglutarate



ABLE

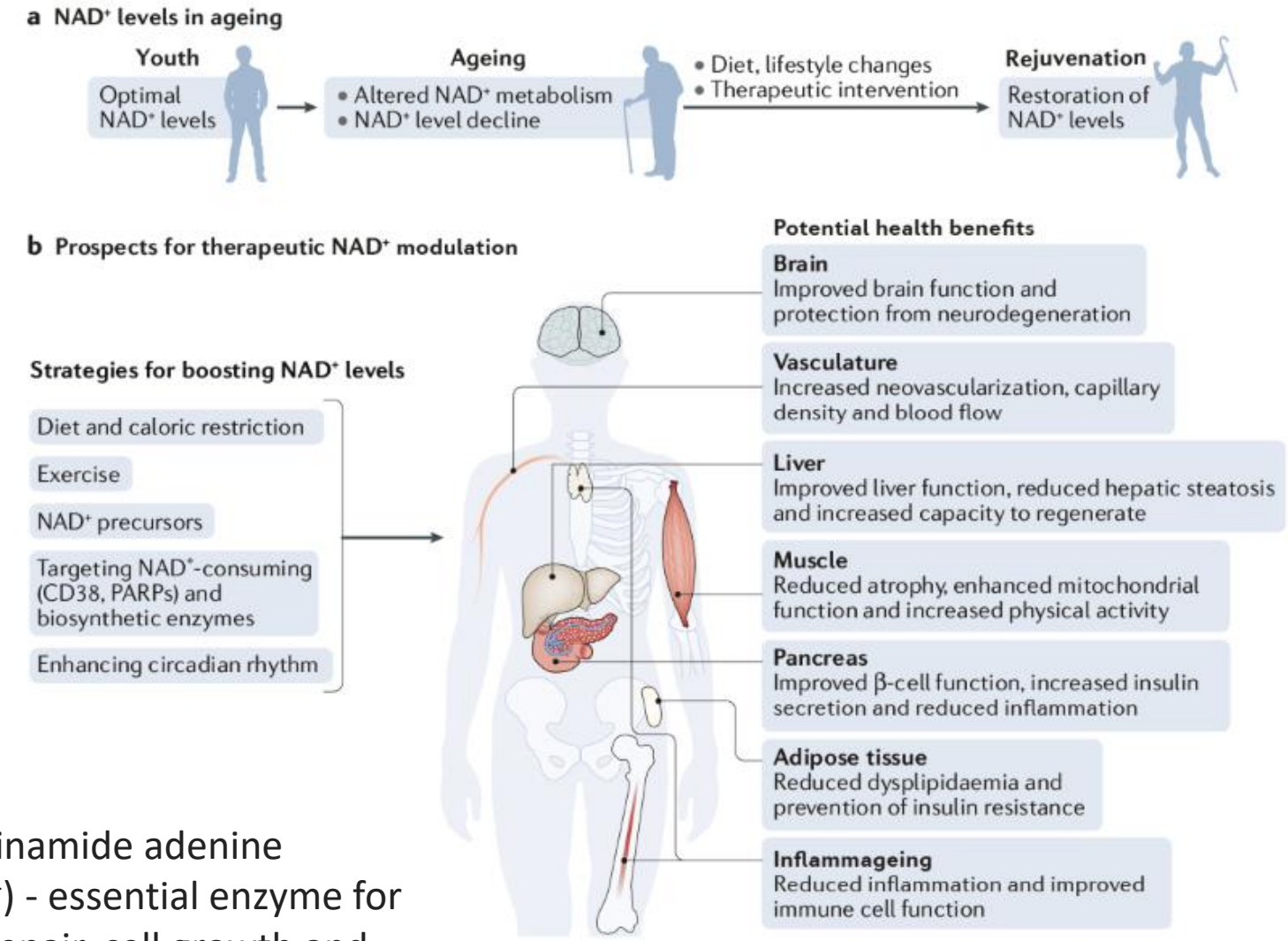
double blinded RCT, 1g Ca-AKG / placebo, 6m + 3 m follow up

40-60 year-old healthy individuals with higher DNA methylation age compared to their chronological age

primary outcome DNA methylation age

Gyanwali et al., Trends Endocrinology Metabolism 2022

Nicotinamide mononucleotide (NMN)



precursors of nicotinamide adenine dinucleotide (NAD^+) - essential enzyme for metabolism, DNA repair, cell growth and survival.

