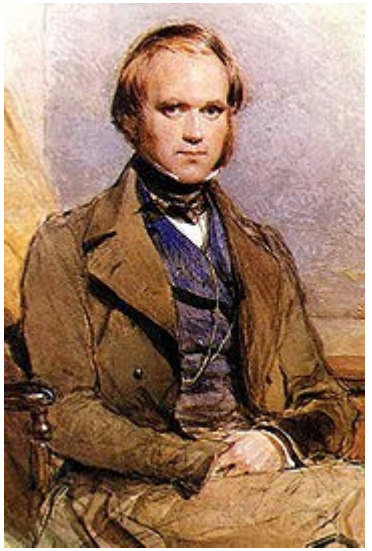
Evolution of Wet-Ware

Darwin: On the Origin of Species

- 24.11.1859
  - On the Origin of Species by Means of Natural Selection, or The Preservation of Favoured Races in the Struggle for Life
- Independent theories
  - The variability of species
  - The common roots of all species
  - Gradualism (steady small changes)
  - The spread of species and building of populations
  - The natural selection as mechanism of evolution



Charles Darwin Wikipedia

Evolution versus Intelligent Design

http://en.wikipedia.org/wiki/File:The_Creation_of_Adam.jpg

- Kreationism and Intelligent Design:
  - “Alternative” to scientifically based theory of evolution
  - A Creator deity has created and designed the world and its species
  - Common disputes and inconsistency in geological history of earth, common descent and solar system
  - Some of the best argument against evolution
    - Next page

Likelihood of emergence of cells

- Fred Hoyle (1915-2001)
  - The likelihood of random emergence of even the simplest cell is as small as the probability that “a tornado sweeping through a junk-yard might assemble a Boing 747 from the materials herein”
  - A variation: That the human eye, as complex as it is, should have been created just by little random changes sounds quite unbelievable

http://i141.photobucket.com/albums/r56/ibbilly/junk_yard.jpg

http://students.ou.edu/R/Nathaniel.L.Rankin-1/Boeing-747-8.jpg

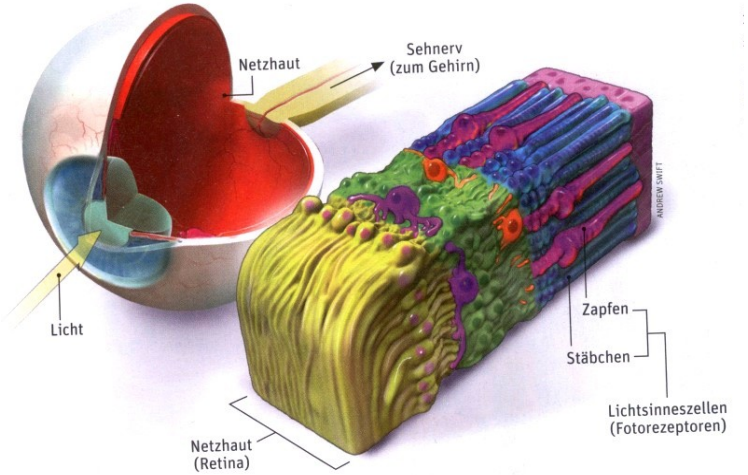
The evolution of the eye

- A plastic demonstration by Richard Dawkins

Richard Dawkins demonstrates the evolution of the eye

Timescale that an eye need to evolve

- Less than 400k years and 250k generations
  - Computer Simulation
    - Dan-E. Nilsson and Susanne Pelger, A Pessimistic Estimate of the Time Required for an Eye to Evolve, 1994.
- The evolution took the wrong junction at least once



