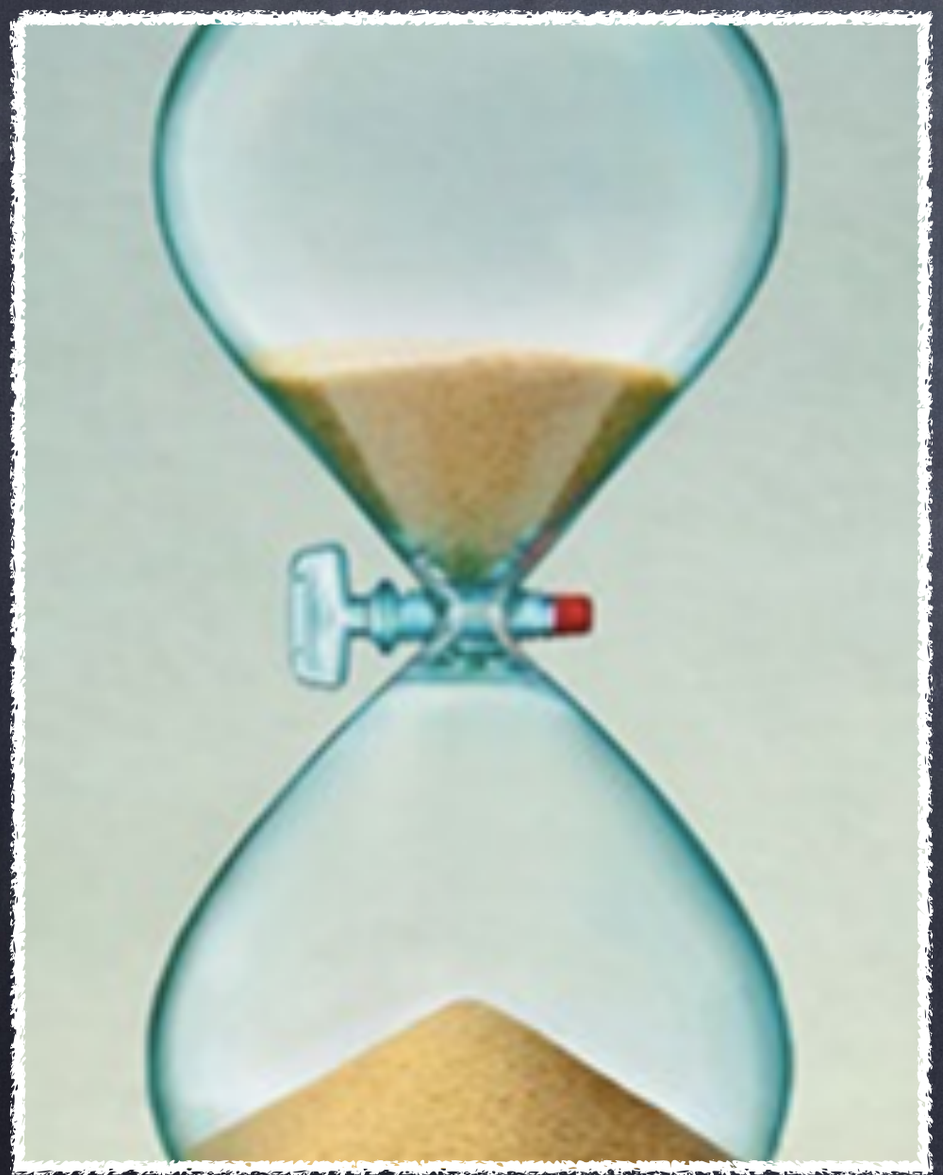
LONGEVITY

Why Die - if we can live forever?



LONGEVITY

Why Die - if we can live forever?

Three aspects

* forever?
* *if* we can
* why die?

What we will *not* talk about:

