AMA
AMERICAN MEDICAL ASSOCIATION

The Future of Aging and its Impact on Health Care: If We Live Healthier, Can We Live Longer?

2 - 3 p.m. CDT | Sunday, June 6

Moderator
Jenny L. Boyer, MD, JD, PhD

Chair-Elect, AMA Senior Physicians Section Governing Council

Professional.
Ethical.
Welcoming.
Safe.

We take harassment and conflicts of interest seriously. Visit **ama-assn.org/codeofconduct** to learn more.

Conduct Liaison for this meeting:
Lauren Robinson
lauren.robinson@ama-assn.org
(312) 464-4926

Confidential reporting:
lighthouse-services.com/ama
(800) 398-1496

AMA

Narayana Murali, MD
Member since 2002

Sponsored by the AMA's Senior Physicians Section (SPS)

Speaker
S. Jay Olshansky, PhD

Professor, School of Public Health at the University of Illinois at Chicago
Research Associate at the Center on Aging at the University of Chicago and at the London School of Hygiene and Tropical Medicine

Speakers' Disclosure

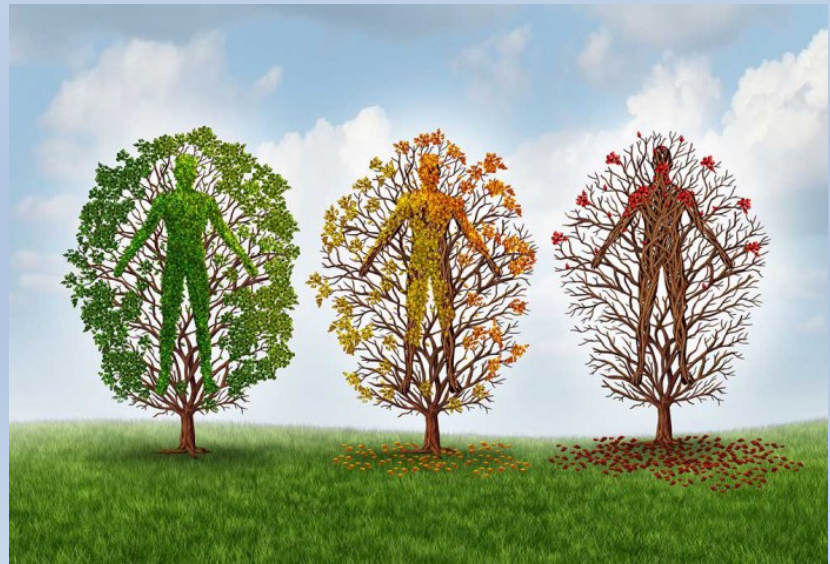
The content of this activity does not relate to any product of a commercial interest as defined by the ACCME; therefore, there are no relevant financial relationships to disclose at this time.

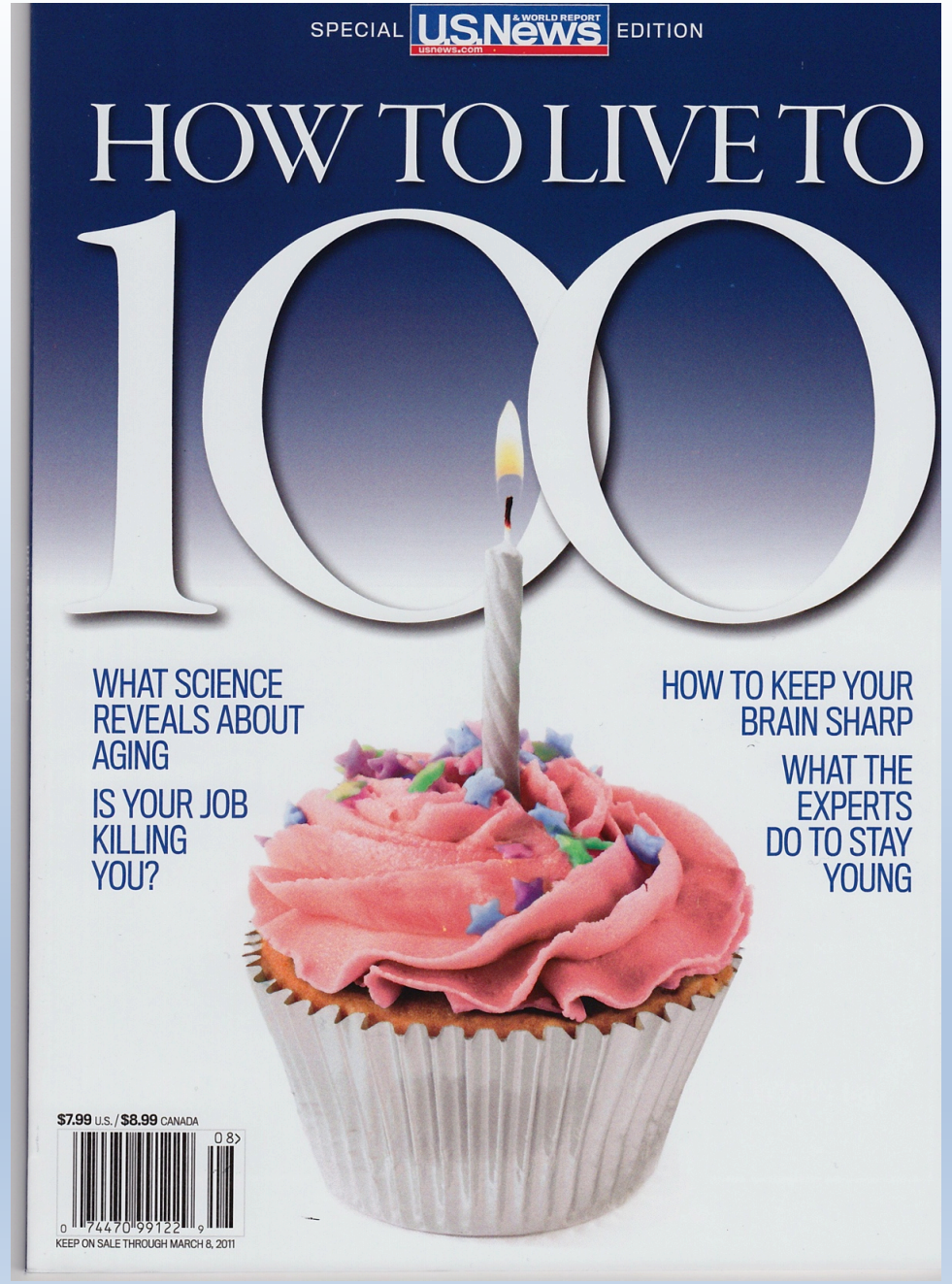
Objectives

Upon completion of this activity, the physician will be able to:

- Assess recent estimates of the upper limits to human longevity
- Identify the most important risk factors for all the most common diseases associated with the biological process of aging
- Describe how to prevent or delay disease and disability.
- Examine the term “Longevity Dividend -- the social, economic, and health benefits that would accrue from successful efforts to slow aging in people.”
- Compare the pros and cons of altering the biological time clock.

The future of aging and its impact on health care: If we live healthier, can we live longer?




SPECIAL U.S.News & WORLD REPORT usnews.com EDITION
HOW TO LIVE TO 100
WHAT SCIENCE REVEALS ABOUT AGING
IS YOUR JOB KILLING YOU?
HOW TO KEEP YOUR BRAIN SHARP
WHAT THE EXPERTS DO TO STAY YOUNG
$7.99 U.S. / $8.99 CANADA
0 74470 99122 9
KEEP ON SALE THROUGH MARCH 8, 2011


THE FIRST PERSON TO LIVE TO 150 IS ALIVE TODAY.
Let's get ready for a longer retirement.
Prudential
Bring Your Challenges

