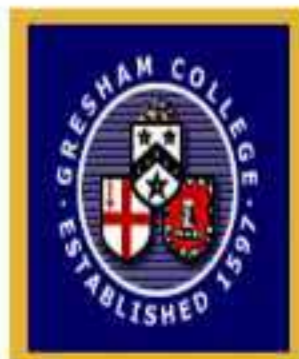


Turning back the hands of time: Ageing gracefully !



Professor Keith Kendrick



Getting old is a major bug-bear for many humans

Getting old is a major bug-bear for many humans

'I grow old... I grow old....

I shall wear the bottoms of my trousers rolled.

Shall I part my hair behind ? Do I dare eat a peach ?

I shall wear white flannel trousers, and walk upon the beach'

T.S. Eliot 'The Love Song of J Alfred Prufrock'



Main questions:

Main questions:

Why do we age ?



Main questions:

Why do we age ?

What effects does ageing have on mental and physical functions ?



Main questions:

Why do we age ?

What effects does ageing have on mental and physical functions ?

What, if anything, can we do about it ?



Is ageing a universal biological process ?

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'Whatever, is begotten, born and dies'

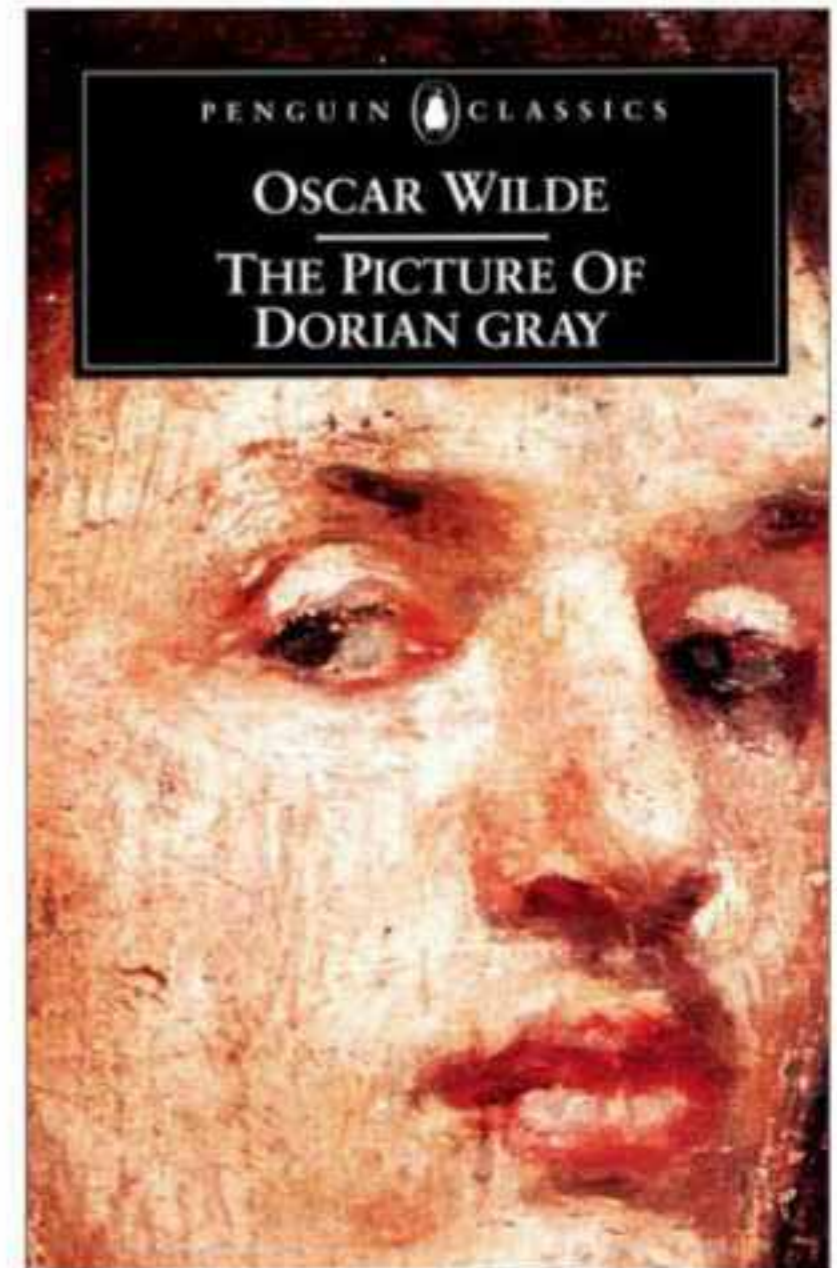


MacGregor family bible

Is ageing a universal biological process ?

'Whatever, is begotten, born and dies'

But not all species appear to age



Is ageing a universal biological process ?

Aquatic species:

Sharks, turtles, alligators, female (but not male!) flounder, lobsters, sturgeon, rainbow trout and a number of other fish



Is ageing a universal biological process ?

Land-based species:

Galapagos tortoise



Is ageing a universal biological process ?

So why aren't we overpopulated by sharks the size of Jaws ?



Is ageing a universal biological process ?

So why aren't we overpopulated by sharks the size of Jaws ?

Answer - they all get killed off by man, predators, injury or disease



Is ageing a universal biological process ?

So why aren't we overpopulated by sharks the size of Jaws ?

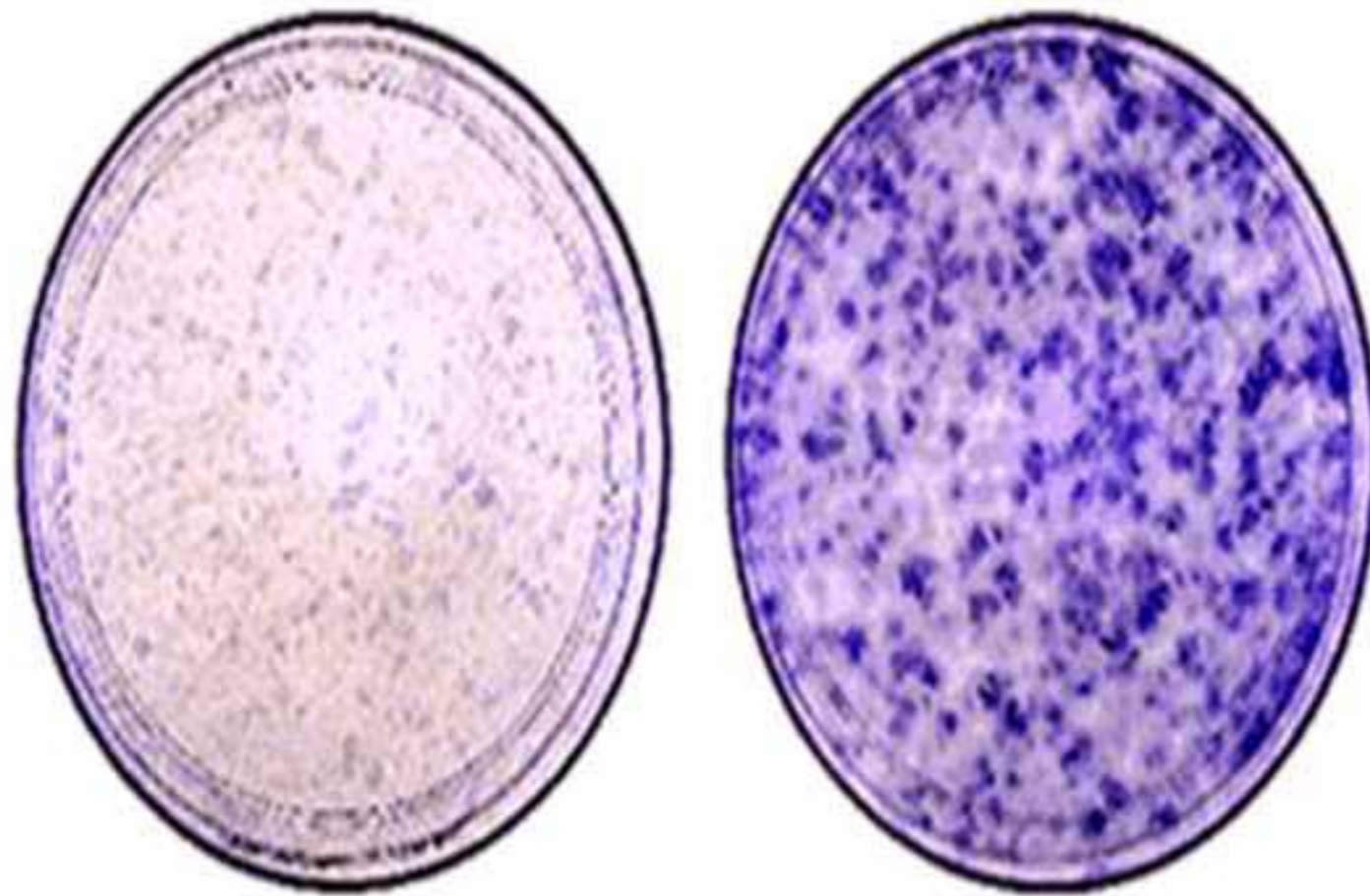
Answer - they all get killed off by man, predators, injury or disease

- and film makers !



Is ageing a universal biological process ?

Immortal cells can be engineered in culture



Is ageing a universal biological process ?

Immortal cells can be engineered in culture

So, in theory at least, something approaching immortality is possible

8 Taoist
immortals



Is ageing a universal biological process ?

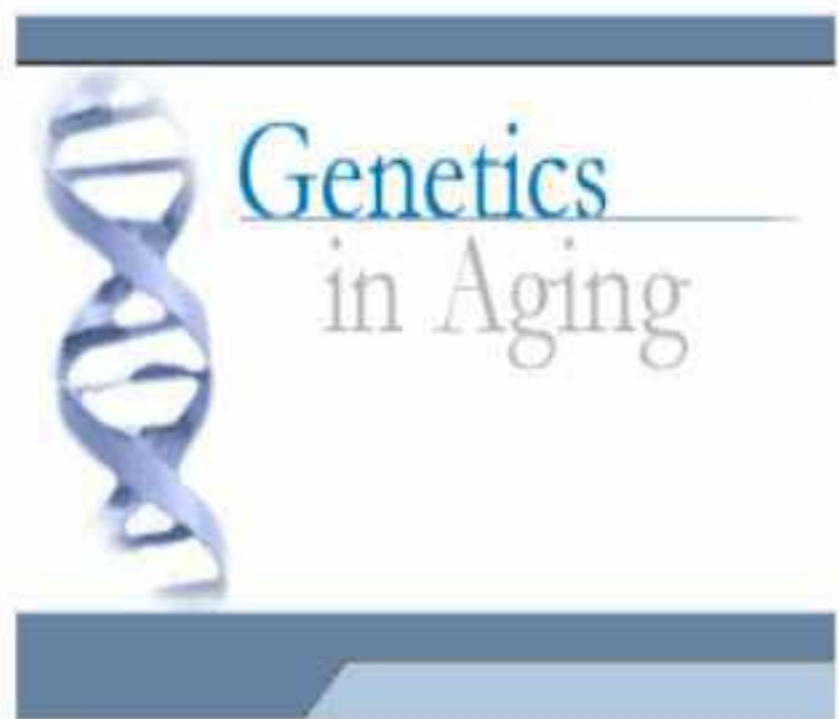
Immortal cells can be engineered in culture

So, in theory at least, something approaching immortality is possible

Sharks fin soup and caviar ?

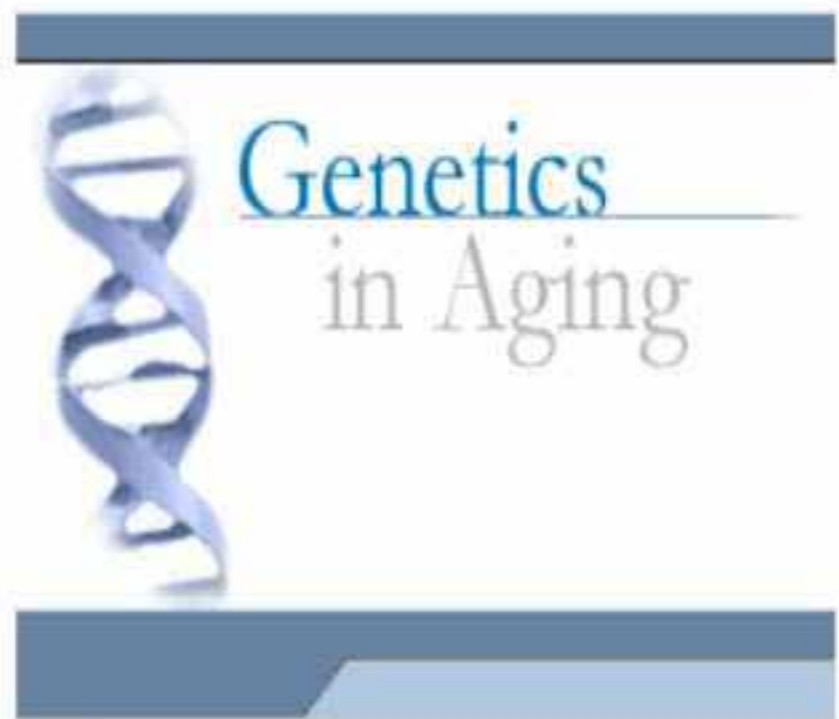


What is research on human ageing hoping to achieve ?



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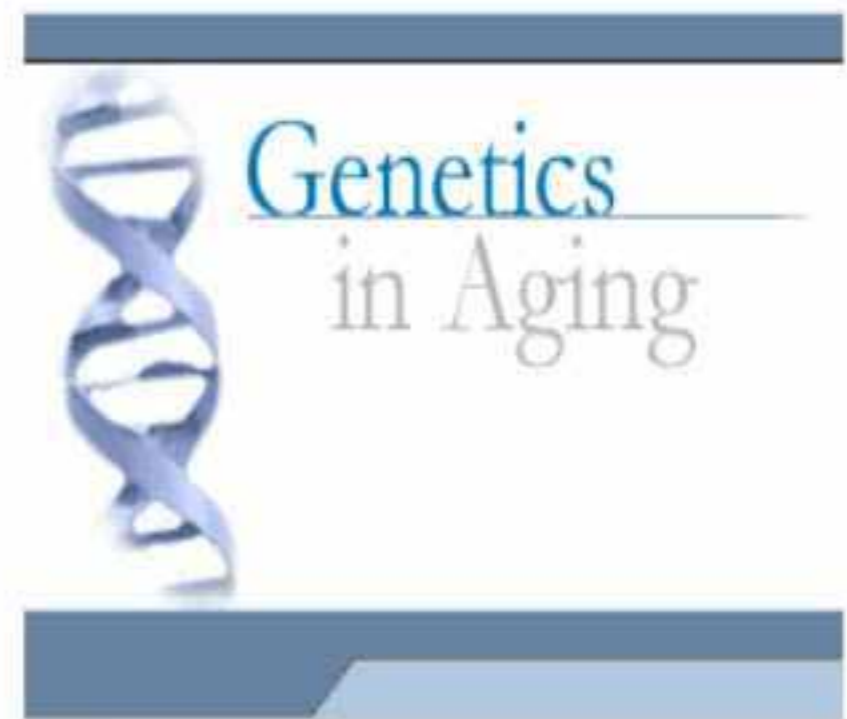
The difference between ageing and longevity



What is research on human ageing hoping to achieve ?

The difference between ageing and longevity

Increasing longevity without preventing ageing would just delay the problem

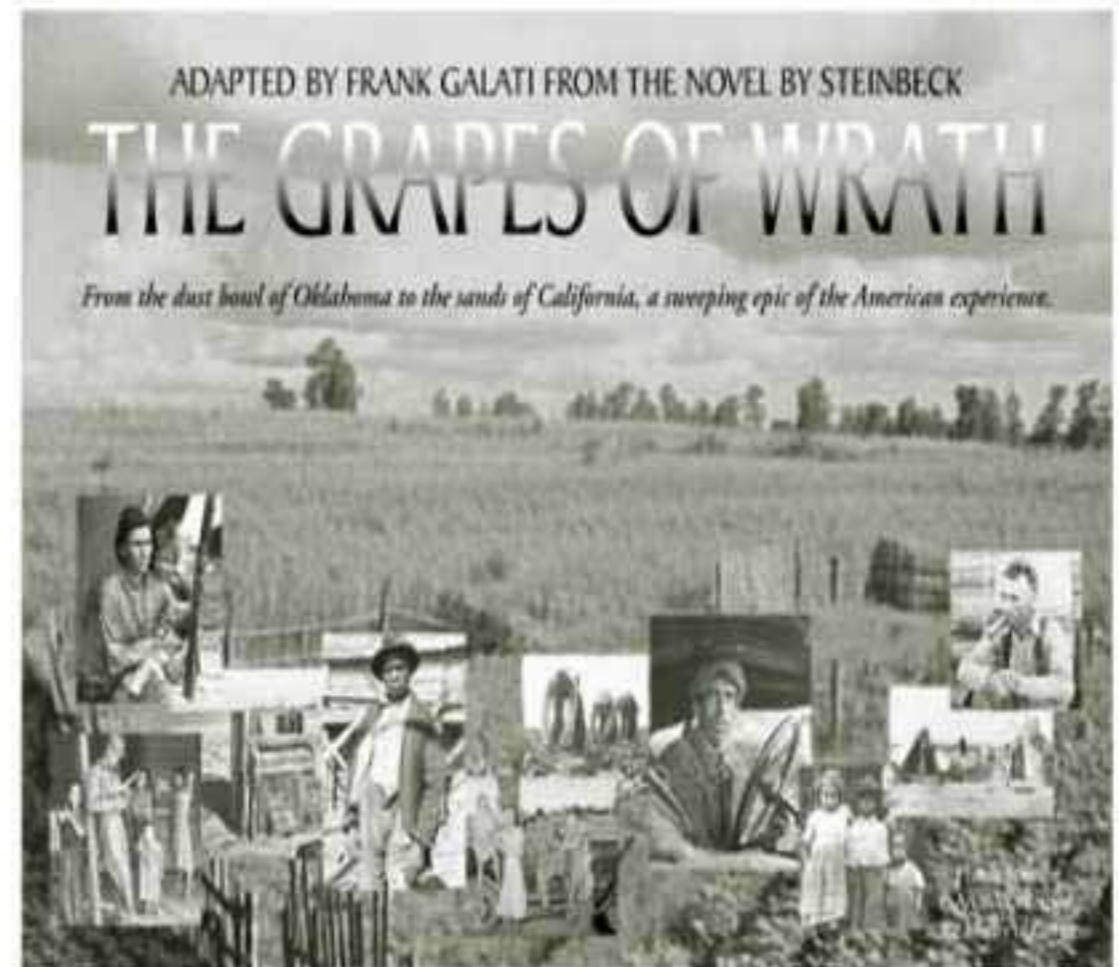


What is research on human ageing hoping to achieve ?

The difference between ageing and longevity

Increasing longevity without preventing ageing would just delay the problem

Potential economic or population disaster



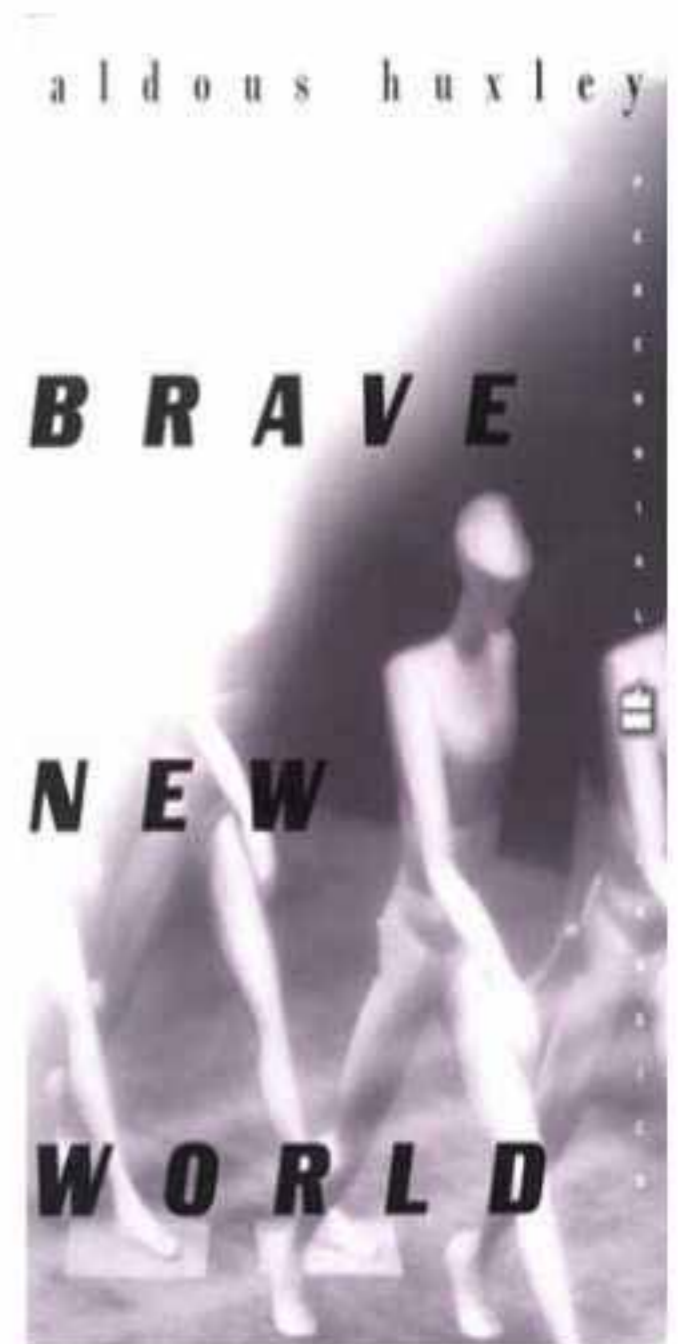
What is research on human ageing hoping to achieve ?

The difference between ageing and longevity

Increasing longevity without preventing ageing would just delay the problem

Potential economic or population disaster

The 'Brave New World' of increasing healthspan



What is research on human ageing hoping to achieve ?

Problem: What makes you die if predation/injury/disease risks are minimal ?

What is research on human ageing hoping to achieve ?

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Final life event strategy ?



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Final life event strategy ?

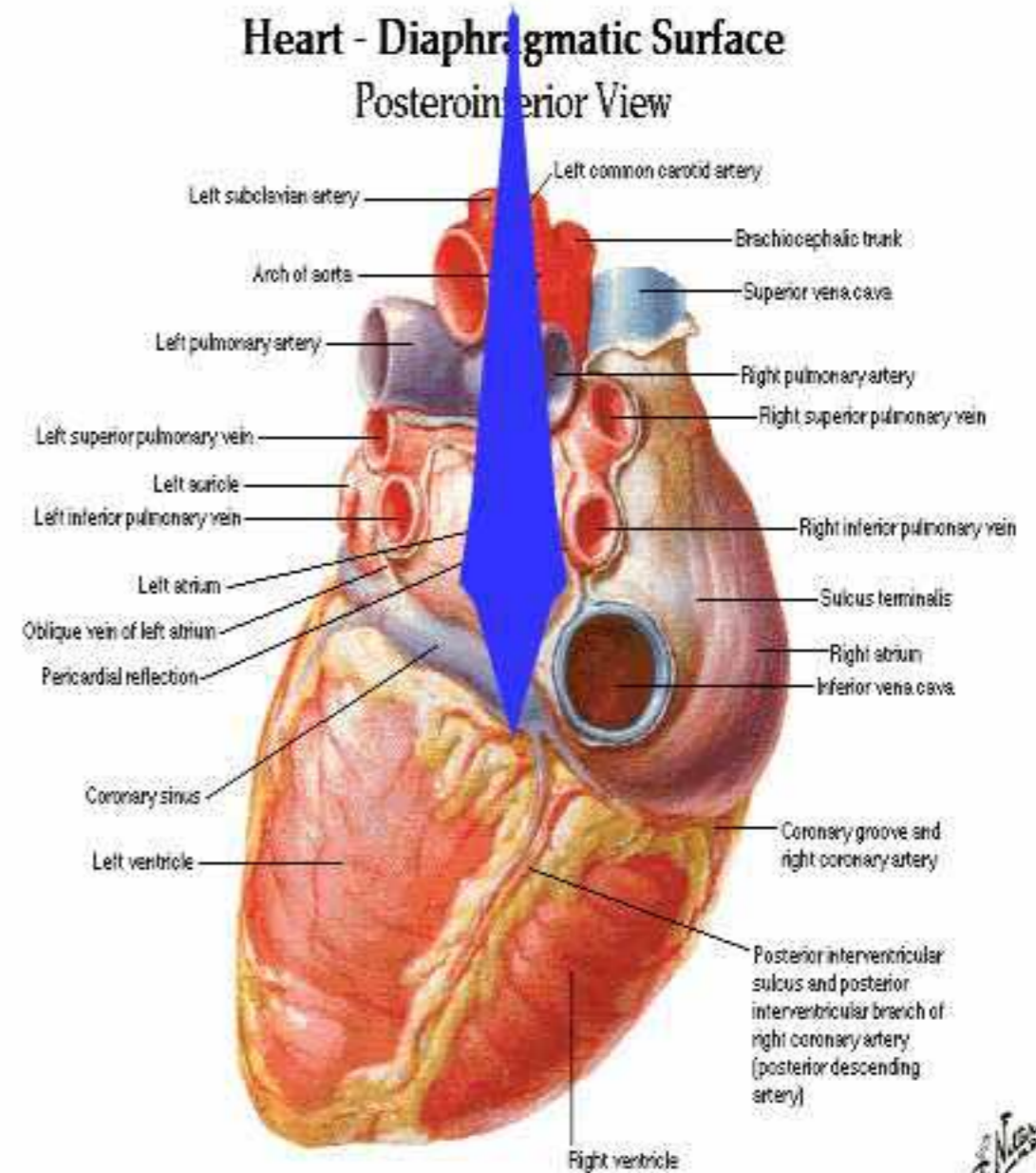


What is research on human ageing hoping to achieve ?

Problem: What makes you die if predation/injury/disease risks are minimal ?

Final life event strategy ?

Programmed heart failure ?



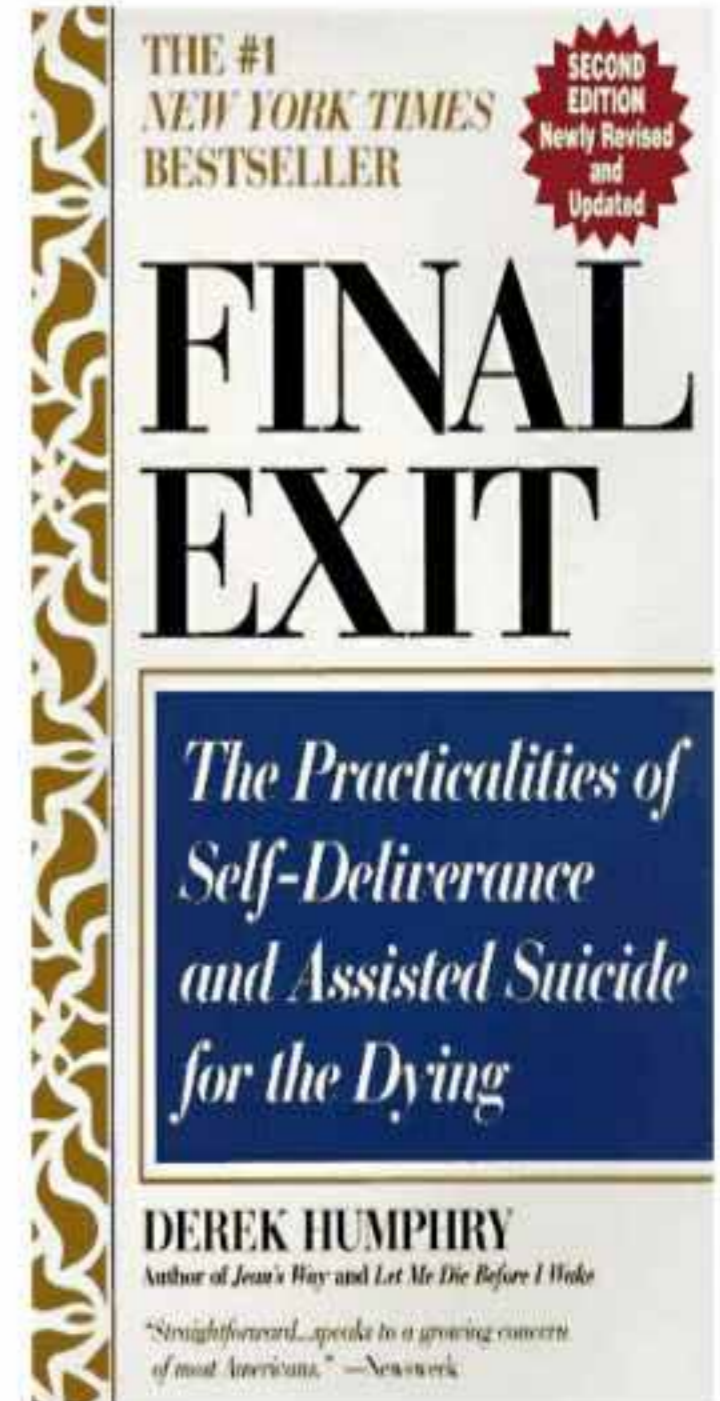
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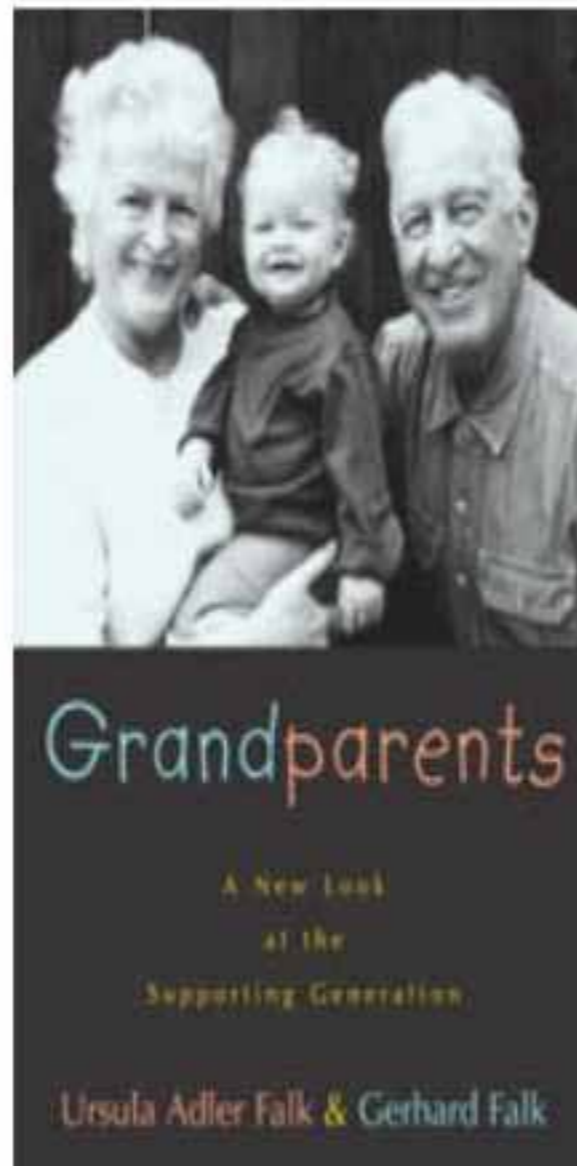
Euthanasia policy ?