Ways to Maximize Your Longevity

EXERCISE - moderately and regularly

DIET - vegetables/Mediterranean diet

SLEEP - 7-9 hrs

STRESS REDUCTION - incl. meditation

RELATIONSHIPS - SEX

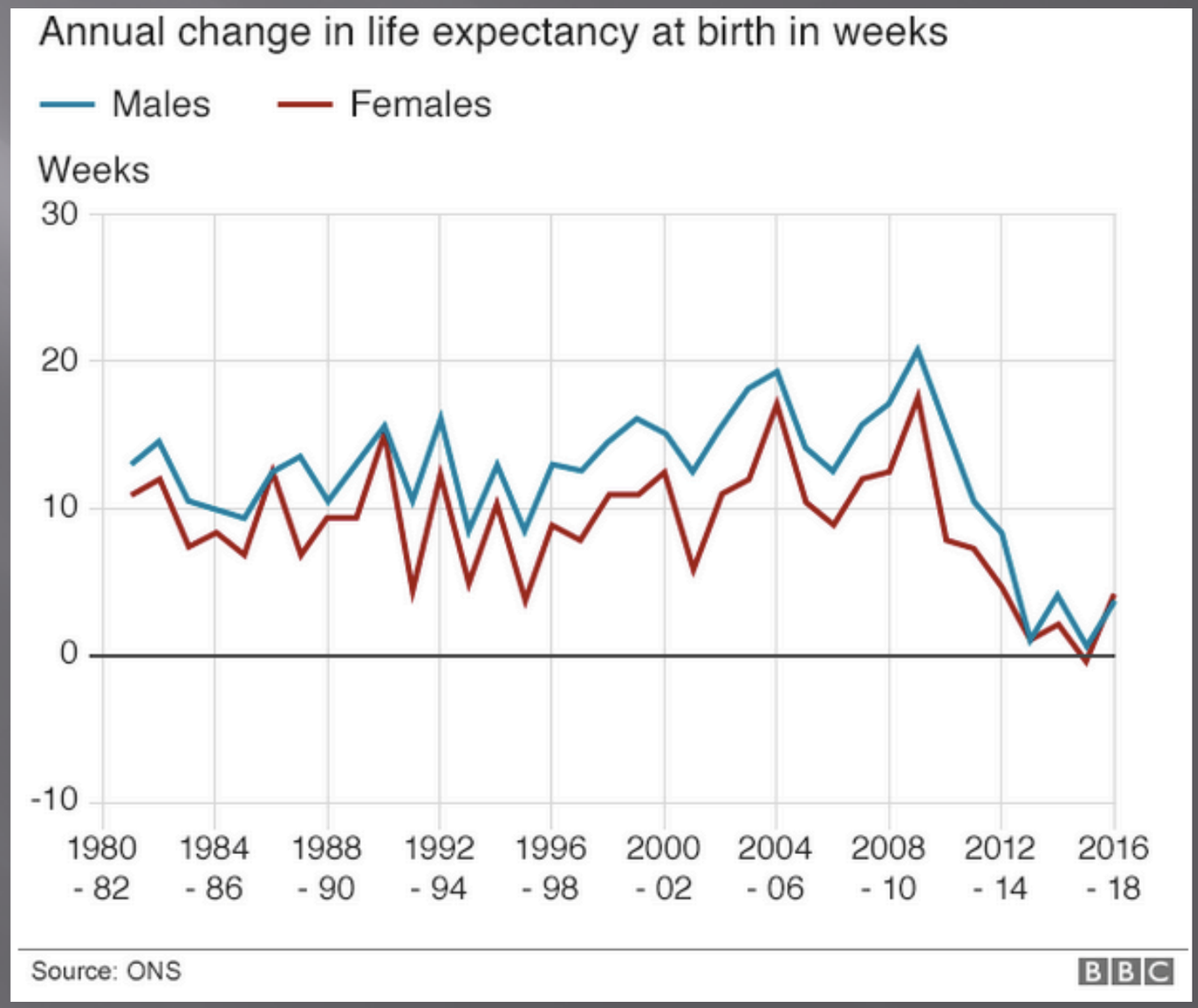
LONGEVITY

Why Die - if we can live forever

What is forever?

Lifespan over the ages

30,000 BC - 1200 AD: 35 years
1400 Century: 40 years
1900 Century: 55 years
Today: 79/83 years



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Why Die - if we can live forever

- What is forever?
  - Life span . . . currently 75/80 years -
    - Heading towards 110-120 years?

      Just how long humans could live remains bitterly contested

      Is there an ultimate limit? (bristlecones: 5000 yrs)

      Chronological age vs. biological age
- Can we? Yes, we can! We will look at that
- Why die? We will discuss that

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The concept of aging

HISTORICALLY:

The medical writer Galen argued back in the 2nd Century AD that aging is a natural process: That one can die simply of old age. This view has dominated for 19 Centuries.

TODAY:

We are beginning to view aging as a pathological condition, a disease we can treat!

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The concept of aging

Aging is the life-long accumulation of damage* to the body that occurs as an unavoidable side effect of the body's normal operation.

