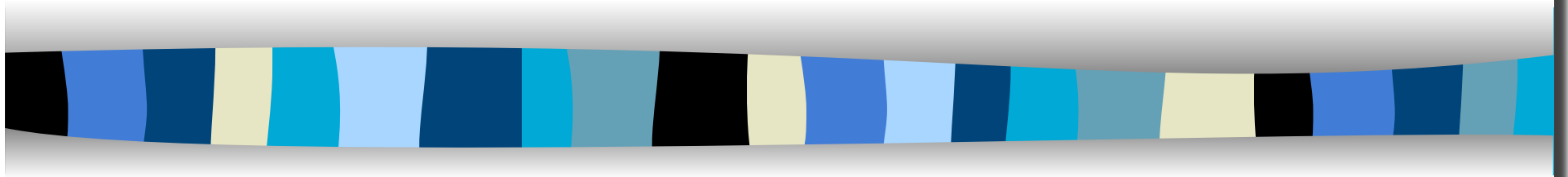


**So...you want to live forever?**



**Why you should care  
about the biology of aging**

**Chris Patil  
Buck Institute for Age Research**



the  
**BUCK**  
INSTITUTE  
FOR AGE RESEARCH

Novato, California

13 years old  
14 laboratory groups  
110 scientists  
~\$10<sup>8</sup> in funding

*Mission:*  
“To increase the  
healthy years of life.”