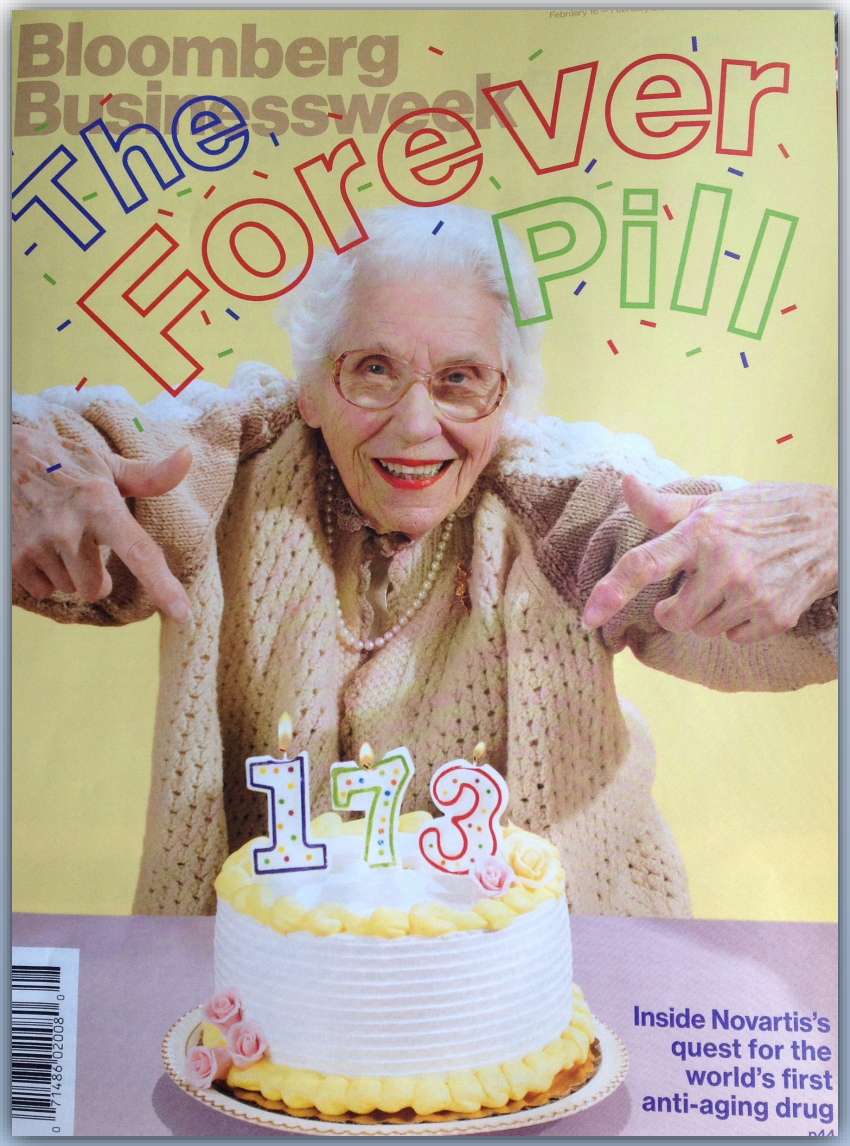

NATIONAL GEOGRAPHIC
THIS BABY WILL LIVE TO BE 120*

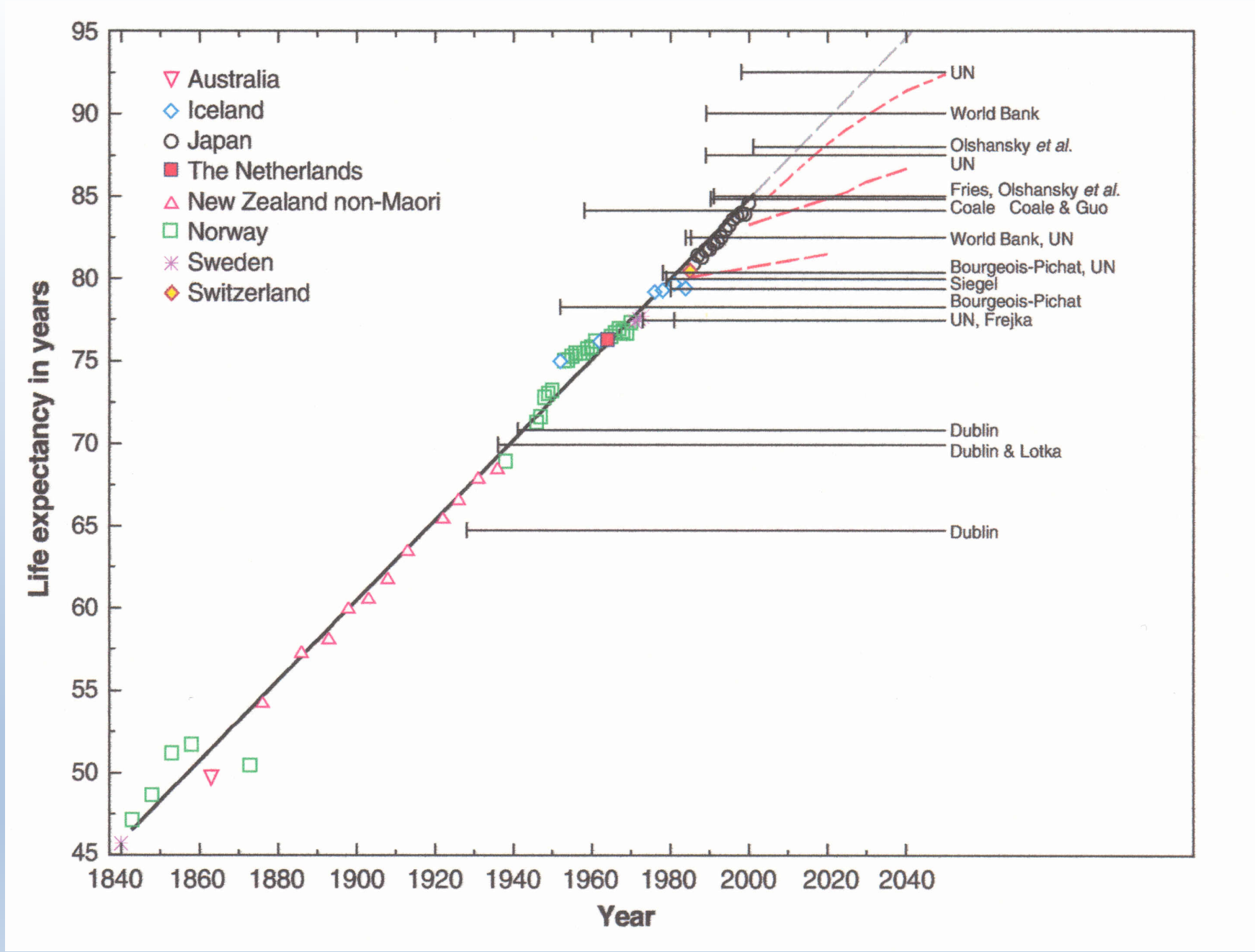

NATIONAL GEOGRAPHIC
THIS BABY WILL LIVE TO BE 120*

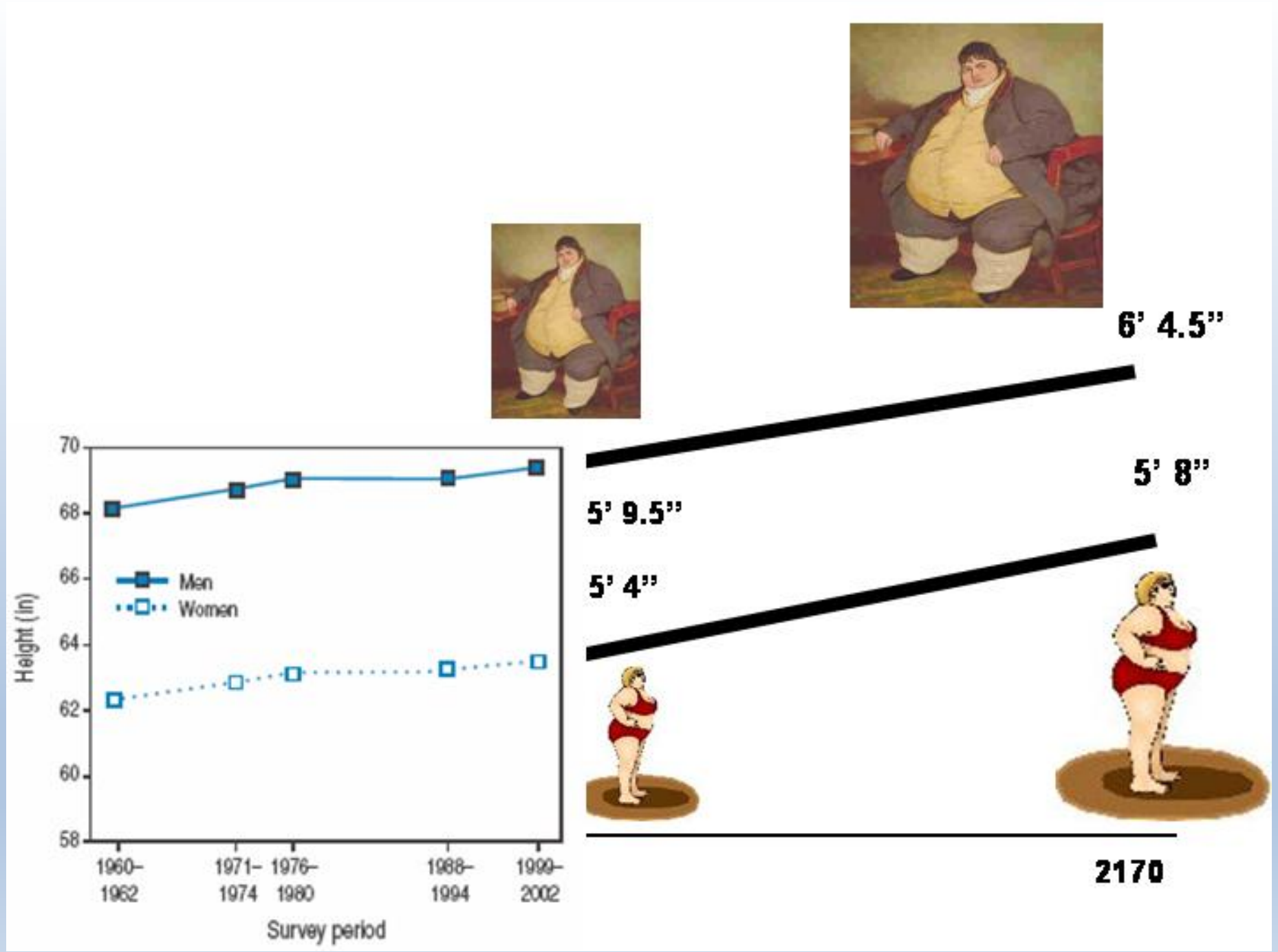

NATIONAL GEOGRAPHIC
THIS BABY WILL LIVE TO BE 120*

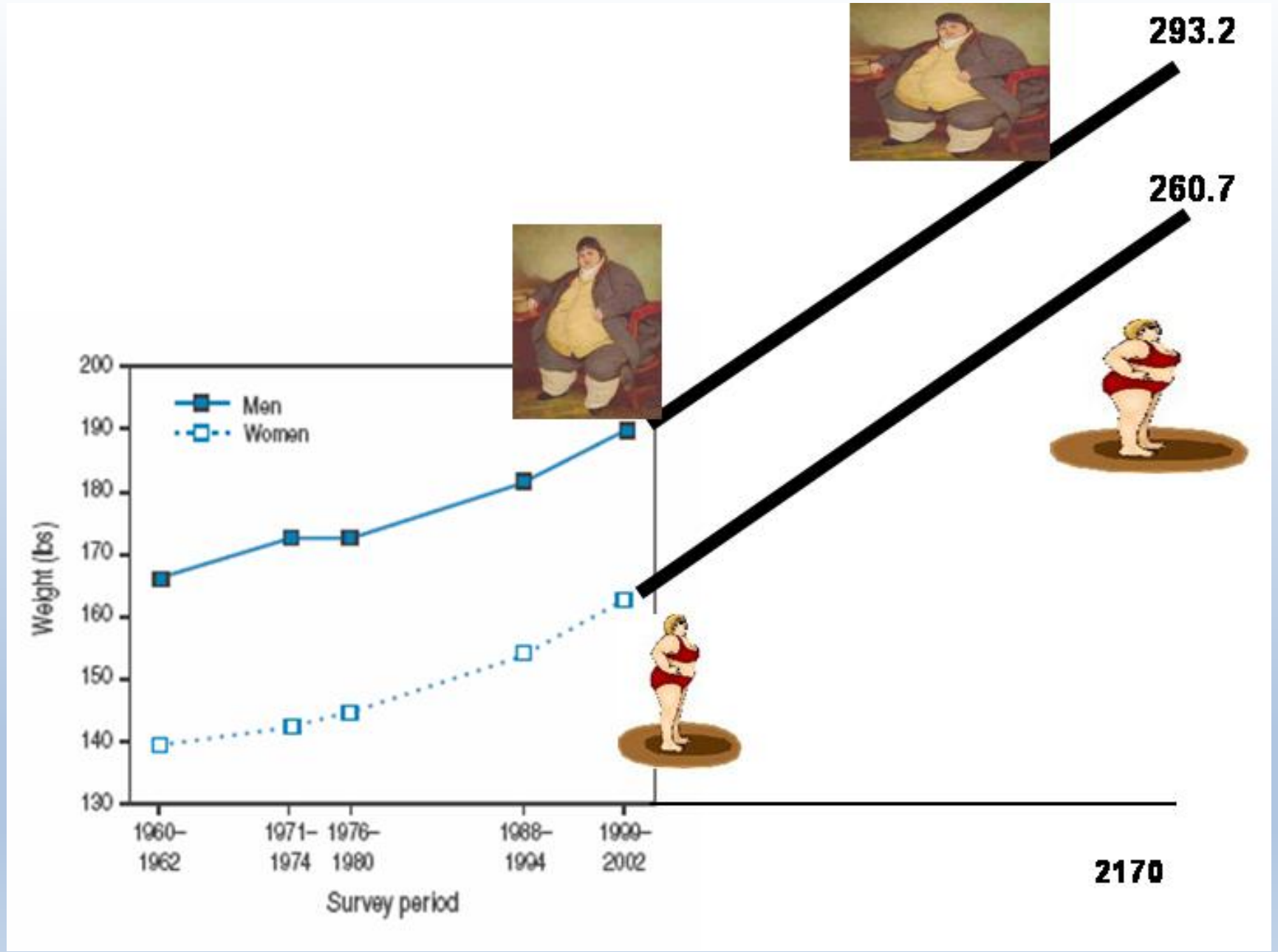

FEBRUARY 23 / MARCH 2, 2015
TIME
SPECIAL
HEALTH
DOUBLE
ISSUE
THIS BABY COULD LIVE TO BE
142 YEARS OLD
Dispatches From the Frontiers of Longevity
time.com


TIME
VOL. 185, NO. 6–7 | 2015
HOW OLD CAN WE LIVE TO BE?
That remains to be seen, but if a promising drug does to humans what it does to mice—a big if—the answer is 142. Mice have a median survival time of 27 MONTHS, but with treatment, the longest-living mouse hit 48 MONTHS, a life 1.77 TIMES LONGER. The median human lifespan is 80 YEARS—so if the oldest person lived 1.77 times longer, he or she would reach 142.

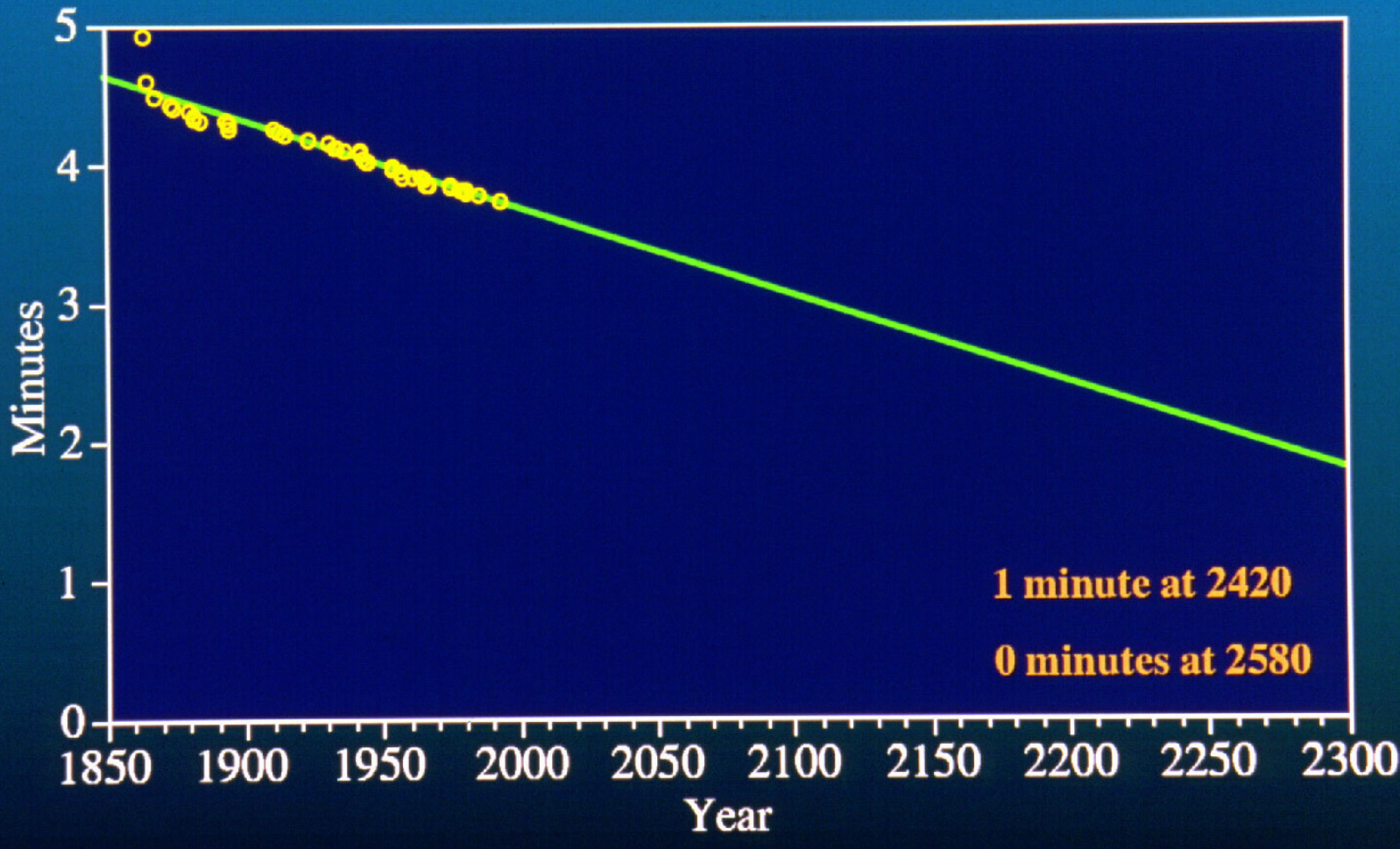

Bloomberg Businessweek
The Forever Pill
173
Inside Novartis's quest for the world's first anti-aging drug
p44


Life expectancy in years
Year
95
90
85
80
75
70
65
60
55
50
45
1840
1860
1880
1900
1920
1940
1960
1980
2000
2020
2040
Australia
Iceland
Japan
The Netherlands
New Zealand non-Maori
Norway
Sweden
Switzerland
UN
World Bank
Olshansky et al.
UN
Fries, Olshansky et al.
Coale Coale & Guo
World Bank, UN
Bourgeois-Pichat, UN
Siegel
Bourgeois-Pichat
UN, Frejka
Dublin
Dublin & Lotka
Dublin

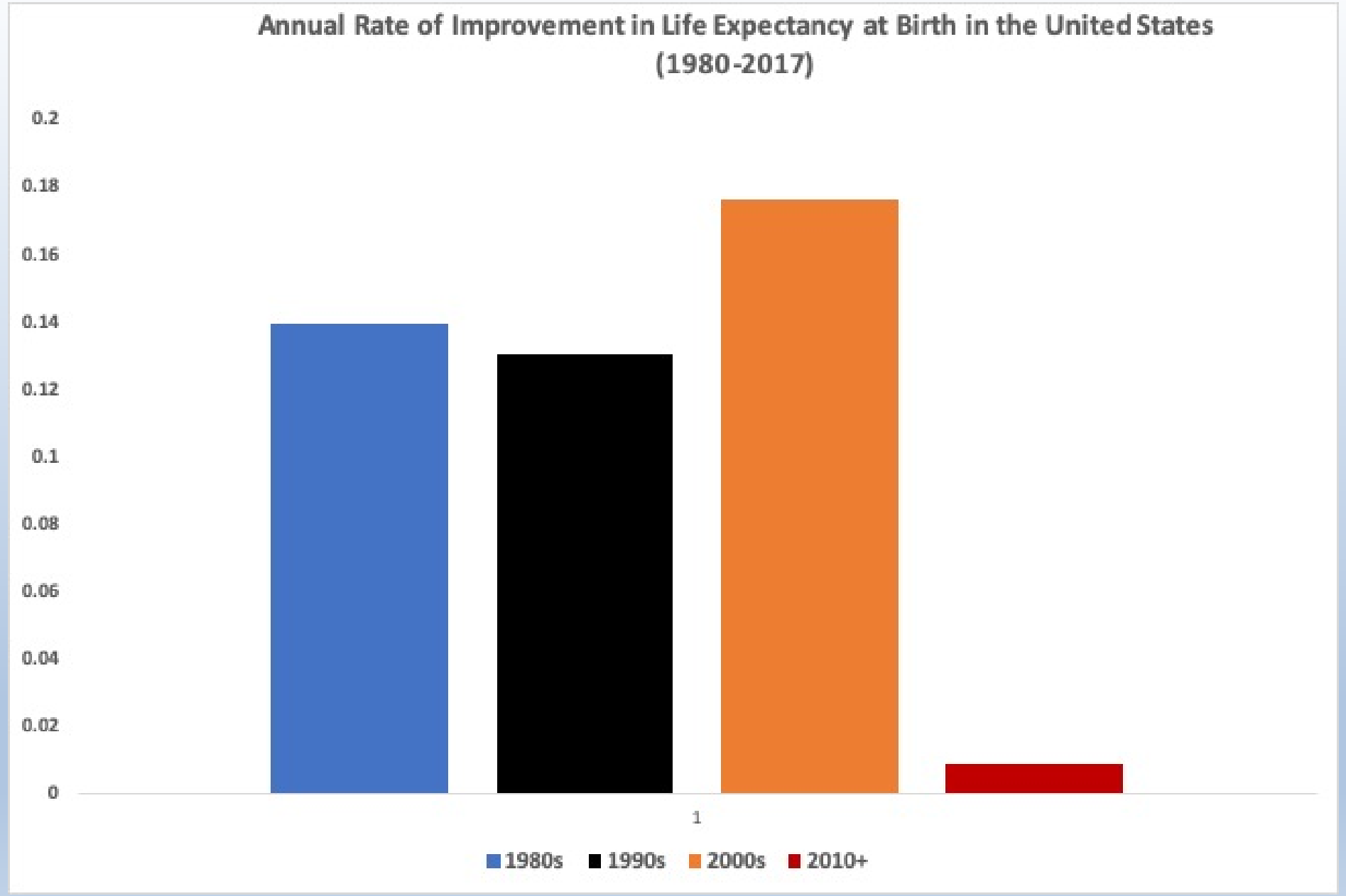

6' 4.5"
5' 8"
5' 9.5"
5' 4"
2170
70
68
66
64
62
60
58
Height (in)
Men
Women
1960–1962
1971–1974
1976–1980
1988–1994
1999–2002
Survey period