*Damage: Changes in structure and composition that the body cannot reverse; too much damage causes diseases and disabilities

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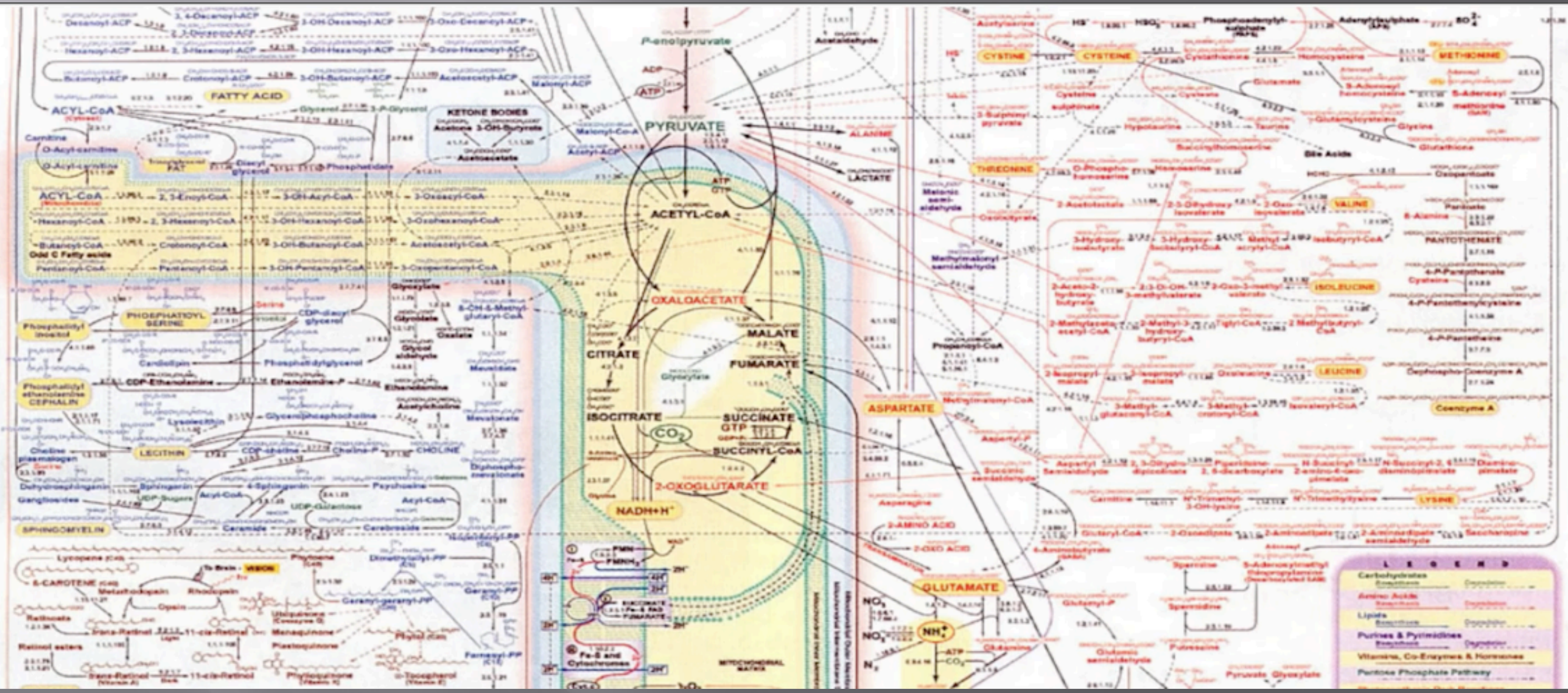

This is why we don’t cover this tonight!

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Why Die - if we can live forever

Blood-derived therapies for neurodegenerative diseases, have found that simply **injecting** older mice with **plasma of young humans** twice a week improved the mice's cognitive functions as well as their physical performance. This practice has seen a 30% increase in lifespan, and increase in muscle tissue and cognitive function.

Genetically Reversing Aging: Salk Institute **made human skin cells in a petri dish look and behave young again**, and mice with premature aging disease were rejuvenated with a 30% increase in lifespan.

Cellular stress response known as cellular senescence is widely recognized as a potent tumor suppressive mechanism. However, recent evidence strengthens the idea that it *also* drives both degenerative and hyper-plastic pathologies (tumor formation) - most likely by promoting chronic inflammation.

25% Life Extension Based on Removal of Senescent Cells

Funding for Anti-Aging Startups: Jeff Bezos and the Mayo Clinic-backed Anti-Aging Startup Unity Biotechnology with $116 million. The company will focus on medicines to slow the effects of age-related diseases by removing senescent cells.

LONGEVITY

Why Die - if we can live forever

Yes we can!

How?

