Natural selection tends only to make each organic being as perfect as, or slightly more perfect than, the other inhabitants of the same country with which it comes into competition. And we see that this is the standard of perfection attained under nature.


CHAPTER VI. DIFFICULTIES OF THE THEORY. pg 163

"The result of natural selection is evolutionary adaptation." (C&R pg 438)

So, what do we mean by an adaptation? *(product noun) vs process (verb)*)

1. **An adaptation** - (adaptive significance, ultimate function or current utility)
   Test w/ experimental manipulation of phenotype and/or pheno-env ‘match’ - see if alternatives perform worse, & why

<table>
<thead>
<tr>
<th>Moller 1994 - Fig. 4.4</th>
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<tbody>
<tr>
<td>Shorten:</td>
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<tr>
<td><strong>Tail length</strong></td>
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<tr>
<td>‘a false dichotomy’</td>
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<tr>
<td>aerodynamics, or to attract females?</td>
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<td>Lengthen:</td>
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**Fitness depends on survival and reproduction.**

Conflicting effects of tail length on survival and reproduction create a fitness tradeoff — stabilizing selection.

The phenotypic trait **tail length** doesn’t ‘perfectly’ max either survival or reproduction; it’s a compromise that **maximizes fitness** by...

---

2. **An adaptation** - evolved in response to past selection
   (c) Phylogenetic methods allow us to infer the history of traits (text ch 25):
   Compare across natural differences: look for patterns of independent converge from dissimilar ancestors to...
Adaptations are ‘better’ than random but not perfect.

Why aren’t organisms perfect?

(see C&R pg 49)

There are various kinds of constraints to evolution:

A. You-can’t-get-there-from-here: selection > mutation
B. You-didn’t-really-want-to-anyway: tradeoffs
C. You-can-but-it-will-take-time-&-luck:

1. Lack of genetic variation (selection > mutation)
2. Transitional phenotypes may be less fit
3. There keeps moving:

Genetic correlations: Side-effects & tradeoffs

Gene Called Link Between Life Span and Cancers NICHOLAS WADE Sept 7, 2006

Biologists have uncovered a deep link between life span and cancer in the form of a gene (p16-Ink4a) that switches off stem cells as a person ages.

The critical gene, well known for its role in suppressing tumors, seems to mediate a profound balance between life and death. It weighs the generation of new replacement cells, required for continued life, against the risk of death from cancer, which is the inevitable outcome of letting cells divide.

To offset the increasing risk of cancer as a person ages, the gene gradually reduces...

The finding suggests that many degenerative diseases of aging are caused by an ... that renew the body’s various tissues and are not just defensive disintegration of tissues under daily wear and tear.

The evolutionary purpose is evidently to avert the risk that a damaged stem cell might evade controls and proliferate into a tumor.

Ageing: Balancing regeneration and cancer
CM Beausejour & J Campisi
NATURE|Vol 443|28 September 2006
Full Text | PDF (166K) Editor’s summary

The proliferation of cells must balance...

Against the risk of developing cancer.
Social Cognitive Evolution in Captive Foxes Is a Correlated By-Product of Experimental Domestication.

B. Hare et al. Current Biology, Volume 15, Issue 3, Pages 226-230

We show here that fox kits from an experimentally domesticated population selectively bred over 45 years to approach humans fearlessly and nonaggressively are not only as skillful as dog puppies in using human gestures but are also more skilled than fox kits from a second, control population not bred for tame behavior (critically, neither population of foxes was ever bred or tested for their ability to use human gestures).

These results suggest that sociocognitive evolution has occurred in the experimental foxes, and possibly domestic dogs, as a correlated by-product of selection on systems mediating fear and aggression, and it is likely the observed social cognitive evolution did not require direct selection for improved social cognitive ability.

Dogs have an unusual ability for reading human communicative gestures (e.g., pointing) in comparison to ... chimps or wolves. ... it is unclear whether this evolution is a result of direct selection for this ability, or as a correlated by-product of selection against fear and aggression toward humans - as is the case with a number of morphological and physiological changes associated with domestication.