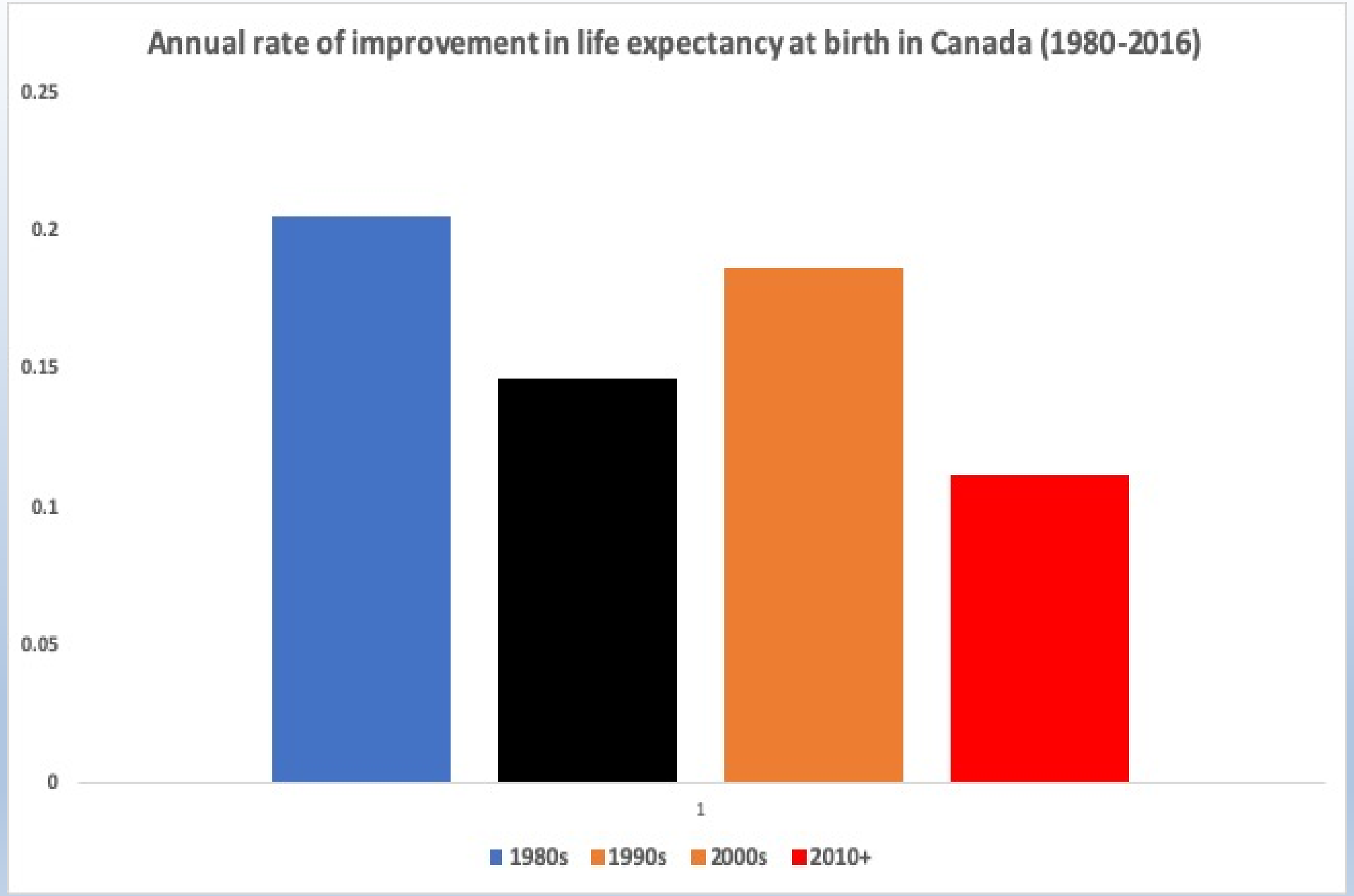

293.2
260.7
200
190
180
170
160
150
140
130
Men
Women
Weight (lbs)
1960–1962
1971–1974
1976–1980
1988–1994
1999–2002
Survey period
2170

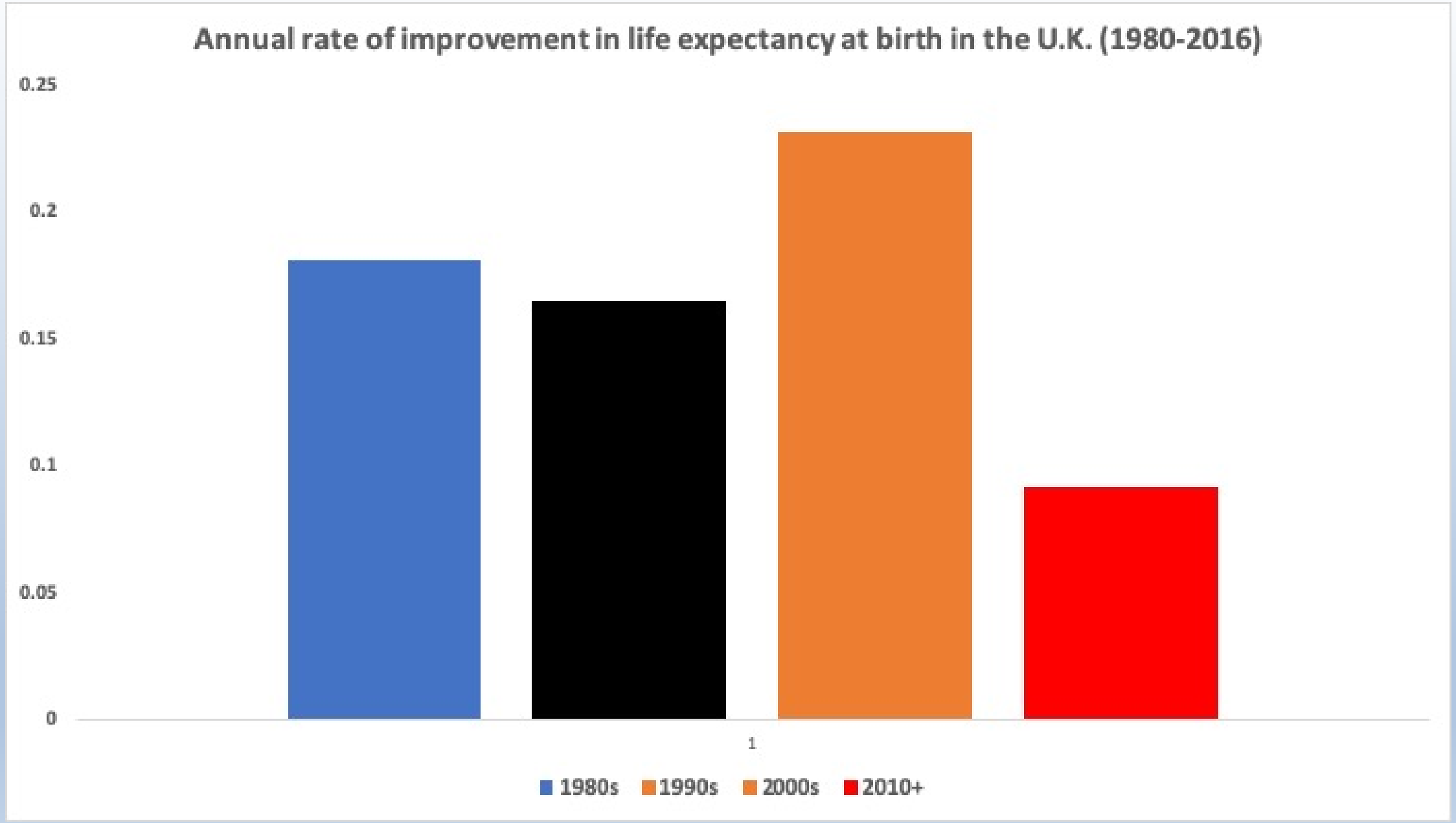
World Record for the 1-Mile Run (Males)

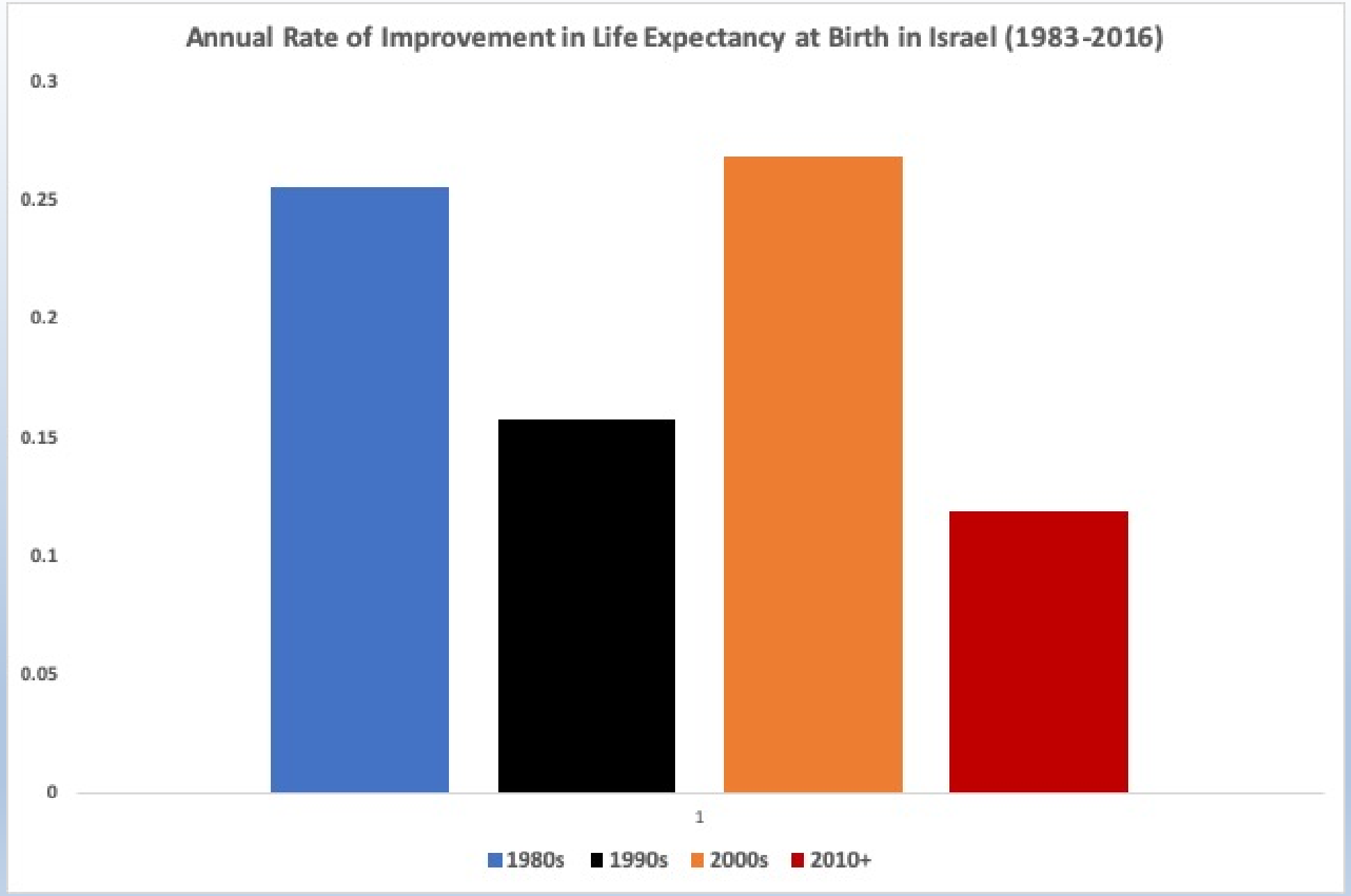


Source: World Almanac, 1985; 1990; 1995


Annual Rate of Improvement in Life Expectancy at Birth in the United States (1980-2017)
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
1
1980s
1990s
2000s
2010+


Annual rate of improvement in life expectancy at birth in Canada (1980-2016)
0.25
0.2
0.15
0.1
0.05
0
1
1980s
1990s
2000s
2010+


Annual rate of improvement in life expectancy at birth in the U.K. (1980-2016)
0.25
0.2
0.15
0.1
0.05
0
1
1980s
1990s
2000s
2010+


Annual Rate of Improvement in Life Expectancy at Birth in Israel (1983-2016)
0.3
0.25
0.2
0.15
0.1
0.05
0
1
1980s
1990s
2000s
2010+

