PETFOOD FORUM

April 29 - May 1, 2024

#petfoodforum • www.PetfoodForumEvents.com

LONGEVITY, LIVE LONG AND PROSPER, THE FOUNTAIN OF YOUTH AND THE MICROBIOME

Juan Gomez-Basauri, Ph.D.

Magellan LLC

PETFOOD FORUM

EXPLORE, DISCOVER, INNOVATE Magellan

LONGEVITY

JGB 2023

PETFOOD FORUM

EXPLORE, DISCOVER, INNOVATE
Magellan

AMBROSIA AND NECTAR

Consumed by the gods to maintain their immortality and eternal youth

Churning of the ocean and the elixir of eternal life

PETFOOD FORUM

EXPLORE, DISCOVER, INNOVATE Magellan

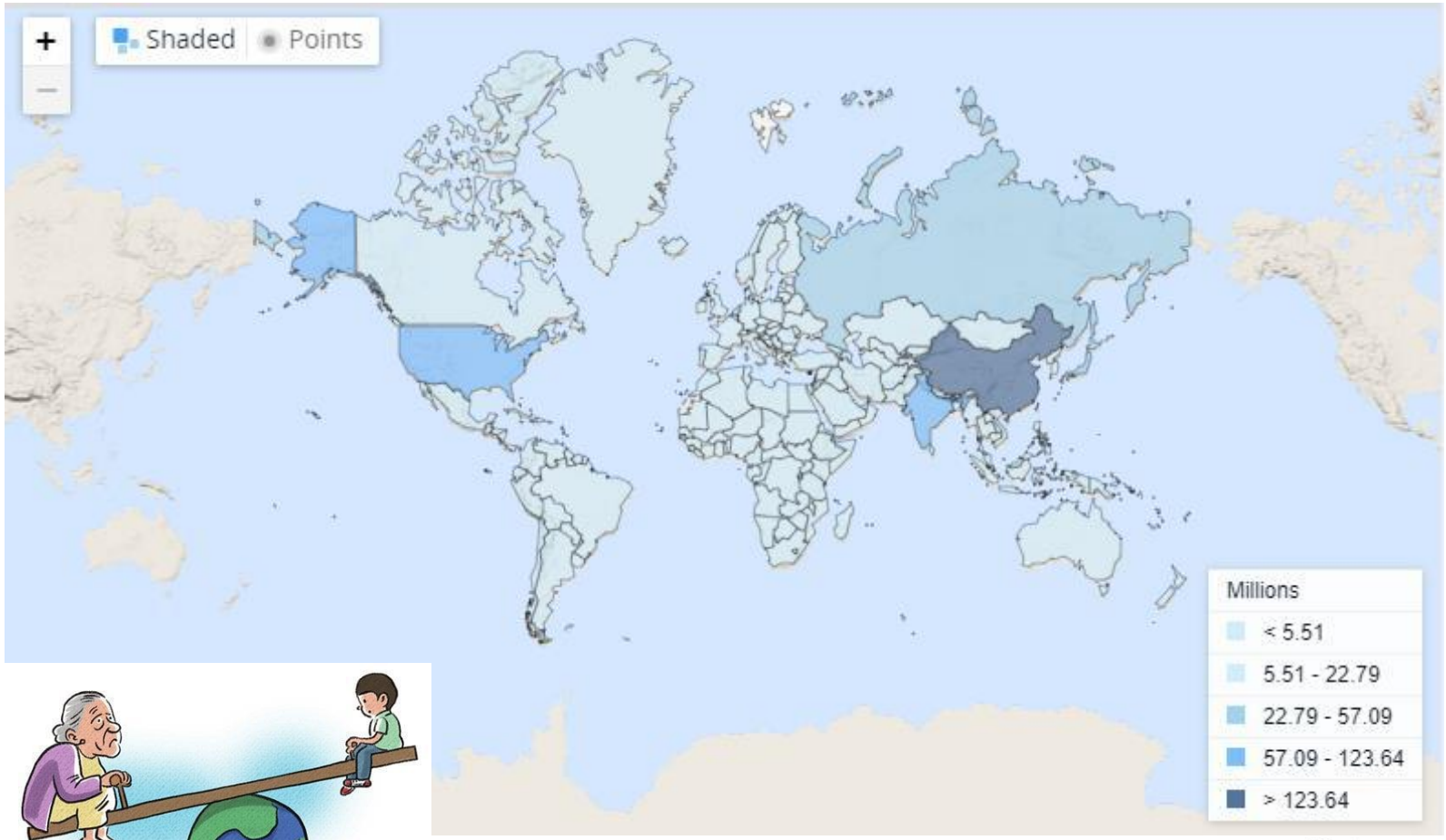
LONGEVITY

PETFOOD FORUM

PETFOOD FORUM

EXPLORE, DISCOVER, INNOVATE
Magellan

WORLD POPULATION IS AGING 780 MILLION

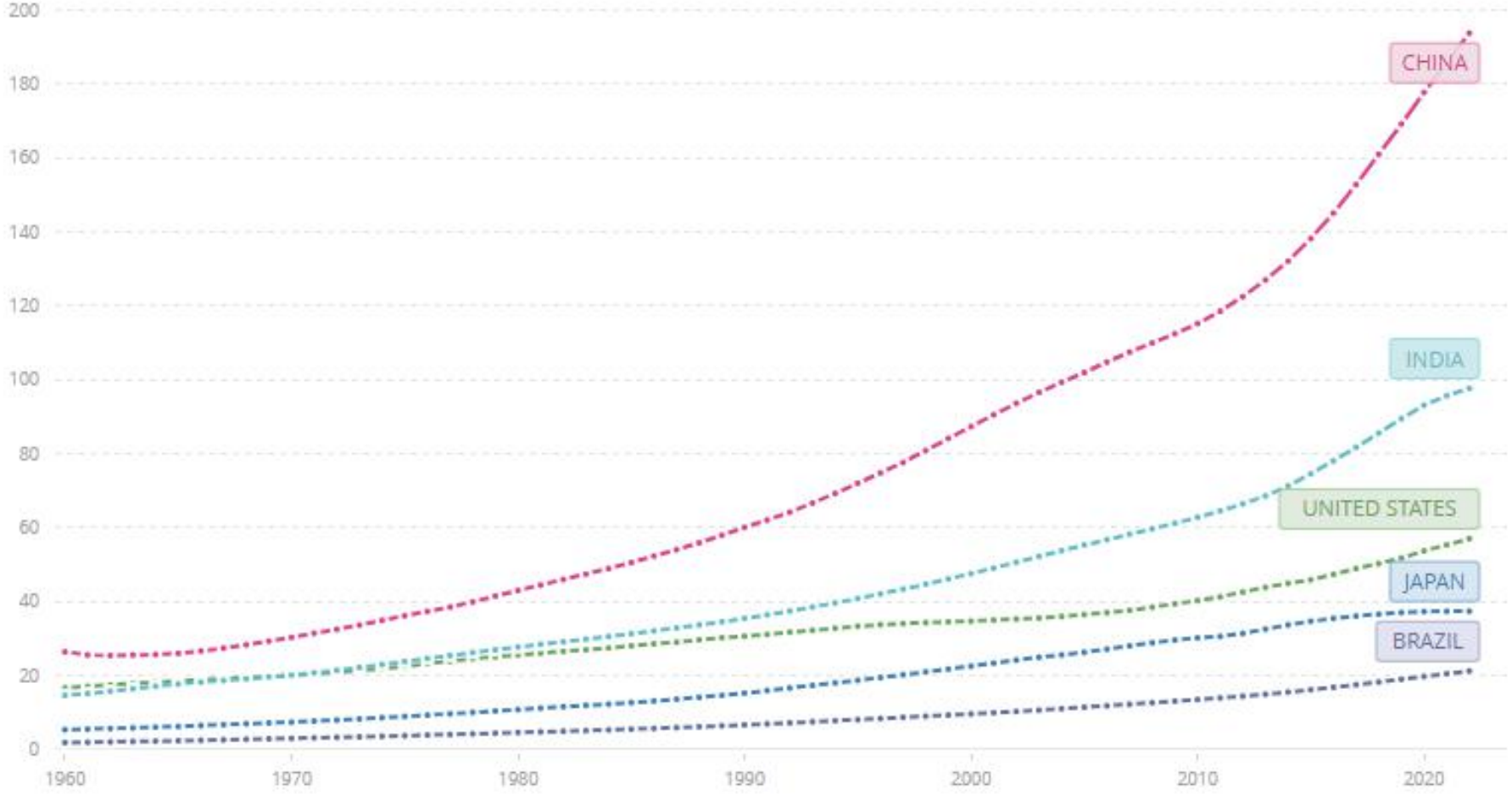


PETFOOD FORUM

EXPLORE, DISCOVER, INNOVATE Magellan

Accessed from https://data.worldbank.org/indicator/SP.POP.65UP.TO?end=2022&start=1960&view=chart&year=2022

AGING POPULATION OVER 65 (Millions)



194

98

57

38

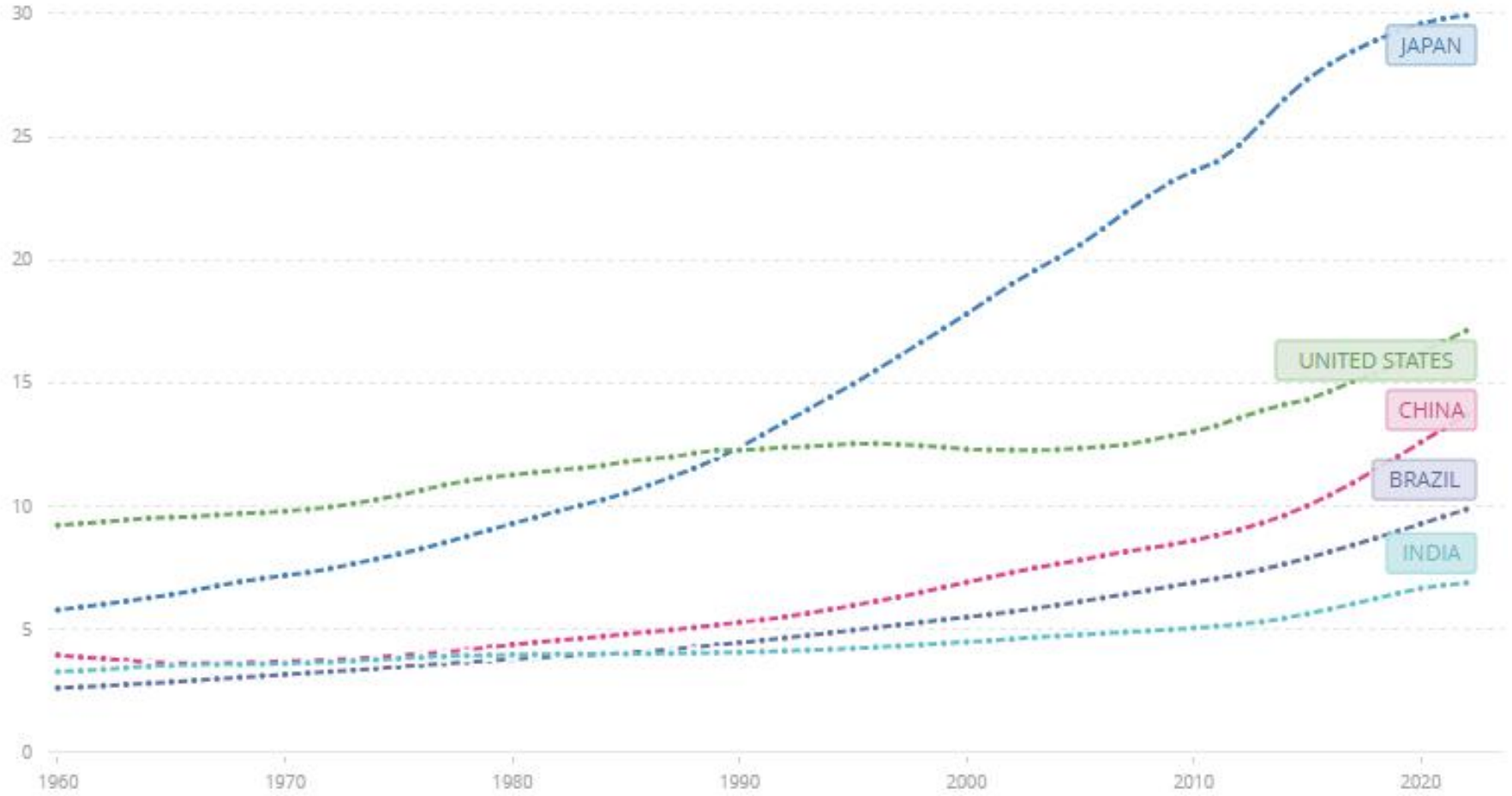
21

PETFOOD FORUM

EXPLORE, DISCOVER, INNOVATE Magellan

Accessed from https://data.worldbank.org/indicator/SP.POP.65UP.TO?end=2022&start=1960&view=chart&year=2022

AGING POPULATION OVER 65 (%)



30%

17%

14%

10%

7%

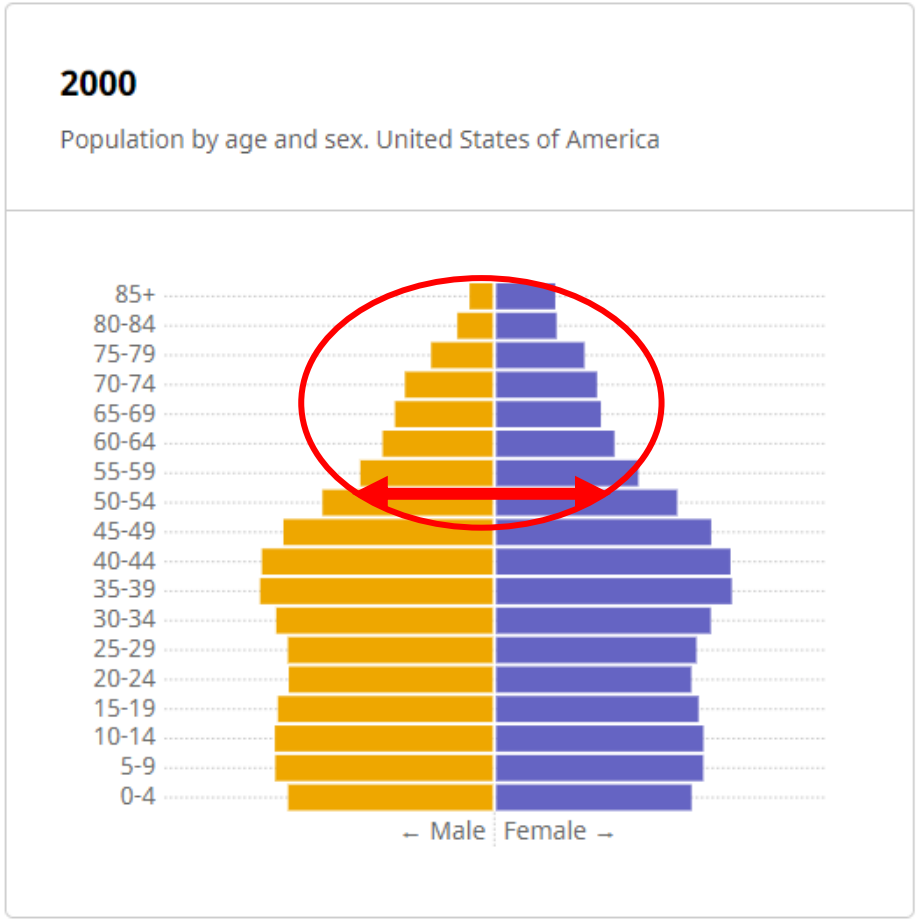
PETFOOD FORUM

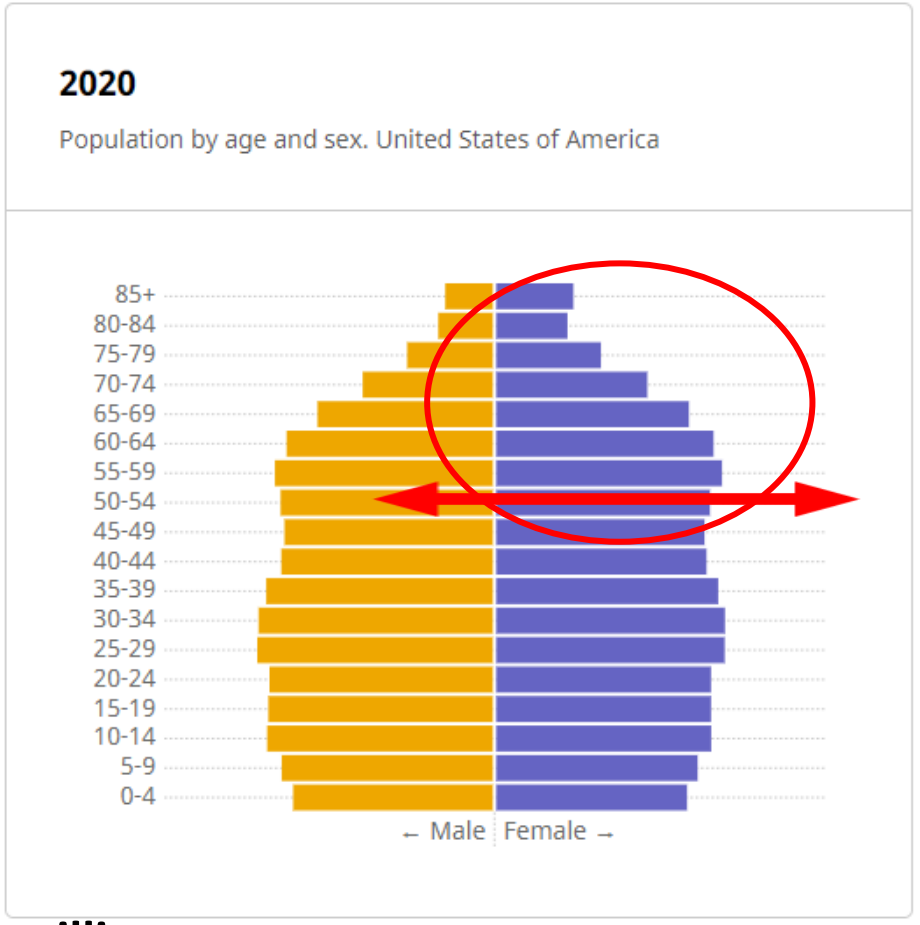
Accessed from https://data.worldbank.org/indicator/SP.POP.65UP.TO?end=2022&start=1960&view=chart&year=2022