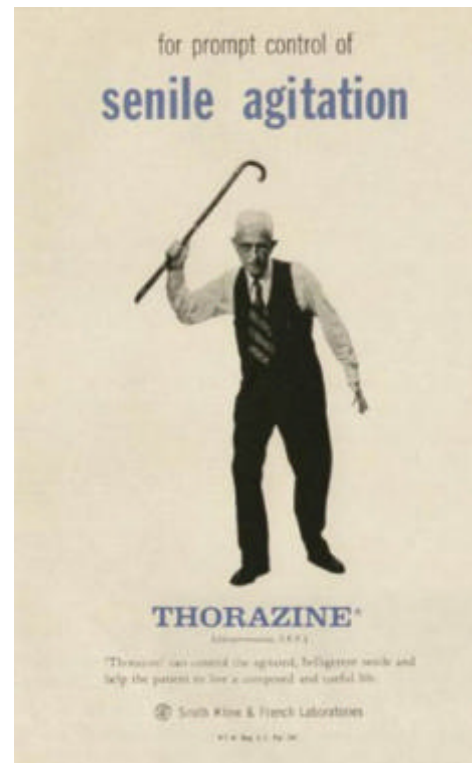


*Ouroboros: Research in the biology of aging*

<http://ouroboros.wordpress.com>

*Image: Buck Institute*

# I am not a gerontologist or a geriatrician



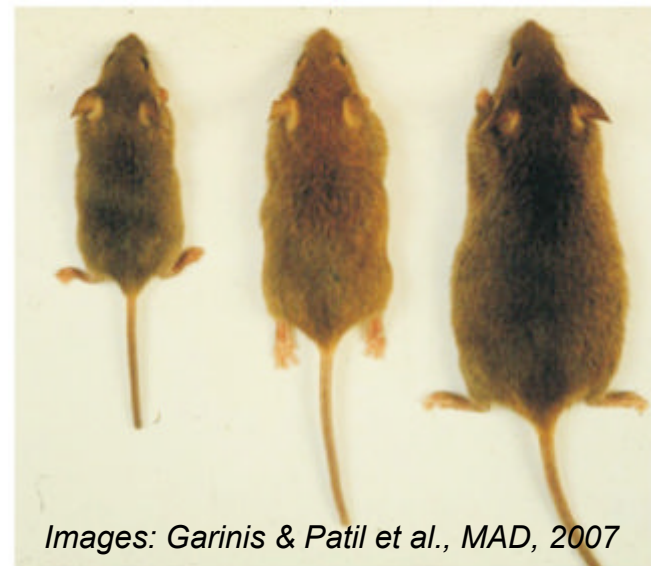
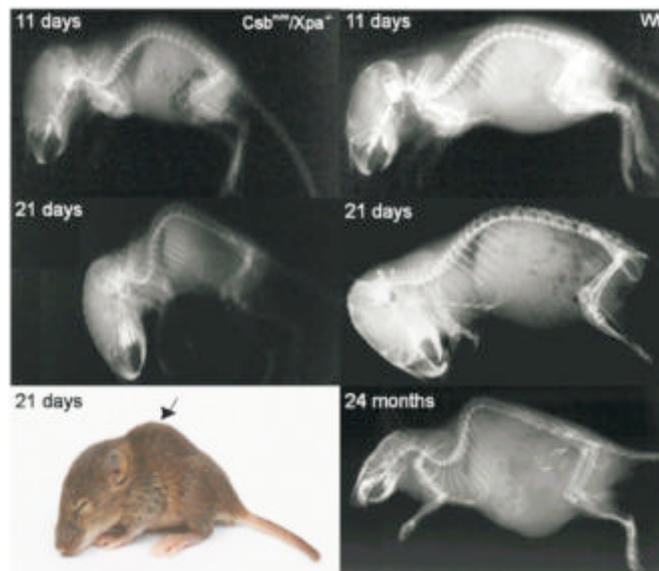
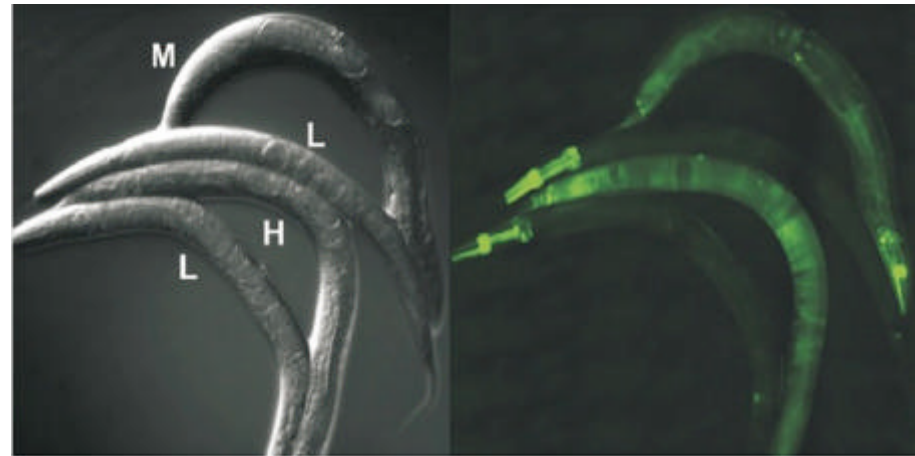
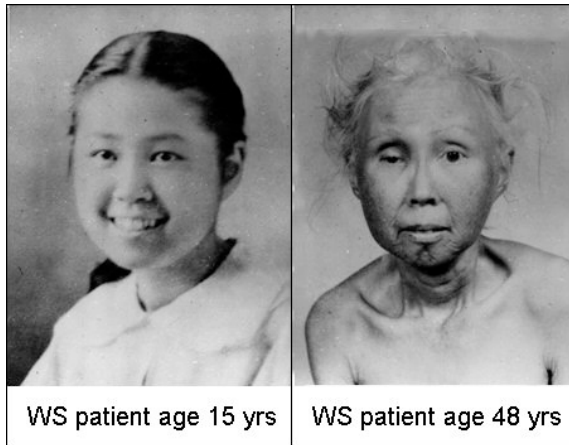
*Image: GlaxoSmithKline archives*