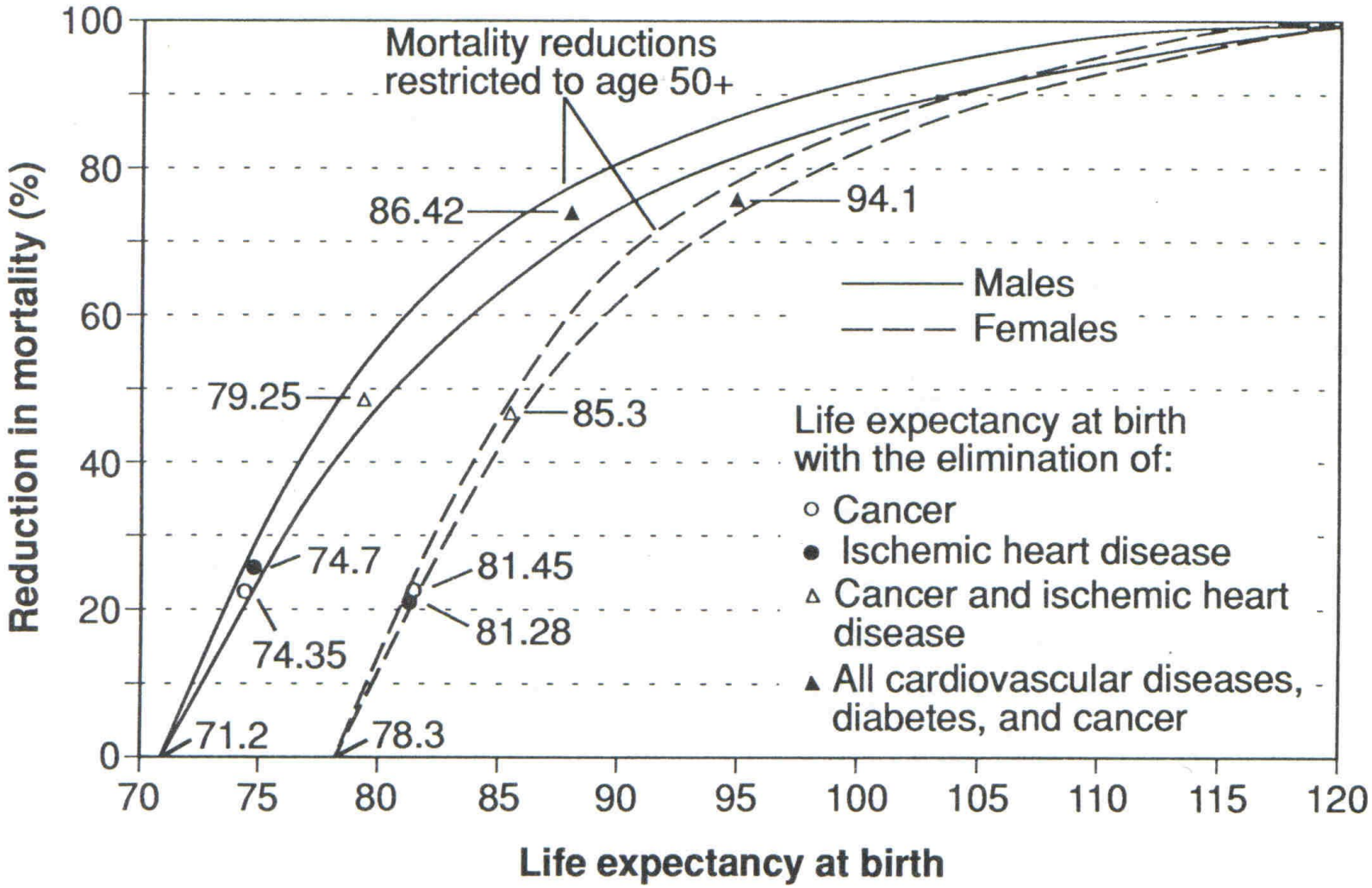
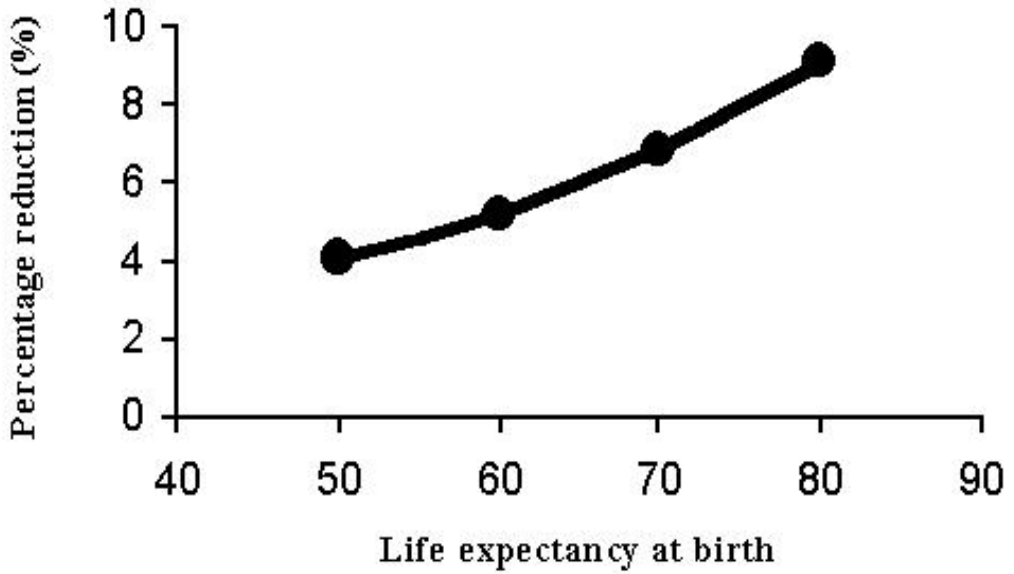


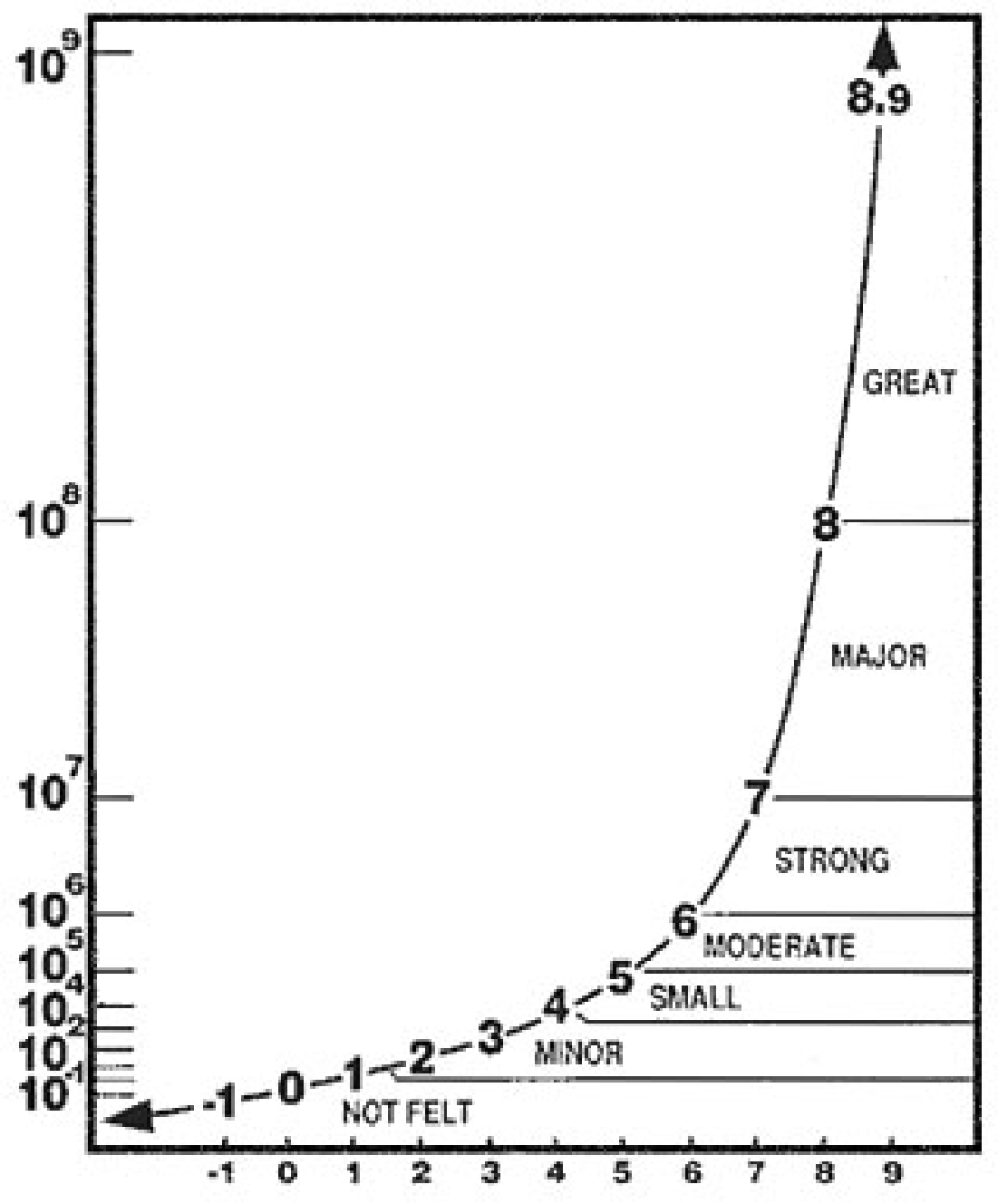
Fig. 2. Percentage of reduction in the conditional probability of death for the United States (from 1985 levels) required to produce a life expectancy at birth from 80 to 120 years.

Source: Olshansky, Carnes and Cassel, 1990. *Science*.

Percentage reduction in death rates at all ages required to raise life expectancy at birth by one year



SOURCE: Olshansky, Carnes and Désesquelles, 2001. Prospects for Human Longevity. *Science*.