Evolutionary theories of ageing

Evolutionary theories of ageing

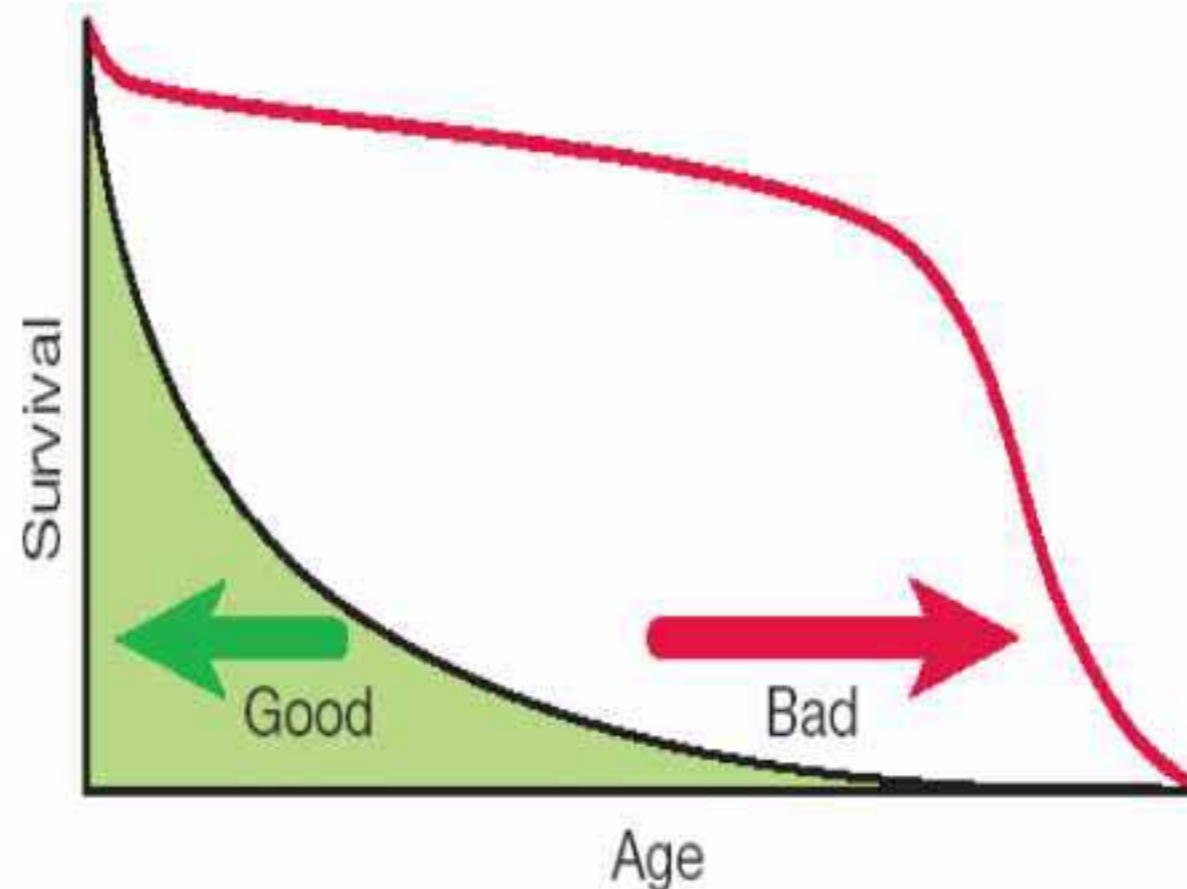
Minimal adaptive pressure to select genes that protect against ageing



Evolutionary theories of ageing

Minimal adaptive pressure to select genes that protect against ageing

Disposable soma hypothesis



Kirkwood *et al*
Nature 2000

Evolutionary theories of ageing

Minimal adaptive pressure to select genes that protect against ageing

Disposable soma hypothesis

Ageing is an indirect consequence of selecting genes for early reproduction



Evolutionary theories of ageing

Sprinters and marathon runners



Evolutionary theories of ageing

Sprinters and marathon runners

Most species run lots of races
in different places and with
different partners !



Evolutionary theories of ageing

Sprinters and marathon runners

Most species run lots of races
in different places and with
different partners !

Big bang species only get to run once !

Evolutionary theories of ageing

If this is correct there should be a reproduction-longevity trade-off



Evolutionary theories of ageing

If this is correct there should be a reproduction-longevity trade-off

If flies breed early they die early



Evolutionary theories of ageing

If this is correct there should be a reproduction-longevity trade-off

If flies breed early they die early

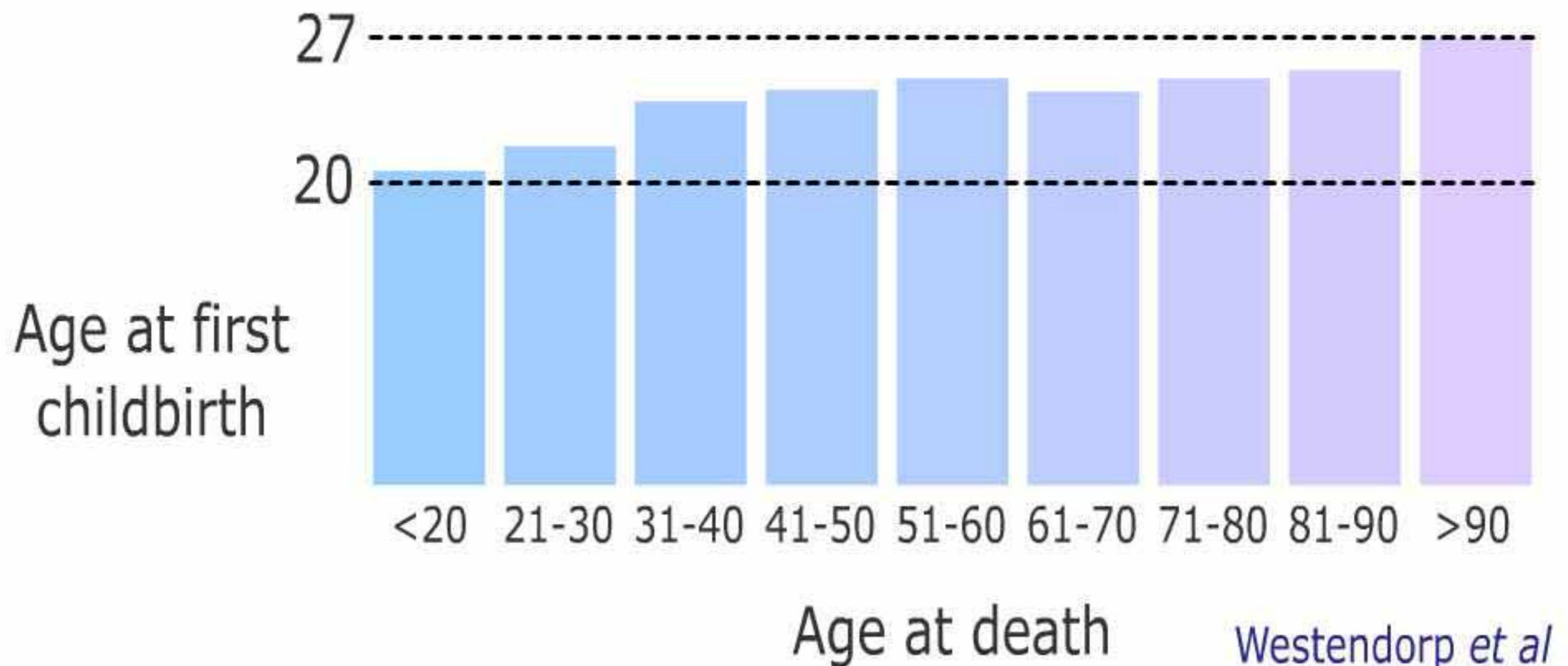


Evolutionary theories of ageing

The same is true of married female British aristocrats from 1740-1876

Evolutionary theories of ageing

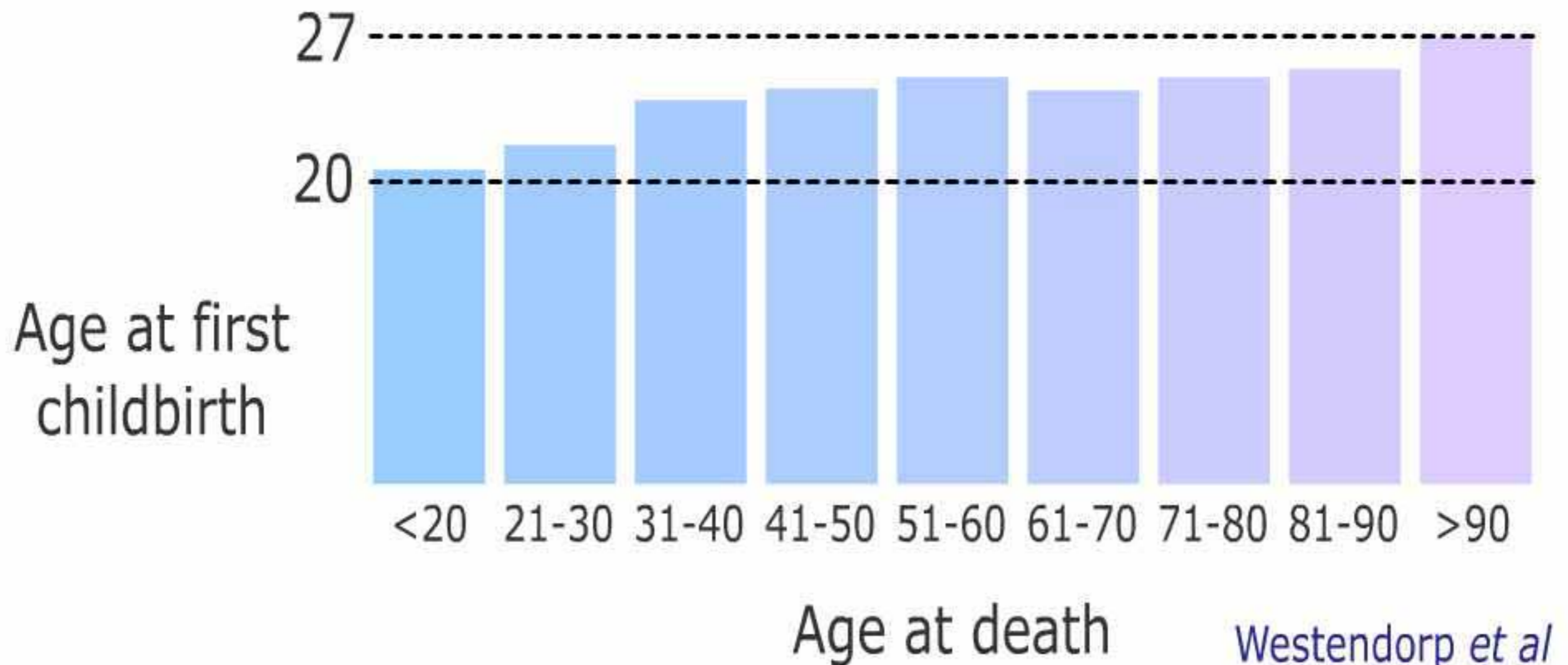
The same is true of married female British aristocrats from 1740-1876



Westendorp *et al*
Nature 1998

Evolutionary theories of ageing

The same is true of married female British aristocrats from 1740-1876



Westendorp *et al*
Nature 1998

But not for their male partners !

Overall conclusion:

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Ageing and death are the indirect result of needing to burn the candle at both ends



So why do some species live longer than others ?



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Surviving long enough to reproduce



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Dependent upon:



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metabolic rate



So why do some species live longer than others ?

Surviving long enough to reproduce

Dependent upon:

- predation, injury and disease risks
- availability of food resources and mates
- developmental time courses and size
- responsibility for parental care
- metabolic rate
- social structures



So why do some species live longer than others ?

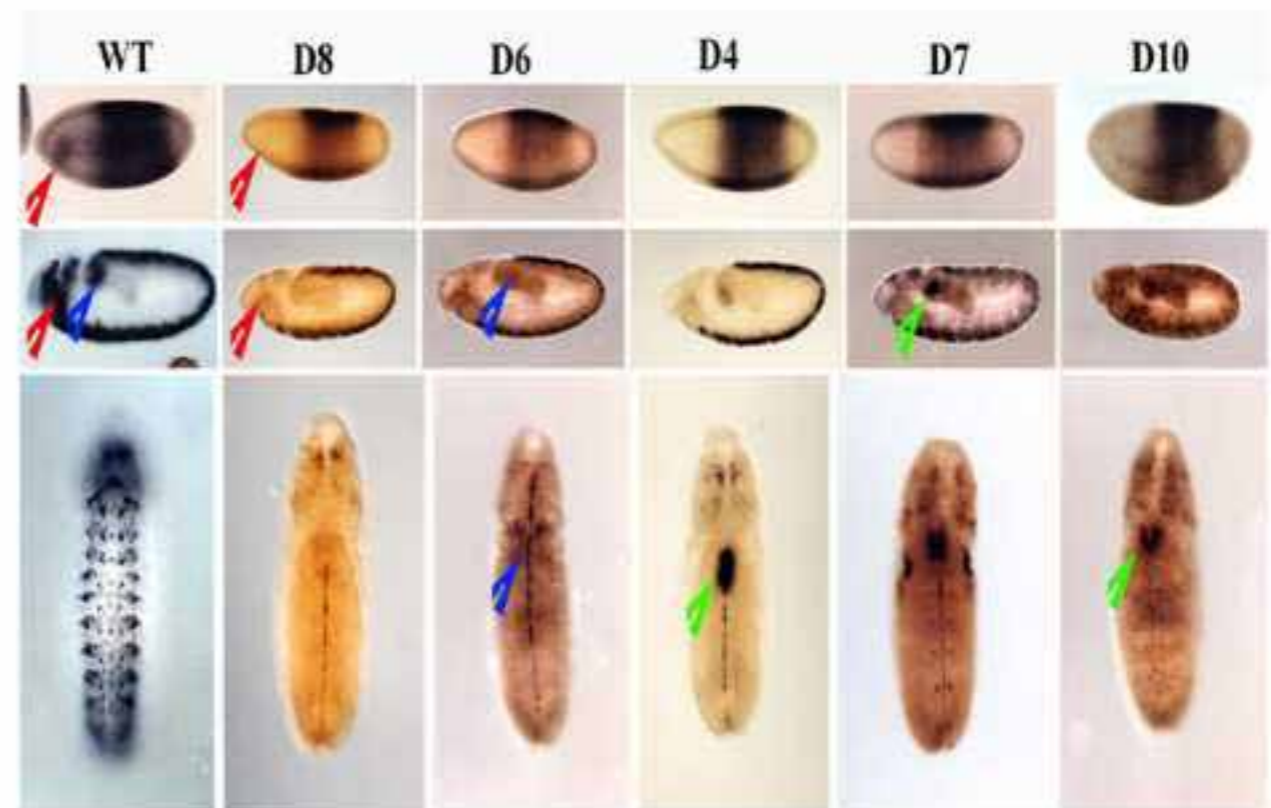
All species need to be prepared to adapt to the unexpected



So why do some species live longer than others ?

All species need to be prepared to adapt to the unexpected

A fast-breeding strategy promotes higher rate of adaptive beneficial mutations



Dichaete expression is lost from different regulatory mutants.

- The anterior domain and brain is lost in all mutants.
- Hindgut expression is missing in D8 and D6.
- Hindgut expression is restored in D4, D7 and D10.

Size, metabolic rate and flight

Size, metabolic rate and flight

Longevity is positively correlated with size



Size, metabolic rate and flight

Longevity is positively correlated with size

Negatively correlated with metabolic rate

Size, metabolic rate and flight

Longevity is positively correlated with size

Negatively correlated with metabolic rate

Birds seem to contradict this



Size, metabolic rate and flight

I believe I can fly !



Size, metabolic rate and flight

I believe I can fly !

Being able to fly reduces predation risk so you can breed slower and live longer



Size, metabolic rate and flight

I believe I can fly !

Being able to fly reduces predation risk so you can breed slower and live longer

So perhaps if we could develop wings and fly we could do the same !



The 'grandmother' effect

Why do humans live longer than chimpanzees ?



The 'grandmother' effect

Why do humans live longer than chimpanzees ?

Mothers helping to raise their daughters' children



The 'grandmother' effect

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Improves survival and production rates



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Lifespan =

max reproductive age $45 + 40 = 85$ years



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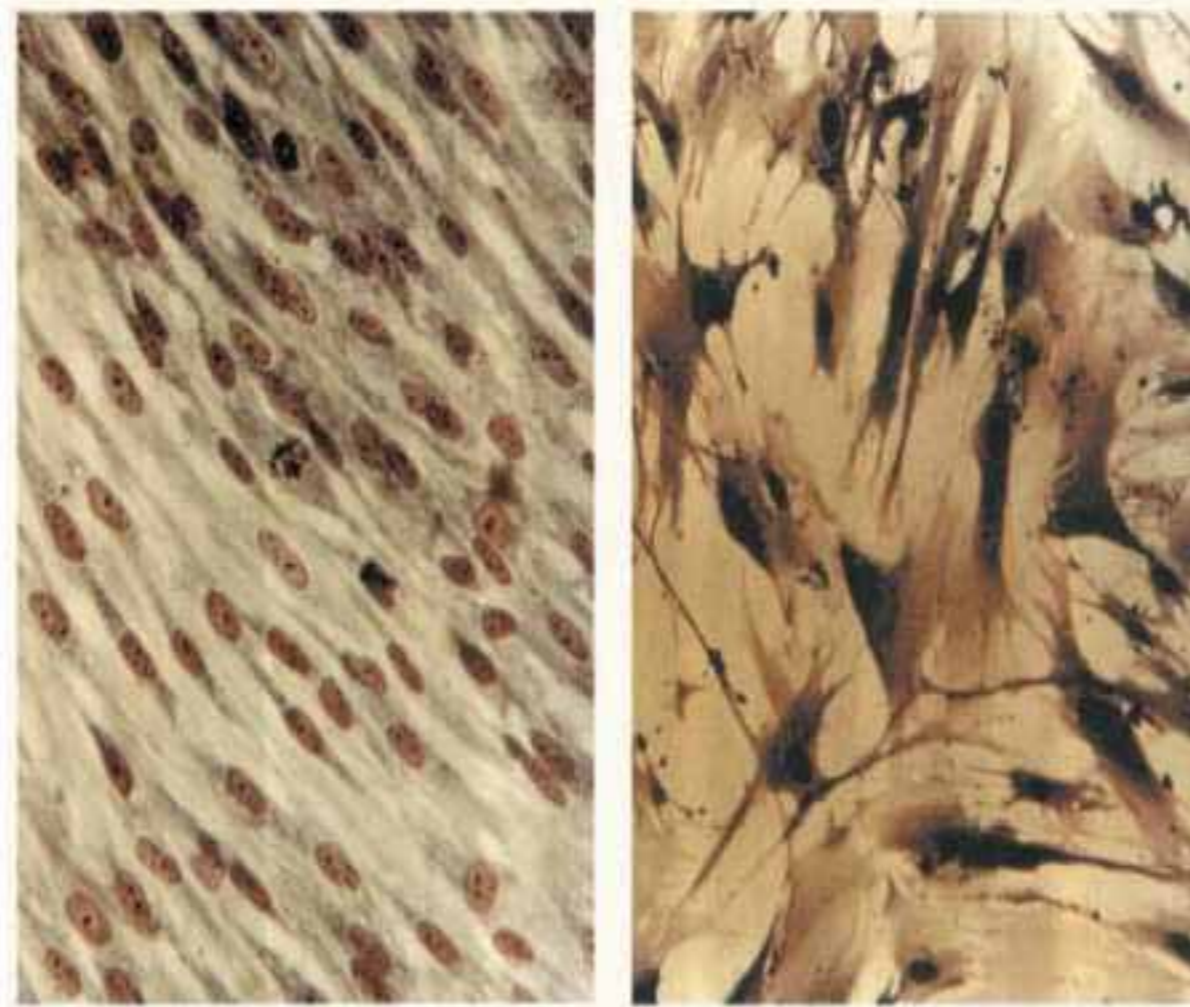
Perhaps we all owe our current extended lifespan to Grandmothers



So what determines longevity ?

So what determines longevity ?

Cells are mortal in culture so ageing must reflect what goes on inside them



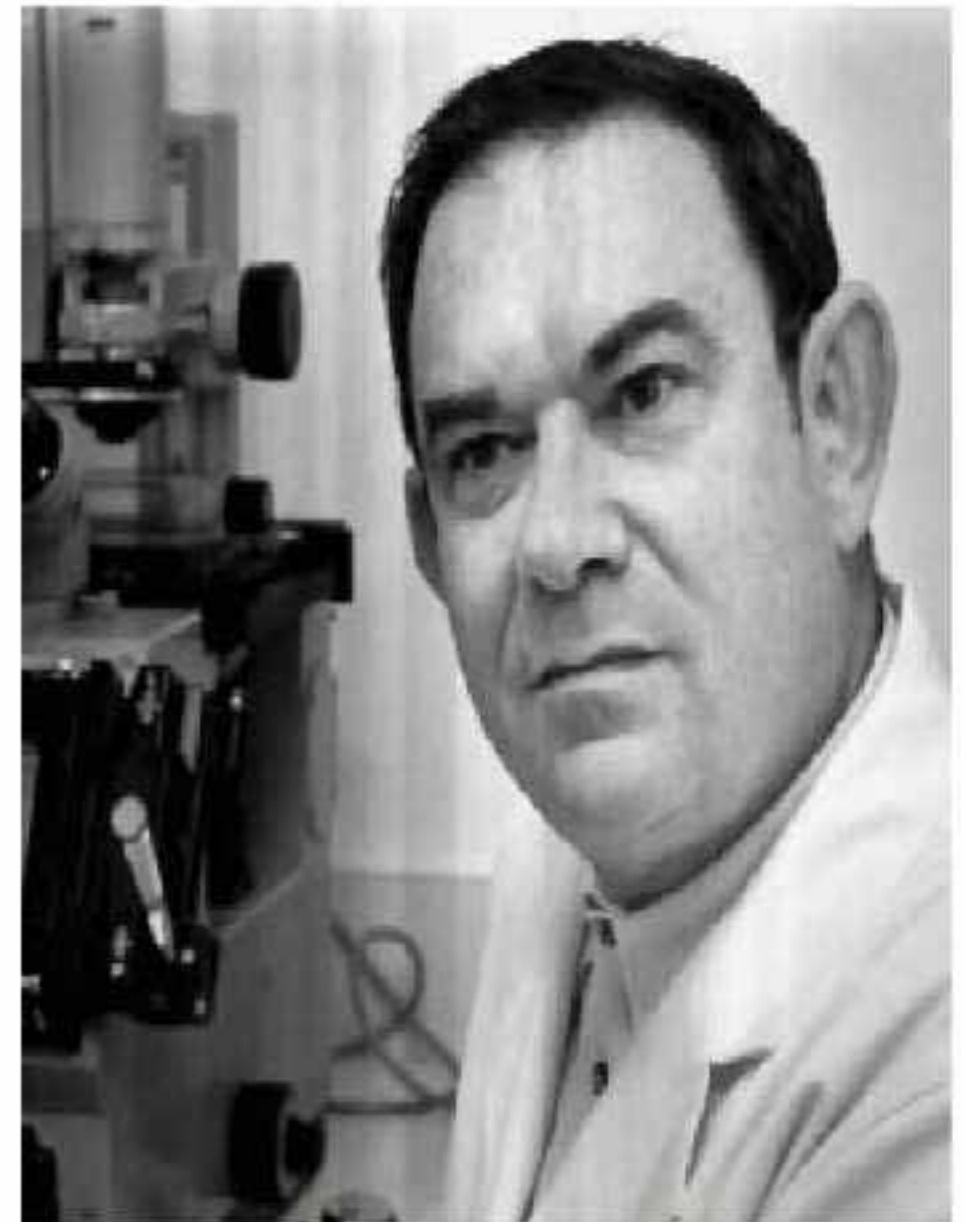
Young cells

Old cells

So what determines longevity ?

Cells are mortal in culture so ageing must reflect what goes on inside them

The Hayflick Hypothesis:

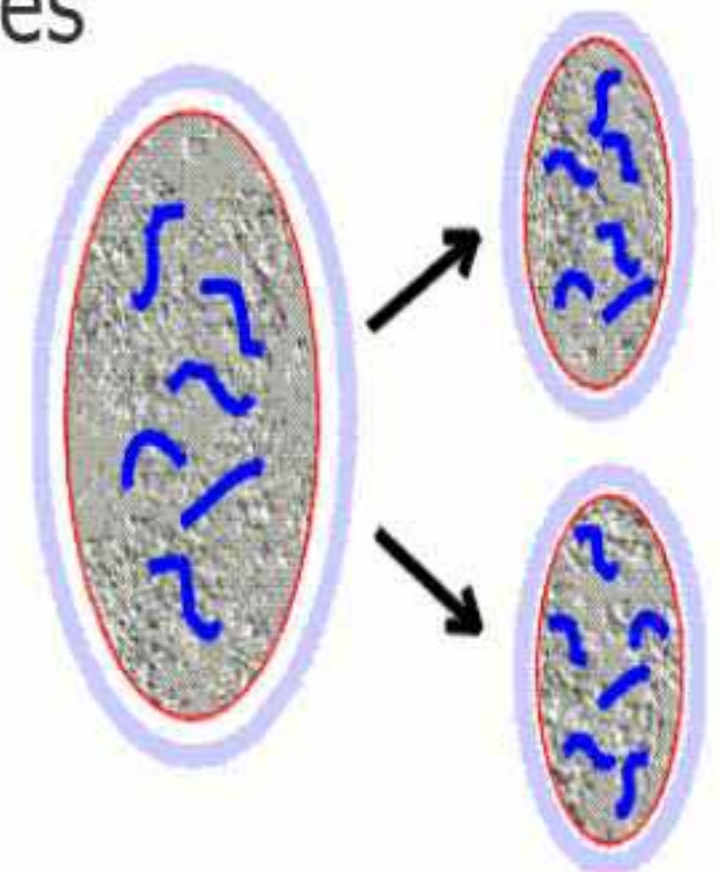


So what determines longevity ?

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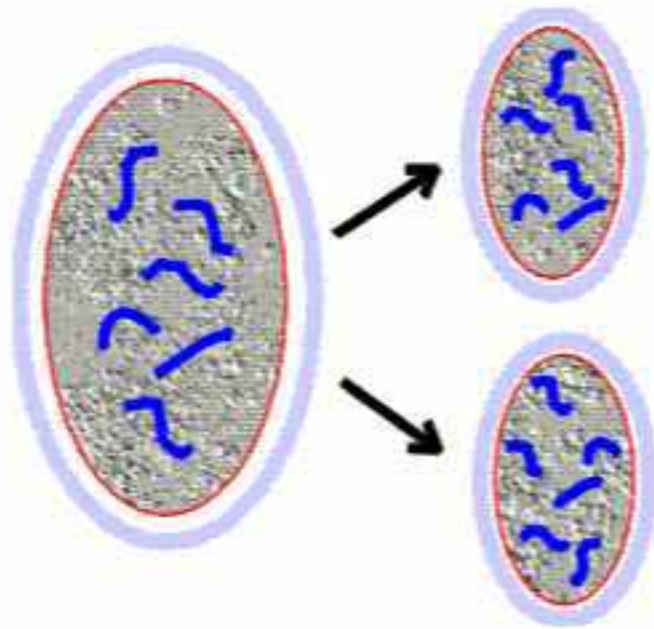
The Hayflick Hypothesis:

Cells can only divide a finite number of times
(around 50 for many human cells)



So what determines longevity ?

Cells have an on-board counter for how many times they have already divided



So what determines longevity ?

Cells have an on-board counter for how many times they have already divided

Number of divisions is correlated with species longevity

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Number of divisions is correlated with species longevity

This does not mean that cells hit the buffers of their division maximum and die



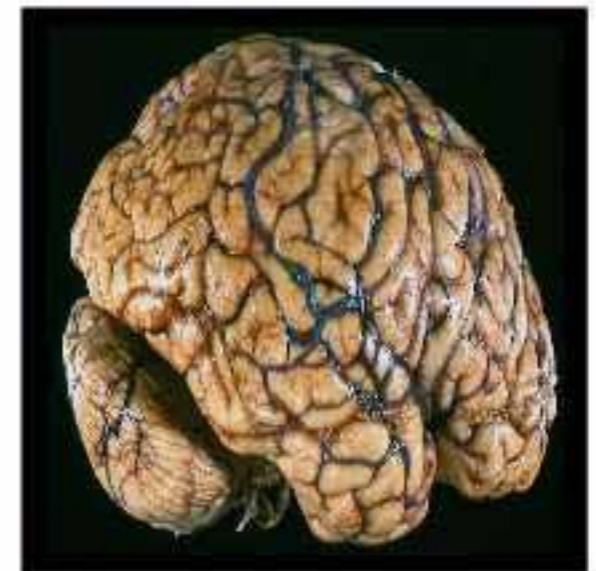
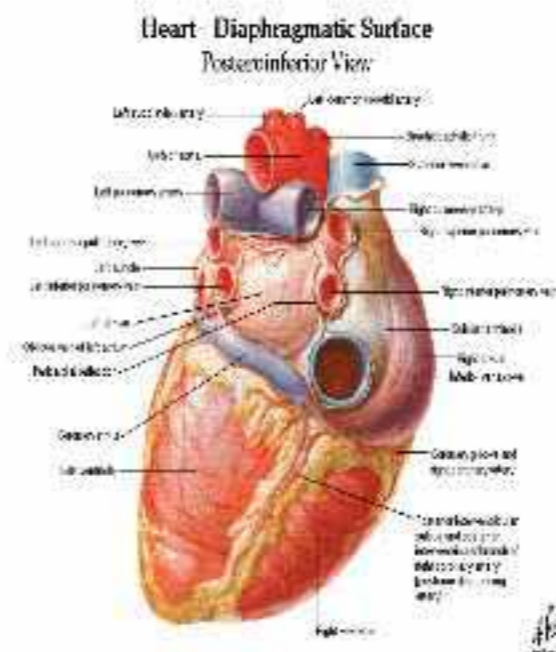
So what determines longevity ?

Cells have an on-board counter for how many times they have already divided

Number of divisions is correlated with species longevity

This does not mean that cells hit the buffers of their division maximum and die

In brain and heart the majority of cells do not divide

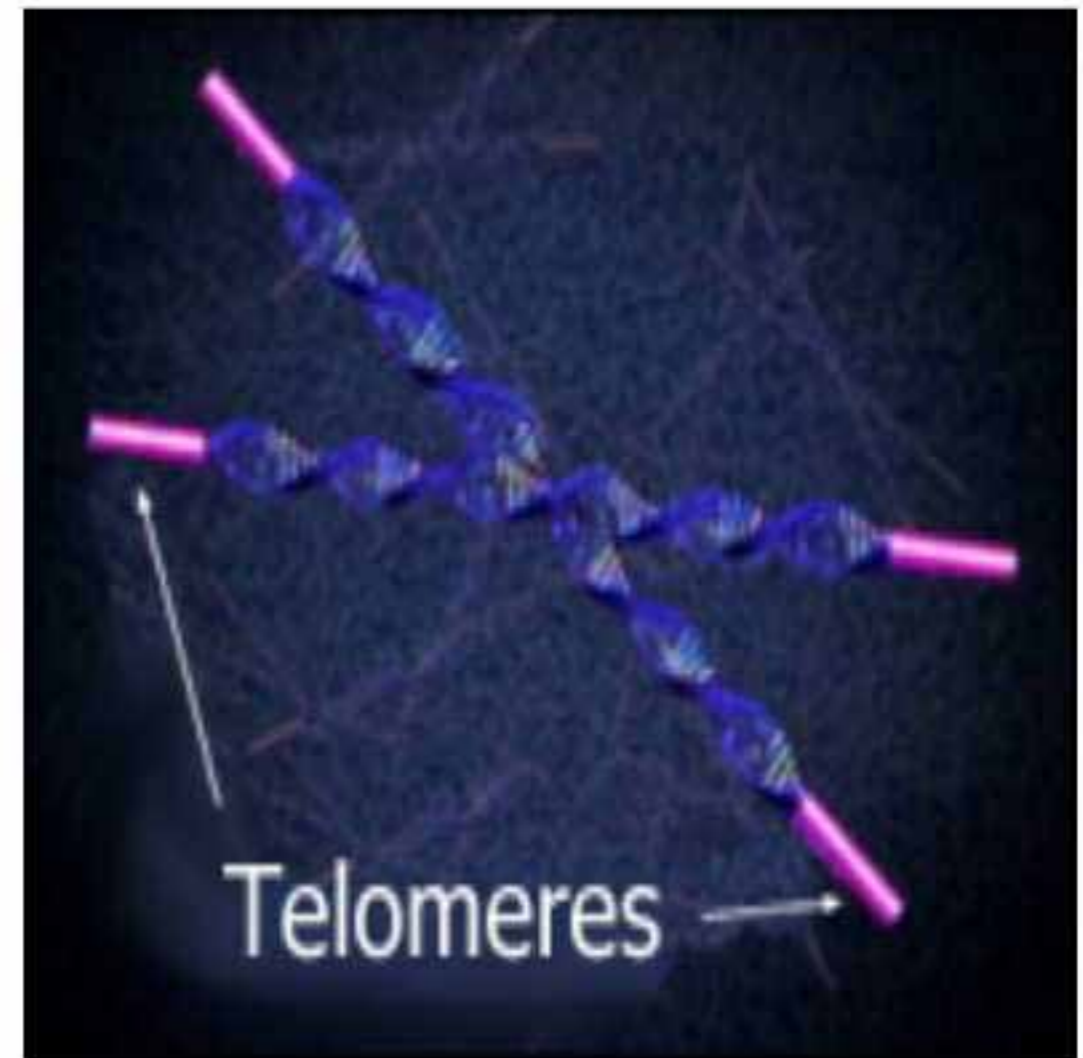


How can cells count their divisions ?

How can cells count their divisions ?

