

Darwinian Medicine

Traditional medical research focus

proximate causes (i.e., "how" or mechanistic)
treating symptoms rather than examining underlying causes of illness

A Darwinian approach to looking at illness can shed some "ultimate"(i.e., "why" or evolutionary) light on this topic.

Niko Tinbergen's "The Four Questions"

	Cause	Origins
Proximate	physiological mechanism	development of mechanism (ontogeny)
Ultimate	natural selection (adaptation)	evolutionary history (phylogeny)

Darwinian Medicine

new & emerging field
novel & controversial ideas
untested hypotheses
worth discussing, because great potential to explain disease & especially to tell us what we don't know

Evolutionary explanations of disease

1. defenses

- coughing is a defense, blocking it can be a mistake
- fever is a defense against infection
 - malarial fever can cure syphilis (J. Wagner von Jauregg got a Nobel Prize in 1927 for this discovery)
 - kids who take acetaminophen take a day longer to recover
 - caveat: high fevers are dangerous!

2. infection

- pathogens are sophisticated and cause damage
 - direct
 - indirect

3. novel environments

- we are designed to run on African plains, modern life is very different (Human Zoo)
- diet, myopia, & ADHD,

4. genes

- environmental interactions e.g., malaria/sickle-cell
- mutations
- cancer

5. design compromises

- bipedality
 - good: frees front feet for other purposes, gives high visibility on African plains, keeps head cooler
 - bad: gives us back problems, hernias, hemorrhoids, weak knees, etc.

6. evolutionary legacies

- esophagus is behind our windpipe (didn't matter when we were fish)

Aging & Death

aging = growing older

senescence = loss of bodily function or deterioration that comes with age

all systems deteriorate at about the same rate, eventually ability to meet any challenges is lost

Patterns

50% dead by 80 years
99% by 100 years
all by 115 years
we have increased average lifespan but not maximum duration,...

Mortality Rates

0.2/1000 at 10
1.35/1000 at age 30
exponential after that, doubling every 8 years
169/1000 at age 90
1/3 at age 100

Explanations

used to be thought that we died to make room for new people ("for the good of the species")
but selection acts on individuals,...

Hypotheses for Senescence

JBS Haldane 1942: selection can't operate on individuals after the age of reproduction
PB Medawar 1946: genes that favor early reproduction at the expense of later life will be selected for
GC Williams 1957: pleiotropy (genes with multiple effects)if a gene improves fitness of a trait at a younger age but worsens it an older age, then it will still be selected for

Tradeoffs observed

flower beetles (live fast, die young)
fruit flies (live longer but have fewer total offspring)