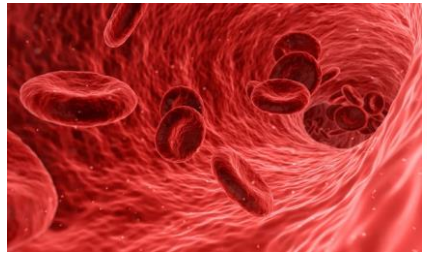
Verdin, Science 2015

Nicotinamide mononucleotide (NMN)

	Placebo, n = 20					300mg NMN, n = 20				
	baseline	day 30	day 60	p1	p2	baseline	day 30	day 60	p1	p2
NAD, mean ± SD (pmol/mL)	8.1±5.2	9.8±8.4	11.8±9.4	0.44	0.14	11.8±11.7	29.8±20.1	32.6±17.9	0.0014	<0.001
Six-minutes walking test, mean ± SD (m)	324±144	310±125	330±117	0.73	0.90	307±108	350±114	380±143	0.23	0.079
Blood biological age, mean ± SD (years)	39.80±7.23	---	45.35±8.22	---	0.029	42.15±6.03	---	43.65±6.73	---	0.46
SF-36, mean ± SD (score)	121.6±13.8	126.9±12.1	128.2±12.9	0.20	0.12	123.6±12.8	131.5±11.7	136.7±12.1	0.058	0.0025

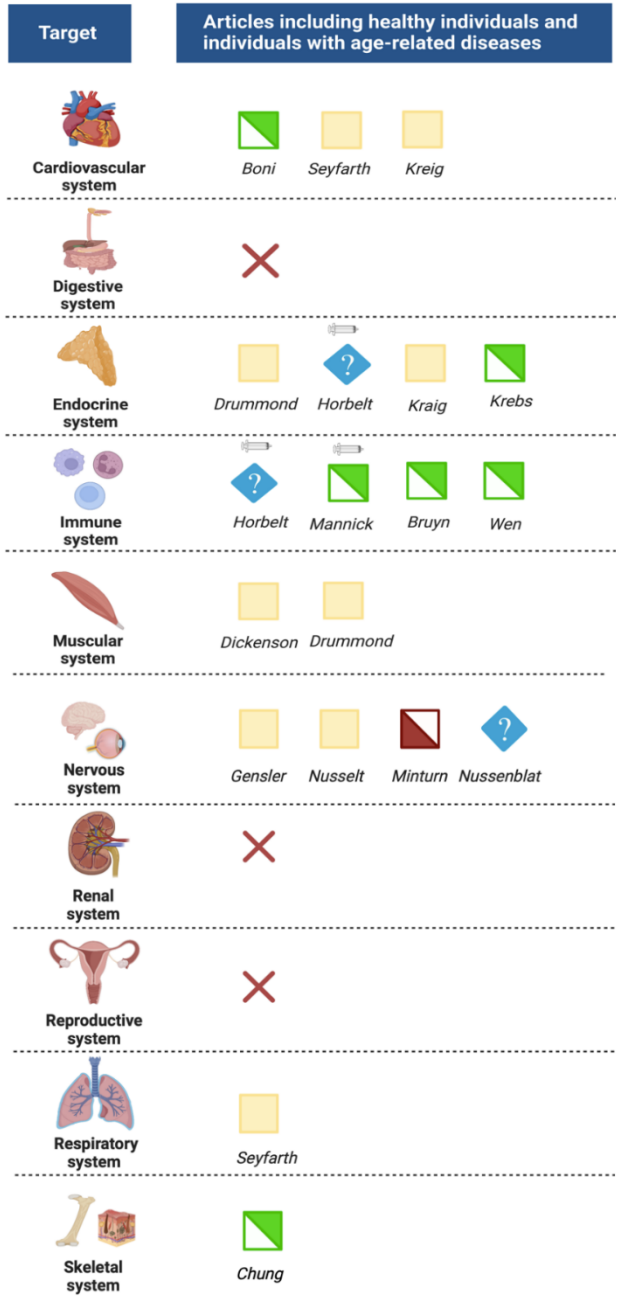
80 men
50 ± 6 years
no chronic disease
NMN for 60 days

600mg NMN, n = 20					900mg NMN, n = 20				
baseline	day 30	day 60	p1	p2	baseline	day 30	day 60	p1	p2
8.0±3.3	39.0±12.6	45.3±11.8	<0.001	<0.001	10.5±6.8	43.1±14.3	48.5±19.8	<0.001	<0.001
289±92	400±85	435±104	<0.001	<0.001	323±113	425±141	480±128	0.016	<0.001
45.20±6.49	---	44.05±6.37	---	0.57	44.30±7.28	---	45.30±5.91	---	0.64
117.6±16.2	129.3±12.5	136.3±12.2	0.015	<0.001	121.9±16.7	135.7±12.0	140.3±11.1	0.0045	<0.001



Lin et al, GeroScience 2022

Rapamycin and rapalogs



LONGER
double blinded RCT, 6mg/week
Rapamycin, 6m + 3 m follow up
40-60 year-old healthy individuals
primary outcome hs-CRP