EXPLORE, DISCOVER, INNOVATE
Magellan

Source: Worldbank.org

POPULATION OF THE USA





335.9 million

+53.5 million change since 2000

Accessed from https://data.who.int/countries/840

AGING

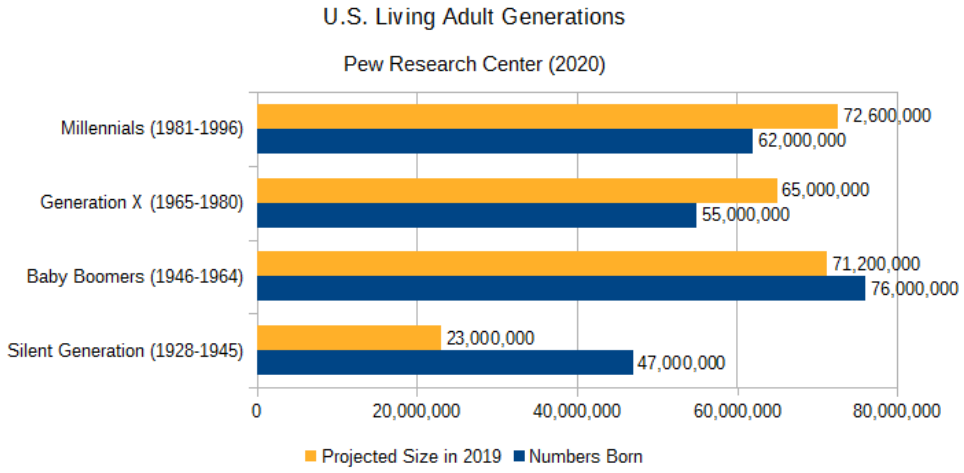
- In 2000 about 30 million, 65 or older
- In 2009, about 40 million, 65 or older
- In 2022, about 57 million, 65 or older
- By 2050, 88.5 million 65 or older

Population by Age Group: Projections 2020 to 2060

The population is projected to reach 404 million by 2060.
(In millions)

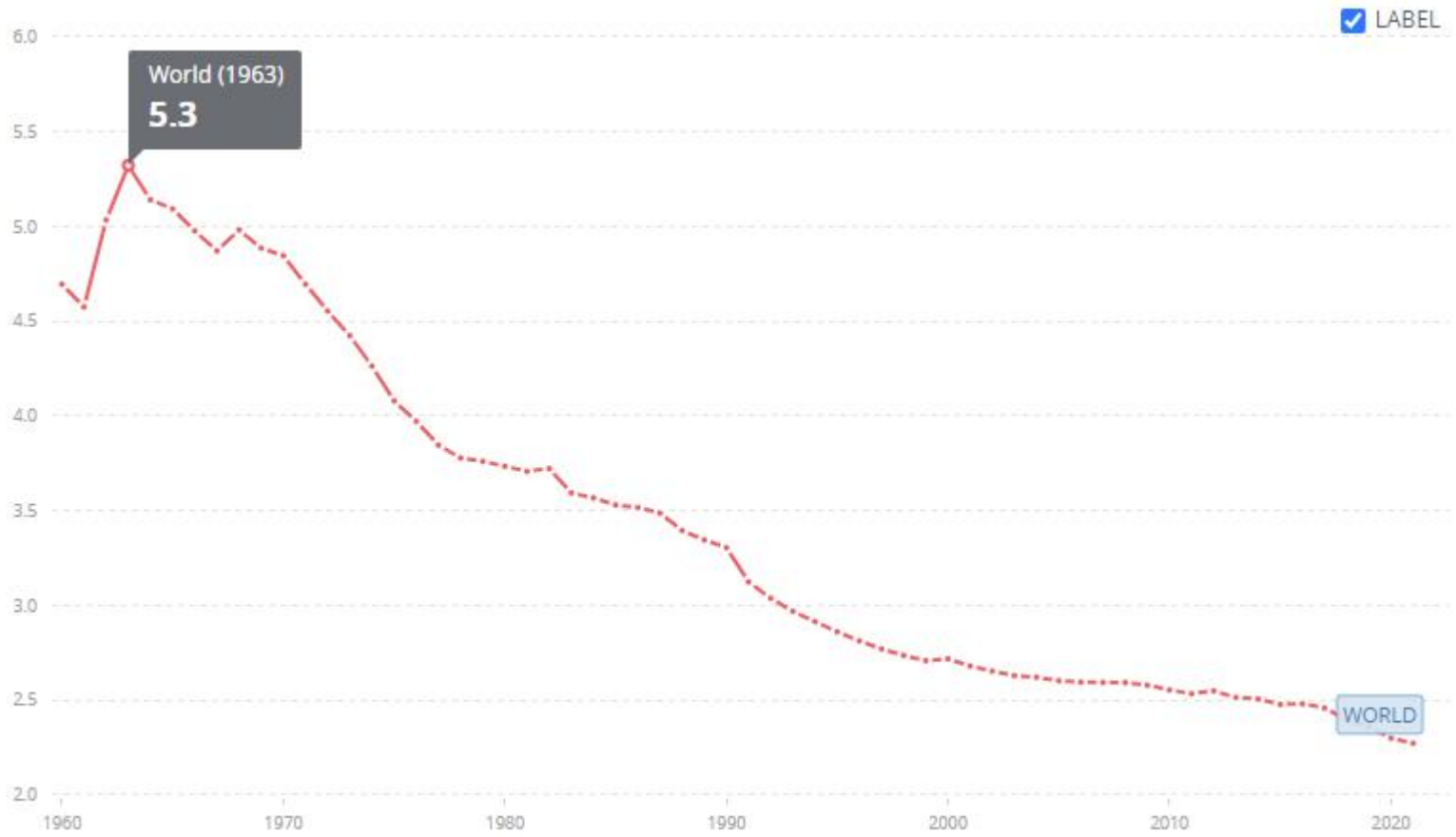
Characteristic	Population						Change from 2016 to 2060	
	2016	2020	2030	2040	2050	2060	Number	Percent
Total population	**323.1**	**332.6**	**355.1**	**373.5**	**388.9**	**404.5**	**81.4**	**25.2**
Under 18 years	73.6	74.0	75.7	77.1	78.2	80.1	6.5	8.8
18 to 44 years	116.0	119.2	125.0	126.4	129.6	132.7	16.7	14.4
45 to 64 years	84.3	83.4	81.3	89.1	95.4	97.0	12.7	15.1
65 years and over	49.2	56.1	73.1	80.8	85.7	94.7	45.4	92.3
85 years and over	6.4	6.7	9.1	14.4	18.6	19.0	12.6	198.1
100 years and over	0.1	0.1	0.1	0.2	0.4	0.6	0.5	618.3

Note: The official population estimates for the United States are shown for 2016; the projections use the Vintage 2016 population estimate for July 1, 2016, as the base population for projecting from 2017 to 2060.
Source: U.S. Census Bureau, 2017 National Population Projections.



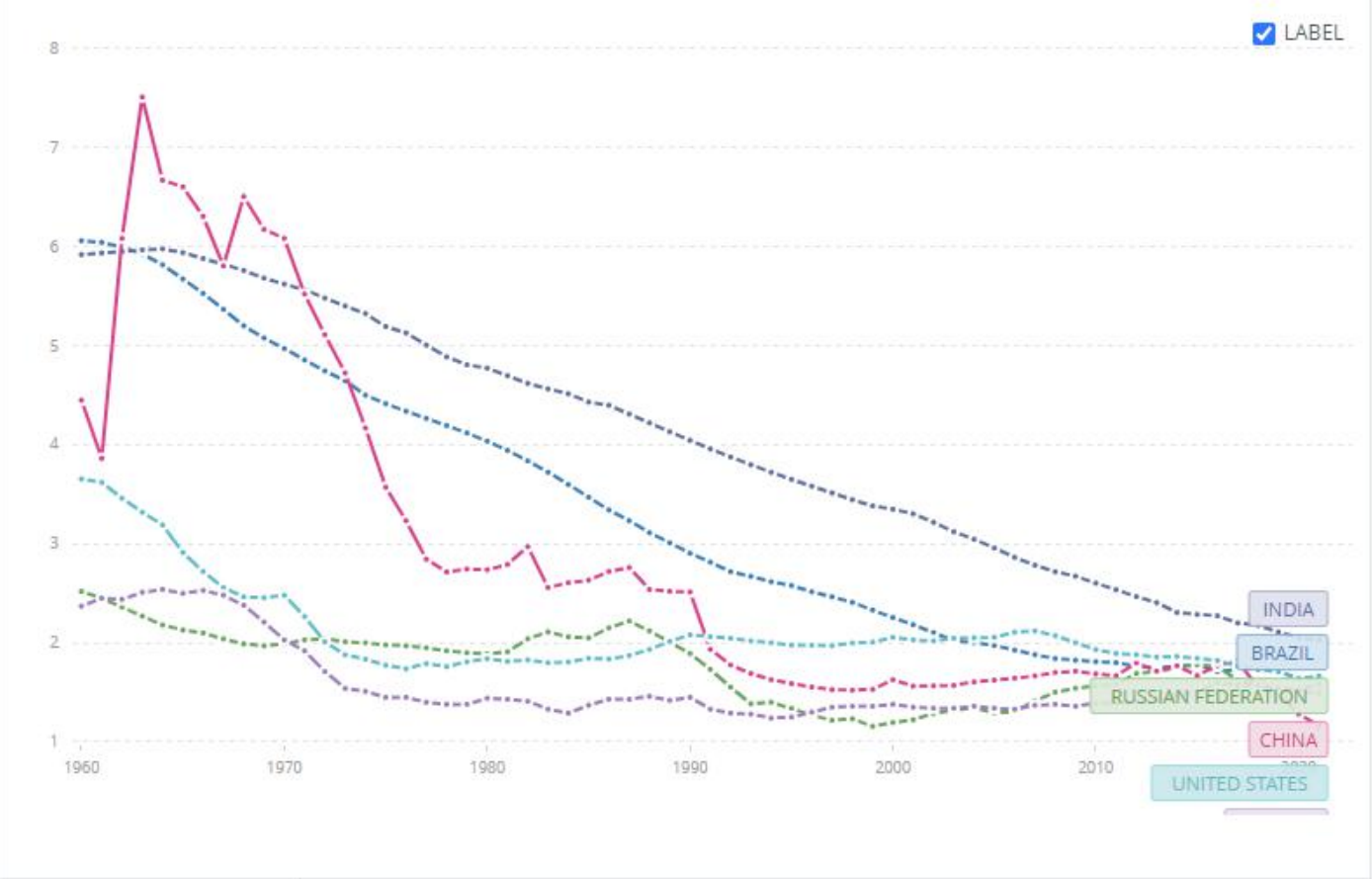
Source: Census Bureau

FERTILITY RATE IS DECLINING



Source: Worldbank.org

FERTILITY RATE, TOTAL (births per woman) - BRAZIL, RUSSIA, INDIA, CHINA, USA, GERMANY

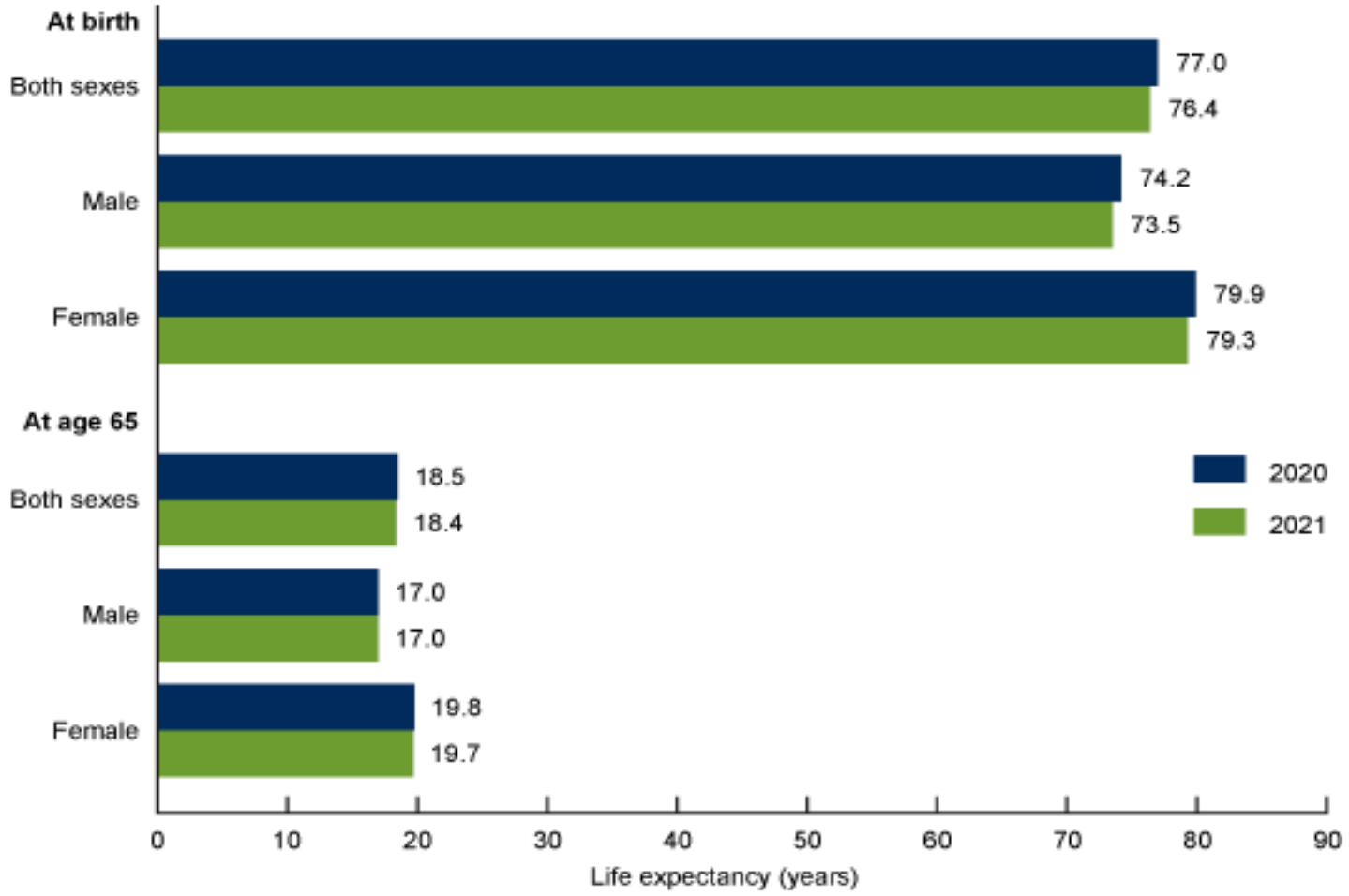


Source: Worldbank.org

PETFOOD FORUM

EXPLORE, DISCOVER, INNOVATE
Magellan

LIFE EXPECTANCY



76.4 years

78.8 years in 2019, before the COVID-19 pandemic.

