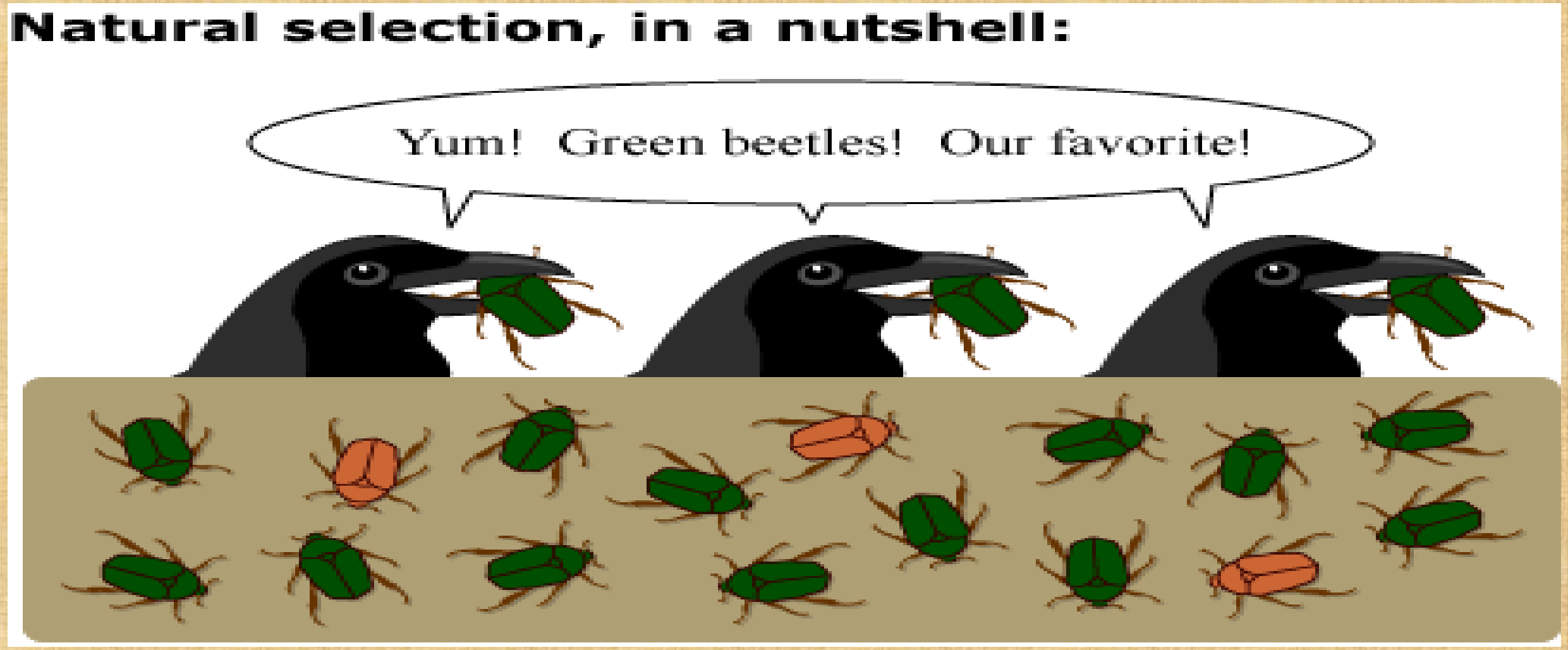
Natural Selection



- **Preset this video** James Cameron France start at :07seconds **https://www.youtube.com/watch?v=ptfsRfiOiWo**
- **Preset this video Start at 0:23 seconds with no visual aid**
- **https://www.youtube.com/watch?v=4kigpJTh160**
- The Evolution of the Television 1930 2030 By: REI3000
- https://www.youtube.com/watch?v=gCejR9QBOBk

- The Invention of Television by:Random Brains
- https://www.youtube.com/watch?v=EVVVGmMX9QQ

- Documentary: The History of Television by: Damian Documentary
- https://www.youtube.com/watch?v=zrvnpJTgrpY

The following information came from the following websites:

Stated Clearly

http://statedclearly.com/videos/

What is Natural Selection?

https://www.youtube.com/watch?v=0SCjhI86grU

What is Evolution?

https://www.youtube.com/watch?v=GhHOjC4oxh8

What is the Evidence for Evolution?

https://www.youtube.com/watch?v=lIEoO5KdPvg

Natural Selection - Crash Course Biology #14

https://www.youtube.com/watch?v=aTftyFboC_M

Examples of Natural Selection

https://www.youtube.com/watch?v=S7EhExhXOPQ

http://www.youtube.com/watch?v=Pt2gHpqfZNA

EVOLUTION

[ev-*uh*-**loo**-sh*uh* n *or, esp. British,* ee-v*uh*-]

1.any process of formation or growth; development:

the evolution of a language; the evolution of the airplane.


Evolution
of
Television
SAMSUNG

Evolution of Television

After its formal introduction at the 1939 World's Fair, the first real commercial televisions became widely available.

What kind of Television is that?

What kind of Television is that?

Radio Television

Let's listen to the greatest show of all time

James Cameron France start at :07seconds

https://www.youtube.com/watch?v=ptfsRfiOiWo

https://www.youtube.com/watch?v=4kigpJTh160

Start at 0:22 seconds (freeze projector screen)


PLEASE
STAND BY

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NEW YORK, MONDAY, OCTOBER 31, 1938. PP

Bloc Parley

Times. alvador. Ameri- merican in De- today Nuevo. Likely erican solid and

Yor- add-

MEAD STANDS PAT AS A NEW DEALER IN BID FOR SENATE

Democratic Candidate Opposes Any Except Minor Changes in Labor and Security Laws

Radio Listeners in Panic, Taking War Drama as Fact

Many Flee Homes to Escape 'Gas Raid From Mars'—Phone Calls Swamp Police at Broadcast of Wells Fantasy

A wave of mass hysteria seized thousands of radio listeners throughout the nation between 8:15

and radio stations here and in other cities of the United States and Canada seeking advice on protective

OUSTED JEWS FIND REFUGE IN POLAND AFTER BORDER STAY

Exiles Go to Relatives' Homes or to Camps Maintained by Distribution Committee

Pana T

PA

https://www.youtube.com/watch?v=4kigpJTh160

Start at 0:23 seconds (freeze projector screen)

Evolution of Television

One of the greatest (and most famous) radio television broadcast premieres 9pm, Wed 30 October on PBS America (Sky 534 & Virgin Media 243).

War of the Worlds: The Panic Broadcast | PBS America by: PBSAmerica

https://www.youtube.com/watch?v=nPEn5k55g-o

Evolution of Television

One of the greatest (and most famous) radio television broadcast occurred on October 30, 1938 was…

The War of the Worlds Radio Broadcast - Short Version by:Bobby Jay Kennerley

https://www.youtube.com/watch?v=CIreKtEi4dM

Orson Welles - War Of The Worlds - Radio Broadcast 1938 - Complete Broadcast. By: David Webb
https://www.youtube.com/watch?v=Xs0K4ApWl4g

Evolution of Television

After its formal introduction at the 1939 World's Fair, the first real commercial televisions became widely available.

However, many networks like NBC and CBS had already been broadcasting for several years.

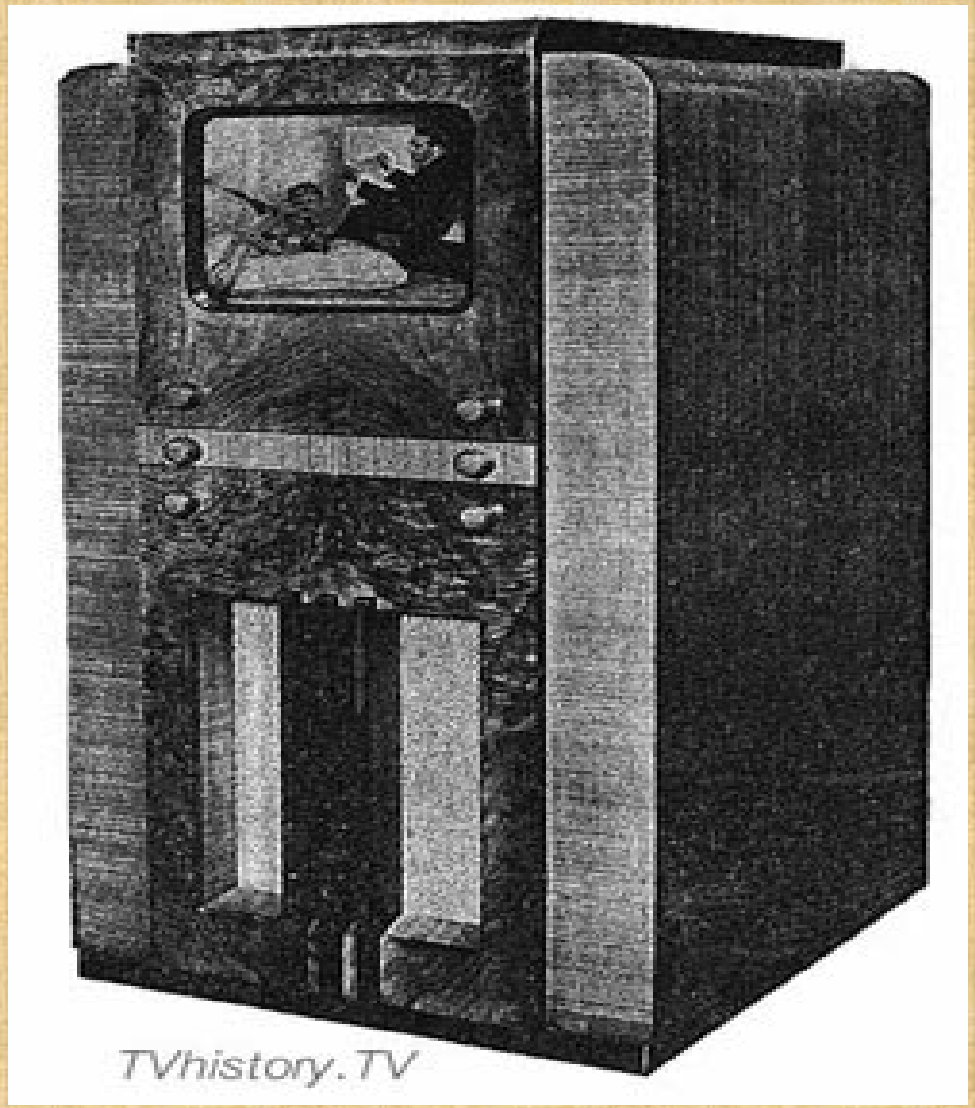
Radio networks were quickly adjusting their studios to accommodate the new medium.

Evolution of Television

Sets were large pieces of equipment with about 12 inch screens.

They cost about $400 to $500

The average household income was about $1300 a year.



Evolution of Television

One of the most recognized images from this early era includes the 1936 Olympics from Berlin in which Hitler announced the opening of the ceremonies.

Evolution of Television

Much of the hype surrounding televisions in the 1940's was swept under the rug with the onset of WWII.

Production of televisions stopped so the U.S. could put their efforts toward developing radar technology.

Evolution of Television

Even though the production of televisions stopped, the innovation persisted and **color was introduced at the early part of the decade.**

This is also when the **television commercial was invented.**

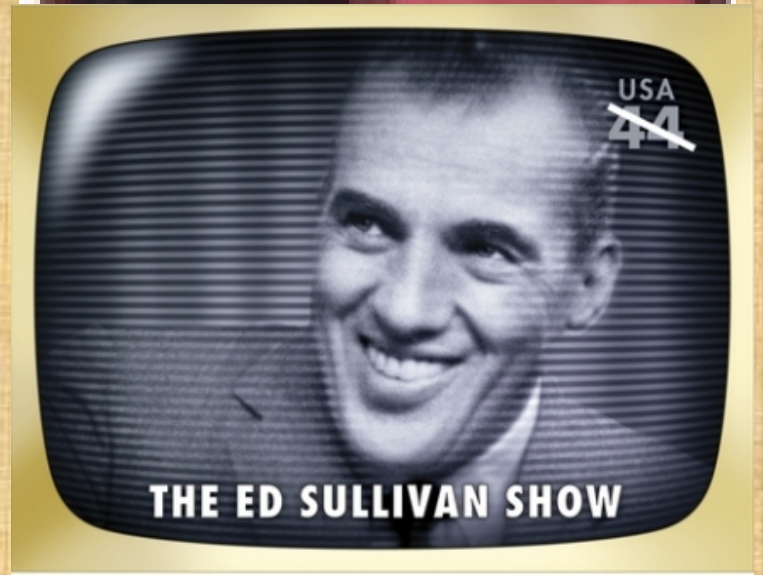
During the war, the television was used as a small propaganda machine. Encouraging people to buy bonds and support the effort.

Evolution of Television

The post-war economy was strong and the late 40's saw a boom in television production.

Two types of models surface the tabletop and console.

People like Milton Berle, Ed Sullivan and Howdy Doody become some of TV's first stars.



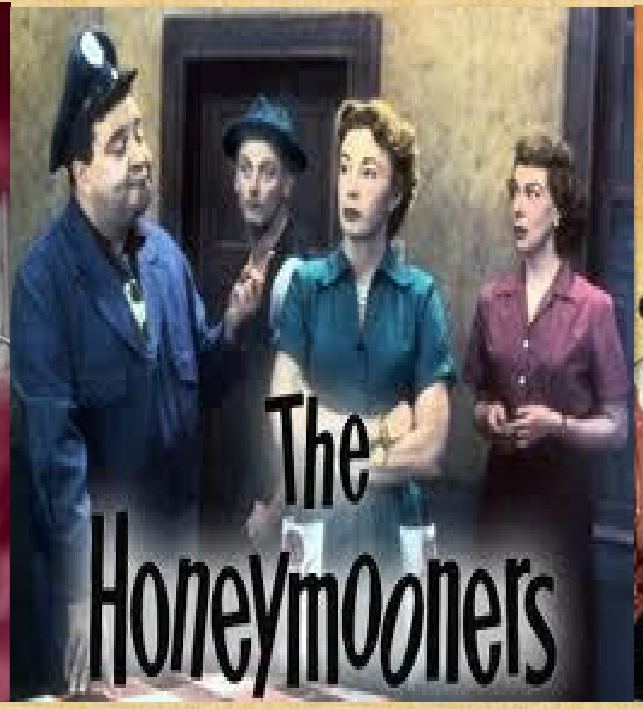
Evolution of Television

Often the 1950's have been seen as the hay day of the economical boom in the United States and the Golden Age of television.

More people are buying consumer electronics, by the end of 1951 and there are more than 8,000,000 TVs in the United States.

The family dinner is revolutionized with the introduction of the TV dinner. Family meals will never be the same.

Evolution of Television



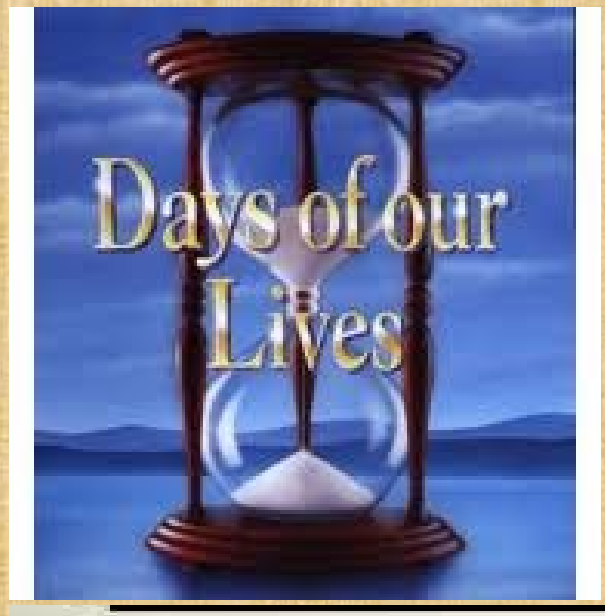
… are some of the most watched programs.

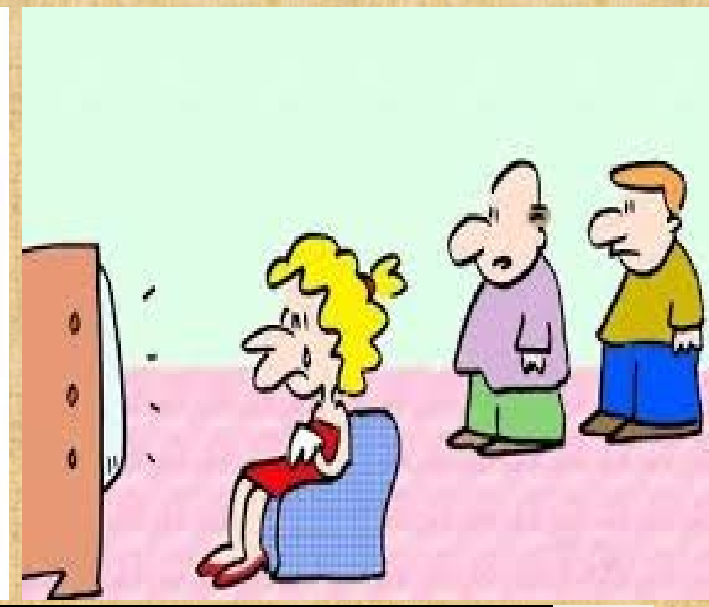
Color becomes the wave of the future and the Remote Control is invented. Although most people had neither.

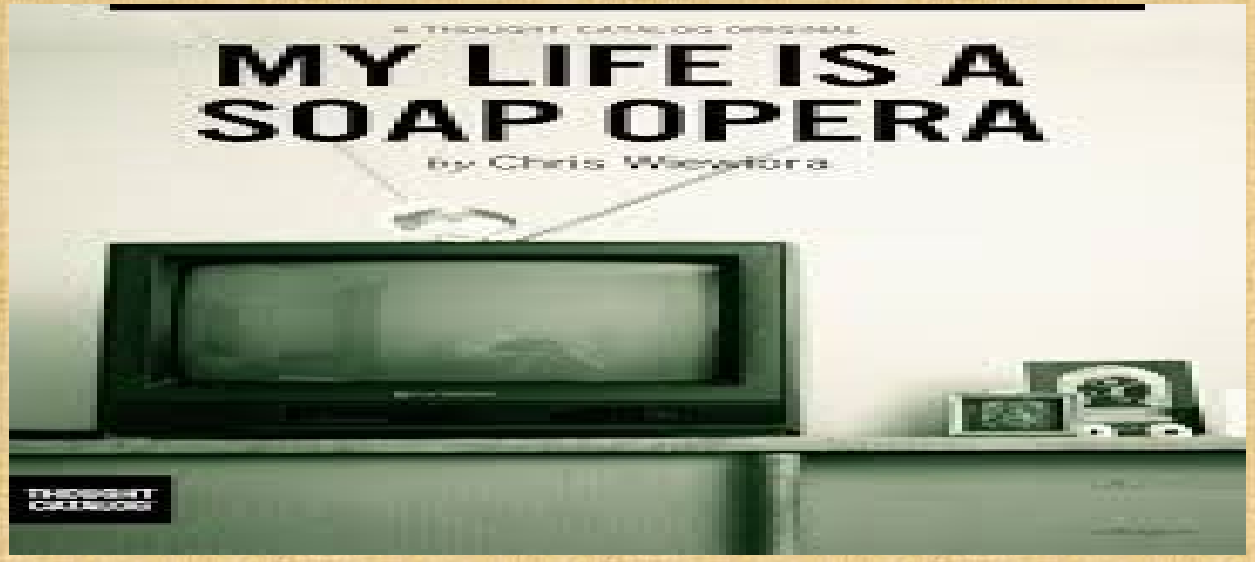
Evolution of Television

The “tube” becomes an advertiser’s dream come true. Products are marketed directly to the consumer by sponsorships.

The “soap opera” is thus named for the cleaning products that sponsored the daytime dramas targeted directly at women.







Evolution of Television

By the end of the decade, a 21-inch black and white set was about $200 and the average 21-inch color set was almost $500.

Evolution of Television

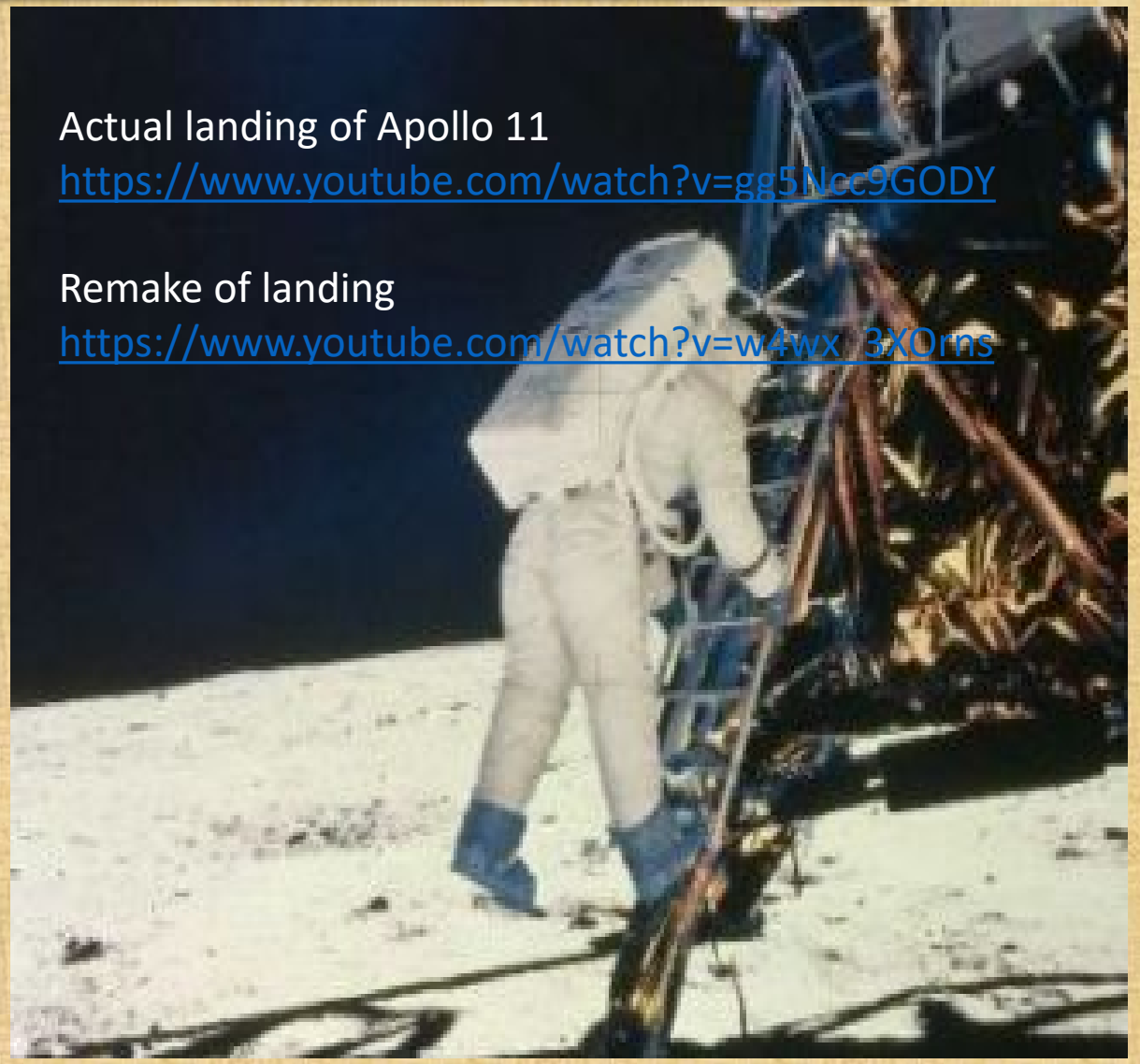
Often the 60's are seen as the end of an era. An age of innocence seen in the 1950s died and would never be seen again in the United States.

After the assassination of President Kennedy, families gathered around to watch the news depicting a changing social climate and growing hostility toward an oppressive government.

Americans begin to get more news from the television than the newspaper.

