EVOLUTION & 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. ***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*

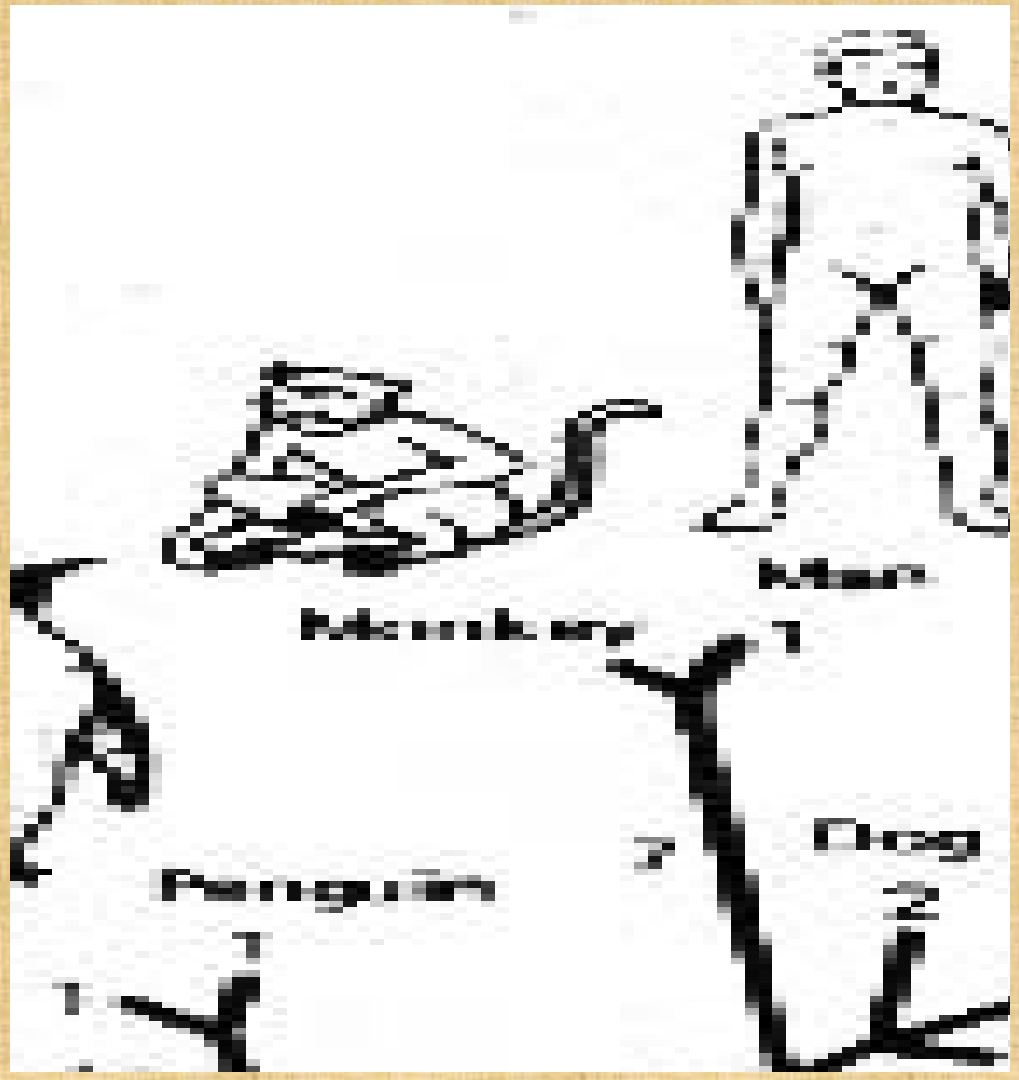
A Fascinatingly Disturbing Thought! Dr. Neil DeGrasse Tyson

