

## Evolution in a Nutshell

There is a lot of misinformation spread about evolution, but it is actually both a clever and simple idea. And it can be explained very easily.

### Artificial Selection

We all know that when a farmer sends some of his animals to the abattoir, he keeps the best animals for breeding. The fastest racehorses go to stud, but the slowest to the knackers yard. And the seeds of the best fruit and vegetables are saved for next year's harvest. This method of improving plants and livestock is common knowledge and is called "artificial selection". People have been doing it for many thousands of years.

### Natural Selection

But when a lion chases down a herd of gazelles and catches the slowest animal, exactly the same thing is happening. By eating the slowest gazelle, the lion has just slightly increased the average speed of the rest of the herd! And the faster gazelles are the ones that are going to breed the next generation. It's just the same as pairing the fastest racehorses to get the next generation of champions. In this case, because humans are not involved, it is called "natural selection" but the principle is the same.

Similarly, slower lions don't eat well, so are weaker and don't win fights to lead the pride - hence have fewer offspring. So the lion's speed is linked to the gazelle's. The same inexorable trend is affecting every living thing - plants and animals, bacteria to whales - each in its own way. Sometimes the advantage is in the camouflage, or in night vision, or tusks, body size, speed or intelligence.

**This process is not random!** It promotes living things that survive to produce offspring, at the expense of other less well suited creatures who will have fewer offspring, which in turn may struggle to breed. Over generations this less well suited line become fewer, or may even die out, while the better suited become the majority.

### Niches for reducing competition

Plants and animals will also do better where direct competition from others of their kind, or similar species, is minimised. This sees living things changing over time to fit a "niche" - a living space of their own. That is why you don't see lions sharing the same area with tigers, as they would compete for food. Eventually one of the groups would die out, have to change their food source or move away. You never get competing species sharing a niche for long.

Niches change over time, as weather patterns change, the mix of other plants, animals, birds and insects changes, jungles and deserts grow, move and retreat, seas rise and fall, mountain ranges form and are worn down. Over millennia, groups of living things can become separated and changed in different ways. Creatures that were the same before separation, may be so different if reunited many generations later, that they can no longer interbreed. This is how new species arise. This is evolution, and is an observed fact.

### "Micro" vs. "Macro" evolution

Some critics of evolution assert that this only describes "micro-evolution". They say "macro-evolution", where creatures change to form a new "kind" has never been observed. This is like saying that 1 + 1 may equal 2, but no-one has ever counted to a million, so it is impossible to get to a million by starting at 1. Or, I can walk to the corner store, but it impossible to walk across the country.

The answer is the same in each case. Yes you can. All you need is enough time.

### Deep Time

We know the real age of the Earth is 4.55 billion years, based on an enormous amount of evidence, which has been rigorously verified, cross-checked and confirmed as being accurate. This fact has been known since 1956.

But what does this vast age really mean? Let's use terms not of time, but of distance. Let 1 metre

(about 3 feet 3 inches ) be 1 million years, so 1 millimetre (about 1/25 inch) is 1,000 years. One average human lifetime is about the width of a hair (around 50 micrometers = 50 years).

Imagine you are holding a 1 metre (or 1 yard) ruler in your hands. That is a million years. And the thickness of a single hair is one lifespan. On this scale all modern technology, such as electricity, radio, television, computers, aeroplanes and cars, were developed in the past 2-3 hair's breadths. The Middle-Ages were a millimetre ago (20 hairs), and the birth of the Abrahamic religions took place about 2 millimetres ago. In the nearest 4 millimetres (1/6 inch) lie the rise and fall of every human empire! Beyond that is the stone age.

The human species emerged just 10 cm (4 inches) in the past. But the controlled use of fire came much earlier, somewhere between 50 to 150 cm (20 inches up to 5 feet). The dinosaurs died out 65 metres (213 feet) ago! They had been around from 250 metres (820 feet, or 273 yards) away.

Life on Earth first started over 10 times further away than that - about 2½ to 3½ kilometres (1½ to 2 miles). The Earth itself was formed about 4½ kilometres away (nearly 3 miles). And the Big Bang? 13.7 kilometres away (about 8½ miles). Are you still holding in your mind that that one human lifetime is one hair's breadth?

Now say that evolution has not had enough time to create life as we see it today!

### Evolution in Action

Evolution is not just in the fossils. Evolution within populations of living organisms is still happening today, and is now an observed fact. This evidence includes laboratory experiments in which **new species were observed to arise!**

One current study on Cichlid Fish from Lake Malawi National Park promises to provide us in the future with a documented speciation event in the wild, the first with an accompanying genetic audit trail.

## Criticisms of Evolution

### Evolution is “just a theory”.

A “scientific theory” is a comprehensive explanation of all the evidence which allows testable predictions to be made in order to check it. It’s **not** a “guess”.

### No transitional fossils have been found.

All fossils are “transitional” as species continue to change and evolve. There are many major transitional fossils including archaeopteryx, Tiktaalik, and Ambulocetus (“walking whale”).

### No speciation ever been observed.

Yes it has! Numerous times, both in the lab and in the wild! There are many scientific papers on this.

### But the new species were still of the same “kind”.

A new species is an interbreeding group that can no longer breed with the original group they came from. “Kind” is an ambiguous and undefined religious term, not a scientific one. And there is no difference between micro- and macro-evolution apart from time, remember? So a new species could become a new “kind” with time.

### Evolution is blind chance – it is mathematically impossible.

Wrong. Selection is not random but favours the best suited individuals for the environment, generation after generation. And this has been observed. If a mathematical model does not match reality, then the model is incorrect.

### Darwinists say ducks evolved from crocodiles. If that were true we would have a crocoduck!

No, evolutionary biologists don’t say that. “Straw man” arguments such as this show a complete lack of understanding of evolution, not an attack on it.

### Irreducible complexity disproves Evolution.

No, it would only imply another process also exists. But so far all attempts to find a genuine example of irreducible complexity have failed, including the blood clotting cascade, the eye, and the bacterial flagellum – which are now all well explained.

### Evolution does not explain the Big Bang, the “fine-tuning” of the Universe, nor how life came from non-life.

Correct. It’s not supposed to – evolution is a theory of biology. For the Big Bang and fundamental constants, talk to physicists. For life from non-life (abiogenesis) talk to organic chemists - and don’t forget to ask about the “RNA World”.

### Evolution is just the new dogma, with scientists protecting their own. It’s a conspiracy.

Wrong. Science is a very competitive discipline. Scientists try to out-do each other all the time, to publish groundbreaking results and take the kudos. Without a doubt, any scientist who overturned the theory of evolution would get the Nobel Prize! So there is no reason for dogma or conspiracy.

## In Summary

Evolution is real, and has been observed in action as well as in the fossil record. The Theory of Evolution explains the observations and predicts results. No other idea about the development of life even begins to have the same explaining power.

There is a concerted attack by those against the Theory of Evolution for religious reasons, but they do not have the facts on their side. Their criticisms are based on, often wilful, ignorance and do not stand up to serious scrutiny.

## Further Information

### Reading

- **Richard Dawkins**
  - The Selfish Gene
  - Climbing Mount Improbable
- **Sean B. Carroll** - The Making of the Fittest
- **Jean-Baptiste de Panafieu** – Evolution

### Web Sites

- **Richard Dawkins** - RichardDawkins.net
- **The Pandas Thumb** - www.pandasthumb.org
- **Talk Origins** - www.talkorigins.org
- **PZ Myers** - scienceblogs.com/pharyngula

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