Telomeres

- the TTAGGGs on the ends of your chromosomes

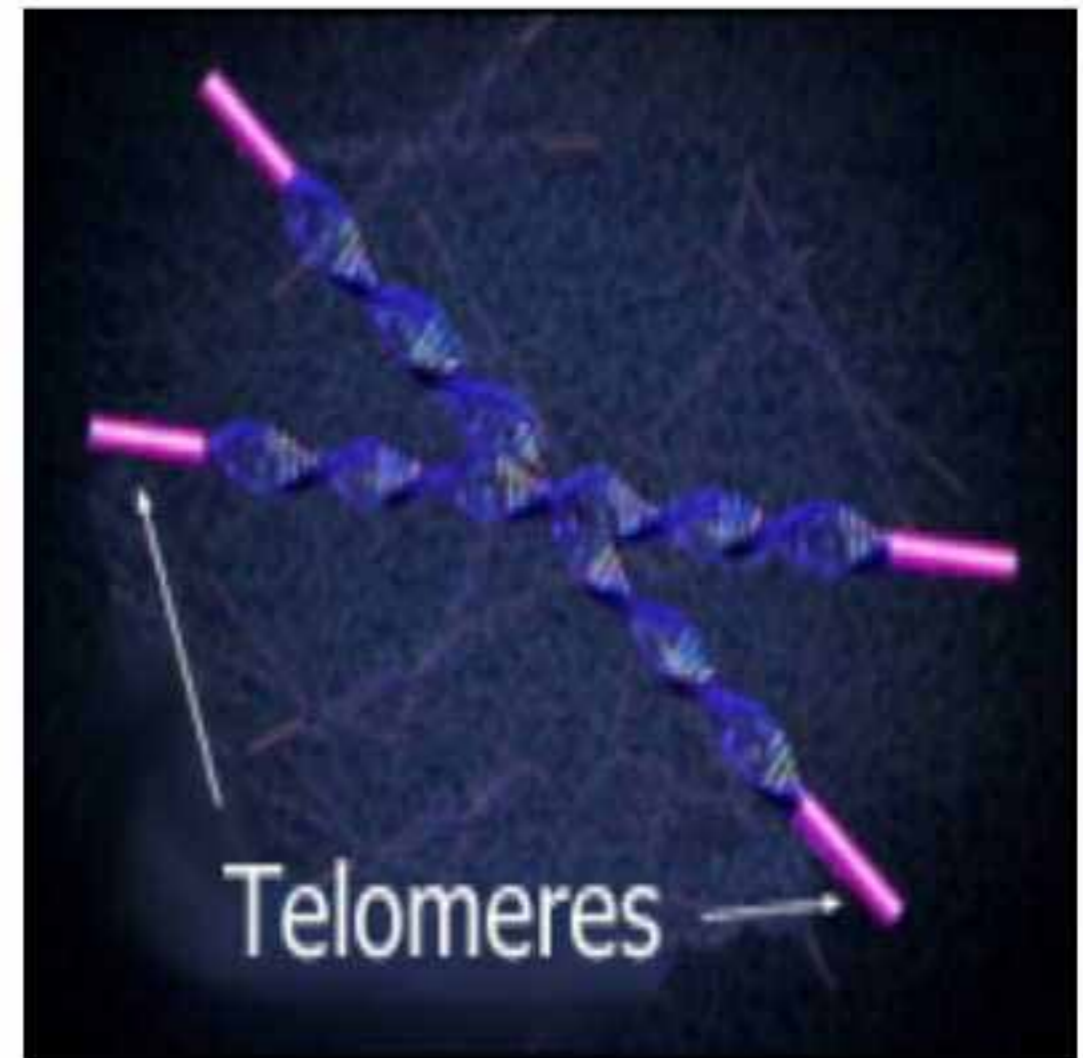


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Telomerase and immortality



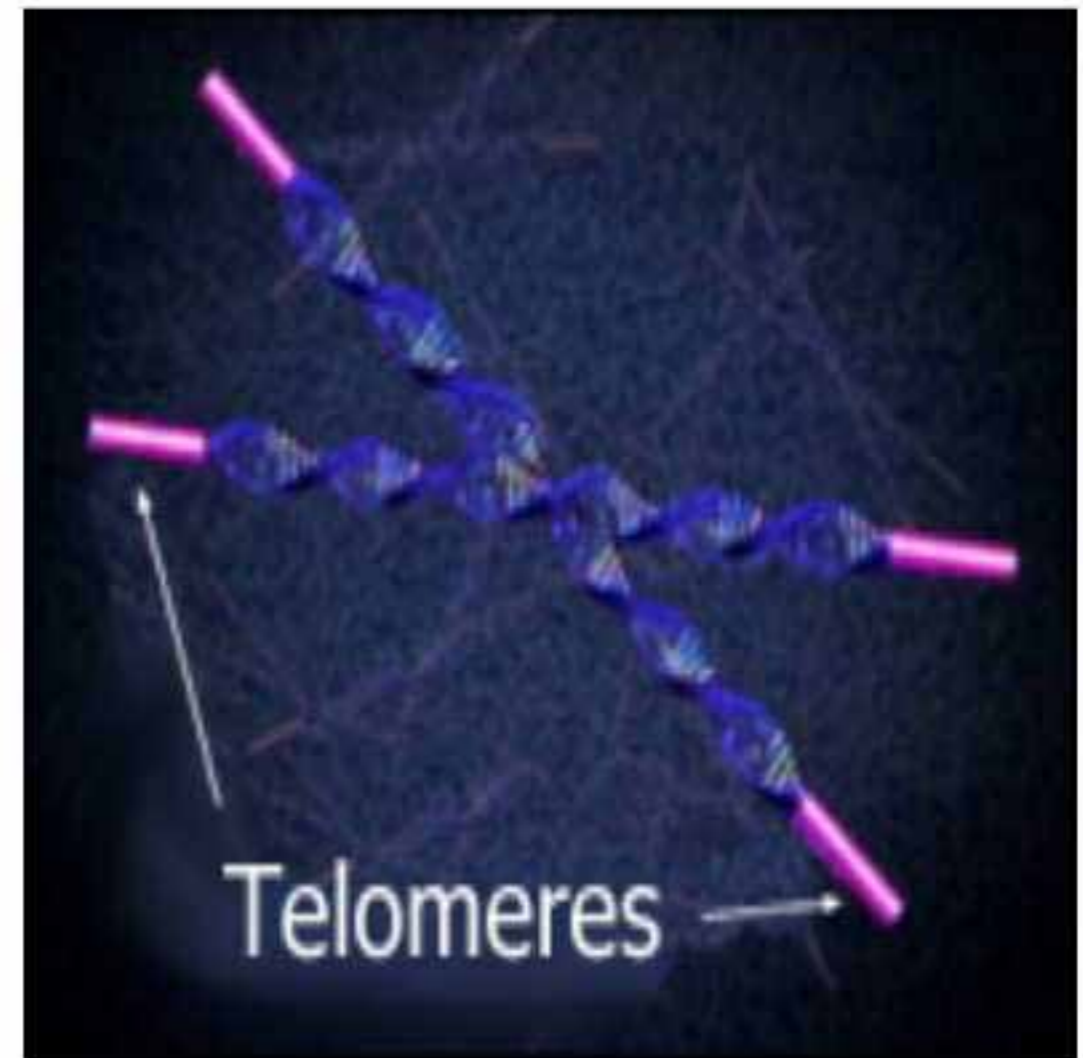
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Telomerase and immortality

- Species that don't age (high levels)



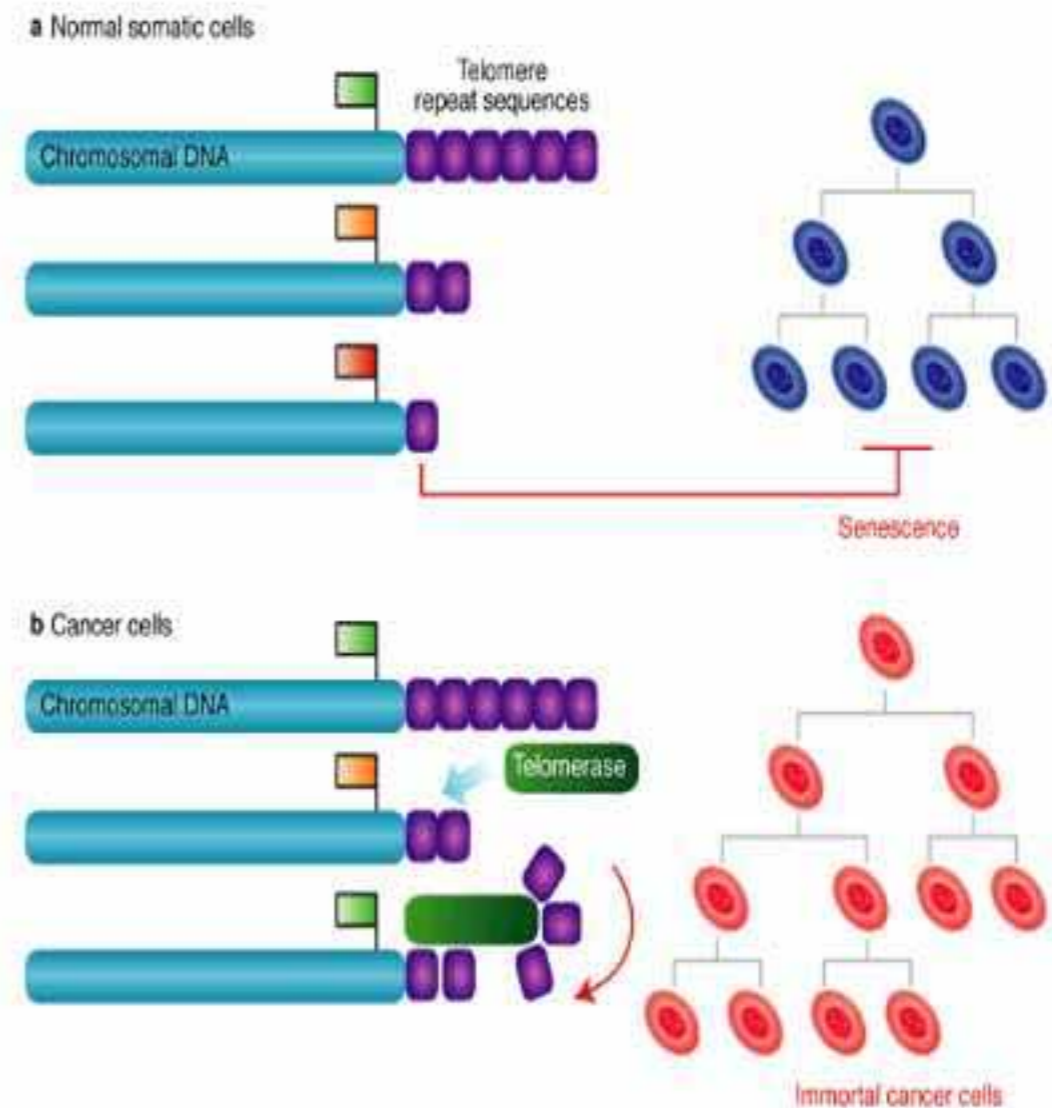
How can cells count their divisions ?

Telomeres

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Telomerase and immortality

- Species that don't age (high levels)
- Cancer cells (high)



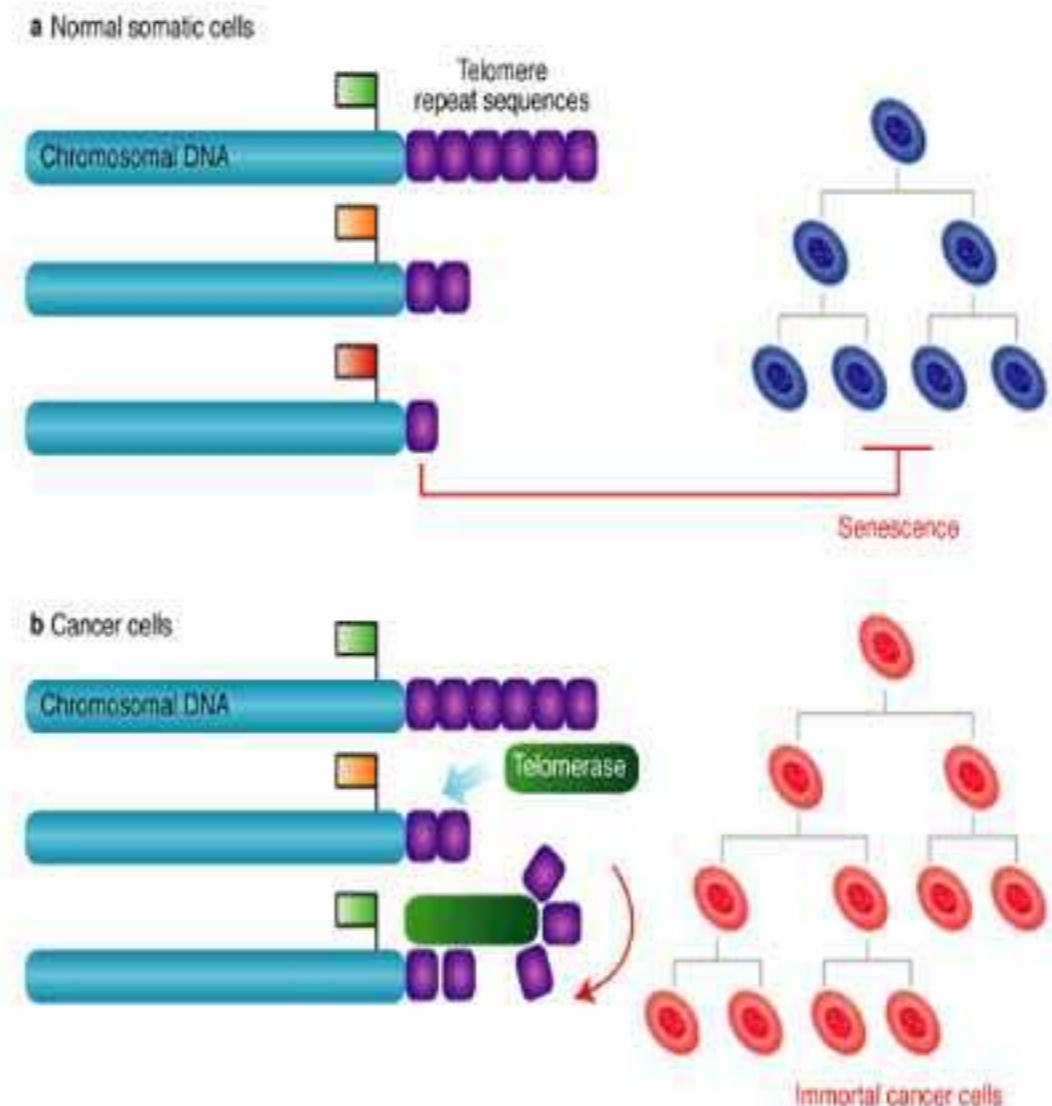
How can cells count their divisions ?

Telomeres

- the TTAGGGs on the ends of your chromosomes

Telomerase and immortality

- Species that don't age (high levels)
- Cancer cells (high)
- Engineered into cells in culture makes them immortal



How can cells count their divisions ?

Accelerated ageing (Progeroid conditions) is associated with shortened telomeres

How can cells count their divisions ?

Accelerated ageing (Progeroid conditions) is associated with shortened telomeres

- Werner's, Bloom's, Hutchinson-Gilford's and Down's syndromes

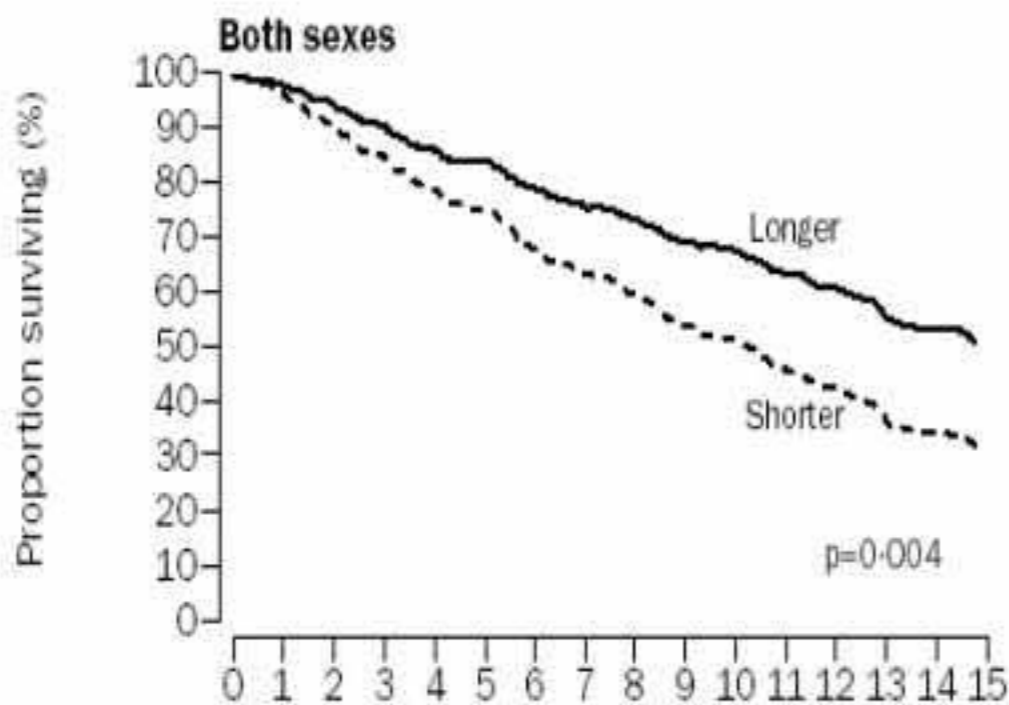


How can cells count their divisions ?

Telomere length may predict life expectancy

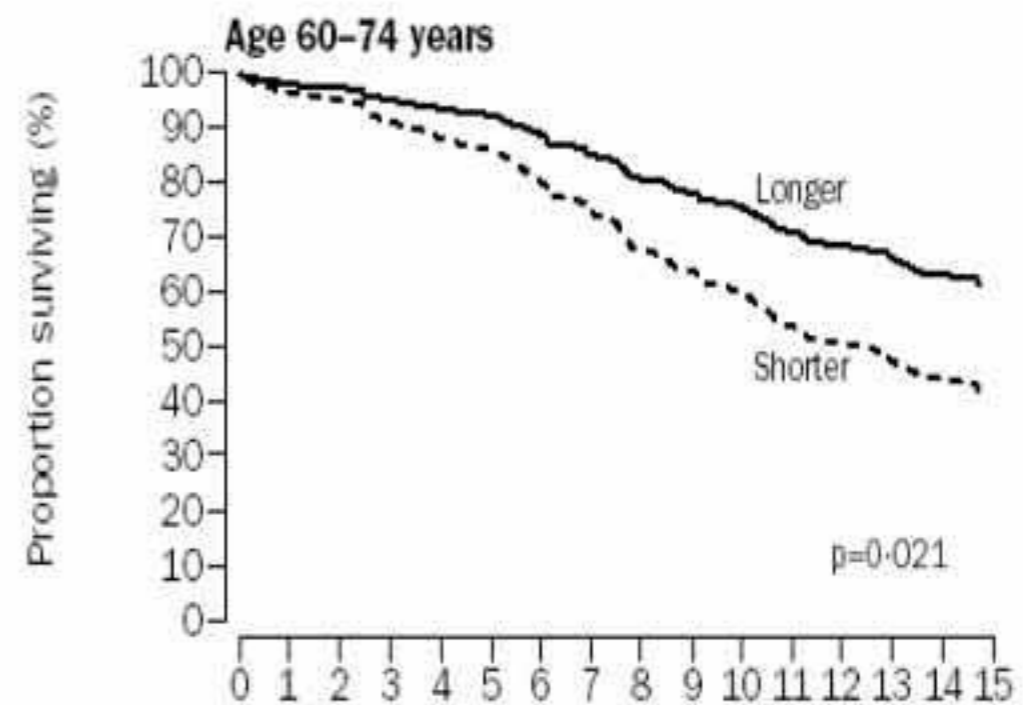
How can cells count their divisions ?

Telomere length may predict life expectancy



Number at risk

Longer	72	71	69	67	60	56	52	51	50	46	45	42	41	36	35	34
Shorter	71	69	63	59	57	56	51	46	43	40	37	34	31	27	25	23

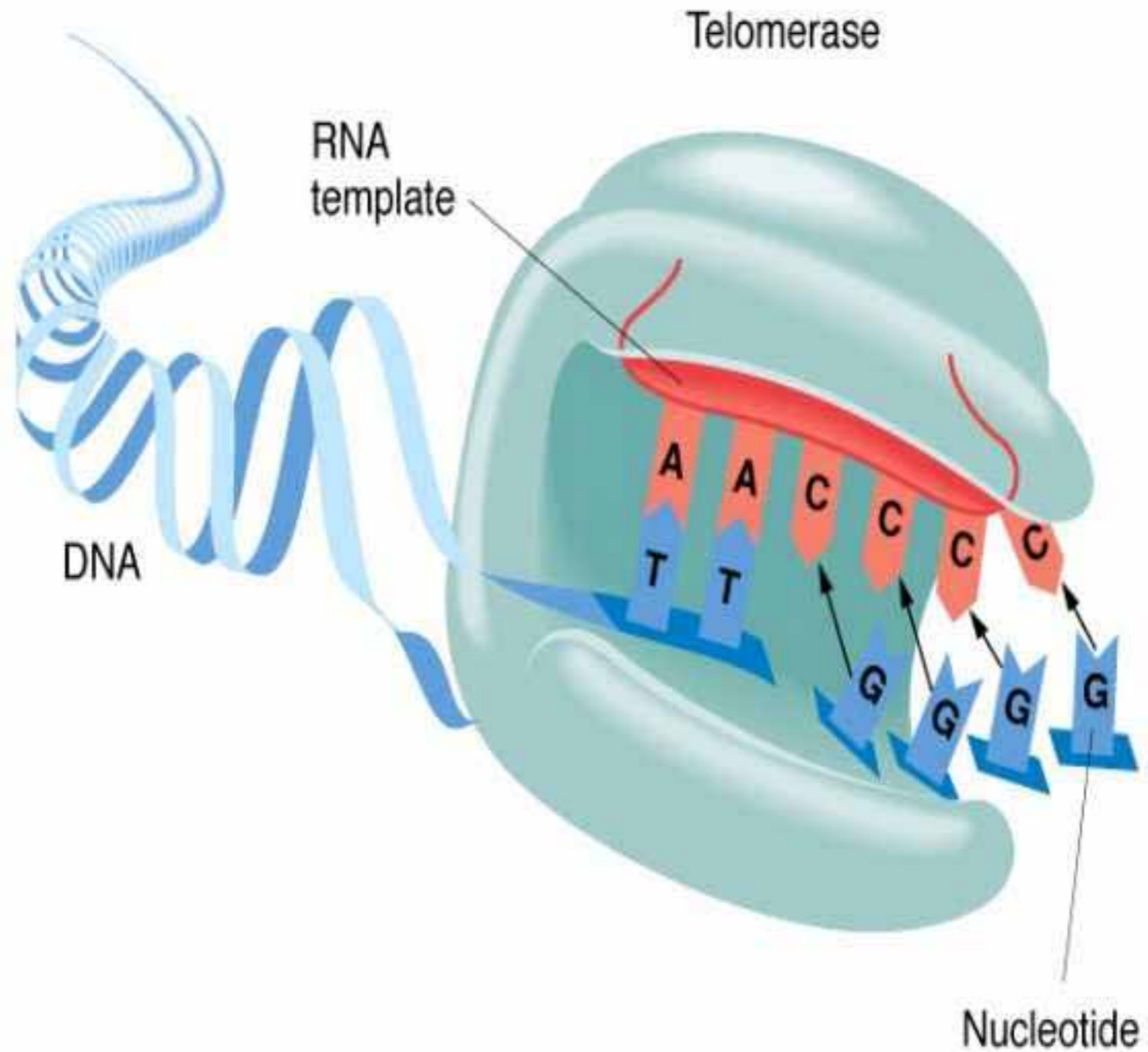


Number at risk

Longer	48	48	47	46	44	41	39	39	38	36	35	33	33	31	30	29
Shorter	45	44	44	42	41	41	39	35	32	32	30	28	26	25	23	22

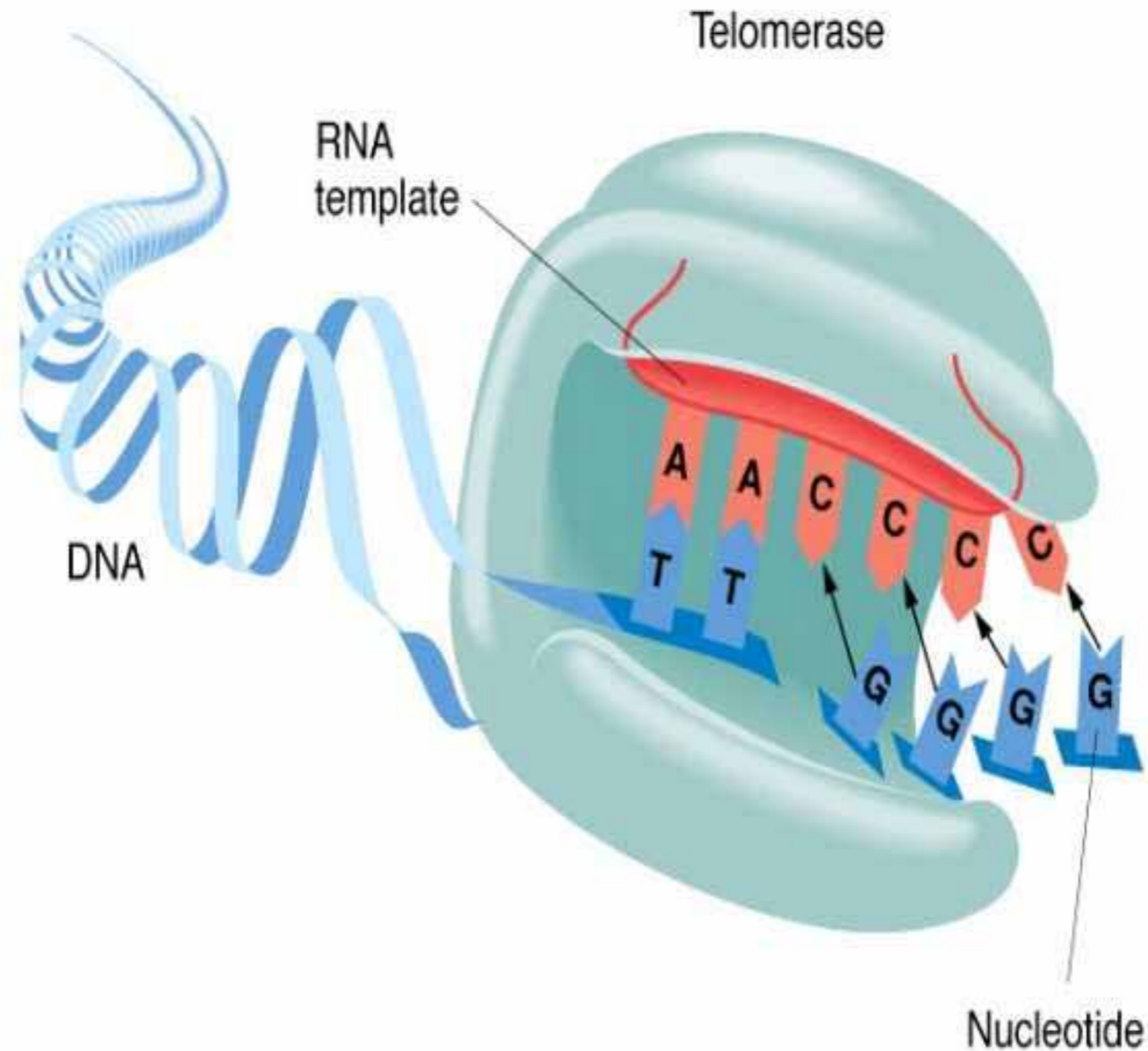
Over 60s with longest telomeres live 4-5 years longer than those with shortest ones [Cawthon et al 2003 Lancet](#)

So is taking telomerase the answer ?



So is taking telomerase the answer ?

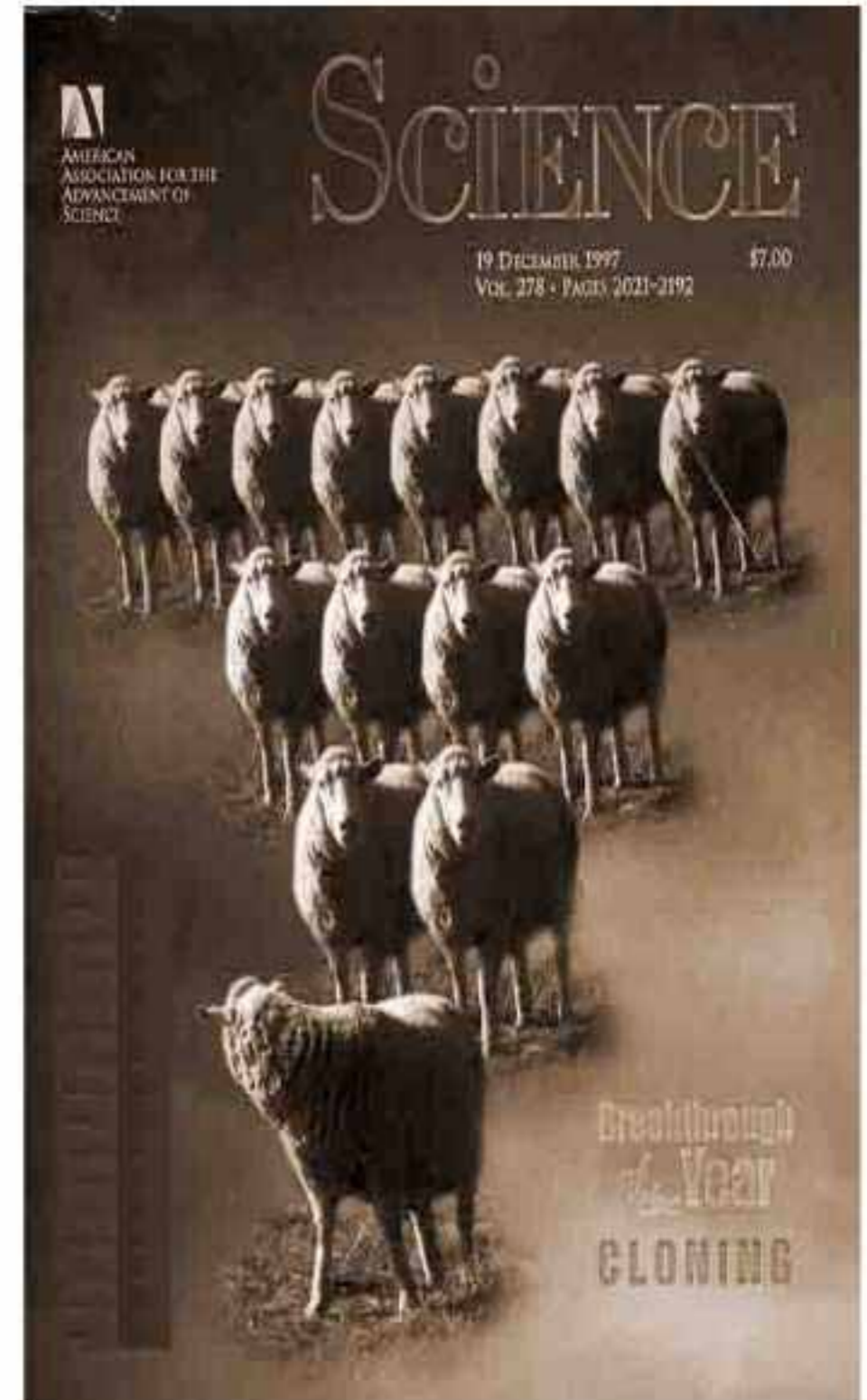
In theory it might help but could increase cancer risk



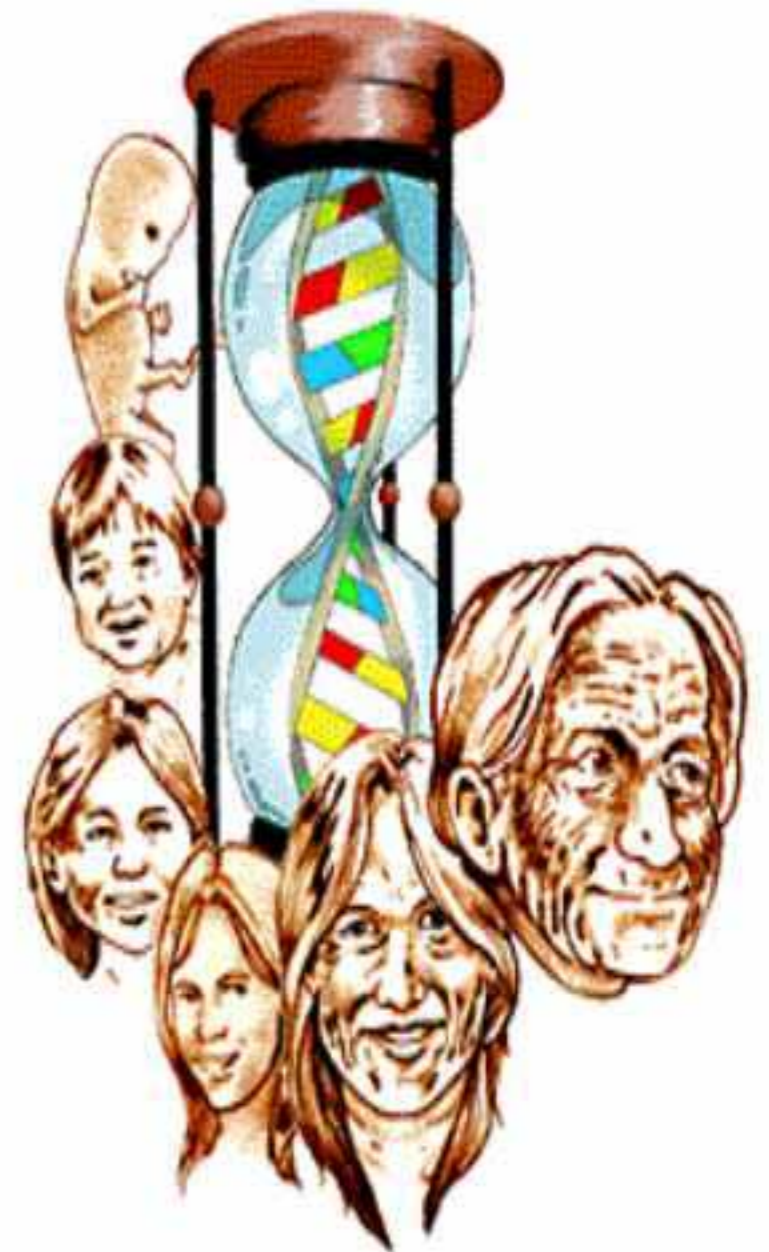
So is taking telomerase the answer ?