- Gene editing
- Telomeres
- Epigenetics

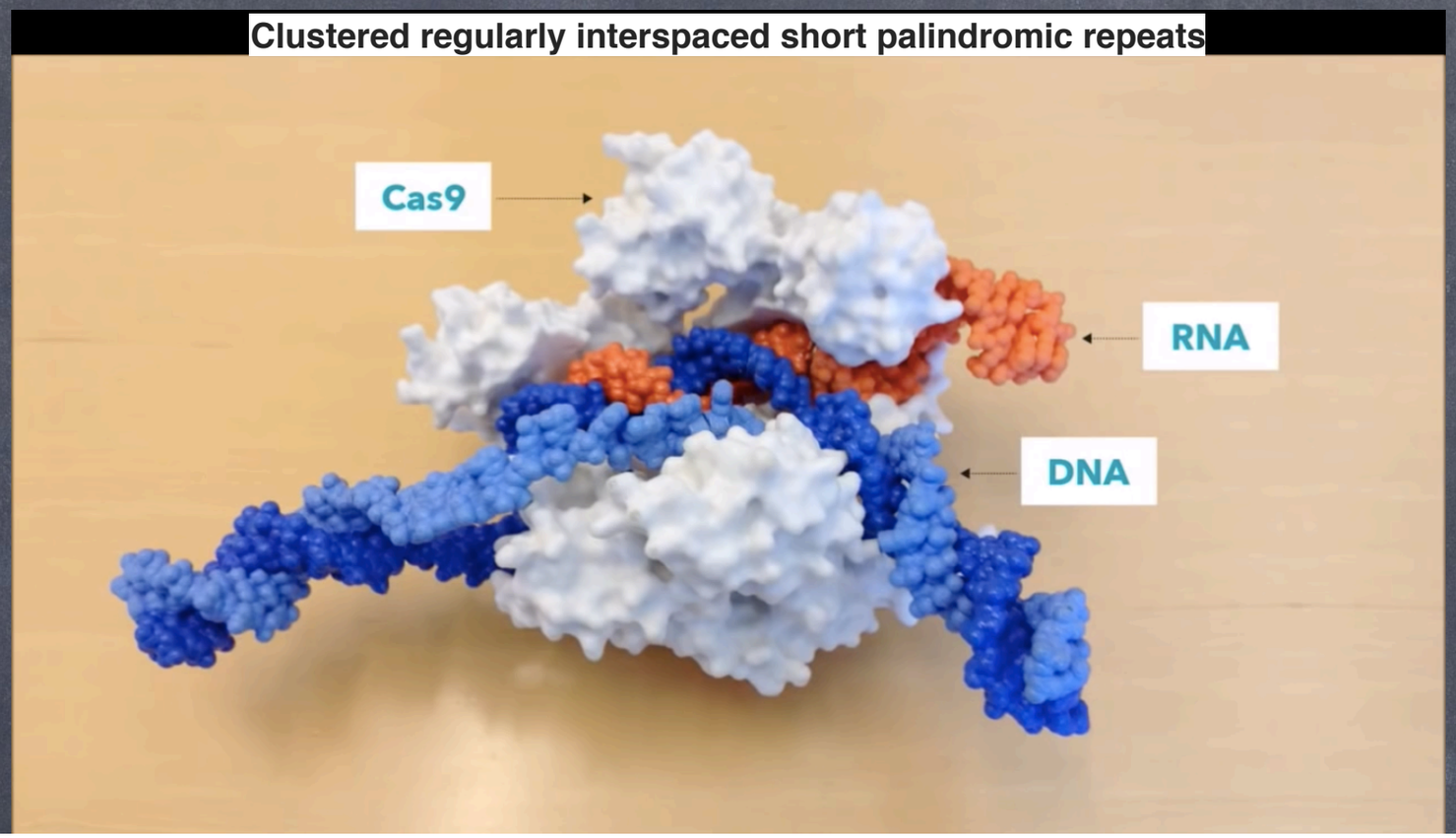
DNA with precision cut

DNA repaired with
new genetic information

Gene editing