## Biogerontology: raison d'être

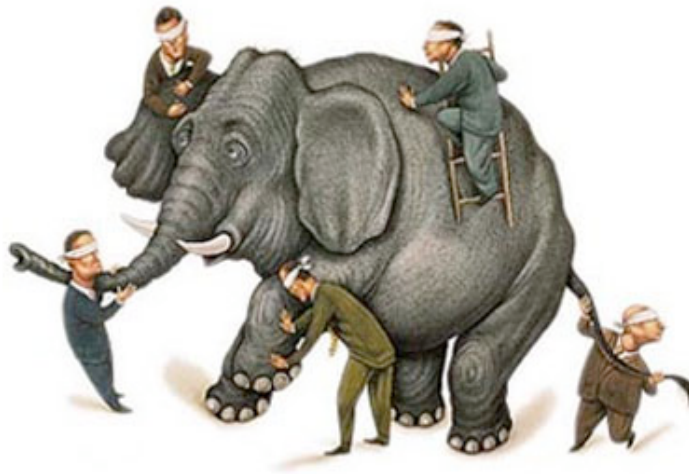


*Image: Scripps Institute*

## How we work: disease, mutants, & models



## What do we know?

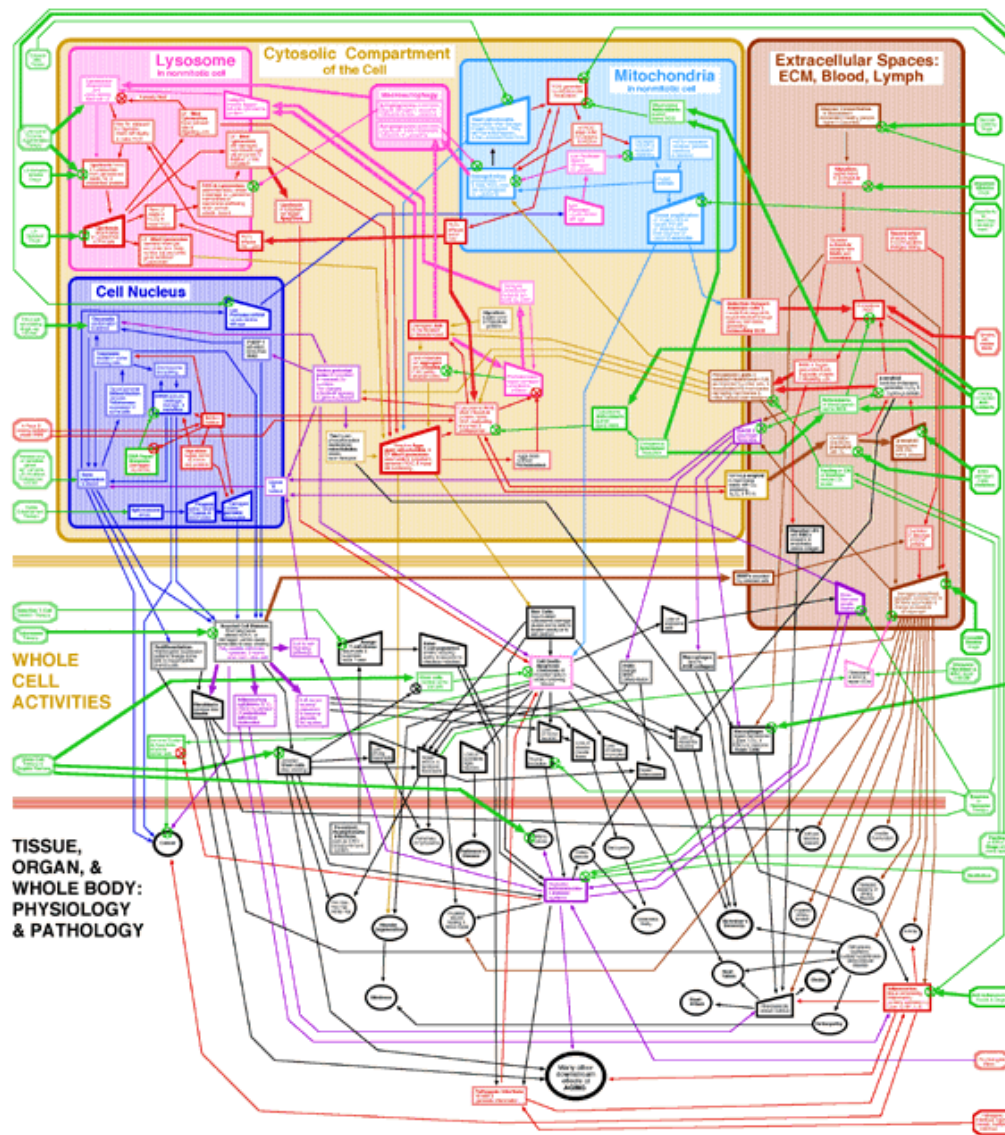


Aging is complex:

