

Anti-Aging: State of the Art

Felix Karg

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Why is aging a problem?

Is aging necessary?

What is aging?

How can we slow down aging?

What can I do?

How can bioinformatics help?

Why is aging a problem?

Is aging necessary?

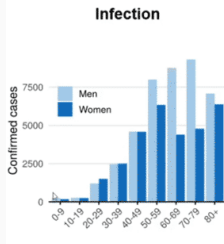
What is aging?

How can we slow down aging?

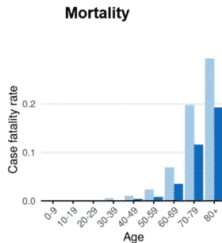
What can I do?

How can bioinformatics help?

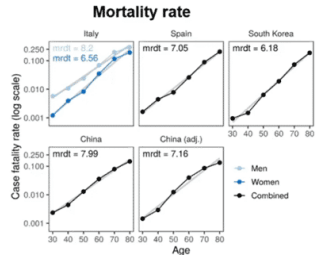
Corona Deaths correlate with Age



Weak age effect in older subjects



Very strong age effect in older subjects



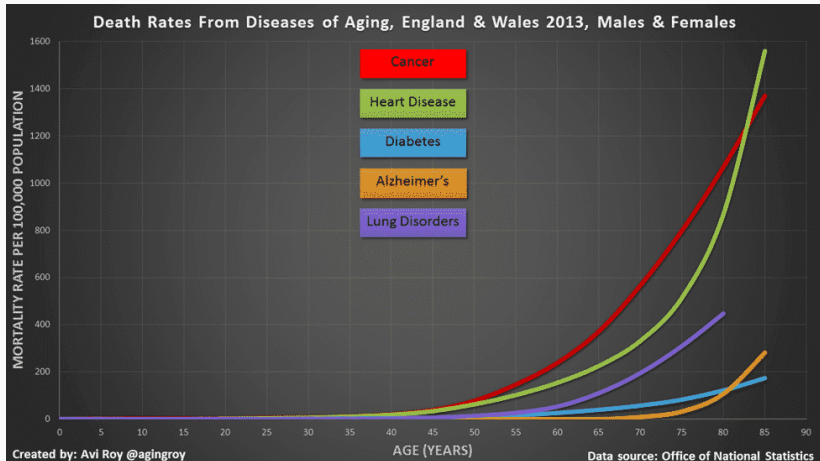
Case fatality rate is close to all-cause mortality rate doubling time

Santesmasses et al. *Aging Cell*, in press

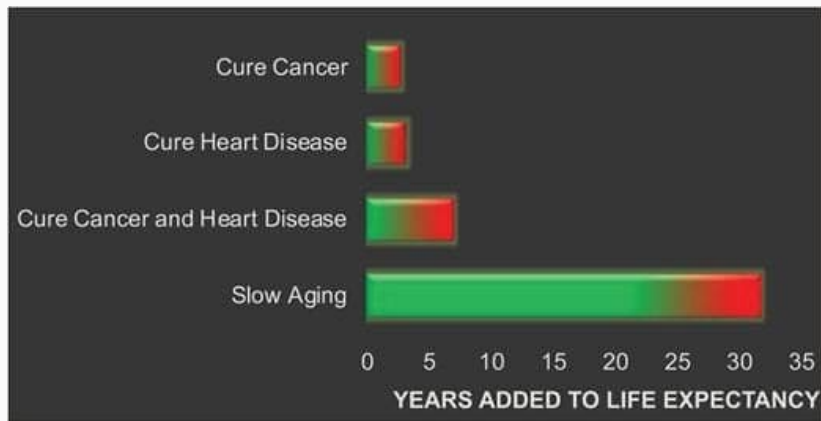
Source:

[Santesmasses et al.(2020)Santesmasses, Castro, Zenin, Shindyapina

All Deaths correlate with Age



Very real Potential in Comparison



Source: [Kaeberlein(2019)]

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Animals that don't senesce (age)

- hydra (biologically immortal) [Martinez(1998)]
- naked mole rats [Ruby and Smith(2018)]
- tortoises [Miller(2001)]
- some sharks: 400y [Pennisi(2016)]
- some clams: 500y [Munro and Blier(2012)]

Conclusion: Biological creatures don't have to age

and how much life got extended: living twice as long QUALY is possible

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Hallmarks of Aging

According to

[López-Otín et al.(2013)López-Otín, Blasco, Partridge, Serrano, and

- Genomic instability
- Telomere attrition
- Epigenetic alterations
- Loss of proteostasis
- Deregulated nutrient-sensing
- Mitochondrial dysfunction
- Cellular senescence
- Stem cell exhaustion
- Altered intercellular communication

Core Pathways of Aging: in detail

Pictures and stuff about how the damage happens

Assumed root causes: free radicals and transposon damage
Maybe not in too much detail? Could fill 30min itself

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Goal of anti-aging research: stop aging / negligible senescence
intermediate goals: slow down aging, increase QUALYs
(QUality-Adjusted-Life-Years)

Potential strategies

Picture with blood exchange, senolytics, cellular reprogramming and others
full slide for each of them

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Some medicaments: Not medical advice!

Exercise, low-calorie-diet, others

Research!

A lot to be done, just see what you can do

Donate!

A lot of money is needed

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Analysis

Simulation

Large datasets, ever-more data

Will need new tools and software

How can bioinformatics help?

Analysis

Simulation

current Pharmaceutical battle: better simulator

AlphaFold2 and others

Questions?



Matt Kaeberlein.

It is Time to Embrace 21st-Century Medicine.

Public Policy & Aging Report, 29(4):111–115, 10 2019.

ISSN 1055-3037.

doi: 10.1093/ppar/prz022.

URL <https://doi.org/10.1093/ppar/prz022>.



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Manuel Serrano, and Guido Kroemer.

The hallmarks of aging.

Cell, 153(6):1194–1217, 2013.



Daniel E Martinez.

Mortality patterns suggest lack of senescence in hydra.

Experimental gerontology, 33(3):217–225, 1998.



JK Miller.

Escaping senescence: demographic data from the three-toed box turtle (*terrapene carolina triunguis*).

Experimental Gerontology, 36(4-6):829–832, 2001.



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The extreme longevity of arctica islandica is associated with increased peroxidation resistance in mitochondrial membranes.

Aging cell, 11(5):845–855, 2012.



Elizabeth Pennisi.

Greenland shark may live 400 years, smashing longevity record — science — aaas.

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~:text=Greenland%20shark%20may%20live%20400%20years%2C%20smashing%20longevity%20record,

-By%20Elizabeth%20Pennisi&text=Imagine%
20having%20to%20wait%20a,by%20at%20least%20a%
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doi: <https://doi.org/10.1111/accel.13230>.

URL <https://onlinelibrary.wiley.com/doi/abs/10.1111/accel.13230>.