https://www.youtube.com/watch?v=aTZyVZBtP70

12 minute talk

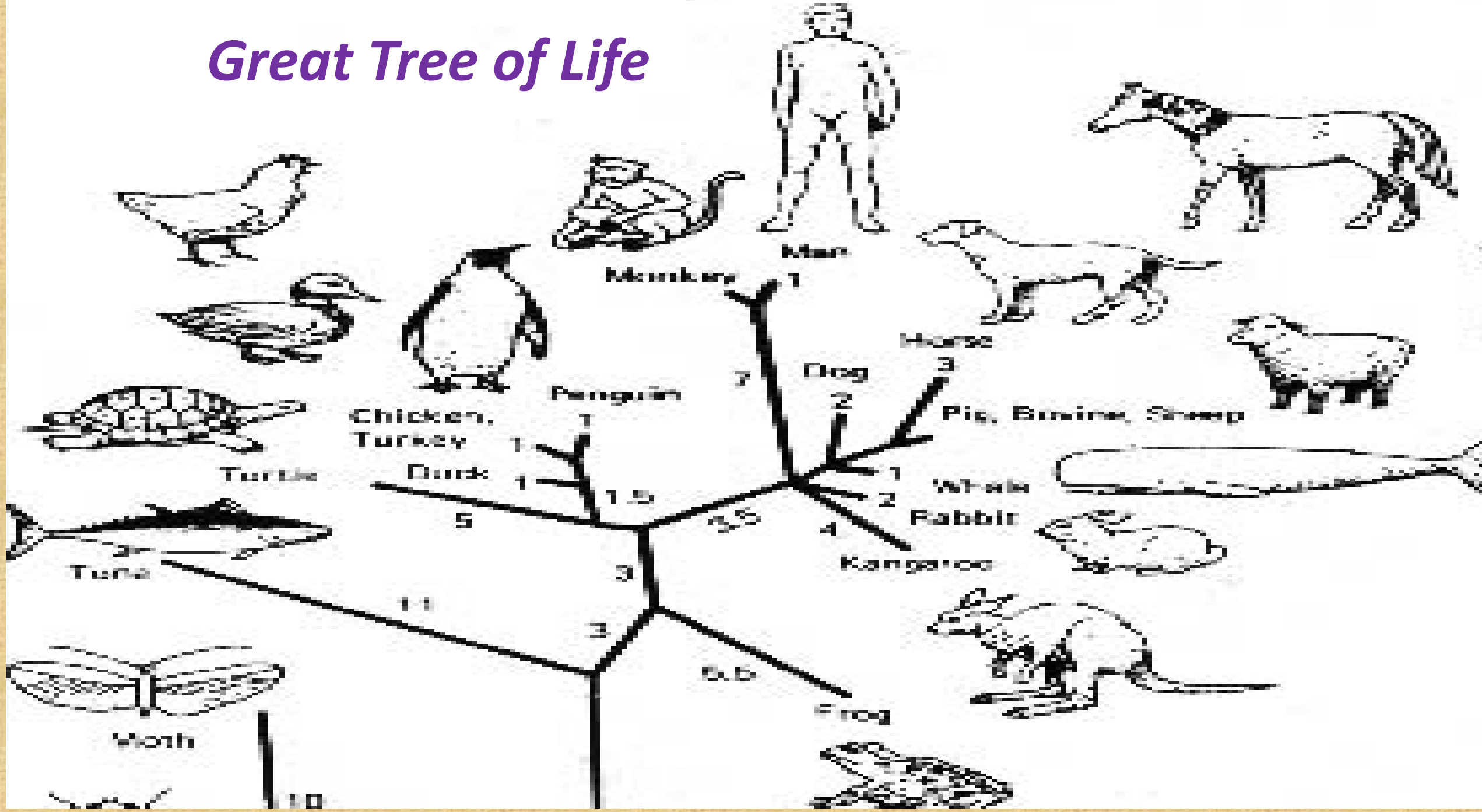
Natural Selection

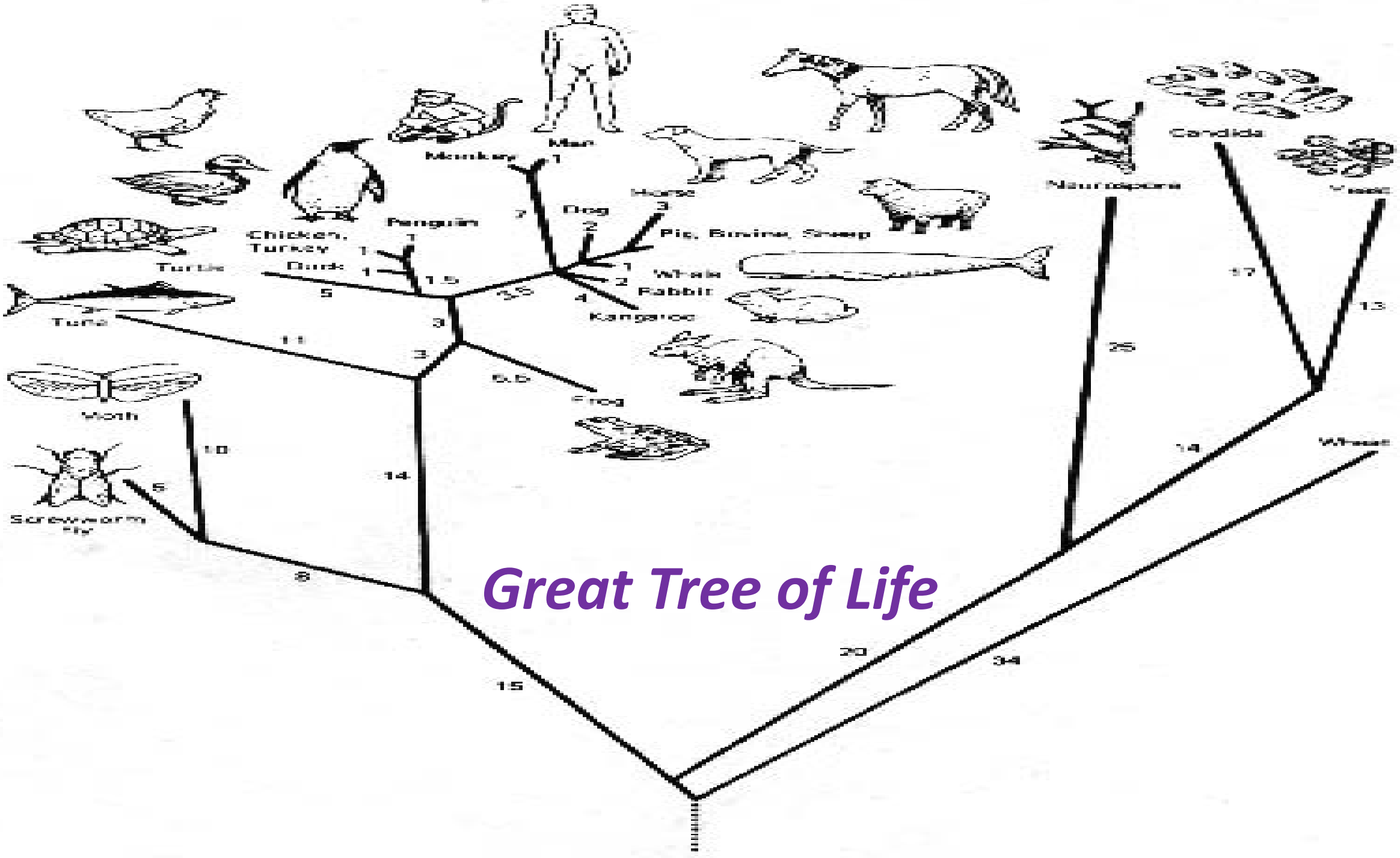
Great Tree of Life



Great Tree of Life

Great Tree of Life




Man
Monkey
Horse
Dog
Pig, Bovine, Sheep
Whale
Rabbit
Kangaroo
Penguin
Chicken, Turkey
Duck
Turtle
Tuna
Moth
Screwworm fly
Frog
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.