Evolution of Television

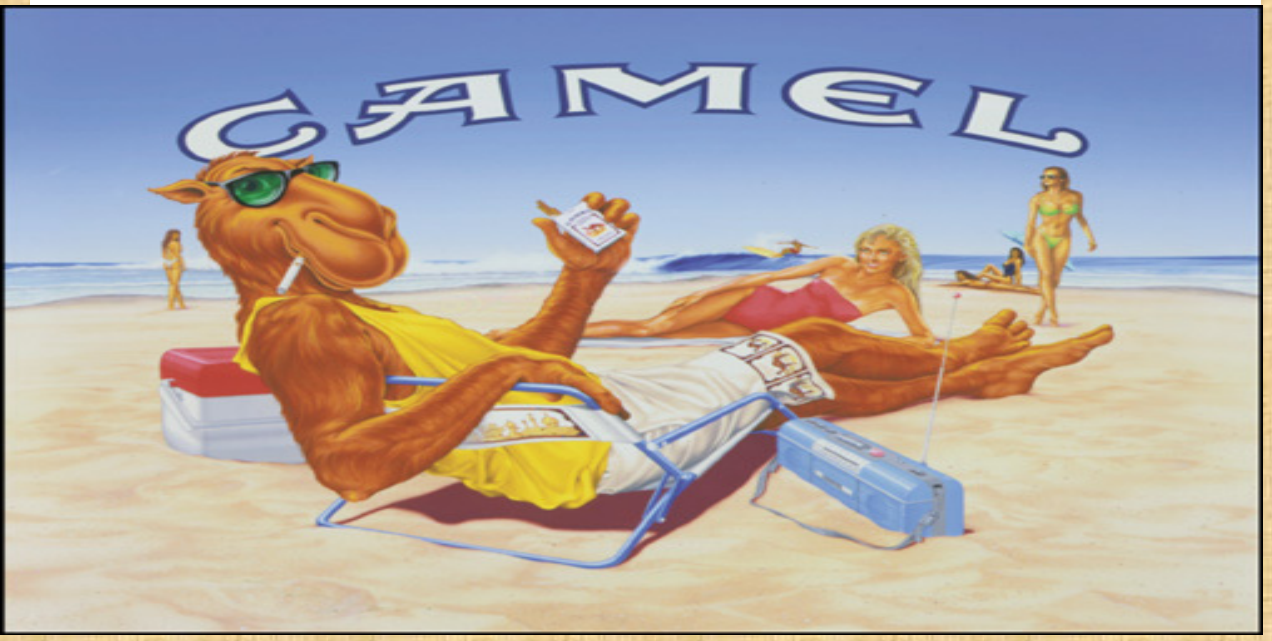
The United States became obsessed with space travel. Everything sold had a space age edge, especially televisions. Everyone gathered to watch shuttle and moon landing. Televisions became more portable and affordable.



Evolution of Television

The Vietnam War is the first conflict to be televised.

Doctors legally advertised



Evolution of Television

Televisions became more portable and affordable.

By the end of the decade there were approximately 78 million television sets in homes across the United States; 200 million around the world.

Evolution of Television

Nighttime broadcasts broke the traditional molds.

Couples were now sleeping in the same beds

and…

Evolution of Television

Actresses could show their belly buttons.

“I Dream a …

Evolution of Television

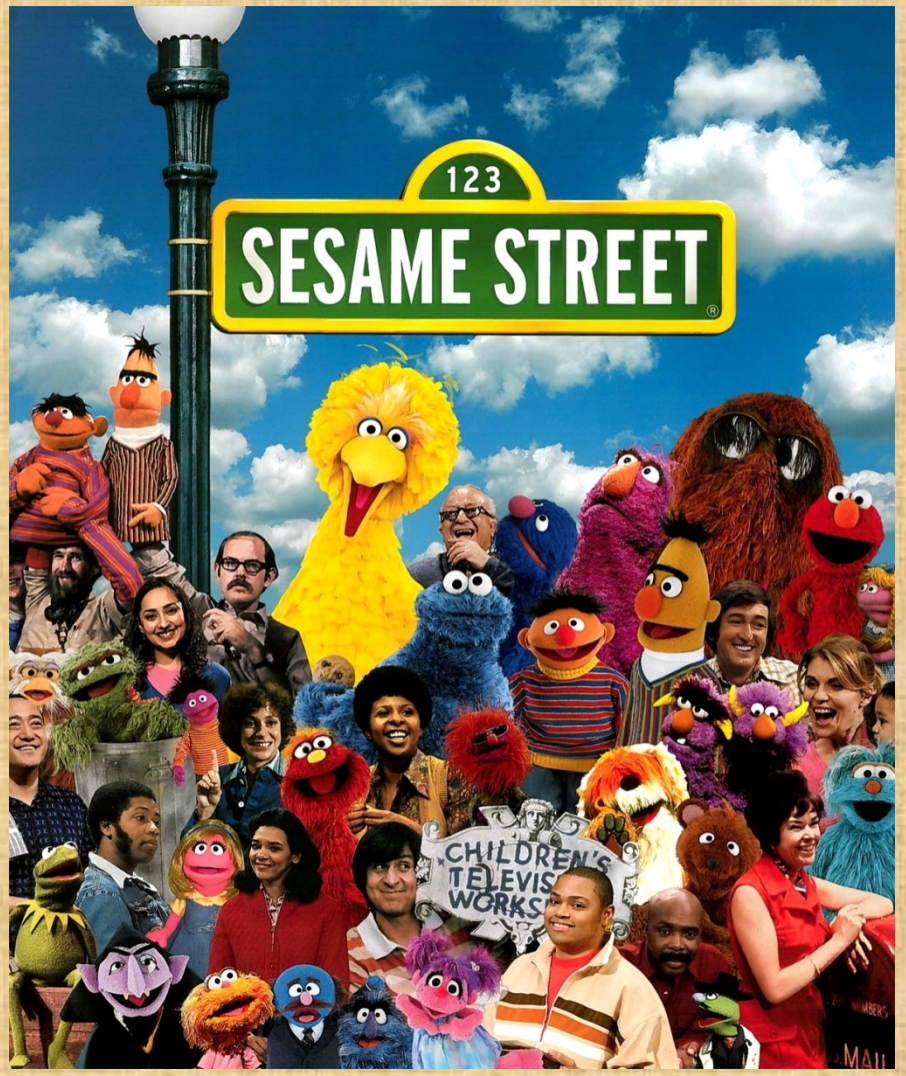
And… "All in the Family" and "M.A.S.H." are two of the most popular evening programs.

Evolution of Television

Sesame Street debuts to children across the country in 1969.

The show is still on the air after almost 50 years.

With 4,500 episodes

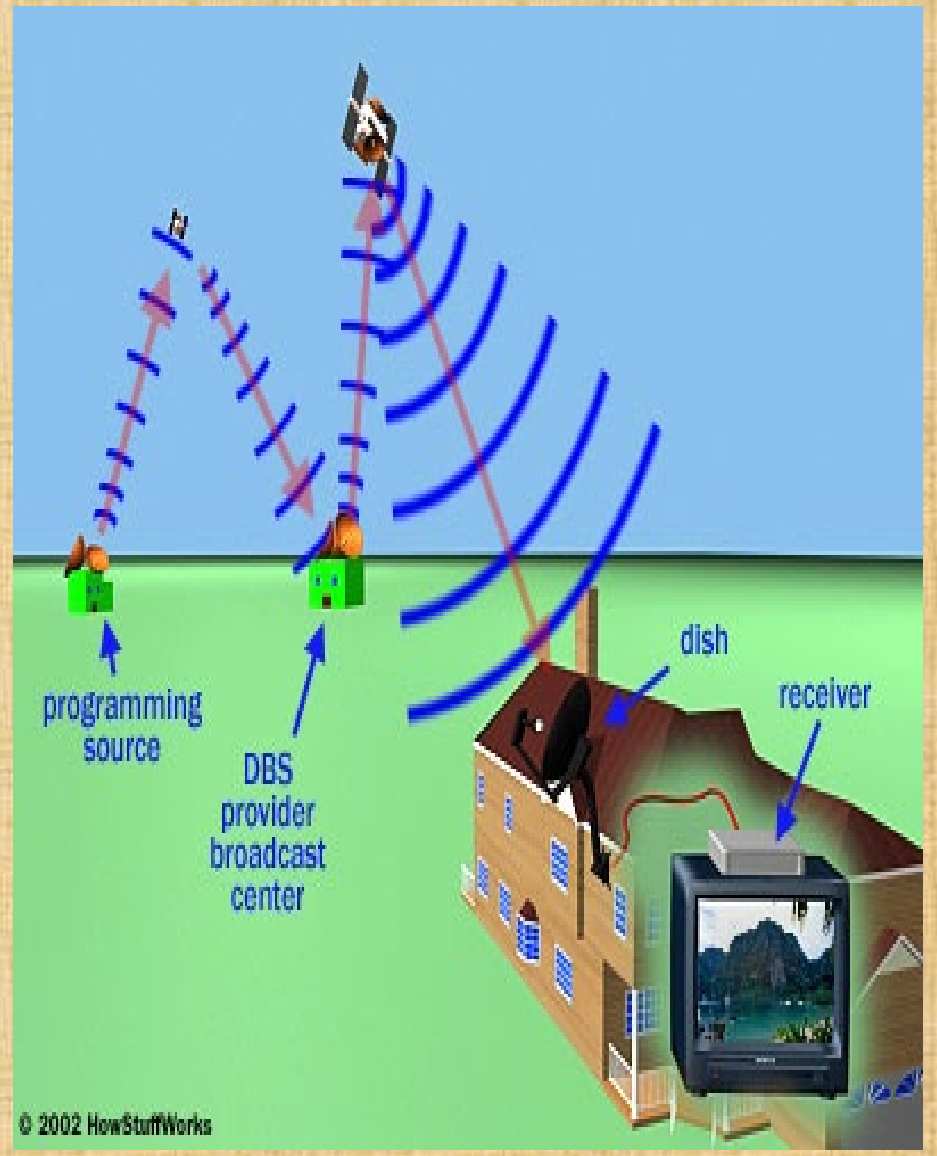


Evolution of Television

The average salary is $7,500 a year and the average price for a TV was between $400 and $700 dollars.

The first direct to broadcast satellite television was launched in 1972.

1978 was the last year large Black and White consoles were manufactured



Evolution of Television

The 80's saw little innovation with the television specifically; however, there became a growing number of television accessories like…

Evolution of Television

…like the VCR and home game consoles like Nintendo.

Evolution of Television

The VCR took the United States by storm. Although introduced in the late 70's, the VCR didn't become a staple in the American home until the mid 1980s. Now, people could watch movies in the comfort of their own home and record and watch their favorite programs on their own timetable.

Evolution of Television

Although cable had been around since the 50's, cable television saw a significant boom during the 80's.

Evolution of Television

Sitcoms were more popular than ever. The 80's spawned programs like "Rosanne," "The Cosby Show" and..

Evolution of Television

…and “Married with Children” (The series' 262-episode run makes it the longest-lasting live-action sitcom in television history.)

Evolution of Television

The 90’s saw big changes in technology all together.

One can arguably say the 1990s was an age of technological change, thanks largely to the Internet. The personal computer became affordable enough for average people to own.

Evolution of Television

The Internet was available through dial-up ISPs like Prodigy and AOL, and information was seemingly at our fingertips.

Let's log onto the internet…

https://www.youtube.com/watch?v=D1UY7eDRXrs

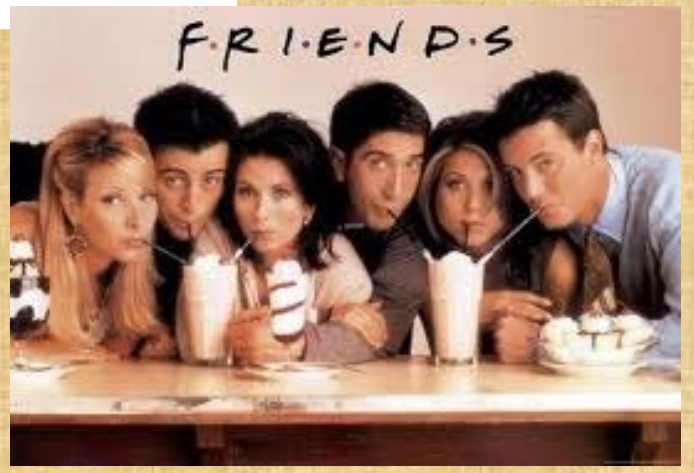
Evolution of Television

Johnny Carson left the Tonight Show in 1993 after more than 30 years on the air.

Cable television programming saw a large boom at the end of the decade.

Evolution of Television

Television programming became more risqué, pushing the FCC's buttons and spawned some of the most loved shows of all time including:



First aired on 12/17/1989 is has more than 599+ episodes. Currently on Season 32

Evolution of Television

Broadcast on HBO, certain series were exempt from standard FCC regulations and frequently depicted scenes with graphic violence and foul language.

Federal Communications Commission

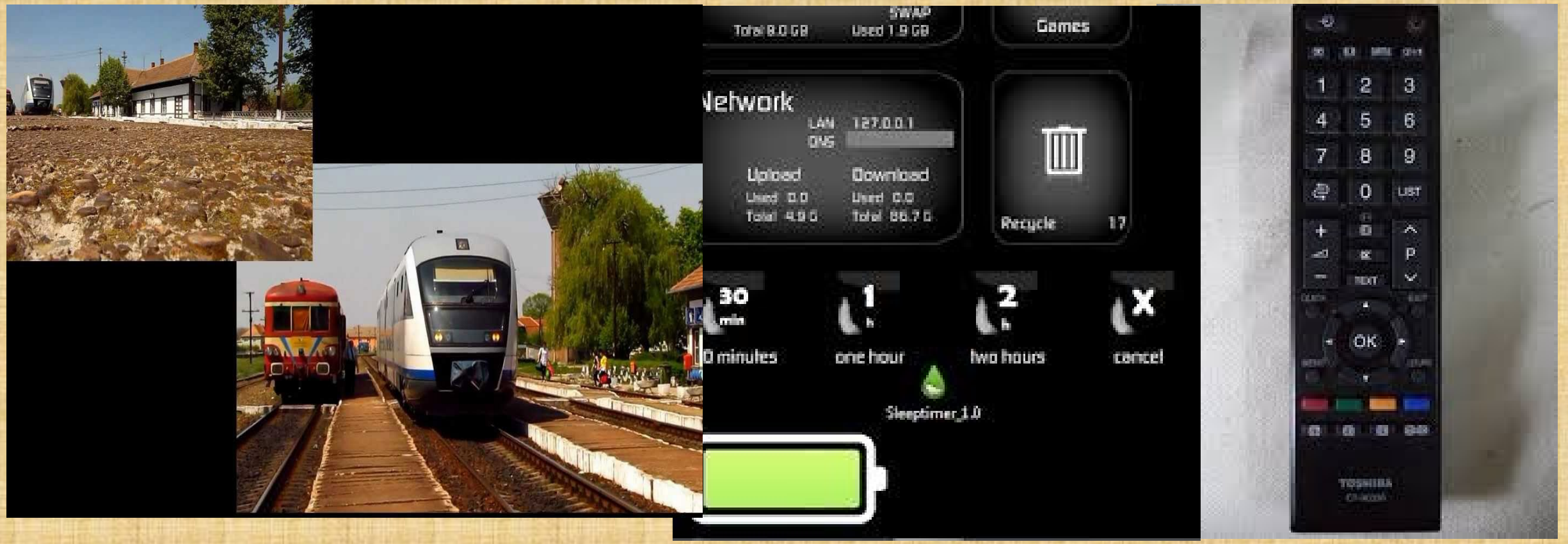
Evolution of Television

In the 2000's various TV technologies like Plasma and LCD are in experimental stages.

Standard CRT televisions still lead the market. However…

Evolution of Television

However, televisions now include additional features like picture in picture, sleep timers and parental controls



Evolution of Television

DVD players take over the home theater experience. Much like the VCR, DVD players were introduced a decade earlier, but took some time to gain momentum. At the beginning of the decade, DVD players were in approximately seven percent of homes; in less than 10 years, more than 80 percent of homes had a DVD player.

Evolution of Television

Thin is in. Advances in LCD and Plasma technology enable television manufacturers to produce a better picture, larger screen sizes and save space.

Evolution of Television

Television goes all digital.

In 2009, all analog televisions will go black.

Networks will only be producing a digital signal.

Evolution of Television

Less than 10 years after the DVD player's introduction, the second wave of video players were introduced touting better quality and longer run times.

Evolution of Television

HD DVD and Blu-ray enter a battle for high definition supremacy.

Evolution of Television

TV goes online

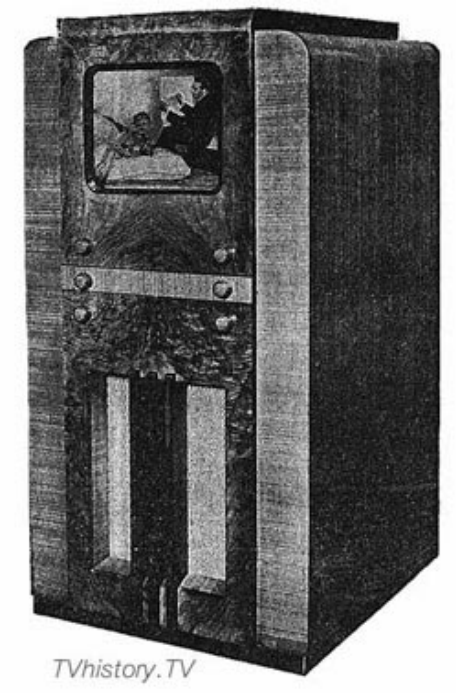
With the introduction of high speed Internet, video streaming and digital recording enter the scene.

Evolution of Television

SMART TV

This has led to many networks making their programs available online.

Evolution of Television



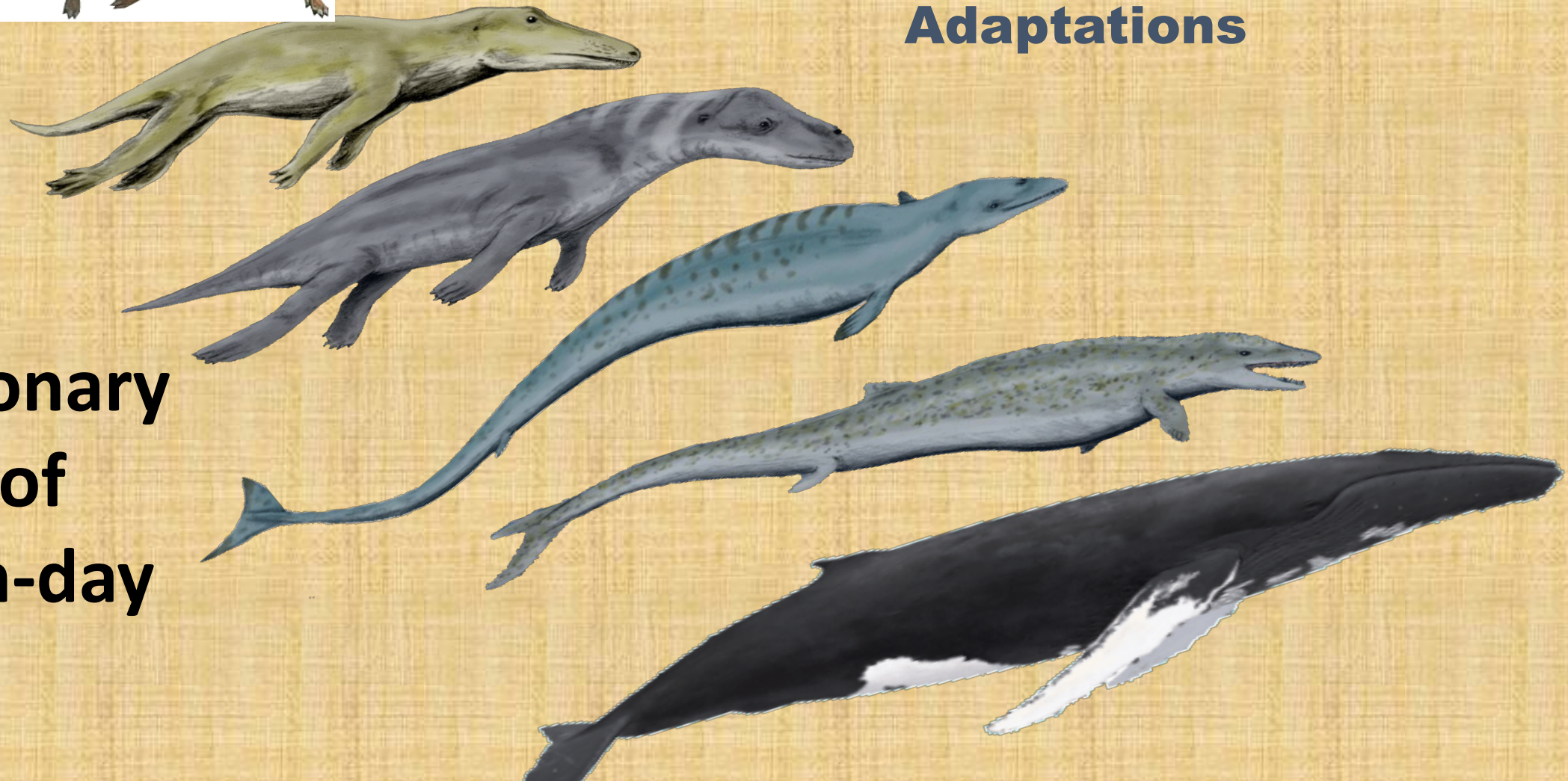
So has the TV changed over time?

What else has changed over time?

The Theory of Whale Evolution

Topics:

Artiodactyls and Hippos
Whale Ancestors
Adaptations



evolutionary history of modern-day whales

Most scientists believe that molecular studies show that hippos and cetaceans share a more common ancestor than do hippos and pigs.

The ancient four-footed mammals that flourished worldwide for 40 million years and then died out in the ice ages are the missing link between the whale and its not-so-obvious nearest relative, the hippopotamus.

Researchers believe that whales and hippos had a common water-loving ancestor 50 to 60 million years ago that evolved and split into two groups: the early cetaceans, which eventually spurned land altogether and became totally aquatic; and a large and diverse group of four-legged beasts called *anthracotheres.*

Hippopotamus

Nearest Living Relative to Whales

Let's Look at Ancient Ancestors

Sinonyx

Jumping back to 60 million years ago, we can find the last shore-dwelling ancestor of modern whales. This animal appears to have been a hyena-like animal called *Sinonyx* which began to enter the sea, presumably to take advantage of the rich food sources of the ocean. *Sinonyx* had dental and facial traits like living whales and dolphins, but had hooves like a goat or cow.

Indohyus

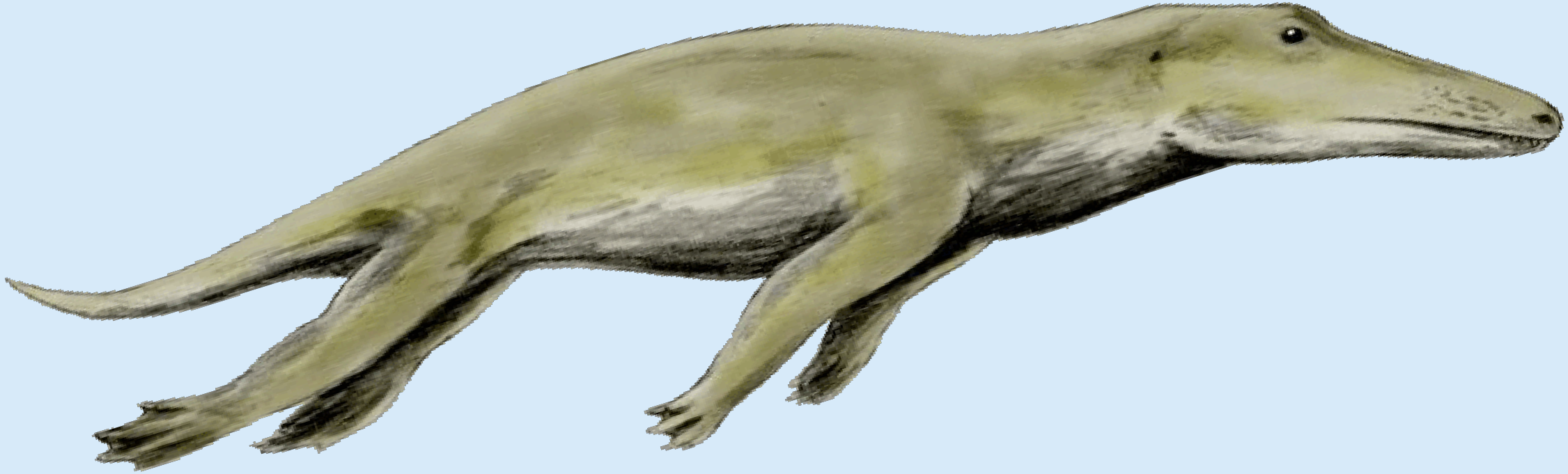
Indohyus was about a 12 to15 pound mammal that looked like a *miniature deer*.

The Indohyus had heavy bones making it slow on land and easier prey for predators. In the water the same structural feature would help it stay on the bottom, where it could forage and hide.