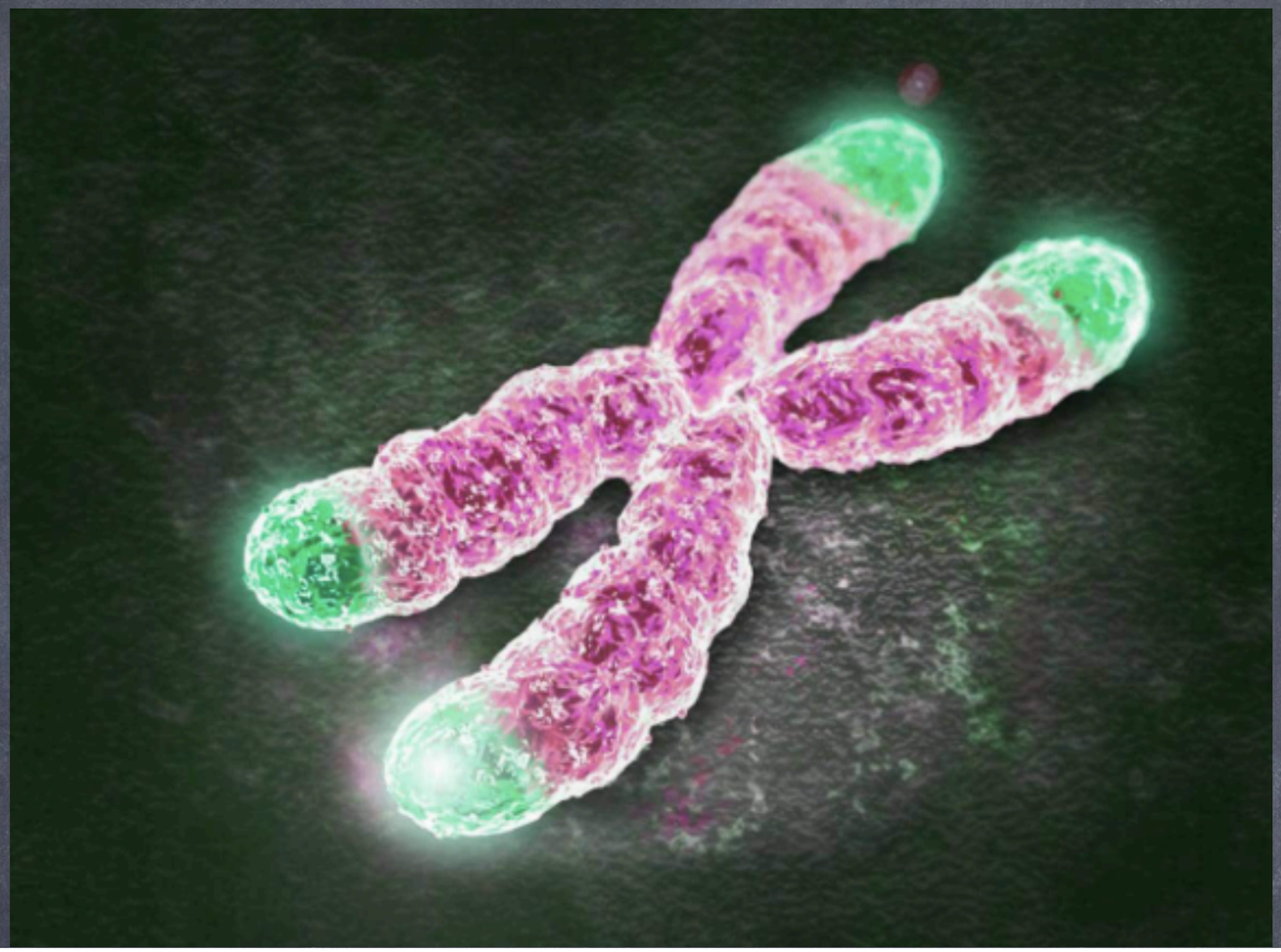
CRISPR-Cas9

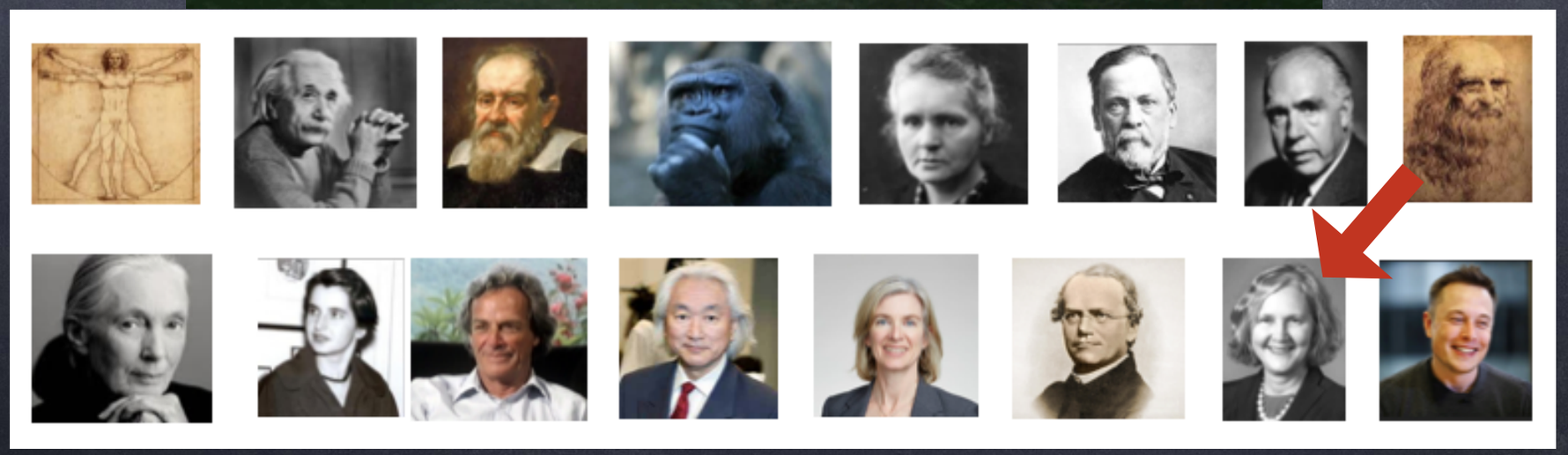
Clustered regularly interspaced short palindromic repeats