In theory it might help but could increase cancer risk

Does cloning from older cells reduce life expectancy of offspring ?

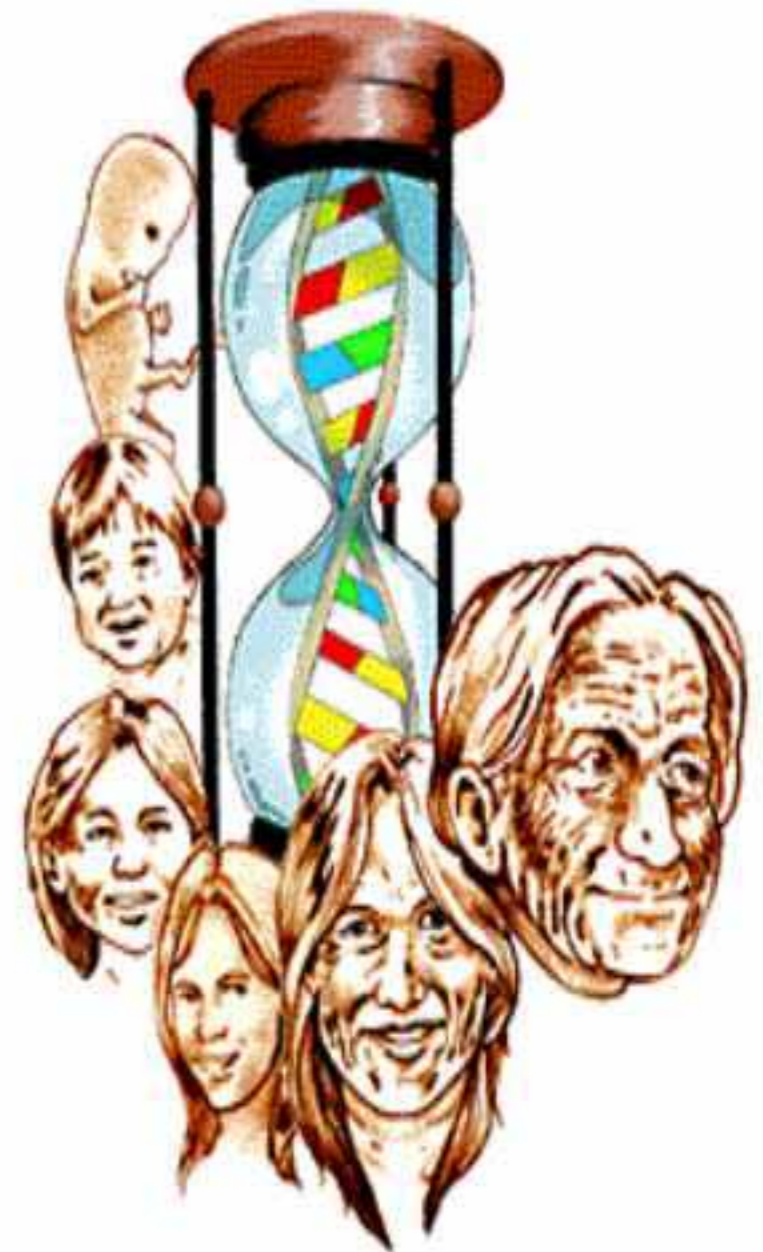


Are there ageing genes ?



Are there ageing genes ?

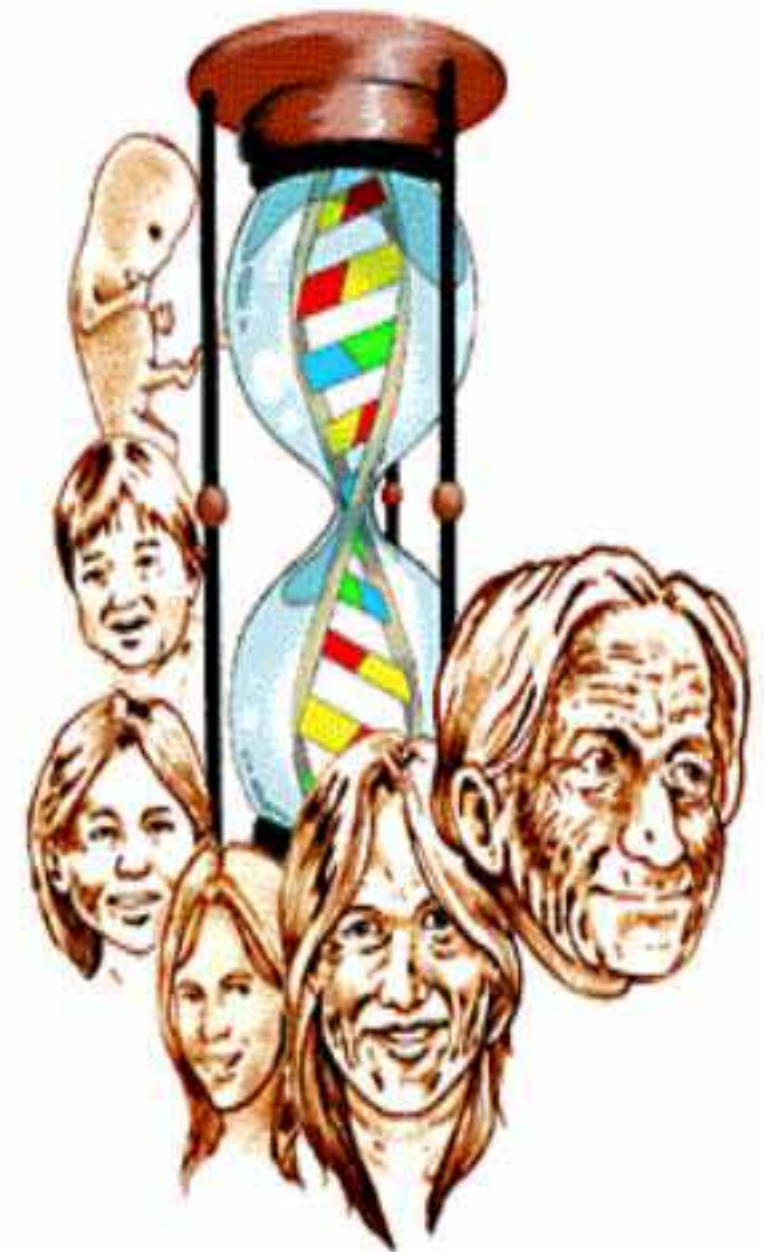
Current estimates from twin studies - 25% genetic contribution to ageing



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Large individual variability in age effects suggests low contribution



Are there ageing genes ?

Current estimates from twin studies - 25% genetic contribution to ageing

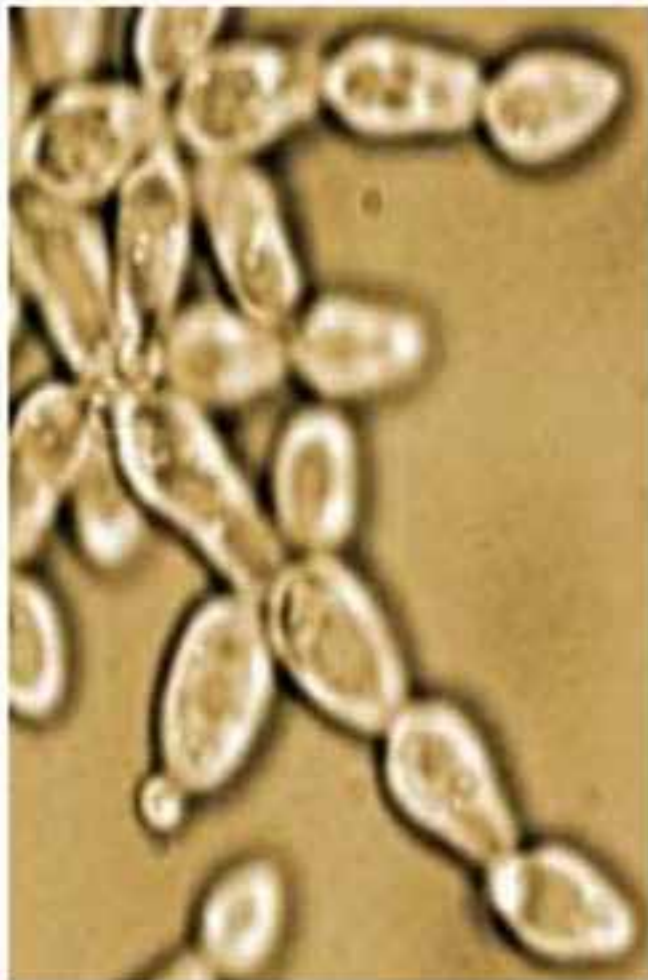
Large individual variability in age effects suggests low contribution

Difficult to select for good ageing genes !



Are there ageing genes ?

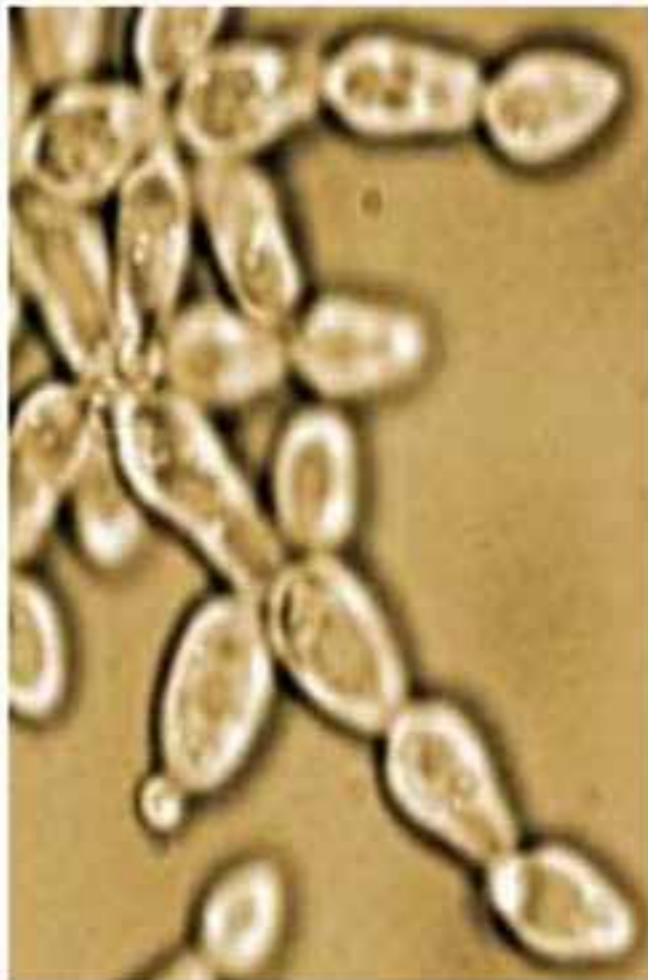
Yeast , worms and flies - model systems



Are there ageing genes ?

Yeast , worms and flies - model systems

Long-lived species are costly and time-consuming models



Are there ageing genes ?

Genetic manipulations can increase longevity by up to 60%



The Methuselah Mouse Prize

\$49,713.78

SHE
"Who Must
Be Obeyed"
Immortality Has Side Effects



Are there ageing genes ?

Genetic manipulations can increase longevity by up to 60%

However does not mean that ageing is eliminated

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Cells age and die because of:



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Cells age and die because of:
- Arrested growth and repair



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Cells age and die because of:

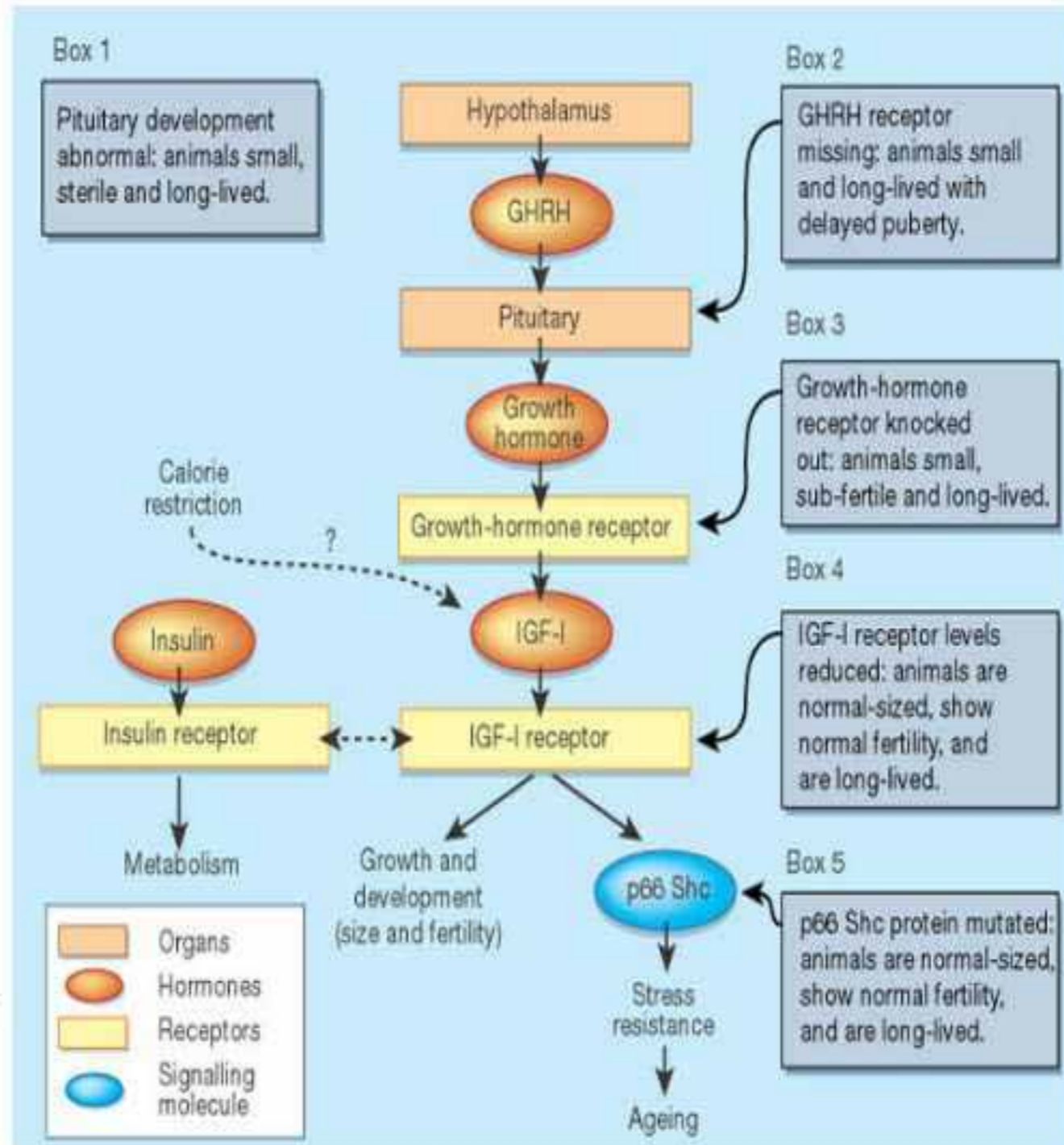
- Arrested growth and repair
- Mutation and DNA damage
- Increased susceptibility to stress



Genes associated with growth and repair

Genes associated with growth and repair

Growth hormone signalling pathways of key importance



Lithgow *et al*
Nature 2003

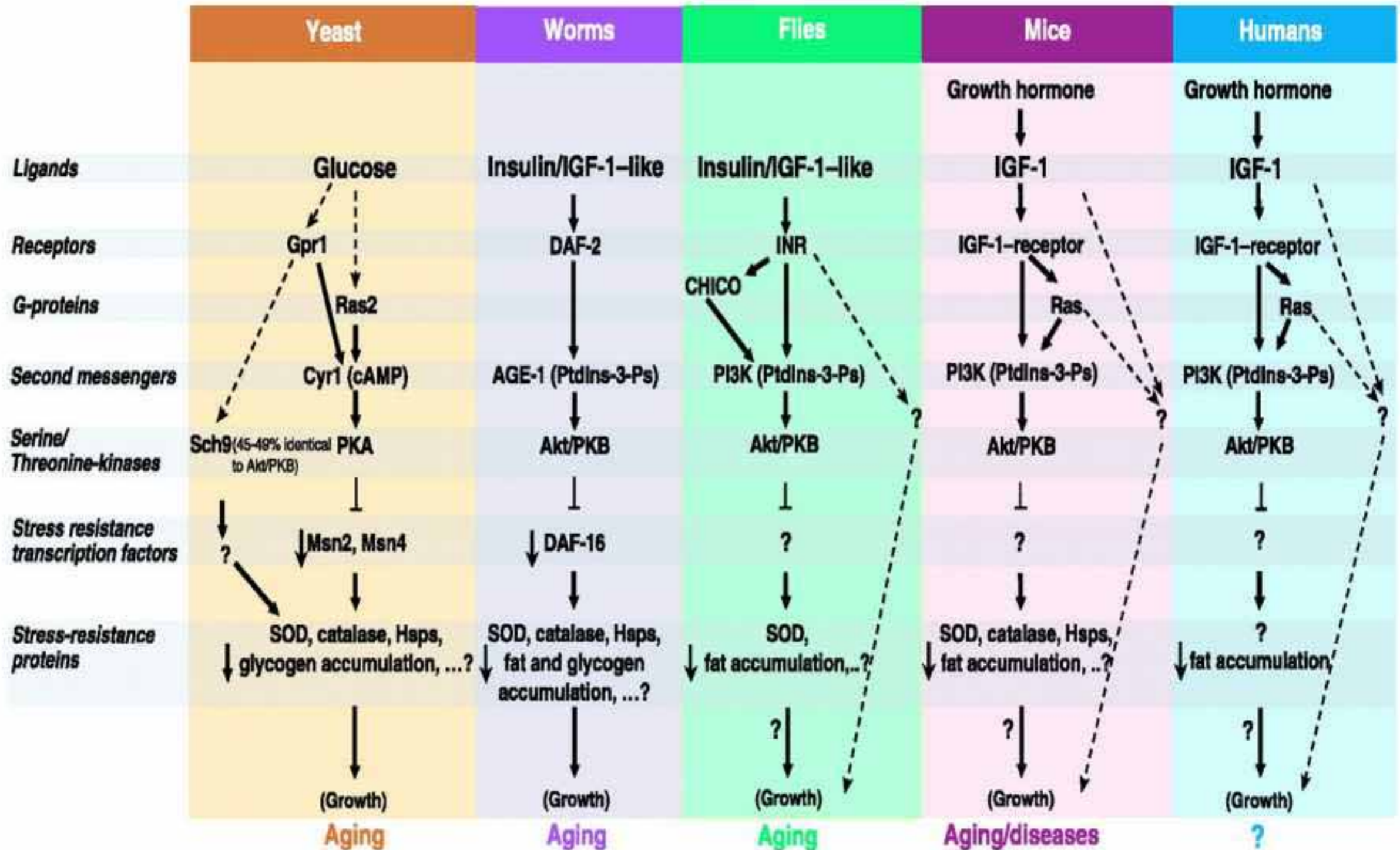
Genes associated with growth and repair

Growth hormone signalling pathways of key importance



Genes associated with growth and repair

Growth hormone signalling pathways of key importance



Genes associated with growth and repair

Growth hormone signalling pathways of key importance

However growth hormone levels decline as we get older

Genes associated with growth and repair

This reduces metabolic efficiency, wound repair and promotes organ failure

Genes associated with growth and repair

This reduces metabolic efficiency, wound repair and promotes organ failure

Growth hormone supplements reverse these effects and may increase longevity



Genes associated with growth and repair

So while reducing growth hormone signalling throughout life may increase longevity...

Genes associated with growth and repair

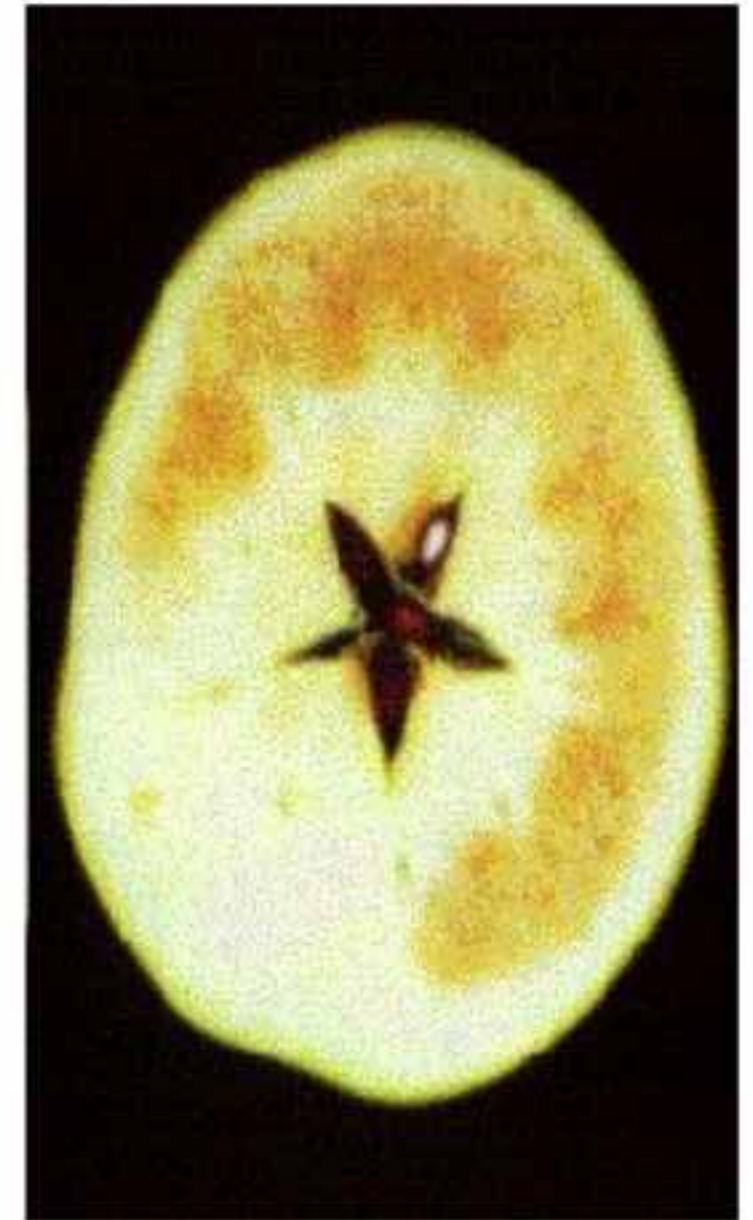
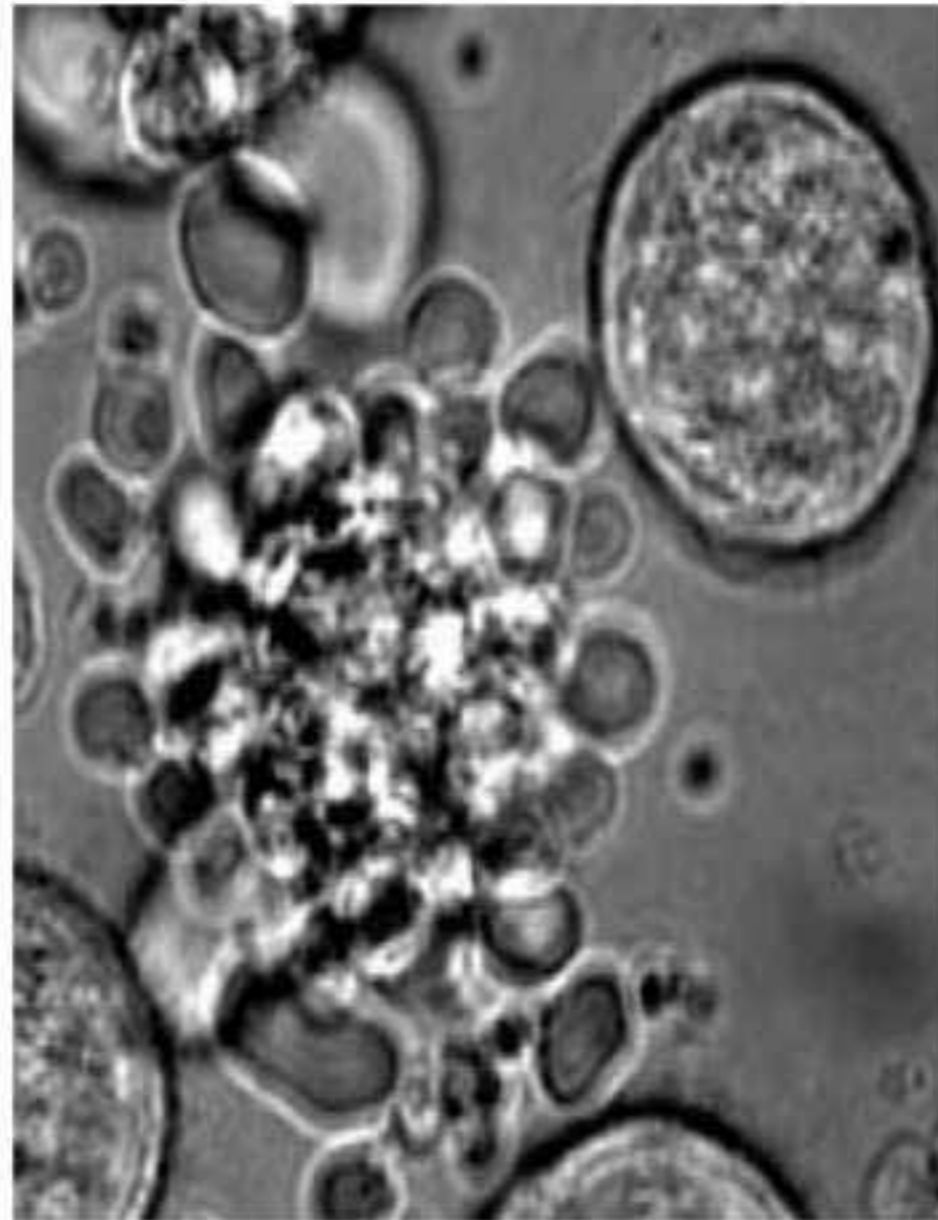
So while reducing growth hormone signalling throughout life may increase longevity...

...when it is reduced normally as a result of ageing it may do the opposite

Genes that prevent cell damage

Genes that prevent cell damage

A major cause of cell damage is oxidative stress by exposure to free-radicals



Genes that prevent cell damage

Ageing and/or longevity can be improved by:

Genes that prevent cell damage

Ageing and/or longevity can be improved by:

Reducing expression of genes triggering free-radical production....



Nitric oxide

Genes that prevent cell damage

Ageing and/or longevity can be improved by:

Reducing expression of genes triggering free-radical production....