Indohyus

It has an unusual bone structure around the animal's ear. It was a little bowl-shaped structure. The inside of that bone is very thick, the outside of the bone is very thin. Whales are the only mammal with this unique bone structure.
It lived about 49 MYA

Ambulocetus



Ambulocetus **lived about 47 million years ago and is one of the best examples of a transitional form between whales and terrestrial animals.**

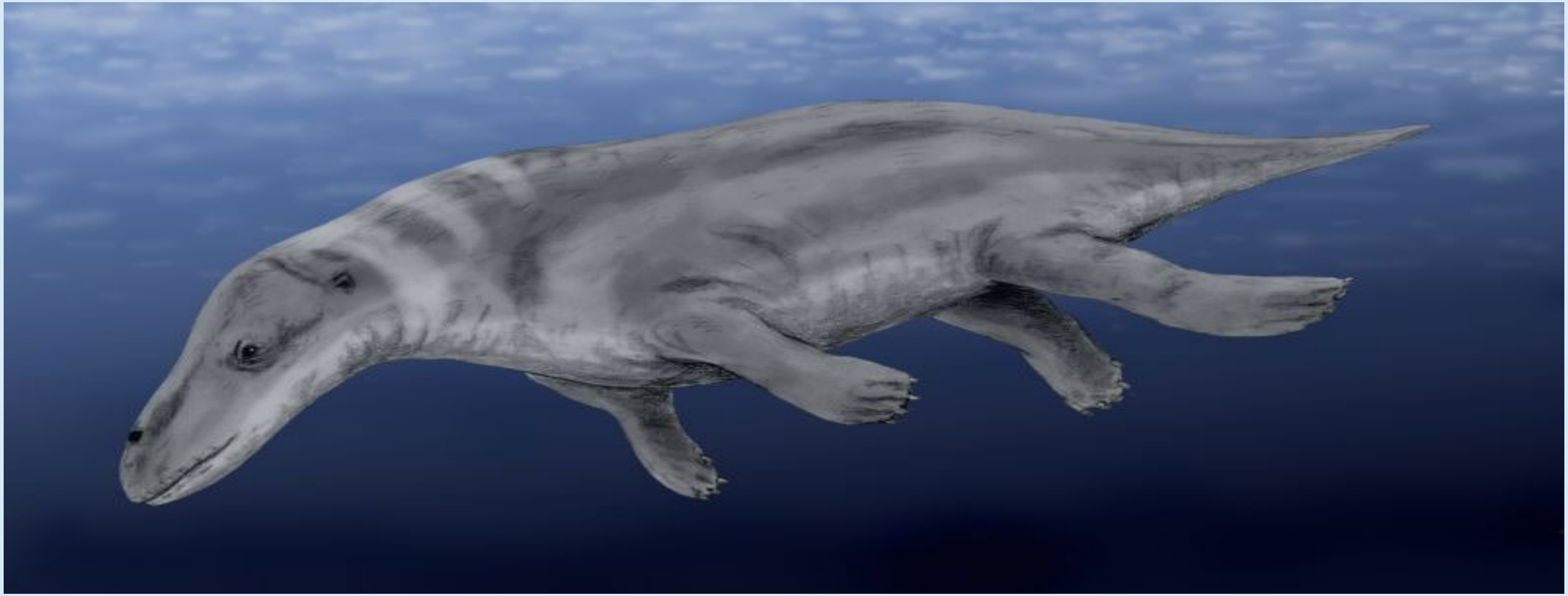
Ambulocetus

Ambulocetus lacked a blowhole, but otherwise had a skull and tooth structure very similar to modern whales. Its spine moved up and down for swimming the way that modern whales do, but its four legs were still functional enough that it was probably able to walk on land in the same way that sea lions do today.

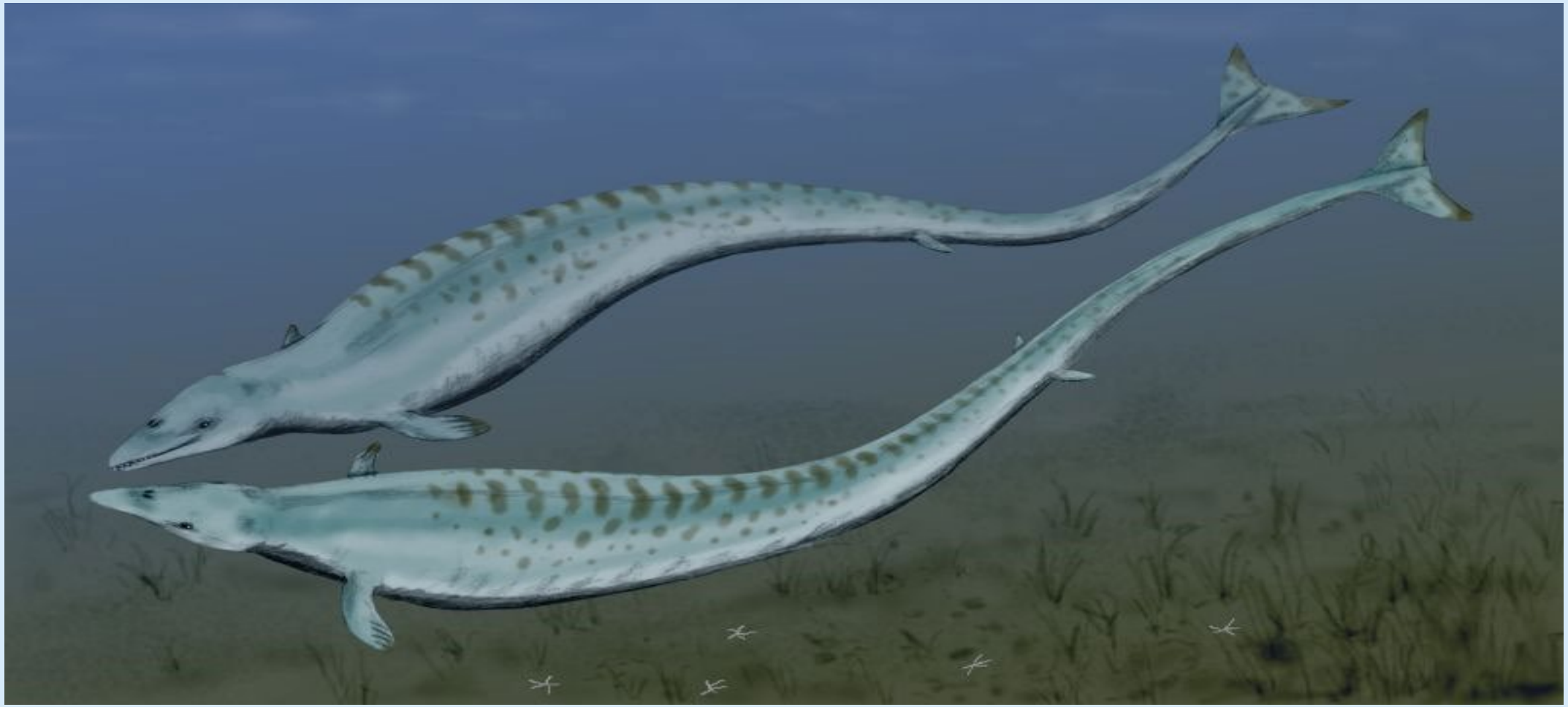
Ambulocetus

This animal is best described as being an amphibious (using both land and sea), sea lion-sized animal that swam and ate fish, but was still somewhat connected to the terrestrial environment.

