Aging and the Human Body

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Everybody will experience aging

... but it is poorly understood
Outline

I. How and why scientists study aging

II. How what we’ve learned applies to humans
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Studying aging will help people

- There are lots of elderly people
  - 2 billion people over age 60 by 2050, according to the UN

- Aging is expensive
  - Alzheimer’s disease patients cost Medicare 60% more than unaffected people

- Aging is fully prevalent, penetrant and incurable
Studying aging is cool

- Fundamental and universal?
- Links to metabolism, repair and maintenance, inflammation
Human aging takes many forms

- Frailty
- Diminished mental capacity
- Wrinkles and cosmetic changes
- More things break
- Increased risk of death with time

Death illustration by Mozaika2 (Own work) [CC BY-SA 3.0 (http://creativecommons.org/licenses/by-sa/3.0)], via Wikimedia Commons. https://commons.wikimedia.org/wiki/File:Death_drawing.png
Hands are public domain art from https://commons.wikimedia.org/wiki/File:Hand_aging.jpg
(Almost) everything ages

Yes
- Humans
- Mice
- Worms & flies

Maybe not
- Planaria
- Turtles
- Bacteria
We study aging using model organisms

- Short lifespan
- Simpler than humans

By Kbradnam (Original text: Zeynep F. Altun, Editor of www.wormatlas.org) [CC BY-SA 2.5 (http://creativecommons.org/licenses/by-sa/2.5)], via Wikimedia Commons
We keep worms on plates and watch them crawl with a microscope.

Worms look like this.

They live on these plates & eat bacteria.
Worms get old, too

- Loss of long-term memory
- Fertility declines
- Muscles start to break down
- Discoloration & fattening
- Eating starts to decline

- Average lifespan: 6 days
- First worms die: Day 15
- Most worms are dead: Day 30

Adult day: 1 2 3 4 5 6 15 20 30
Scientists commonly measure lifespan curves.

Some genetic changes prolong life (in worms)

There are many ways to extend a worm’s lifespan

- Energy and metabolism
  - Insulin
  - Mitochondria (the cell’s “power plant”)
  - Calorie restriction
- Pharmaceutical drugs such as metformin
Long-lived ≠ healthy

(We don’t want to be like this sad zombie)
Quick recap

• Most animals age
• Scientists study aging in model organisms
• Some things can drastically increase the lifespan of these model organisms
Questions?
Outline

I. How and why scientists study aging

II. How what we’ve learned applies to humans
Aging humans have advantages – and challenges – that worms don’t have

- Every *C. elegans* worm has 959 cells
- Humans have about 30 trillion
- Humans replace cells and can devote resources to maintenance
Cells are replaced in the human intestine all the time

interior of the intestine

cells lining the intestine

interior of the body
Cells don’t divide forever

- Scientists can grow some types of cells in dishes
- Early 1960s, Leonard Hayflick noticed they weren’t immortal
- Stopped dividing – “senescence”
Telomeres keep track of cell divisions
Telomeres shorten with each cell division
Should we remove senescent cells?

• Can’t just cut the brakes
• Eliminating senescent cells helps in mice
• More work needs to be done

Some things help youthfulness in multiple tissues

The effects of young blood can be drastic

Scientists are still studying what is causing these effects

Clinical trials are underway

- Alkahest is giving blood from young donors to patients with Alzheimer’s disease
- It’s a long shot
- The results are expected later this month

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Scientists are making progress, but there’s still lots of work to be done!

• We know of interventions that help worms and mice – people, not so much
• We still have much to learn about why and how aging occurs
• A handful of clinical trials are underway
• Lifespan is not the same as healthy life
• A healthy diet and exercise are the best bet
Thank you!

*SITN would like to acknowledge the following organizations for their generous support*

Harvard Medical School
Office of Communications and External Relations
Division of Medical Sciences

The Harvard Graduate School of Arts and Sciences (GSAS)

The Harvard Graduate Student Council (GSC)

The Harvard Biomedical Graduate Students Organization (BGSO)

The Harvard/MIT COOP
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