- Jennifer Doudna - Numerous Prizes 2015

Telomeres





Elizabeth Blackburn - Nobel Prize 2009

O M G ! ! ! - I’m loosing my telomeres!!

Telomeres

Nobel Prize Award 2009

- Telomere length is determined genetically
- Shorter telomeres are linked to shorter lifespans

- Both *average* telomere length and the *rate* of telomere shortening varies between species.
Fx: Humans are born with shorter telomeres than mice, but mice telomeres shorten 100-times faster than humans.

- https://www.youtube.com/watch?v=lBngws_cWho

- 2:00 - 5:45 min 6:00 - 12:00 min
- mechanism stress

Telomeres

Surprise:

You can lengthen your telomeres and increase your chances at a longer life through *endurance exercise!*

Fx: *sciencedirect.com* (2017) and the *European Heart Journal* (2018) found that

- Telomerase activity spikes in people who regularly do endurance exercises
- People who run regularly appear to be biologically younger than those who don't. But it takes some effort: A little exercise won't cut it. You have to work out regularly at high levels (*Science Daily*).

Biohacking:

https://bigthink.com/surprising-science/telomere-aging?rebelltitem=4#rebelltitem4

Epigenetics

Epigenetics is: Anything other than DNA that determines the development of an organism.

Specifically:

Factors that cause changes in how individual genes behave

These *factors* (methyl groups) come from the nutrition, environmental chemicals, pharmaceutical drugs, pollutants, etc. – even aging and stress!

They tag on to the DNA as early as in utero - or anytime later in life

Epigenes

EPIGENETIC MECHANISMS

are affected by these factors and processes:

- **Development** (in utero, childhood)
- **Environmental chemicals**
- **Drugs/Pharmaceuticals**
- **Aging**
- **Diet**