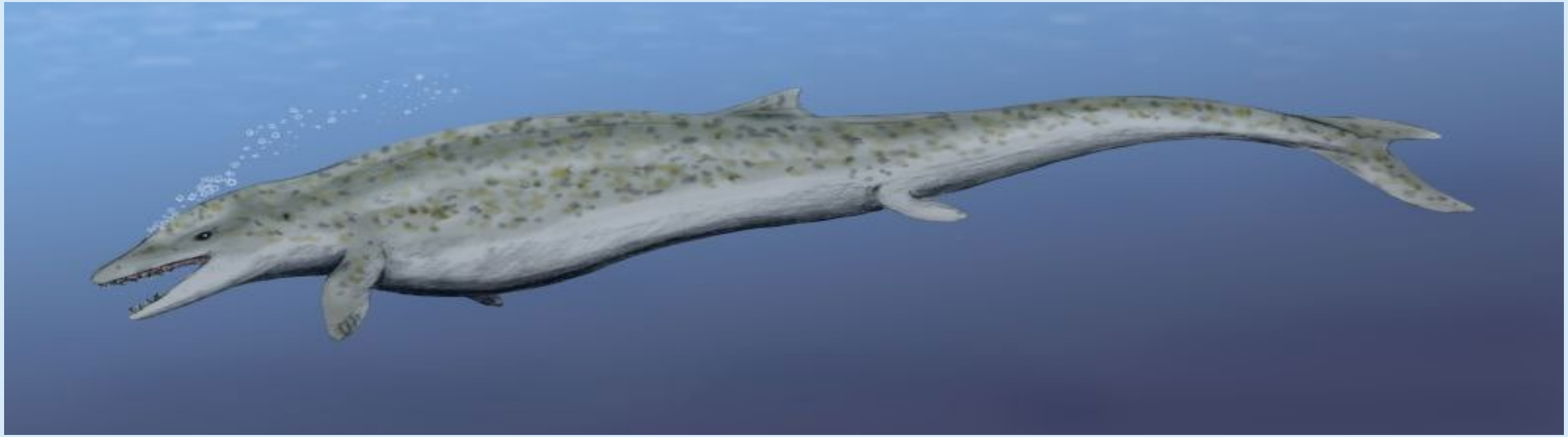
Rodhocetus



Basilosaurus

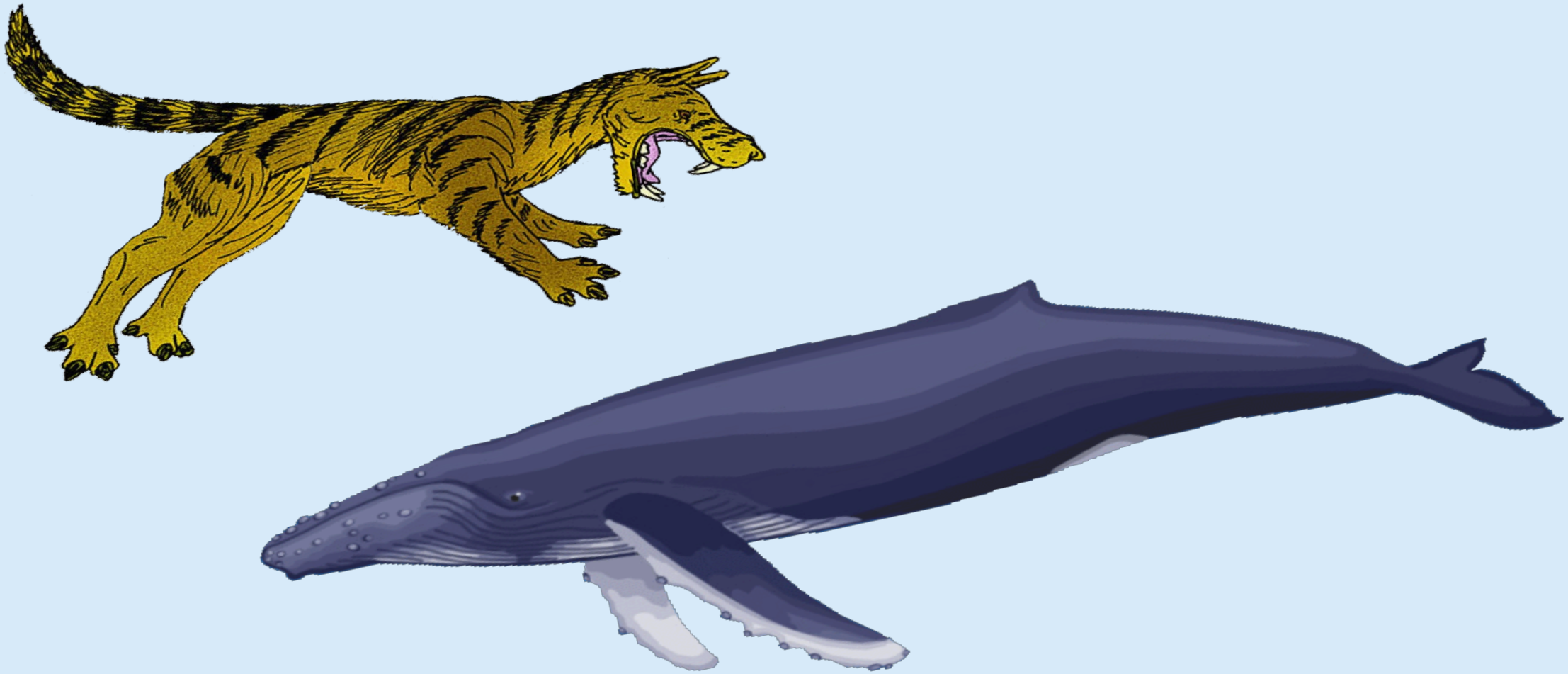


Dorudon



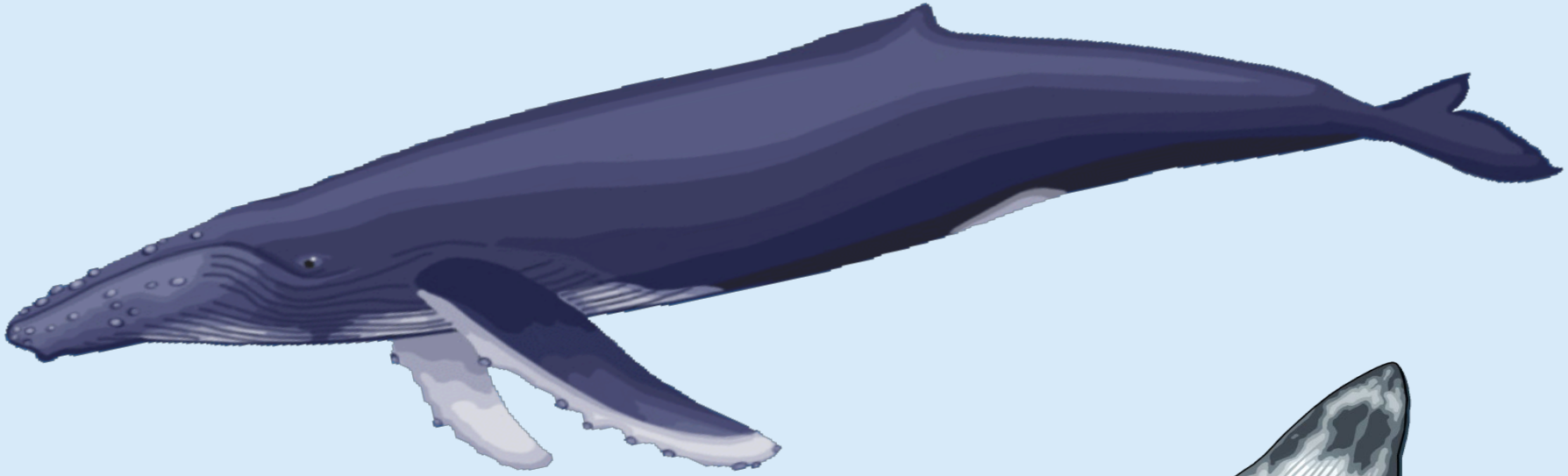
Adaptations

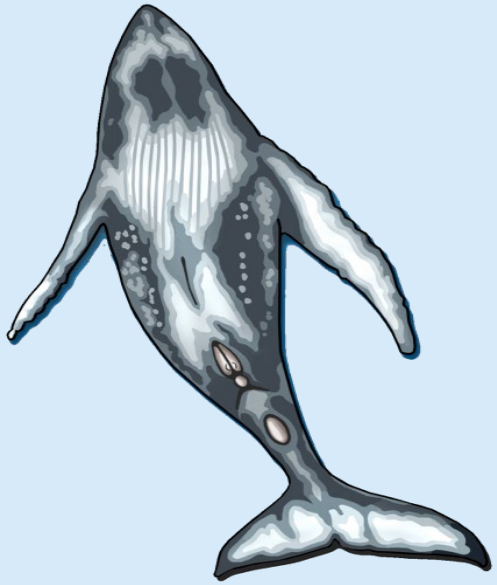
From Sinonyx to Humpback Whale



Adaptations

Streamlined Body





Adaptations

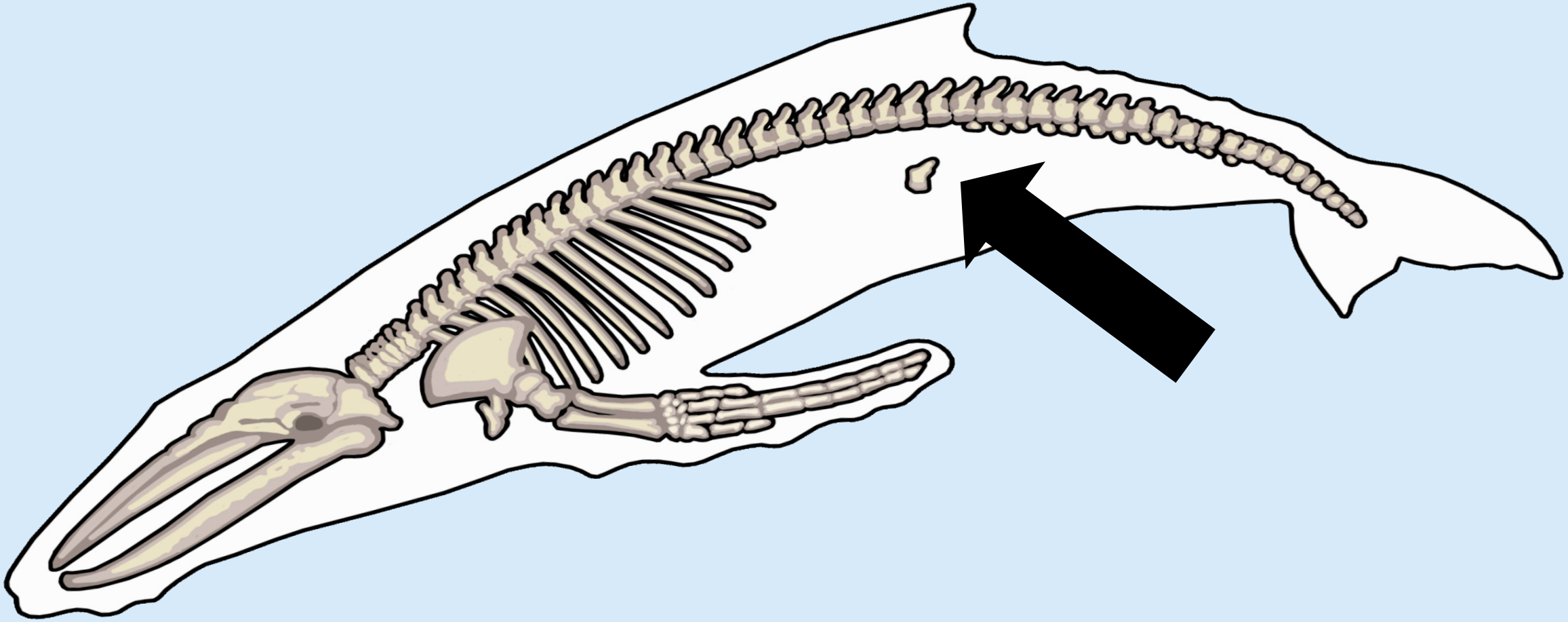
Forelimbs Modified Into Flippers

Adaptations

Tail Broadened Horizontally

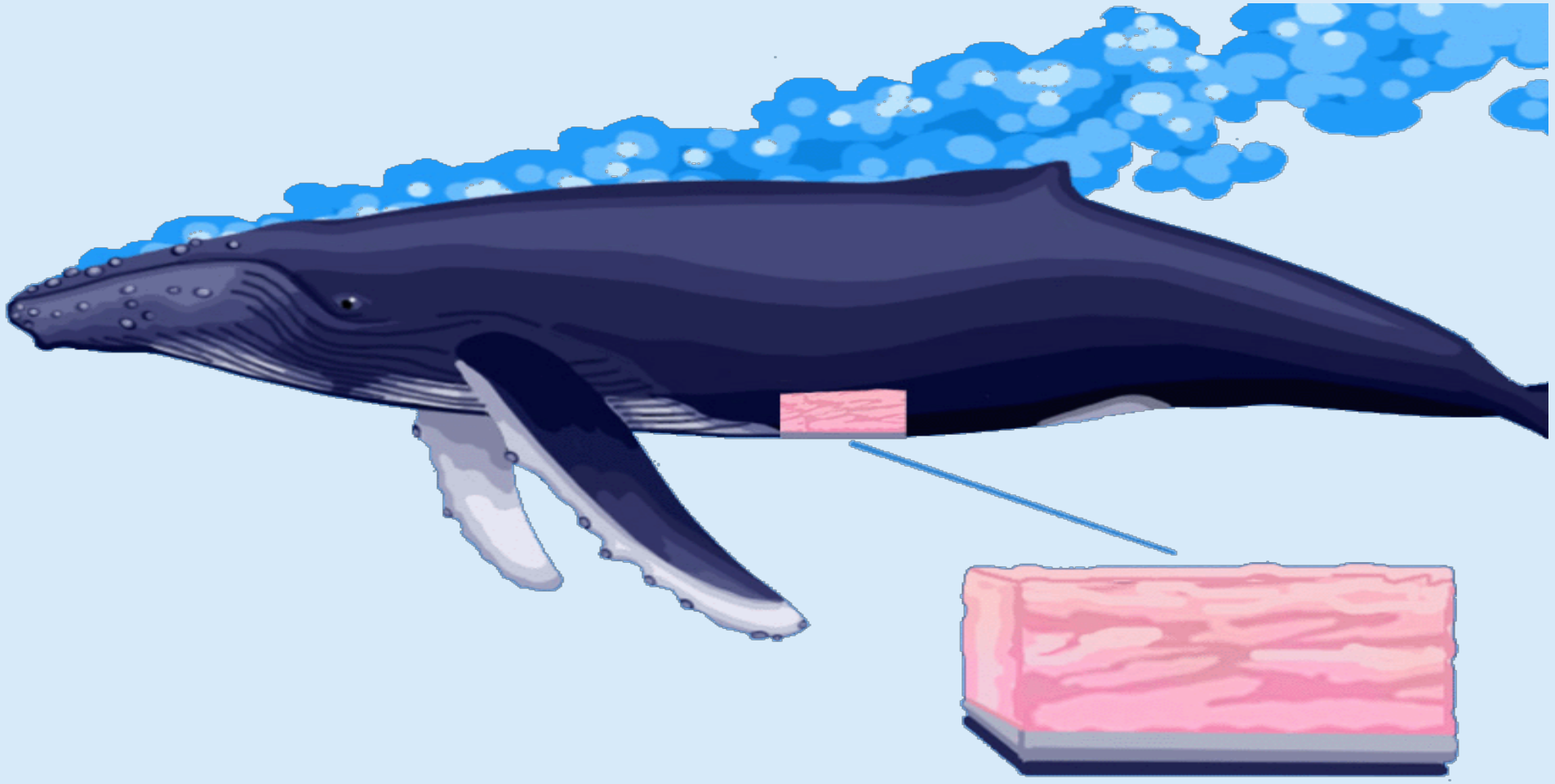
Adaptations

Hind Limbs Disappeared Completely



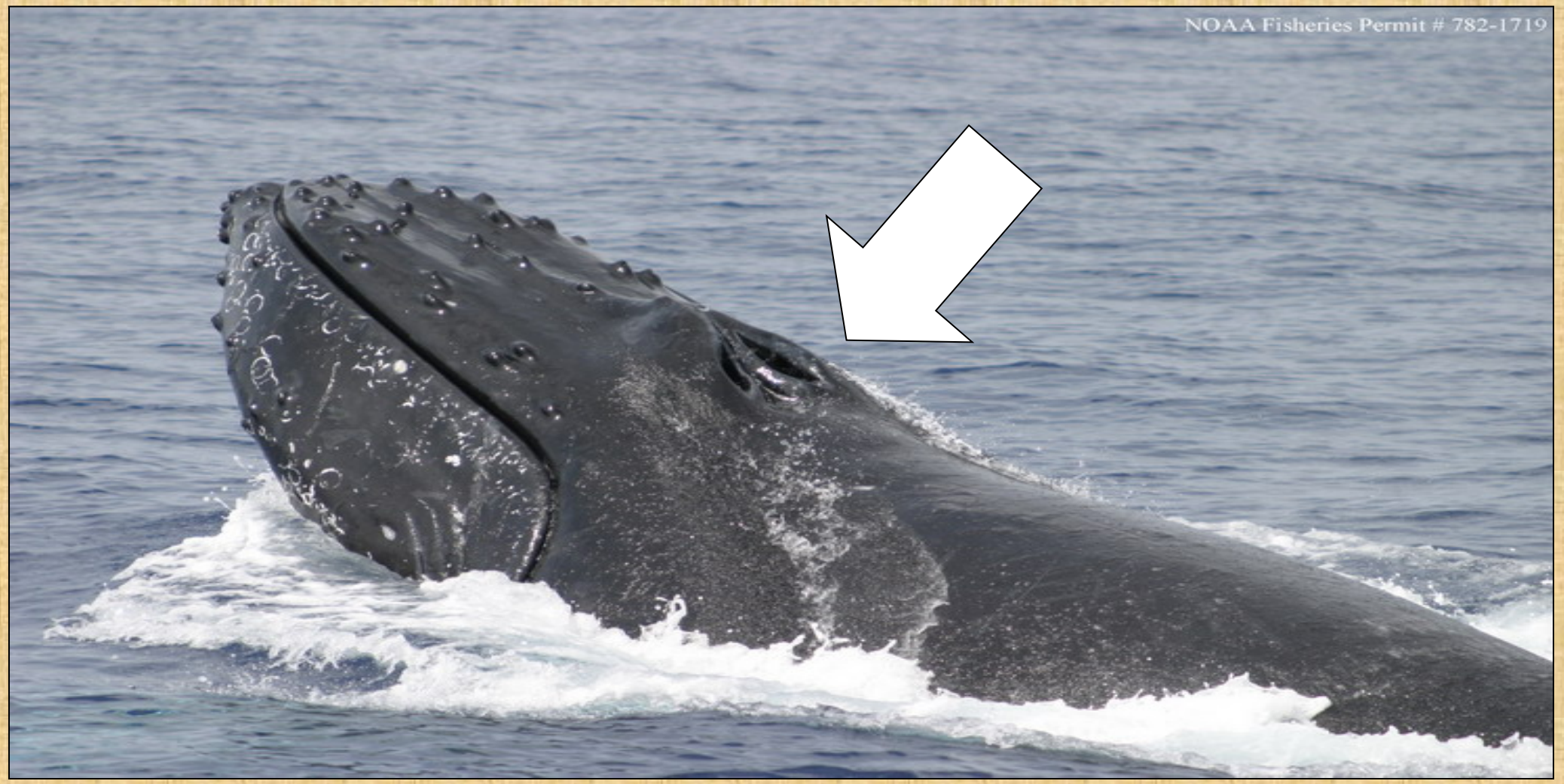
Adaptations

Blubber Instead of Hair



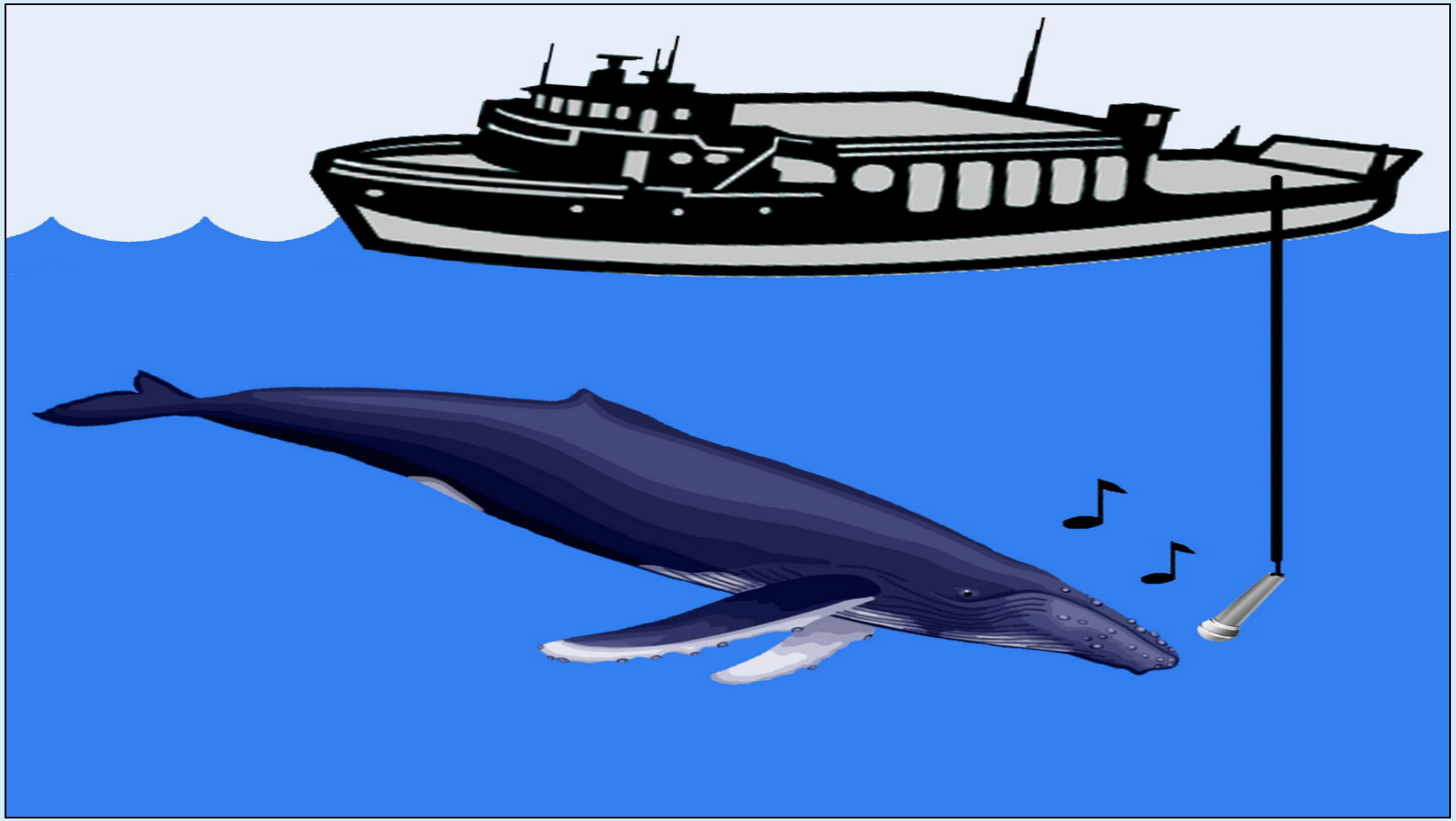
Adaptations

Nostrils on Top of Head



Adaptations

Highly Developed Hearing



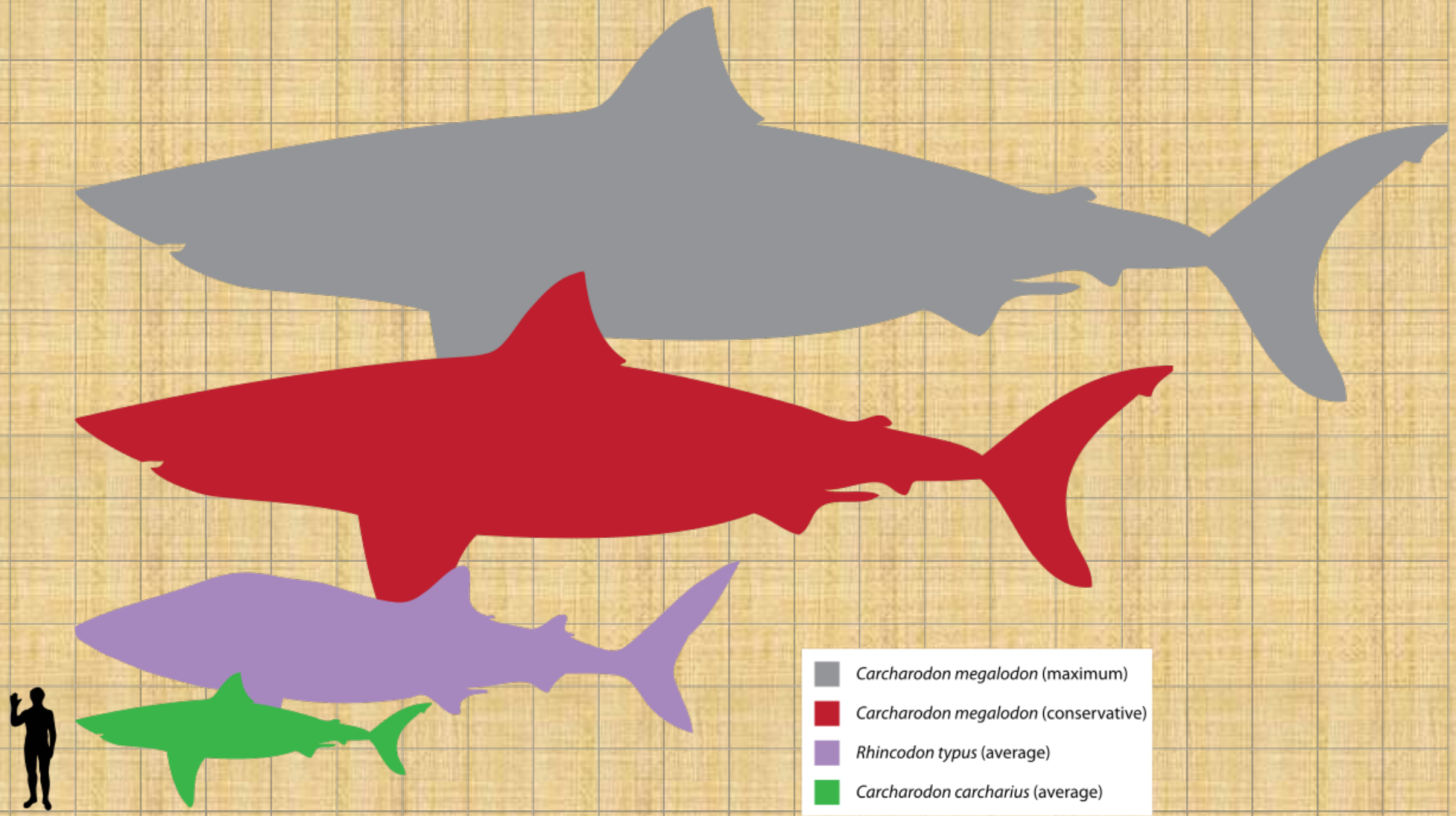
The End

EVOLUTION

[ev-*uh*-**loo**-sh*uh* n *or, esp. British,* ee-v*uh*-]

So what are some "living things" that have been around longer than dinosaurs that have NOT really evolved?

EVOLUTION


20m
Carcharodon megalodon (maximum)
Carcharodon megalodon (conservative)
Rhincodon typus (average)
Carcharodon carcharius (average)

Genetic Drift

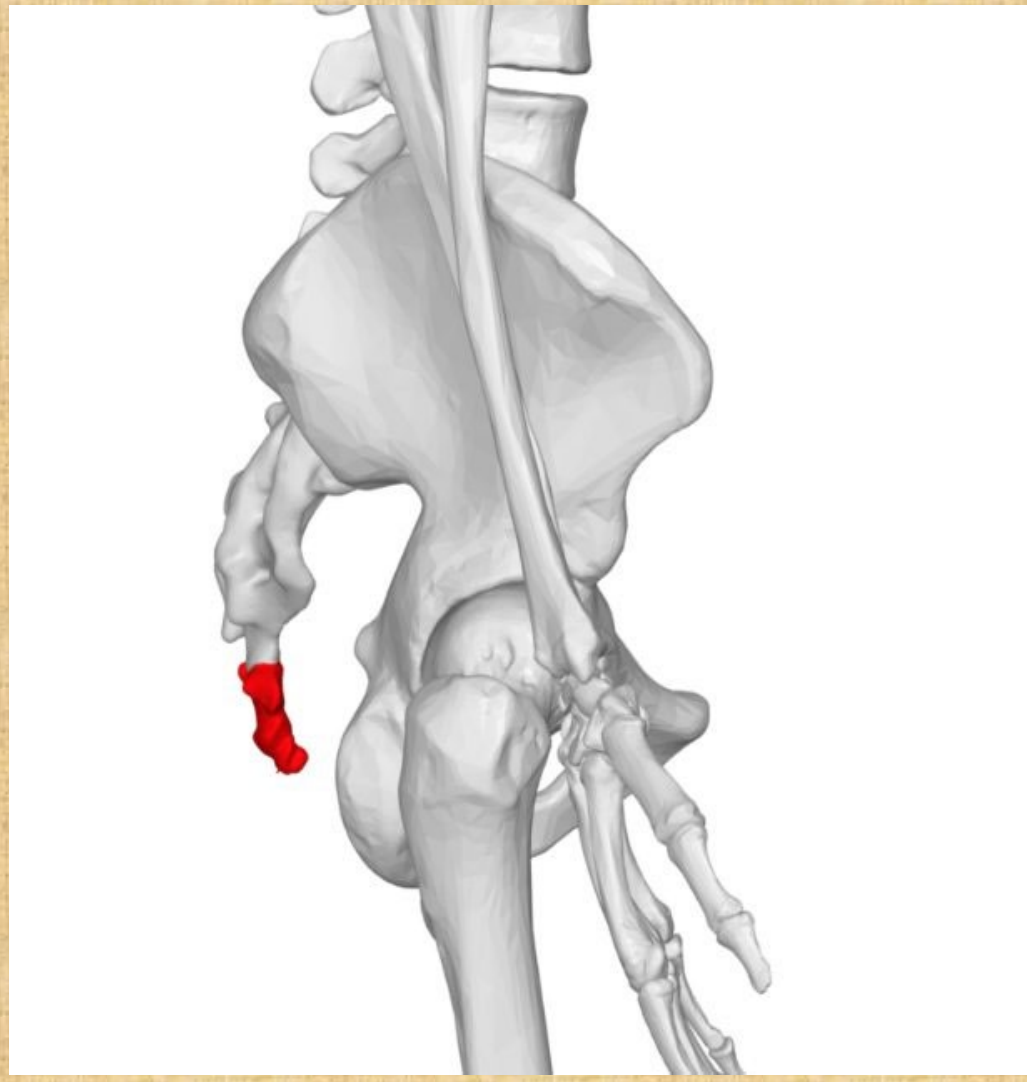
So *what are some* changes humans have undergone ?

mutation, and genetic drift.

Useless Body Parts : You Can Actually Live Without

https://list25.com/25-useless-body-parts-you-can-actually-live-without/5/

- **Tailbone**
  - Our tailbone is actually a group of fused vertebrae at the bottom of our spine. Also called the “Coccyx,” these bones are what’s left of our tails. No, really. We don’t need them. Humans lost the need for tails when we learned to walk upright. It would be kinda cool to still have tails, but apparently the universe in it’s infinite wisdom doesn’t let evolution work on the basis of “you know what would be really cool?”.



Useless Body Parts : You Can Actually Live Without

https://list25.com/25-useless-body-parts-you-can-actually-live-without/5/

- **Wisdom Teeth**

- Wisdom Teeth were quite useful once upon a time, when humans had a more caveman-esque diet. However they aren't necessary now. Most people have them removed as they hurt quite a bit and can cause a whole host of issues, including migraines. However, evolution seems to be taking notes, and now some people are born without wisdom teeth! Yay!..

Useless Body Parts : You Can Actually Live Without

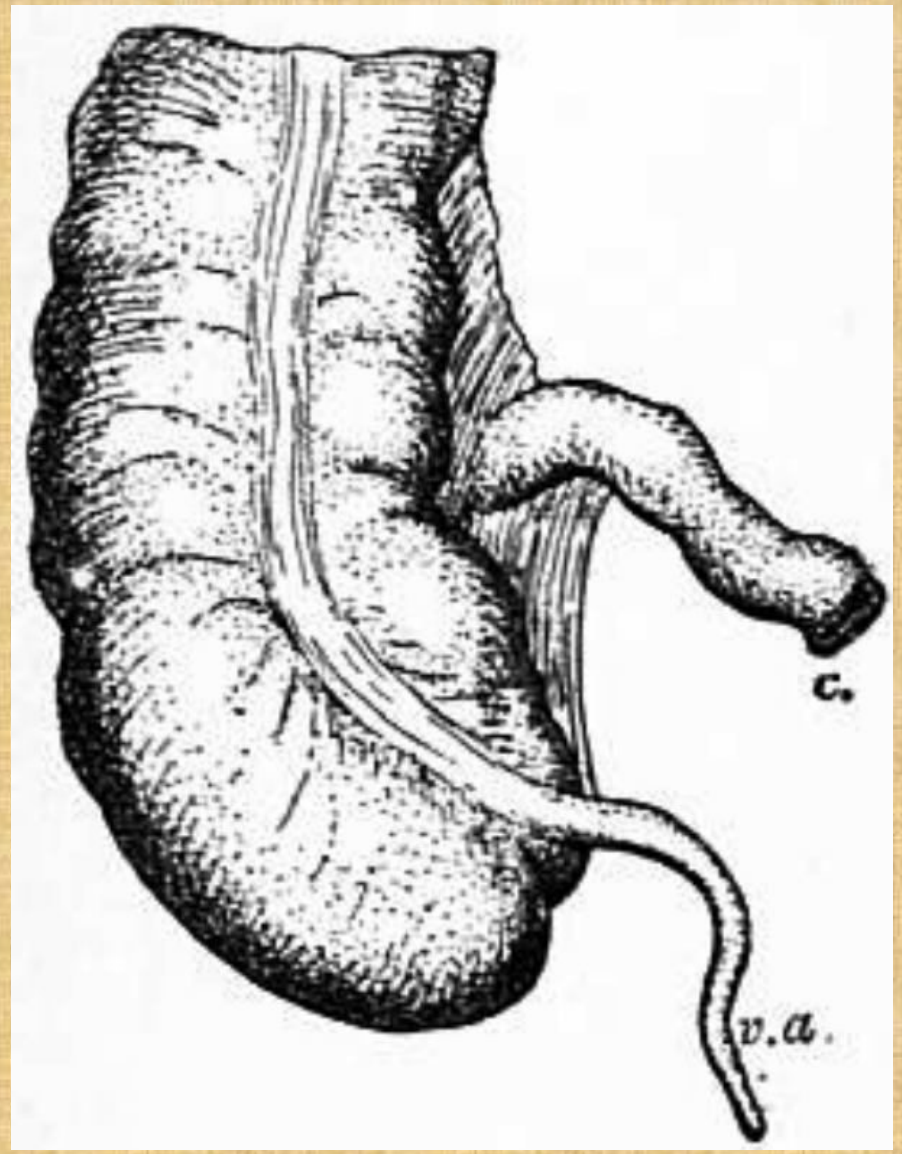
https://list25.com/25-useless-body-parts-you-can-actually-live-without/5/

- **Extra Toes**
  - We really don’t need the 5th one (the “pinky toe”) on account of walking upright and on the ground, instead of clinging to and swinging from branches. All lesser apes need 5 toes for these things. Having five full toes basically just lets us pick up dirty laundry off the floor. We could walk and run just fine with less than five.

Useless Body Parts : You Can Actually Live Without

https://list25.com/25-useless-body-parts-you-can-actually-live-without/5/

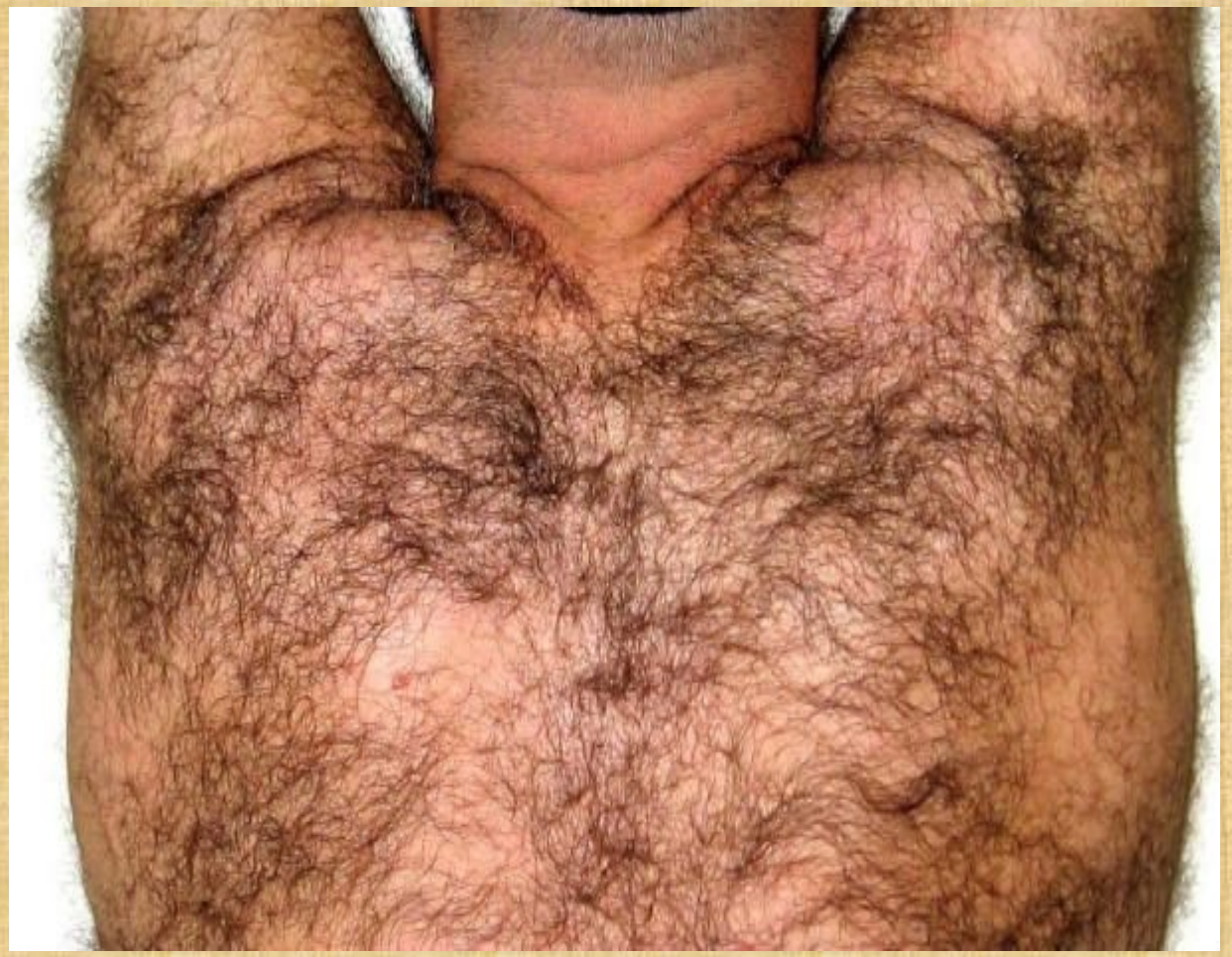
- **Appendix**
- The Appendix is currently useless because we no longer need it to digest high levels of cellulose. (We cook our food now! Which yes, decreases nutrients, but it makes the remaining nutrients more readily available to our body. Overall it's a win to cook your veggies.) Since we don't eat large amounts of raw plant matter, the appendix generally just gets infected and bursts, sometimes..



Useless Body Parts : You Can Actually Live Without

https://list25.com/25-useless-body-parts-you-can-actually-live-without/5/

- **Body Hair**
- We have explanations and uses for all the hair on our head – insulate our body temp, keep sweat out of our eyes…beards could even play a roll in sexual attraction. But what, exactly, is back and chest hair for? We don't really "*need*" body hair.