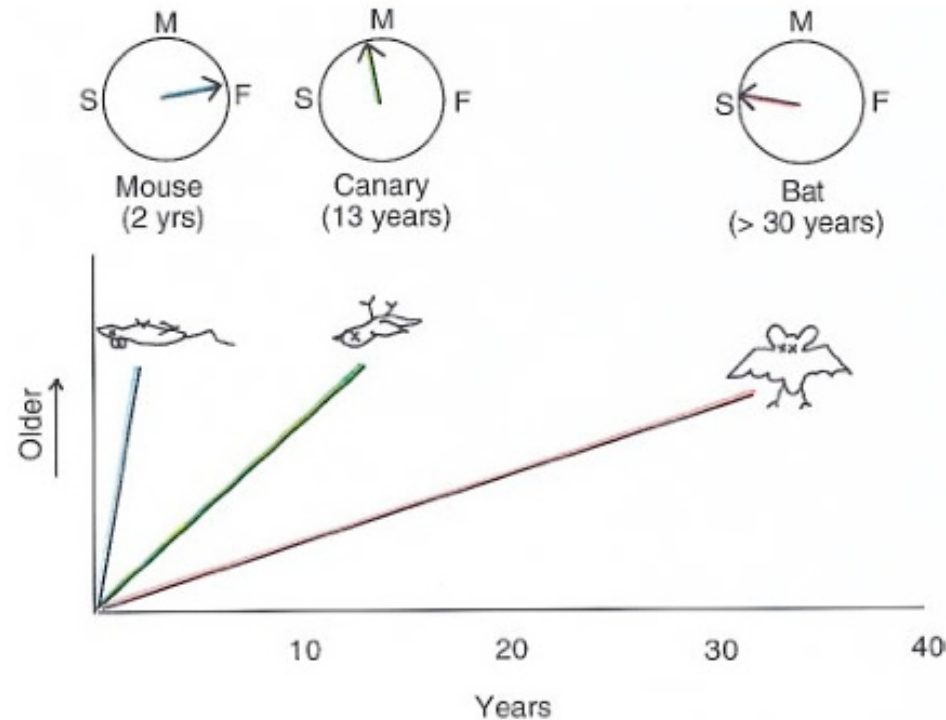
- hormones
- DNA damage
- protein misfolding
- oxidation
- telomere shortening
- calorie restriction
- gene activity

Some unification has taken place – this causes its own problems

There is no single cause of aging, no “Aging Gene”, and therefore no magic bullet



## Exploiting evolutionary differences to find conserved mechanisms of aging



Despite the diversity of lifespans, “healthspan” is a durable concept

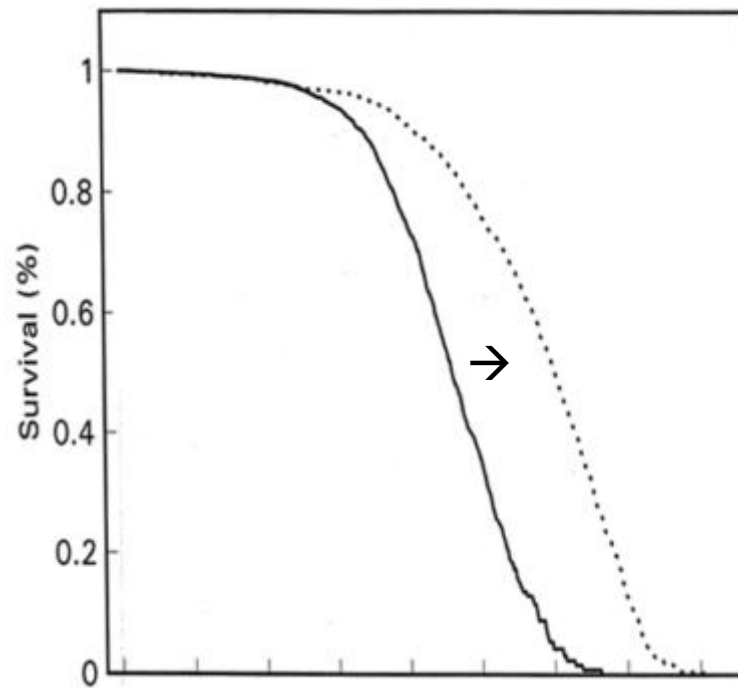
Making a virtue out of necessity: **CLADE**  
(Comparing Longevity and Aging Determinants across Evolution)