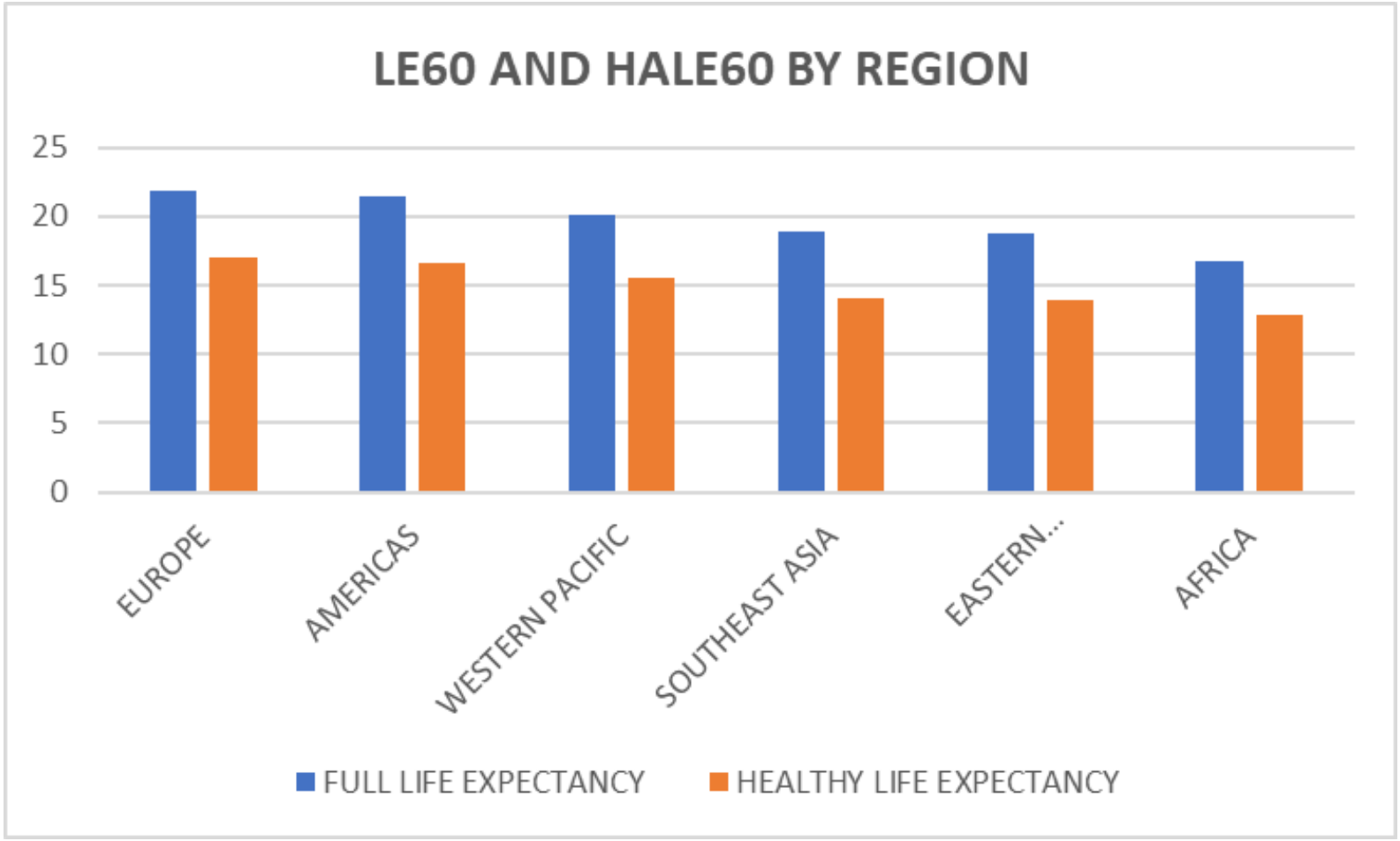
LIFE EXPECTANCY vs HEALTHY LIFE (QUALITY OF LIFE)

- Shift in focus:
- Extending “healthy life span” the period of life when people live without disability.

PETFOOD FORUM

EXPLORE, DISCOVER, INNOVATE Magellan

LIFE EXPECTANCY (LE) vs HEALTHY LIFE EXPECTANCY (HALE) AT 60 YEARS



From https://www.census.gov/content/dam/Census/library/visualizations/2021/comm/healthy-life-expectancy.pdf

WHAT IS AGING

- An accumulation of damage, to macromolecules, cells, tissues and organs.
- Refers to a time-sequential functional decline of the body including weakness, increased susceptibility to disease, loss of mobility, loss of agility among others

- Eyesight
- Hearing
- Taste
- Touch and Smell
- Arthritis
- Skin condition
- Brain “senior moments”

PETFOOD FORUM

EXPLORE, DISCOVER, INNOVATE Magellan

THEORIES OF AGING

- **Programmed theory**
  - Aging follows a biological timetable. The timetable would depend on changes in gene expression affecting systems responsible for maintenance, repair and defense responses.
    - Programmed longevity
    - Endocrine theory
    - Immunological decline theory

- **Damage or error theory**
  - Emphasizes environmental assaults to living organisms inducing cumulative damage at various levels, wear and tear, cross-linking, free radicals

Adapted from: Mercado-Saenz et al., 2010; K. Jin 2010; Pinto da Costa el al., 2016.

HOW ABOUT OUR COMPANION ANIMALS?

CREAM PUFF

PETFOOD FORUM

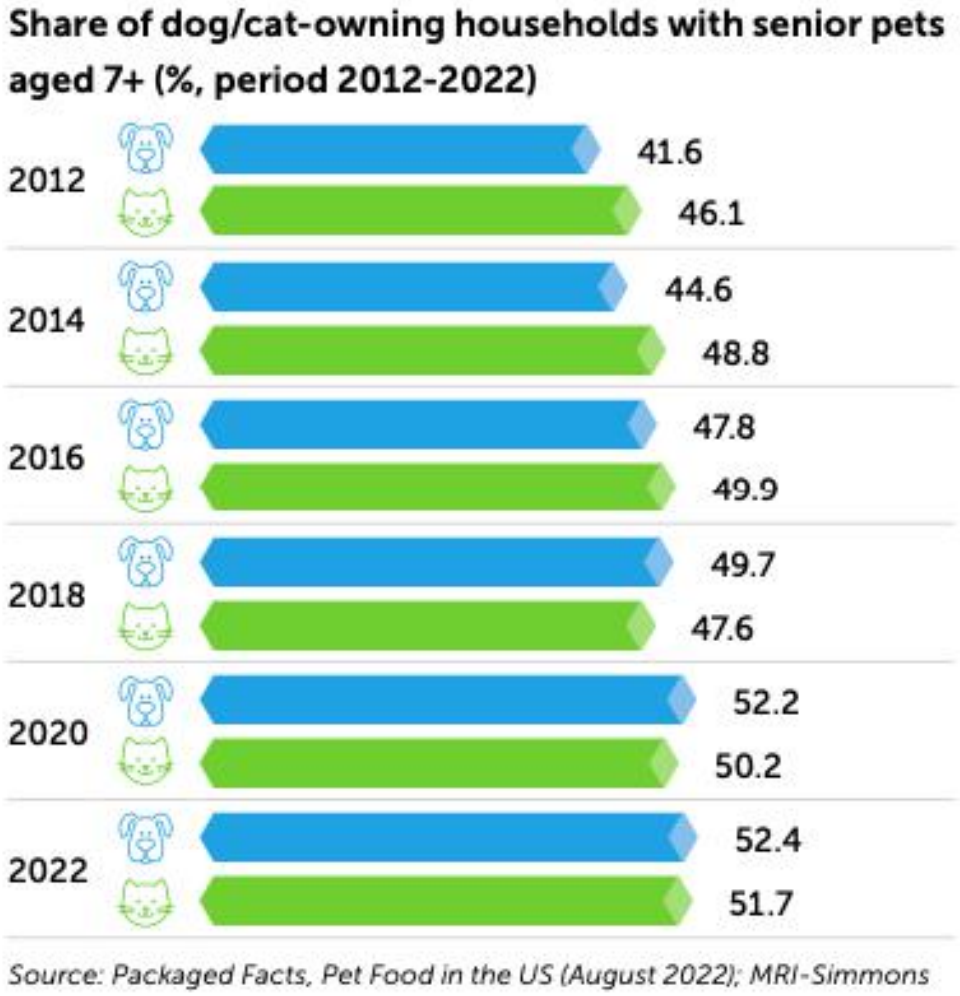
EXPLORE, DISCOVER, INNOVATE Magellan

AGING PETS

The overall pet population is living longer due to better nutrition and vet care

There is a shift towards smaller breeds which have a longer life span

45 % of dog owners have a dog aged 7 and older, while 46% of cat owners have a cat in the oldest age bracket.



Source: Packaged Facts Pet Food in the US August 2022); MRI-Simmons

NUMEROUS STUDIES

Innovation in Aging, 2023, **7**, 1–14
https://doi.org/10.1093/geroni/igac080
Advance access publication 25 December 2022
Original Research Article

THE GERONTOLOGICAL SOCIETY OF AMERICA®

Pet Ownership and Maintenance of Physical Function in Older Adults—Evidence From the Baltimore Longitudinal Study of Aging (BLSA)

Erika Friedmann, PhD,[1,*] Nancy R. Gee, PhD,[2] Eleanor M. Simonsick, PhD,[3] Erik Barr, MS,[1] Barbara Resnick, RN, PhD,[1] Emily Werthman, RN,[1] and Ikmat Adesanya, RN, MPH[1]

[1]University of Maryland School of Nursing, Baltimore, Maryland, USA.
[2]Department of Psychiatry, School of Medicine, Virginia Commonwealth University, Richmond, Virginia, USA.
[3]Intramural Research Program, National Institute on Aging, National Institutes of Health, Baltimore, Maryland, USA.
*Address correspondence to: Erika Friedmann, PhD, University of Maryland School of Nursing, 655 W. Lombard St., Baltimore, MD 21201, USA.
E-mail: Friedmann@umaryland.edu

Decision Editor: J. Tina Savla, PhD, FGSA

Abstract

Background and Objectives: Pet ownership or human–animal interaction has been associated with better health outcomes in individuals disease or disability. We hypothesized that pet ownership, as well as dog ownership and cat ownership separately, are associated with mair ing physical function, and leisure time physical activity and that among dog owners, dog walking is associated with maintaining these outc for generally healthy community-dwelling older adults participating in the Baltimore Longitudinal Study of Aging.

Research Design and Methods: A total of 637 men (44.1%) and women aged 50–100 years (M = 68.3, standard deviation [SD] = 9.6) pleted a comprehensive pet ownership questionnaire that ascertained pet ownership history 10–13 years and had serial assessments of phy function every 1–4 years prior. Linear or generalized linear mixed models with time varying pet ownership were used to examine chan physical function over a mean of 7.5 years (range 1–13, SD = 3.6) according to pet ownership.

Results: Pet owners (n = 185) were significantly younger (p < .001) and had fewer comorbidities (p = .03) than nonowners; thus, age comorbidities were included as covariates in the longitudinal analyses. Physical function and leisure time physical activity declined with a across all outcomes (p < .001); the decline was slower among pet owners in overall physical performance (p < .001), rapid gait speed (p = usual gait speed (p = .032), cardiorespiratory fitness (p < .001), and physical well-being (p = .002) controlling for age and comorbidities. Cha in leisure time physical activities with aging did not differ between pet owners and nonowners. Dog walking was not independently relat the maintenance of physical function or leisure time physical activity with aging.

Discussion and Implications: This study provides the first longitudinal evidence that pet ownership is associated with maintained phy function among community-dwelling generally healthy older adults.

Keywords: Functional status, Healthy aging, Human–animal interaction, Leisure time activity, Physical performance

frontiers in Veterinary Science

ORIGINAL RESEARCH
published: 25 June 2020
doi: 10.3389/fvets.2020.00293

Pet Ownership Patterns and Successful Aging Outcomes in ty Dwelling Older Adults

y R. Gee[2], Eleanor M. Simonsick[3], Stephanie Studenski[3], larr[1], Melissa Kitner-Triolo[3] and Alisha Hackney[1]

sterns and Adult Health, University of Maryland School of Nursing, Baltimore, MD, Animal Interaction, Department of Psychiatry, School of Medicine, Virginia Commonwealth States, [3] Intramural Research Program, National Institute on Aging, National Institutes of tes

ing cognitive and physical functions, worsening psychological ed mortality risk and morbidity typically accompany aging. The lth needs will continue to increase as the proportion of the years increases. Pet ownership (PO) has been linked to better r adults, particularly those with chronic conditions. Much of the is known about PO patterns as people age or the contribution ng in community-dwelling older adults. This study examines PO community-dwelling older adults and the relationship of PO to unctions and psychological status.

frontiers in Veterinary Science

CONCEPTUAL ANALYSIS
published: 07 June 2021
doi: 10.3389/fvets.2021.655191

Healthy, Active Aging for People and Dogs

Sandra McCune[1,2] and Daniel Promislow[3,4]*

[1] School of Psychology, School of Life Sciences, University of Lincoln, Lincoln, United Kingdom, [2] Animal Matters Consultancy Ltd., Stamford, United Kingdom, [3] Department of Lab Medicine and Pathology, University of Washington School of Medicine, Seattle, WA, United States, [4] Department of Biology, University of Washington, Seattle, WA, United States

Dogs act as companions who provide us with emotional and physical support. Their shorter lifespans compel us to learn about the challenges and gifts of caring for older individuals. Our companion dogs can be exemplars of healthy or unhealthy aging, and sentinels of environmental factors that might increase or decrease our own healthy lifespan. In recent years, the field of aging has emphasized not just lifespan, but healthspan—the period of healthy, active lifespan. This focus on healthy, active aging is reflected in the World Health Organization's current focus on healthy aging for the next decade and the 2016 Healthy Aging in Action initiative in the US. This paper explores the current research into aging in both people and companion dogs, and in particular, how the relationship between older adults and dogs impacts healthy, active aging for both parties. The human-dog relationship faces many challenges as dogs, and people, age. We discuss potential solutions to these challenges, including suggestions for ways to continue contact with dogs if dog ownership is no longer possible for an older person. Future research directions are outlined in order to encourage the building of a stronger evidence base for the role of dogs in the lives of older adults.