Genetic Drift

***Other less known* changes humans have undergone**

Useless Body Parts : You Can Actually Live Without

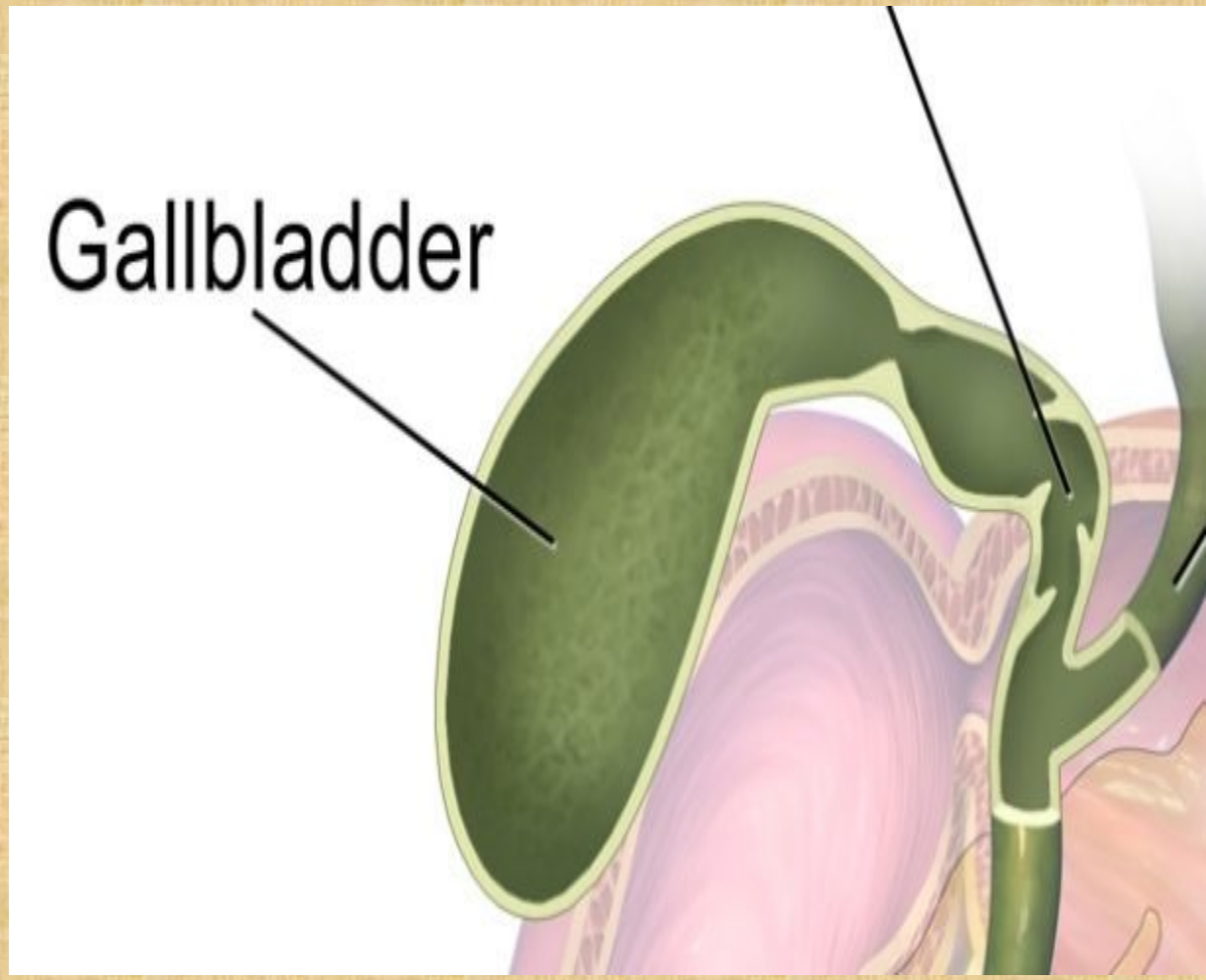
https://list25.com/25-useless-body-parts-you-can-actually-live-without/5/

- **Tonsils**
- Technically tonsils are lymph nodes, which in general are pretty darn important (if you like having a immune system). But Tonsils often get infected and inflamed so repeatedly that they just get removed. Many times they are just more trouble than they're worth. That we're aware of, no one has ever died due to lack of tonsils.

Useless Body Parts : You Can Actually Live Without

https://list25.com/25-useless-body-parts-you-can-actually-live-without/5/

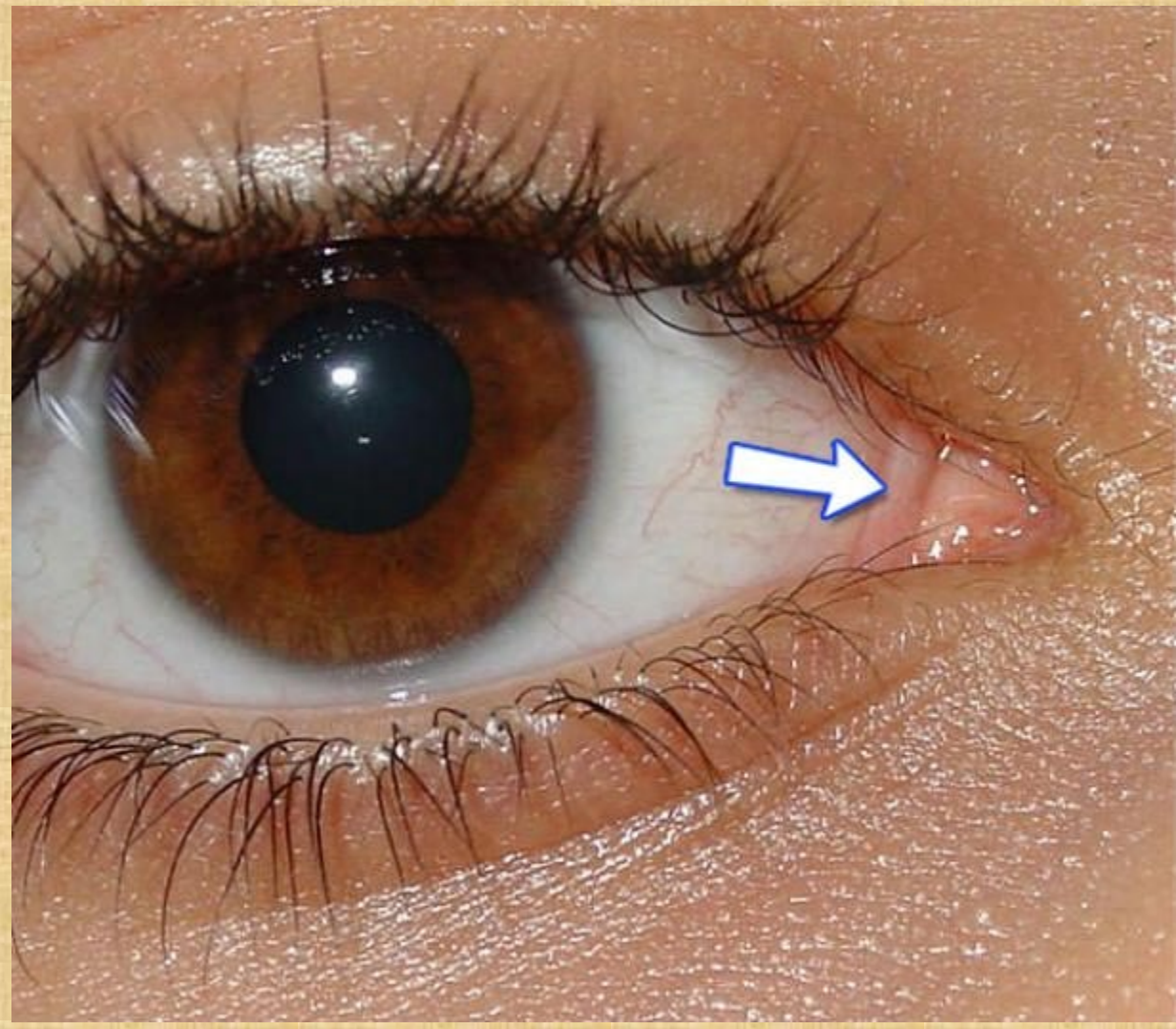
- **Gallbladder**
  - The gallbladder is a pouch that holds bile (made by the liver) and slowly releases it into the digestive tract. It also makes painful stones and can cause problems from cancer (which spreads to necessary organs) and inflammation. Most people that have to have it removed don’t notice much of a difference.



Useless Body Parts : You Can Actually Live Without

https://list25.com/25-useless-body-parts-you-can-actually-live-without/5/

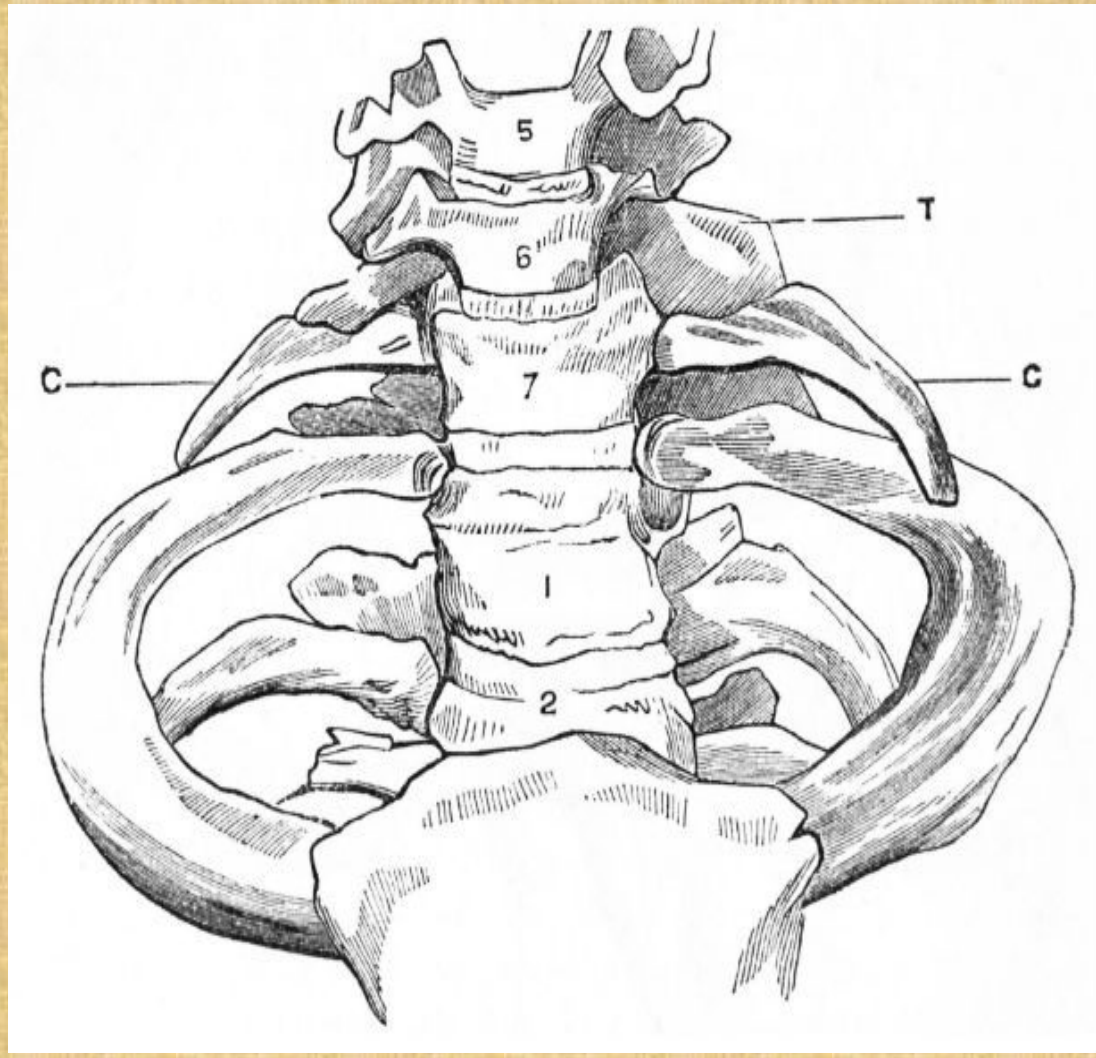
- **Plica Semilunaris**
- Reptiles and birds have third eyelids, and humans just have…a tiny bit of one left in the corner of our eye that does nothing. It's called the Plica Semilunaris, and it hangs out next to the tear duct.



Useless Body Parts : You Can Actually Live Without

https://list25.com/25-useless-body-parts-you-can-actually-live-without/5/

- **Cervical Ribs**
- Cervical ribs, located above the collarbone, occur in very few humans, but enough that it's a well known thing. Gorillas and Chimpanzees also have an extra set of ribs, instead of the standard 12 that most humans have. The extra set doesn't do anything, and most don't even know they have them; it could, however, cause neck pain in some people.



Useless Body Parts : You Can Actually Live Without

https://list25.com/25-useless-body-parts-you-can-actually-live-without/5/

- **Darwin's Point**
- Some people have a small folded bit of skin towards the top of their ear. It’s called Darwin’s Point, and it’s just a remnant of when our ears needed to be shaped differently for survival, as such a shape would’ve allowed us to hear distant sounds, alerting us to both danger and potential foods.

Useless Body Parts
You Can Actually Live Without

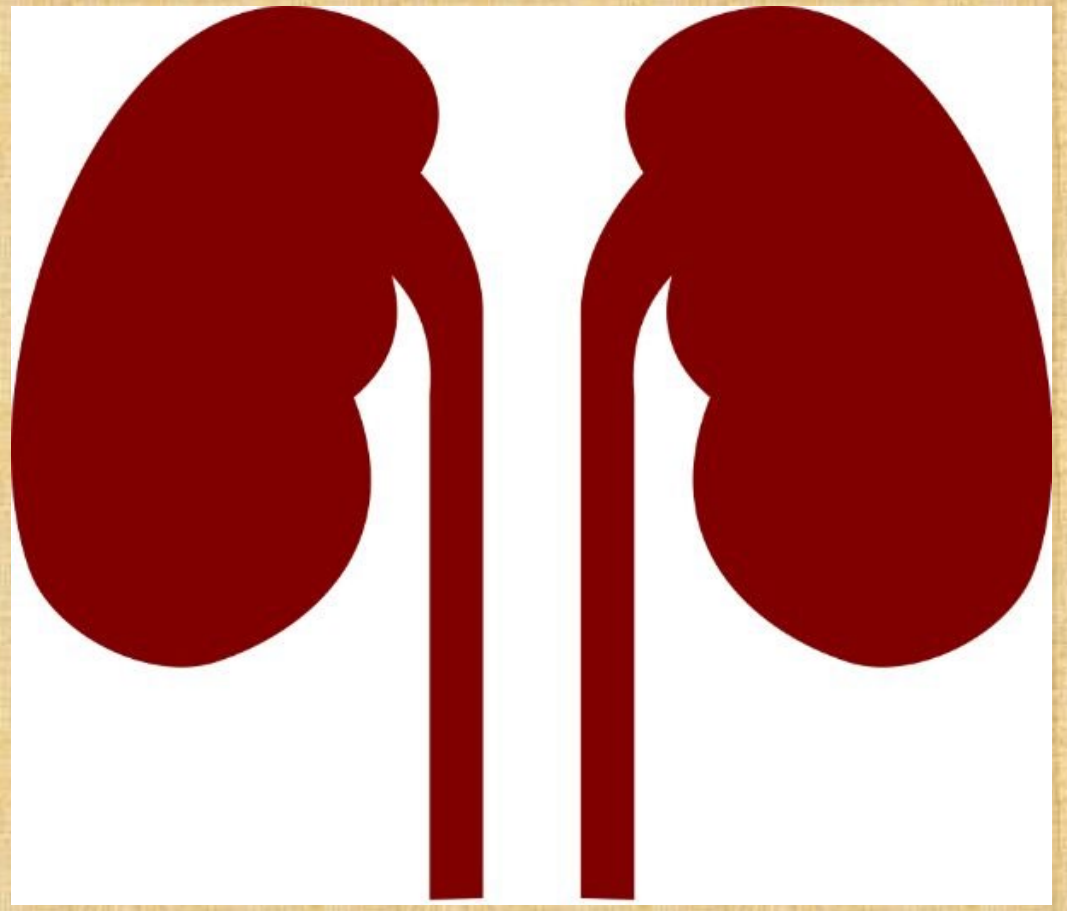
https://list25.com/25-useless-body-parts-you-can-actually-live-without/5/

- **Arrector Pili Muscles**
  - These are tiny tiny muscles attached to our hair follicles. They're what gives us goosebumps by contracting in order to make the hair stand up. Yeah, we don't really need them.

Useless Body Parts : You Can Actually Live Without

https://list25.com/25-useless-body-parts-you-can-actually-live-without/5/

- **"Redundancy Organs“**
- We have a lot of redundancy organs. So okay, technically they aren’t useless, not even a little bit; they’re actually quite awesome. But you can and could happily get by your whole life with one kidney, or only one ovary, or only one testicle. You only need one of these organs for them to perform their function. If you lose one, the other compensates.



EVOLUTION

[ev-*uh*-**loo**-sh*uh* n *or, esp. British,* ee-v*uh*-]

So let's define it!

EVOLUTION

[ev-*uh*-**loo**-sh*uh* n *or, esp. British,* ee-v*uh*-]

1. **any process of formation or growth; development**: *the evolution of a language; the evolution of the airplane.*

EVOLUTION

[ev-*uh*-**loo**-sh*uh* n *or, esp. British,* ee-v*uh*-]

1. any process of formation or growth; development: *the evolution of a language; the evolution of the airplane.*

* **a product of such development; something** **evolved**:*The exploration of space is the evolution of decades of research.*

EVOLUTION & NATURAL SELECTION

EVOLUTION

[ev-*uh*-**loo**-sh*uh* n *or, esp. British,* ee-v*uh*-]

1. ***Biology.*** **change in the gene pool of a population from generation to generation by such processes as mutation, natural selection, and genetic drift**.

EVOLUTION

[ev-*uh*-**loo**-sh*uh* n *or, esp. British,* ee-v*uh*-]

1. *Biology.* change in the gene pool of a population from generation to generation by such processes as mutation, natural selection, and genetic drift.

2. a **process of gradual, peaceful, progressive change or development**, as in social or economic structure or institutions.

EVOLUTION

There are two ways of thinking:

EVOLUTION

There are two ways of thinking:

1. ***Decent with Modification***

EVOLUTION

There are two ways of thinking:

1. Decent with Modification

2. Common Decent

DECENT WITH MODIFICATION

Is the observable FACT that when parents have children, those children often look and behave slightly different than their parents, and slightly different than each other.

They descend from their parents with modifications.

COMMON DECENT

***Is the idea that all life on Earth is related*.**
We descended from a common ancestor through the gradual process of decent with modification over many, many generations, a single original species is thought to have given rise to all the life we see today

EVOLUTION

There are two ways of thinking:

YOUR homework is to watch Two videos.

What is Natural Selection &

Stated Clearly https://www.youtube.com/watch?v=0SCjhI86grU

Natural Selection - Crash Course Biology #14

CrashCourse https://www.youtube.com/watch?v=aTftyFboC_M

Natural Selection

The (R)Evolution of Theory

The theory of EVOLUTION is one of the great intellectual revolutions of human history, drastically *changing* our perception of the world and of our place in it. Charles Darwin put forth a coherent theory of evolution and amassed a great body of evidence in support of this theory.

Natural Selection

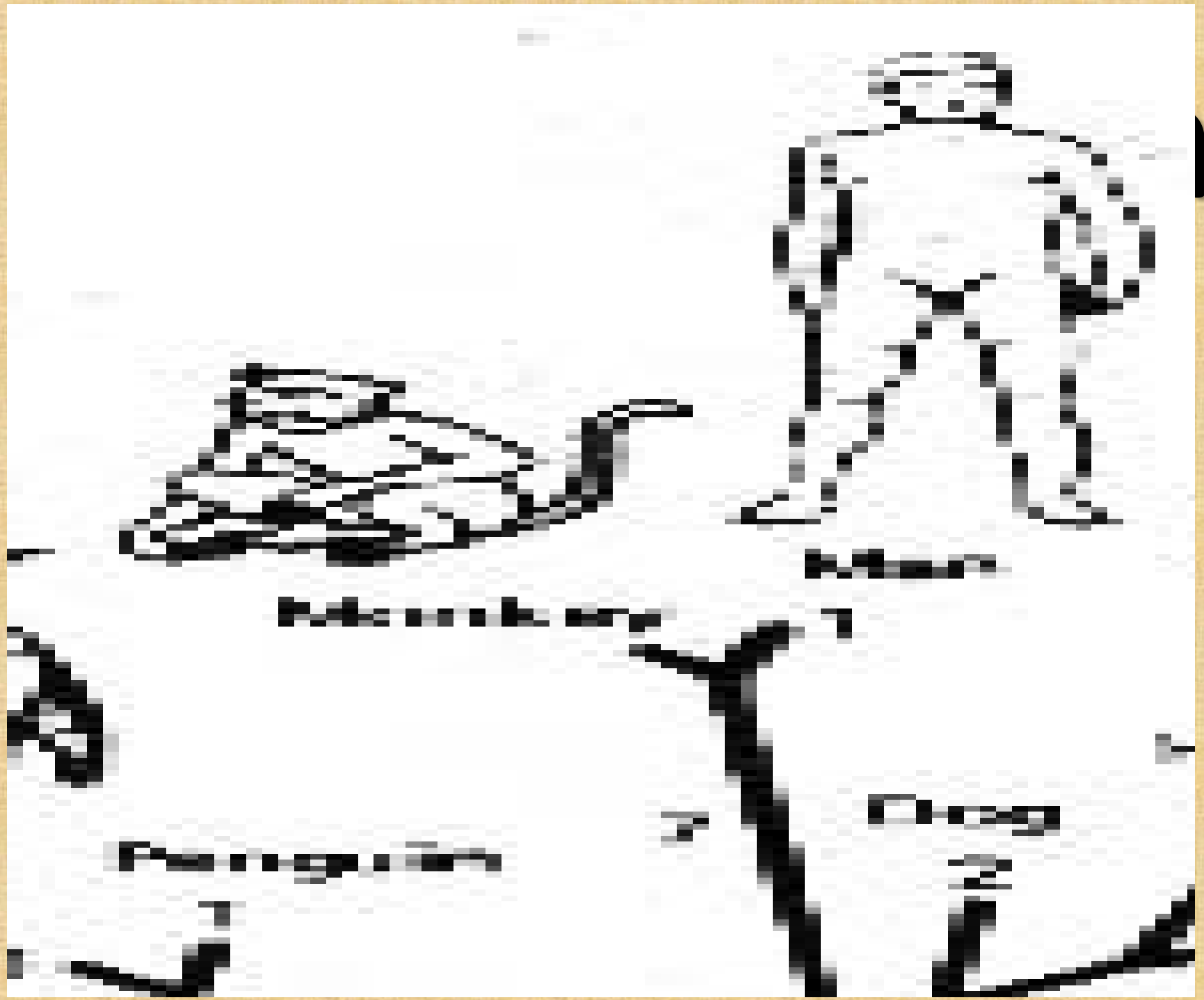
The (R)Evolution of Theory

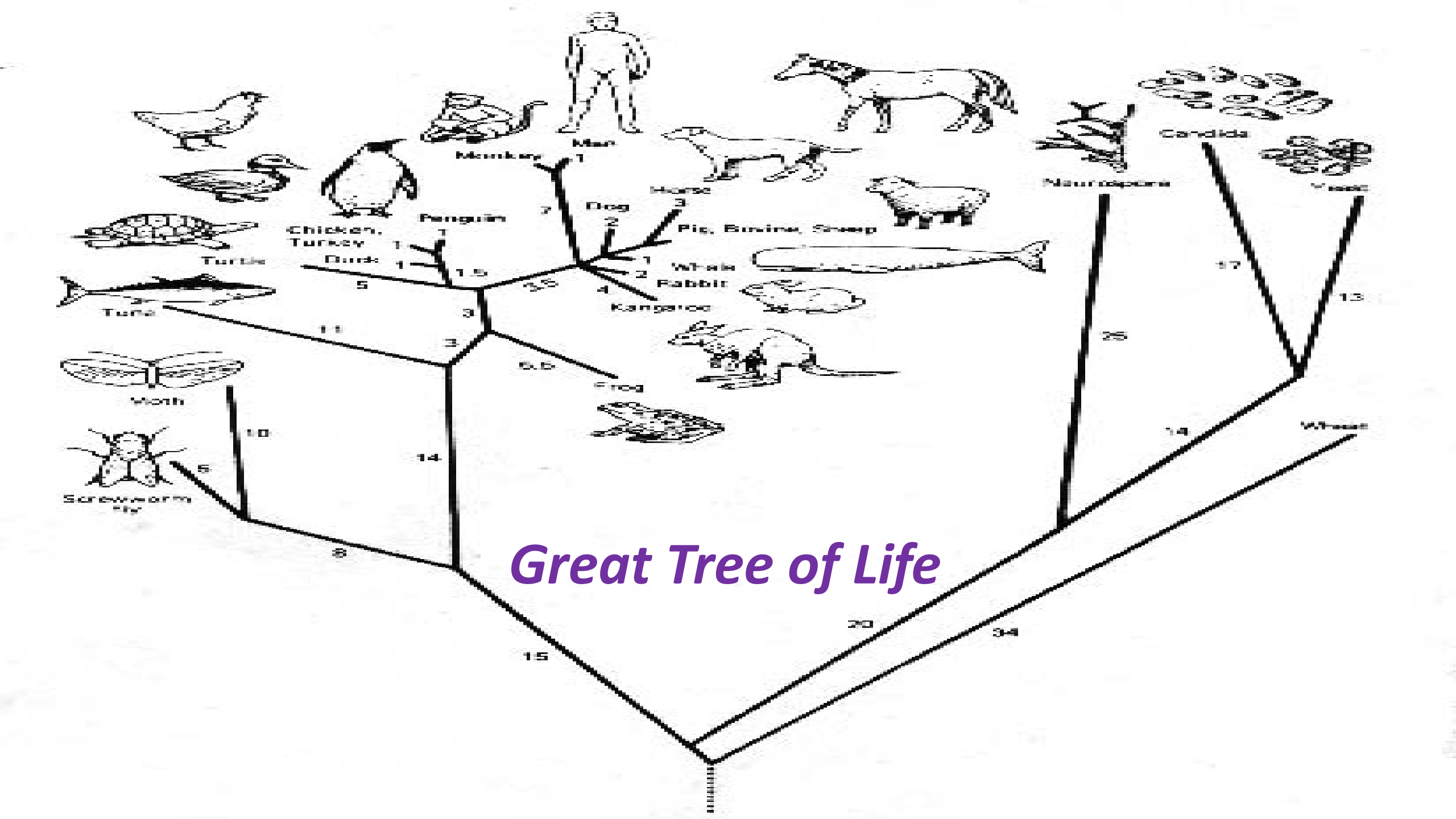
In Darwin's time, most scientists *fully believed that each organism and each adaptation* was the work of the creator.