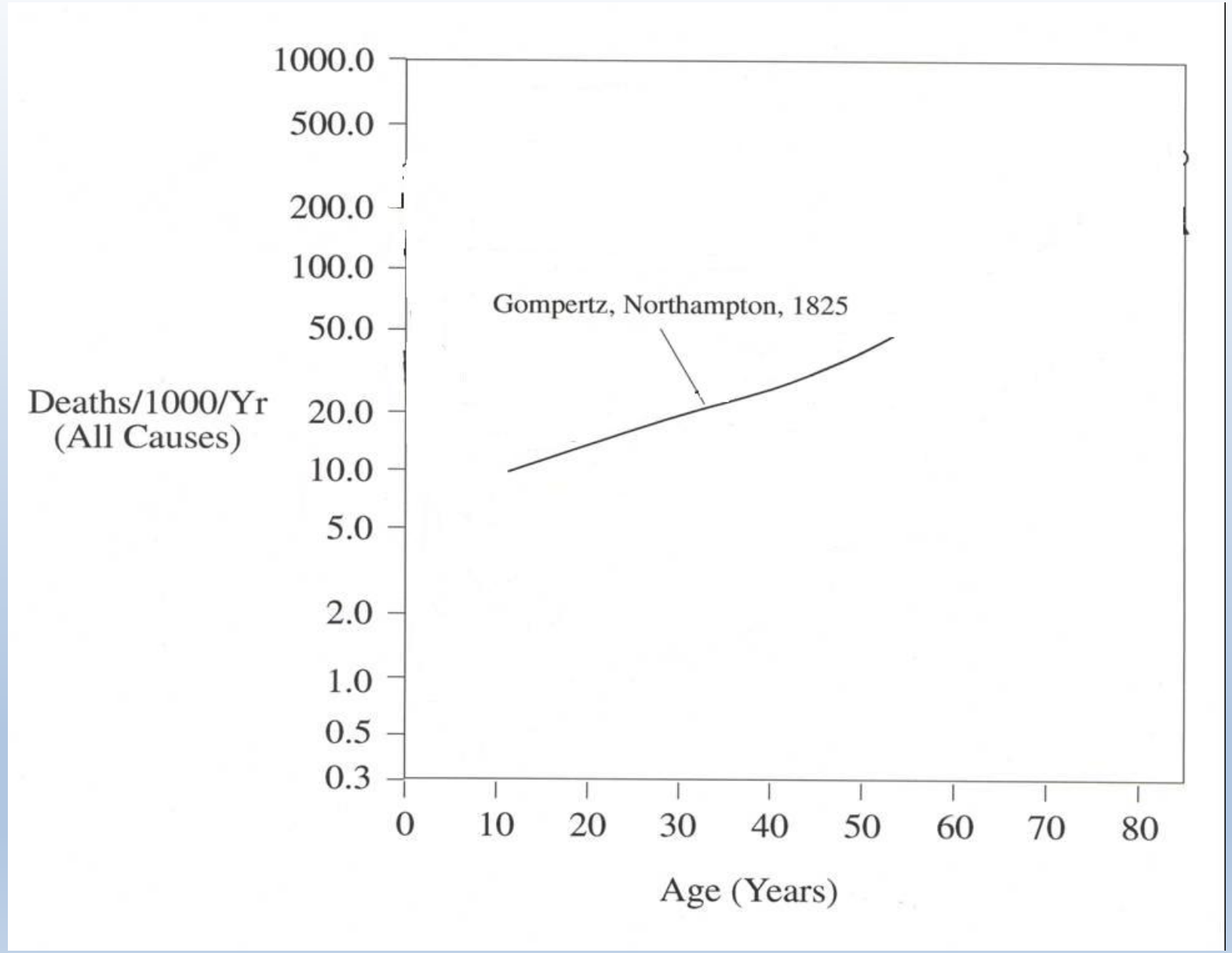
Seismic energy yield

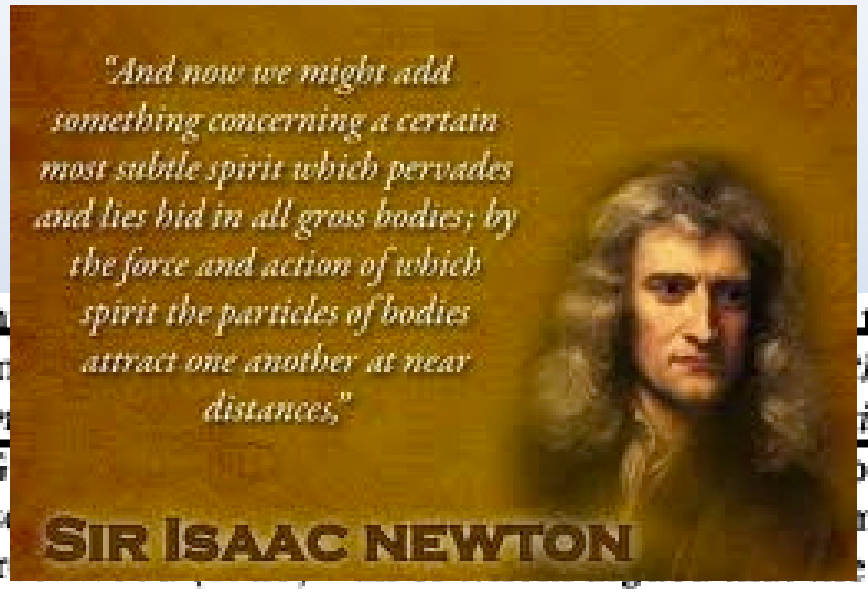
7.0 – 7.1 = 200 kilotons

8.0 – 8.1 = 6 megatons

9.0 – 91 = 300 megatons

Richter Scale used to measure energy released during an earthquake

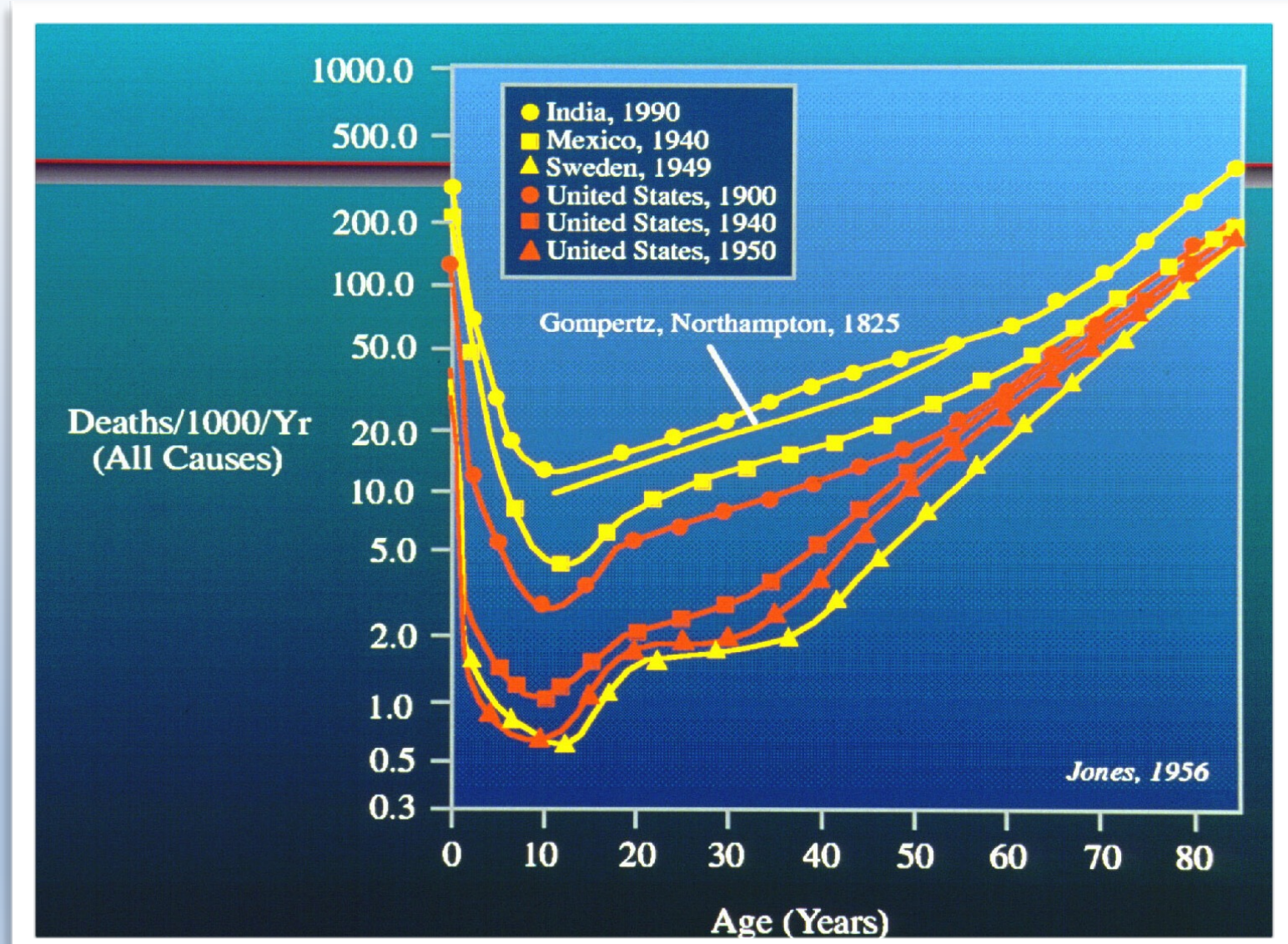

1000.0
500.0
200.0
100.0
50.0
20.0
10.0
5.0
2.0
1.0
0.5
0.3
Deaths/1000/Yr
(All Causes)
Gompertz, Northampton, 1825
0
10
20
30
40
50
60
70
80
Age (Years)



separated Gom... to provide a biologi-
cal explanation... *this law of mortality, I endeavored to en... istence"* (1825: 333).
The work of G... ol of thought within the actuarial s... n (1867), Brownlee (1919), and Gr... life table embodied biological principles in addition to its traditional role as a working tool for actuaries. The "law of mortality" was originally developed as an actuarial tool with a focus exclusively on human mortality, but enhanced by modest speculation about the biology of aging.

1687 Newton's Law of Universal Gravitation

Gompertz (1825) – summarized in Olshansky and Carnes (1997) Ever Since Gompertz

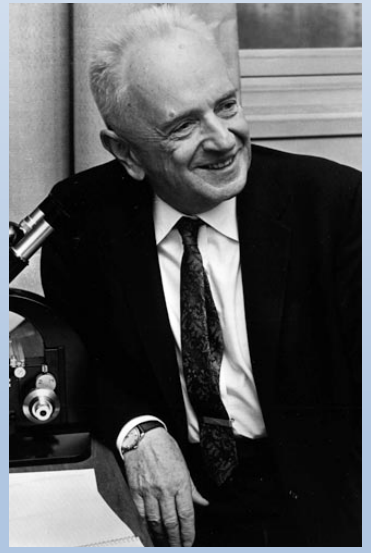

1000.0
500.0
200.0
100.0
50.0
20.0
10.0
5.0
2.0
1.0
0.5
0.3
Deaths/1000/Yr
(All Causes)
India, 1990
Mexico, 1940
Sweden, 1949
United States, 1900
United States, 1940
United States, 1950
Gompertz, Northampton, 1825
Jones, 1956
0
10
20
30
40
50
60
70
80
Age (Years)

The Bridge of Life

The Chances of Death by Karl Pearson (1897)

Why does death occur with such regularity?

"Nothing in biology makes sense except in the light of evolution."

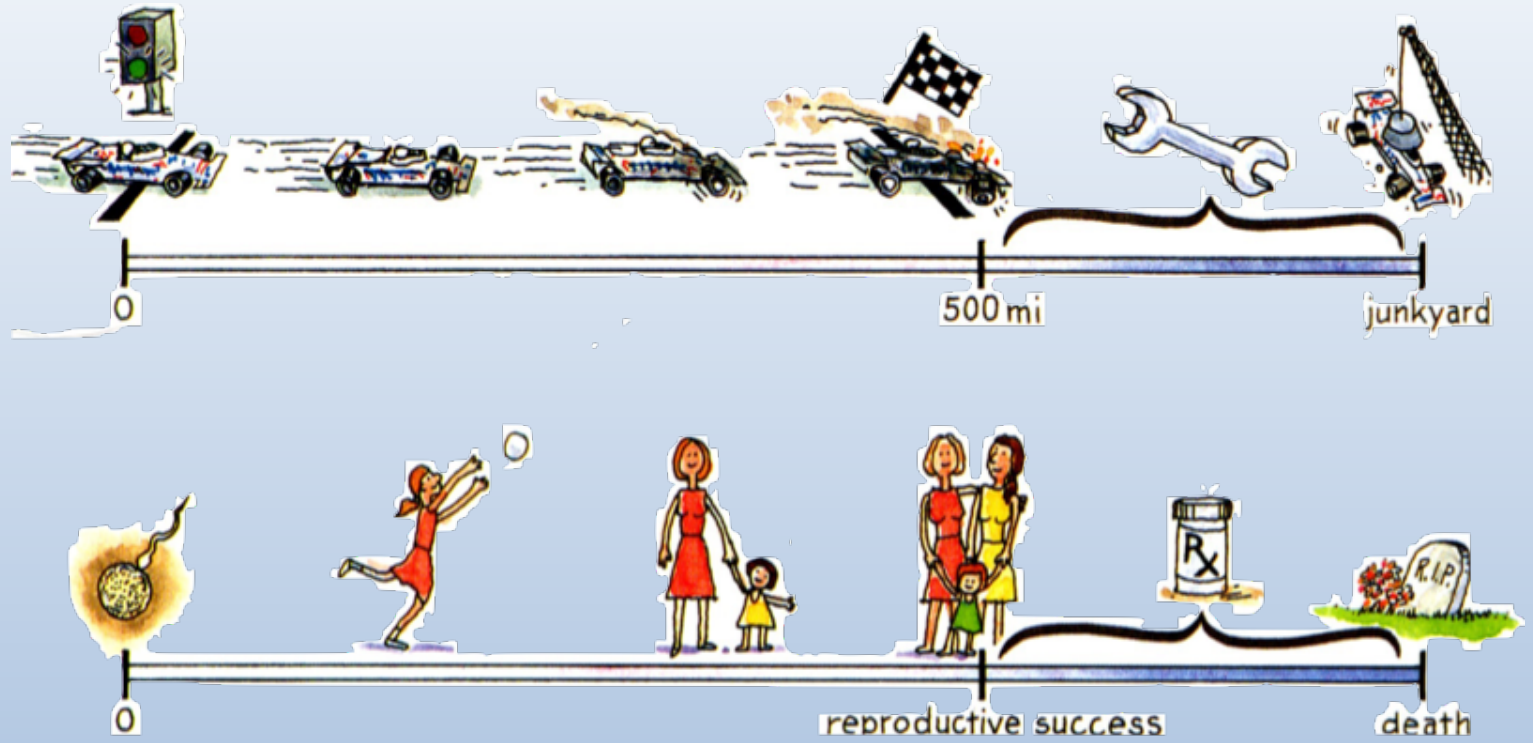


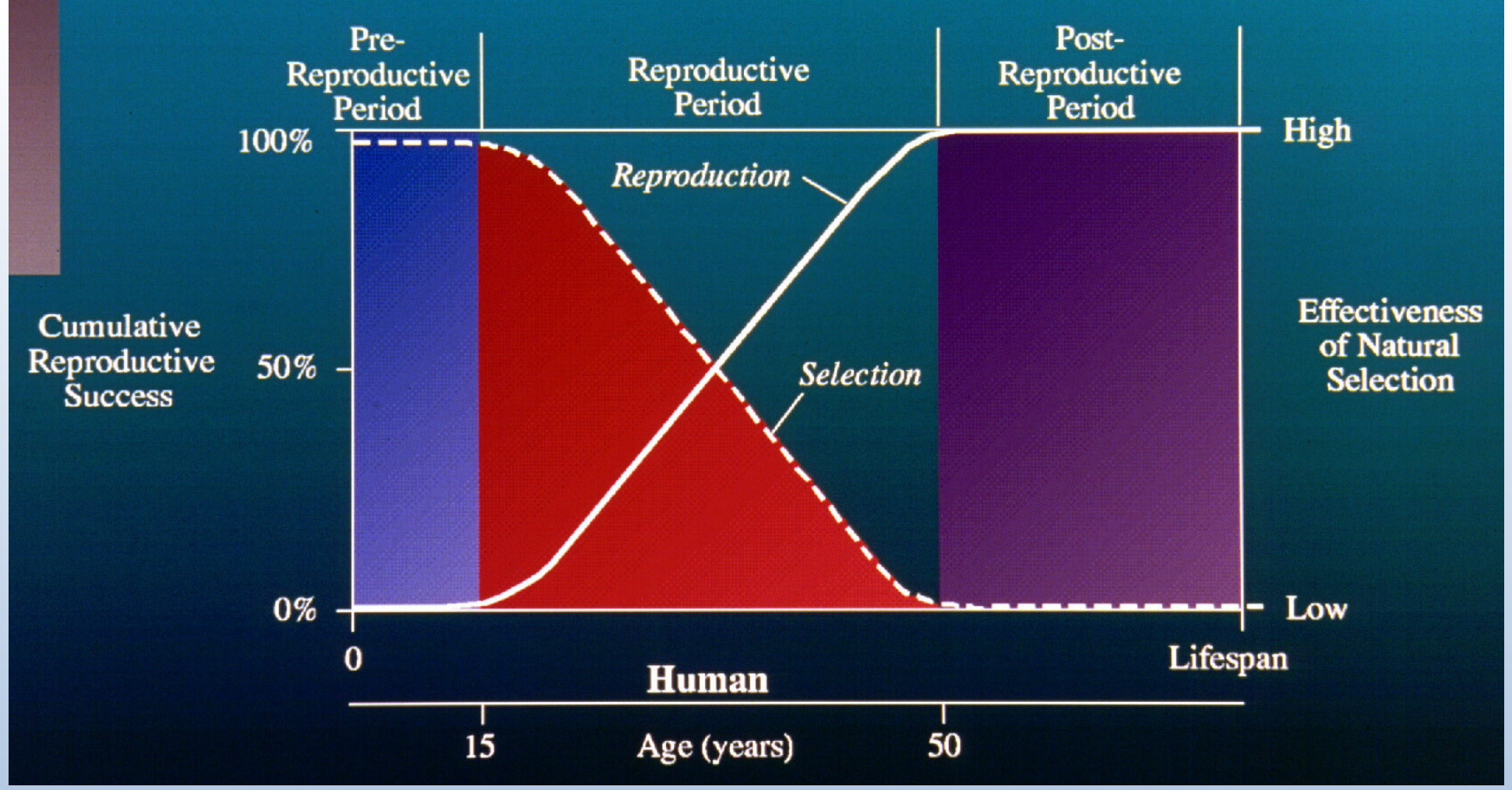
Theodosius Dobzhansky

The American Biology Teacher, March 1973

WHY Do We Age and Live as Long as We Do?


BENTLEY


0
500 mi
junkyard
0
reproductive success
death
Rx
R.I.P.



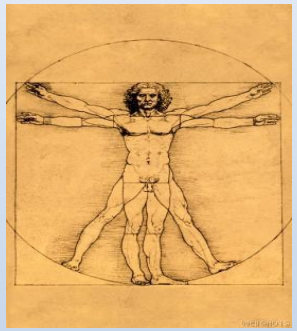
There is a remarkable consistency to the timing of death across species.

Duration of life is calibrated to the onset and length of a species' reproductive window.