Keywords: aging, dogs, human-animal interaction, healthspan, healthy aging

OPEN ACCESS

Edited by:
Lynette Arnason Hart,
University of California, Davis, United States

Reviewed by:
James Serpell,
University of Pennsylvania,

However… not many studies on lifespan and aging pets

Dog Aging Project

Accelerating discovery & for dogs and

OUR RESEARCH GOALS

Morris Animal

PLOS ONE

RESEARCH ARTICLE

Longevity and mortality in cats: A single institution necropsy study of 3108 cases (1989–2019)

Michael S. Kent[1]*, Sophie Karchemskiy[2¤a], William T. N. Culp[1], Amandine T. Lejeune[1], Patricia A. Pesavento[3], Christine Toedebusch[1], Rachel Brady[2¤b], Robert Rebhun[1]

1 Department of Surgical and Radiological Sciences, School of Veterinary Medicine, University of California, Davis, Davis, CA, United States of America, **2** William T. Prichard Veterinary Medical Teaching Hospital, School of Veterinary Medicine, University of California, Davis, Davis, CA, United States of America, **3** Department of Pathology, Microbiology and Immunology, School of Veterinary Medicine, University of California, Davis, Davis, CA, United States of America

¤a Current address: Animal Medical Center, New York, NY, United States of America
¤b Current address: Cell and Molecular Biology Program, Colorado State University, Fort Collins, CO, United States of America
* mskent@ucdavis.edu

Check for updates

PETFOOD FORUM

frontiers | Frontiers in Veterinary Science

ORIGINAL RESEARCH
published: 04 April 2022
doi: 10.3389/fvets.2022.859041

Aging in Cats: Owner Observations and Clinical Finding in 206 Mature Cats at Enrolment to the Cat Prospective Aging and Welfare Study

Nathalie Dowgray[1,2], Gina Pinchbeck[3], Kelly Eyre[1], Vincent Biourge[4], Eithne Comerford[1,5] and Alexander J. German[1,5]*

[1] Institute of Life Course and Medical Sciences, University of Liverpool, Liverpool, United Kingdom, [2] International Cat Care, Tisbury, United Kingdom, [3] Institute of Infection, Veterinary and Ecological Sciences, University of Liverpool, Liverpool, United Kingdom, [4] Royal Canin Research Centre, Aimargues, France, [5] School of Veterinary Science, University of Liverpool, Liverpool, United Kingdom

LIFE EXPECTANCY FOR COMPANION ANIMALS

scientific reports

OPEN

Life tables of annual life expectancy and mortality for companion dogs in the United Kingdom

Kendy Tzu-yun Teng[1✉], Dave C. Brodbelt[2], Camilla Pegram[2], David B. Church[3] & Dan G. O'Neill[2]

A life table is a tabulated expression of life expectancy and mortality-related information at specified ages in a given population. This study utilised VetCompass data to develop life tables for the UK companion dog population and broken down by sex, Kennel Club breed group, and common breeds. Among 30,563 dogs that died between 1st January 2016 and 31st July 2020, life expectancy at age 0 was 11.23 [95% confidence interval (CI): 11.19–11.27] years. Female dogs (11.41 years; 95% CI: 11.35–11.47) had a greater life expectancy than males (11.07 years; 95% CI: 11.01–11.13) at age 0. Life tables varied widely between breeds. Jack Russell Terrier (12.72 years; 95% CI: 12.53–12.90) and French Bulldog (4.53 years; 95% CI: 4.14–5.01) had the longest and shortest life expectancy at age 0, respectively. Life tables generated by the current study allow a deeper understanding of the varied life trajectory across many types of dogs and offer novel insights and applications to improve canine health and welfare. The current study helps promote further understanding of life expectancy, which will benefit pet owners and the veterinary profession, along with many other sectors.

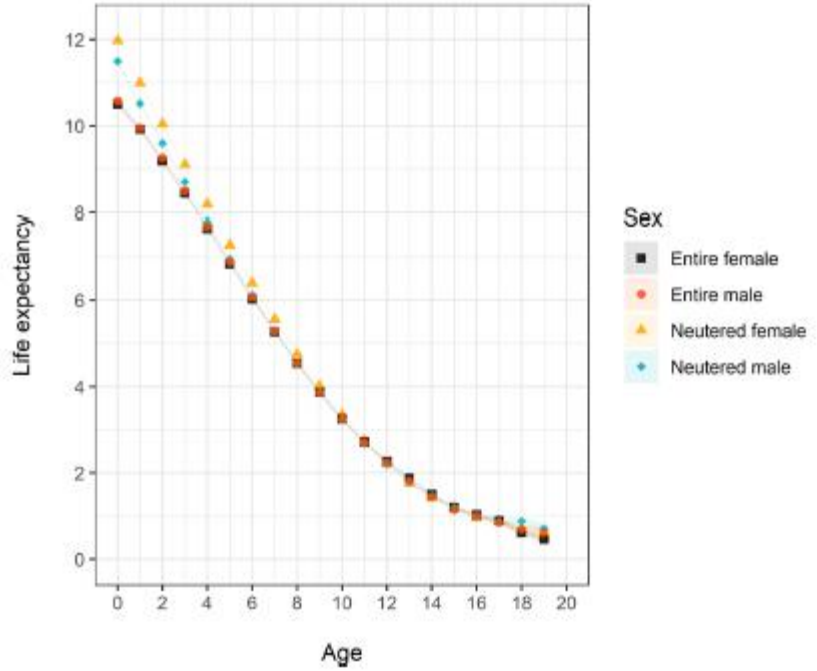


Figure 1. Life expectancy and the 95% confidence interval for female and male dogs at different ages (year) under primary veterinary care in the UK.

Fig from Tzu-yun Teng et al.; 2022

PETFOOD FORUM

EXPLORE, DISCOVER, INNOVATE Magellan

frontiers | Frontiers in Veterinary Science

TYPE Original Research
PUBLISHED 21 February 2023
DOI 10.3389/fvets.2023.1082102

Check for updates

OPEN ACCESS

EDITED BY
Sabine G. Gebhardt-Henrich,
University of Bern, Switzerland

REVIEWED BY
Silvan Urfer,
University of Washington, United States
Cristina Aybar,
University of Valencia, Spain
Christos Skiadas,
International Society for the Advancement of Science and Technology, Greece

Life expectancy tables for dogs and cats derived from clinical data

Mathieu Montoya[1]*, Jo Ann Morrison[2], Florent Arrignon[3], Nate Spofford[2], Hélène Charles[1], Marie-Anne Hours[1] and Vincent Biourge[1]

[1]Royal Canin, Aimargues, France, [2]Banfield Pet Hospital, Vancouver, WA, United States, [3]MAD Environnement, Nailloux, France

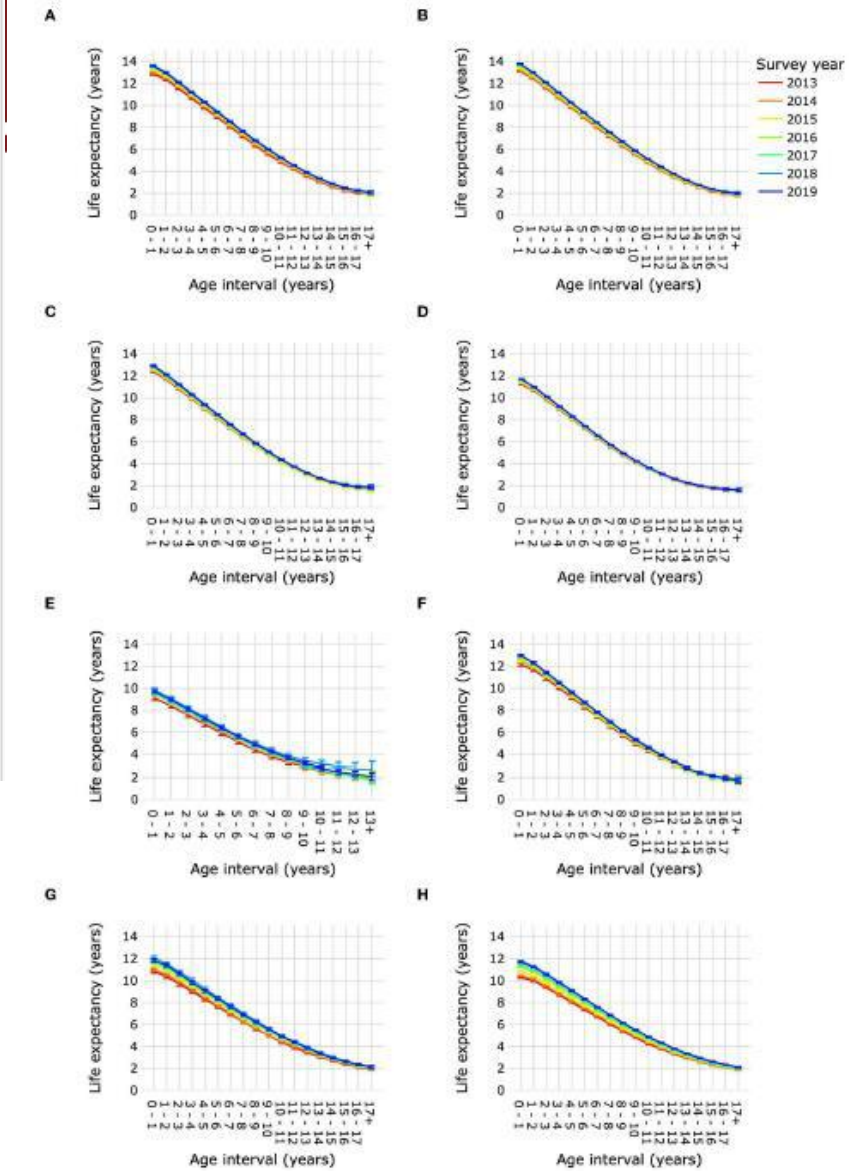


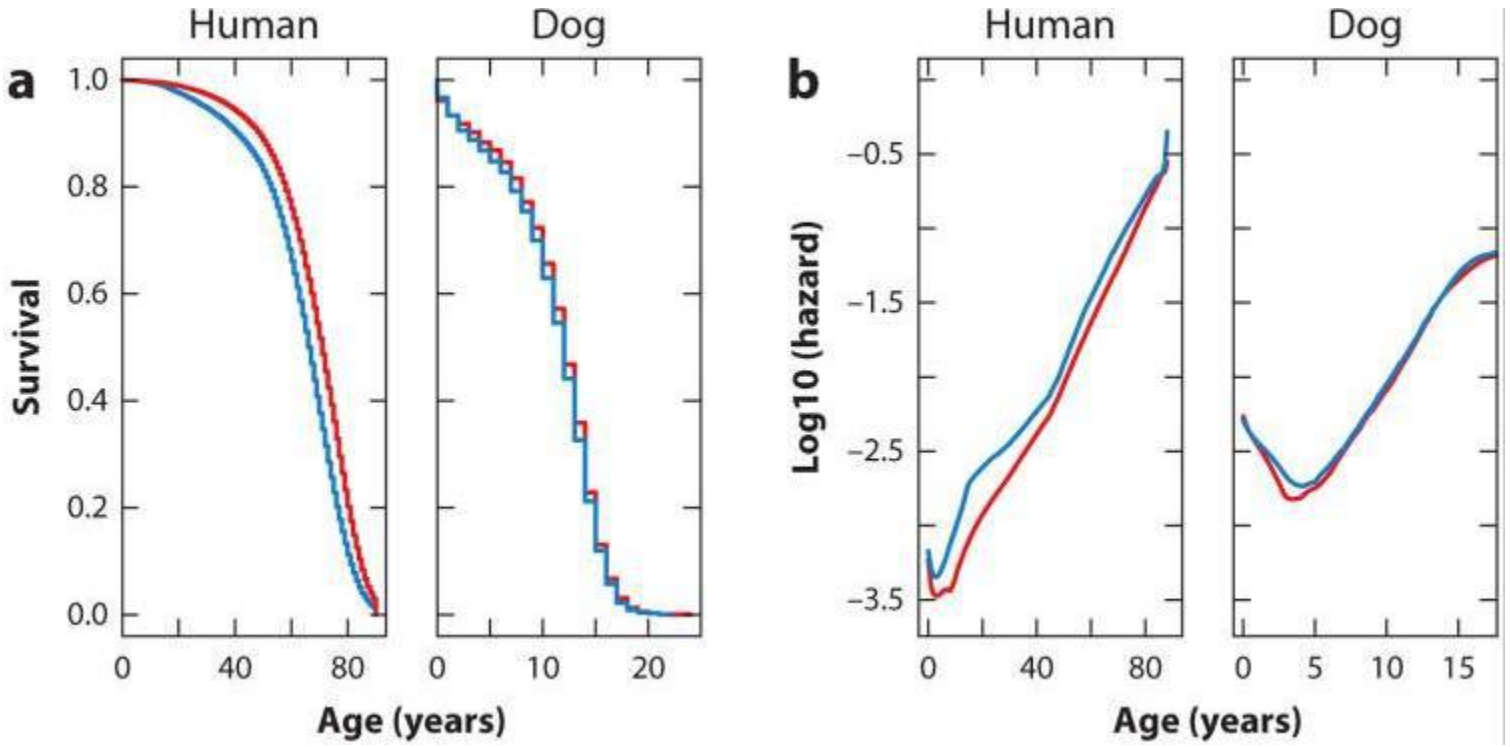
Fig from Montoya et al.; 2023

LIFE EXPECTANCY FOR COMPANION ANIMALS

PETFOOD FORUM

EXPLORE, DISCOVER, INNOVATE
Magellan

REMARKABLE SIMILARITY



As reproduced by Ruple et al., 2022 from Hoffman et al., 2018
data are from the US Census Bureau, and canine data are from the VetCompass database

REMARKABLE SIMILARITY

Dogs share the same diseases with humans, in particular age-related diseases

HUMANS

- Cardiovascular
- Renal and hepatic
- Sarcopenia
- Diabetes
- Obesity
- Joint disease
- Neurodegeneration
- Cataracts
- Immune-mediated illnesses
- Cancer

CANINES

- Renal and hepatic
- Sarcopenia
- Diabetes
- Obesity
- Joint disease
- Neurodegeneration
- Cataracts
- Immune-mediated illnesses
- Cancer

