



The Greatest Show on Earth **By Richard Dawkins**

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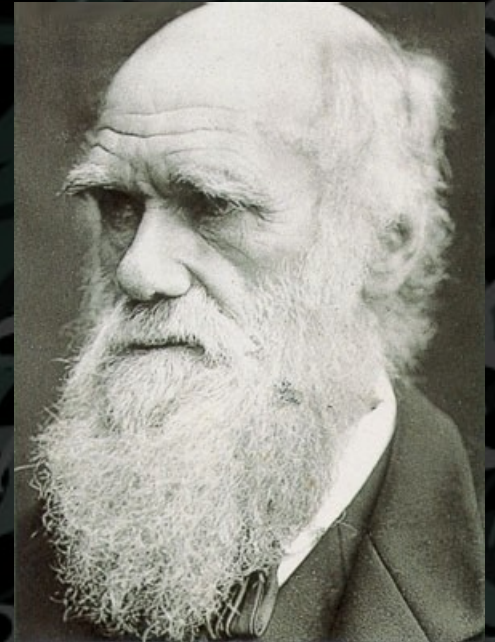
Richard Dawkins

- Ethologist, evolutionary biologist and popular science author
- Retired from Oxford
- Early fame in 1976 for *The Selfish Gene* (invented the meme)
- One of the “Four Horsemen”, perhaps the world's leading atheist
- “Darwin's Rottweiler”



Why this book?

- 2006's *The God Delusion* is a leading atheism text
- That and many previous biology books assumed the reader understood evolution
- Dawkins realized it was time to explain the evidence for Darwin's theory of Evolution by Natural Selection



Only a theory?

- There's nothing "only" about a real scientific theory.
- Dawkins explains very carefully the difference between the way a scientist uses the word "theory" and the common usage
- Attempts to introduce a new word for a scientific theory: *theorum*

Dogs, cows and cabbages

- Artificial selection shows the power of chosen mutations
 - Dog breeds with artificial isolation
 - Cows bred for milk supply have extreme output
 - Broccoli, cauliflower, kohlrabi, kale, Brussels sprouts, spring Greens, romanesco, and cabbage are all cabbages
- Line of changes back through time - when were the rabbit's ancestor's not rabbits?

The primrose path to macro-evolution

- Previous examples showed artificial selection
- Flowers and insects show an example of selection in nature – they sculpt each other!
- Natural selection for sex, camouflage, etc.
- Wolves turned into dogs when they started hanging around people (selecting themselves)
 - Experiment reproduced with Foxes in Siberia
 - Suggests linked traits

The primrose path to macro-evolution

- Friendlier with humans, put their ears down, wag tails when happy, and have begun to vocalize and bark like domesticated dogs
- Lance knew the scientist's grandson

Silence and slow time

- Fossils dated with multiple clocks
- Tree rings for 11,500 years
- Radiometric clocks are explained
- Many radiometric clocks give overlapping bands of confidence, and they corroborate each other
- Order of geological strata around the world and their fossils are always consistent – unexplainable by a global flood