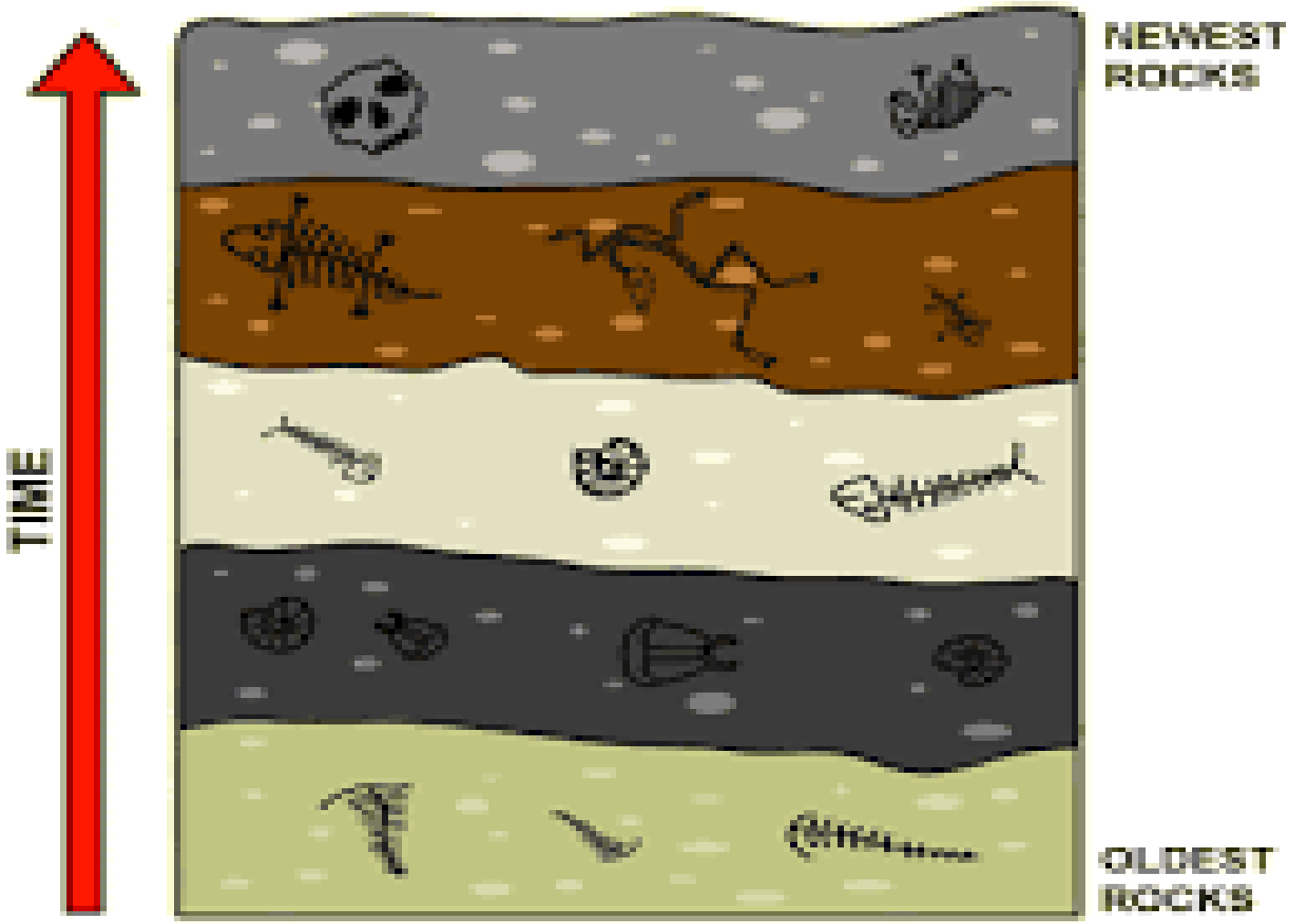
Natural Selection

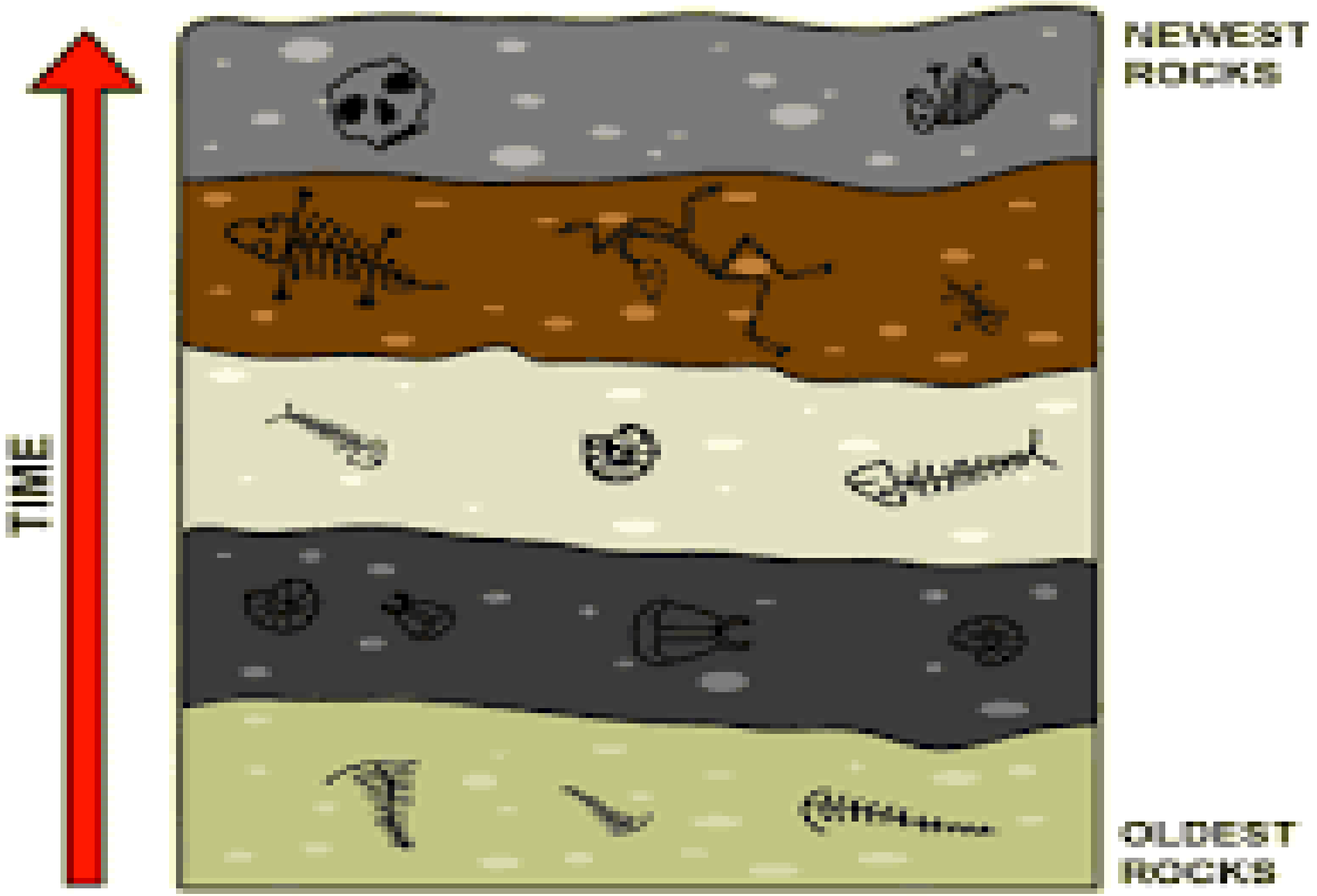
- **No one knew how old the earth was, but geologists were beginning to make estimates that the earth was considerably older than explained by biblical creation. Geologists were learning more about *strata*, or *layers formed by successive periods of the deposition of sediments*.**