*Image: Kenyon, Cell, 1996*



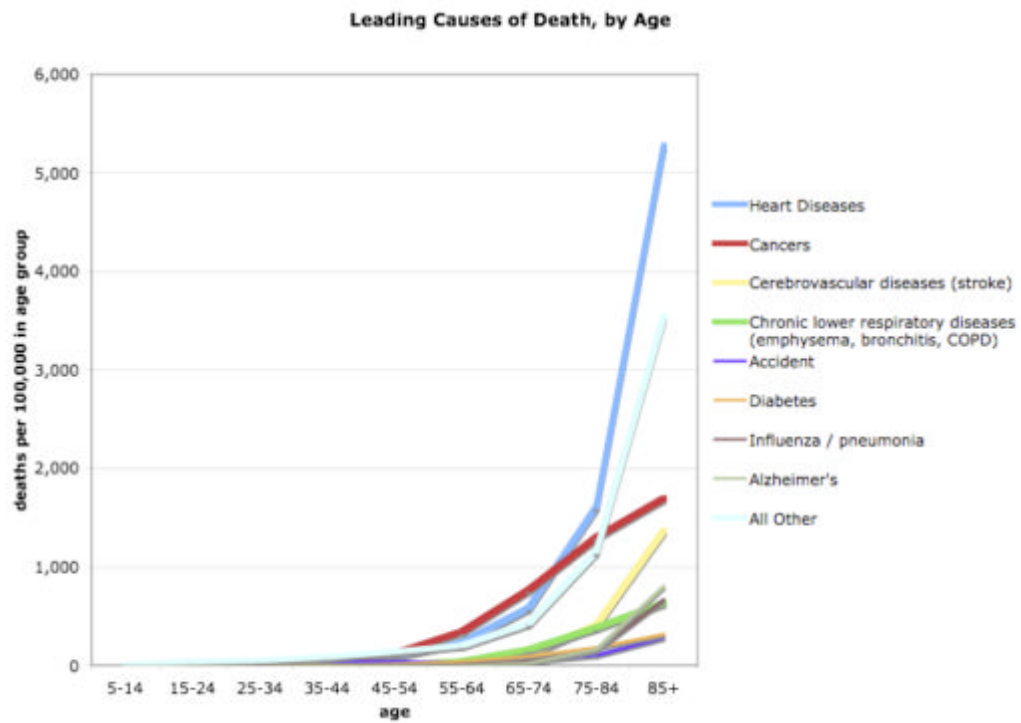
**“To increase the healthy years of life”**

