

# Rejuvenation biotechnology

Life of the Swiss (and global) population:  
more and more. Death? Not so much...

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# Everything you need to know about future mortality

- Most people (nowadays) die from being sick
- Most sickness (nowadays) is due to aging
- Aging is the accrual of living-derived damage
- That damage can foreseeably be repaired

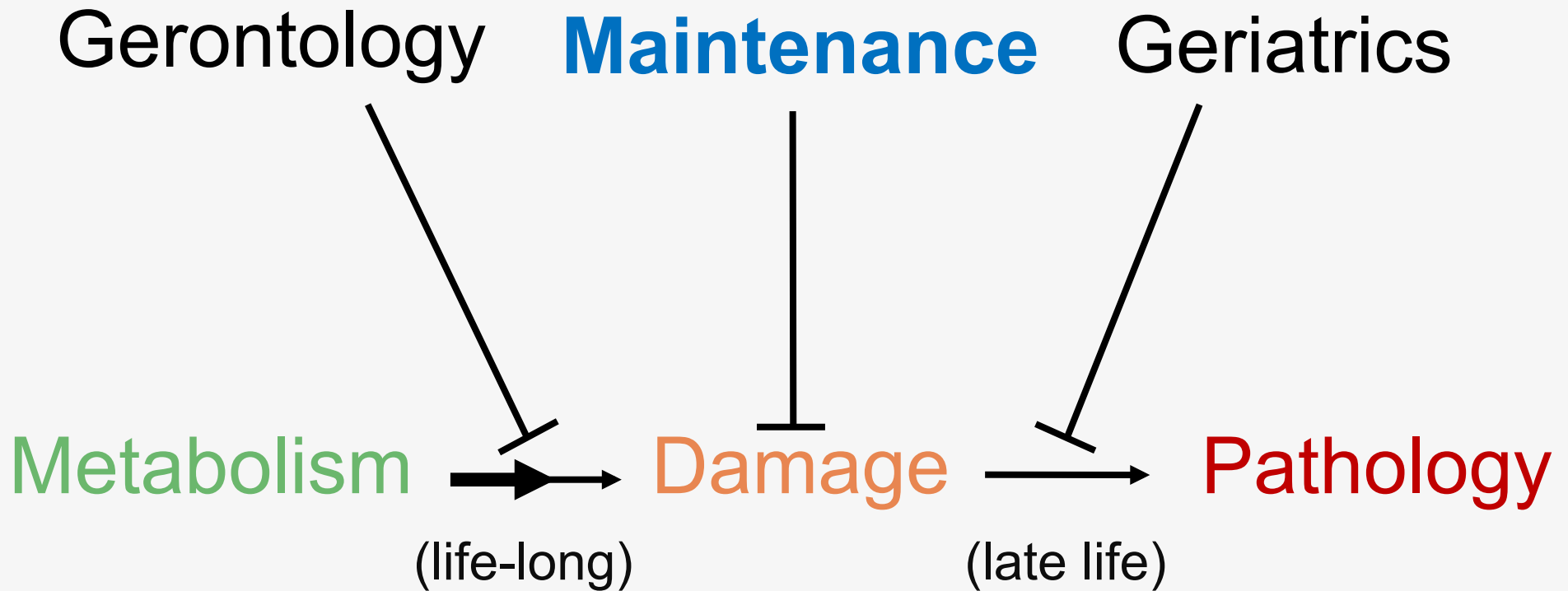
# Everything you need to un-learn about future mortality

- “Mortality rate doubling time is immutable”
- “Period life expectancy will evolve smoothly”
- “People will always think they’ll die when their parents did”
- “Comprehensive rejuvenation is fantasy”

# Aging in three words



# Three candidate approaches



# Comparison: car maintenance



# The “seven deadly things” & their fixes

<b>Damage type</b>	<b>The maintenance approach</b>
Cell loss, cell atrophy	Replace, using stem cells
Division-obsessed cells	Reinforce, using telomere control
Death-resistant cells	Remove, using suicide genes etc
Mitochondrial mutations	Reinforce, using backup copies
Intracellular waste products	Remove, using foreign enzymes
Extracellular waste products	Remove, using immune system
Extracellular matrix stiffening	Repair, using crosslink-breakers

**Existence of any 8<sup>th</sup> is looking increasingly unlikely**

# Things you may be thinking right now

- This guy looks crazy; what do “credentialed” people think about these ideas?
- Even if he’s right, are the consequences for longevity big/near enough to affect my work?
- Even if they are, will society let it happen?



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# What do other experts think?