The ‘EEA’: the ‘good old days’ on the savanna
women: staying closer to home, more verbal & nurturing
men: navigating far from home, analyzing, using muscle & tools

Are lawns a grand effort at environmental (EEA) restoration?

Is aggression a vestige?

Time lags


The Collapse and Revival of American Community (2000). New York: Simon & Schuster.] claims that Americans are socially and civically disengaged because they watch too much TV.

I contend that, because evolved psychological mechanisms have difficulty comprehending entities that did not exist in the environment of evolutionary adaptedness (EEA), humans should fail to distinguish between real friends and the imaginary ones they see on TV.

... analysis of the US General Social Survey (GSS) data indicates that watching certain types of TV shows has the same effect on subjective satisfaction with friendships as having more friends and socializing with them more often.

... consistent with my contention that where every realistic image of someone you repeatedly and routinely saw was your real friend. !?!!
Gene flow can disrupt local adaptation, resulting in a kind of ‘average’ adaptation that is not ‘perfectly’ specialized to any of the local environments.


Abstract: … Using blue tits in Mediterranean habitat mosaics ... compares two isolated landscapes {mainland, France island of Corsica} and ... two habitat types {deciduous evergreen trees}

Deciduous habitats are more common than evergreen habitats on the mainland whereas the opposite is true on the island.

Results suggest that:
(1) on a regional scale, each population is {life history traits have evolved in such away that breeding success is high;}
(2) in the less common habitats within each landscape, birds are clearly mistimed - they mismatch the best period of food availability, and hence their breeding success is lower; ...

Gene flow is used to manage pesticide resistance

Field tests on managing resistance to Bt-engineered plants. Shelton et al. Nature Biotechnology 18: (3) 339-342 MAR 2000

Several important crops have been engineered to express toxins of Bacillus thuringiensis (Bt) for insect control. (bacterial toxin paralyses insect gut) Bt-transgenic plants can greatly reduce the use of broader spectrum insecticides, but {the evolution of} insect resistance may hinder this technology. {human resistance to eating plants that produce Bt toxin may hinder technology!}

Present resistance management strategies rely on: {the idea/hope/hyp is that} will disrupt the evolution of Bt resistance in the treatment areas

We have used Bt-transgenic broccoli plants and the diamondback moth as a model system to examine resistance management strategies. … Results indicate that great care must be taken to ensure that refuges … produce adequate numbers of susceptible alleles. {enough gene flow to disrupt local adaptation to Bt}
Clearly, sex confers some benefit in addition to reproduction: otherwise, sexual individuals would soon be outcompeted whenever asexual individuals appeared by mutation or migration. Consider a pop. of insects in which 1/2 the females reproduce sexually & 1/2 half reproduce only asexually.

... the asexual condition would increase in frequency because all of the females’ offspring would be daughters that would produce more reproductive daughters. In contrast, half of the offspring of the sexual females would be males, which ... would themselves produce no offspring. This is the "twofold disadvantage" of sex.

Coevolution & the Red Queen

Sex is an evolutionary enigma (see C&R sec 23.4 & Nielson 2006. Science 311,960 - 961).

It is far inferior to asexual repro. as measured by reproductive output. Consider a pop. of insects in which 1/2 the females reproduce sexually & 1/2 half reproduce only asexually.

Maternal versus paternal inheritance of HLA class I alleles among HIV-infected children: consequences for clinical disease progression.


When children acquire HIV infection from their mothers they acquire virus with a history of encounter with maternal HLA (MHC) -mediated immune responses. (the HIV has a history of selection to adapt to (evade) maternal mhc products)

We tested whether time to AIDS diagnosis or death, among a cohort of 59 HIV-infected children in NYC followed from birth for up to 12 years, was associated with maternally- or paternally-inherited child HLA class I alleles, and with HLA similarity between mother and child.

HIV-infected children with an HLA allele usually associated with slow disease — — — — — — experienced a slower progression to AIDS or death

no association was observed.

CONCLUSION: HLA-mediated selective pressures on the virus in a transmitting mother-infant pair may undermine HLA-mediated viral control in the child.