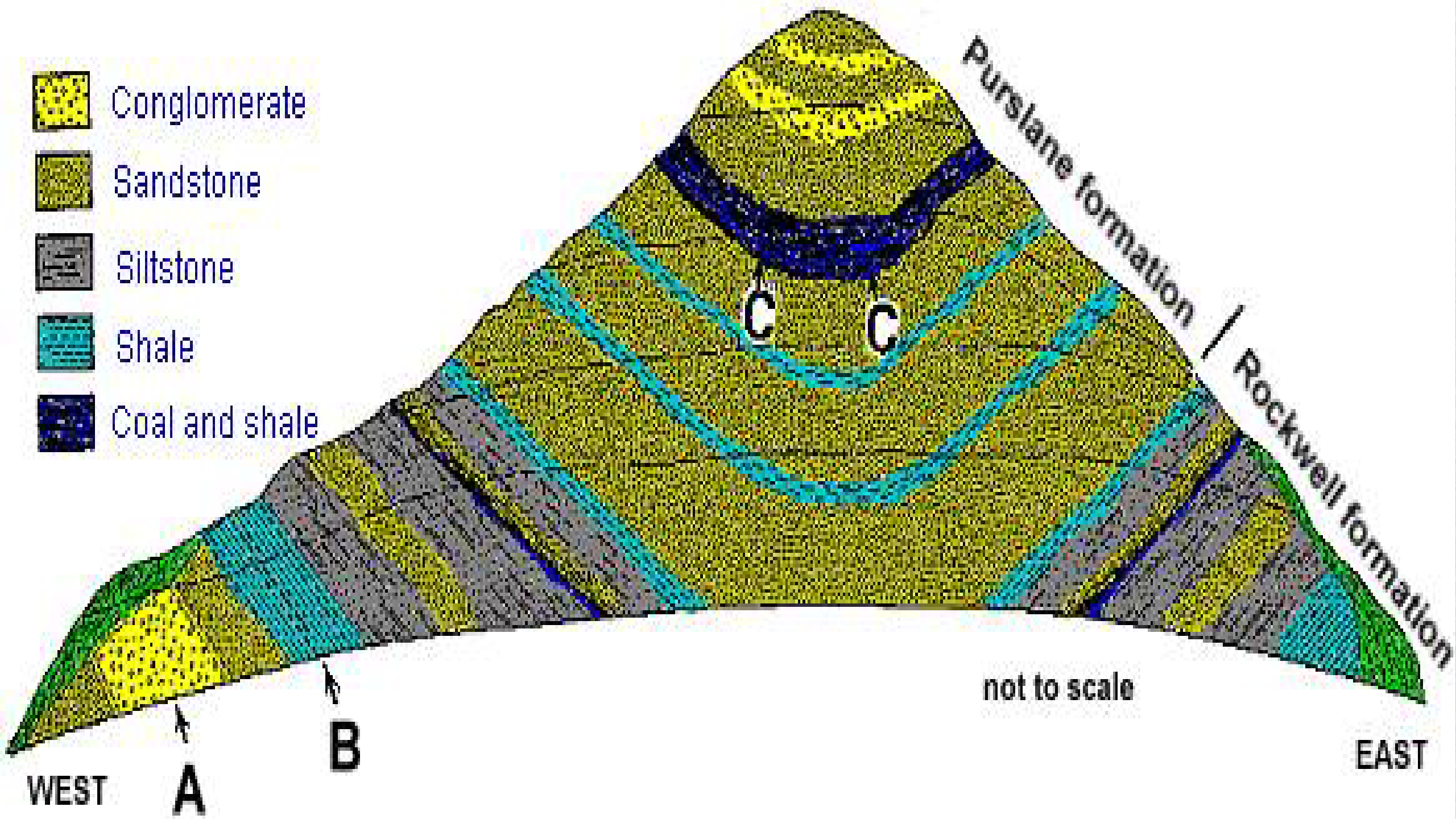
- **This suggested a time sequence, with younger strata overlying older strata.**