Quality of life



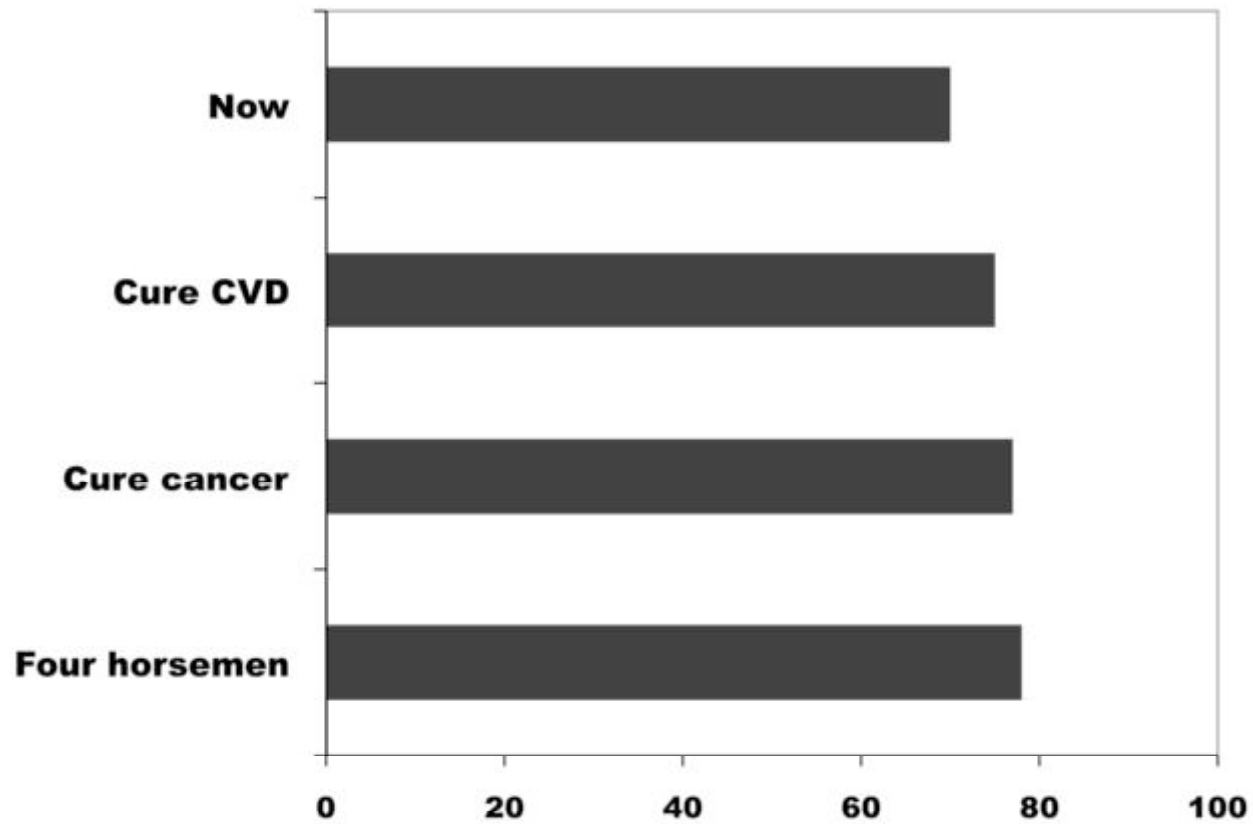
Time

# Aging as *the* major risk factor



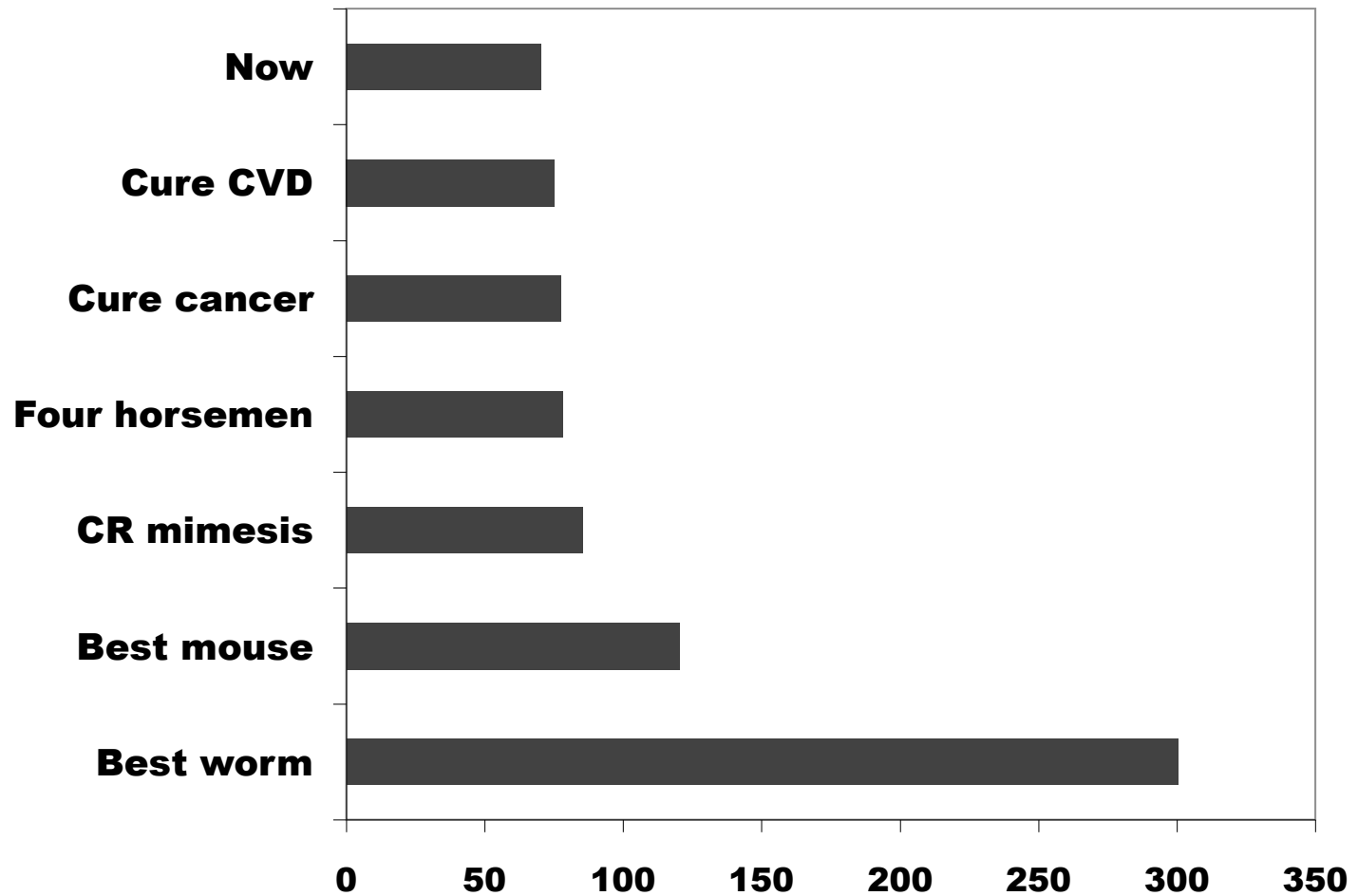
Data: CDC

## Incremental vs. radical change



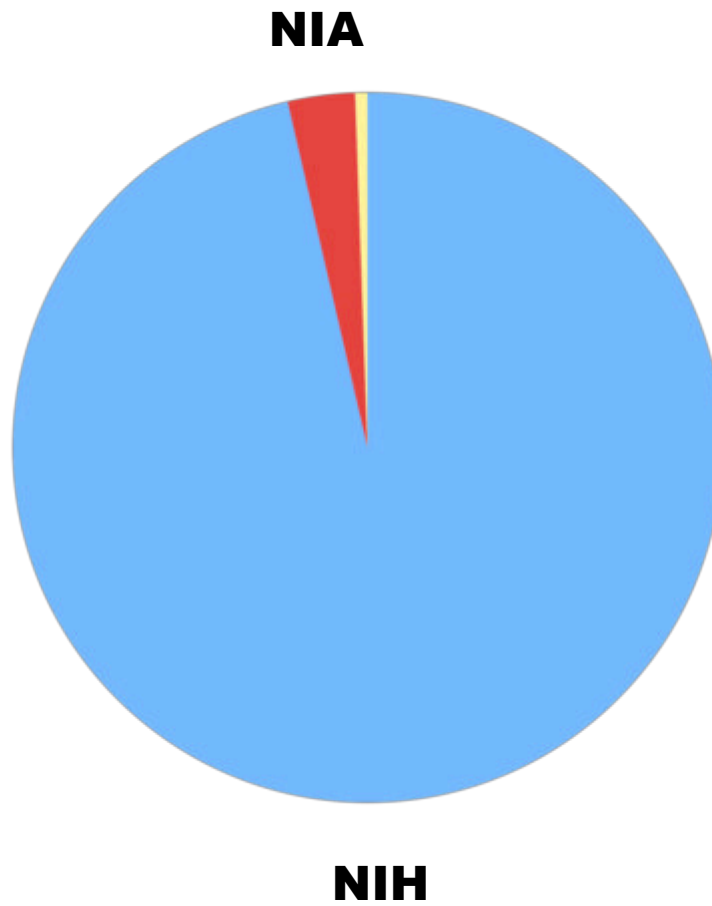
*Data: Olshansky et al., Science, 1990*

## Incremental vs. radical change



*Data: Olshansky et al., Science, 1990*