PETFOOD FORUM

EXPLORE, DISCOVER, INNOVATE Magellan

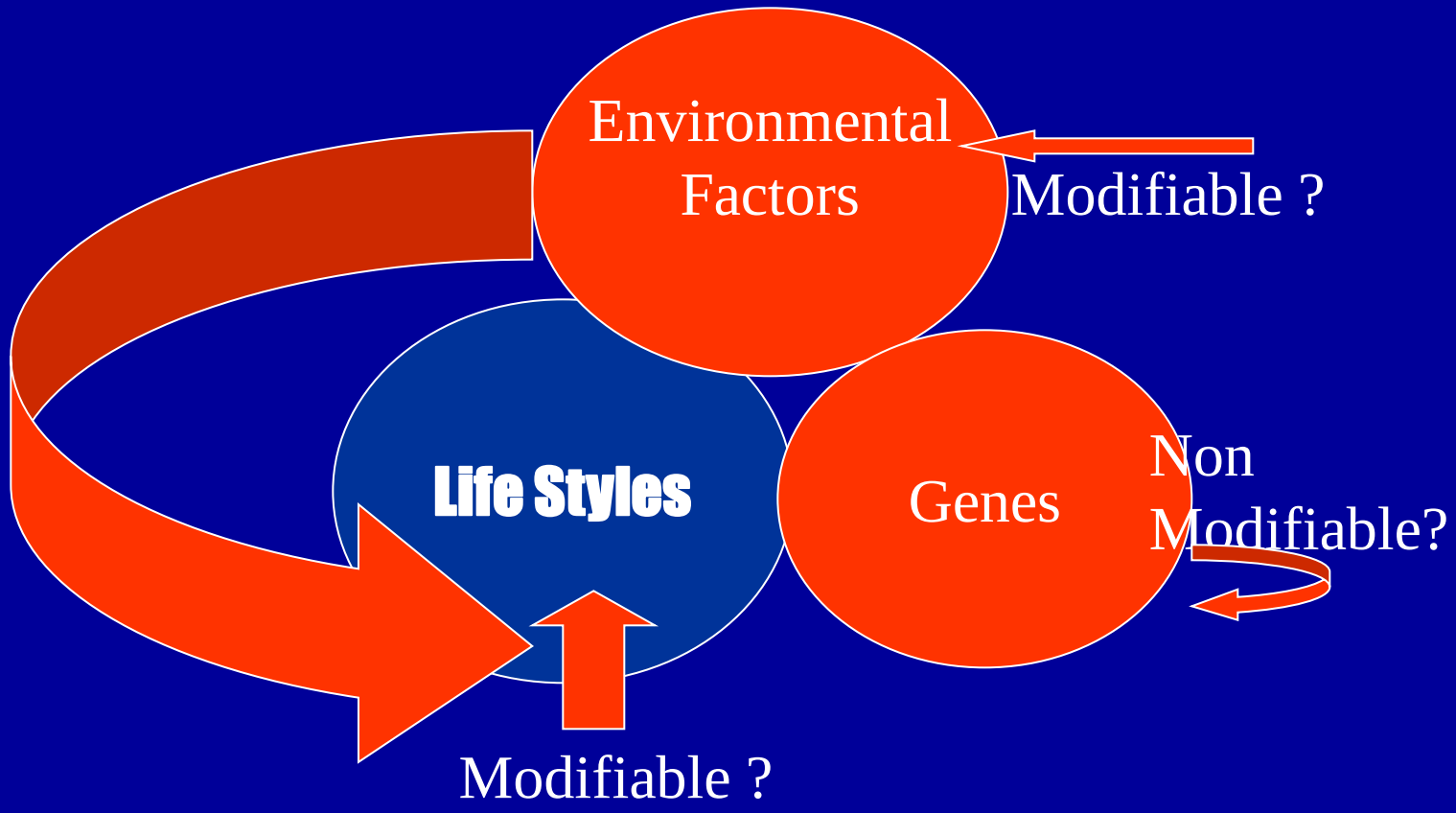
THE LONGEVITY QUEST

For humans and companion animals

PETFOOD FORUM

Magellan

Nutrition and Health Gaps

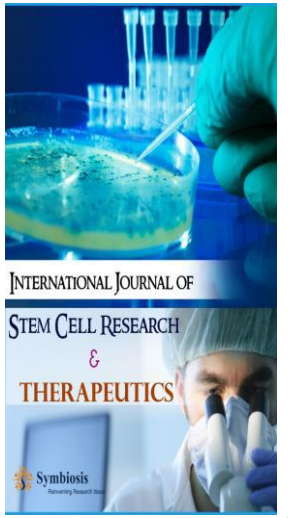


Juan Gomez-Basauri, Ph.D. circa 2001

Lifestyle

Environment

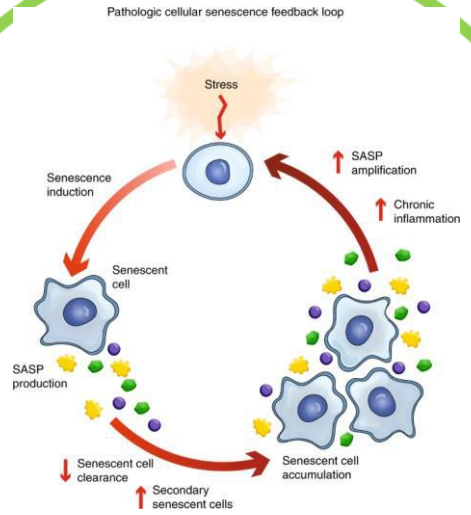
Regenerative Medicine



JGB2024

Genes

JGB2024



Senescence Senolytics

JGB2024

Personalized Medicine

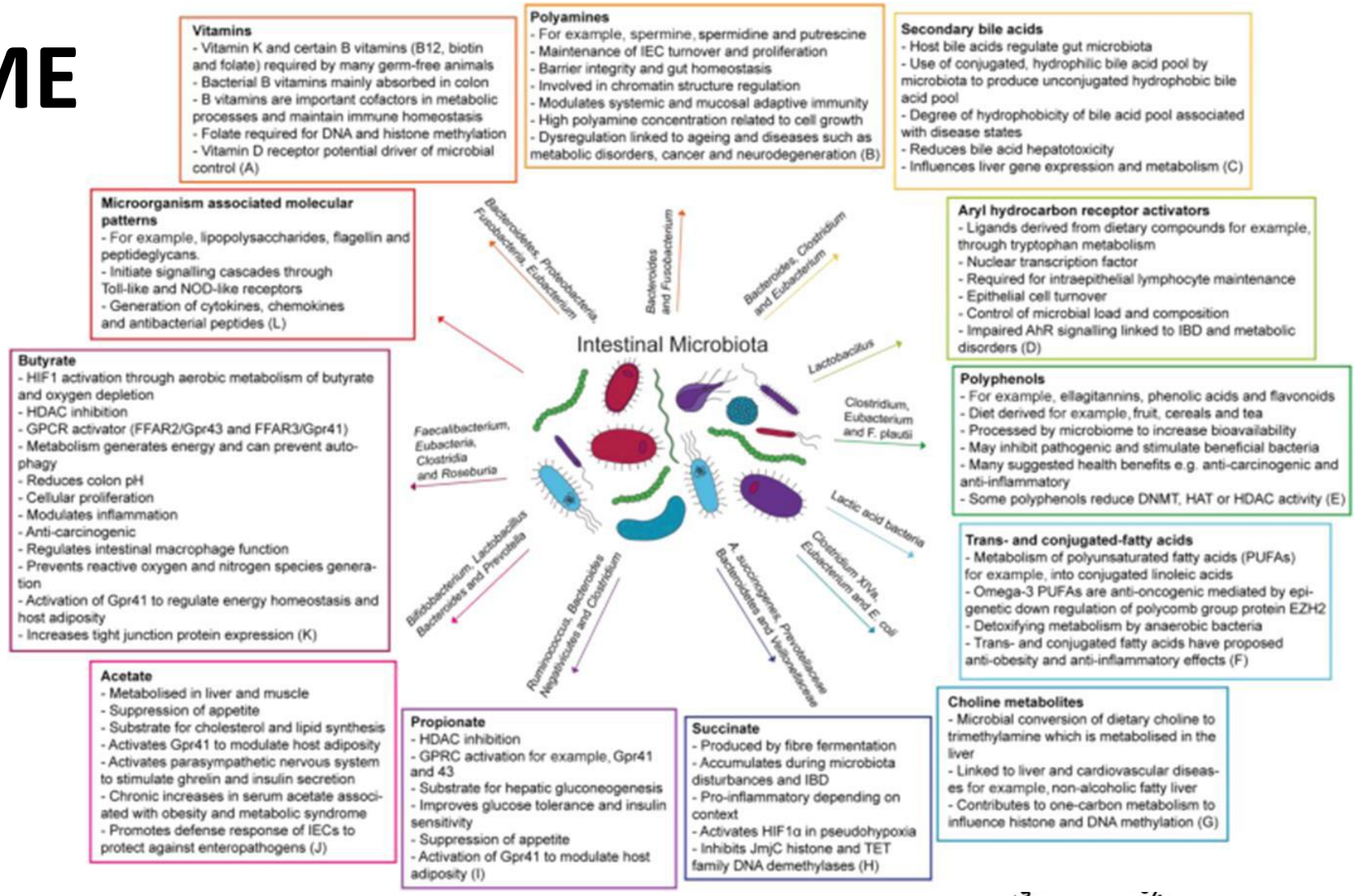
JGB2024

PETFOOD FORUM

EXPLORE, DISCOVER, INNOVATE
Magellan

THE MICROBIOME

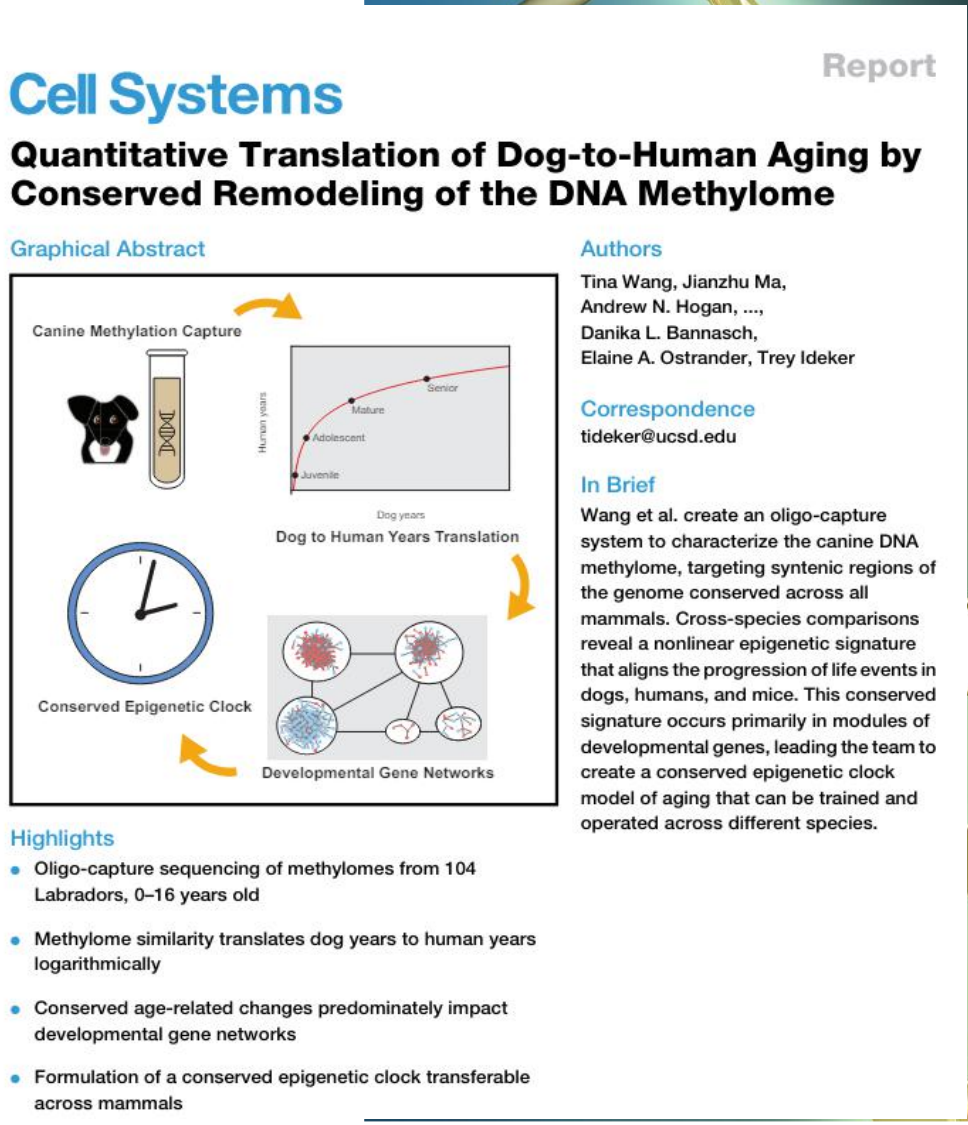
LIFESTYLE: DIET



From Fellows and Varga-Weisz, 2019

THEORIES OF AGING

Epigenetic Programing



Report

Cell Systems

Quantitative Translation of Dog-to-Human Aging by Conserved Remodeling of the DNA Methylome

Graphical Abstract

Authors

Tina Wang, Jianzhu Ma, Andrew N. Hogan, ..., Danika L. Bannasch, Elaine A. Ostrander, Trey Ideker

Correspondence

tideker@ucsd.edu

In Brief

Wang et al. create an oligo-capture system to characterize the canine DNA methylome, targeting syntenic regions of the genome conserved across all mammals. Cross-species comparisons reveal a nonlinear epigenetic signature that aligns the progression of life events in dogs, humans, and mice. This conserved signature occurs primarily in modules of developmental genes, leading the team to create a conserved epigenetic clock model of aging that can be trained and operated across different species.

Highlights

- Oligo-capture sequencing of methylomes from 104 Labradors, 0–16 years old
- Methylome similarity translates dog years to human years logarithmically
- Conserved age-related changes predominately impact developmental gene networks
- Formulation of a conserved epigenetic clock transferable across mammals

PETFOOD FORUM

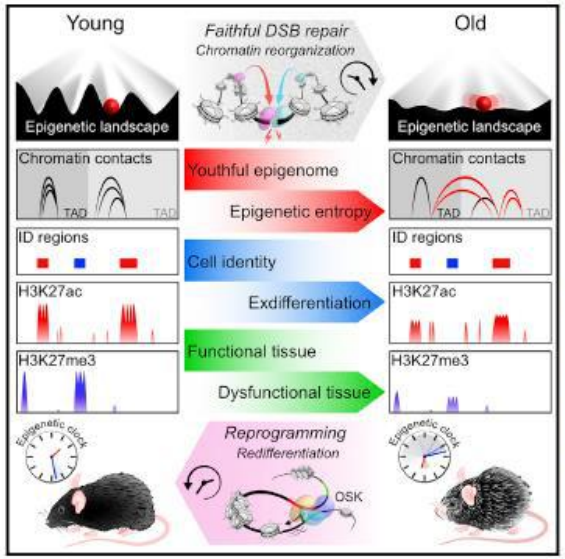
Wang et al., 2020, Cell Systems 11, 176–185 August 26, 2020 Elsevier Inc.

Cell

Article

Loss of epigenetic information as a cause of mammalian aging

Graphical abstract



Authors

Jae-Hyun Yang, Motoshi Hayano, Patrick T. Griffin, ..., Andreas R. Pfenning, Luis A. Rajman, David A. Sinclair

Correspondence

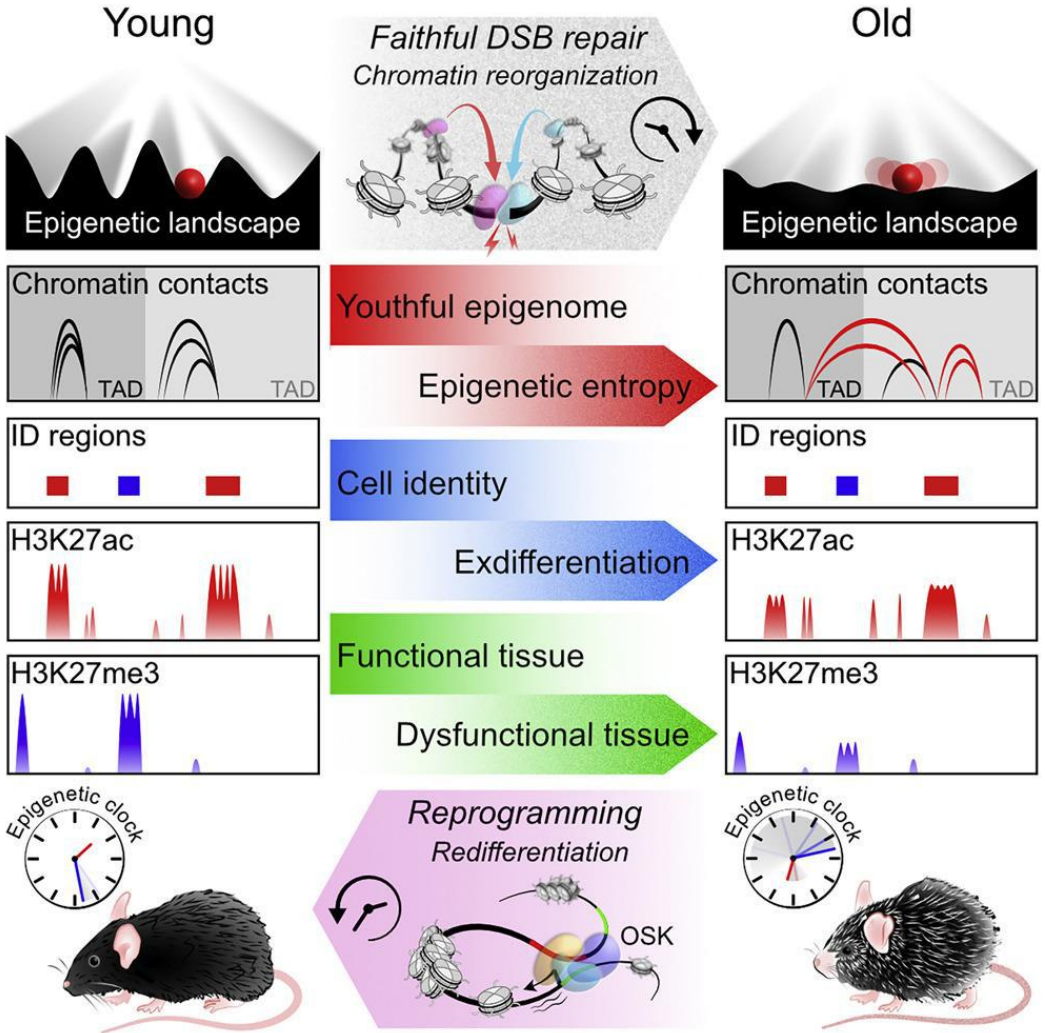
jae-hyun_yang@hms.harvard.edu (J.-H.Y.), david_sinclair@hms.harvard.edu (D.A.S.)

In brief

Aging is characterized by changes in cellular identity and function over time. This process is driven by changes in chromatin factor localization during DNA break repair, which alters the epigenome and advances the epigenetic clock. Expression of a subset of Yamanka factors, OSK, can reverse these changes and modulate aging.