Natural Selection

The (R)Evolution of Theory

In other words, *all of the similarities and dissimilarities among* groups of *organisms* that are the result of the branching process creating the *Great Tree of Life*




Man
Monkey
Horse
Dog
Penguin
Chicken, Turkey
Duck
Turtle
Tuna
Pig, Bovine, Sheep
Whale
Rabbit
Kangaroo
Frog
Moth
Screwworm fly
Neurospora
Candida
Yeast
Wheat
Great Tree of Life

Natural Selection

However, by the 19th Century, a number of natural historians were beginning to think of evolutionary change as an explanation for patterns observed in nature. The following ideas were part of the intellectual climate of Darwin's time.

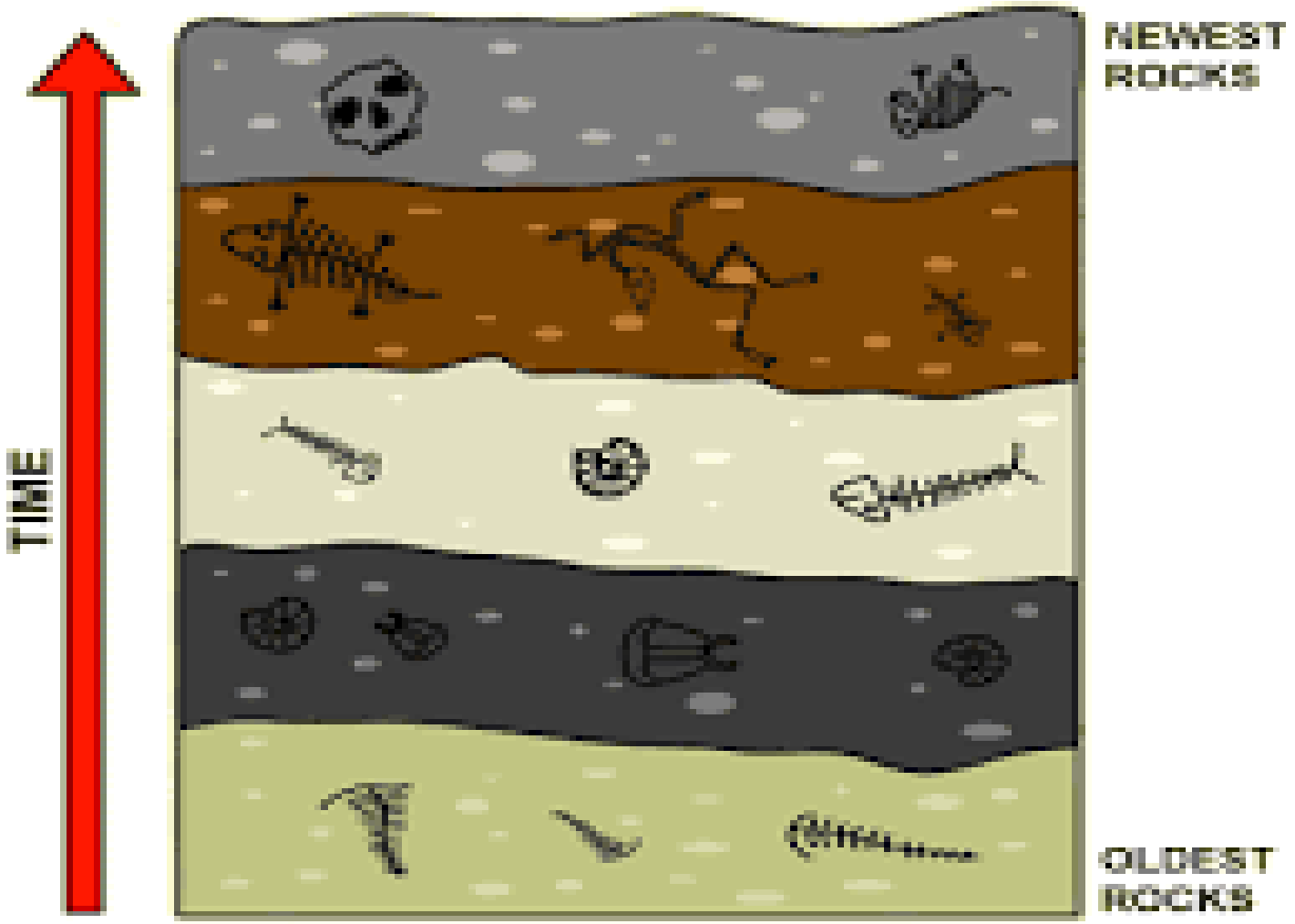
Natural Selection

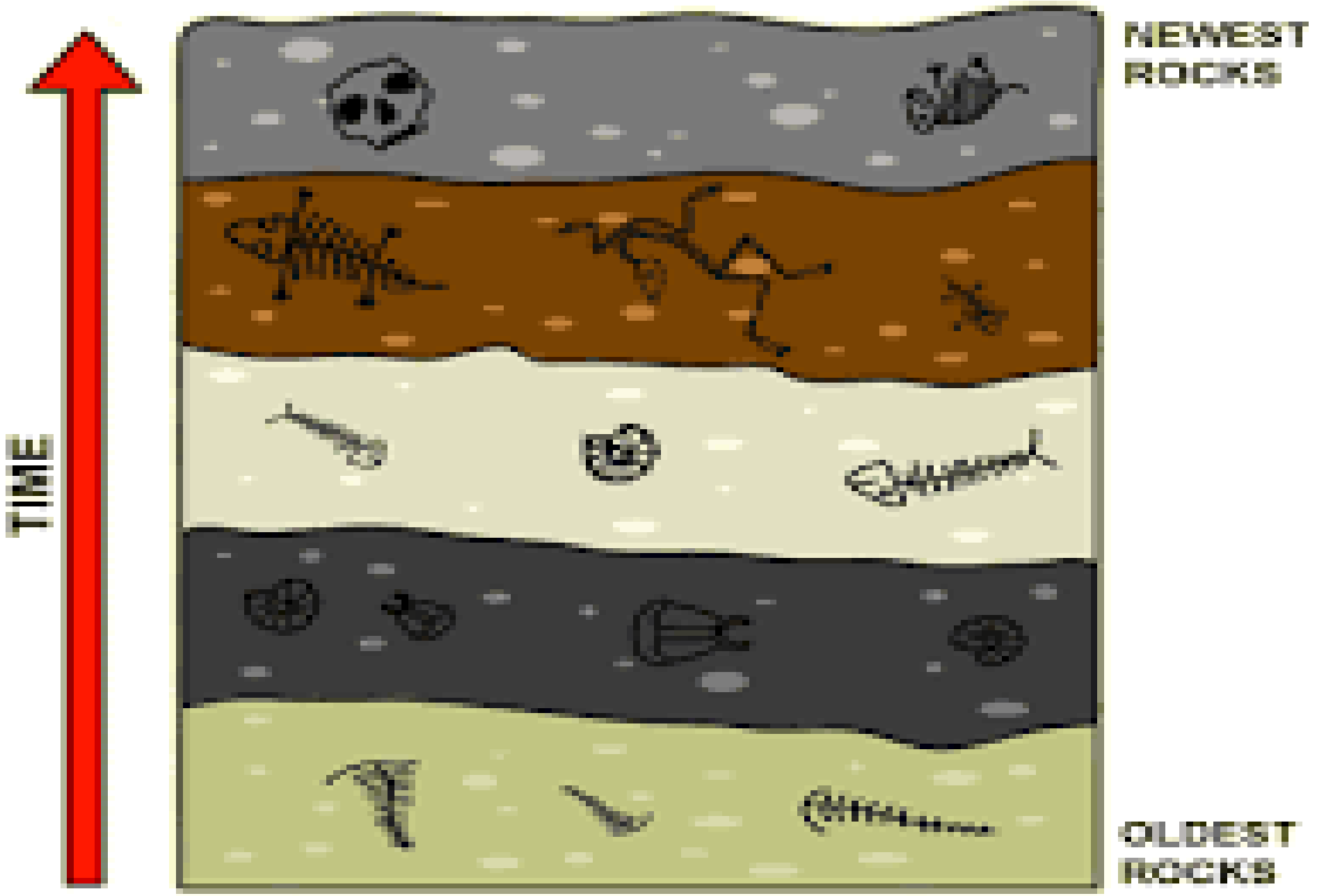
- **No one knew how old the earth was, but geologists were beginning to make estimates that the earth was considerably older than explained by biblical creation. Geologists were learning more about *strata*, or *layers formed by successive periods of the deposition of sediments*.**

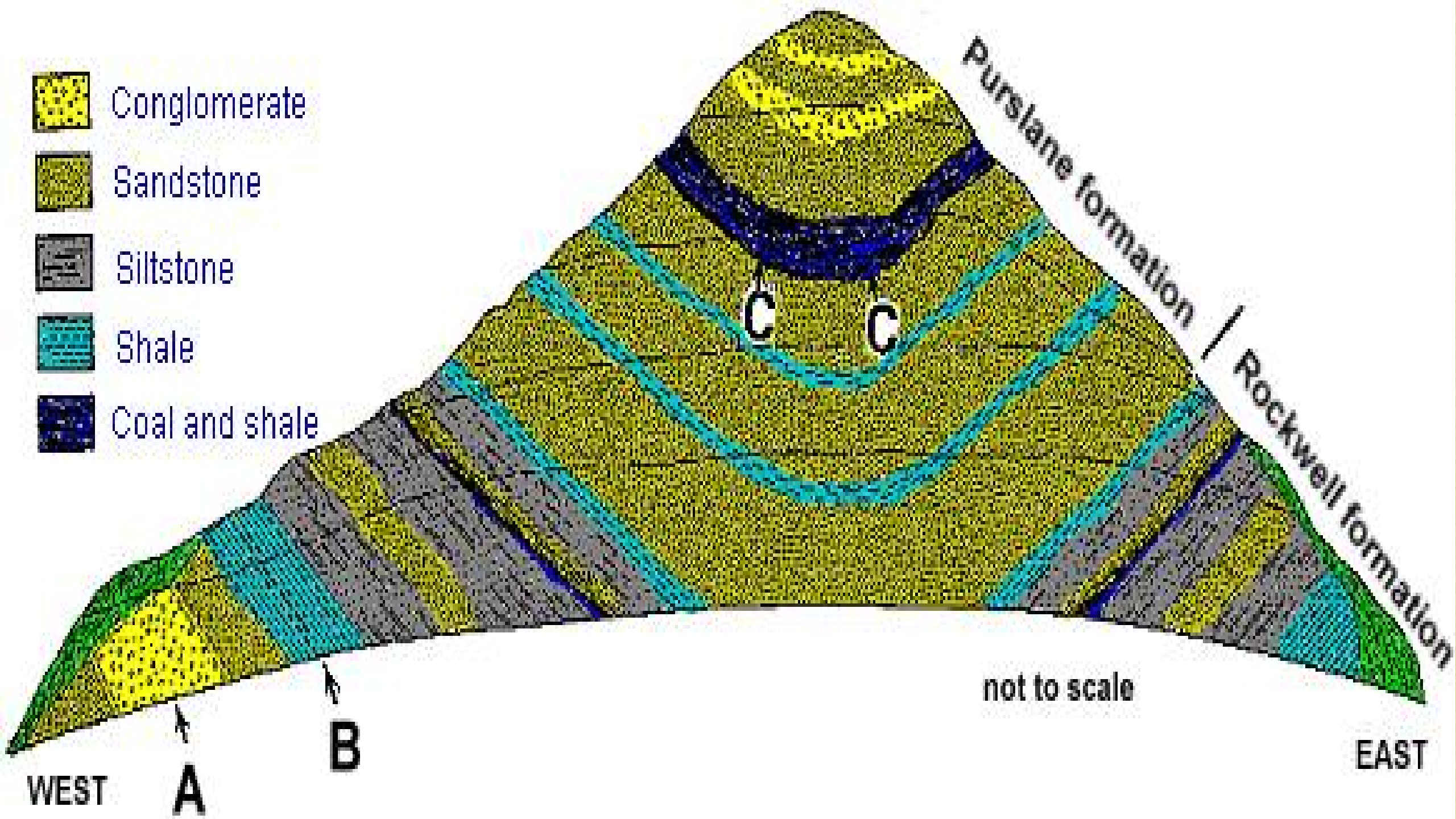
- **This suggested a time sequence, with younger strata overlying older strata.**

Natural Selection

- ***strata***, younger strata overlying older strata.




TIME
NEWEST ROCKS
OLDEST ROCKS


Conglomerate
Sandstone
Siltstone
Shale
Coal and shale
Purslane formation / Rockwell formation
C
C
not to scale
WEST
A
B
EAST

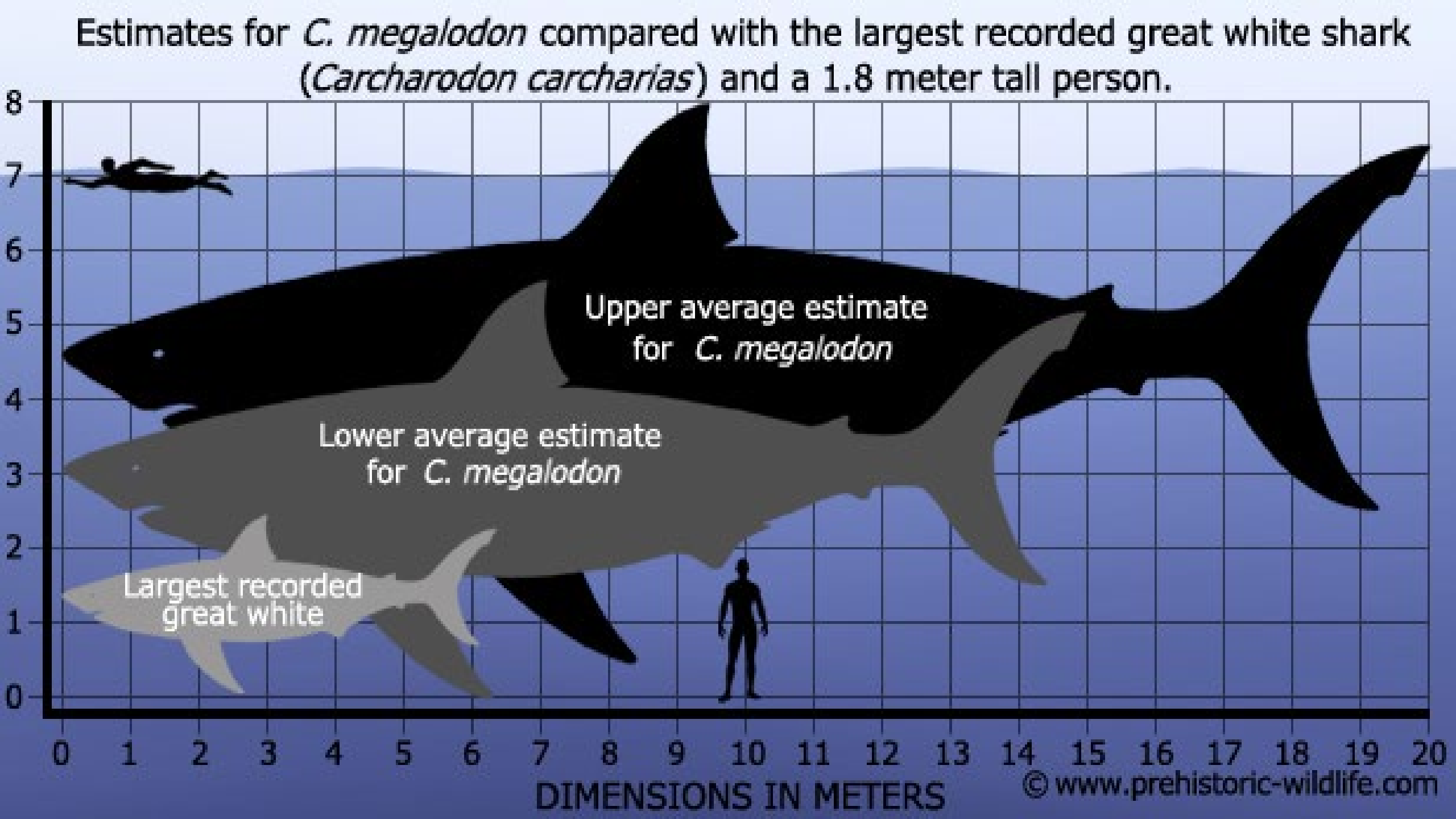

EAST
68
40
©Morteza S Lowe

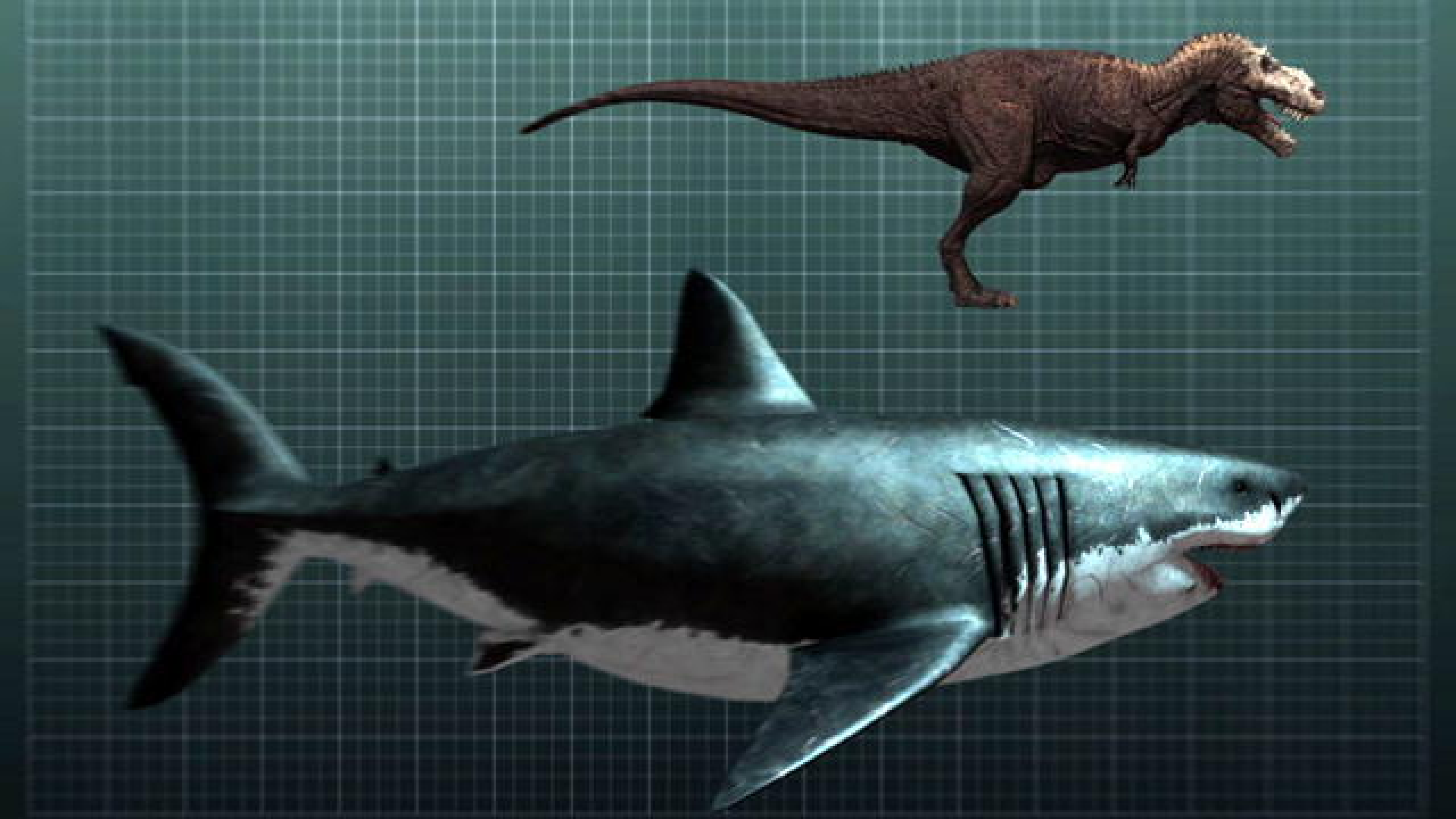
Natural Selection

- **A concept called uniformitarianism, due largely to the *influential geologist* Charles Lyell, undertook to decipher earth history under the working hypothesis that present conditions and processes are the key to the past, by investigating ongoing, observable processes such as erosion and the deposition of sediments.**

Natural Selection

•Discoveries of fossils were accumulating during the 18th and 19th centuries. At first naturalists thought they were finding remains of unknown but still living species. As fossil finds continued, however, it became apparent that nothing like giant dinosaurs was known from anywhere on the planet. Furthermore, as early as 1800, Cuvier pointed out that the deeper the strata, the less similar fossils were to existing species.


Estimates for C. megalodon compared with the largest recorded great white shark (Carcharodon carcharias) and a 1.8 meter tall person.
Upper average estimate for C. megalodon
Lower average estimate for C. megalodon
Largest recorded great white
0 1 2 3 4 5 6 7 8
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DIMENSIONS IN METERS
© www.prehistoric-wildlife.com



Natural Selection

- Jean-Baptiste Lamarck (1744-1829) is the most famous of these. In 1801, he proposed organic evolution as the explanation for the physical similarity among groups of organisms, and proposed a mechanism for adaptive change based on the inheritance of acquired characteristics.

Natural Selection

•He wrote of the giraffe:

"We know that this animal, the tallest of mammals, dwells in the interior of Africa, in places where the soil, almost always arid and without herbage, obliges it to browse on trees and to strain itself continuously to reach them. This habit sustained for long, has had the result in all members of its race that the forelegs have grown longer than the hind legs and that its neck has become so stretched, that the giraffe, without standing on its hind legs, lifts its head to a height of six meters."

Natural Selection

- Similarities among groups of organisms were considered evidence of relatedness, which in turn suggested evolutionary change. Darwin's intellectual predecessors accepted the idea of evolutionary relationships among organisms, but they could not provide a satisfactory explanation for how evolution occurred.

Natural Selection

In essence, this says that the necks of Giraffes became long as a result of continually stretching to reach high foliage.

Larmarck was incorrect in the hypothesized mechanism, of course, but his example makes clear that naturalists were thinking about the possibility of evolutionary change in the early 1800's.