Before our very eyes

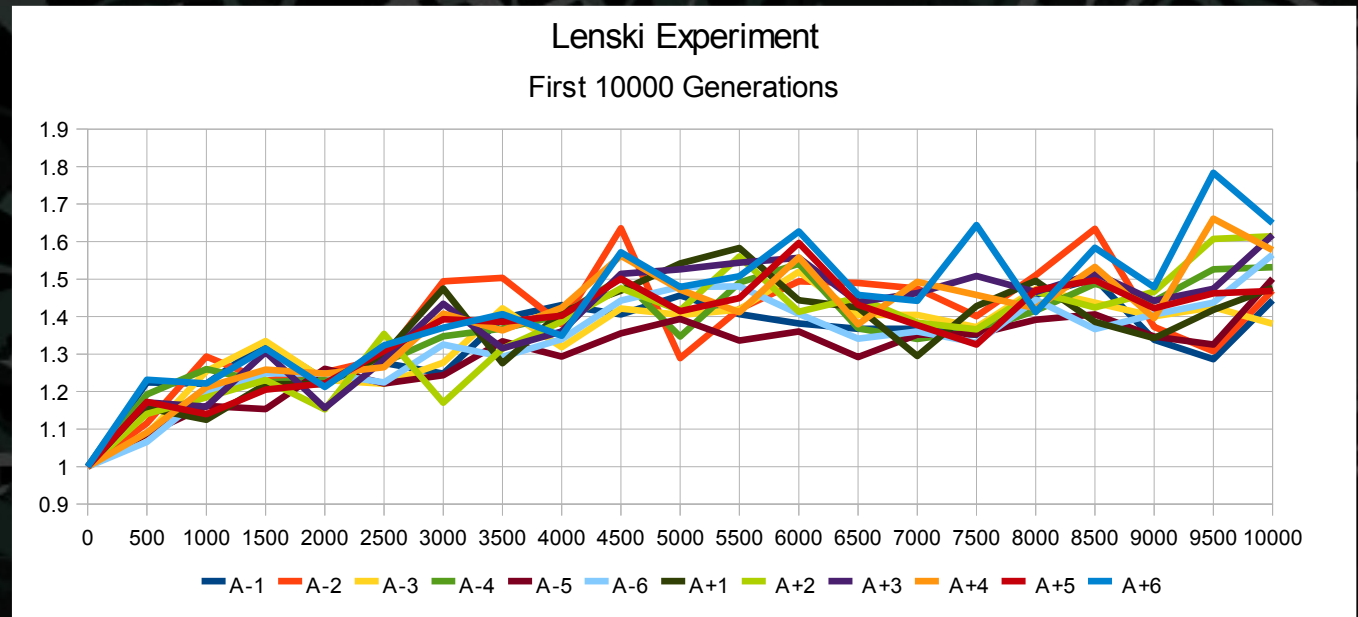
- Some evolution is remarkably quick, and therefore need not rely on fossil evidence
- Tusk weight of Ugandan elephants decreased 30% in 35 years, probably due to hunting pressure
- Lizards on a Croatian island evolved new stomach features in 37 years
- Reproducible changes in guppies seen in streams

Before our very eyes

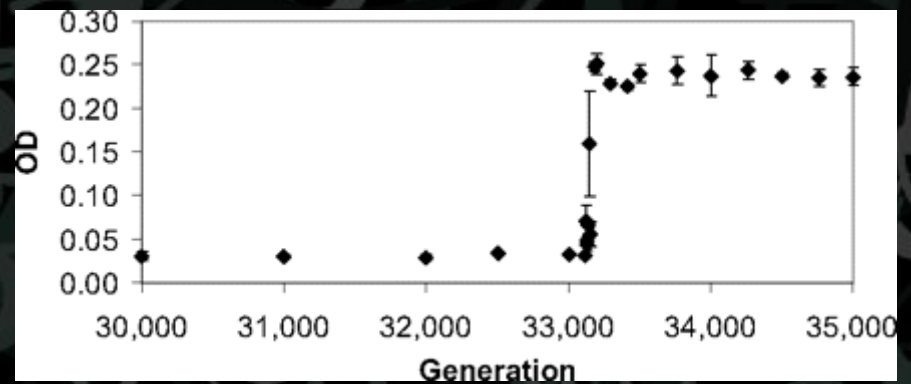
- Lenski experiment
 - Fascinating research with 45,000 generations of *e. Coli* in a lab
 - Twelve parallel lines of evolution
 - Intermediate generations saved
 - All lines became more efficient eaters
 - Two mutations combined to enable one line to eat a food that *e. Coli* can't otherwise digest

Before our very eyes

General growth



Citrate Mutation
in Ara-3



Missing link? What do you mean, 'missing'?

- Creationists focus on fossils, but evolution is fully demonstrated without a single fossil
- Crocoduck



Missing link? What do you mean, 'missing'?