Hodzic et al., Gerongology; Hodzic et al., in preparation

New longevity clinic to provide patients 'customised' health plan to slow ageing

Alexandra Hospital

SHEBA Tel HaShomer

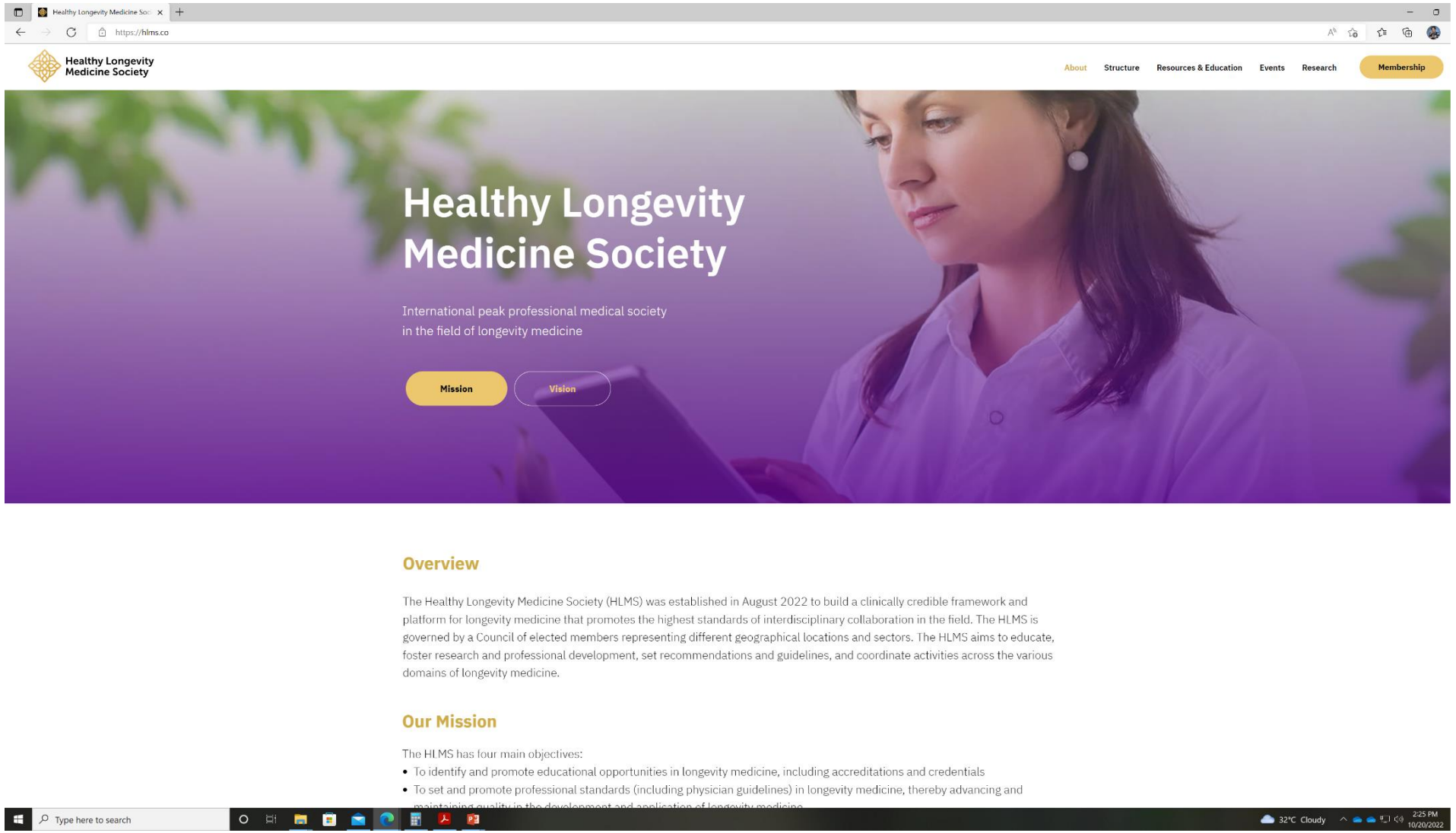
MAYO CLINIC

1 of 2 Alexandra Hospital staff demonstrate the Facial Ageing test done with a special camera. ST PHOTO: GIN TAY

Joyce Teo
Senior Health Correspondent

PUBLISHED SEP 7, 2022, 5:10 PM SGT

Healthy Longevity Medicine is optimizing healthspan by targeting ageing processes across the lifespan



Info / membership: hlms.co

Have questions? Get in touch at LongevityAcademy@nus.edu.sg

*Health **technology** is advancing.*
*Human **lifespan** is extending.*
*But **healthspan** is not catching up.*
*However, healthspan **extension** is proven in **animal** models!*

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