Natural Selection

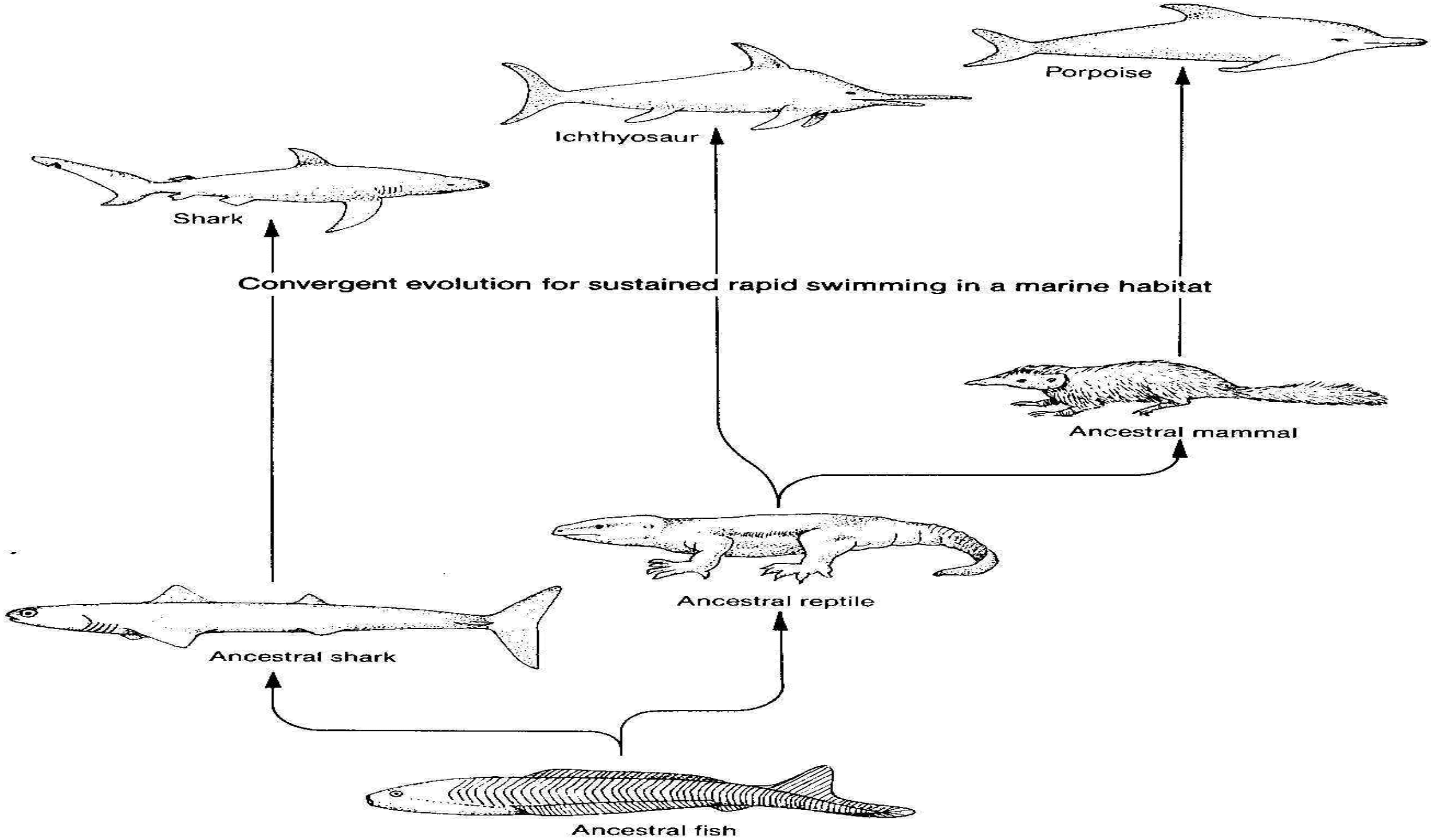
- **Darwin was influenced by observations made during his youthful voyage as naturalist on the survey ship *Beagle*. On the *Galapagos Islands* he noticed the slight variations that made tortoises from different islands recognizably distinct. He also observed a whole array of unique finches, the famous "Darwin's finches," that exhibited slight differences from island to island.**

Natural Selection

- **In addition, they all appeared to resemble, but differ from, the common finch on the mainland of Ecuador, 600 miles to the east. Patterns in the distribution and similarity of organisms had an important influence of Darwin's thinking.**

Natural Selection

•In 1859, Darwin published his famous On the Origin of Species by Means of Natural Selection, a tome of over 500 pages that marshalled extensive evidence for his theory. Publication of the book caused a furor - every copy of the book was sold the day that it was released. Members of the religious community, as well as some scientific peers, were outraged by Darwin's ideas and protested.


Porpoise
Ichthyosaur
Shark
Convergent evolution for sustained rapid swimming in a marine habitat
Ancestral mammal
Ancestral reptile
Ancestral shark
Ancestral fish

Natural Selection

•Most scientists, however, recognized the power of Darwin's arguments. Today, school boards still debate the validity and suitability of Darwin's theory in science curricula, and a whole body of debate has grown up around the controversy We do not have time to cover all of Darwin's evidence and arguments, but we can examine the core ideas. What does this theory of evolution say?

Natural Selection

Darwin's Theory

Darwin’s theory of evolution entails the following fundamental ideas. The first three ideas were already under discussion among earlier and contemporaneous naturalists working on the “species problem” as Darwin began his research. Darwin’s original contributions were the mechanism of natural selection and copious amounts of evidence for evolutionary change from many sources. He also provided thoughtful explanations of the consequences of evolution for our understanding of the history of life and modern biological diversity.

Natural Selection

- **Biodiversity: The variety and complexity of life on Earth.**

Natural Selection

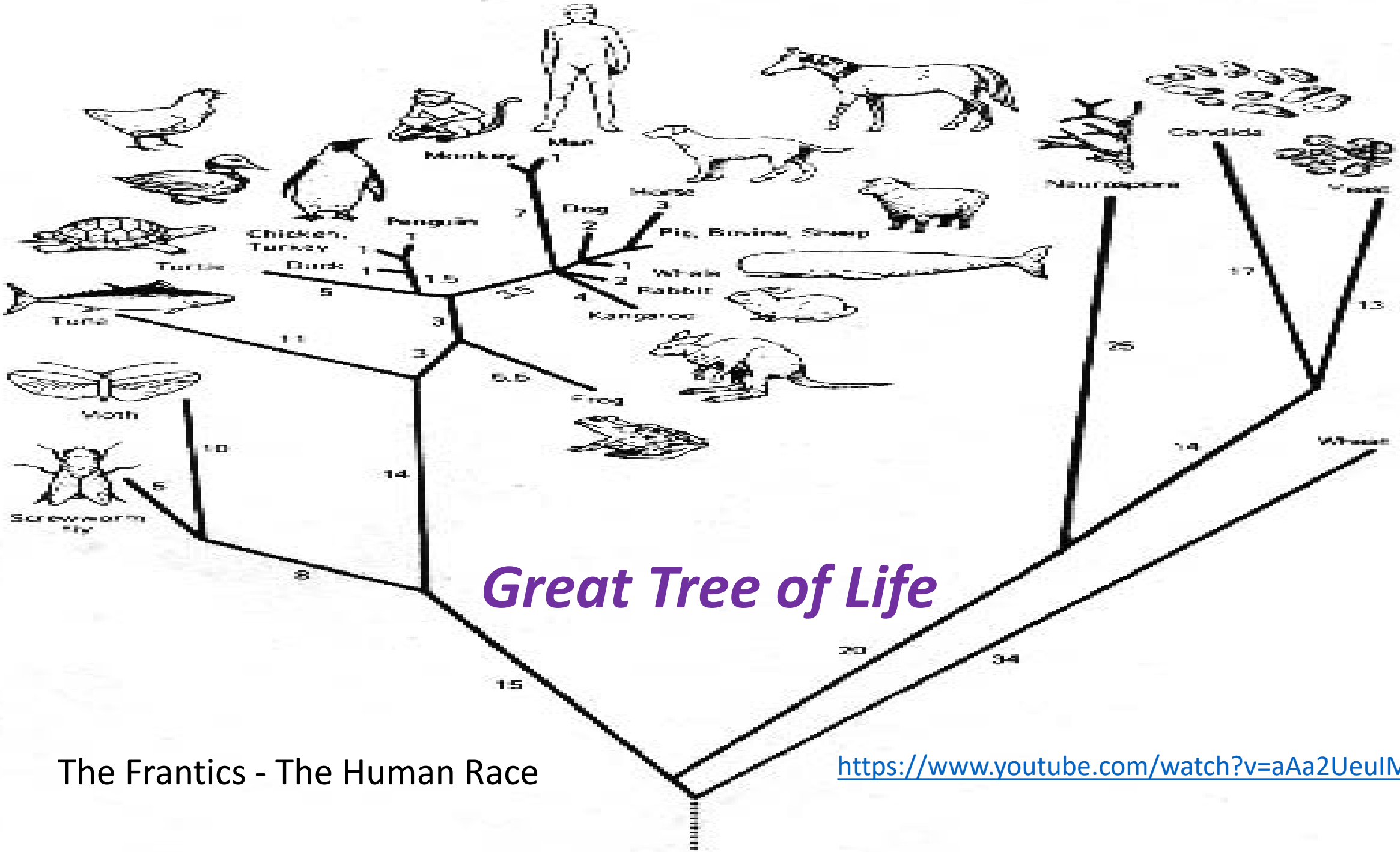
Darwin's Theory

•Species (populations of interbreeding organisms) change over time and space. The representatives of species living today differ from those that lived in the recent past, and populations in different geographic regions today differ slightly in form or behavior. These differences extend into the fossil record, which provides ample support for this claim.

Natural Selection

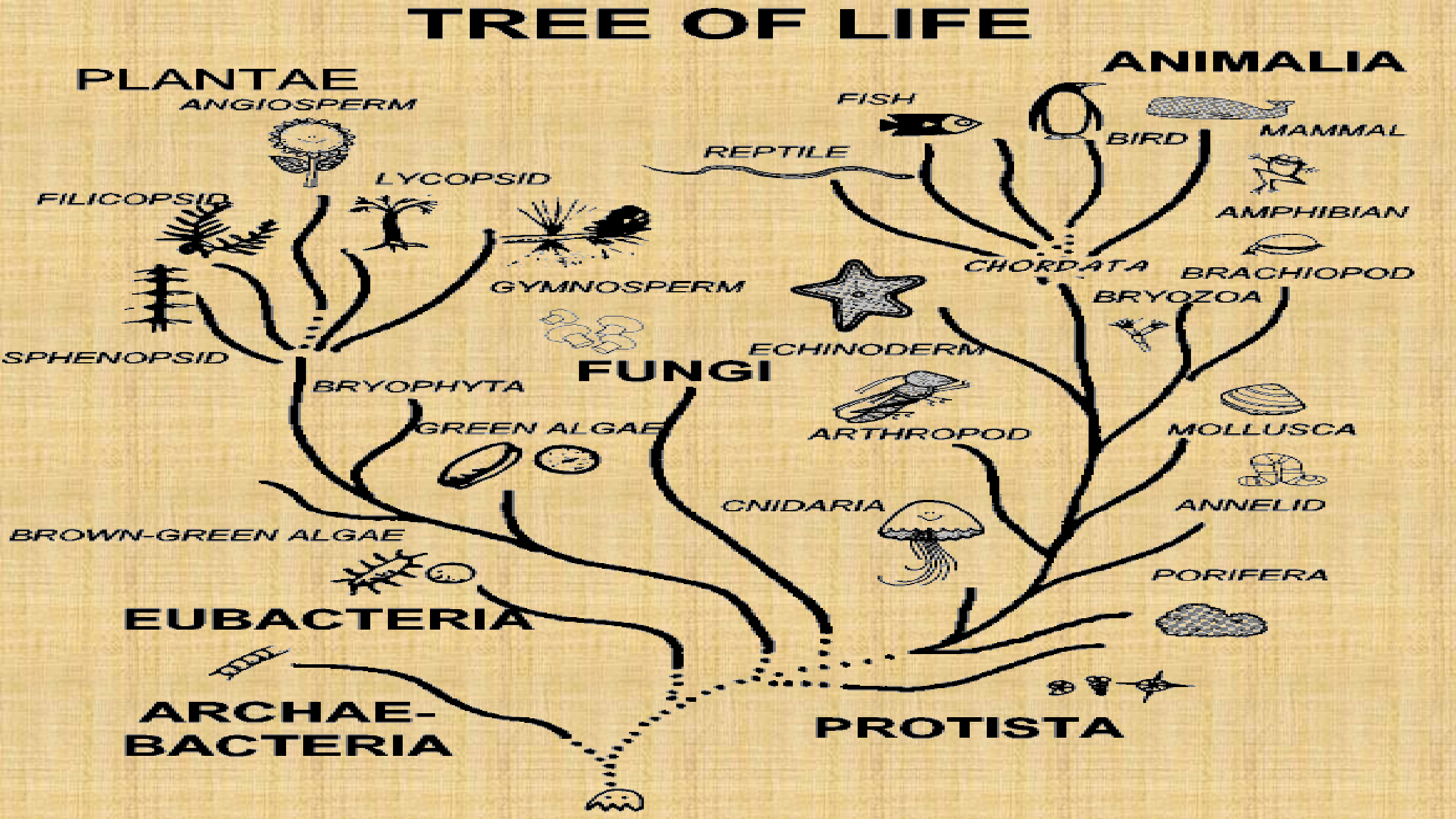
Darwin's Theory

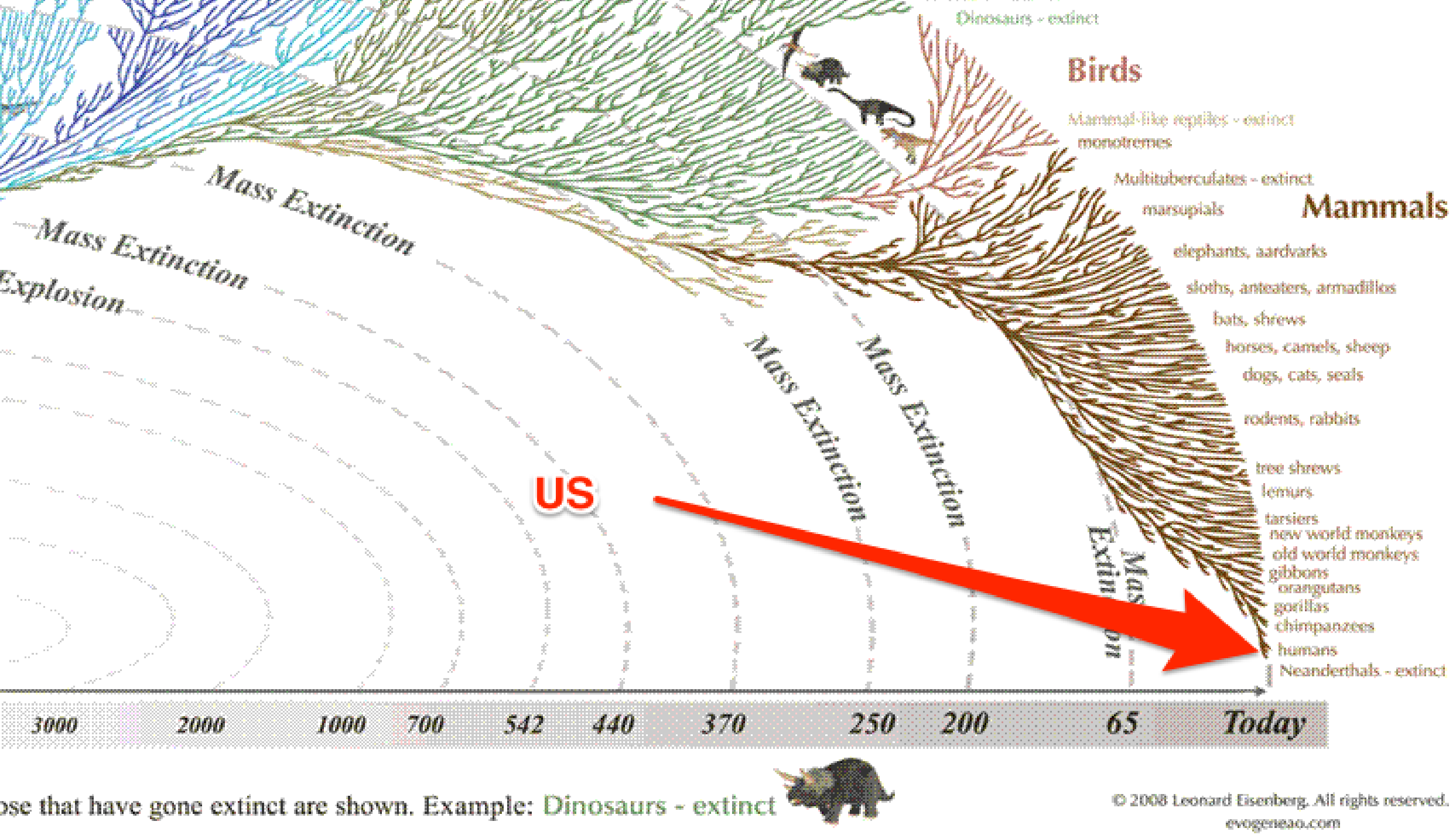
•All organisms share common ancestors with other organisms. Over time, populations may divide into different species, which share a common ancestral population. Far enough back in time, any pair of organisms shares a common ancestor. For example, humans shared a common ancestor with chimpanzees about eight million years ago, with whales about 60 million years ago, and with kangaroos over 100 million years ago. Shared ancestry explains the similarities of organisms that are classified together: their similarities reflect the inheritance of traits from a common ancestor.



The Frantics - The Human Race

https://www.youtube.com/watch?v=aAa2UeuIMu0


TREE OF LIFE
PLANTAE
ANGIOSPERM
LYCOPSID
FILICOPSID
GYMNOSPERM
SPHENOPSID
BRYOPHYTA
GREEN ALGAE
BROWN-GREEN ALGAE
EUBACTERIA
ARCHAE-
BACTERIA
FUNGI
ANIMALIA
FISH
REPTILE
BIRD
MAMMAL
AMPHIBIAN
CHORDATA
BRACHIOPOD
BRYOZOA
ECHINODERM
ARTHROPOD
MOLLUSCA
ANNELID
CNIDARIA
PORIFERA
PROTISTA



ose that have gone extinct are shown. Example: Dinosaurs - extinct

Natural Selection

Darwin's Theory

- **Evolutionary change is gradual and slow in Darwin's view. This claim was supported by the long episodes of gradual change in organisms in the fossil record and the fact that no naturalist had observed the sudden appearance of a new species in Darwin's time. Since then, biologists and paleontologists have documented a broad spectrum of slow to rapid rates of evolutionary change within lineages.**

Natural Selection

- **Evolution: The process whereby new species arise from earlier species by accumulated changes. Often referred to as "descent with modification."**

Natural Selection

- **Natural Selection: The process by which individuals in a population inherit genes that allow them to survive and be reproductively successful.**

Natural Selection

The Process of Natural Selection

Darwin's process of natural selection has four components.

Natural Selection

The Process of Natural Selection

Darwin's process of natural selection has four components.

1.Variation. Organisms (within populations) exhibit individual variation in appearance and behavior. These variations may involve body size, hair color, facial markings, voice properties, or number of offspring. On the other hand, some traits show little to no variation among individuals—for example, number of eyes in vertebrates.

Natural Selection

The Process of Natural Selection

Darwin's process of natural selection has four components.

2.Inheritance. Some traits are consistently passed on from parent to offspring. Such traits are heritable, whereas other traits are strongly influenced by environmental conditions and show weak heritability.

Natural Selection

The Process of Natural Selection

Darwin's process of natural selection has four components.

3.High rate of population growth. Most populations have more offspring each year than local resources can support leading to a struggle for resources. Each generation experiences substantial mortality.

"Deer season"

Natural Selection

The Process of Natural Selection

Darwin's process of natural selection has four components.

4.Differential survival and reproduction. Individuals possessing traits well suited for the struggle for local resources will contribute more offspring to the next generation.

The Process of Natural Selection

Darwin's process of natural selection has four components.

1. Variation. Organisms (within populations) exhibit individual variation in appearance and behavior.

2. Inheritance. Some traits are consistently passed on from parent to offspring.

3. High rate of population growth.

4. Differential survival and reproduction

Natural Selection

The Process of Natural Selection

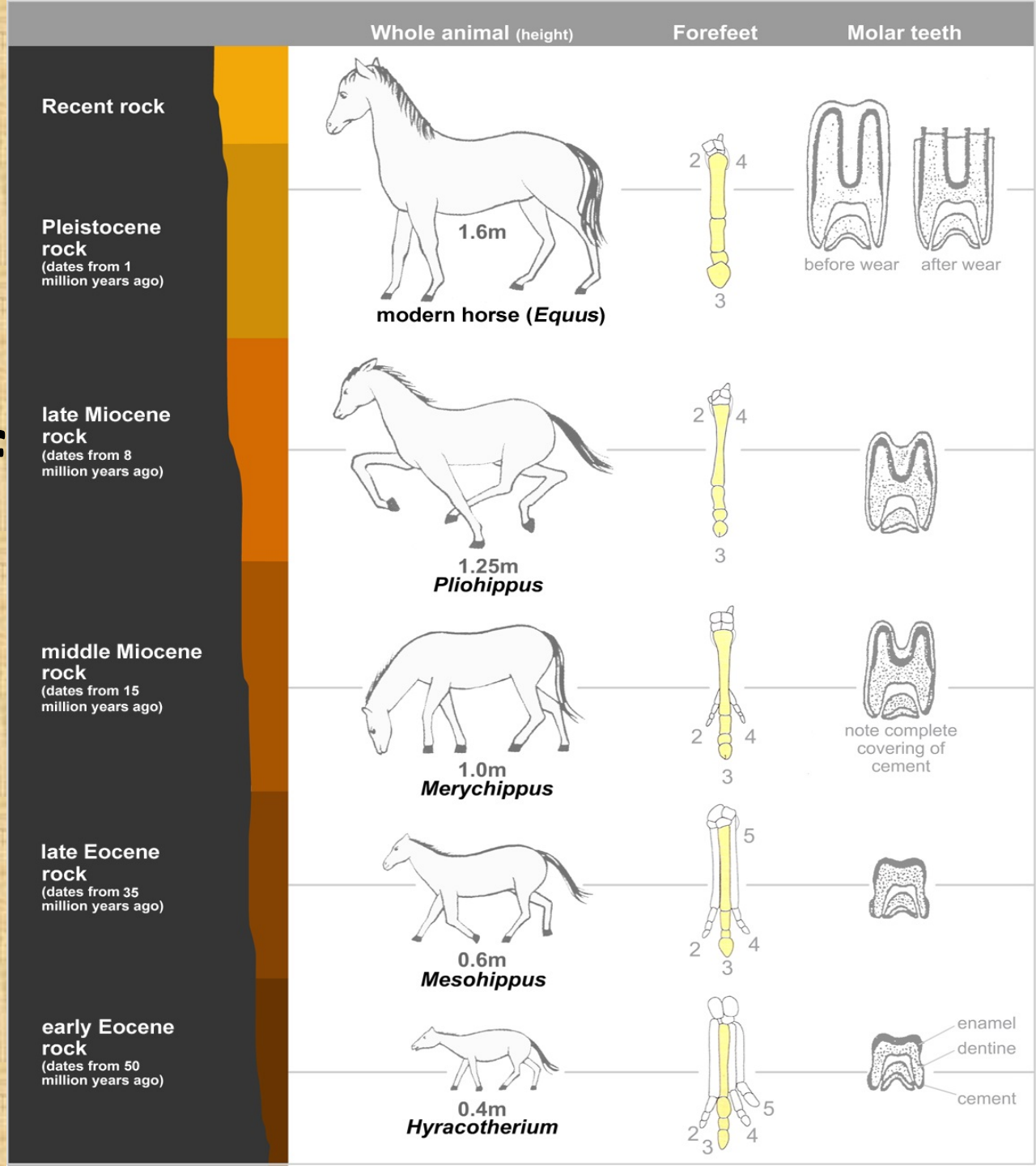
From one generation to the next, the struggle for resources (what Darwin called the "struggle for existence") will favor individuals with some variations over others and thereby change the frequency of traits within the population. This process is natural selection. The traits that confer an advantage to those individuals who leave more offspring are called *adaptations*.

Natural Selection

- ***Adaptation***: **A change in an organism over time that helps it to survive in its environment.**

- Katydid from Costa Rica

- This image shows a representative sequence, but should not be construed to represent a "straight-line" evolution of the horse. Reconstruction, left forefoot skeleton (third digit emphasized yellow) and longitudinal section of molars of selected prehistoric horses



Natural Selection

The Process of Natural Selection

In order for natural selection to operate on a trait, the trait must possess heritable variation and must confer an advantage in the competition for resources. If one of these requirements does not occur, then the trait does not experience natural selection. (We now know that such traits may change by other evolutionary mechanisms that have been discovered since Darwin's time.)

Natural Selection

Natural selection operates by comparative advantage, not an absolute standard of design. "…as natural selection acts by competition for resources, it adapts the inhabitants of each country only in relation to the degree of perfection of their associates" (Charles Darwin, On the Origin of Species, 1859).