- The very term "missing link" is nonsense because it's impossible to say which generation was the new species
- Cambrian Explosion means that corpses became fossils then, not that life started then
- Scientists predicted *Tiktaalik* based on evolution

Missing persons? Missing no longer

- Comparisons of hominid skulls shows the evolution clearly
- Confusion on a missing link comes from confusion on the border between species (Australopithecus habilis, Homo habilis, Australopithecus rudolfensis, Homo rudolfensis)
- Just go and look...
<http://www.youtube.com/watch?v=YFjoEgYOgRo>

You did it yourself in nine months

- DNA is instructions, not a blueprint
- Bottom-up “design”, shape of embryo created based on local conditions and rules
- Enzymes catalyze everything
- History of all 558 cells of a larval worm decoded – differentiation due to local rules

The ark of the continents

- Speciation through “islands” of whatever form
- Separation between and within Galapagos Islands enabled speciation
- Plate tectonics provided isolation - why else are marsupials only in Australia?

Plate tectonics explains distribution patterns and supports “old earth”

The tree of cousinship

- Homology shows that basic structures – bones, segments, etc. are shared within major classes
- Mutations in unused DNA provide another clock
- Comparison of these mutations show which species are most related – and every gene examined shows the same family tree!

History written all over us

- Vestigial features show history and development (unintelligent design)
 - Useless or repurposed wings on birds
 - Eye buds in subterranean animals
 - Gills seen in human embryology
 - Koala pouches are upside down

History written all over us

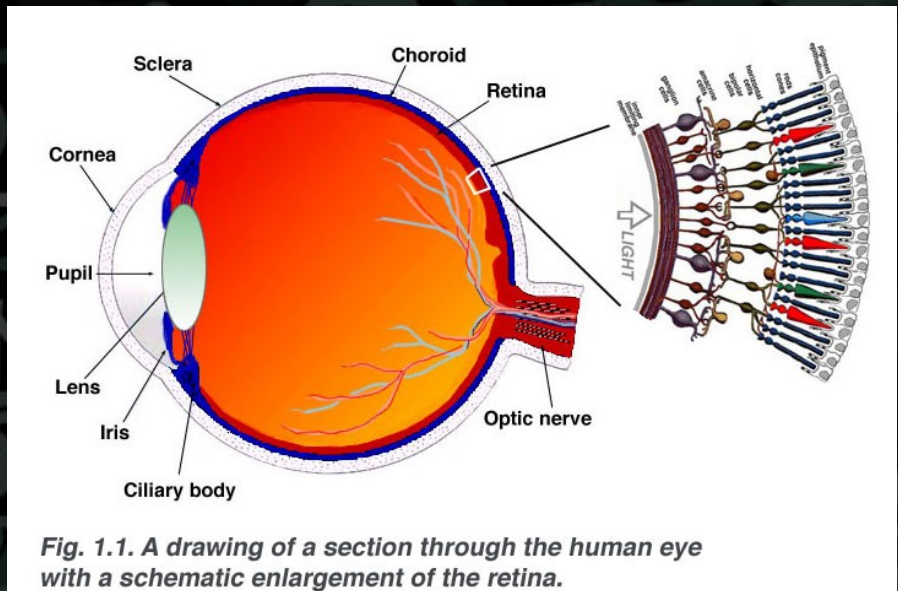
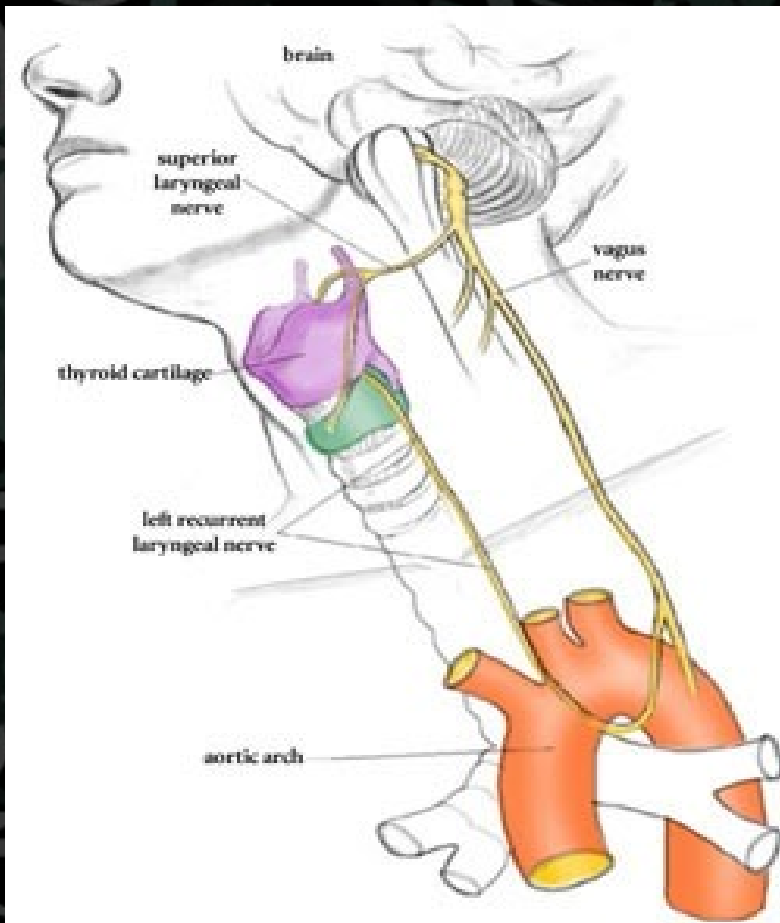