Highlights

- Cellular responses to double-stranded DNA breaks erode the epigenetic landscape
- This loss of epigenetic information accelerates the hallmarks of aging
- These changes are reversible by epigenetic reprogramming
- By manipulating the epigenome, aging can be driven forward and backward



PETFOOD FORUM

Magellan

Jae-Hyun Yang et al.; 2023

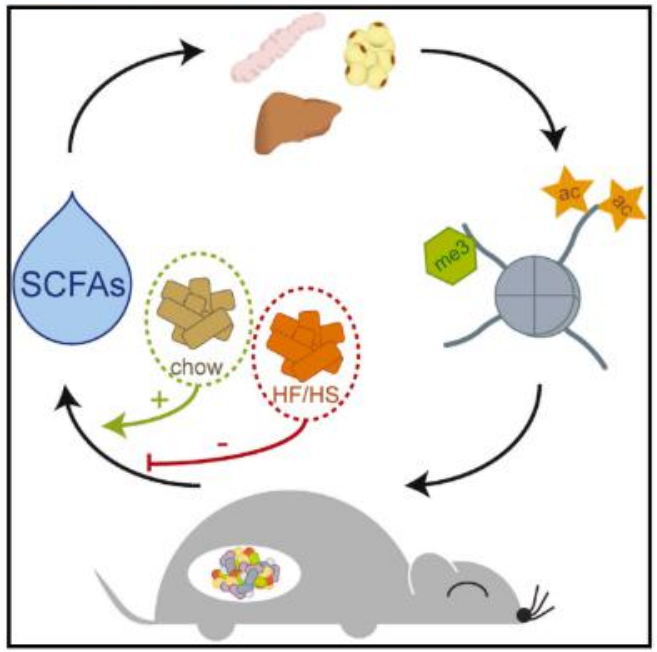
Source: ***Cell*** **2023 Volume 186 Issue 2 Pages 305-326 (January 2023) DOI: (10.1016/j.cell.2022.12.027)**

Short Article

Molecular Cell

Diet-Microbiota Interactions Mediate Global Epigenetic Programming in Multiple Host Tissues

Graphical Abstract



Authors

Kimberly A. Krautkramer, Julia H. Kreznar, Kymberleigh A. Romano, ..., Alan D. Attie, Federico E. Rey, John M. Denu

Correspondence

ferey@wisc.edu (F.E.R.), john.denu@wisc.edu (J.M.D.)

In Brief

The gut microbiota is an important metabolic organ and associated with a number of robust metabolic and immunologic host phenotypes. Krautkramer et al. report that diet-gut microbiota interactions mediate host epigenetic programming in a variety of host tissues.

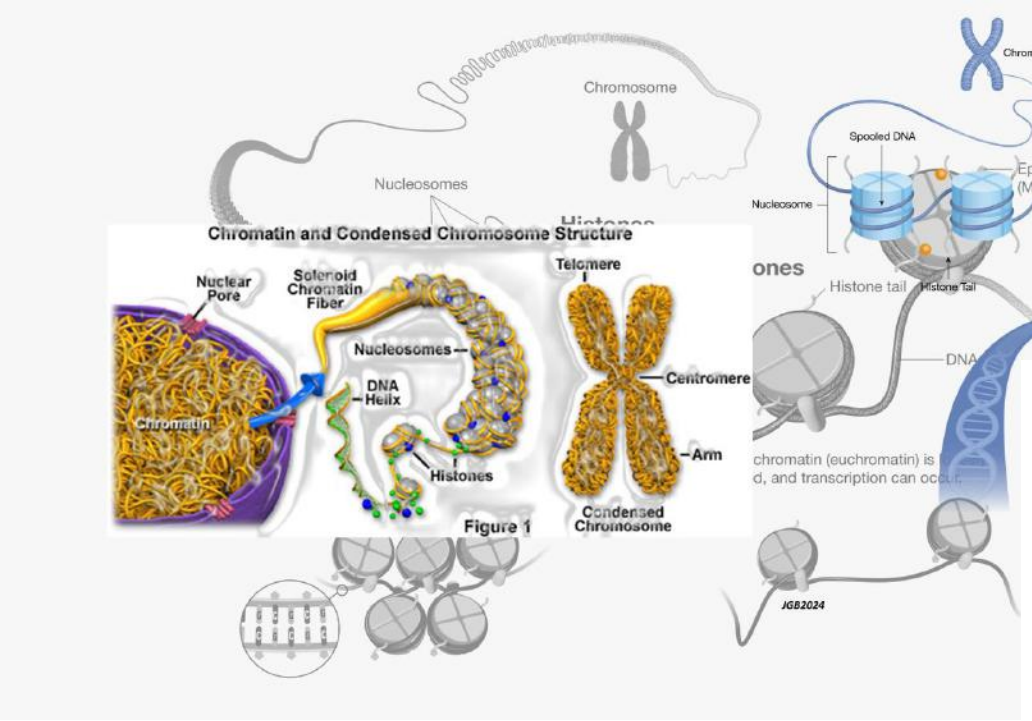
Highlights

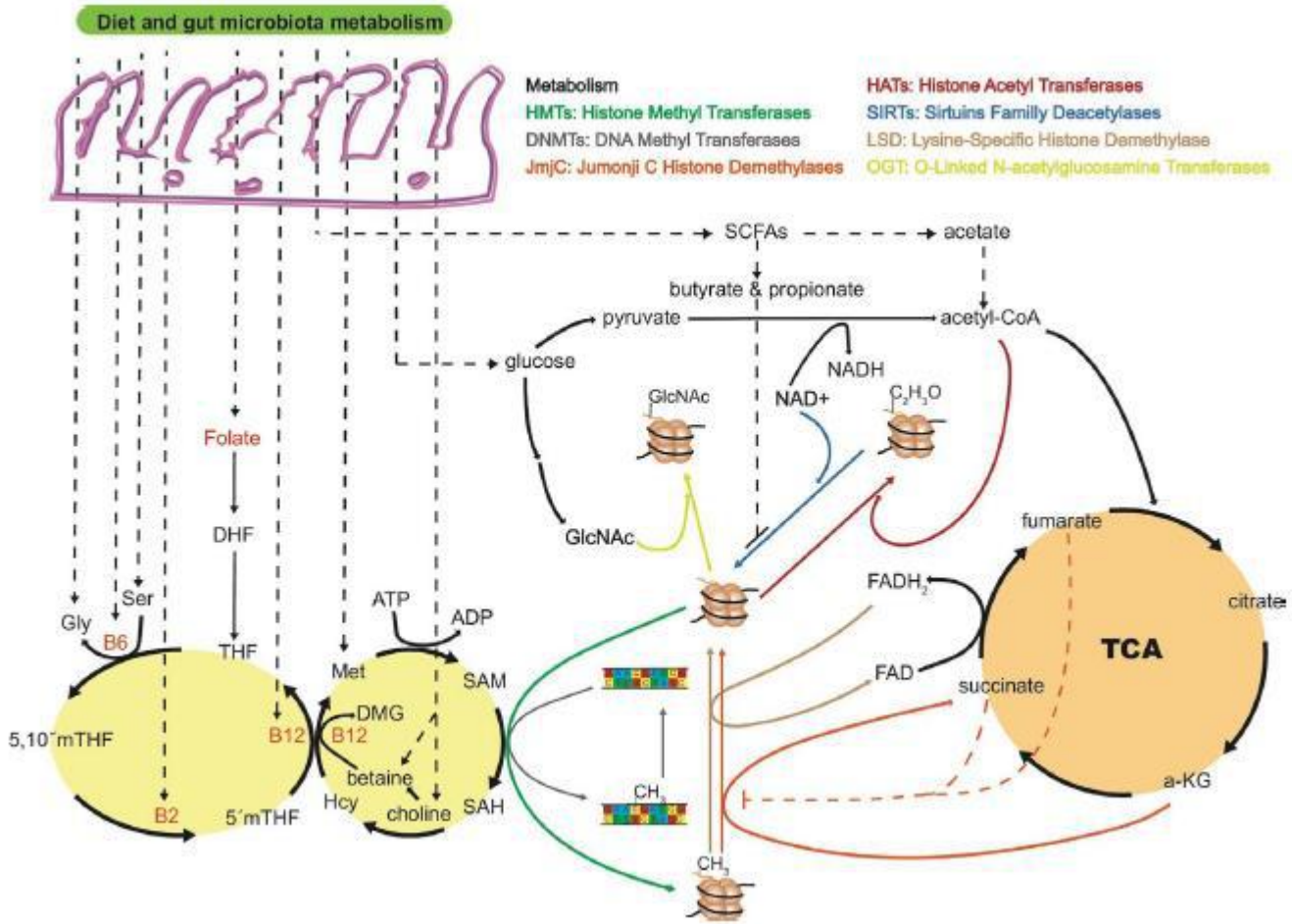
- Gut microbiota alter host histone acetylation and methylation in multiple tissues
- Western diet suppresses microbiota-driven SCFA production and chromatin effects
- SCFAs recapitulate microbiota-driven chromatin and transcriptional effects

Accession Numbers

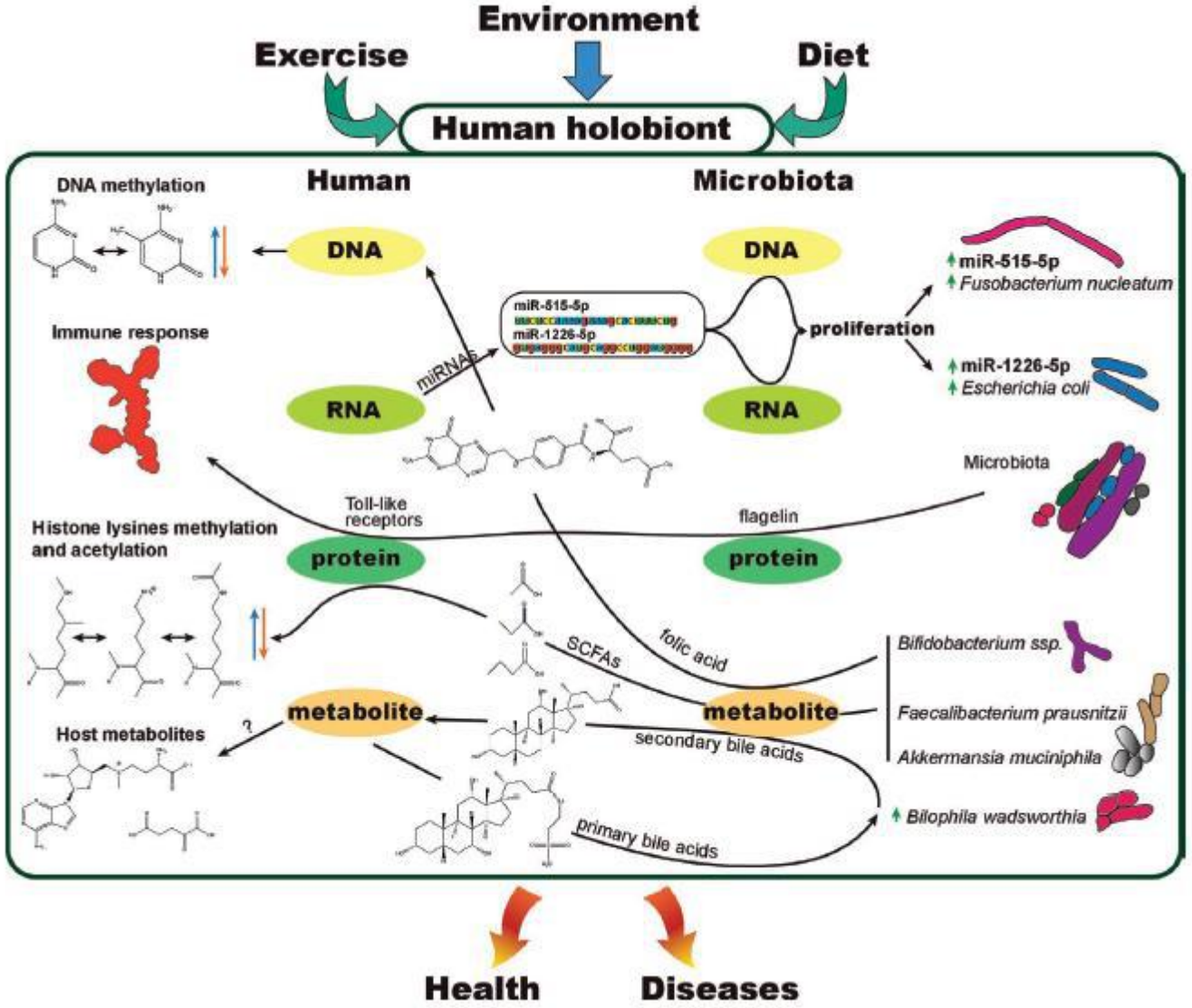
GSE81115
GSE81117

Krautkramer et al.; 2016. 64(5):982-992. doi: 10.1016/j.molcel.2016.10.025. Epub 2016 Nov 23. Mol Cell.





Miro-Blanch and Yanez, 2019. Frontiers in Geneticshttps://www.frontiersin.org/journals/genetics/articles/10.3389/fgene.2019.00638/full



Miro-Blanch and Yanez, 2019. Frontiers in Geneticshttps://www.frontiersin.org/journals/genetics/articles/10.3389/fgene.2019.00638/full

PNAS RESEARCH ARTICLE | GENETICS OPEN ACCESS

DNA methylation clocks for dogs and humans

Steve Horvath[a,b,1], Ake T. Lu[a,1], Amin Haghani[a,1], Joseph A. Zoller[b], Caesar Z. Li[b], Andrea R. Lim[a], Robert T. Brooke[c], Ken Raj[d], Aitor Serres-Armero[e], Dayna L. Dreger[e], Andrew N. Hogan[e], Jocelyn Plassais[e], and Elaine A. Ostrander[e,2]

Contributed by Elaine A. Ostrander; received November 22, 2021; accepted April 5, 2022; reviewed by Eniko Kubinyi and Peter Laird

DNA methylation profiles have been used to develop biomarkers of aging known as epigenetic clocks, which predict chronological age with remarkable accuracy and show promise for inferring health status as an indicator of biological age. Epigenetic clocks were first built to monitor human aging, but their underlying principles appear to be evolutionarily conserved, as they have now been successfully developed for many mammalian species. Here, we describe reliable and highly accurate epigenetic clocks shown to apply to 93 domestic dog breeds. The methylation profiles were generated using the mammalian methylation array, which utilizes DNA sequences that are conserved across all mammalian species. Canine epigenetic clocks were constructed to estimate age and also average time to death. We also present two highly accurate human–dog dual species epigenetic clocks ($R = 0.97$), which may facilitate the ready translation from canine to human use (or vice versa) of antiaging treatments being developed for longevity and preventive medicine. Finally, epigenome-wide association studies here reveal individual methylation sit... that may underlie the inverse relationship between breed weight and lifespan. Overall, we describe robust biomarkers to measure aging and, potentially, health status in canin...

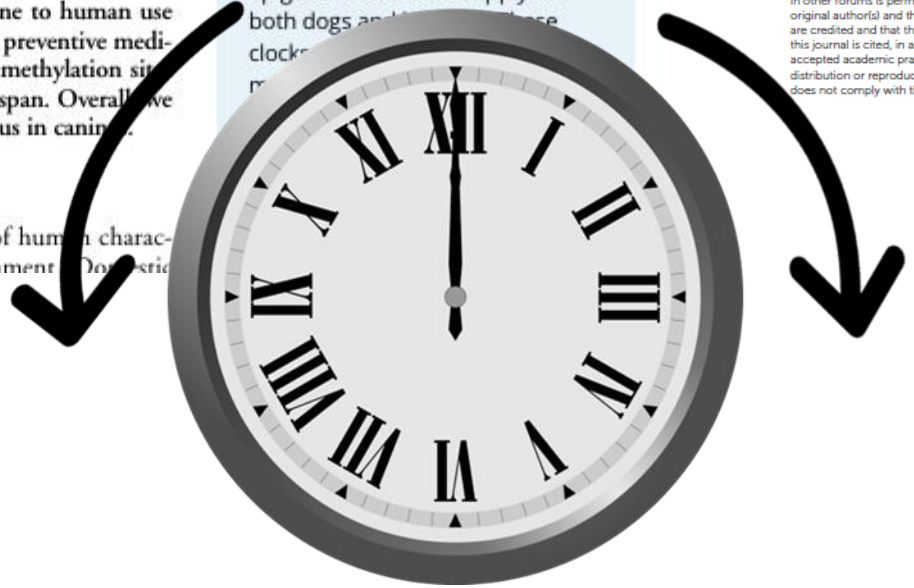
Significance

Epigenetic estimators of age (known as clocks) allow one to identify interventions that slow or reverse aging. Previous epigenetic clocks only applied to one species at a time. Here, we describe epigenetic clocks that apply to both dogs an... clock...

dog | *Canis familiaris* | methylation | epigenetic clock | aging

Ideally, model species for antiaging research should be representative of hum... charac-teristics such as size and genetic diversity, as well as shared environment. Do...