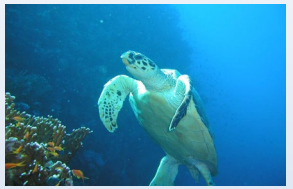
1,000 days
mouse

5,000 days
dog

26,000 days
elephant



45,000 days
Human
(max)
29,000 (avg)

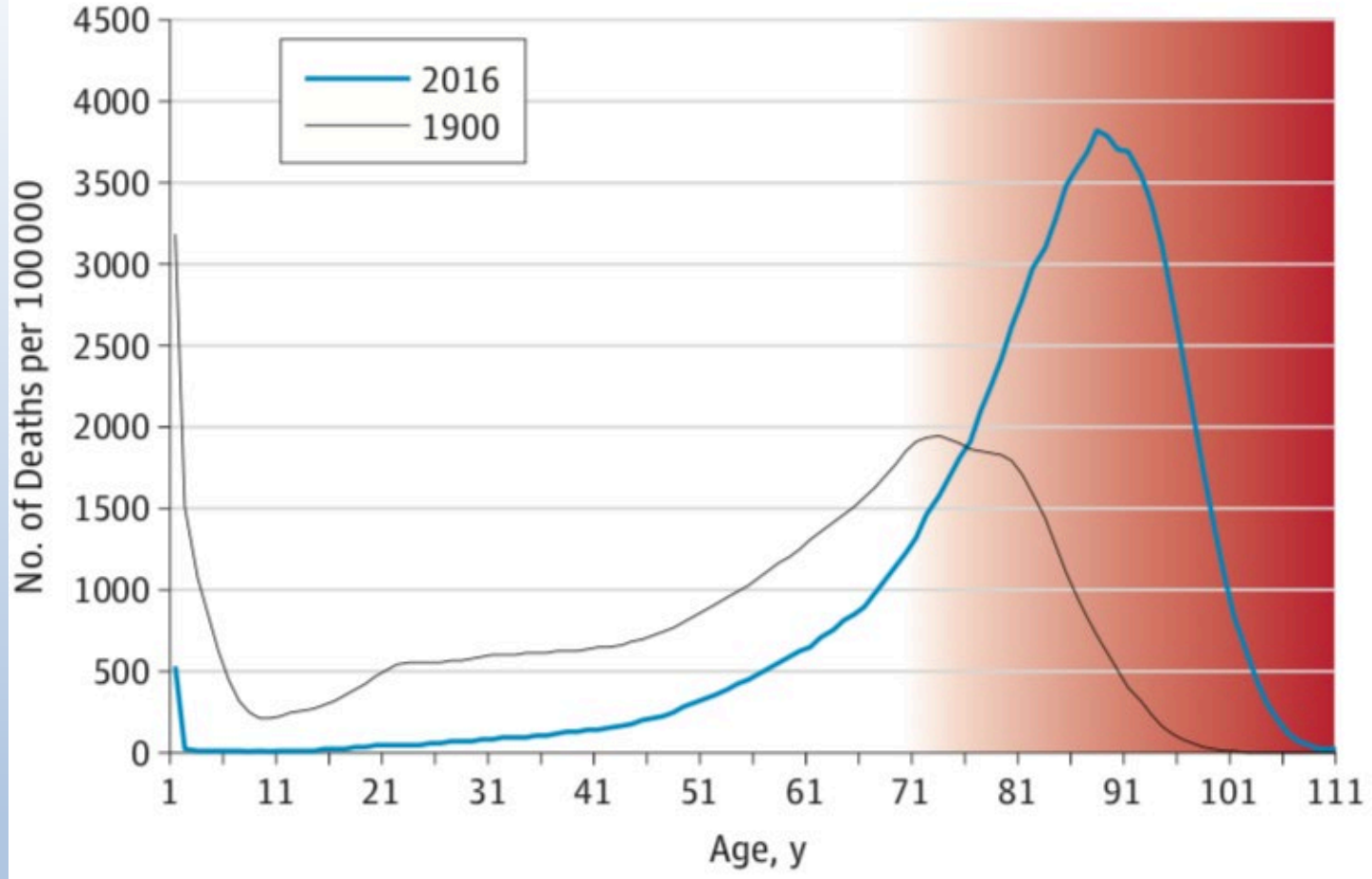


55,000 days
sea turtle

77,000 days
bowhead whale

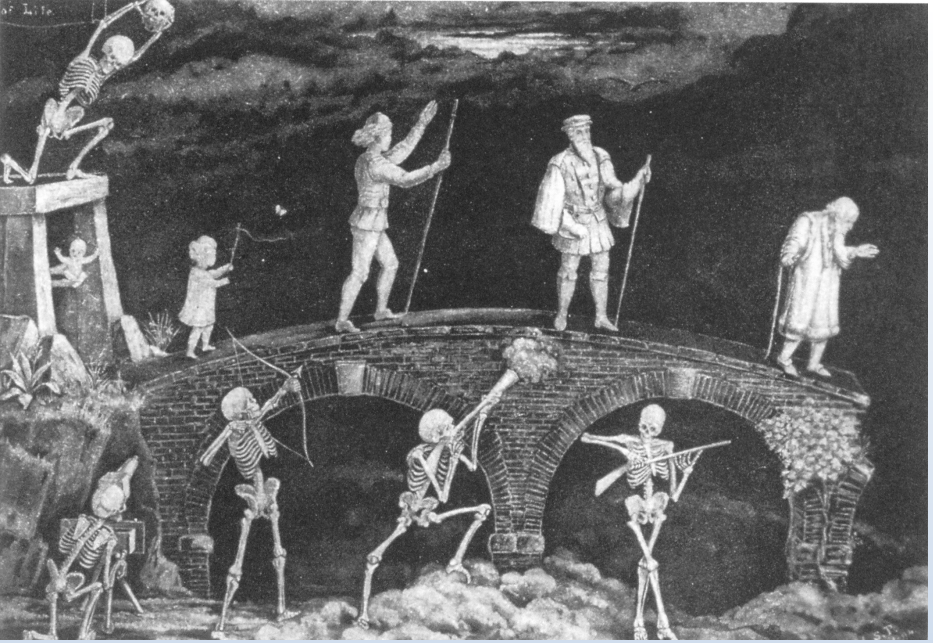
146,000 days
Greenland shark

Figure. Age Distribution of Life Table Deaths for Women in the United States, per 100 000 People, 1900 and 2016

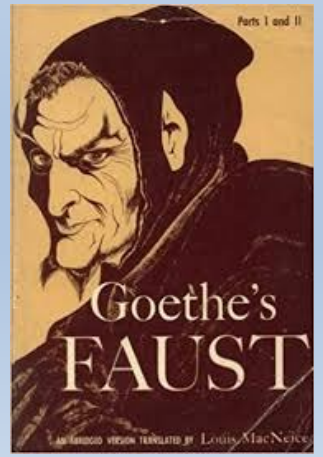


The red zone represents a period in life when the risk of frailty and disability begins to increase rapidly. The goal of aging science is to delay and compress the red zone, which may extend healthy life. Sources: 1900 data from Bell and Miller[1]; 2016 data from Human Mortality Database.[2]

Olshansky, S.J. 2018. *JAMA*.320(13):1323-1324

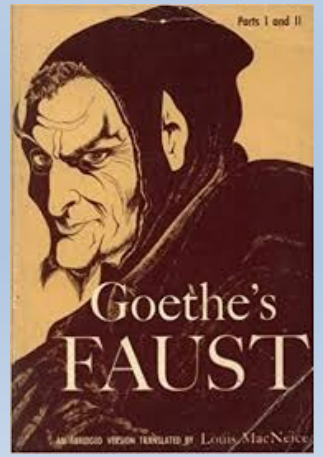


The Faustian Longevity Bargain



Faust's Bargain

- Faust is disillusioned with his own limits to knowledge -- turns to suicide.
- Mephistopheles makes Faust an offer. Faust's soul in exchange for unlimited knowledge and continuous youthful vigor.
- The story of Faust is a metaphor for a bargain that at first seems appealing, but with time is revealed to be a ruse.



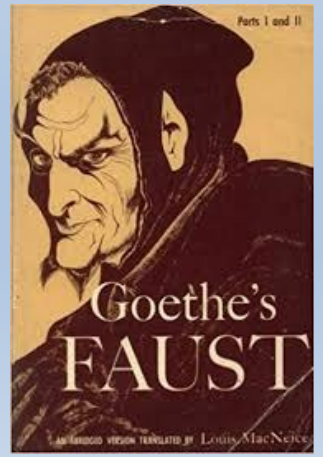
The First Longevity Bargain

The Offer

- Declines in infant and child mortality
- 30 years added to life expectancy at birth
- Most get to survive past age 65

The Price

- Heart disease, cancer, stroke, Alzheimer's, etc.
- Dramatic increase in all fatal and disabling conditions of aging
- An insatiable thirst for more longevity



The Latest Longevity Bargain

The Offer

- Reductions in cancer, stroke, and heart disease
- Incrementally smaller gains in longevity (weeks and months)
- Decelerating increases in life expectancy
- Additional survival into extreme old age

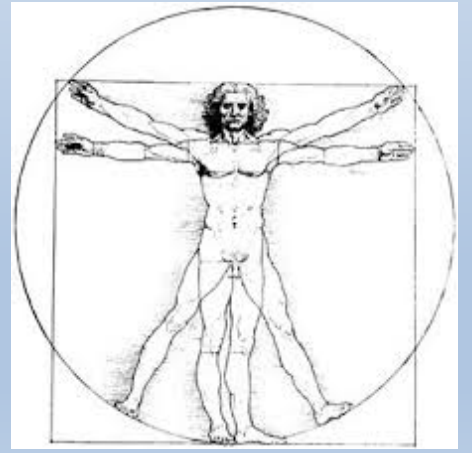
The Price

- Our fears about Alzheimer's disease and other neurological conditions rising dramatically come true
- Increased prevalence and duration of frailty and disability
- The Failures of Success becomes reality

Logic Behind Longevity Dividend/Geroscience

- The timing of reproduction is calibrated to the level of hostility in the environment.

- Fixed genetic programs for growth and development, reproduction, human body design, and our life history are all byproducts.



77,000 days

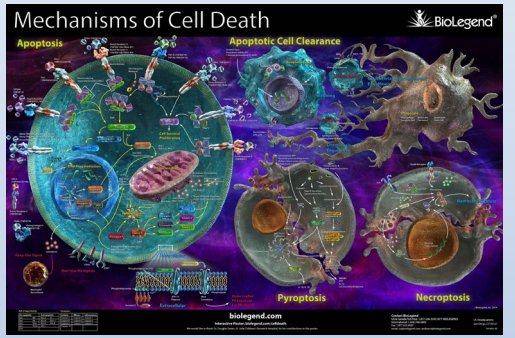
1,000 days

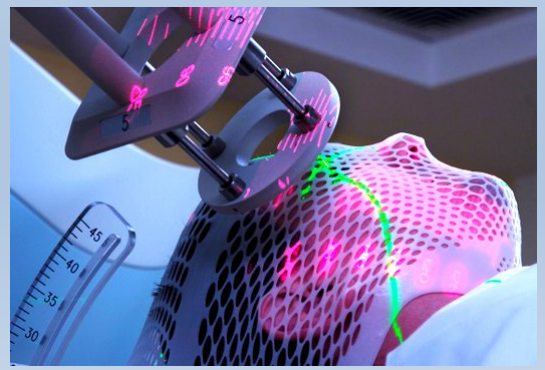
- Duration of life is calibrated to reproduction and limited by body design.

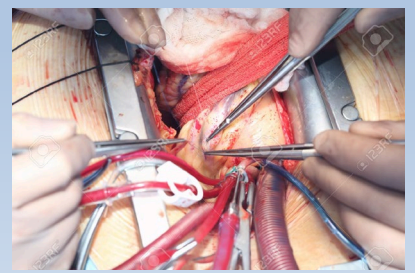
Logic Behind Longevity Dividend/Geroscience

- Aging is an inadvertent byproduct of fixed genetic programs for early life events.

- In long-lived populations, aging becomes the most important risk factor for the diseases and infirmities linked to old age.





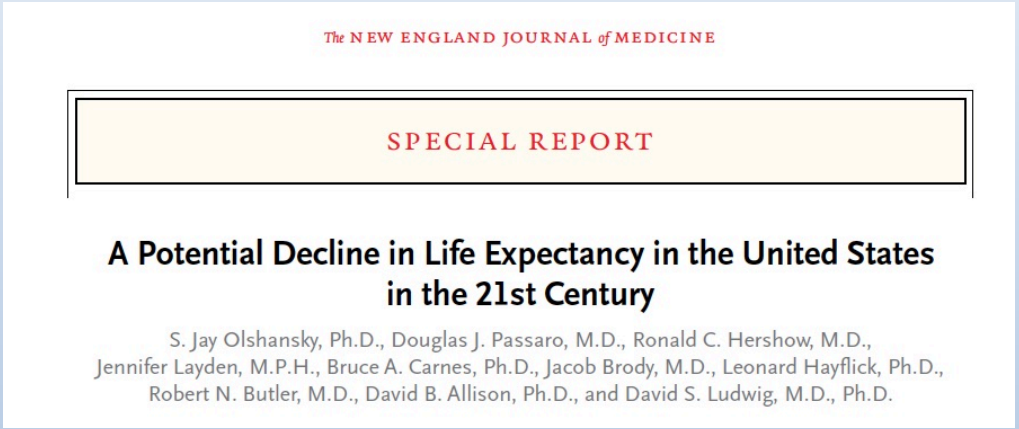


- Life extension caused only by disease reduction exposes the saved population to an elevated risk of aging becoming an even more powerful risk factor.

Logic Behind Longevity Dividend/Geroscience

- Death is a zero sum game. When one disease declines, another must rise – known as competing risks or whack-a-mole. It's all about tradeoffs.

- Life expectancy will soon level off or even decline as we approach the limits of our body design.



The NEW ENGLAND JOURNAL of MEDICINE

SPECIAL REPORT

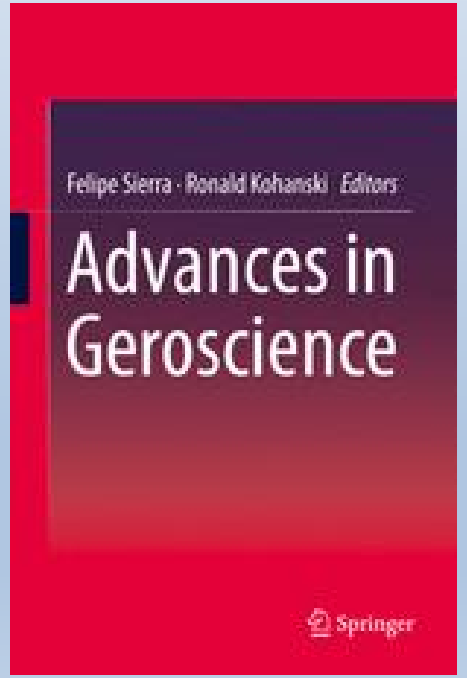
A Potential Decline in Life Expectancy in the United States in the 21st Century

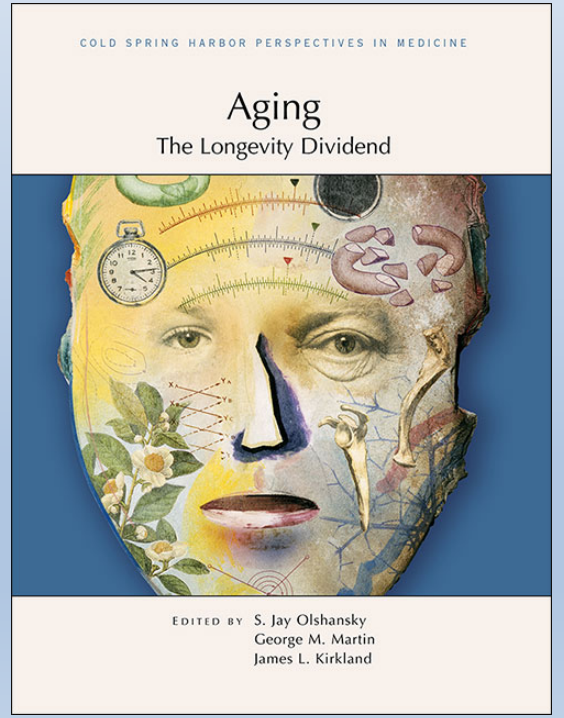
S. Jay Olshansky, Ph.D., Douglas J. Passaro, M.D., Ronald C. Hershow, M.D., Jennifer Layden, M.P.H., Bruce A. Carnes, Ph.D., Jacob Brody, M.D., Leonard Hayflick, Ph.D., Robert N. Butler, M.D., David B. Allison, Ph.D., and David S. Ludwig, M.D., Ph.D.