....or increasing expression of genes preventing it

Superoxide
dismutase



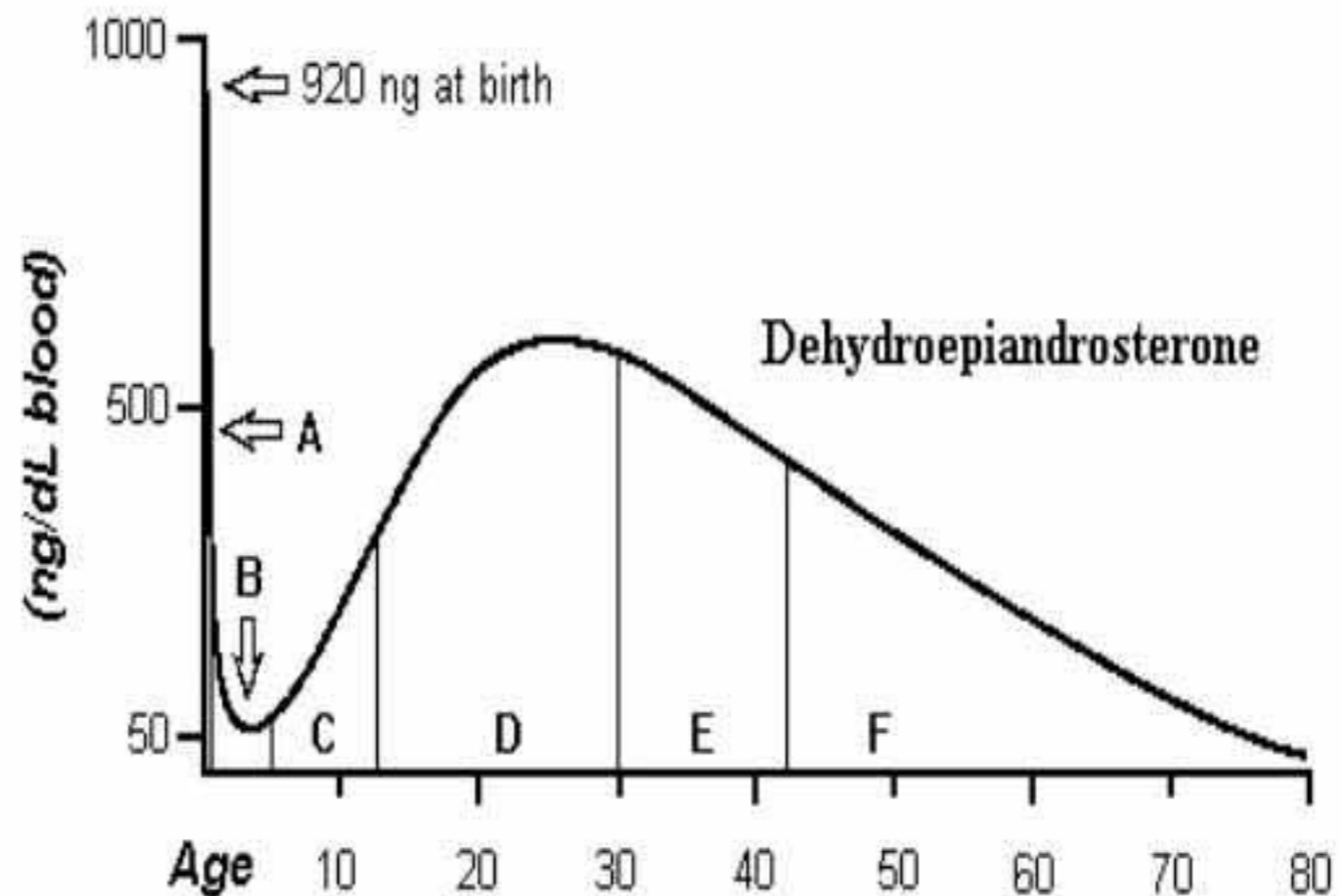
Immunity and inflammation

Ageing organisms all have reduced immunocompetance

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Ageing organisms all have reduced immunocompetance

The adrenal hormone dehydroepiandrosterone (DHEA) reduced to 10-20% by age 75

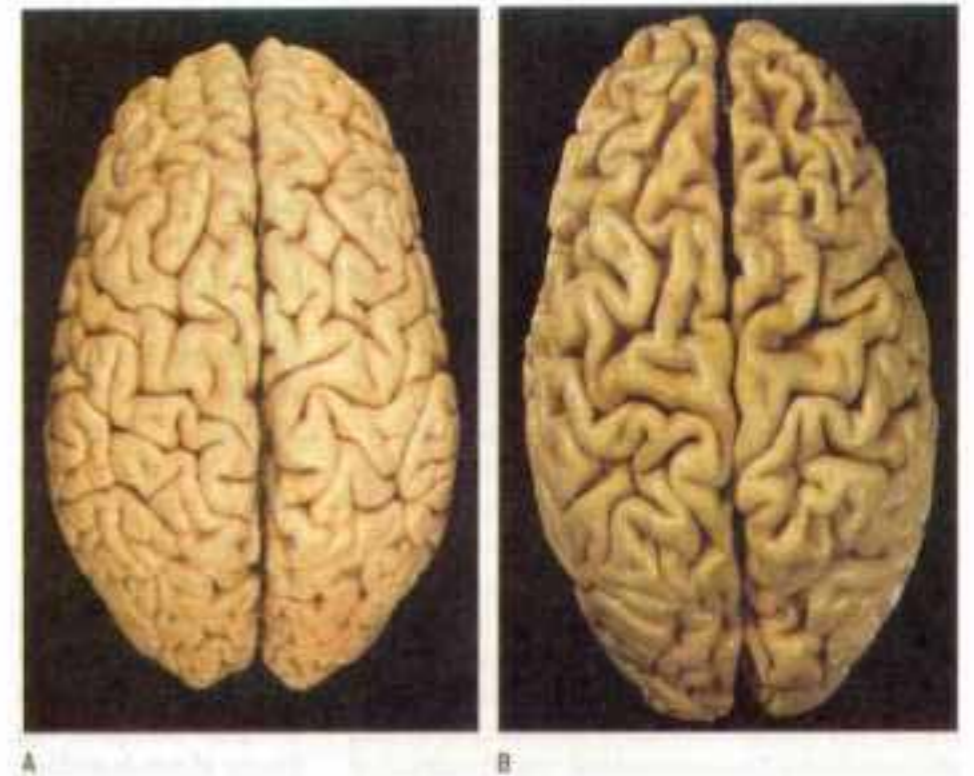


Immunity and inflammation

Ageing organisms all have reduced immunocompetance

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Neurodegenerative diseases involve a strong inflammatory component



Immunity and inflammation

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Neurodegenerative diseases involve a strong inflammatory component

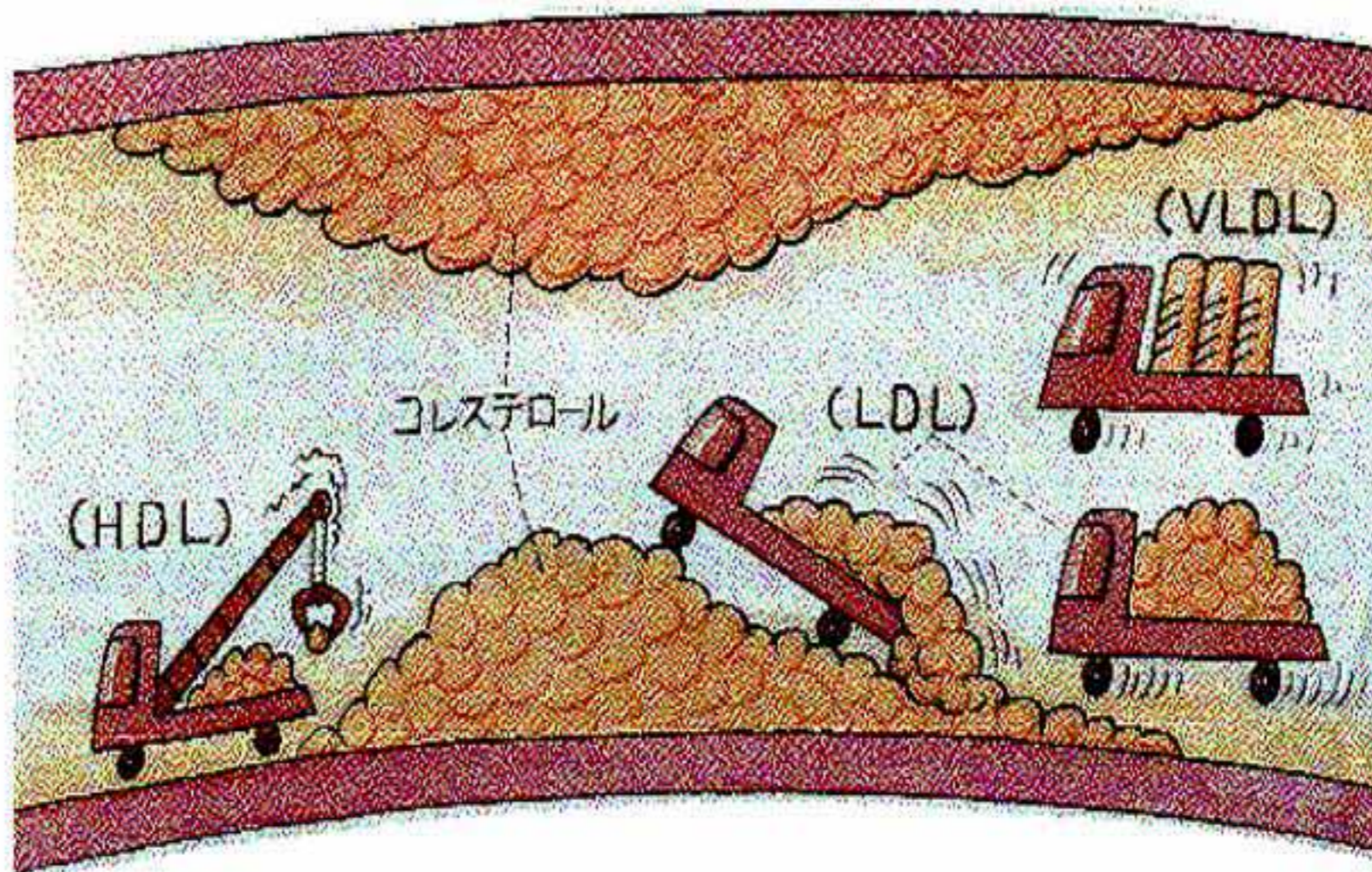
Much interest in potential benefits of anti-inflammatory drugs - aspirin etc



Cholesterol

Cholesterol

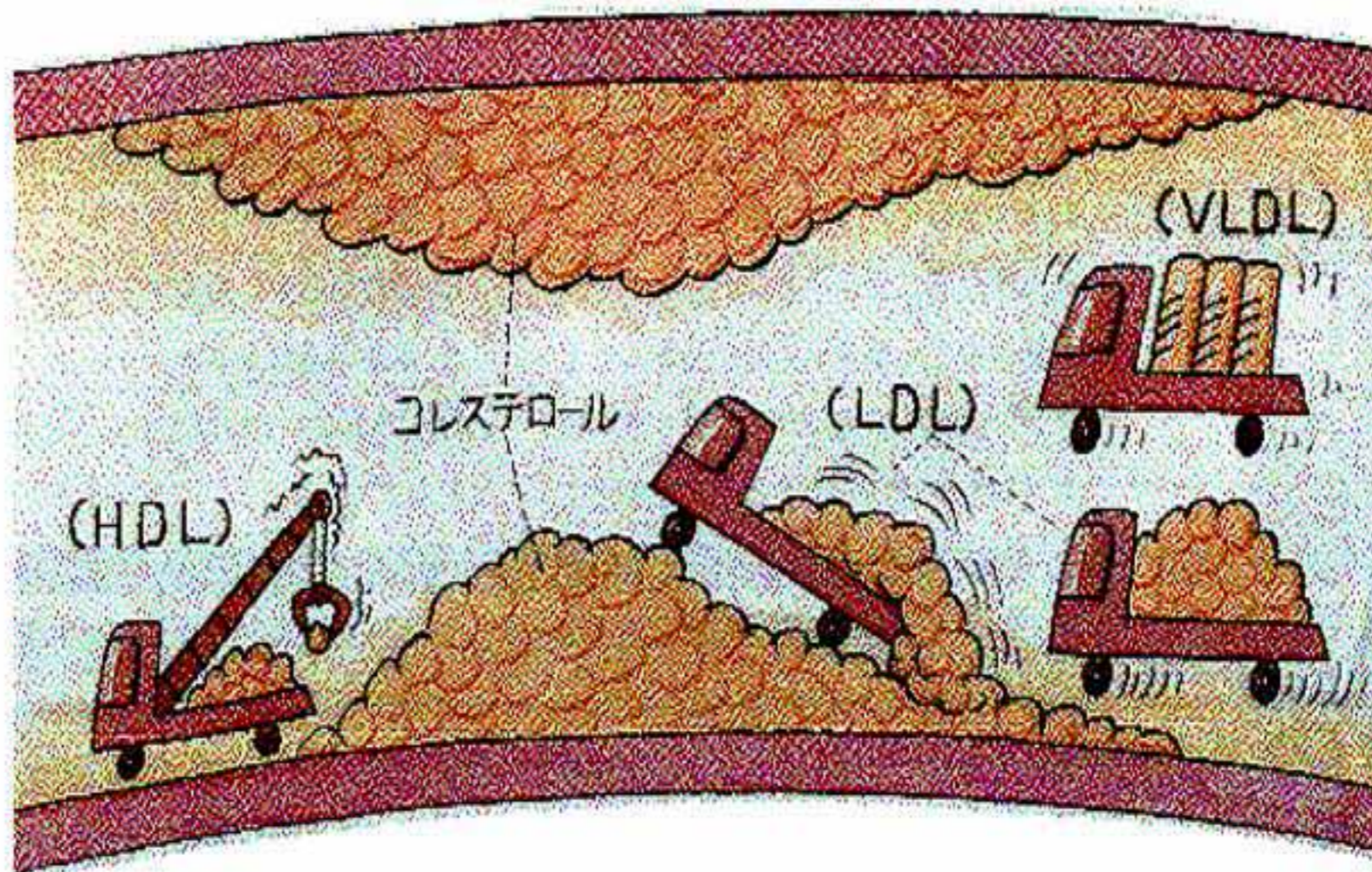
Two major forms of cholesterol measured in blood:



Cholesterol

Two major forms of cholesterol measured in blood:

High-density lipoproteins
(HDL) 'good'

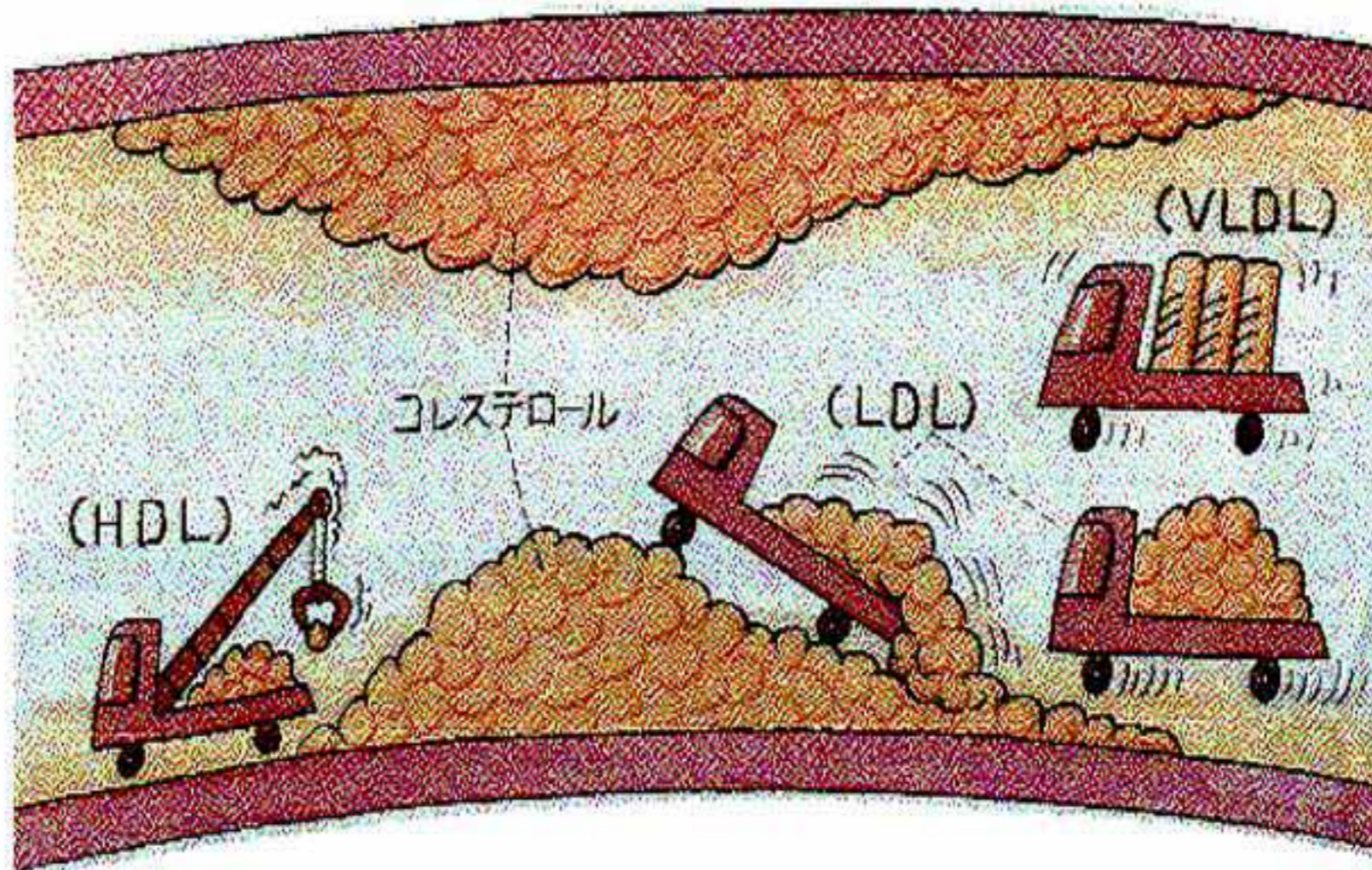


Cholesterol

Two major forms of cholesterol measured in blood:

High-density lipoproteins
(HDL) 'good'

Low-density lipoproteins
(LDL) 'bad'



Cholesterol

Living to >100 years is associated with having genes that protect against LDL and boost HDL

LDL (bad)



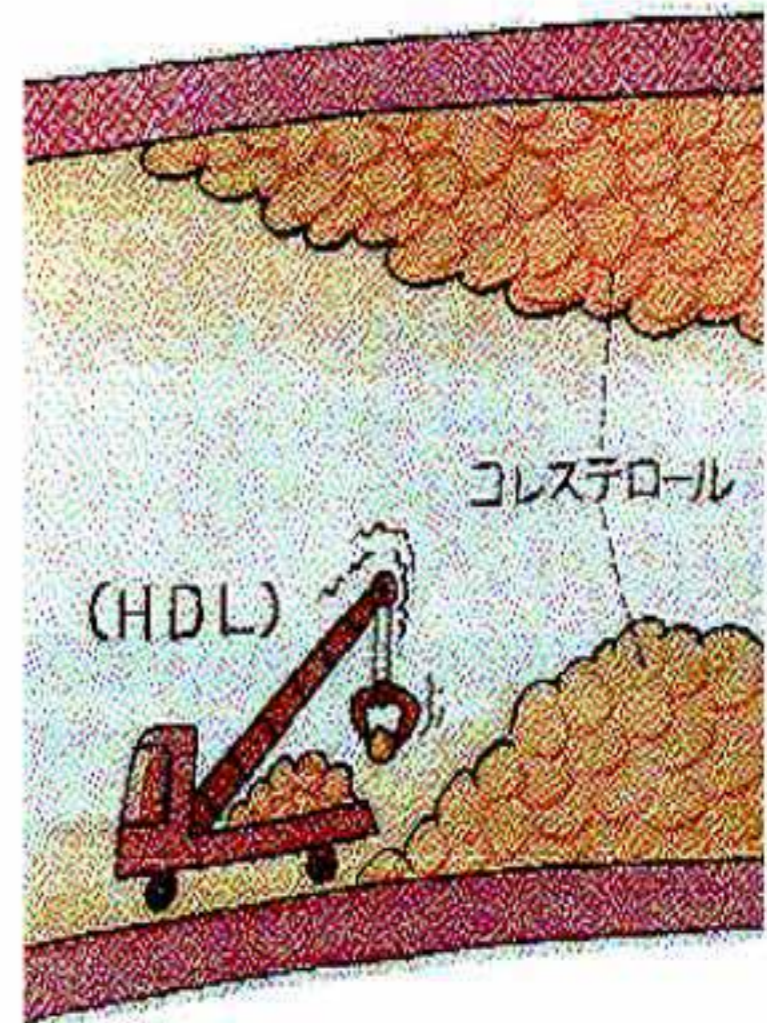
Cholesterol

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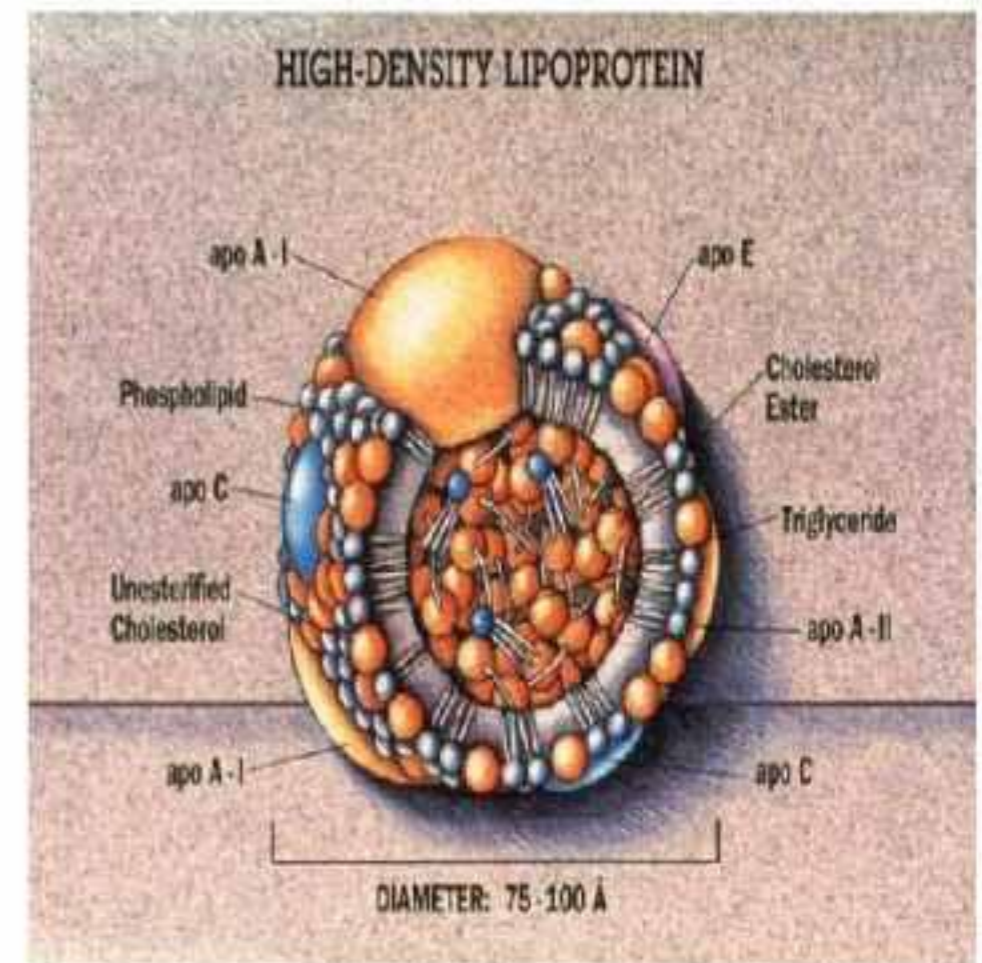


HDL (good)



Cholesterol

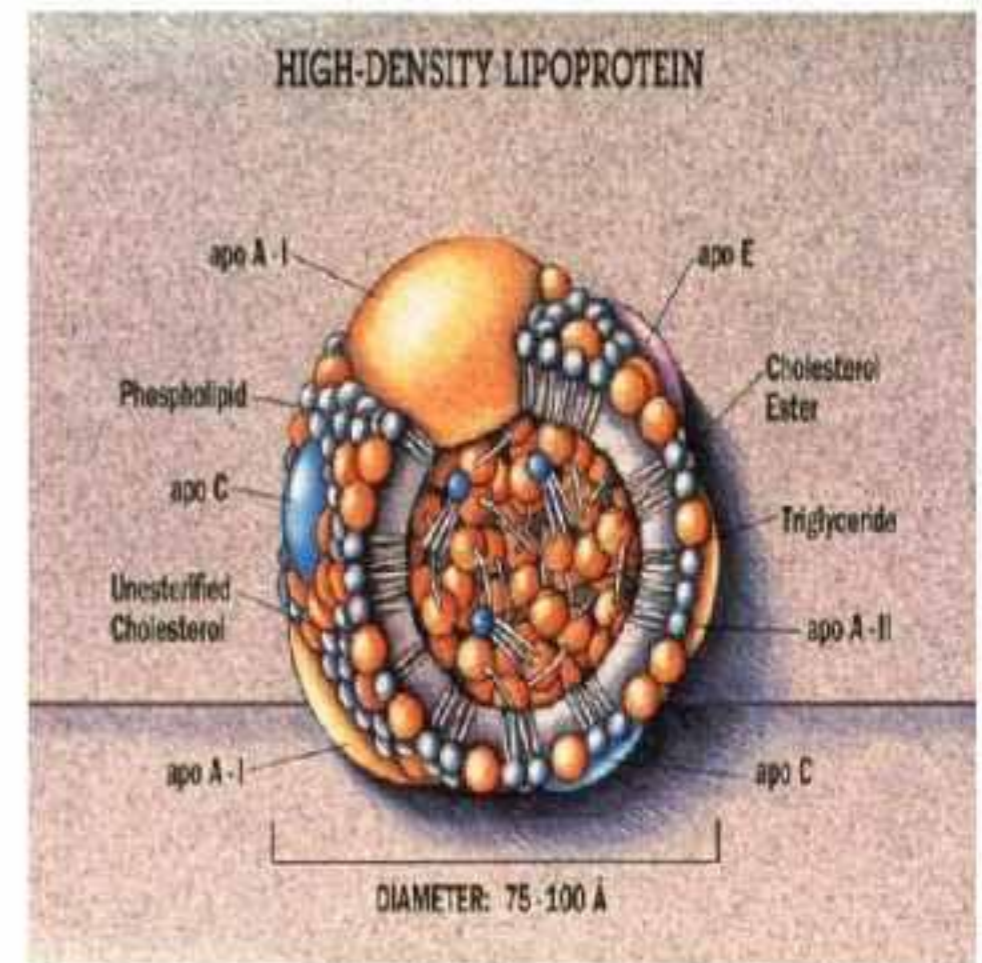
Apolipoprotein E (ApoE) is a central component for cholesterol-carrying lipoprotein complexes



Cholesterol

Apolipoprotein E (ApoE) is a central component for cholesterol-carrying lipoprotein complexes

ApoE4 - higher risk of cardiovascular and Alzheimers disease

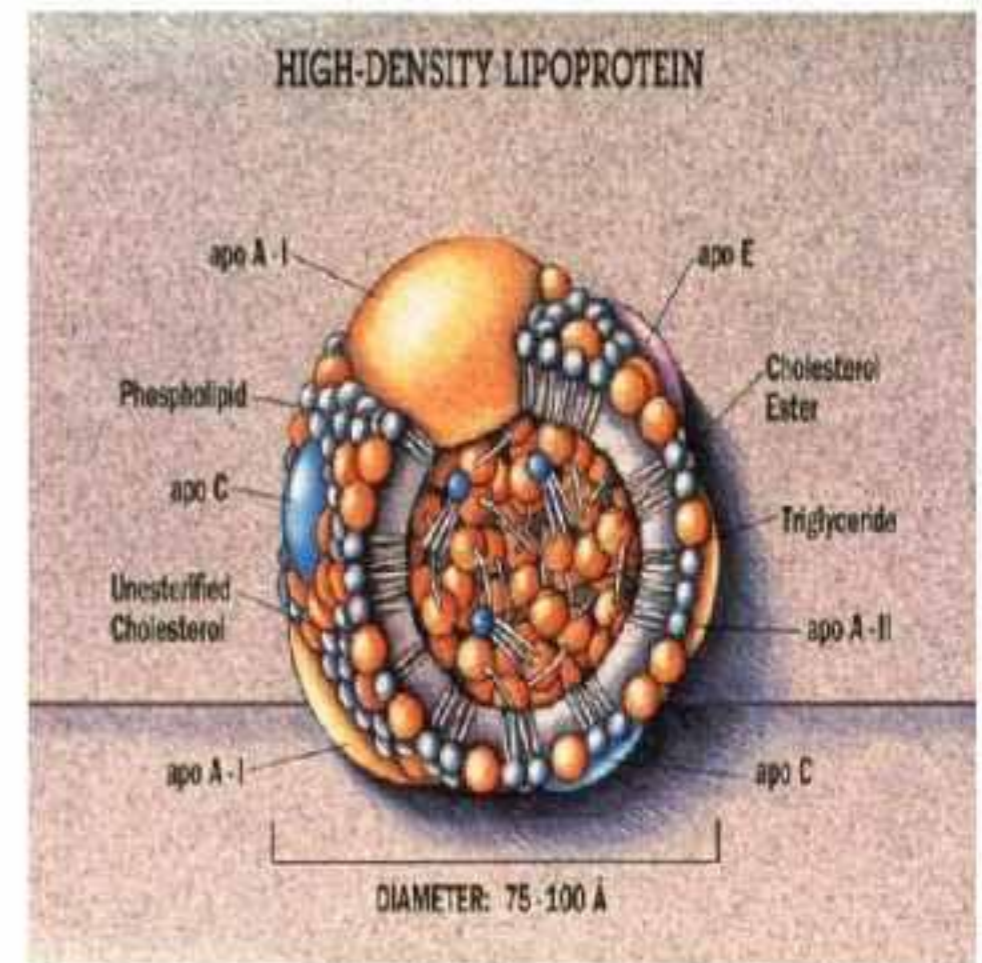


Cholesterol

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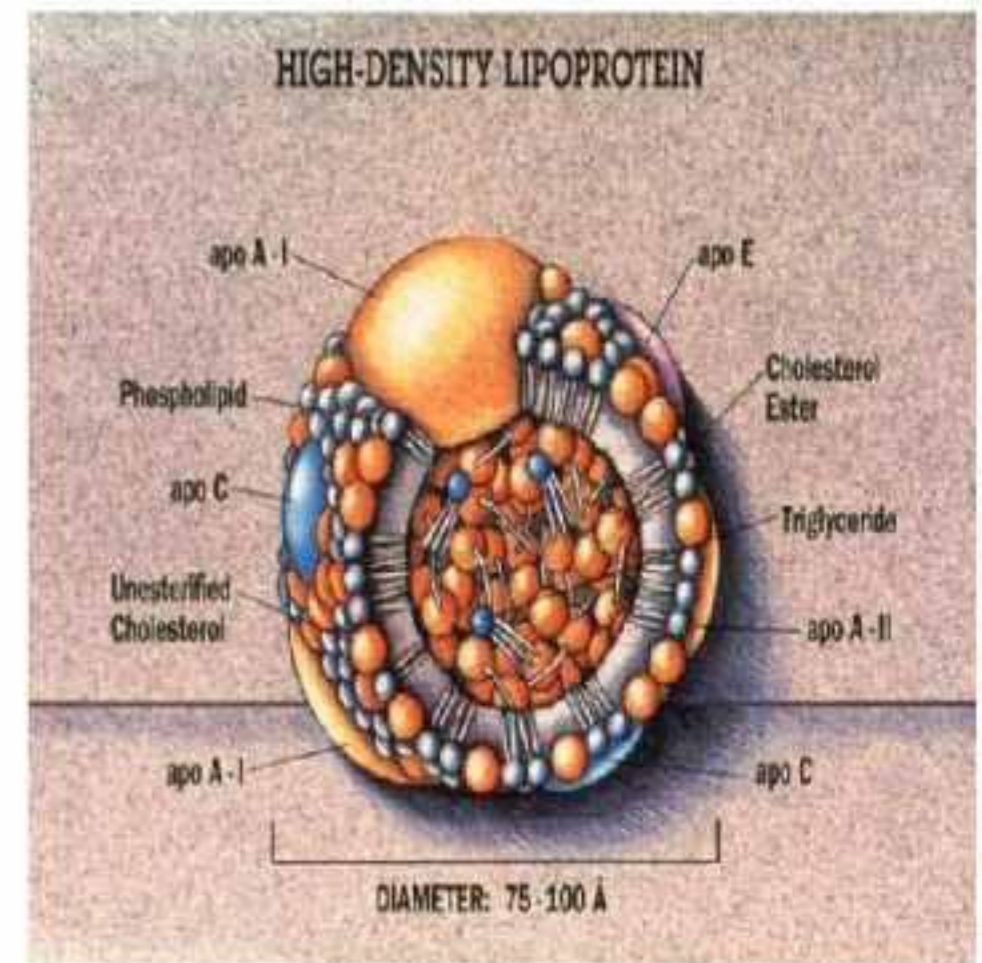
Cholesterol

Apolipoprotein E (ApoE) is a central component for cholesterol-carrying lipoprotein complexes

ApoE4 - higher risk of cardiovascular and Alzheimers disease

Those who live over 100 are half as likely to carry this form of the gene

And have the ApoE2 form which is more protective



Cholesterol

The 1405v variant of cholesterol ester transfer protein in Ashkenazi Jews

(Barzilai et al JAMA 2003)



Why do females live longer than males ?

Why do females live longer than males ?

Life expectancy for human males in developed countries is 4-6 years less than for females

Why do females live longer than males ?

Life expectancy for human males in developed countries is 4-6 years less than for females

Not specific to humans



Why do females live longer than males ?

The oldest documented woman is Jeanne Calment



Why do females live longer than males ?

The oldest documented woman is Jeanne Calment

- died in 1997 at 122 years and 164 days



Why do females live longer than males ?

The oldest documented man is Yukichi Chuganji



Why do females live longer than males ?

The oldest documented man is Yukichi Chuganji

- died in 2003 at 114 years



Why do females live longer than males ?

One key factor may be testosterone



Arnold Schwarzenegger
Governor of California

Why do females live longer than males ?

One key factor may be testosterone

In both humans and other species castration is associated with increased longevity

Shabnam Mausi
(First eunuch elected to India's Legislative Assembly)



Why do females live longer than males ?

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Unlikely to prove a popular means of living longer

Why do females live longer than males ?

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Economy castration



Effects of lifestyle and nutrition on ageing

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75% of the influence on the ageing process is of a non-genetic origin

Effects of lifestyle and nutrition on ageing

75% of the influence on the ageing process is of a non-genetic origin

Lifestyle factors are likely to play a major part

KEN WEINGART

LIFESTYLE

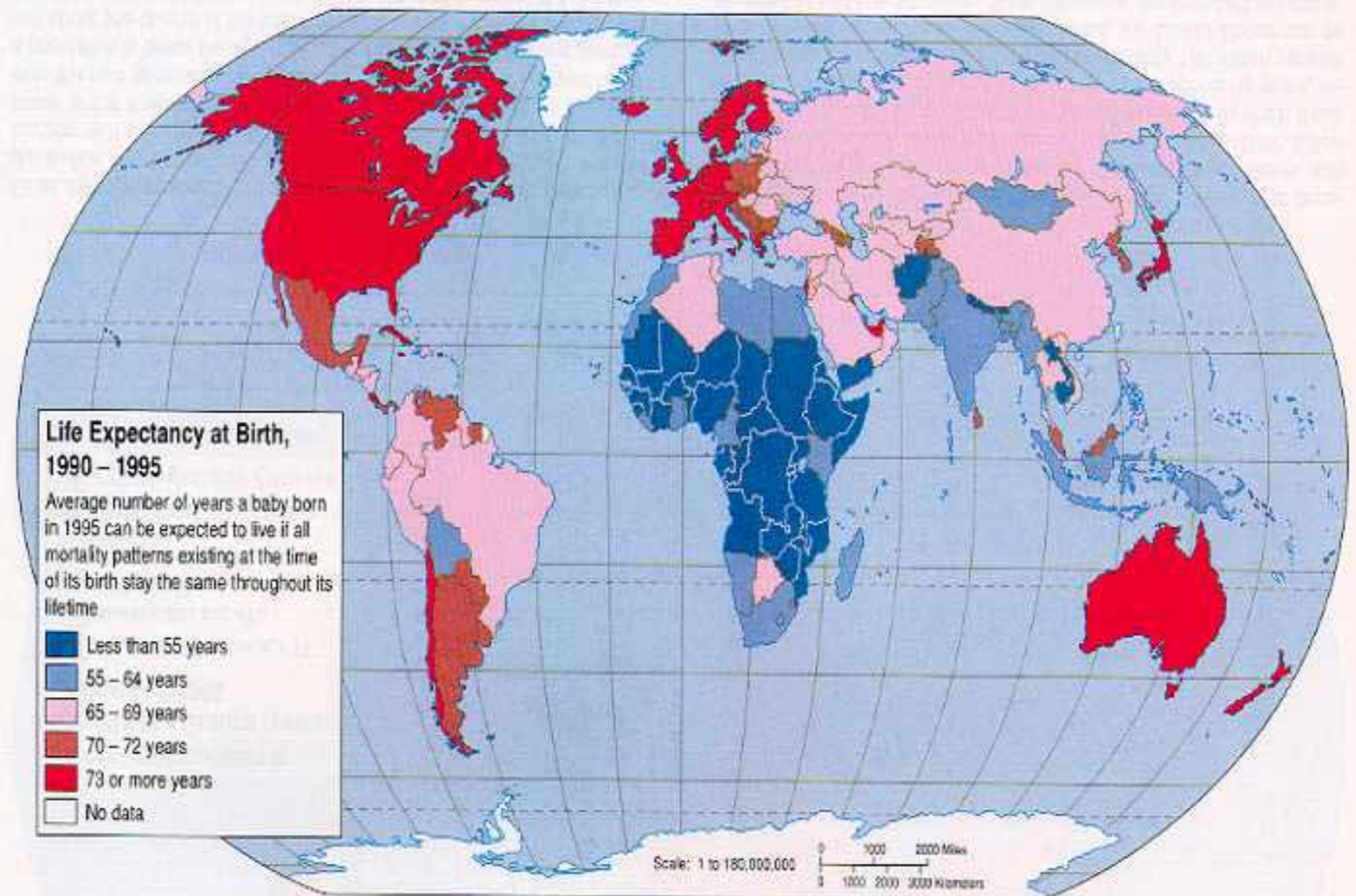
[TO LIFESTYLE PAGE 2](#)

[BACK TO HOMEPAGE](#)

Effects of lifestyle and nutrition on ageing

This is reflected by changing national economies

Map 11 Average Life Expectancy at Birth



Effects of lifestyle and nutrition on ageing

We invest large amounts of money on pills and potions to help prolong healthy life !