Natural Selection

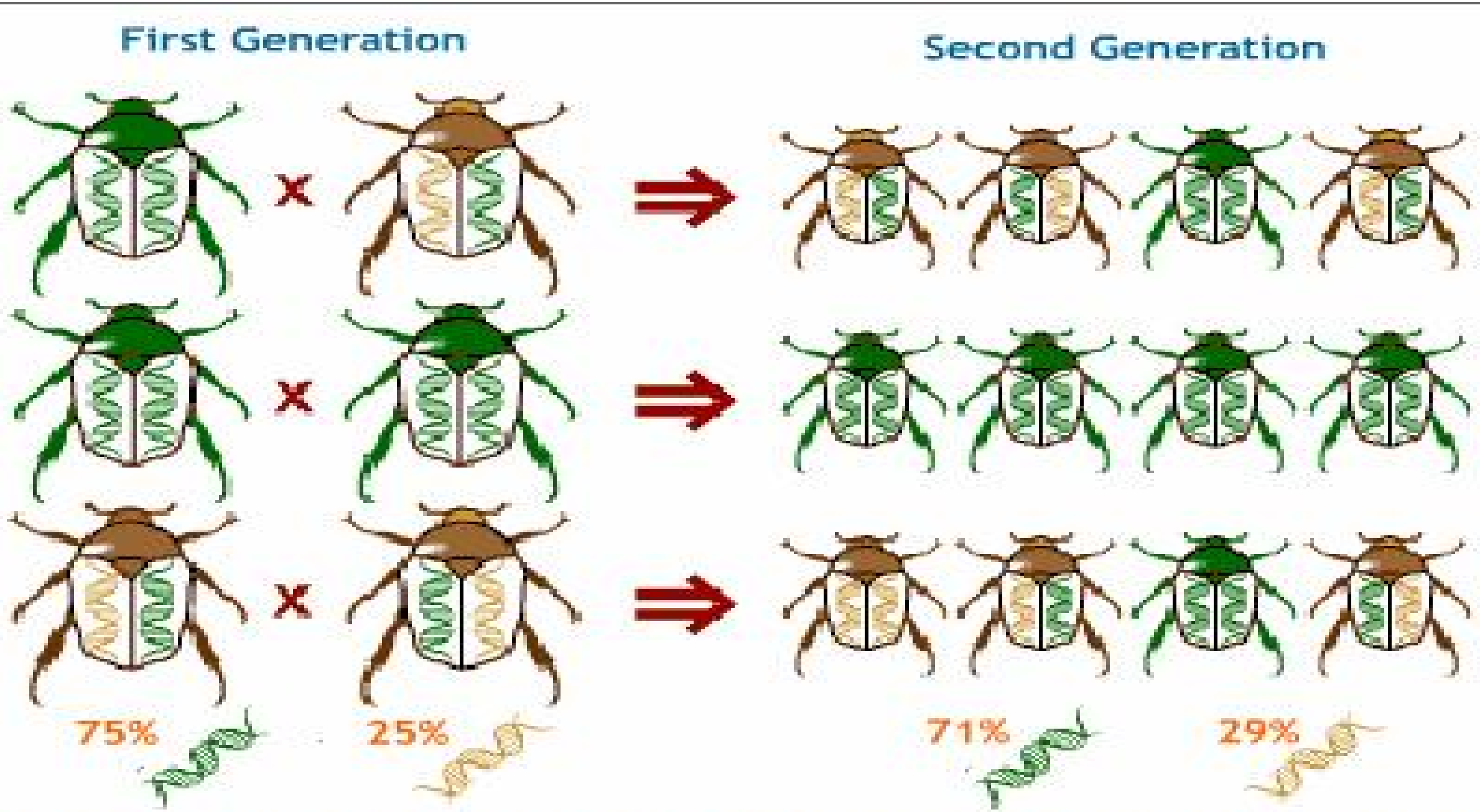
During the twentieth century, genetics was integrated with Darwin's mechanism, allowing us to evaluate natural selection as the differential survival and reproduction of genotypes, corresponding to particular phenotypes.

Natural Selection

Natural selection can only work on existing variation within a population. Such variations arise by mutation, a change in some part of the genetic code for a trait. Mutations arise by chance and without foresight for the potential advantage or disadvantage of the mutation. In other words, variations do not arise because they are needed.

Natural Selection

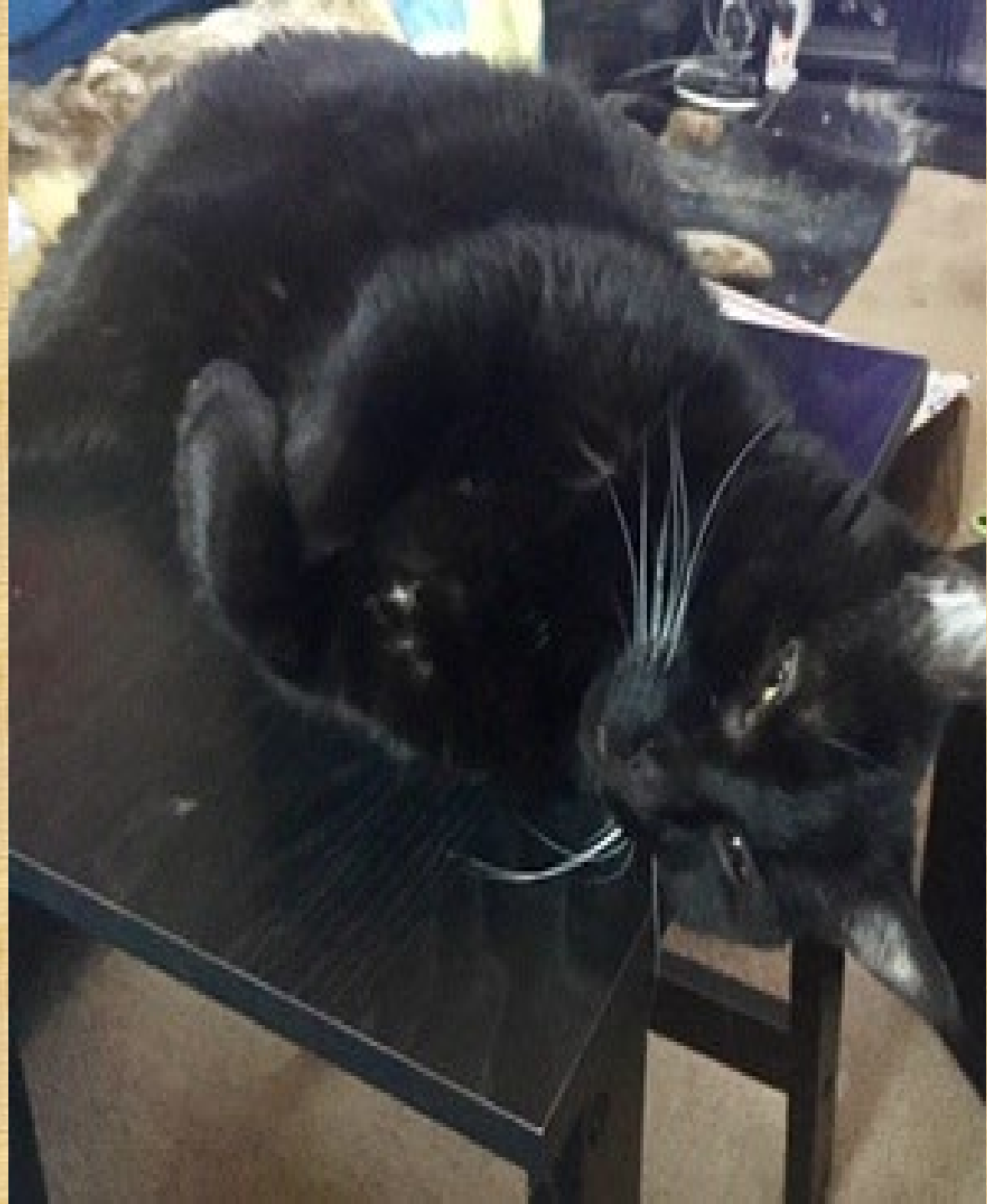
- **Variation: Differences in individual living things from each other.**


First Generation
Second Generation
75%
25%
71%
29%
The Frequency of an Inherited Trait Changed Over Generations

Natural Selection

- **Fitness: The ability of a living thing to survive and reproduce in its environment.**

Natural Selection



Natural Selection

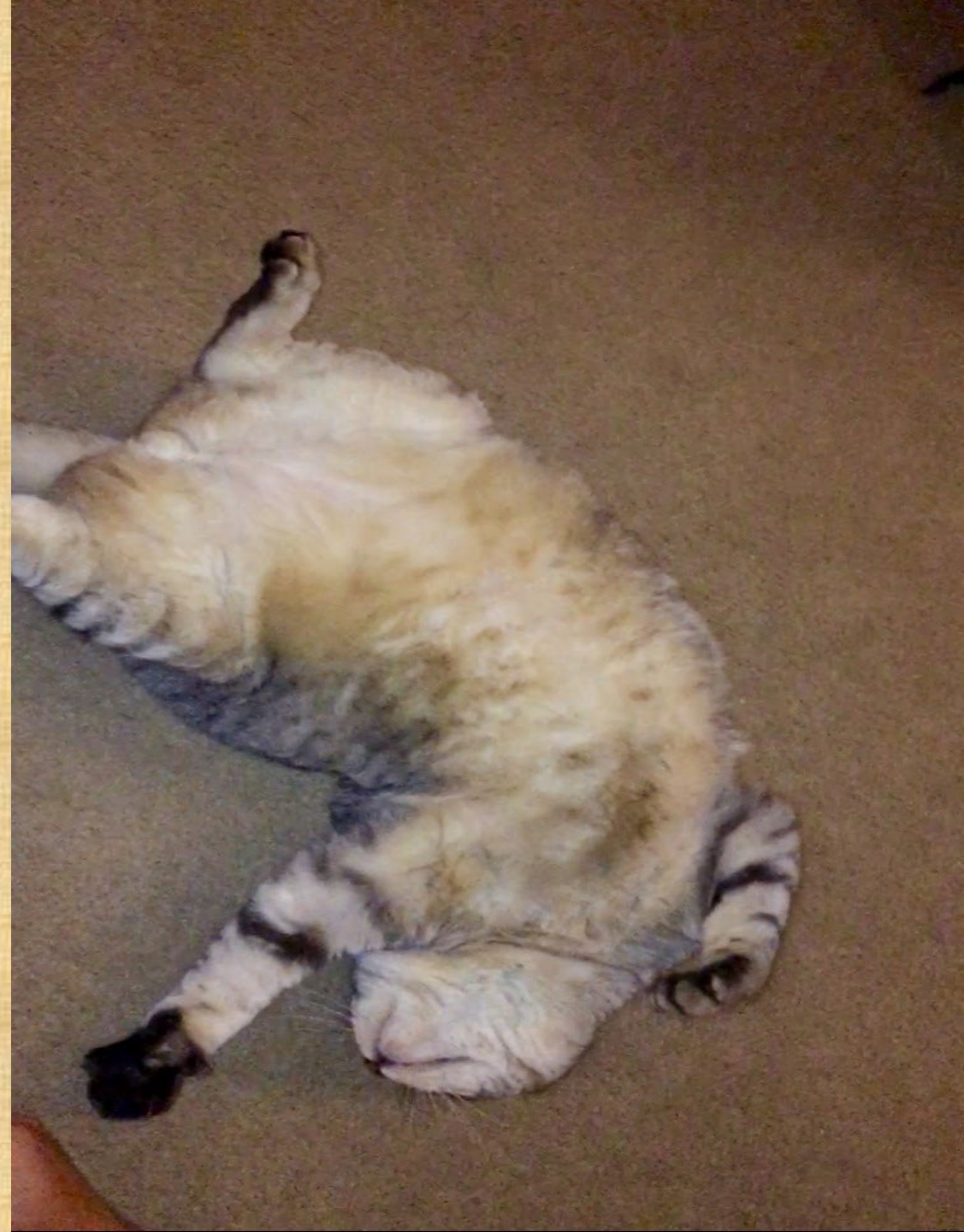
Natural Selection

Natural Selection

- **Structural-body structure**
  (example: porcupine's quills)

Natural Selection

Natural Selection



Natural Selection

- **Camouflage: Appearance that is designed for hiding in the environment.**

Natural Selection

Natural Selection

Natural Selection

Natural Selection

Natural Selection

Natural Selection

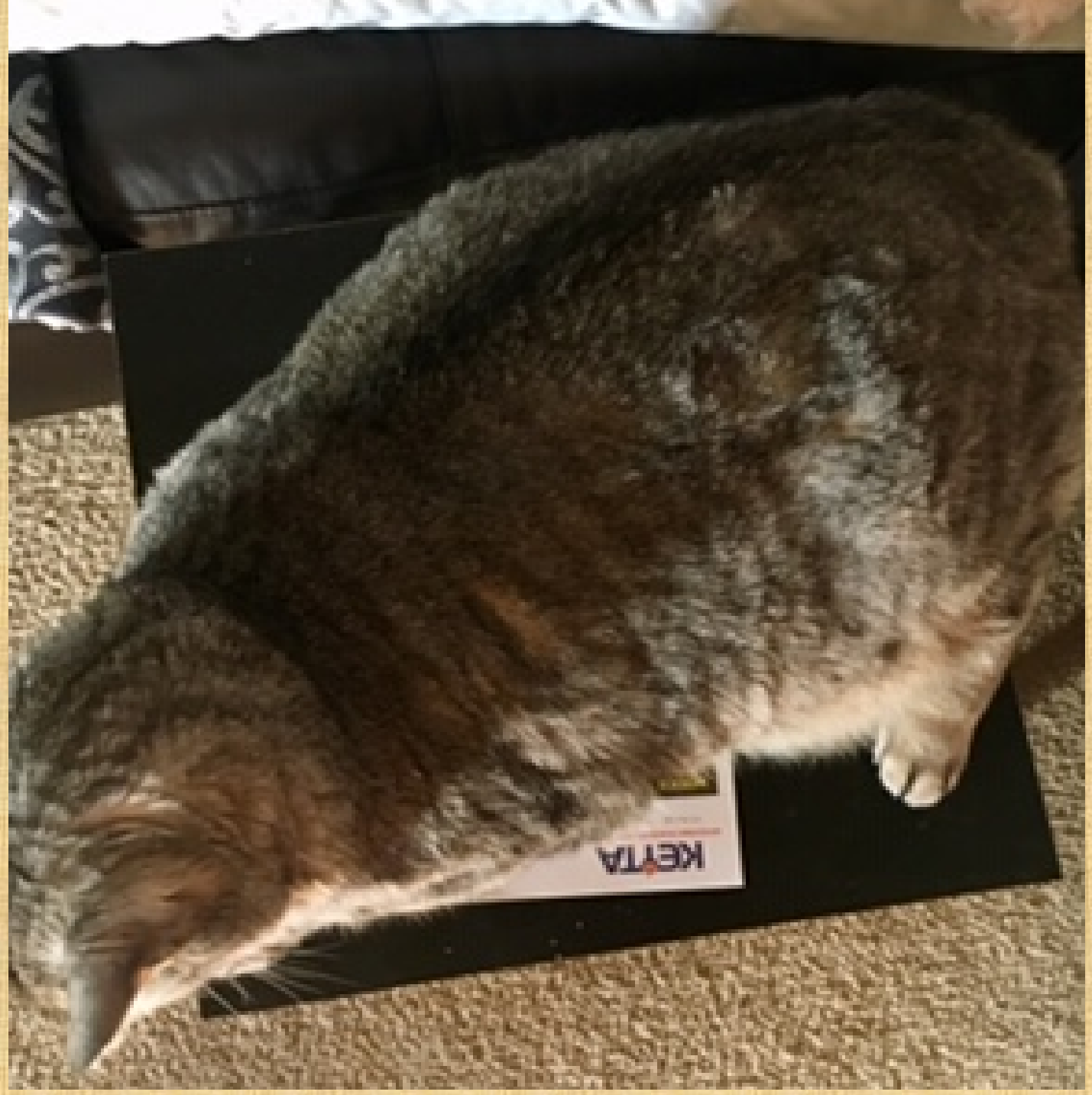
Natural Selection

Natural Selection

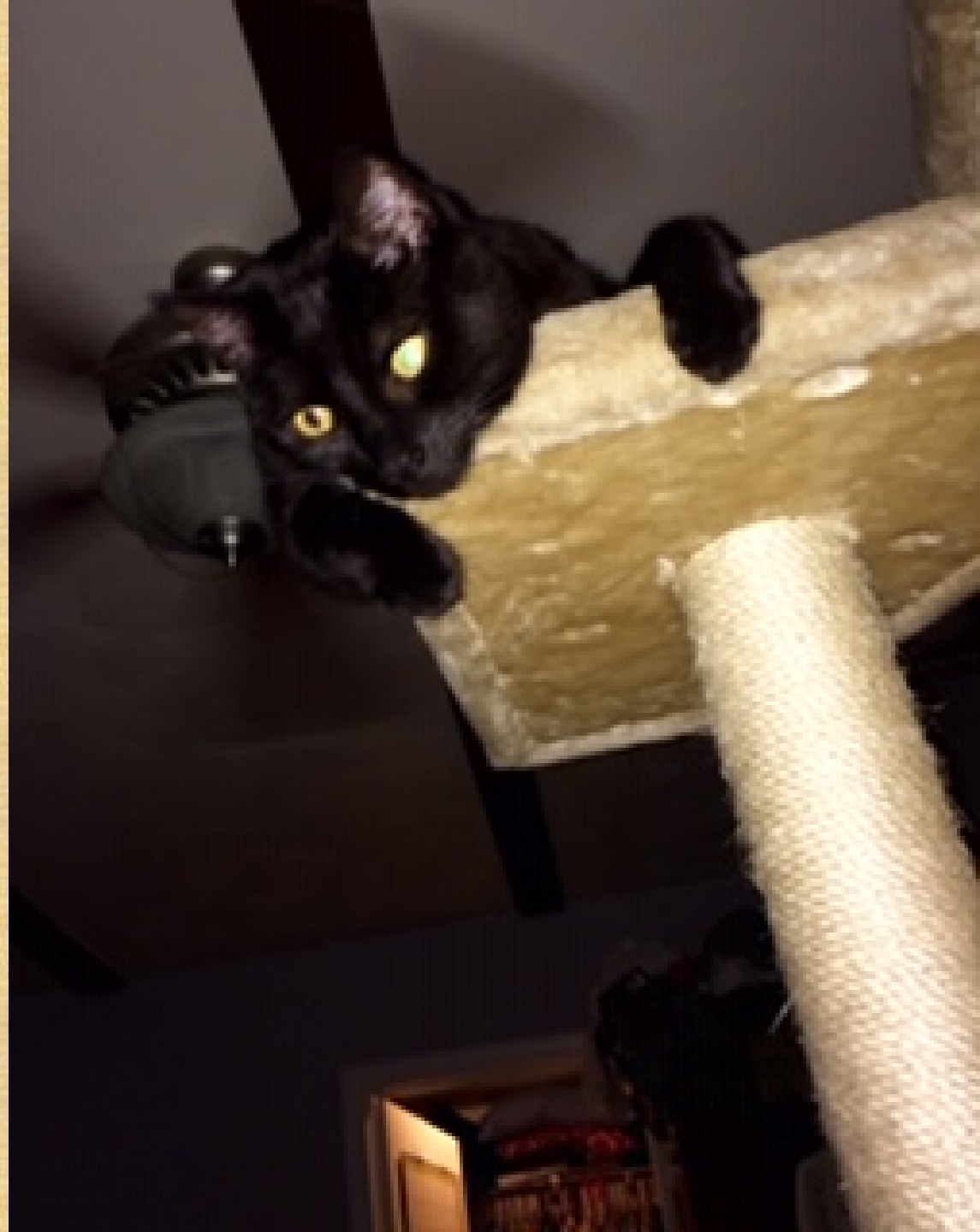
- **Competition: Living things striving for food, living space, mates, and other resources.**

Natural Selection

Natural Selection



Natural Selection



Natural Selection

- **Functional- the way body functions are carried out. (example: how we use our lungs to breathe.)**

Natural Selection

Natural Selection

Natural Selection

- **Behavioral- how living things react to the environment. (example: how wolves hunt in packs.)**

Natural Selection

Natural Selection

Summary

Darwin's theory of evolution fundamentally changed the direction of future scientific thought, though it was built on a growing body of thought that began to question prior ideas about the natural world.

Natural Selection

Summary

The core of Darwin's theory is natural selection, a process that occurs over successive generations and is defined as the differential reproduction of genotypes.

Natural Selection

Summary

Natural selection requires heritable variation in a given trait, and differential survival and reproduction associated with possession of that trait.

Examples of natural selection are well-documented, both by observation and through the fossil record.

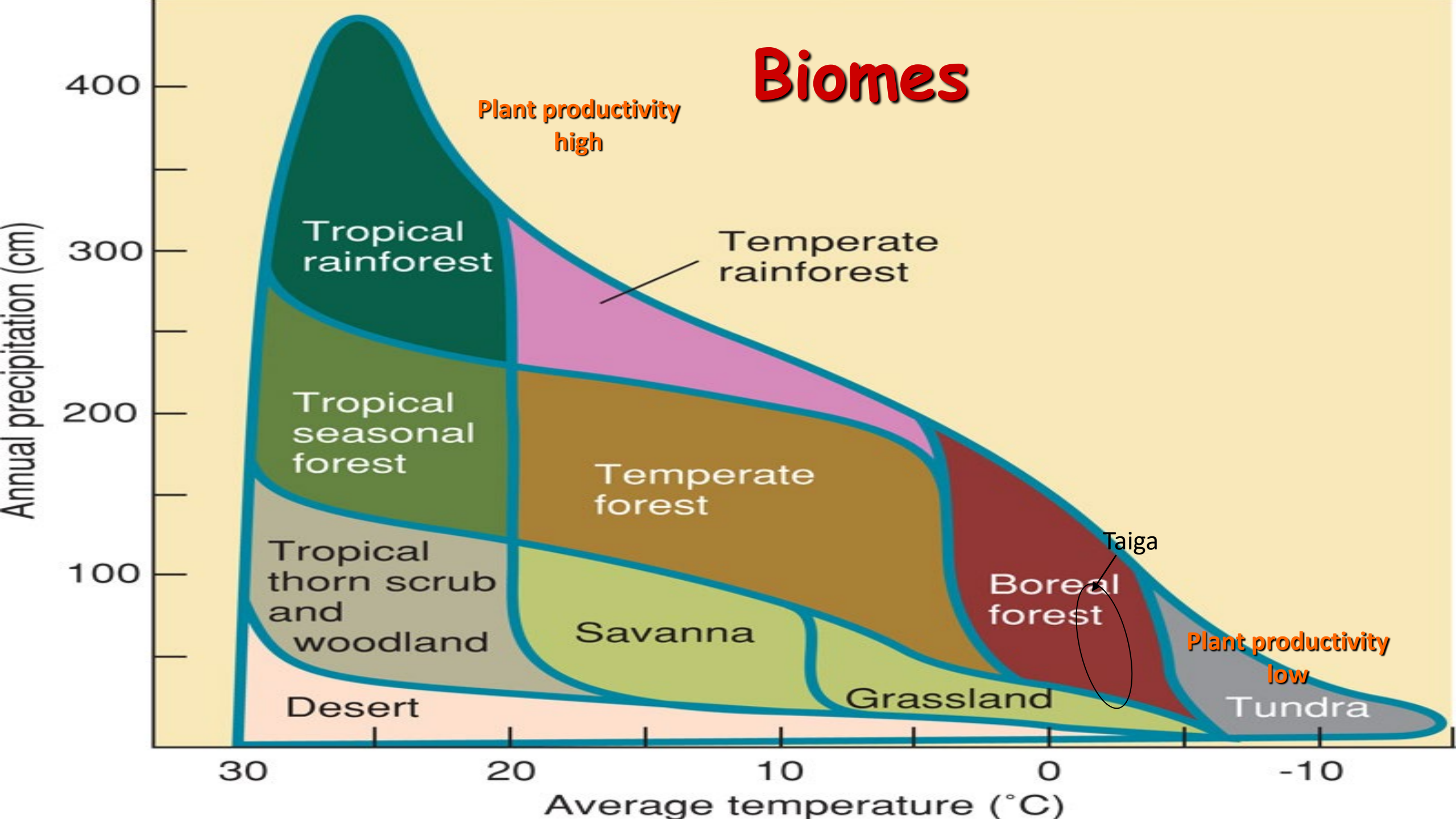
Selection acts on the frequency of traits, and can take the form of stabilizing, directional, or diversifying selection

Natural Selection

End

https://lessons.ummu.umich.edu/2k/gc1_self_tests/natural_selection

Biomes


Plant productivity high
Tropical rainforest
Temperate rainforest
Tropical seasonal forest
Temperate forest
Tropical thorn scrub and woodland
Savanna
Boreal forest
Taiga
Grassland
Tundra
Desert
Plant productivity low
Annual precipitation (cm)
400
300
200
100
30
20
10
0
-10
Average temperature (˚C)