HEALTH ENDPOINTS

- **Cancer**
- **Autoimmune disease**
- **Mental disorders**
- **Diabetes**

CHROMOSOME

CHROMATIN

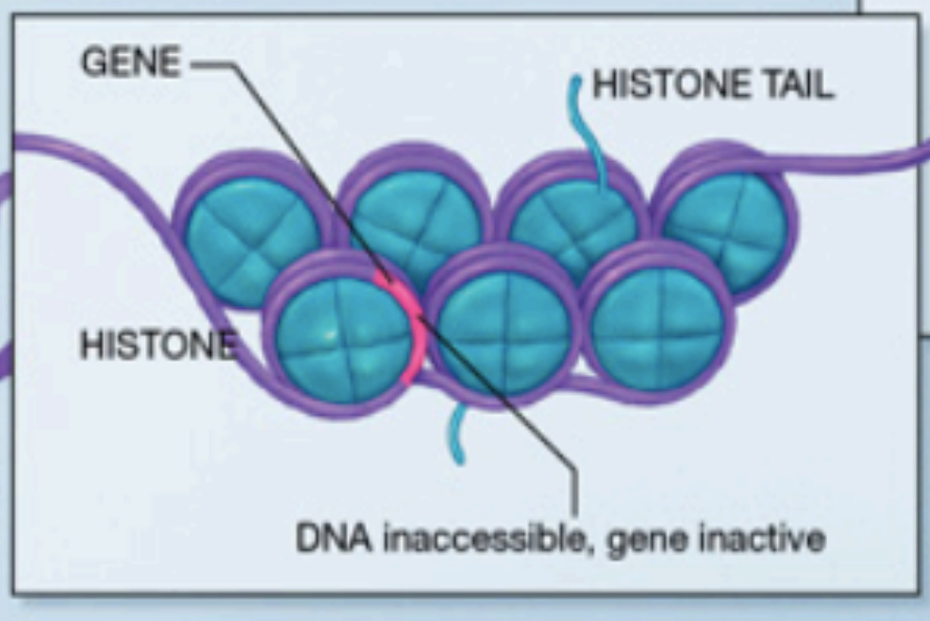
METHYL GROUP

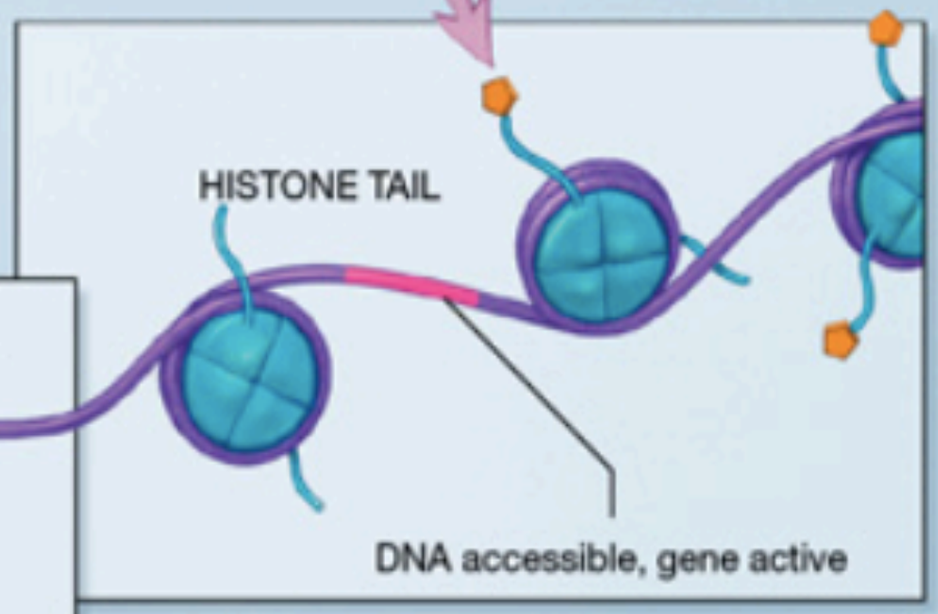
EPIGENETIC FACTOR

DNA

DNA methylation

Methyl group (an epigenetic factor found in some dietary sources) can tag DNA and activate or repress genes.