Effects of lifestyle and nutrition on ageing

We invest large amounts of money on pills and potions to help prolong healthy life !

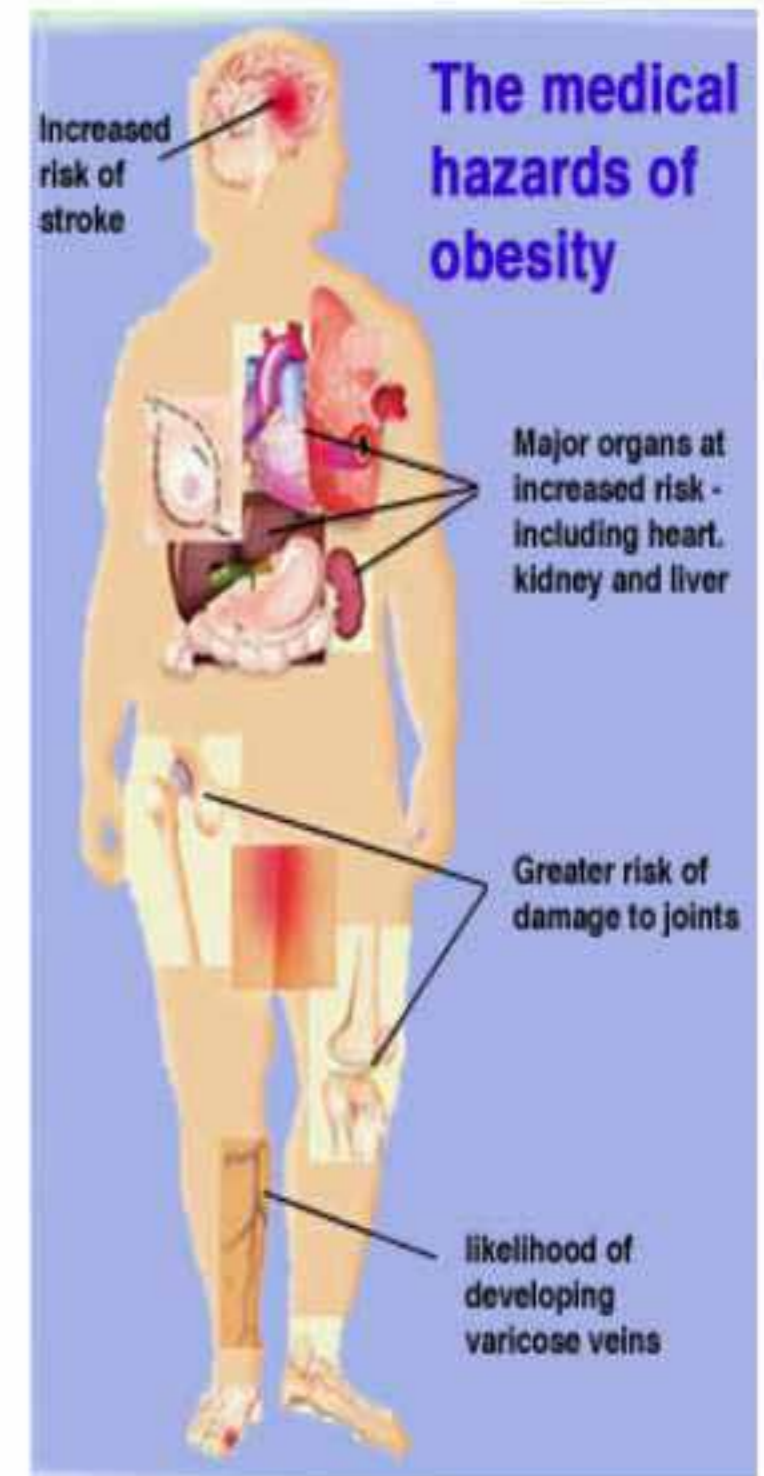
Alcohol, smoking, addictive drugs, high fat foods and sugar and lack of exercise are all bad news



Restricting calories

Restricting calories

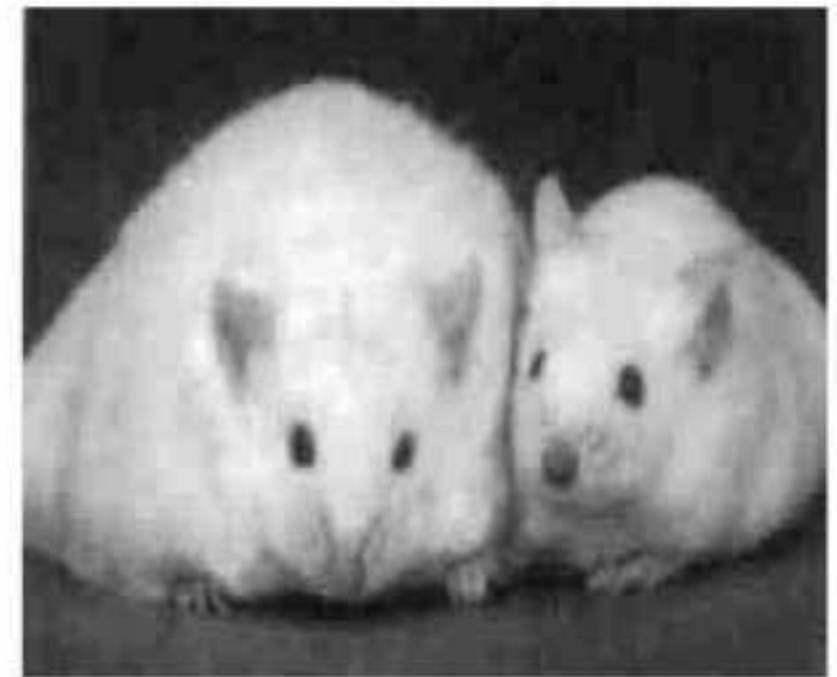
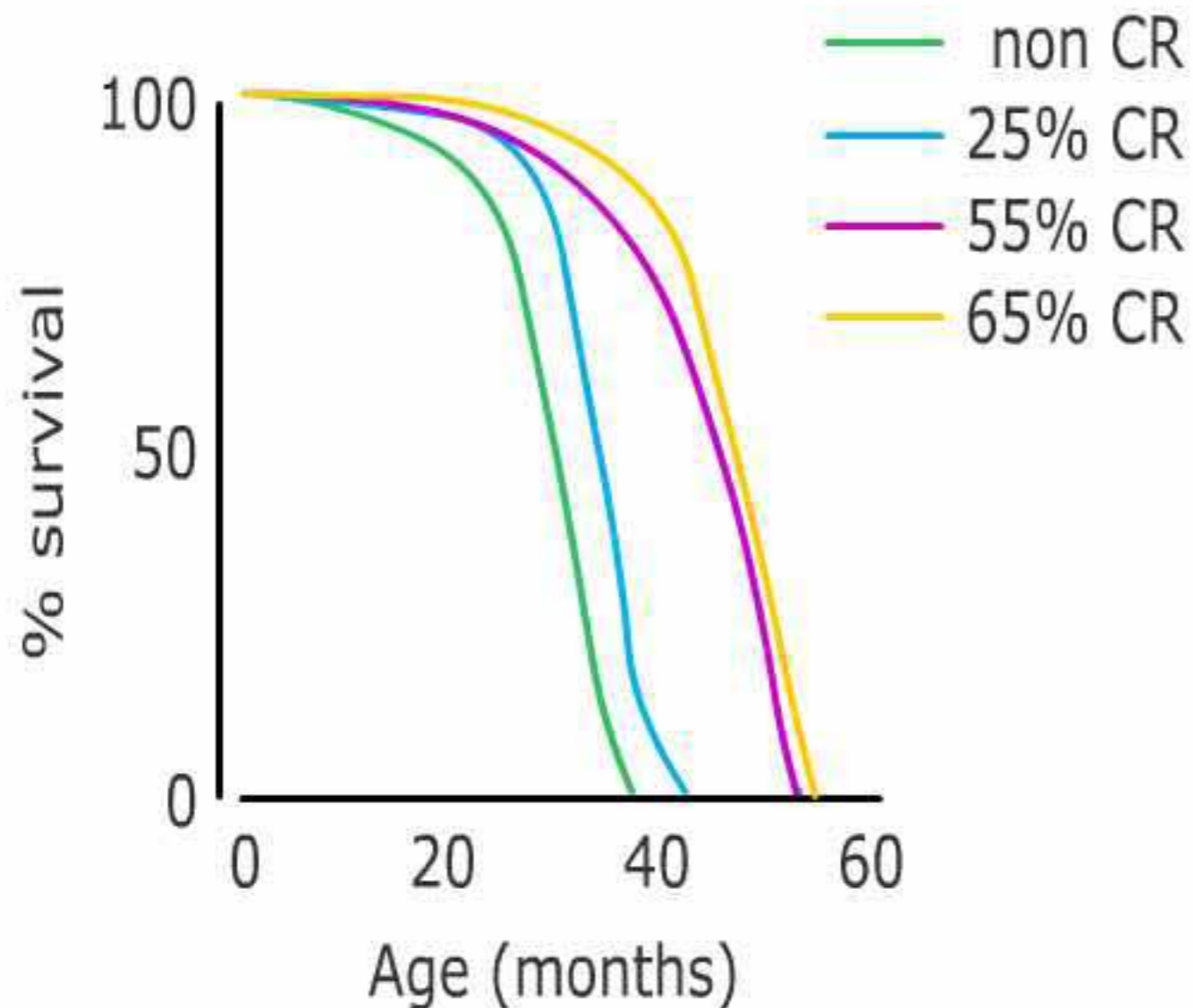
Excessive calorie intake leading to obesity will in general shorten life



Restricting calories

In animals lifespan can be doubled by reducing calorie intake (40-75%)

Life span of CR mice vs non-CR mice



Restricting calories

In animals lifespan can be doubled by reducing calorie intake (40-75%)

It reduces IGF-1 levels and expression of genes associated with DNA damage and oxidative stress

Restricting calories

In animals lifespan can be doubled by reducing calorie intake (40-75%)

It reduces IGF-1 levels and expression of genes associated with DNA damage and oxidative stress

It increases that of genes promoting protein and energy metabolism and biosynthesis (Lee et al 1999)

Restricting calories

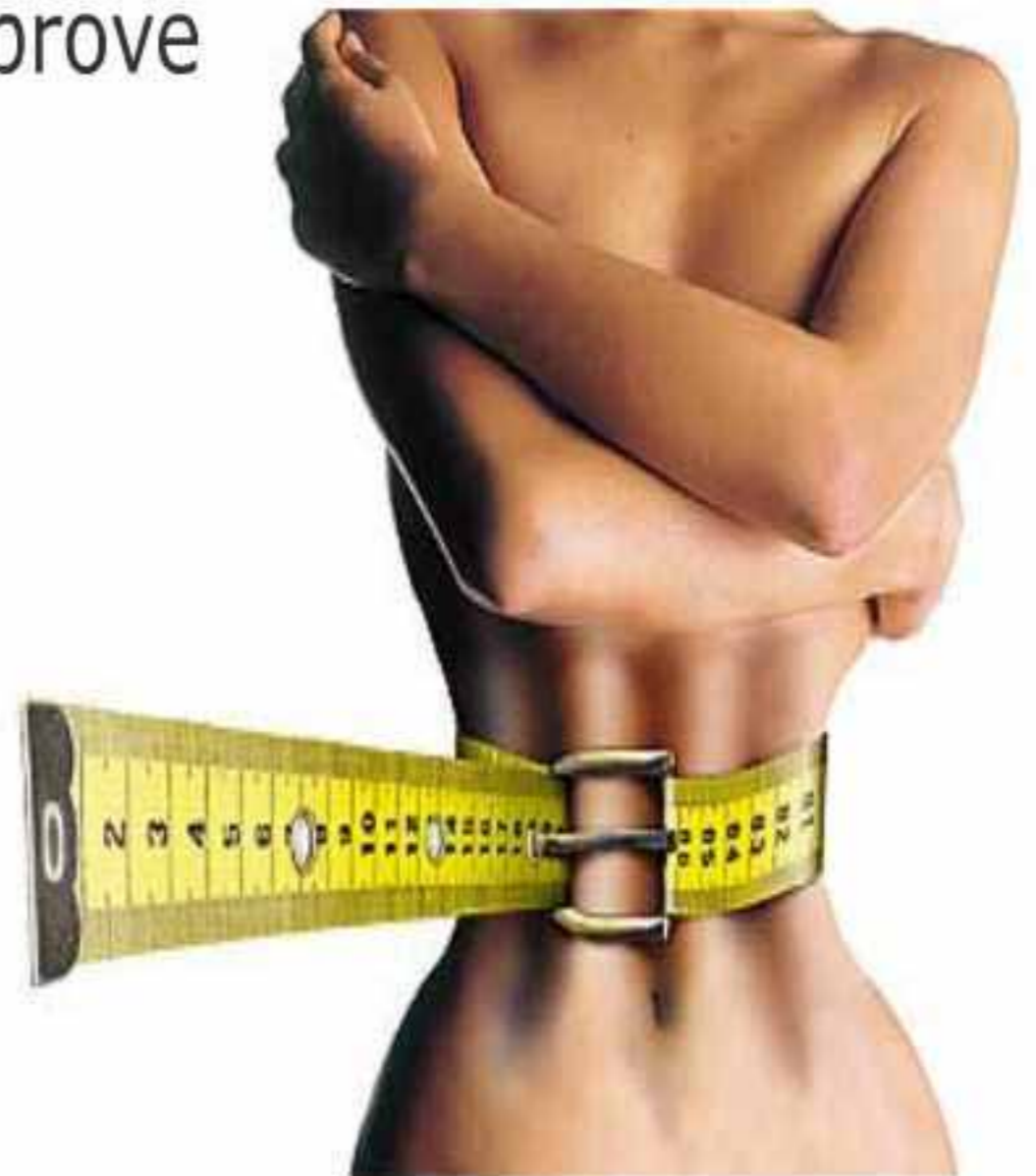
Humans ? - problem of getting it wrong: anorexia



Restricting calories

Humans ? - problem of getting it wrong: anorexia

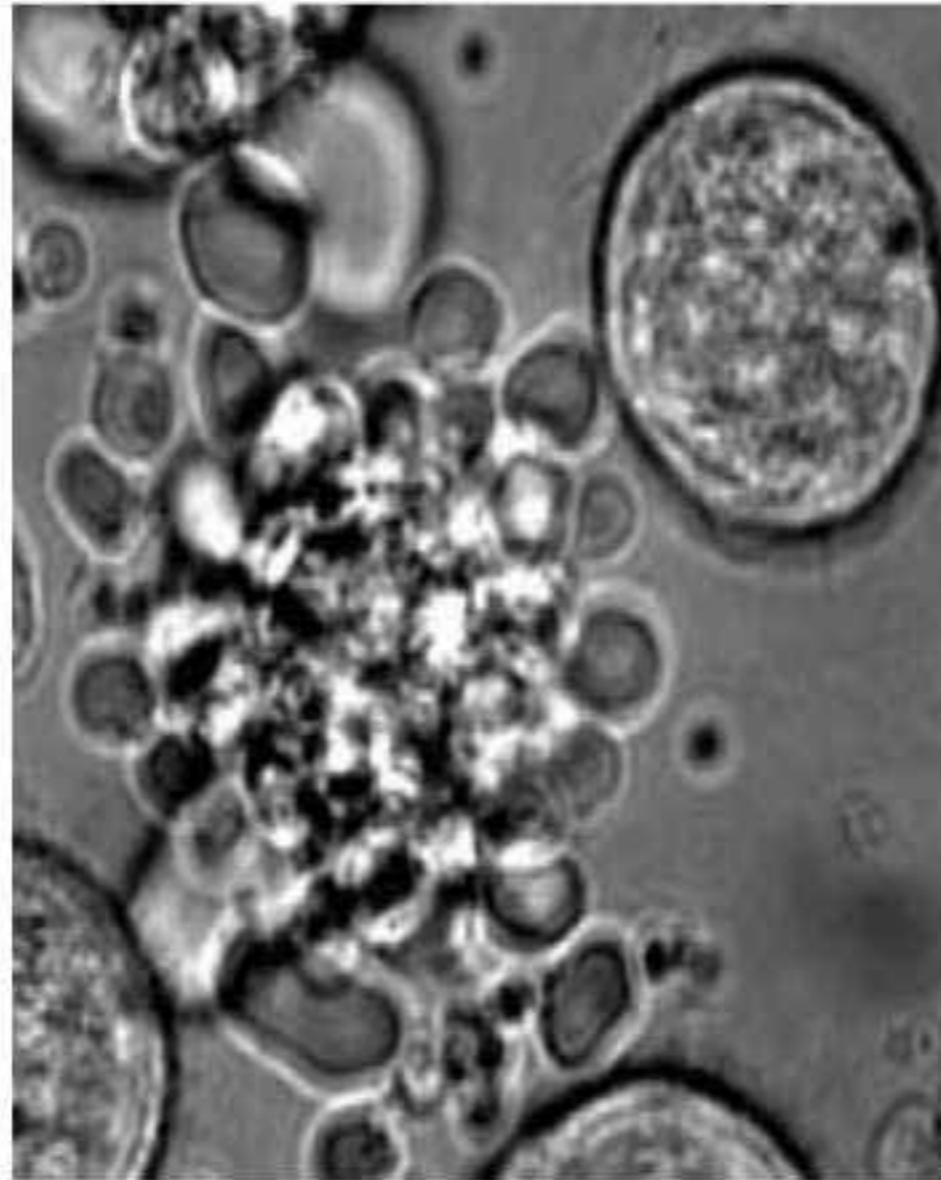
Near starvation diet is unlikely to prove a popular panacea for ageing



Anti-oxidants

Anti-oxidants

A major cause of cell death is oxidative stress



Anti-oxidants

A major cause of cell death is oxidative stress

Anti-oxidant substances should be beneficial for prolonging life



Linus Pauling

Anti-oxidants

A major cause of cell death is oxidative stress

Anti-oxidant substances should be beneficial for prolonging life

- vitamin C



Anti-oxidants

A major cause of cell death is oxidative stress

Anti-oxidant substances should be beneficial for prolonging life

- vitamin C
- vitamins A, E and selenium



Anti-oxidants

Low blood Vitamin C levels are strongly predictive of mortality



Anti-oxidants

Low blood Vitamin C levels are strongly predictive of mortality

Efficacious effects of taking mega-dose vitamin C supplements remain controversial



Anti-oxidants

Poor quality early diet low in anti-oxidants reduces longevity in zebra finches



Anti-oxidants

Poor quality early diet low in anti-oxidants reduces longevity in zebra finches

Taking combined vitamin E and C supplements reduces chances of Alzheimer's disease (Zandi et al, 2004)

BBC NEWS WORLD EDITION

Last Updated: Tuesday, 20 January, 2004, 02:07 GMT

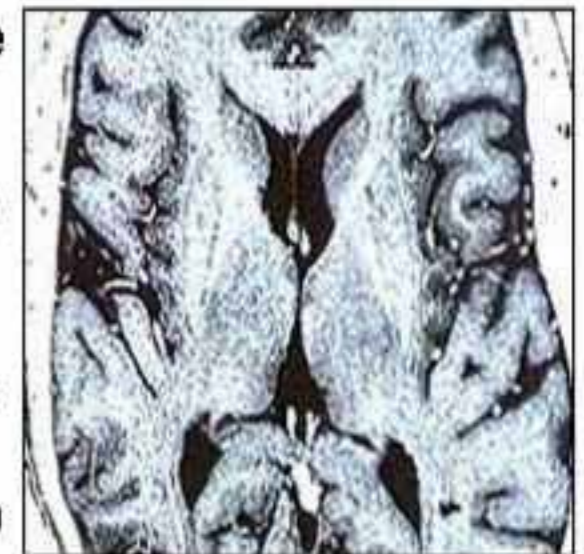
[E-mail this to a friend](#)

[Printable version](#)

Vitamins 'cut Alzheimer's effect'

It may be possible to reduce the effects of Alzheimer's disease by taking the right combination of vitamins, US research suggests.

Scientists have found vitamins E and C may protect the ageing brain - but only if taken together.



Alzheimer's causes damage to the brain

Anti-oxidants

Phenols present in a number of foods can also act as antioxidants



Anti-oxidants

Phenols present in a number of foods can also act as antioxidants

Chocolate taken in moderation can increase longevity



Anti-oxidants

Phenols present in a number of foods can also act as antioxidants

Chocolate taken in moderation can increase longevity

But only by 0.92 years in 7,841 Harvard graduates
(Lee, British Medical Journal, 1998)

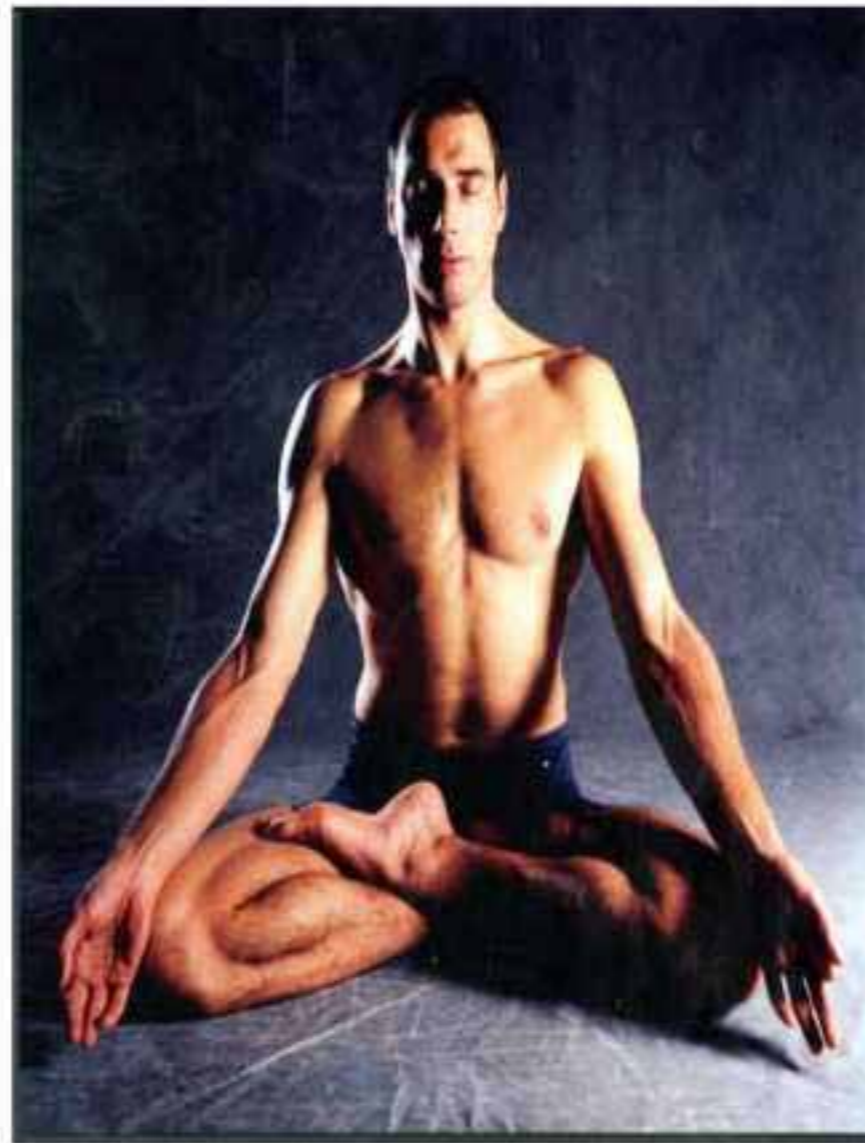


Stress



Stress

Most common feature of those who live longest is low stress



Stress

Most common feature of those who live longest is low stress

Soldiers in prolonged combat can age as much as 20 years in a few years



Best advice if exposed to constant stress:

Stress

Best advice if exposed to constant stress:

Get out of the situation...



Stress

Best advice if exposed to constant stress:

Get out of the situation...

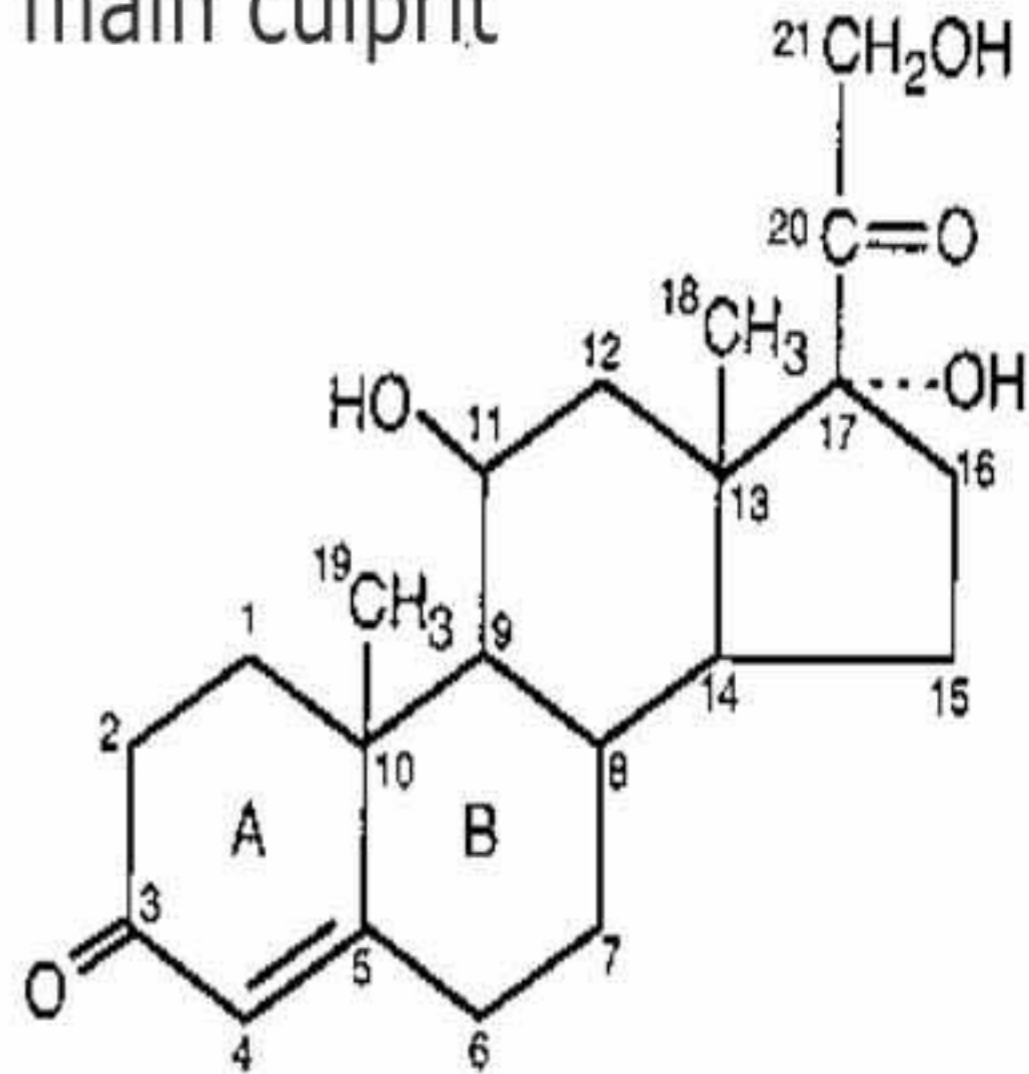
... or try stress management



**“This is my relaxation tape—
it’s the sound of ocean waves crashing
onto the shore, snatching my boss’s body off
his beach chair and carrying him out to sea.”**

Stress

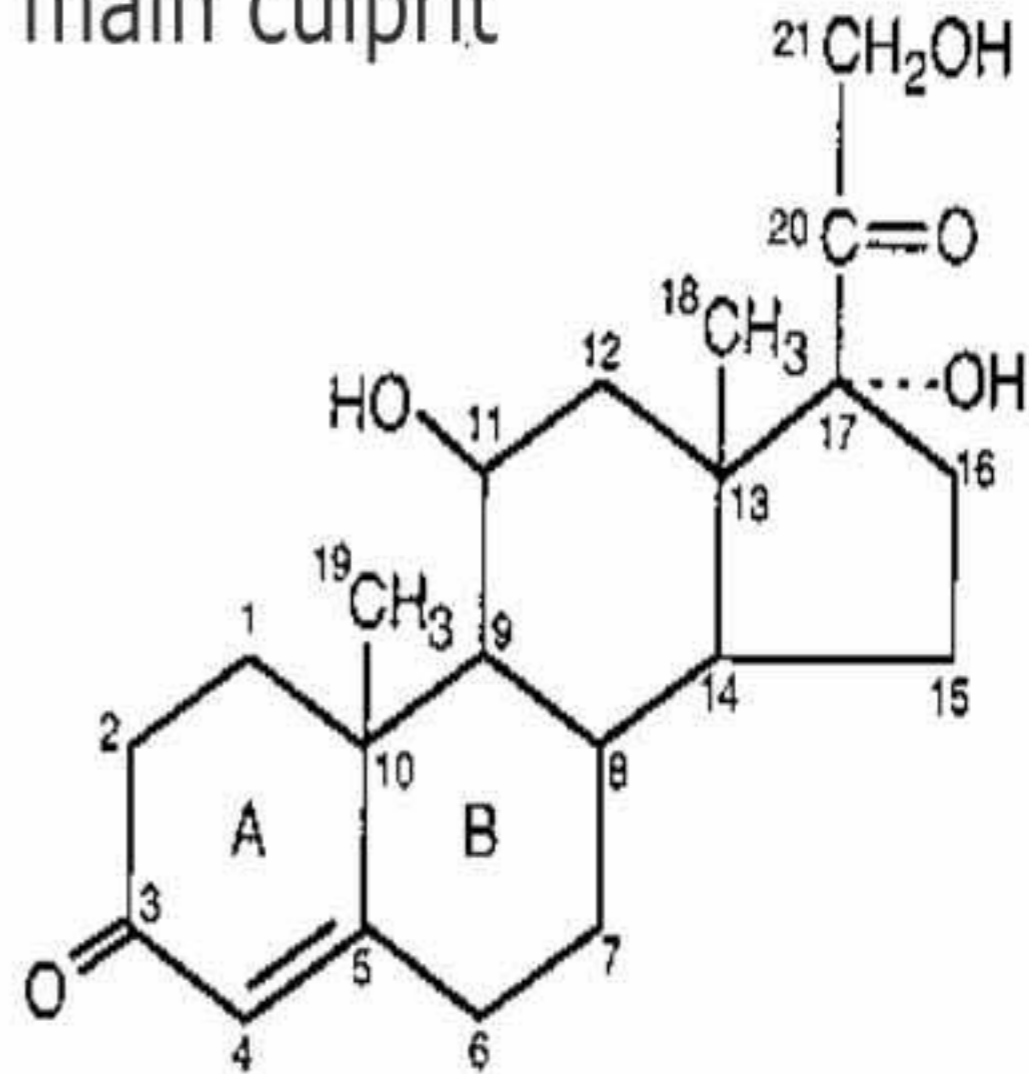
Adrenal cortisol release is the main culprit



Stress

Adrenal cortisol release is the main culprit

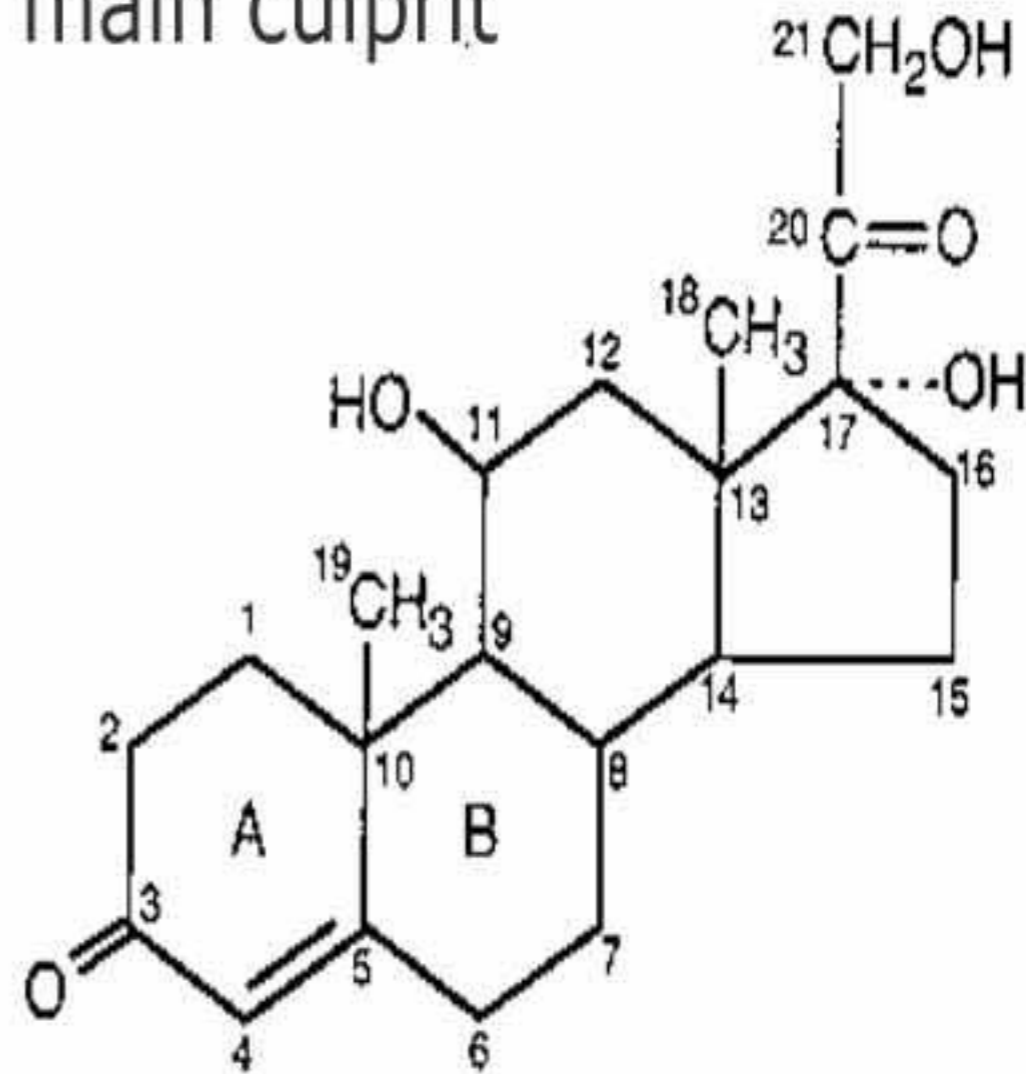
It is good in the short term
for preparing you for
appropriate action...