## Rational allocation of resources?

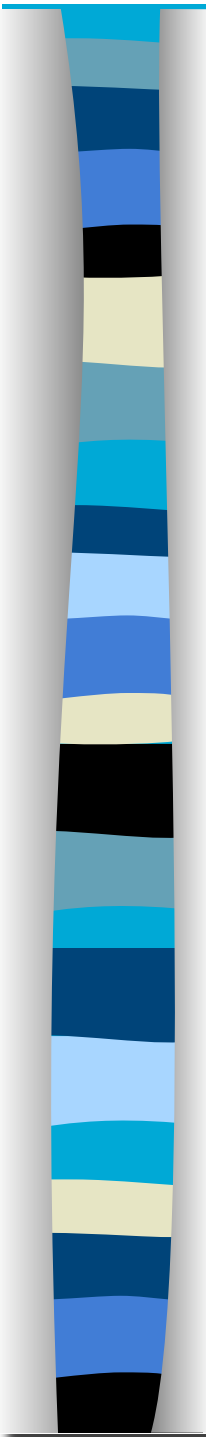


Data: [nia.nih.gov](http://nia.nih.gov)

## Institutional barriers



Aging is not recognized by the relevant authorities as a pathological condition



## Technical barriers



Longevity studies, by definition, take a long time:

- expense
- compliance problems
- confounding variables such as lifestyle

How do you know whether it's working?