Fig. 1.1. A drawing of a section through the human eye with a schematic enlargement of the retina.

Arms races and 'evolutionary theodicy'

- Theodicy is the “problem of evil/suffering”
- Why don't all trees agree to a set height or predator and prey agree to a policy?
- Survival of the fittest means all fight for the best advantage
- *Red Queen Hypothesis*
 - “It takes all the running you can do to keep in the same place”

There is grandeur in this view of life

- Thus, from the war of nature, from famine and death, the most exalted object which we are capable of conceiving, namely, the production of the higher animals, directly follows. There is grandeur in this view of life, with its several powers, having been originally breathed into a few forms or into one; and that, whilst this planet has gone cycling on according to the fixed law of gravity, from so simple a beginning endless forms most beautiful and most wonderful have been, and are being evolved.

— Charles Darwin, *The Origin of Species* (1859)

The history-deniers

Imagine that you are a teacher of Roman history and the Latin language, anxious to impart your enthusiasm for the ancient world -- for the elegiacs of Ovid and the odes of Horace, the sinewy economy of Latin grammar as exhibited in the oratory of Cicero, the strategic niceties of the Punic Wars, the generalship of Julius Caesar and the voluptuous excesses of the later emperors. That's a big undertaking and it takes time, concentration, dedication. Yet you find your precious time continually preyed upon, and your class's attention distracted, by a baying pack of ignoramuses (as a Latin scholar you would know better than to say ignorami) who, with strong political and especially financial support, scurry about tirelessly attempting to persuade your unfortunate pupils that the Romans never existed. There never was a Roman Empire. The entire world came into existence only just beyond living memory. Spanish, Italian, French, Portuguese, Catalan, Occitan, Romansh: all these languages and their constituent dialects sprang spontaneously and separately into being, and owe nothing to any predecessor such as Latin.

Instead of devoting your full attention to the noble vocation of classical scholar and teacher, you are forced to divert your time and energy to a rearguard defence of the proposition that the Romans existed at all: a defence against an exhibition of ignorant prejudice that would make you weep if you weren't too busy fighting it.

Conclusion

- A very easy read
- Often funny
- Appealing analogies, like the crime scene
- Can be considered condescending towards religion – missing the target audience?
- Palaeontology, embryology, anatomy, genetics, artificial breeding and geography brought together to show the evidence

Conclusion

- “(A) primer on how to communicate the ideas of science to a wider audience. It's an overview and a synthesis, and it takes each piece of evidence and makes them part of a narrative.” - PZ Myers

http://scienceblogs.com/pharyngula/2009/09/the_greatest_show_on_earth_the.php