Stress

Adrenal cortisol release is the main culprit

It is good in the short term
for preparing you for
appropriate action...



...but bad in long-term because it promotes cell death

Environmental toxins and food additives

Environmental toxins and food additives

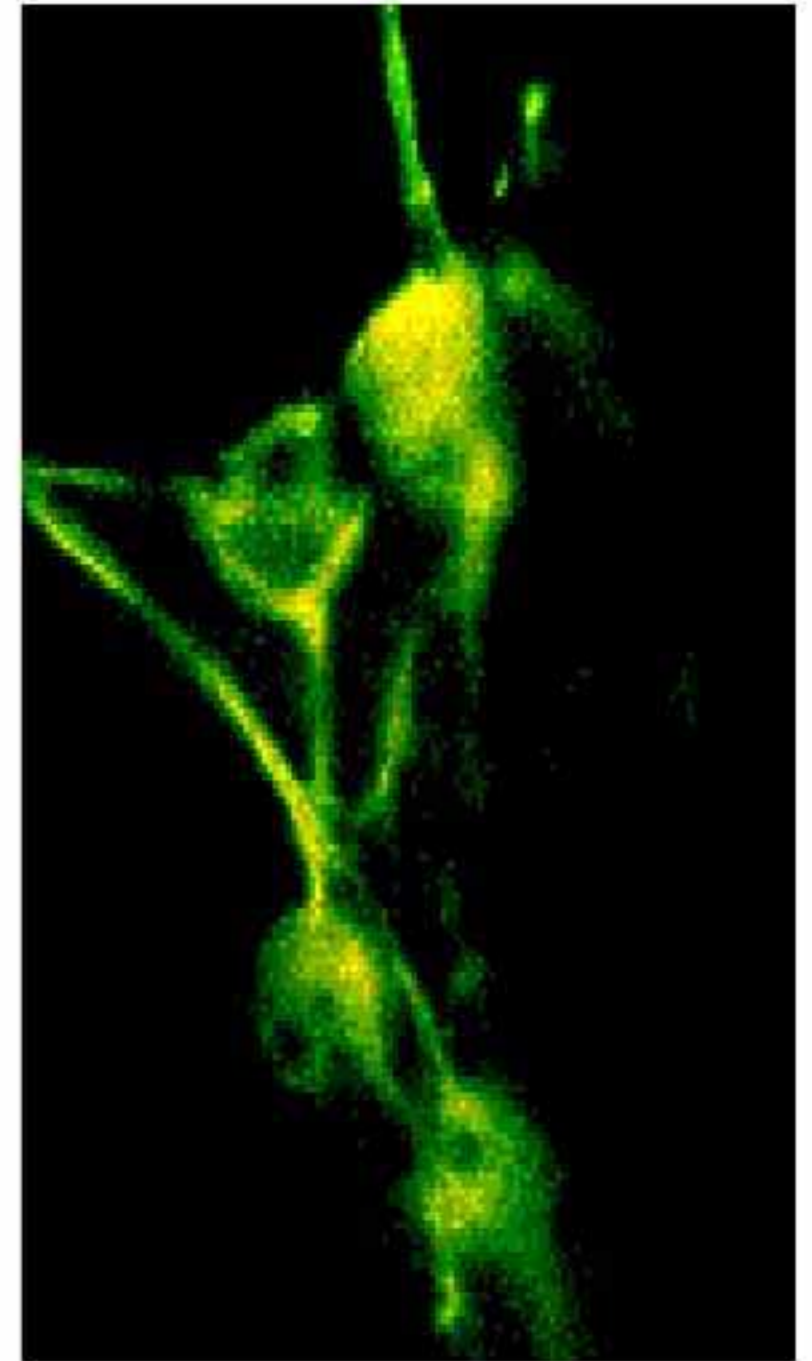
May preserve your body in death but not in life !



The ageing brain and peripheral nervous system

The ageing brain and peripheral nervous system

Most adult brain cells, like those of heart muscle, do not divide

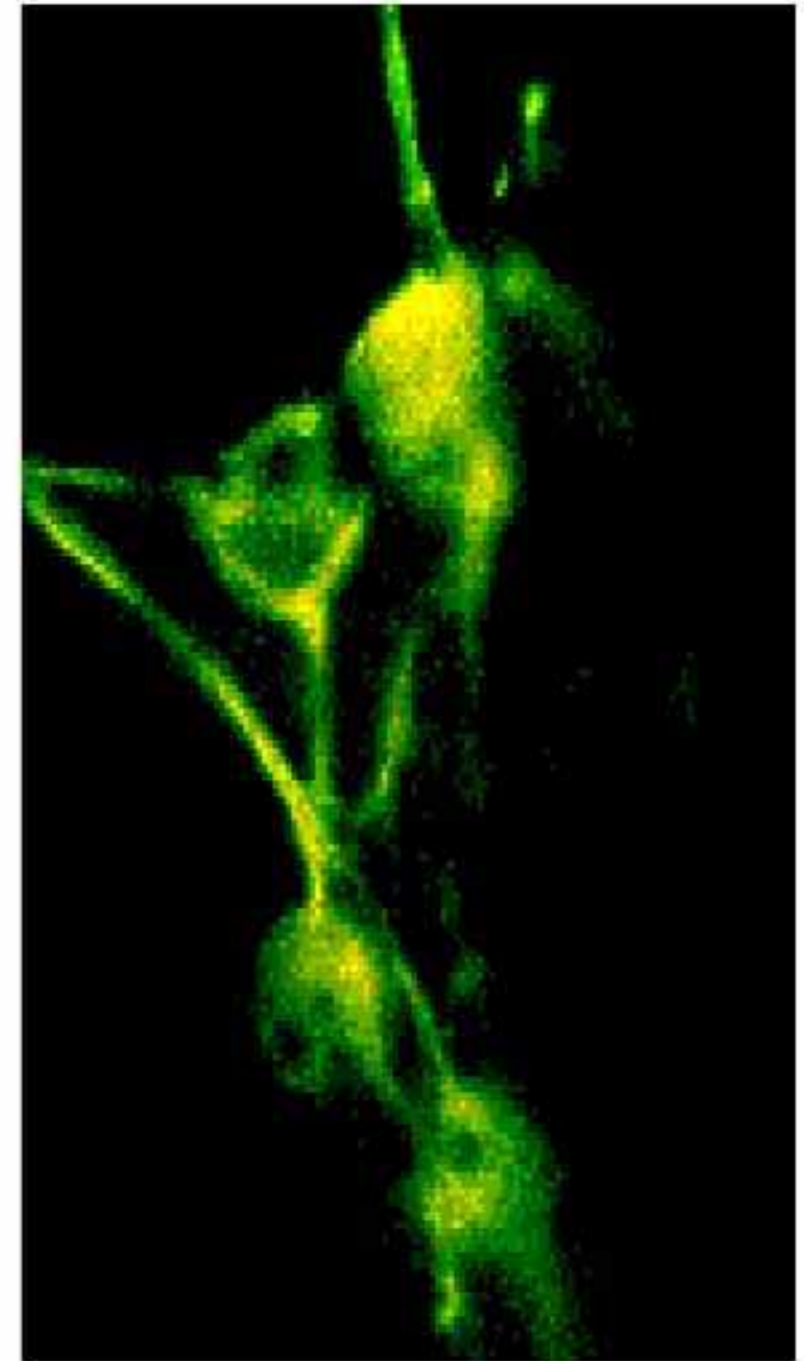


Neuronal stem cell

The ageing brain and peripheral nervous system

Most adult brain cells, like those of heart muscle, do not divide

Progressive cell loss occurs as we age (up to 35% in some regions)



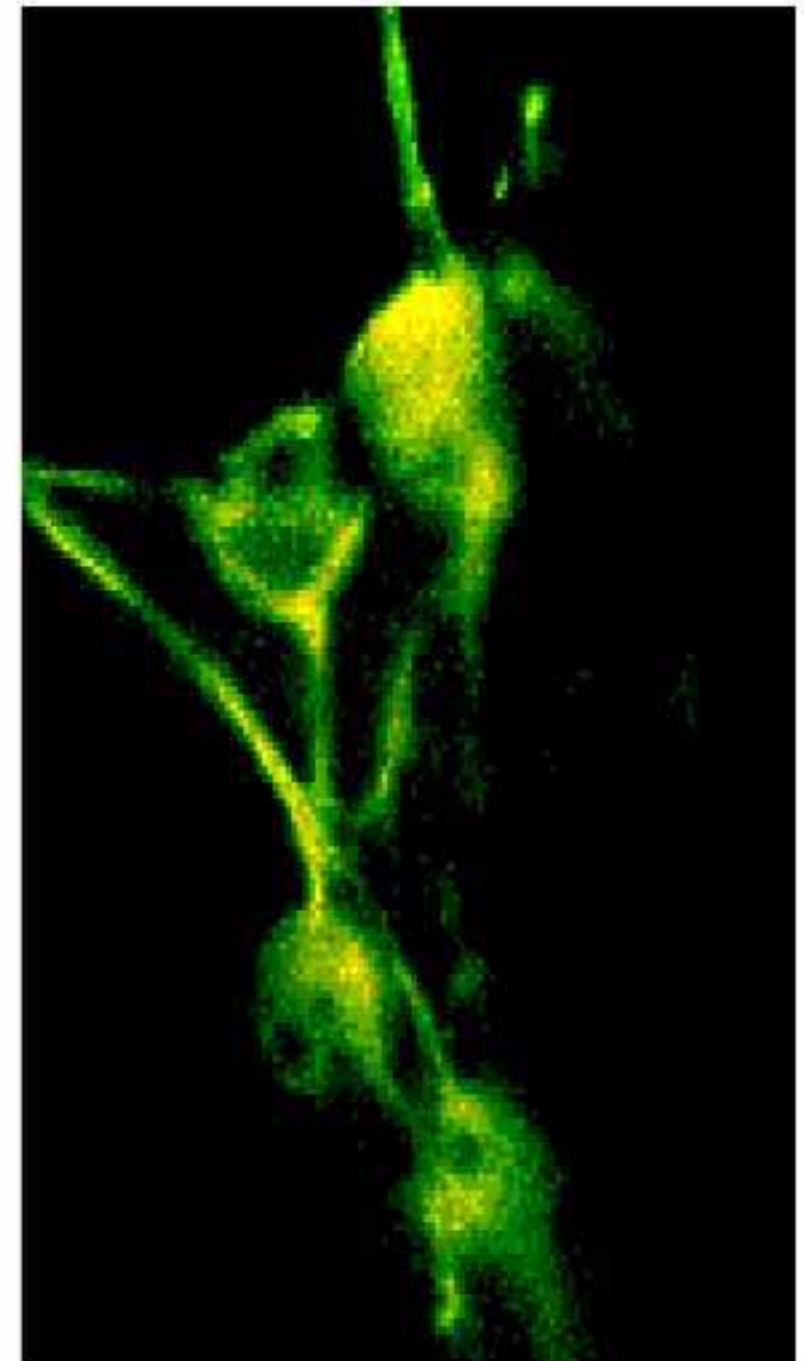
Neuronal stem cell

The ageing brain and peripheral nervous system

Most adult brain cells, like those of heart muscle, do not divide

Progressive cell loss occurs as we age (up to 35% in some regions)

Altered connectivity and cell function are more important



Neuronal stem cell

The ageing brain and peripheral nervous system

Common neurological problems in elderly humans are:



The ageing brain and peripheral nervous system

Common neurological problems in elderly humans are:

Slowed reaction time



The ageing brain and peripheral nervous system

Common neurological problems in elderly humans are:

Slowed reaction time

Slowness and narrowed range of perception



The ageing brain and peripheral nervous system

Common neurological problems in elderly humans are:

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Slowness and narrowed range of perception

Reduced sense of smell



The ageing brain and peripheral nervous system

Common neurological problems in elderly humans are:

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Common neurological problems in elderly humans are:

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The ageing brain and peripheral nervous system

Common neurological problems in elderly humans are:

Slowed reaction time

Slowness and narrowed range of perception

Reduced sense of smell

Reduced motor activity

Reduced muscular power

Impairment of fine co-ordination and agility



The ageing brain and peripheral nervous system

Common neurological problems in elderly humans are:

Slowed reaction time

Slowness and narrowed range of perception

Reduced sense of smell

Reduced motor activity

Reduced muscular power

Impairment of fine co-ordination and agility

Thinness of leg muscles



So what kinds of mental functions are affected ?

On the down side:

Slowed reaction and decision times

Forgetting new information

Difficulty in active memory but not passive processing

Decline in ability to solve difficult problems

Decline in spatial learning and memory

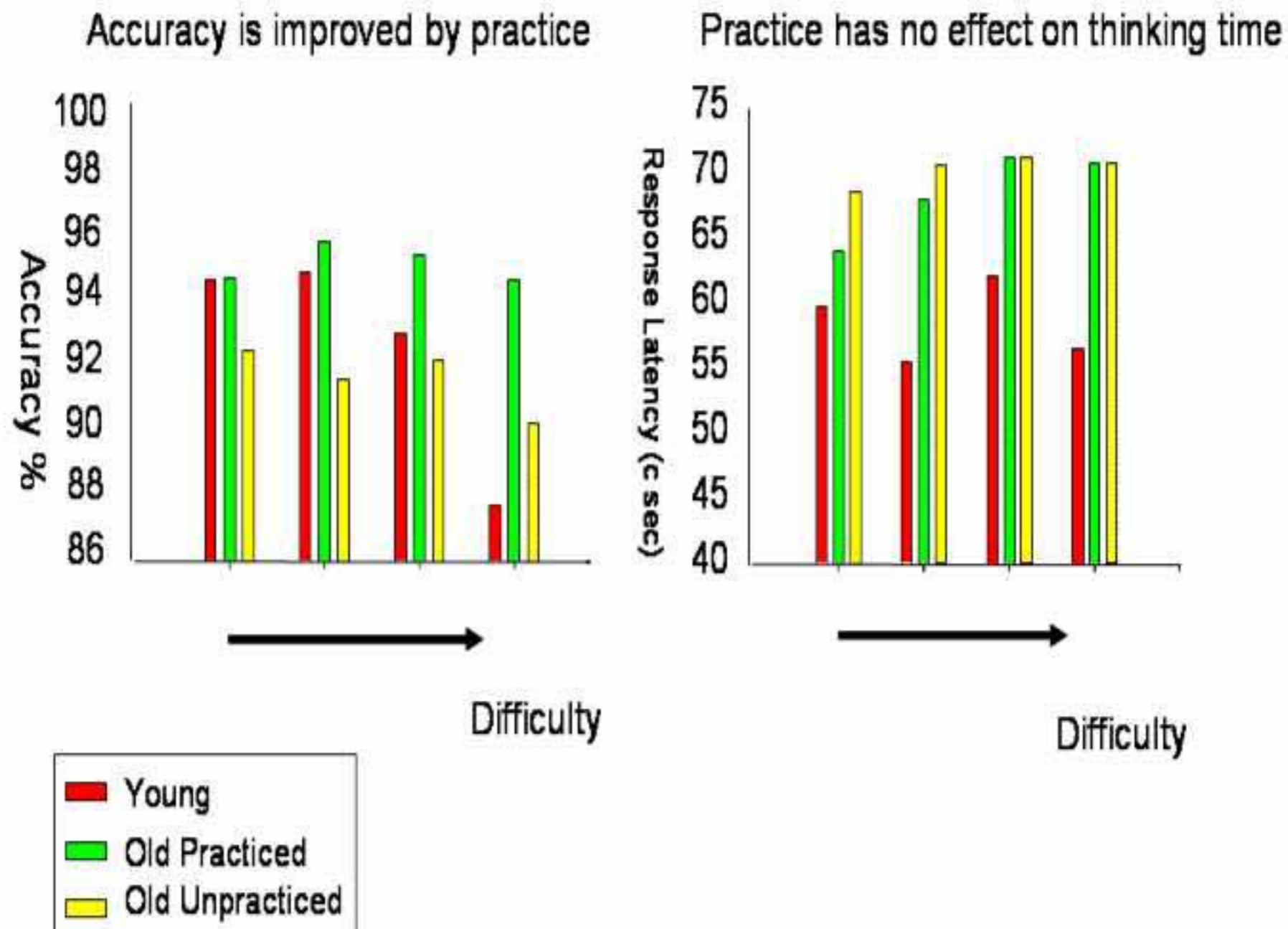
Decline in both global and selective attention

Increased incidence of depression



Use it or lose it !

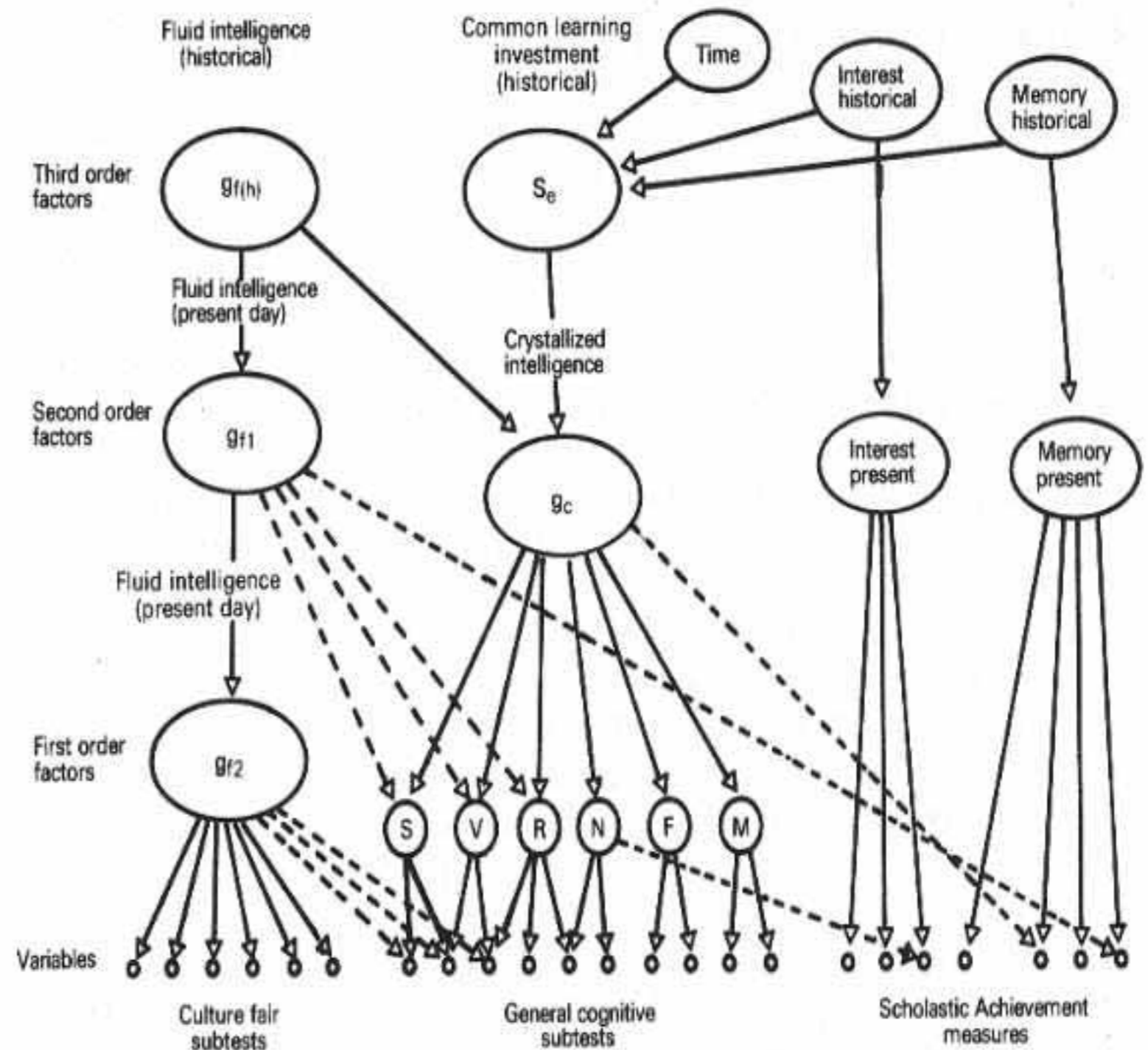
There is considerable support for this principle



Wilkinson *et al*

Use it or lose it !

Difference between crystallised (Gc) and fluid (Gf) mental abilities



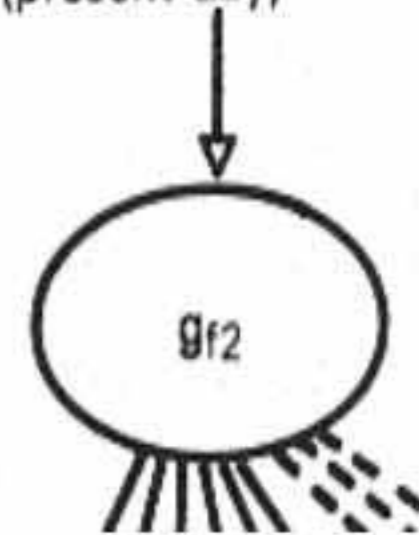
Use it or lose it !

Difference between crystallised (Gc) and fluid (Gf) mental abilities

Gc (knowledge of past events) does not decline with normal ageing

Gf (ability to apply novel strategies for learning new information) does decline

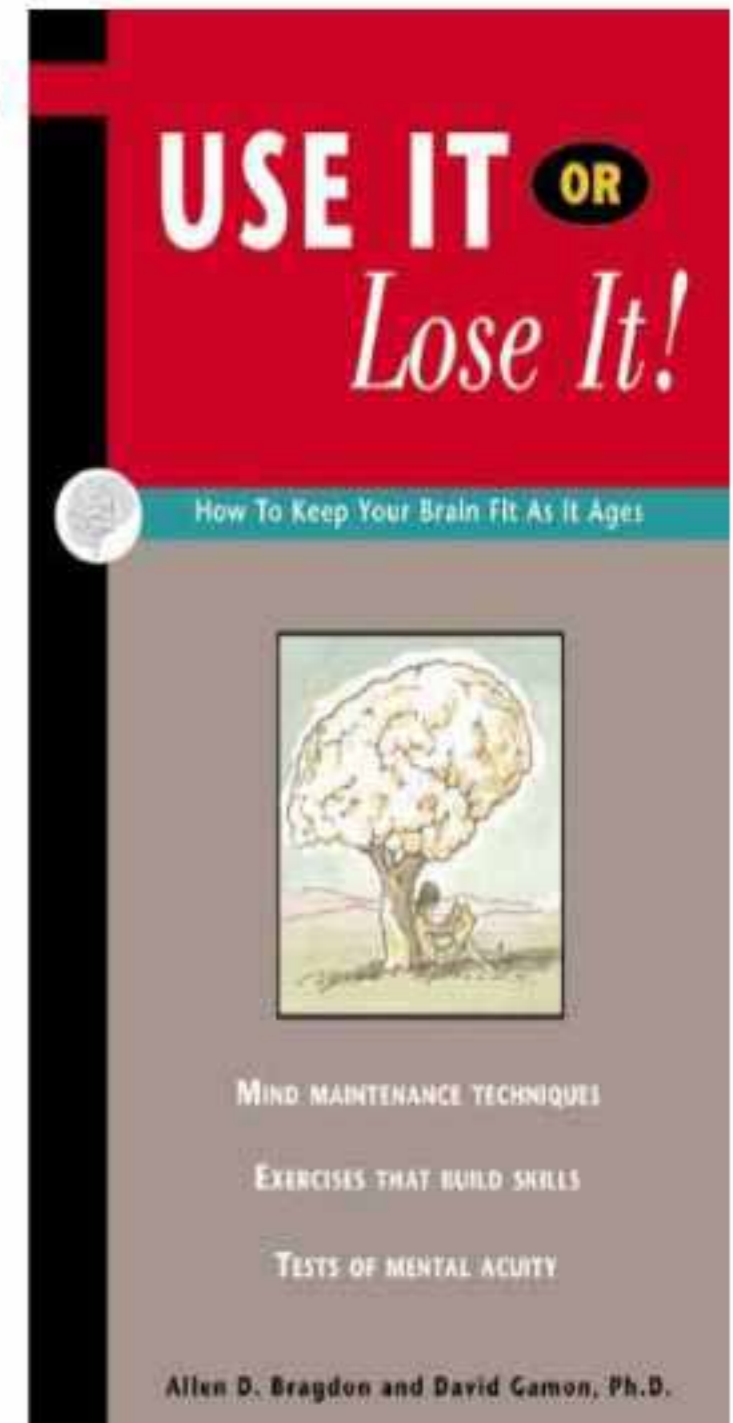
Fluid intelligence
(present day)



Use it or lose it !