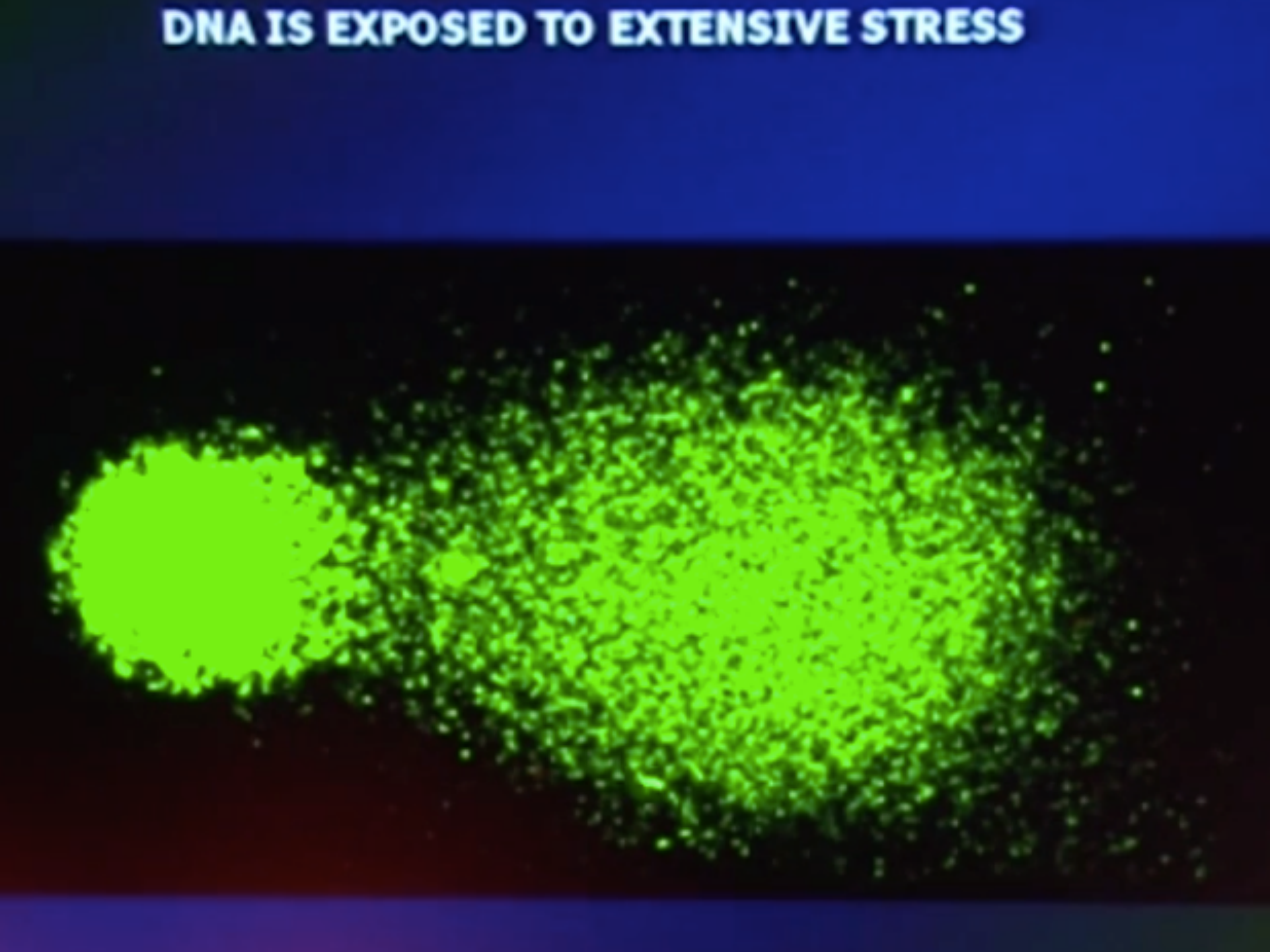


Histone modification

The binding of epigenetic factors to histone "tails" alters the extent to which DNA is wrapped around histones and the availability of genes in the DNA to be activated.

Histones are proteins around which DNA can wind for compaction and gene regulation.

DNA IS EXPOSED TO EXTENSIVE STRESS



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Why Die - if we can live forever

TED TALK: Reverse Aging with Neurobics I Marisa Peer

https://www.youtube.com/watch?v=E1r5HHuW_Vc

0 - 5 min

(12 min total)

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Why Die - if we can live forever

Yes we can! How?

- Gene editing
- Telomeres
- Epigenetics
- . . . and now we can add: Remove senescence cells

LONGEVITY

Why Die - if we can live forever

Yes we can!

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- . . . and now we can add: Remove senescence cells

Kurzweil: 10 years out, we will reach the point of “longevity escape velocity” — the point at which, for every year we live, science is able to extend our life for more than a year!

LONGEVITY

So, we can live forever - but should we?

REFLECTION:

Is the pursuit of immortality merely a narcissistic fantasy that takes resources away from more pressing issues?

LONGEVITY

So, we can live forever - but should we?

KEY QUESTIONS

Is the human lifespan not long enough as it is?
There is more to life than more life!

Should we embrace our end . . . or cure aging?

- Will viewing aging as a treatable disease shift the emphasis away from healthy living?

Is extended lifespan good for humankind and society?

- If not, can we avoid it?
- Who will decide on that?
- Who benefits from that (inequality)?

LONGEVITY

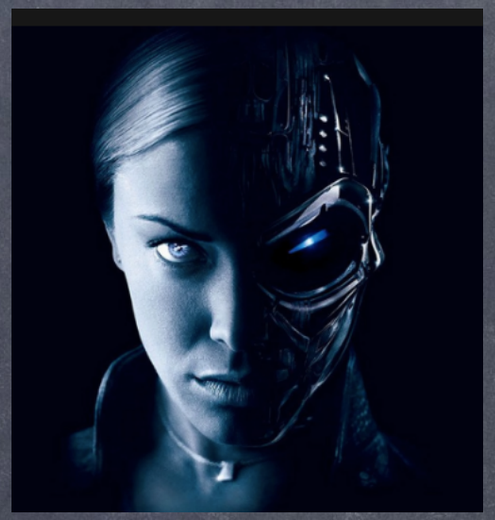
We can live forever - but should we?

A whole other story . . . HUMAN v. 2.0

Starting Point on the way to Humans v. 2.0

- Most recently . . . besides the artificial limbs, pacemakers and exoskeletons, we have

  - artificial retina
  - cochlear implants
  - satnavs (sub-dermal compass)
  - brain pace makers (30,000 patients) to alleviate symptoms of Alzheimer's



Starting Point on the way to Humans v. 2.0

With today's technology, we can replace . . .

- skin,
- hair,
- eyelashes,
- joints (shoulders, elbows, wrists, jaws, hips, knees, toes, fingers),
- arteries,
- hearts/heart valves,
- limbs and bones,
- breasts,
- entire organs –
- and we can even change our sex!

What's left?

5 Steps toward Human v.2.0

Not much . . .

- 1. Artificial voice (already on its way)
- 2. Skeleton (better than Calcium: kevlar, titanium)
- 3. Digestive tract (better fermentor; better extractor)
- 4. Blood (better oxygen transportation; self, propelling —> no heart
- 5. Brain - the last frontier (downloadable to a external hard disk)

and then? Are we still human?


It will be fun!
Thank You
. . . very Much !