Horvath et al.; 2021



frontiers | Frontiers in Veterinary Science

TYPE Original Research
PUBLISHED 22 August 2023
DOI 10.3389/fvets.2023.1213287

Check for updates

OPEN ACCESS

EDITED BY
Shengfa F. Liao,
Mississippi State University, United States

REVIEWED BY
Zhongyue Yang,
University of California, Davis, United States
Emily Coffey,
University of Minnesota Twin Cities, United States

*CORRESPONDENCE
Anna Fernández-Pinteño
anfernandez@affinity-petcare.com

RECEIVED 27 April 2023
ACCEPTED 13 July 2023
PUBLISHED 22 August 2023

CITATION
Fernández-Pinteño A, Pilla R, Manteca X, Suchodolski J, Torre C and Salas-Mani A (2023) Age-associated changes in intestinal health biomarkers in dogs. *Front. Vet. Sci.* 10:1213287. doi: 10.3389/fvets.2023.1213287

Age-associated changes in intestinal health biomarkers in dogs

Anna Fernández-Pinteño[1]*, Rachel Pilla[2], Xavier Manteca[3], Jan Suchodolski[2], Celina Torre[1] and Anna Salas-Mani[1]

[1]Department of Research and Development, Affinity Petcare, L'Hospitalet de Llobregat, Spain, [2]Gastrointestinal Laboratory, Department of Small Animal Clinical Sciences, Texas A&M University, College Station, TX, United States, [3]School of Veterinary Science, Universitat Autònoma de Barcelona, Bellaterra, Spain

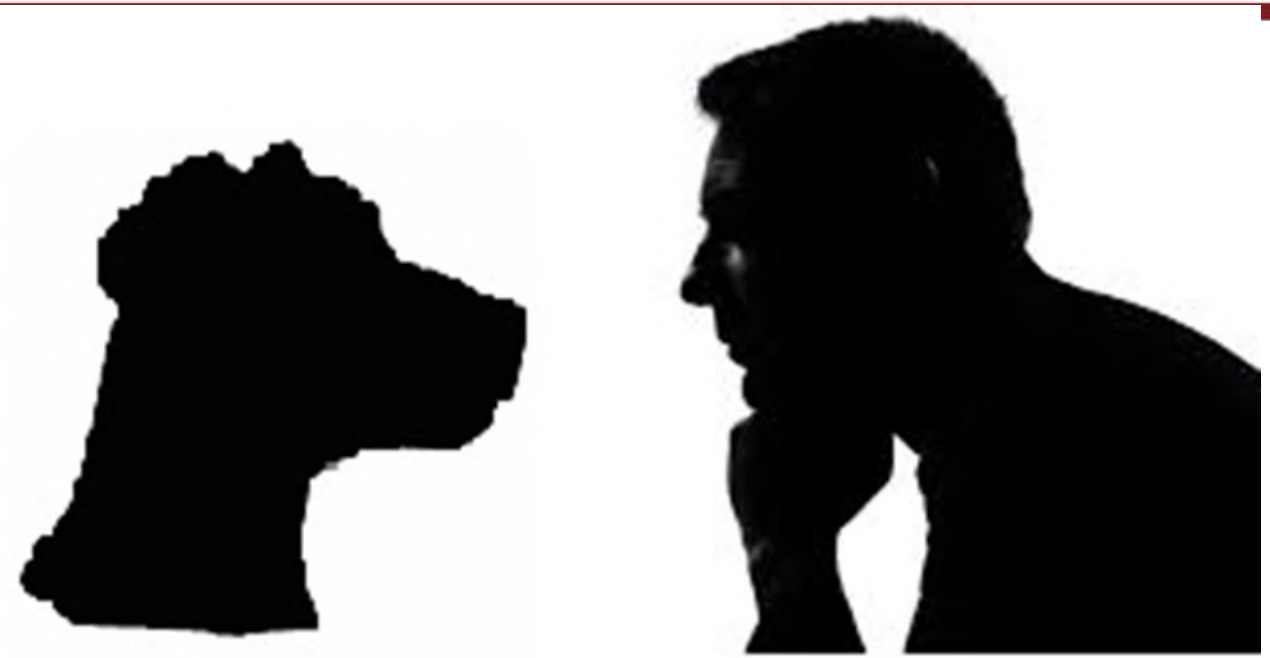
The gut microbiome is critical for maintaining host health. In healthy humans, the aging process is one of the main factors modulating the changes in the intestinal microbiota. However, little is known about the relationship between gut health, microbiota, and the aging process in dogs. The present study aims to explore the differences in the intestinal microbiota and intestinal health based on fecal biomarkers in a population of dogs of different ages. The study involved 106 dogs of different breeds aged between 0.2 and 15 years categorized as senior (>7 years; $n = 40$), adult (2–7 years; $n = 50$), and junior (<2 years; $n = 16$). Fecal samples were collected during the same period at the same facilities. The analysis included the following gut health indicators: 16S rRNA gene sequencing to investigate the differences in the fecal microbiota; qPCR to determine the dysbiosis index; fecal short-chain fatty acid concentrations; fecal calprotectin; and immunoglobulin A. Beta diversity analysis revealed a significant difference with a small effect size ($p = 0.003$; $R = 0.087$) among age categories based on the unweighted UniFrac metric, but no significance was observed based on the weighted UniFrac metric or Bray–Curtis distances. There were no significant differences in the alpha diversity measures or the fecal dysbiosis index among age categories. Senior dogs had significantly higher relative abundance proportions in phyla Bacteroidota and Pseudomonadota and the genus *Faecalibacterium*, but not on qPCR analysis. At the family level, *Ruminococcaceae*, Uncl. *Clostridiales*.1, *Veillonellaceae*, *Prevotellaceae*, *Succinivibrionaceae*, and *Bacteroidaceae* abundances were higher in the senior category than in the adult and/or junior categories. Relative proportions, but not concentrations of fecal acetate, were higher in the senior category, while butyrate, isovaleric acid, and valeric acid were lower. The valeric acid concentration was significantly lower in the senior category than in the adult category. Calprotectin and immunoglobulin A levels did not differ significantly across groups. In conclusion, this study observed multiple minor changes in the fecal microbiota composition and the relative amount of short-chain fatty acids in dogs among different age groups, but studies in larger populations representative of all ages are warranted to refine the present results.

KEYWORDS
fecal microbiota, canine, aging, intestinal health, nutrition

Fernandez pinteno et al.; 2023

PETFOOD FORUM

EXPLORE, DISCOVER, INNOVATE Magellan

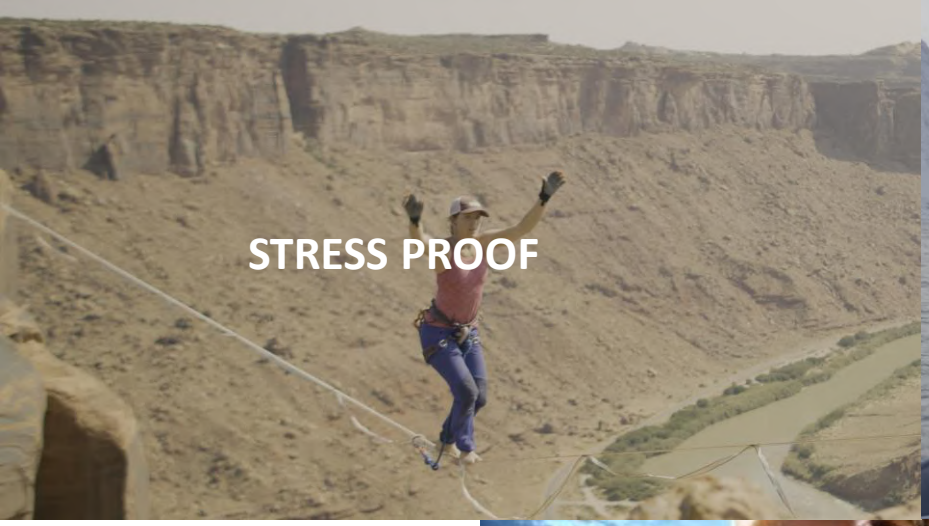


LIVE LONG AND PROSPER

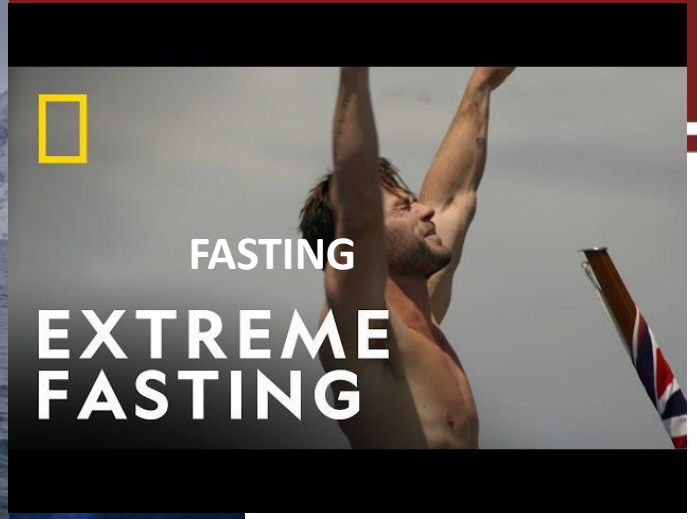
PETFOOD FORUM

EXPLORE, DISCOVER, INNOVATE Magellan

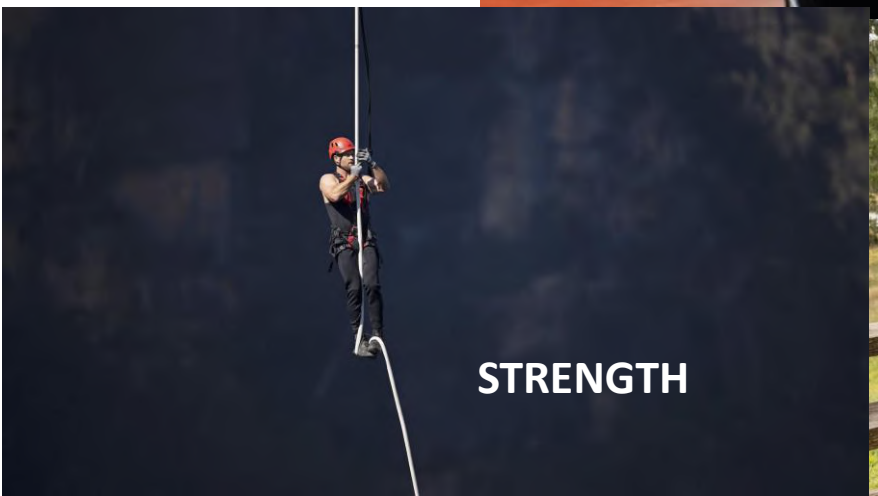
Source: World Economic forum. Downloaded from https://www.weforum.org/agenda


STRESS PROOF

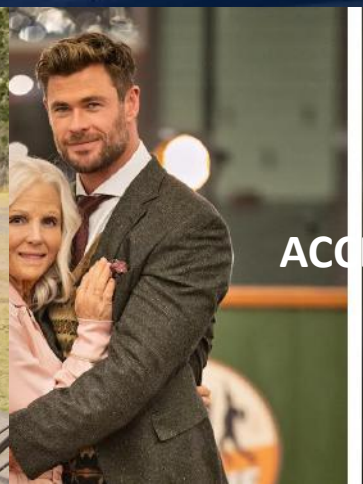

SHOCK

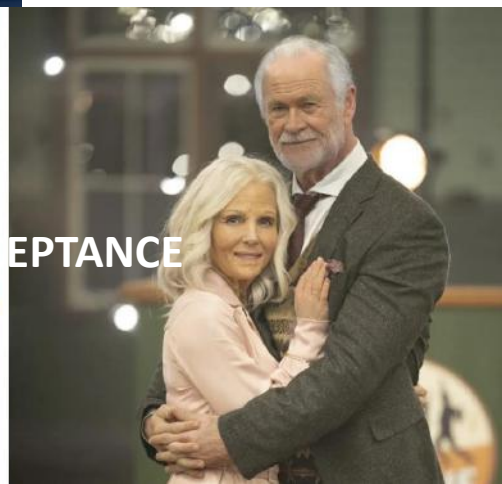

FASTING
EXTREME
FASTING


NATIONAL
GEOGRAPHIC
LIMITLESS
with CHRIS HEMSWORTH
Original series
Nov 16 only on
Disney+