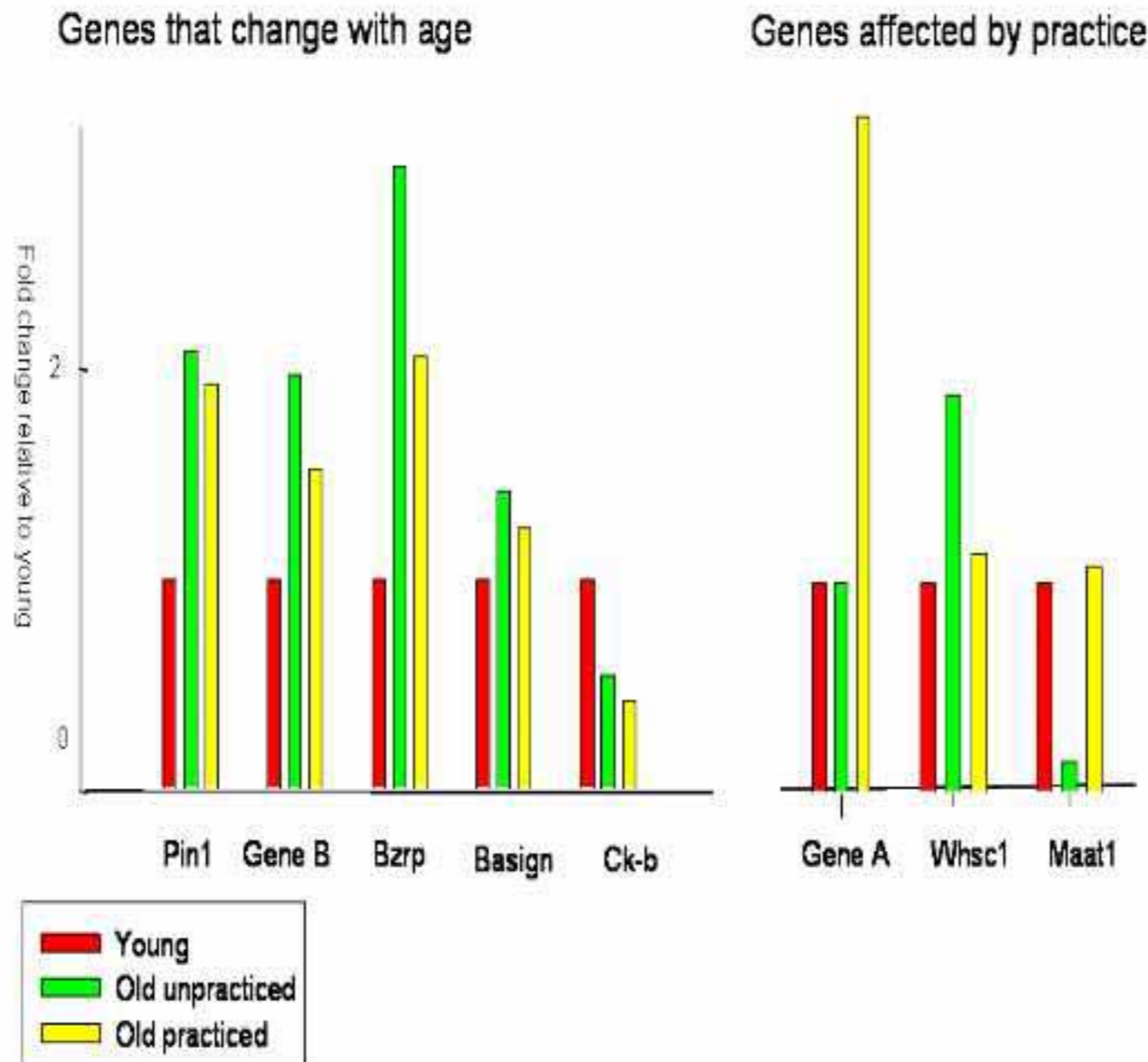
However, if you practice building strategies during early life you retain them

You are likely to be able to use these for most new information



Genes associated with cognitive decline

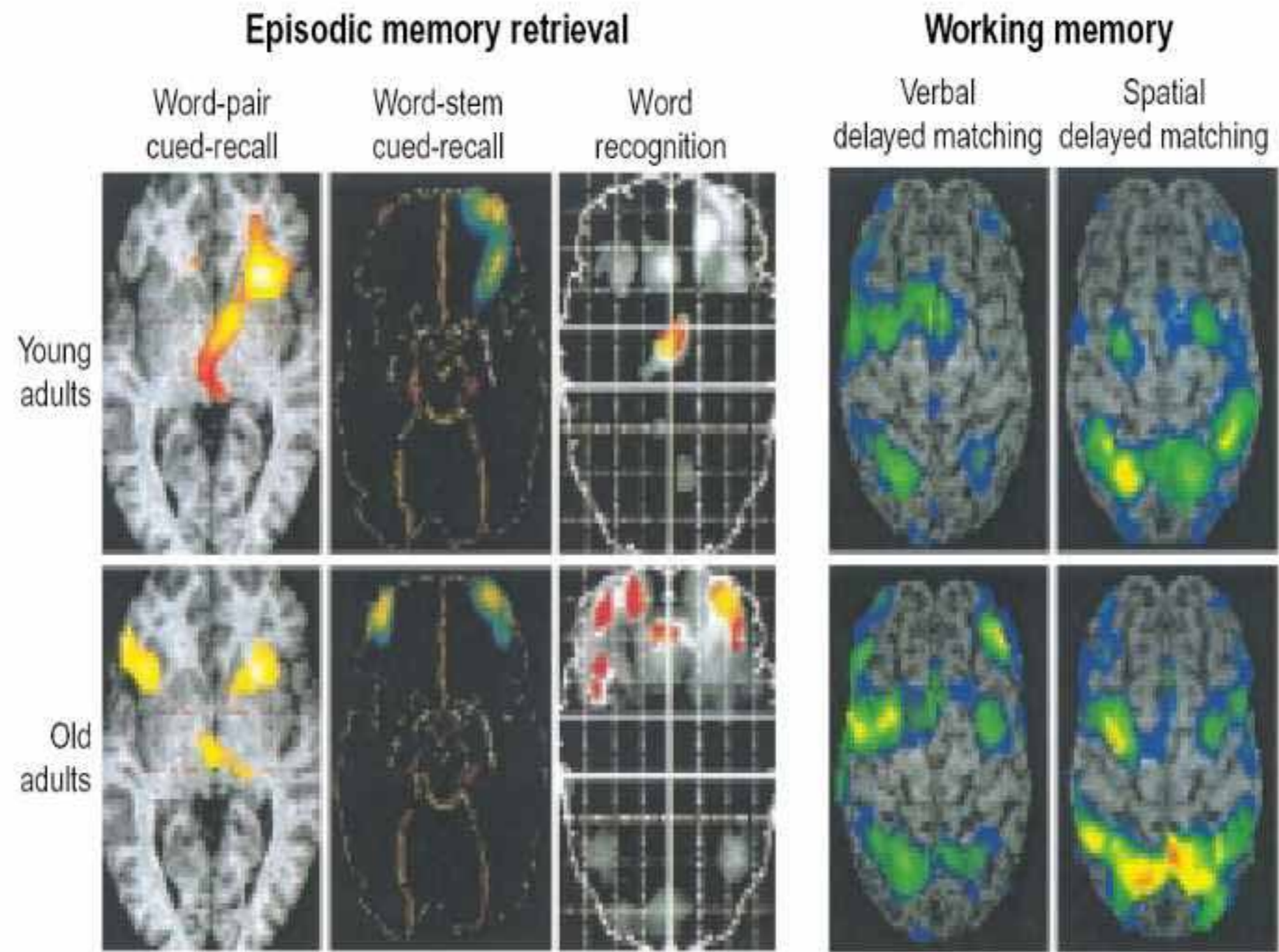
Gene and protein screening studies have been successful in identifying new targets



Wilkinson *et al*

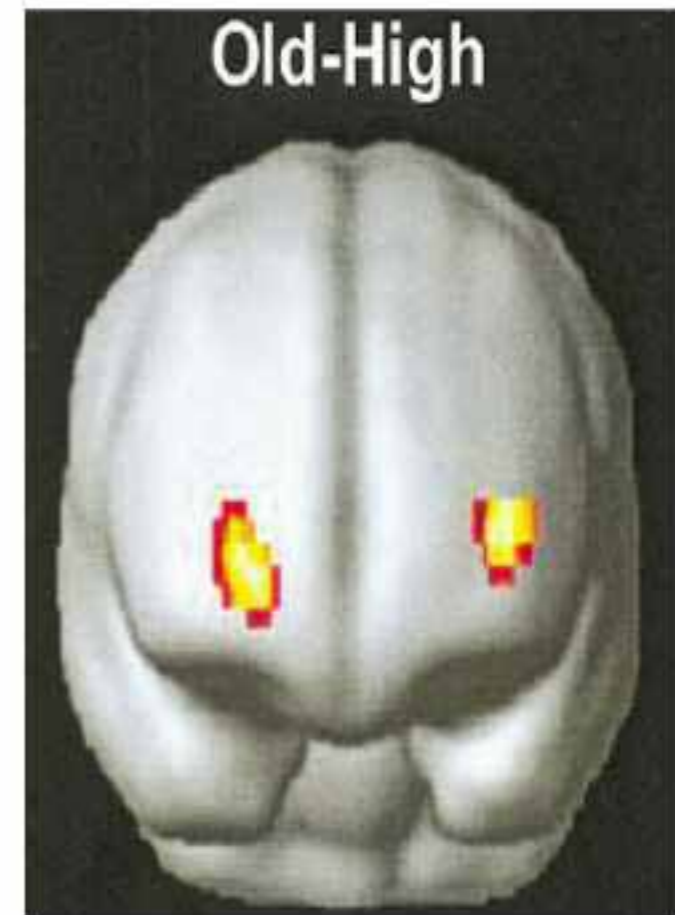
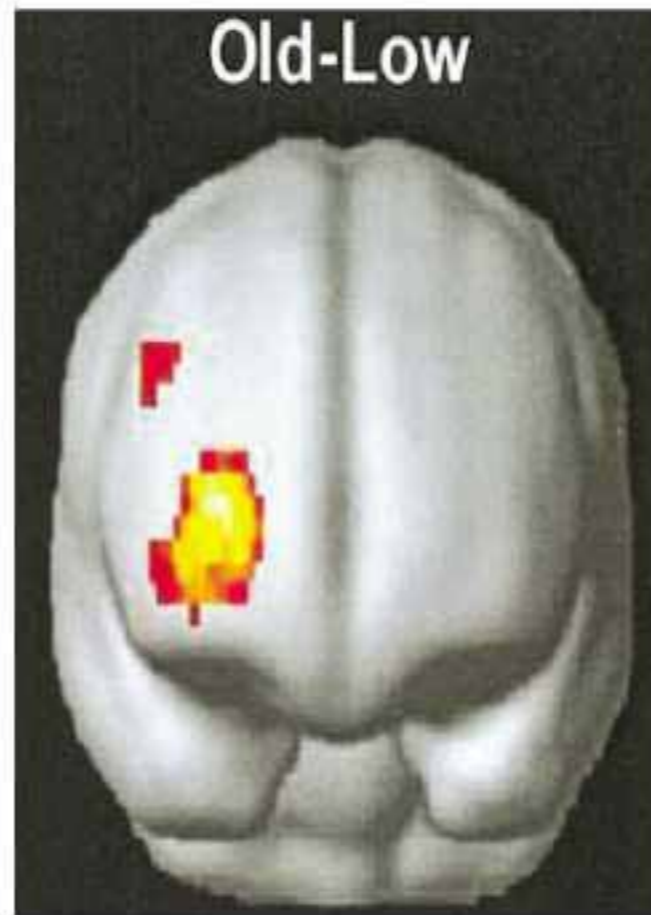
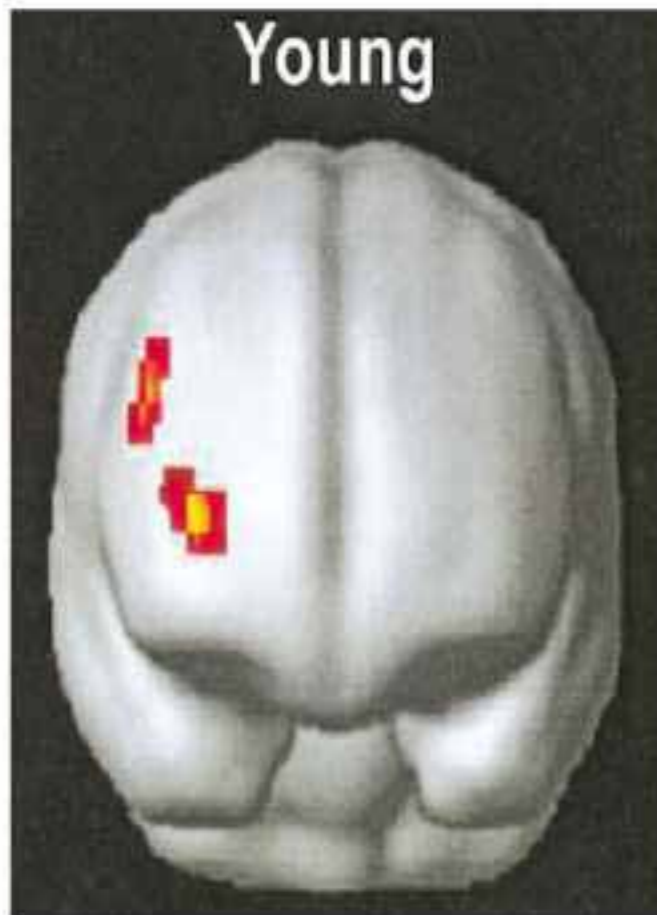
Changes in the way the ageing brain processes information

Good old brains do it differently from young ones



Changes in the way the ageing brain processes information

Good old brains do it differently from young ones

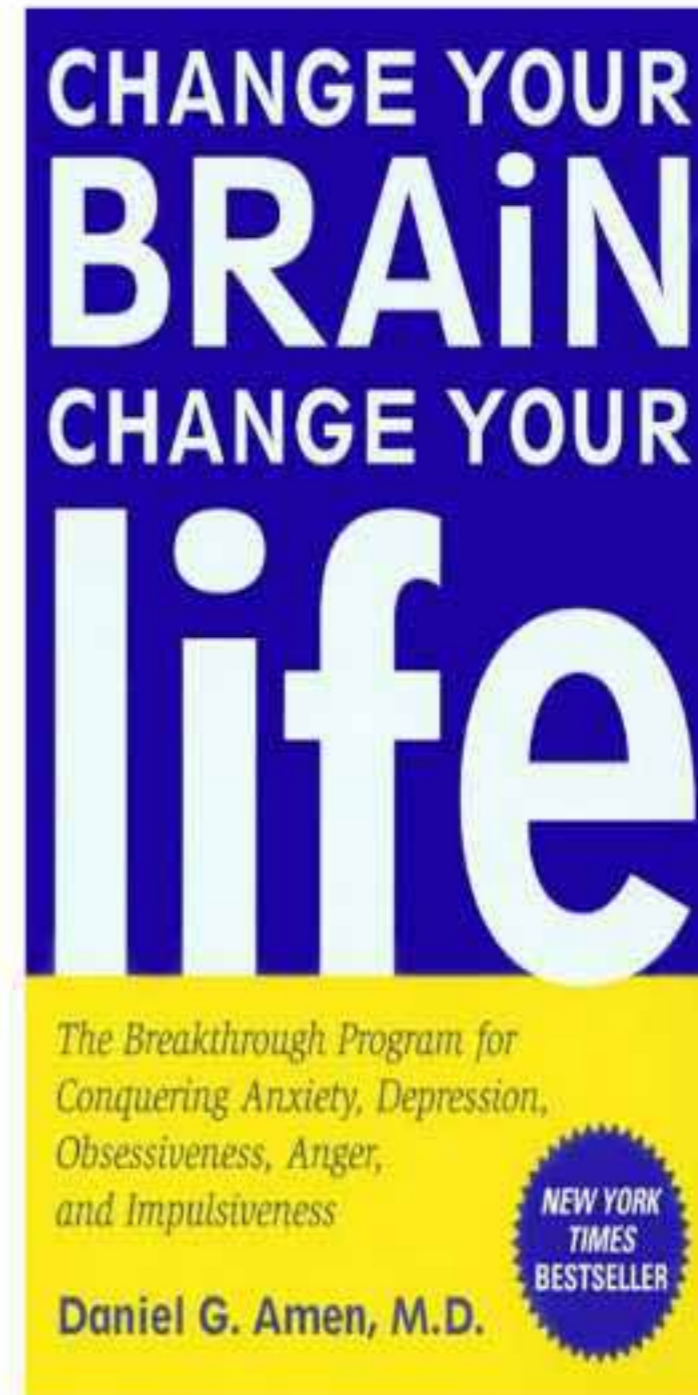


Changes in the way the ageing brain processes information

Having to use more of the brain may explain:

Why age slows down
processing information...

... and increases creativity



Perception of time

Time can subjectively pass more quickly as we age

Exponential progression of time perception equivalents ?

10-20 = 20-40 = 40-80



Perception of time

Time can subjectively pass more quickly as we age

Exponential progression of time perception equivalents ?

10-20 = 20-40 = 40-80

Perception of an extended life from 80-160 same as 10-20 ?

Age decline in registering routine events may make things appear to happen faster

Perception of time

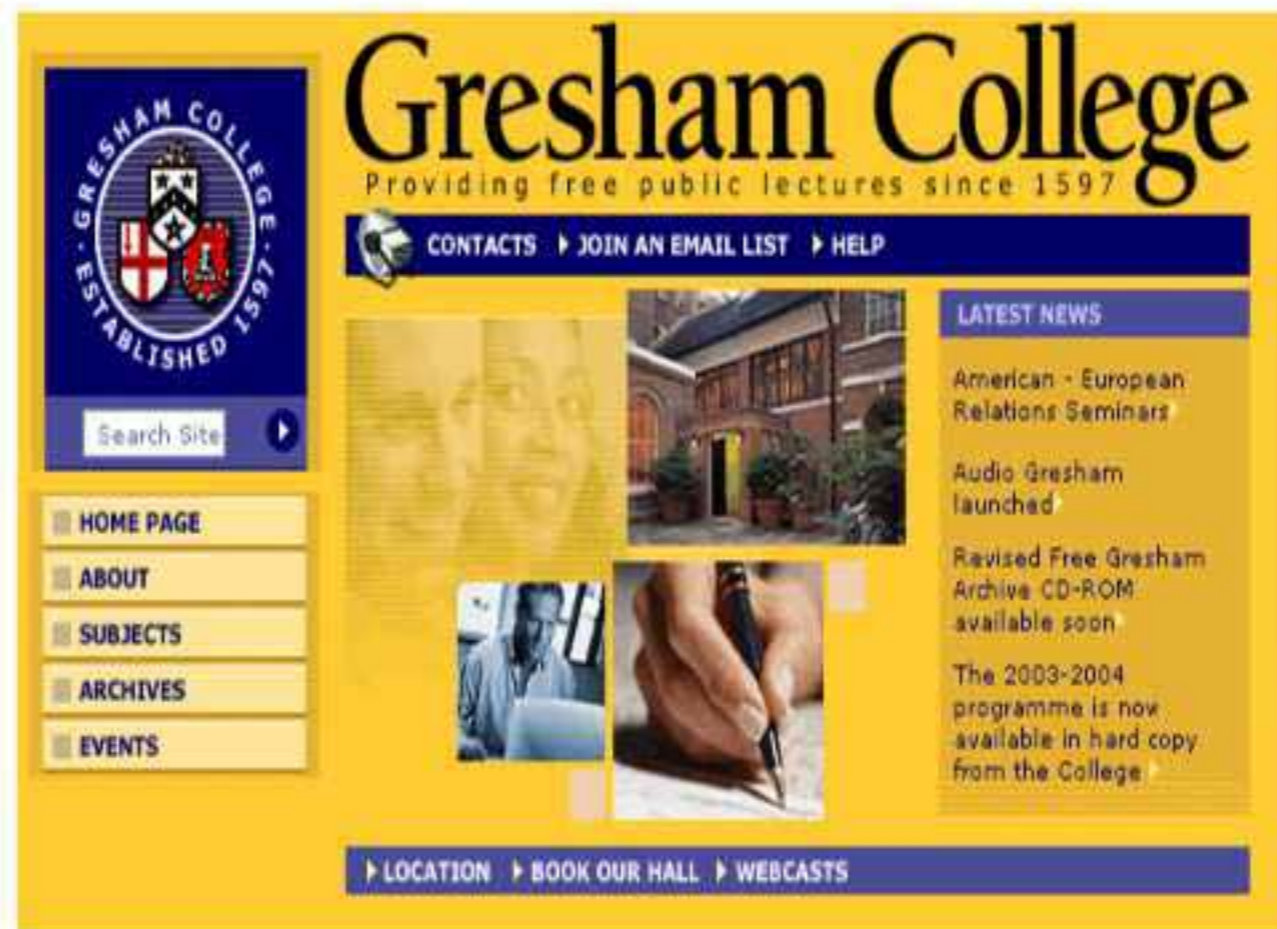
Each day's events flash by in a blur of inattention !



Perception of time

Solutions:

Make sure you try to attend to and remember more daily events



Perception of time

Solutions:

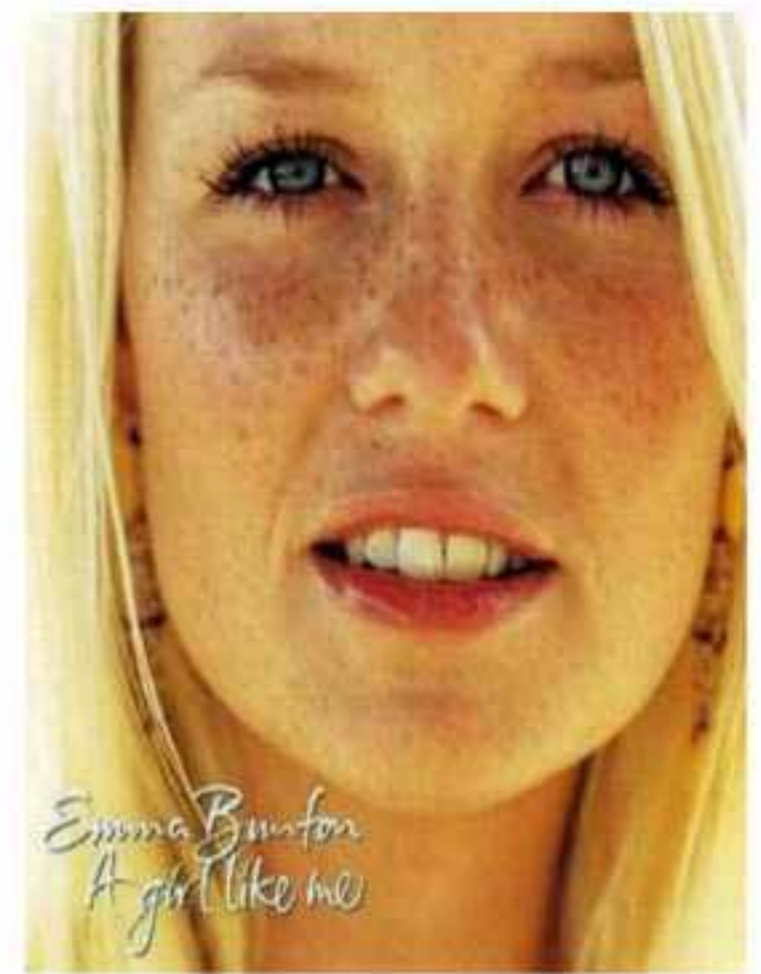
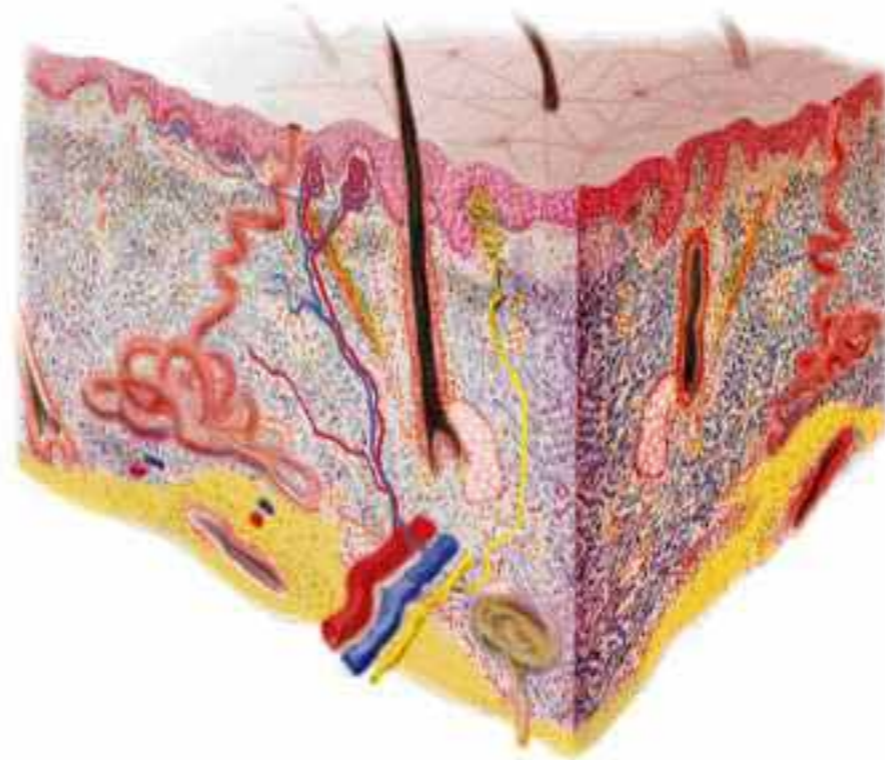
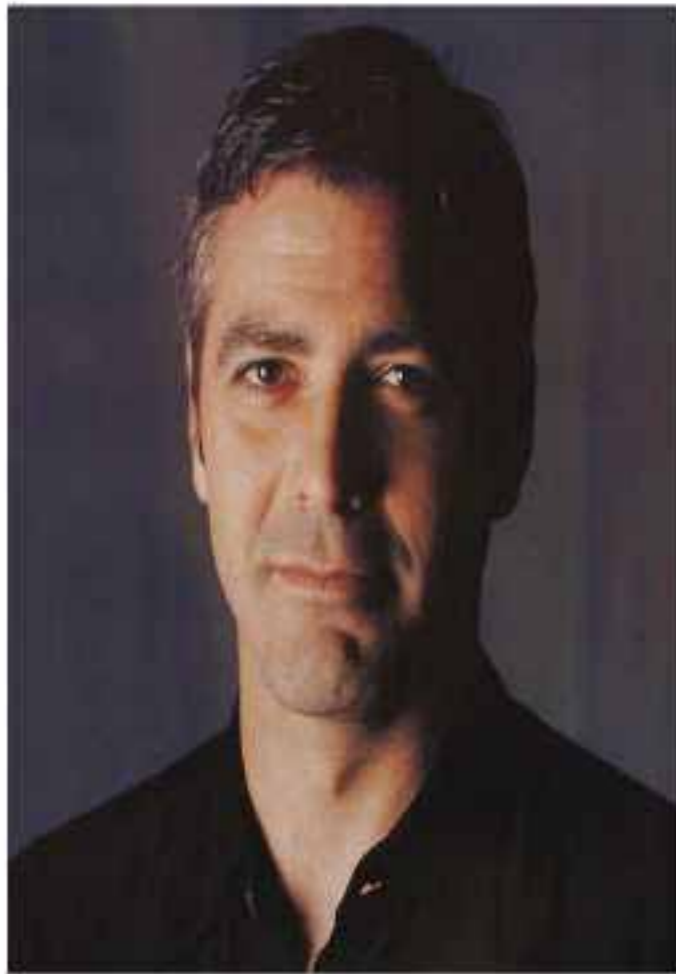
Make sure you try to attend to and remember more daily events

Get more involved in stimulating life events !



The consequences of ageing in society

Beauty is only skin deep



The consequences of ageing in society

Beauty is only skin deep

Increasing concern with disguising the external physical signs of ageing



COSMETIC BOTOX



The consequences of ageing in society

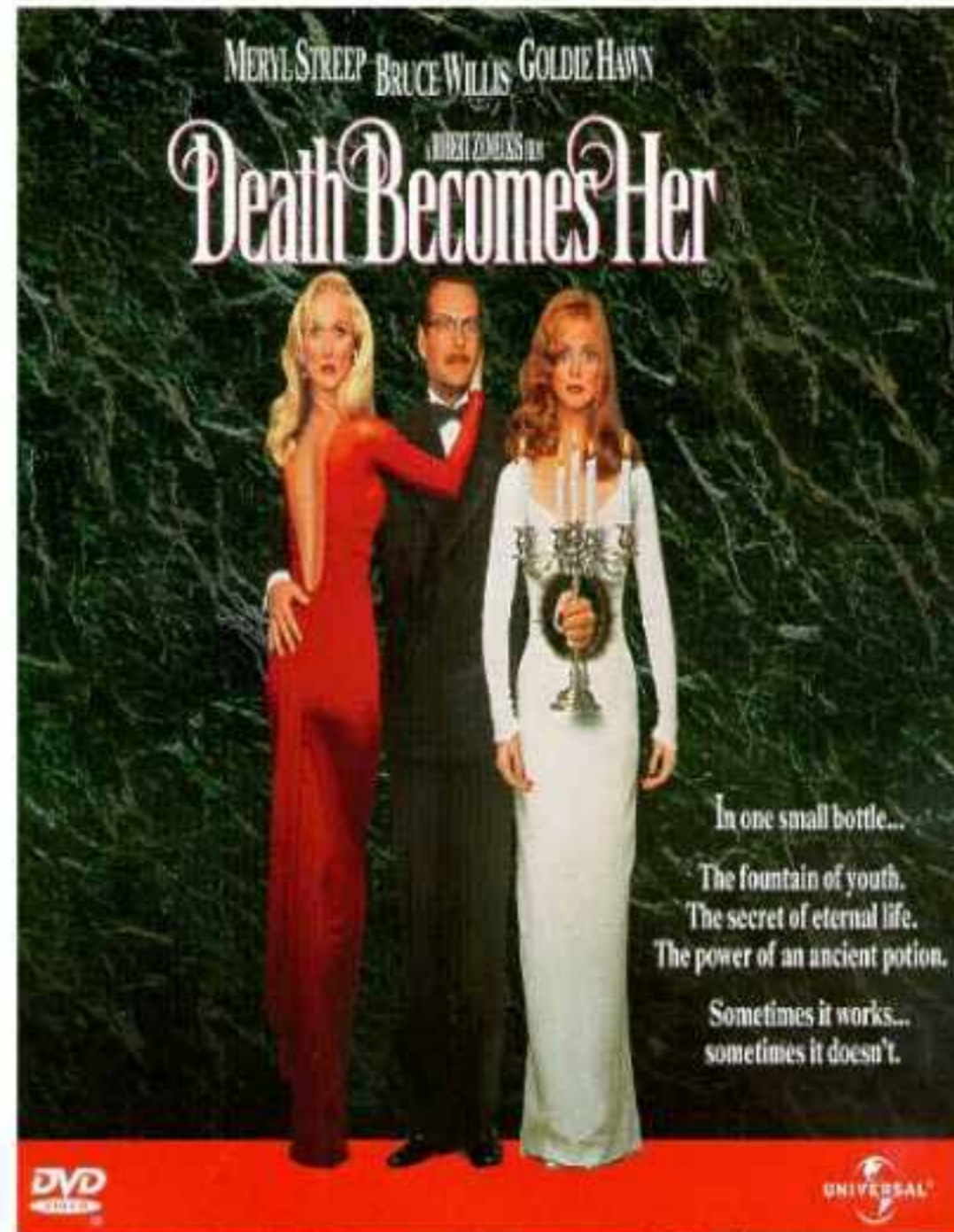
Beauty is only skin deep

Increasing concern with disguising the external physical signs of ageing

Ageing skin, connective tissue and muscle changes are inevitable although variable in degree and time course

The consequences of ageing in society

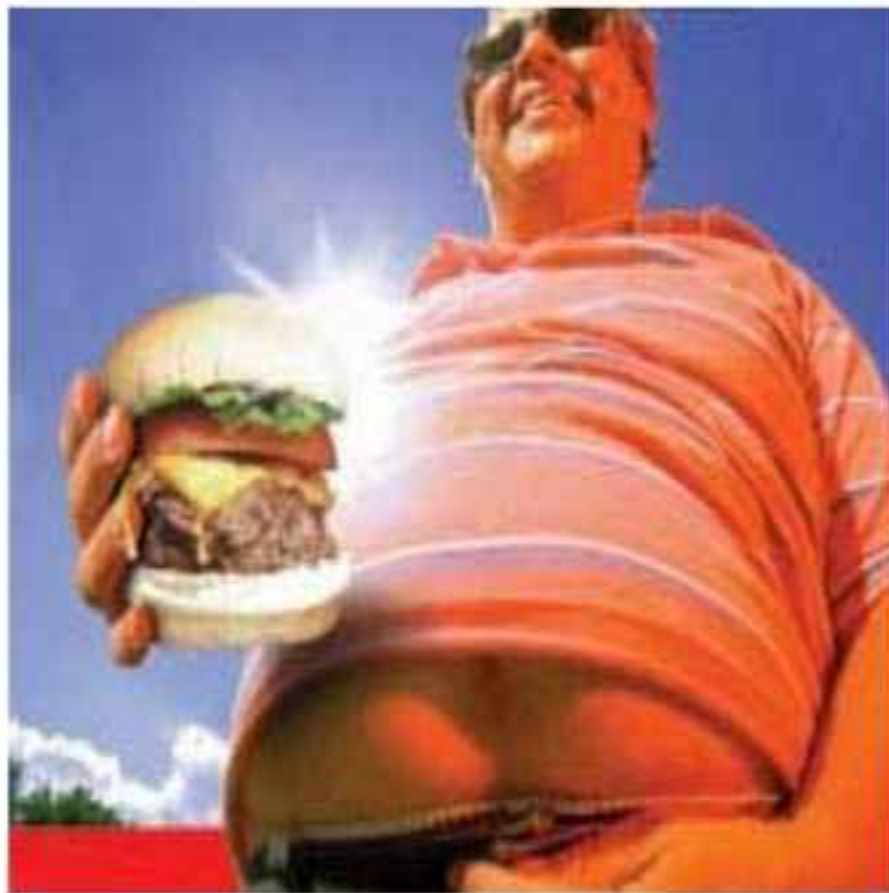
Outrageous claims made for pills and potions



The consequences of ageing in society

Outrageous claims made for pills and potions

Experts: diet, exercise and avoid too much sun



The consequences of ageing in society

Outrageous claims made for pills and potions

Experts: diet, exercise and avoid too much sun

Obsessive concern with youthful looks often linked with difficulty in adjusting to different phases of life

With each phase some advantages are lost while others can be gained

Such inflexibility may prevent us from adapting beneath the surface

The consequences of ageing in society

Even if we can invent effective surgery free methods of maintaining the exterior...



The consequences of ageing in society

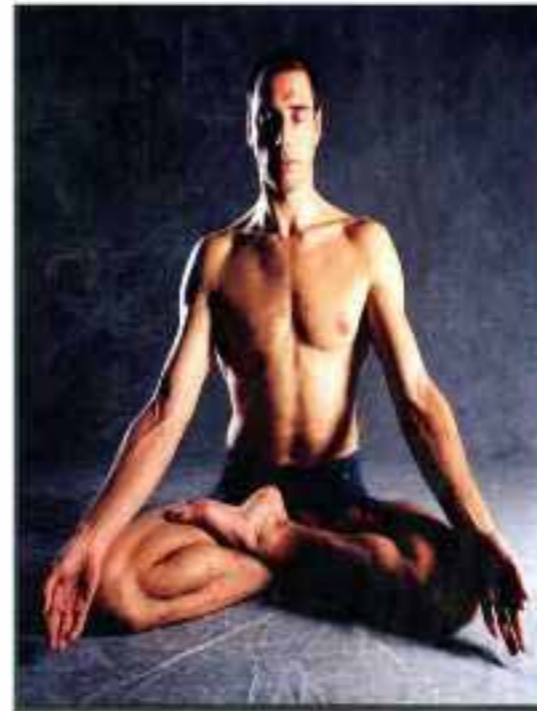
... the importance of adjusting positively to the changing phases of our lives will not diminish



"What fits your busy schedule better, exercising one hour a day or being dead 24 hours a day?"

The consequences of ageing in society

General positive lifestyle features will also still be essential



Some general conclusions:

Ageing may be a consequence of investment in reproduction

Baby-sitting grandmothers may have increased human lifespan

Ageing is mainly about changes occurring within cells

They can count the years as accurately as we can !

Some general conclusions:

25% of ageing is down to genes, 75% to lifestyle and other factors

Growth and repair mechanisms are of key importance

Genes promoting HDL cholesterol are strongly associated with longevity

Extending lifespan may be easier than preventing ageing

Some general conclusions:

Reducing stress, healthy diet and exercise are important

Vitamins C and E, red wine and chocolate can be beneficial

Mental dysfunction due to ageing is not inevitable if you continue to use your brain

Ageing brains can be more creative

Some general conclusions:

The key to ageing gracefully is accepting and maintaining a positive attitude to change