Andrew Swift, The primate Eye, Spektrum der Wissenschaft, 2010

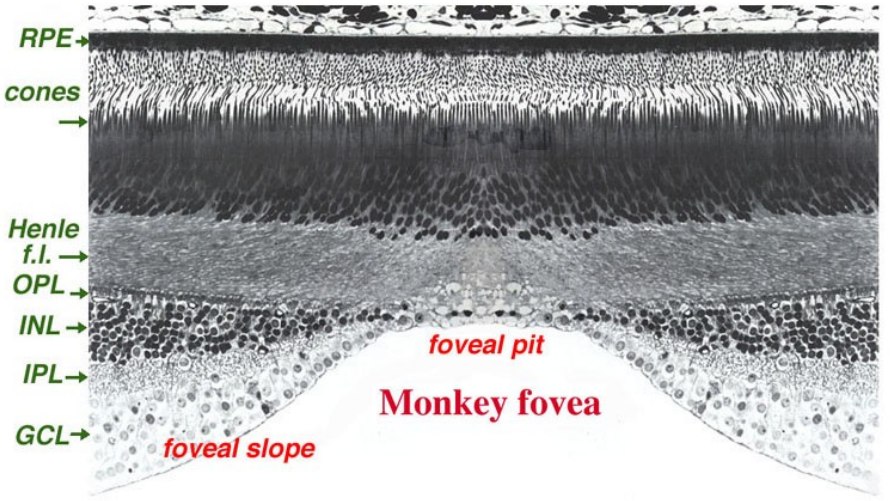


Fig. 12b. Vertical section of the monkey fovea from Hagerman and Johnson (1991).

How Lifeforms adapt to environmental changes

- Hot-wired (nervous-system required)
  - Fast adaptation to environmental changes
  - Is learned from trial and error or teached from other individuals
  - Requires flexible “control system”

http://farm3.static.flickr.com/2191/1877693990_693d607597.jpg?v=0

Update time: 20 minutes

- Hard-wired
  - Inherited from ancestors
    - Tiny Changes at each reproduction cycle (“slow”)
  - Guarantees the individuals are capable to survive
    - (exact copy of survivable organism is survivable as well)

When does adaptation matters?

http://globalconditions.files.wordpress.com/2007/04/ftsharks_800x600.jpg

- At high evolutionary pressure
  - Any cause that reduces success (causes selection)
- the best fit organism wins the battle for resources
  - e.g. Antibiotic resistance of bacteria
  - e.g. Malaria is a selective pressure for humans and has pushed a hemoglobin cell mutation that grants some resistance against the virus (but unfortunately causes sickle-cell disease reducing life expectancy)

Role of diversity

- A gene pool must be diverse to be able to react on environmental changes
- A population converges over time to a state in which it is maximally fit to the environment
  - Optimal conditions for reproduction and growth

http://msnbcmedia2.msn.com/j/MSNBC/Components/Photo/_new/091019-dinosaur-crater-hmed.hmedium.jpg

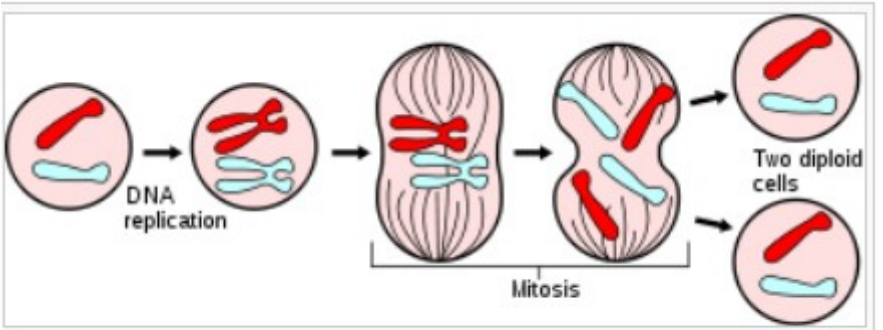
- Unfortunately specialization causes inflexibility
  - The reason of the extinction of the dinosaurs
    - To hot and nothing to eat

