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

Confidential reporting:
lighthouse-services.com/ama
(800) 398-1496
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Narayana Murali, MD
Member since 2002
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?
THIS BABY COULD LIVE TO BE 142 YEARS OLD
Dispatches From the Frontiers of Longevity

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 little 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.
World Record for the 1-Mile Run (Males)

Annual rate of improvement in life expectancy at birth in Canada (1980-2016)
Annual rate of improvement in life expectancy at birth in the U.K. (1980-2016)
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.

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

Seismic energy yield

7.0 – 7.1 = 200 kilotons

8.0 – 8.1 = 6 megatons

9.0 – 9.1 = 300 megatons

Richter Scale used to measure energy released during an earthquake
Gompertz (1825) – summarized in Olshansky and Carnes (1997) Ever Since Gompertz

Newton’s Law of Universal Gravitation

“...and now we might add something concerning a certain most subtle spirit which pervades and lies hid in all gross bodies; by the force and action of which spirit the particles of bodies attract one another at near distances.”
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?
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
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; 2016 data from Human Mortality Database.
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.

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

1,000 days

77,000 days
• 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.
• 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.

• 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

Risk Factors for Heart Disease

Risk Factors for Cancer

Risk Factors for Cancer

Risk Factors for Alzheimer’s Disease

Risk Factors for Alzheimer’s Disease

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
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