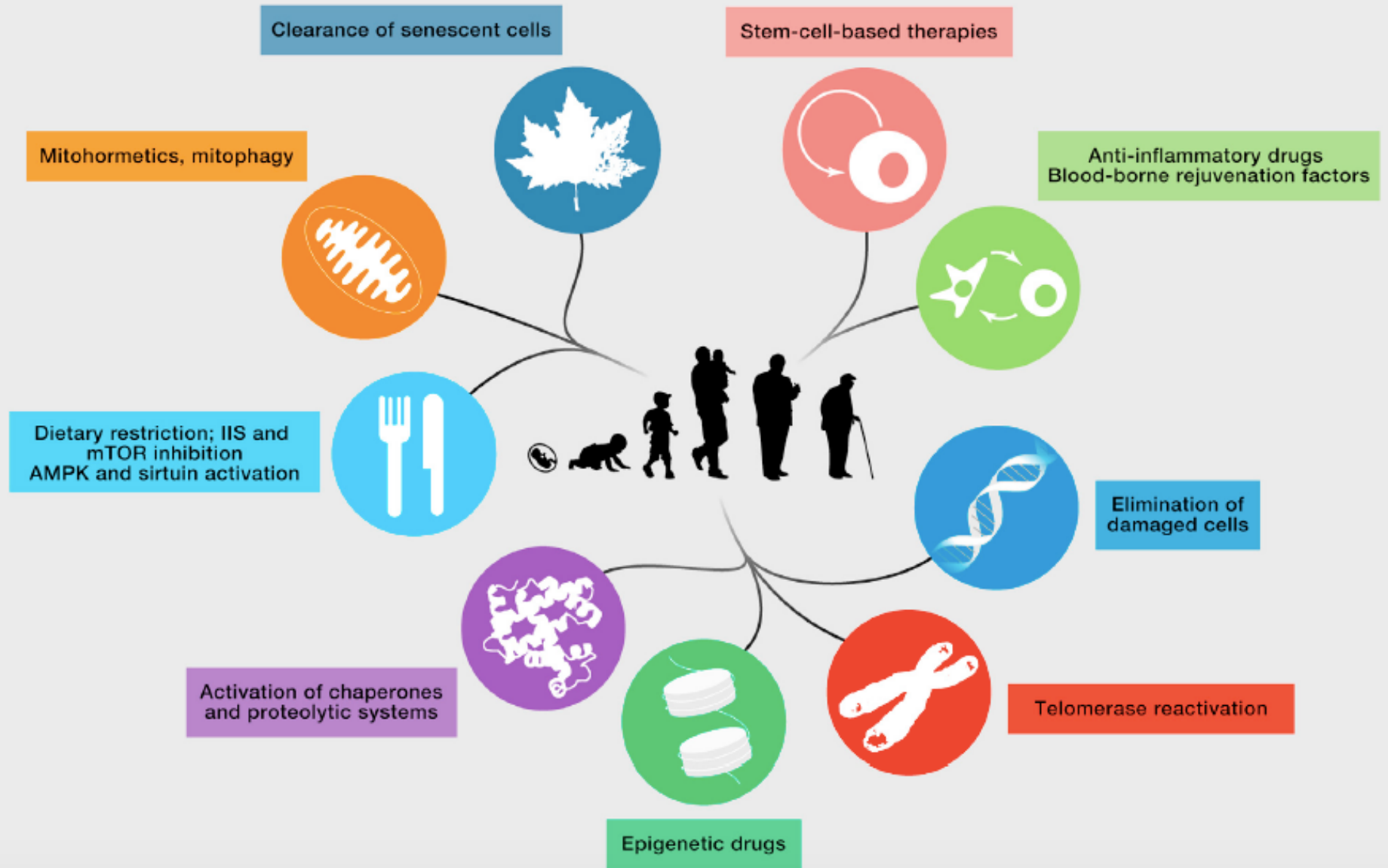
See their names, their awesome credentials and their hard-hitting endorsement of our research approach at

[www.sens.org/about/leadership/research-advisory-board](http://www.sens.org/about/leadership/research-advisory-board)

# Cell 153:1194 (2013)



# Cell 153:1194 (2013)



# Our implementation progress

- Total synthesis of glucosepane, allowing identification of antibodies and degraders (Science 2015)
- Modified bacterial enzyme protects cells from atherogenic oxysterols (Biotech. Bioeng. 2012)
- Catalytic antibodies chop up cardiotoxic amyloid (J. Biol. Chem. 2014)
- Two out of 13 mitochondrial genes successfully relocated to the nucleus (Nucl. Acids Res. 2016)

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# So... longevity?

- We ***DON'T WORK ON LONGEVITY***, whatever the media may like to tell you
- However, we know that this medicine may increase longevity a lot, I mean really a lot
- We think this is a good thing, even though it will put people like you out of business 😊



# How BIG is the longevity side-benefit?

- Rejuvenation therapies may never be perfect; the first-generation version may give “only” ~30y extra life
- However, that would buy us time to develop better ones, with which to “re-rejuvenate” the same people, and so on (“**longevity escape velocity**”)
- So...?



# How BIG is the longevity side-benefit?

- Western mortality rate in the 20s is under  $10^{-3}/y$
- If it didn't rise with age (and in fact it will surely fall with time), most people would live to over 1000
- Period (i.e. "headline") life expectancy will very suddenly become incalculable (literally!)

# How NEAR is the longevity side-benefit?

- This is pioneering technology, so we don't know
- Guess: 50% chance in 20-25y if funding rises soon
- At least 10% chance it'll take >100y
- That's for the therapies I've mentioned today
- They will probably give around 30yr extra life
- LEV thenceforth seems inevitable
- **Everyone will understand the above this decade**

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# Sociological considerations

- Overpopulation?
- Inequality of access?
- Immortal dictators?
- Boredom?
- Pensions collapse?

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# Sociological considerations

- No age-related ill-health
- Elderly *contribute* wealth
- Energy to explore novelty
- Flexible career structure
- Not a burden on your kids



sens research foundation

reimagine aging

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