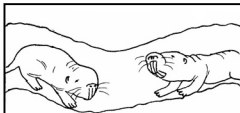
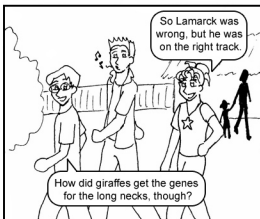


Lamarck believed that giraffes had long necks because every generation of giraffe used and stretched its neck a little more, and then passed its longer neck onto its offspring.



Likewise, his explanation for the tiny eyes on the naked mole rats we saw earlier today would have occurred because they don't use their eyes in the dark, and each generation would have eyes that shrank a bit more due to disuse.



Through random mutations.



Oh, mutations! Like the-

No, not like whatever superhero you were about to mention.

Our old pal DNA makes copies of itself every time a cell divides, including when an organism is making eggs and sperm (they're both called gametes).

TGGTCACTGCACTACGATCCATGGT  
ACCACT

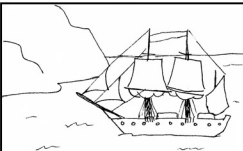
A G A T  
C C C

Sometimes though, it isn't copied perfectly. The resulting slight change can have anything from no effect to a *huge* effect on how the cell develops. In a gamete, it may affect the entire resulting organism.

Now Charles Darwin didn't know about DNA back in the 1800's, but he still theorized that random change

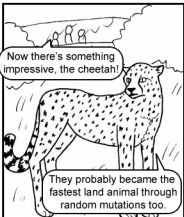


could somehow occur, creating variability in the traits of a species.



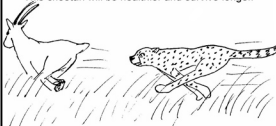
Darwin made many observations on animals and fossils while on a 5-year voyage around the world on the HMS Beagle.

Now there's something impressive, the cheetah!



They probably became the fastest land animal through random mutations too.

A cheetah with a mutation that lets it run faster would be able to catch more food than the other cheetahs. This cheetah will be healthier and survive longer.



For nearly all organisms, the healthier you are and the longer you survive means the more offspring you will likely produce.

Darwin believed that traits that were beneficial would be passed on and would become present in higher and higher proportions of the population,

because every individual with the good trait would survive to have more offspring than those that don't.

Likewise, some mutations can cause organisms to have bad traits, which decrease their chances of surviving or reproducing.

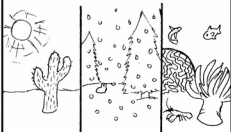
Let me see if I get this-  
Mutations create variability in species traits, and the good traits have a better chance of being passed on because the organism has a better chance of living?

Yeah! Darwin called that whole process natural selection, as a comparison to selection made by humans when farmers pick what livestock to breed in order to get the meatiest cow or whatever.

A rather barbaric practice!

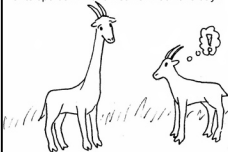
Hey, we're all entitled to our opinions. Me, I could eat steak every day!

So nature's doing the selecting?



Well, yes, natural forces like climate and interaction with other species determine which traits will be most successful.

But where did the giraffes come from? Was an antelope born with a freakish neck one day?



Um, probably nothing that drastic.

It was more likely a gradual change from an ancestral animal. Darwin referred to gradual change in species over time as evolution.



EOHIPPIUS



MERYCHIPPUS



EQUUS

Do you remember the ancestors of horses our teacher showed us?

Oh yeah, they had started out small, but over millions of years became like the horses we know today.

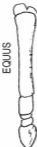
Well, that was a example of evolution.



EOHIPPIUS



MERYCHIPPUS



EQUUS

Their feet changed too - from having several toes to having just one toe, which is now the hoof.



I'm still a bit confused about how new species come about. What about these polar bears?

Well, the effectiveness of a variation in trait depends on the habitat.



A white bear would stand out in a forest, but blends in nicely in the Arctic, where a brown bear would stick out like a sore thumb.

So as the ancestral bears spread out and settled into different climates, natural selection worked differently in each area



and produced polar bears, black bears, grizzly bears... you see what I mean.

Another example are the 14 finch species in the Galapagos islands.



They all evolved from 3 mainland species, and each has a different beak best suited to eating a different kind of food, such as seeds, fruit, insects, and even blood!

Blood?? So it's a vampire... finch?



Yes, but don't worry Jason, they don't live here and the don't attack--



There's one now!!



AAAH!



Oh, I'm sorry. That's just a sparrow.



Why am I friends with you?



Guys, let's get going. It's getting a bit late.



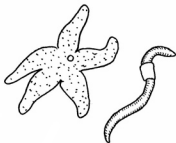
So bears are related to each other, and giraffes must have common ancestors with some other animals.



Well, "relations" are really measured by how far back you have to go to reach a common ancestor with another species



Pretty far back with this guy, I'm sure.



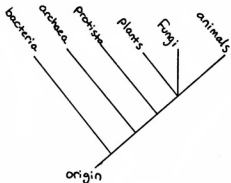
Not as far as you'd have to go for a sea star, or an earthworm, or even an amoeba!

Wait, is *everything* related?

The theory is that yes, everything descended from the same lifeform, over several billion years and a LOT of natural selection.



Based on similarities between species and with genetic research, scientists can theorize which species are related and how they arose. They usually show these relationships in a crazy branched thing called a phylogenetic tree - which can show ALL life or just a part, such as how different kinds of molluscs or lizards are related to each other.



The zoo closes soon, so we should head out.

Well that was a fun day!

Even if once again we learned a ton of biology.

Oh come on! What did you expect at the zoo? Besides, everything in life can teach us something.

True, but he does have a point. That was kinda dorky.