- lifespan is a crummy endpoint
- we can't measure physiological age accurately

→ We need biomarkers of age



## **Attitudinal barriers I: Moral objections**

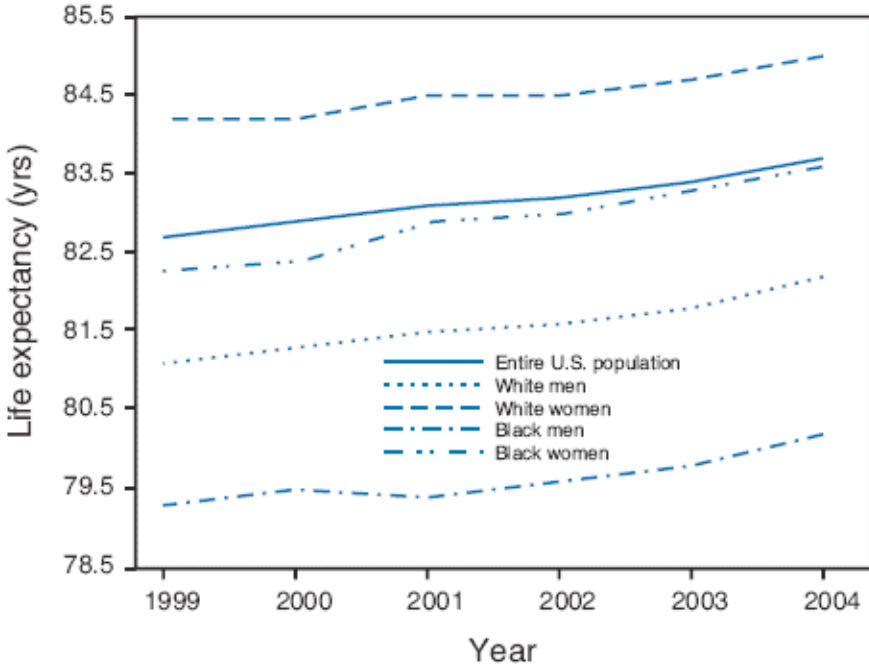
“It’ll ruin Social Security.”

“The older generation should step aside to make room for the young.”

“If people never died, it would be impossible for younger people to find a place for themselves.”

“Life’s finite nature gives it meaning.”

# Attitudinal barriers II: It's too hard



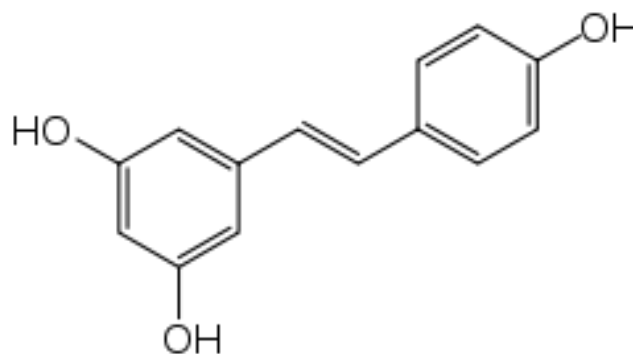
We're already at 20% of "actuarial escape velocity" – without real anti-aging medicine



## **“Enabling” technologies**

1. “-Omics”
2. Biomarkers
3. Stem cells
4. *In vivo* control of gene expression

## “Effective” technologies I: Small molecules



Resveratrol and its derivatives are the frontrunners

These compounds will not provide a “fountain of youth”...

...and they *certainly* won't be labeled as such

*Image: Wikipedia*

## Effective technologies II: Cell-based therapy



Tissue engineering: “replacement parts” to replace gross anatomical issues

We don’t have a true “plug and play” science of stem cells – yet

Old “niche” does not efficiently support stem cell growth and function

*Images: AP; Lee lab @ Dalhousie*



## Prevent or repair age-related damage?

- Prevent (or delay):

PRO: Relatively easy - happening now

CON: Never 100% efficient; eventually you die.

- Repair (or reverse):

PRO: Could yield true “negligible senescence”

CON: Mind-blowingly hard; earliest attempts failed.



## Summary:

1. Biogerontology exists.
2. Aging is a hard problem...
3. ...that is nonetheless worth studying.

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