- We may be on the verge of an accelerated increase in diseases we are most afraid of – such as Alzheimer's

Logic Behind Longevity Dividend/Geroscience

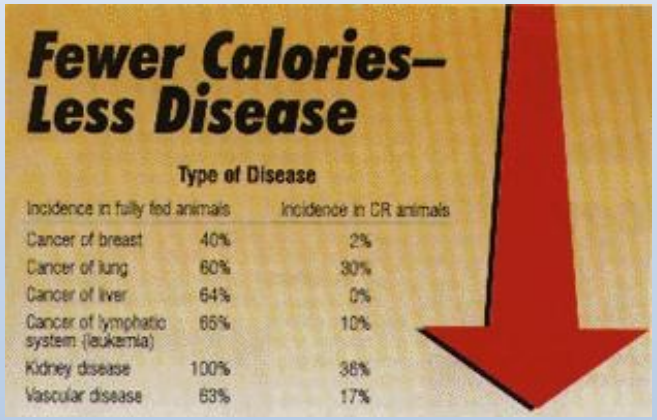
- A new paradigm in public health is required -- attack all fatal and disabling diseases at once by modulating the biological processes of aging.
- Geroscience becomes the most effective method of primary prevention of all fatal and disabling diseases.





Do We Need to Know in Advance Which Scientific Pathways to the Longevity Dividend Will Work?

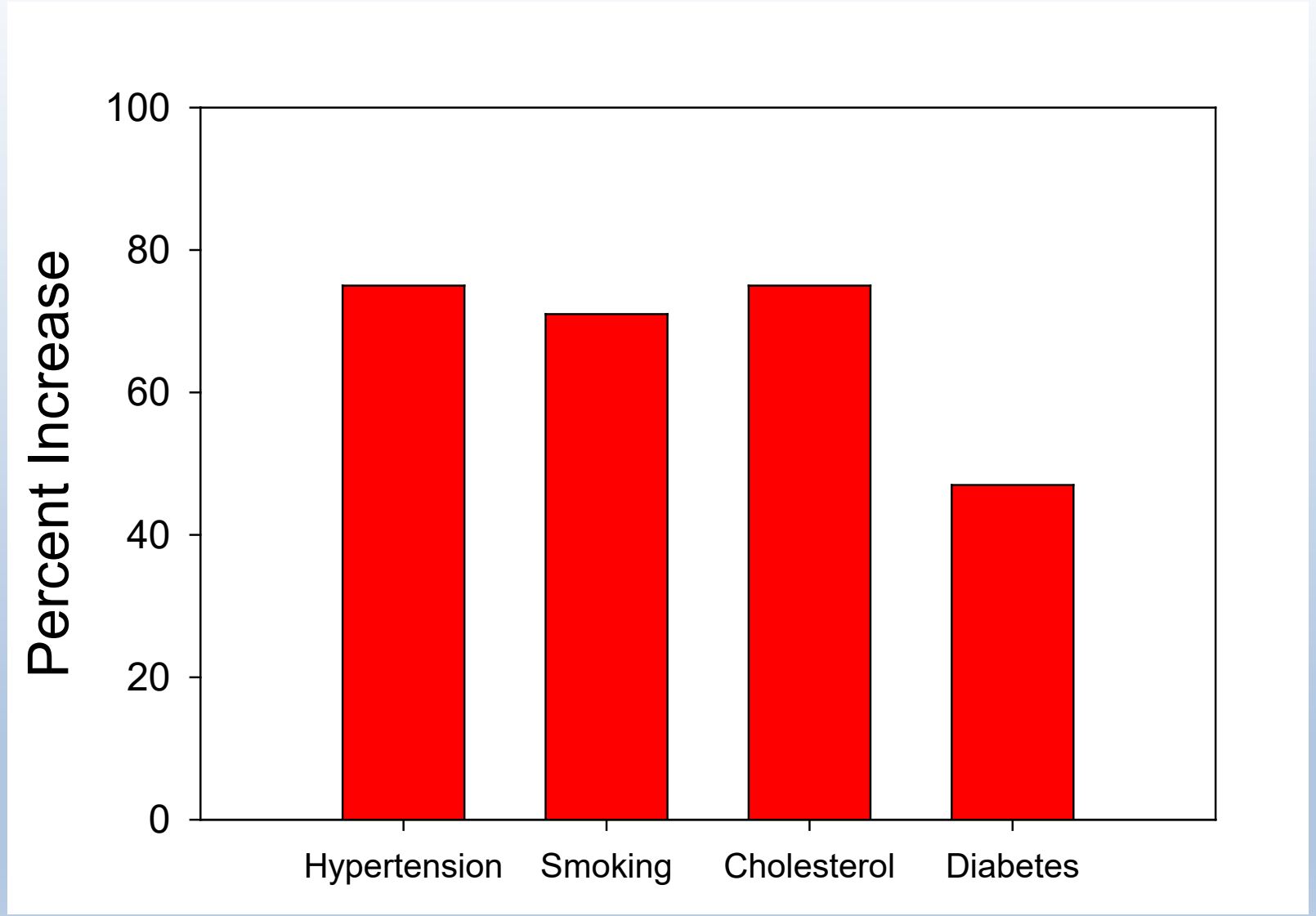
Genetics of long-lived people



Caloric restriction

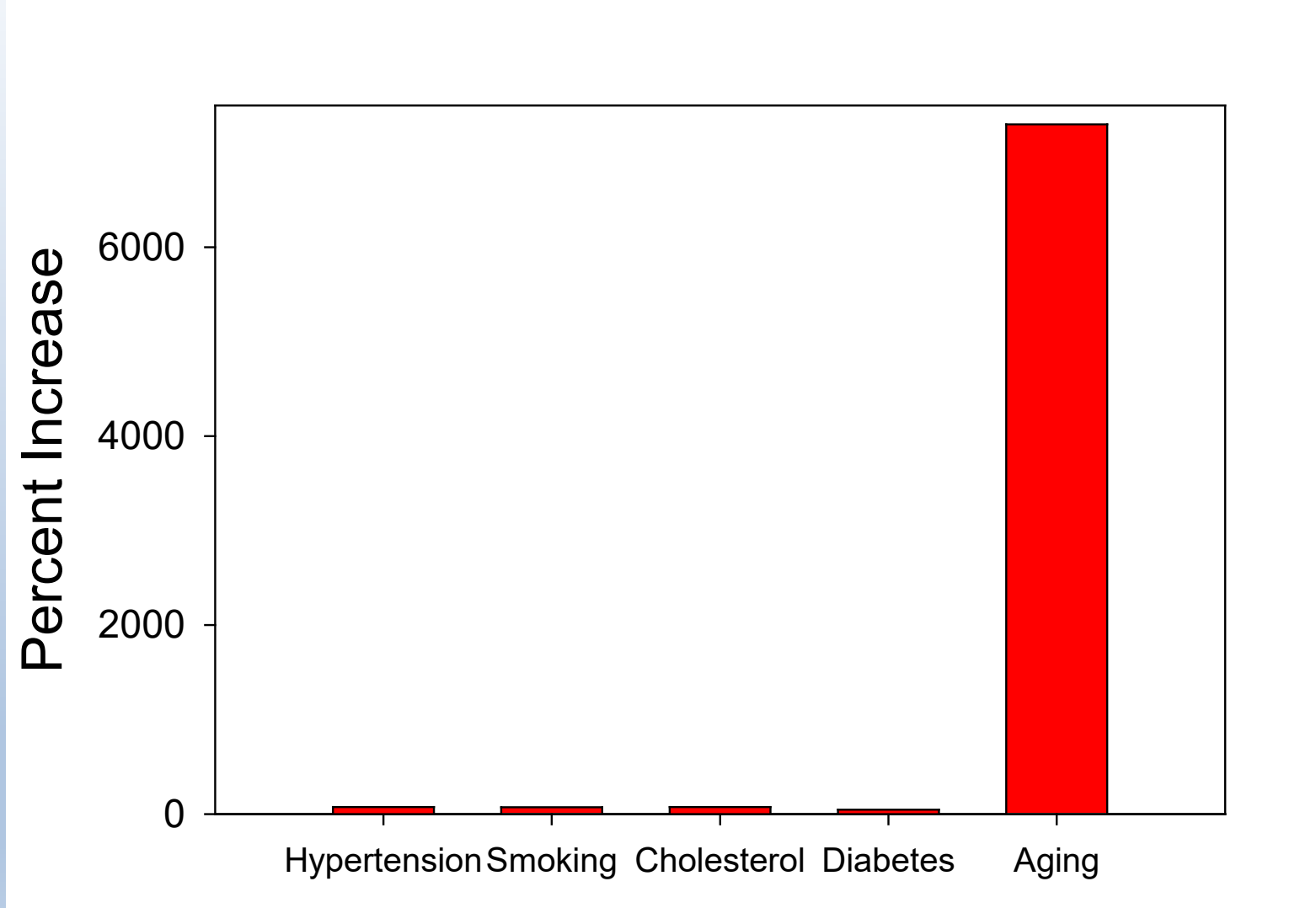
Compounds with properties that appear to slow aging

Risk Factors for Heart Disease



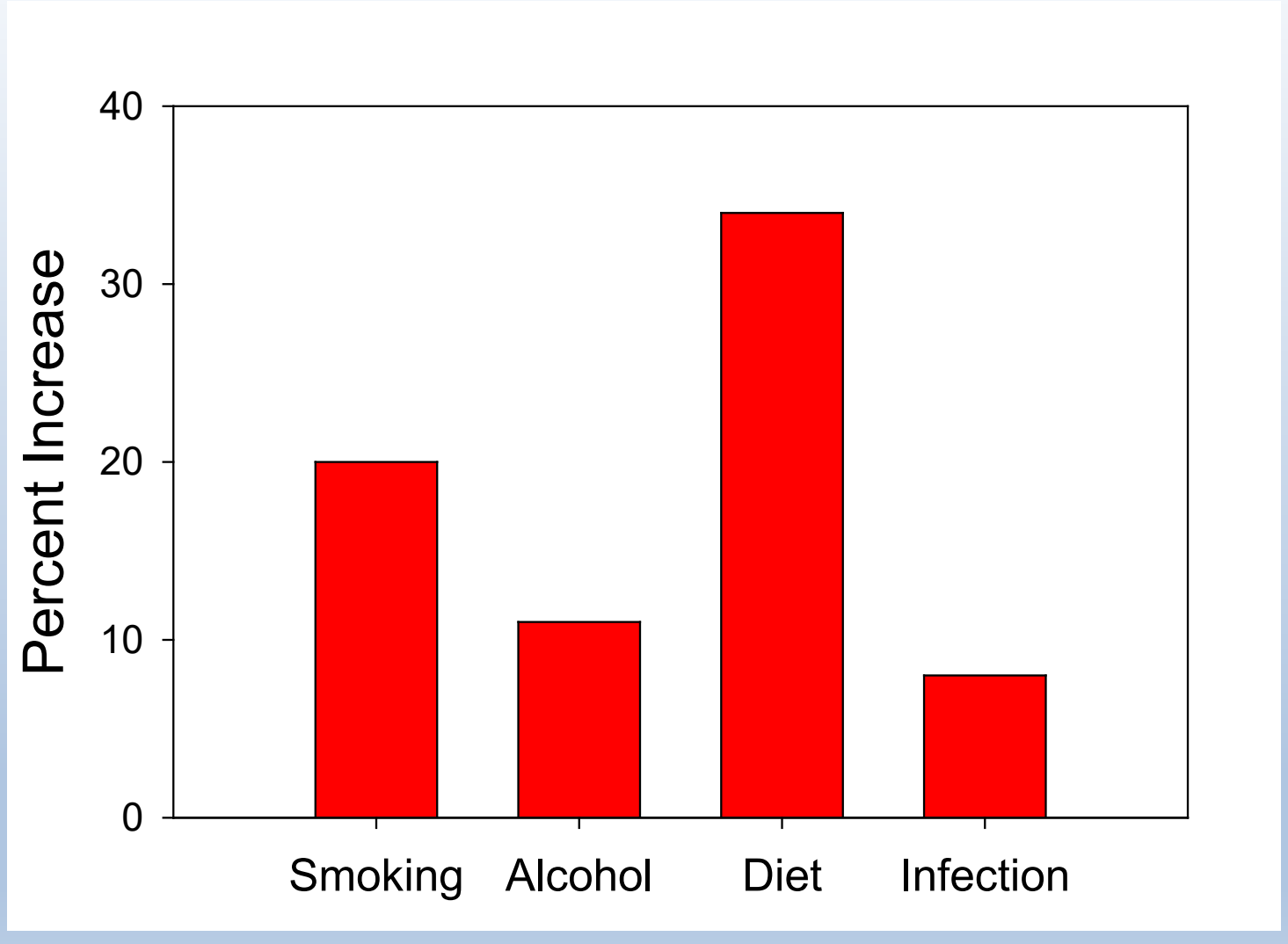
Source: Aging as a Risk Factor. Kochanek KD, Xu J, Murphy SL, Miniño AM, Hsiang-Ching K (2011). Deaths: Preliminary Data from 2009. *National Vital Stats. Rep*. (2009) 59(4):1-68. **Change 1999 – 2009 in Deaths from Selected Diseases** (comparison of data from Kochanek et al. (2011) Table 2 with Heron et al (2009) Table 9). Heron M, Hoyert DL, Murphy SL, Xu J, Kochanek KD, Tejada-Vera B (2009). Deaths: Final data for 2006. .*Natl Vital Stats. Rep*. 57(14):1-136. Interpreted as percentage increase in the risk of death for a specified disease independent of all other risk factors.