The means of evolution

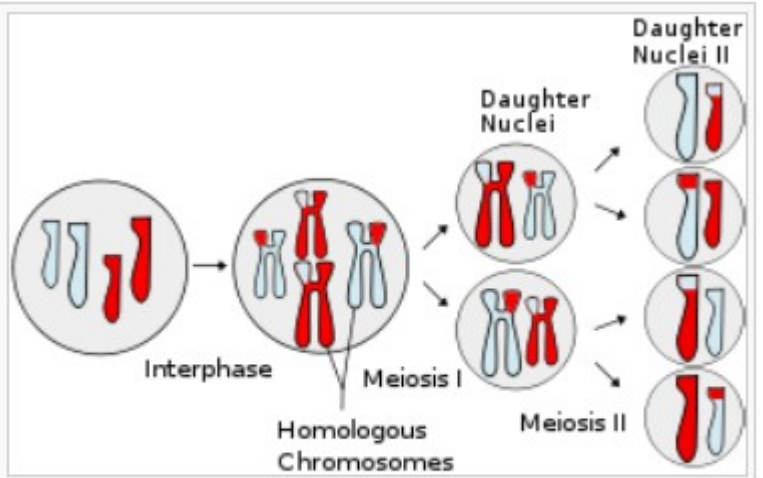
- What causes a genome change
  - Mutation
  - Crossover
- Evaluating the changes
  - Selection of those individuals which fit best to environment
- Spread of the new genome
  - Those individuals that live longer can have more offspring

Reproduction

- Mitosis
  - Identical copy of cell nucleus
  - asexual
- Meiosis
  - Essential for sexual reproduction
  - Generates genetically distinct individuals



Mitosis divides the chromosomes in a cell nucleus.

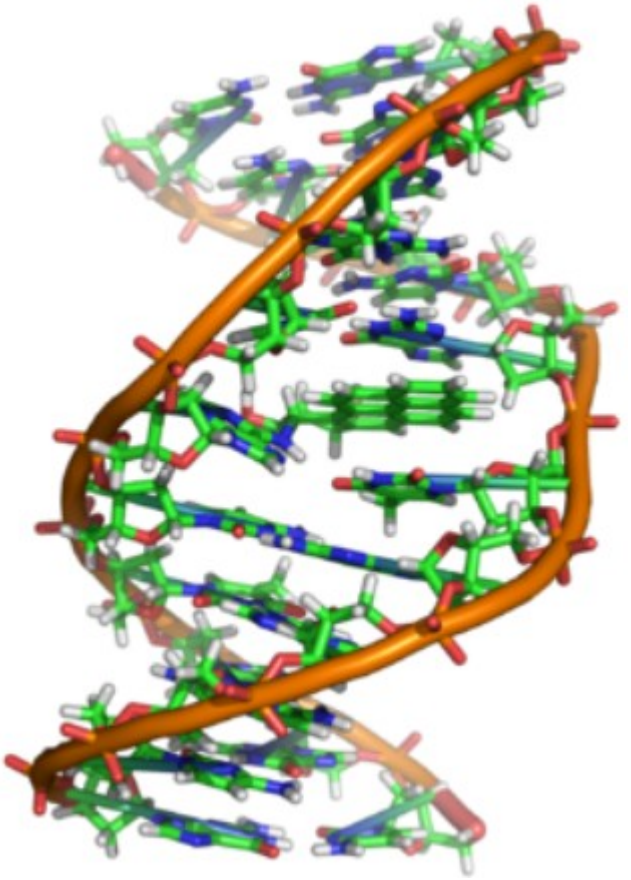


Events involving meiosis, showing chromosomal crossover

All images wikipedia

What causes genetic mutation?

- Radiation,Viruses, Mutagenic chemicals
- Transcription errors in DNA replication
- Change or delete existing genes
  - Causes even structural changes making individuals less likely to interbreed (deutsch: kreuzen) and forces creation of new species



http://en.wikipedia.org/wiki/Mutation

- This mutation is directionless as there is no direction of change (neither good nor bad)