STRENGTH


MEMORY

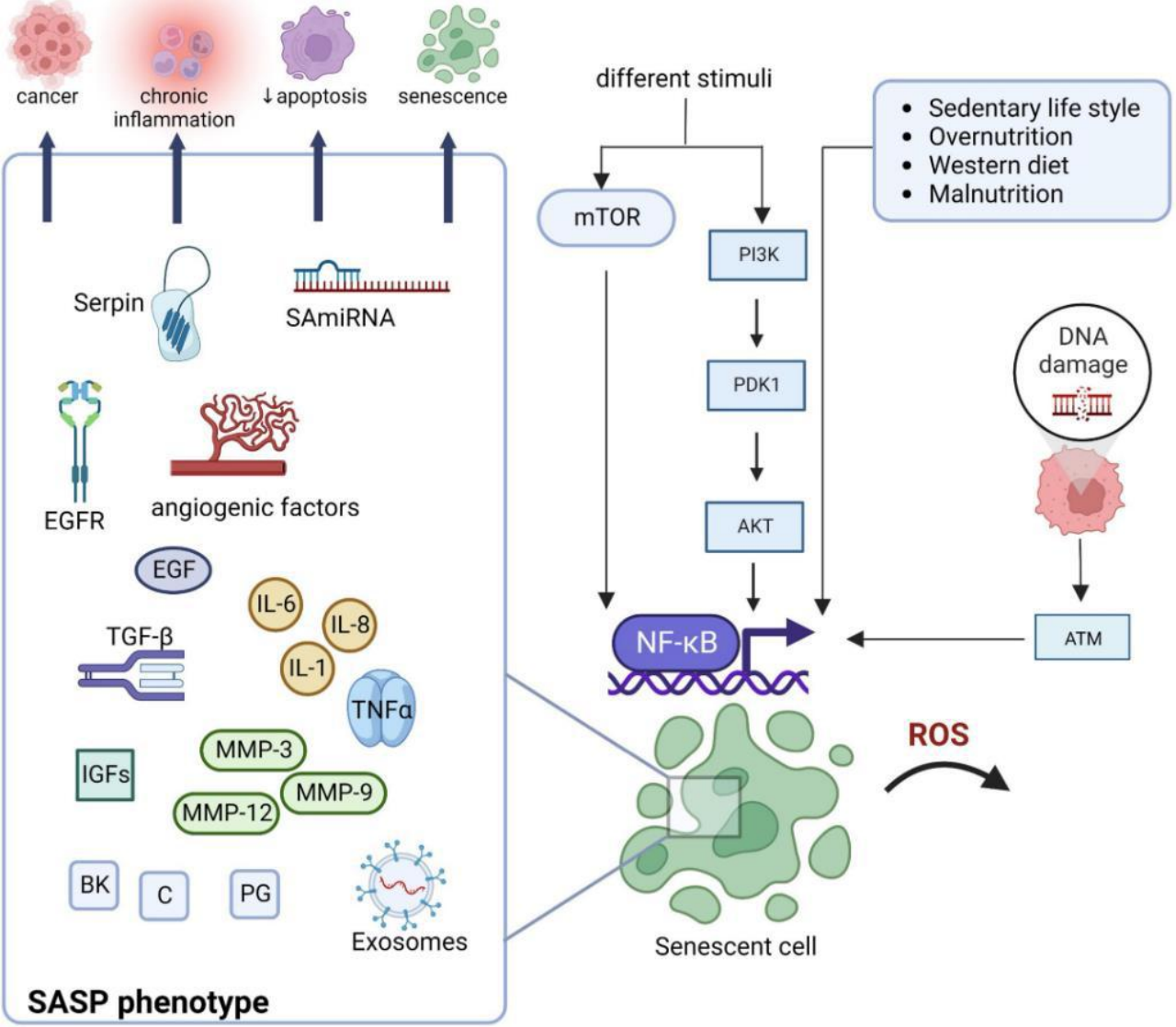

ACCEPTANCE

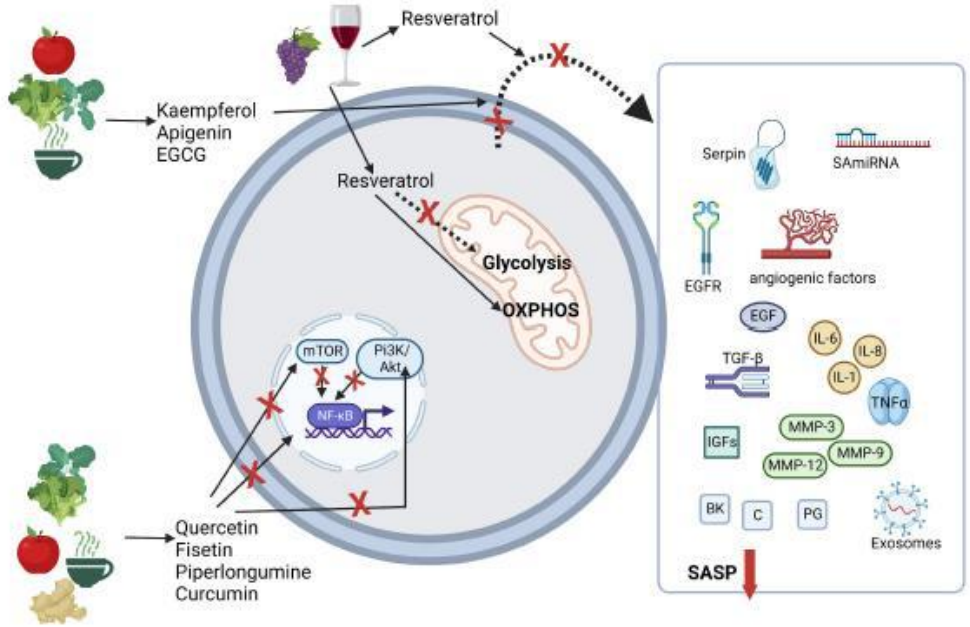



Live
Long
and
Prosper


Live
Long
and
Prosper

Senolytic drugs





Natural Senotherapeutics

PETFOOD FORUM

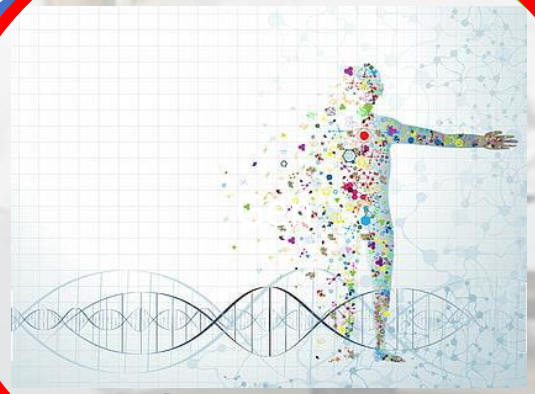
EXPLORE, DISCOVER, INNOVATE
Magellan

Source: Luis et al.; 2022. https://doi.org/10.3389/fnut.2022.958563

BRINGS ME BACK

Lifestyle

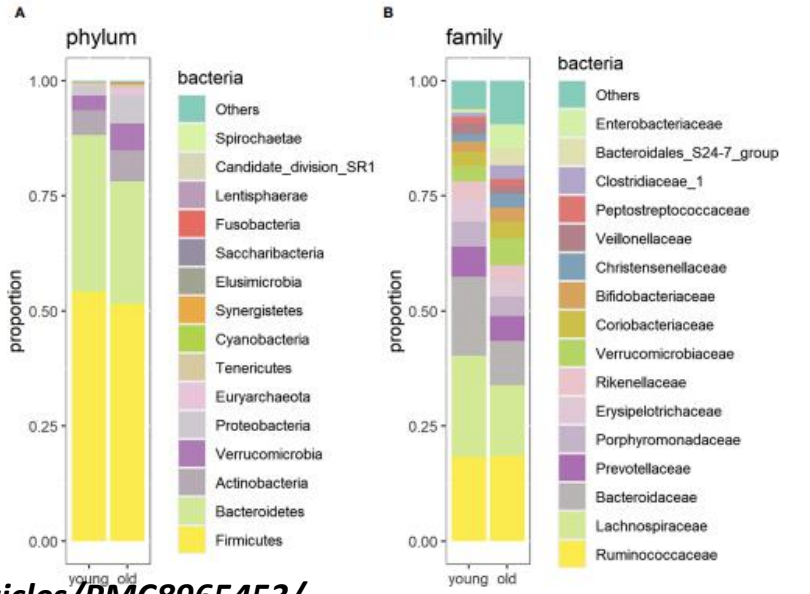
Environment



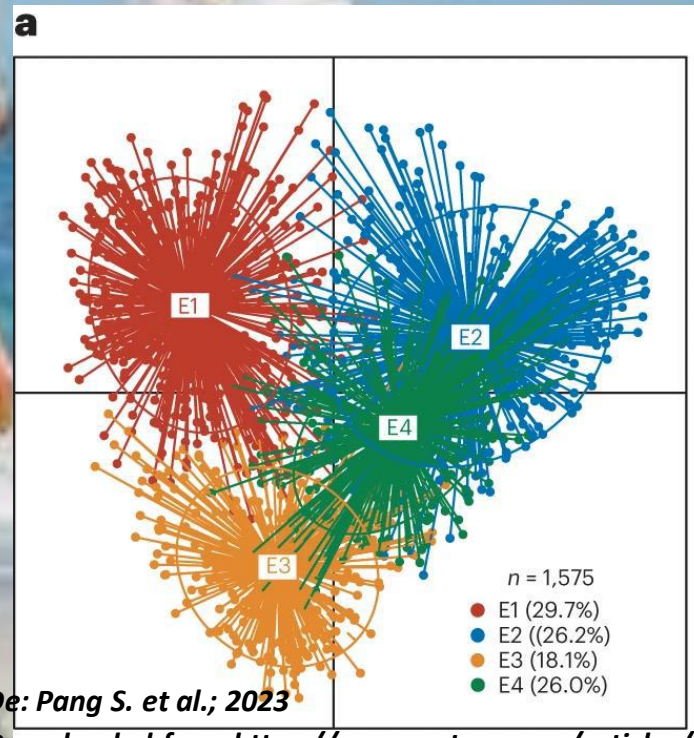
Genes

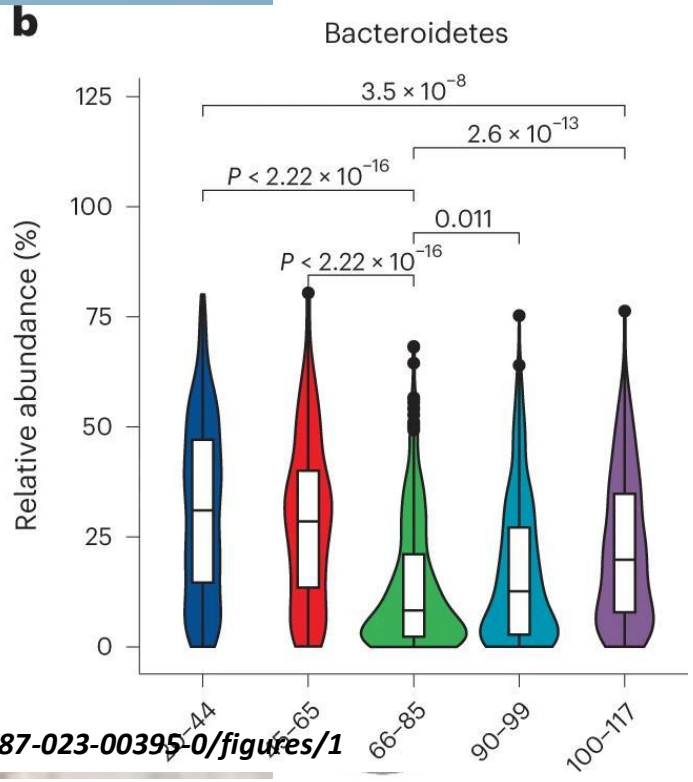
Long & Healthy Life

Lifestyle and diet play a key role when we talk about healthy lifespan

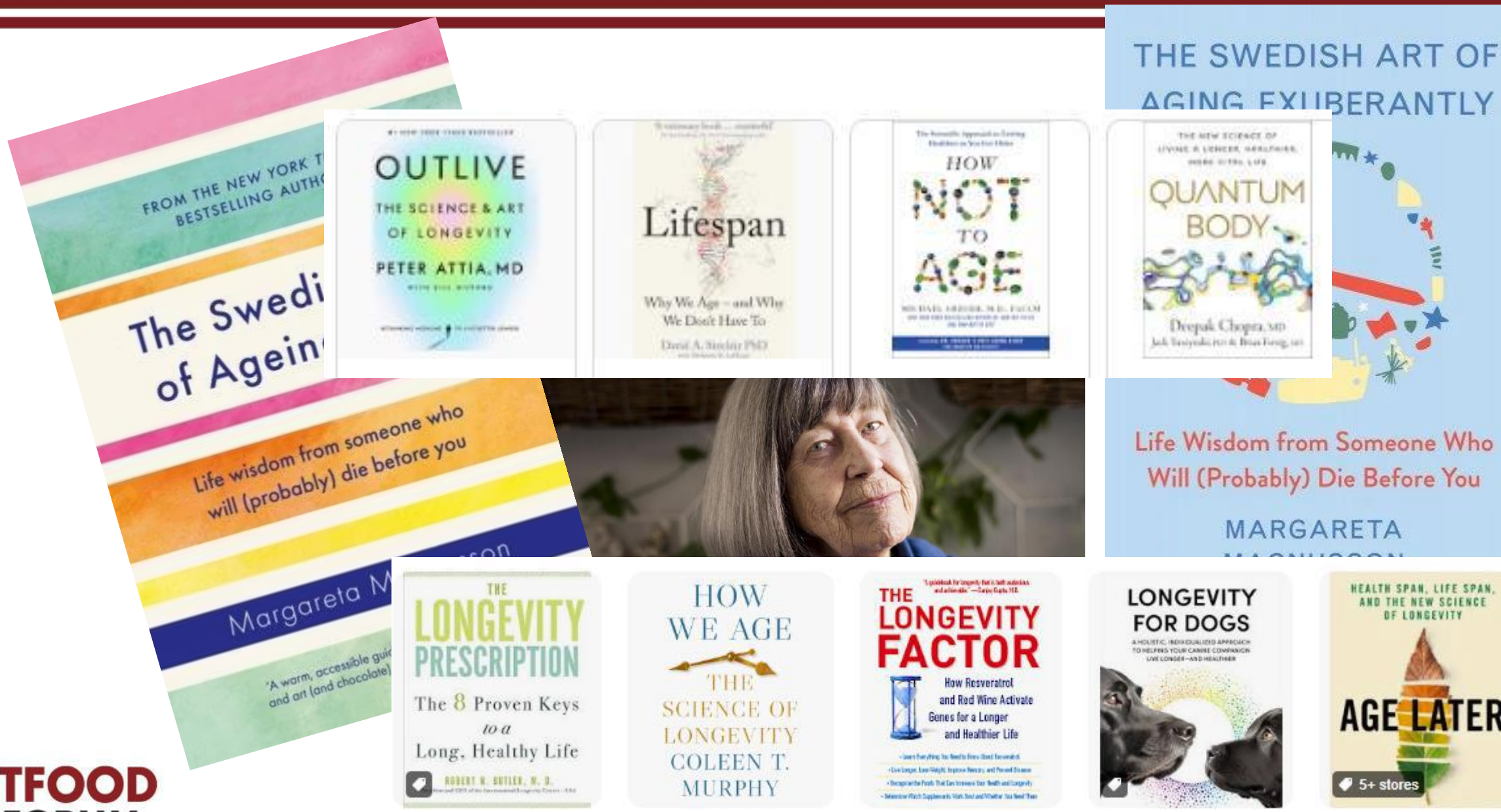


De: Sepp et al.; 2022
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8965453/





De: Pang S. et al.; 2023
Downloaded from https://www.nature.com/articles/s43587-023-00395-0/figures/1



PETFOOD FORUM

FINAL THOUGHTS

- Life expectancy has increased both for people and companion animals, however, what is important is the last stretch, how well and what kind of quality of life one has at this stage
- The current development of life tables for companion animals allows for a better understanding of what kind of nutritional and veterinary interventions would be needed for life expectancy and healthy life span
- Continuing longevity studies will provide valuable insights into what factors influence life expectancy and healthy life span for people and pets

PETFOOD FORUM

EXPLORE, DISCOVER, INNOVATE Magellan

FINAL THOUGHTS

- As advances in knowledge and deep understanding of the role the microbiome plays in aging, will allow to design and develop diets to improve the health and wellbeing of not only people but also our companion animals.
- Identifying how individual nutrients affect the gut microbiome and epigenetic programing, i.e. understanding their functions and interaction with genes will provide the framework for Personalized and “Petsonalized” nutrition for a longer, healthy lifespan for people and pets

PETFOOD FORUM

EXPLORE, DISCOVER, INNOVATE Magellan

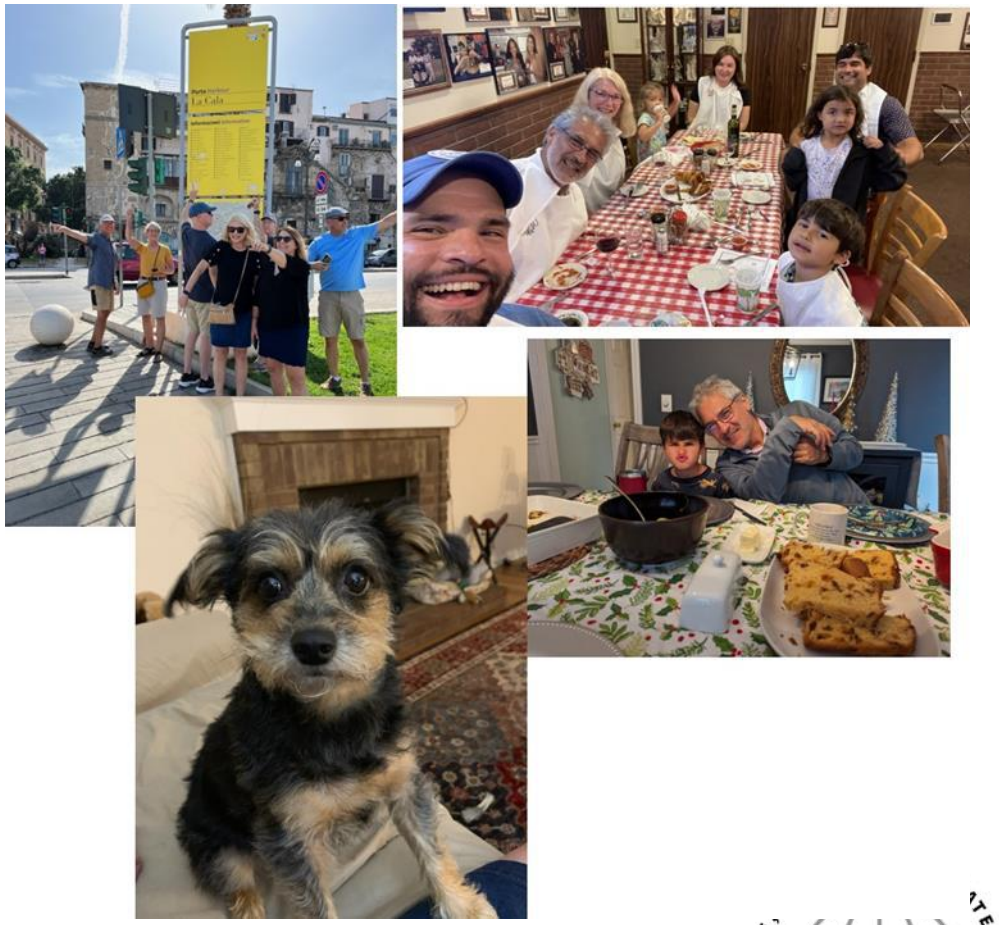
FINALLY
…the secret

PETFOOD FORUM

EXPLORE, DISCOVER, INNOVATE
Magellan

…IMPORTANT

- MEANING AND PURPOSE
- FAMILY
- FRIENDS
- COLLEAGUES
- ENJOY THE MOMENT
- DON’T SWEAT THE SMALL STUFF



PETFOOD FORUM

Magellan

Count your age by friends, not years.
Count your life by smiles, not tears.

John Lennon

PETFOOD FORUM

EXPLORE, DISCOVER, INNOVATE
Magellan

THANKS!

PETFOOD FORUM

EXPLORE, DISCOVER, INNOVATE
Magellan