Risk Factors for Heart Disease



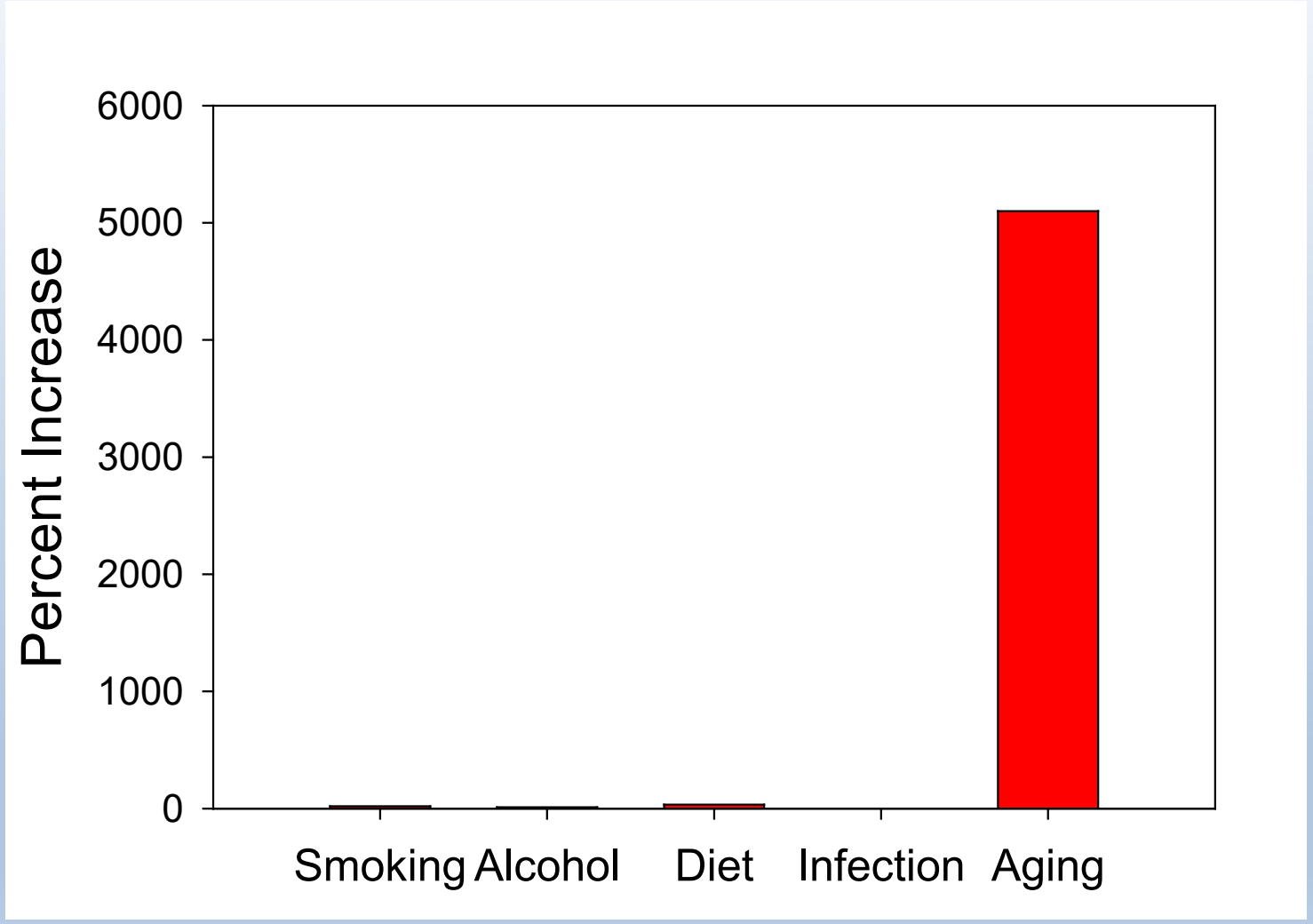
Source: Aging as a Risk Factor. Kochanek KD, Xu J, Murphy SL, Miniño AM, Hsiang-Ching K (2011). Deaths: Preliminary Data from 2009. *National Vital Stats. Rep*. (2009) 59(4):1-68. **Change 1999 – 2009 in Deaths from Selected Diseases** (comparison of data from Kochanek et al. (2011) Table 2 with Heron et al (2009) Table 9). Heron M, Hoyert DL, Murphy SL, Xu J, Kochanek KD, Tejada-Vera B (2009). Deaths: Final data for 2006. .*Natl Vital Stats. Rep*. 57(14):1-136.

Risk Factors for Cancer



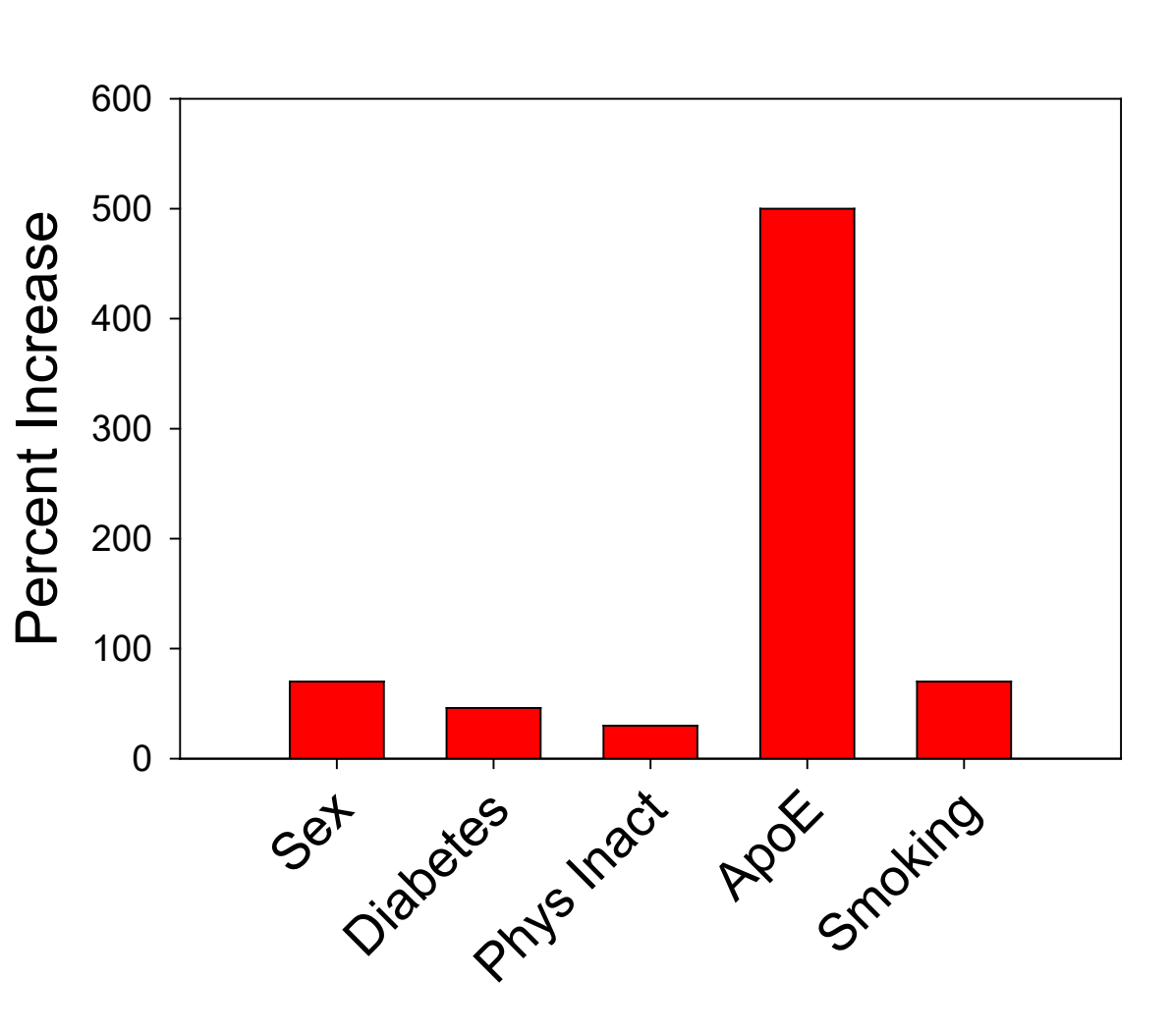
Source: Aging as a Risk Factor. Kochanek KD, Xu J, Murphy SL, Miniño AM, Hsiang-Ching K (2011). Deaths: Preliminary Data from 2009. *National Vital Stats. Rep*. (2009) 59(4):1-68. **Change 1999 – 2009 in Deaths from Selected Diseases** (comparison of data from Kochanek et al. (2011) Table 2 with Heron et al (2009) Table 9). Heron M, Hoyert DL, Murphy SL, Xu J, Kochanek KD, Tejada-Vera B (2009). Deaths: Final data for 2006. .*Natl Vital Stats. Rep*. 57(14):1-136.

Risk Factors for Cancer



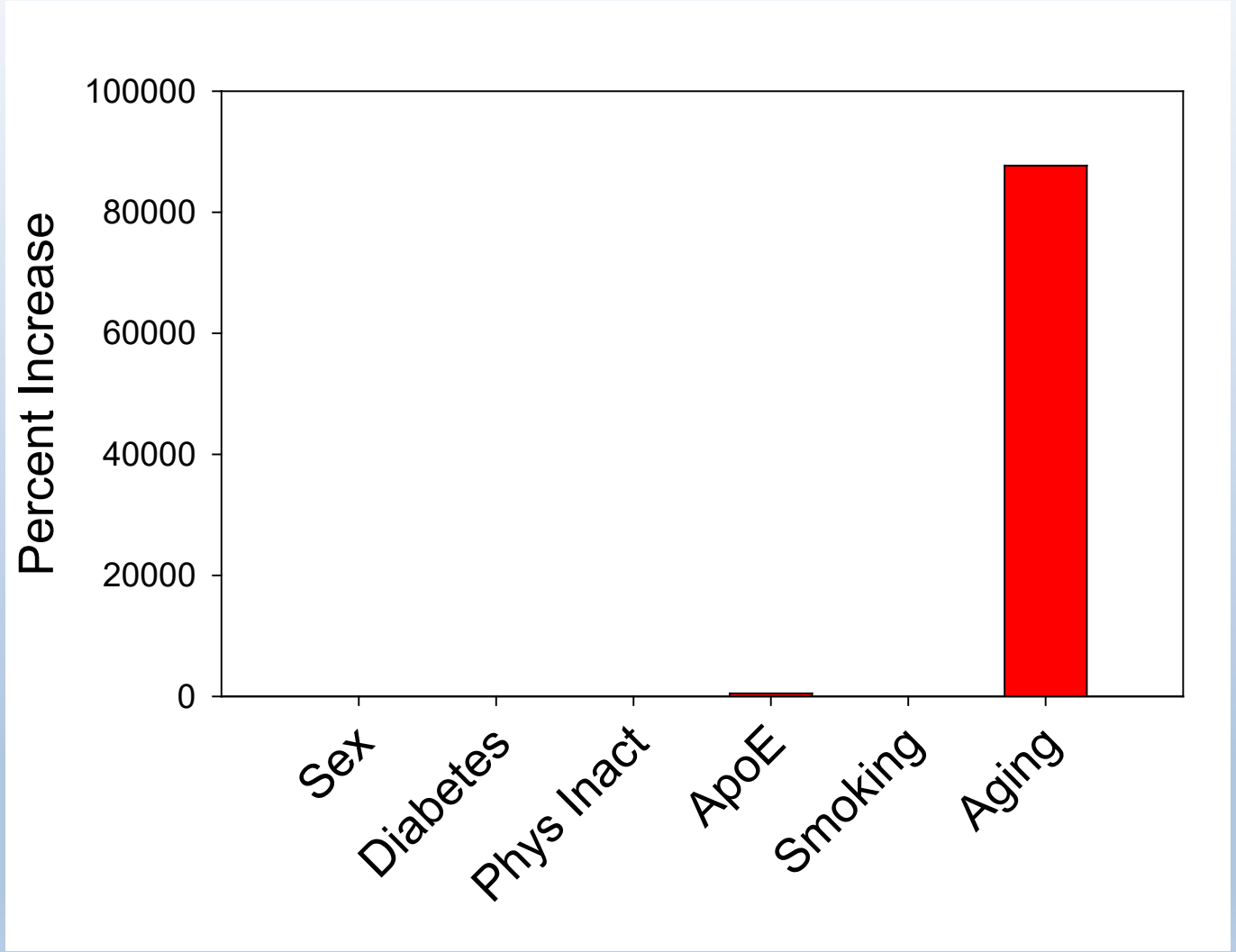
Source: Aging as a Risk Factor. Kochanek KD, Xu J, Murphy SL, Miniño AM, Hsiang-Ching K (2011). Deaths: Preliminary Data from 2009. *National Vital Stats. Rep*. (2009) 59(4):1-68. **Change 1999 – 2009 in Deaths from Selected Diseases** (comparison of data from Kochanek et al. (2011) Table 2 with Heron et al (2009) Table 9). Heron M, Hoyert DL, Murphy SL, Xu J, Kochanek KD, Tejada-Vera B (2009). Deaths: Final data for 2006. .*Natl Vital Stats. Rep*. 57(14):1-136.

Risk Factors for Alzheimer's Disease



Source: Aging as a Risk Factor. Kochanek KD, Xu J, Murphy SL, Miniño AM, Hsiang-Ching K (2011). Deaths: Preliminary Data from 2009. *National Vital Stats. Rep*. (2009) 59(4):1-68. **Change 1999 – 2009 in Deaths from Selected Diseases** (comparison of data from Kochanek et al. (2011) Table 2 with Heron et al (2009) Table 9). Heron M, Hoyert DL, Murphy SL, Xu J, Kochanek KD, Tejada-Vera B (2009). Deaths: Final data for 2006. .*Natl Vital Stats. Rep*. 57(14):1-136.

Risk Factors for Alzheimer's Disease



Source: Aging as a Risk Factor. Kochanek KD, Xu J, Murphy SL, Miniño AM, Hsiang-Ching K (2011). Deaths: Preliminary Data from 2009. *National Vital Stats. Rep*. (2009) 59(4):1-68. **Change 1999 – 2009 in Deaths from Selected Diseases** (comparison of data from Kochanek et al. (2011) Table 2 with Heron et al (2009) Table 9). Heron M, Hoyert DL, Murphy SL, Xu J, Kochanek KD, Tejada-Vera B (2009). Deaths: Final data for 2006. .*Natl Vital Stats. Rep*. 57(14):1-136.


REMEMBER THE TWENTY EXTRA YEARS YOU ADDED TO YOUR LIFE THROUGH CLEAN, HEALTHY LIVING? - WELL, THESE ARE THEM.

Facilitator
Jenny L. Boyer, MD, JD, PhD

Chair-Elect, AMA Senior Physicians Section Governing Council

Questions from Audience Members

If you have questions, contact
Alice Reed, Group Manager,
AMA Senior Physicians Section

alice.reed@ama-assn.org

Physicians' powerful ally in patient care