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

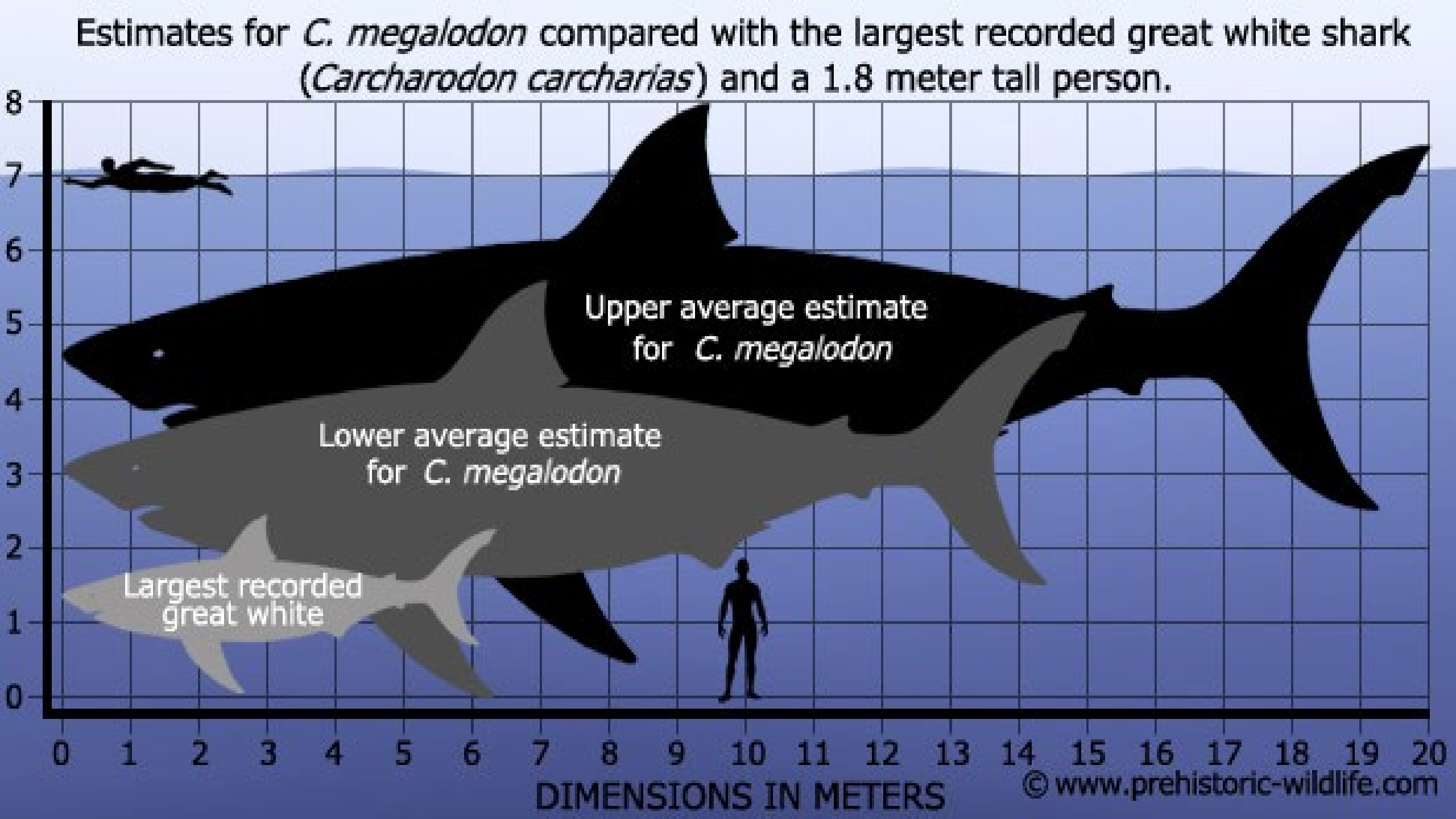

EAST
68
40
©Moraliza S Lowe

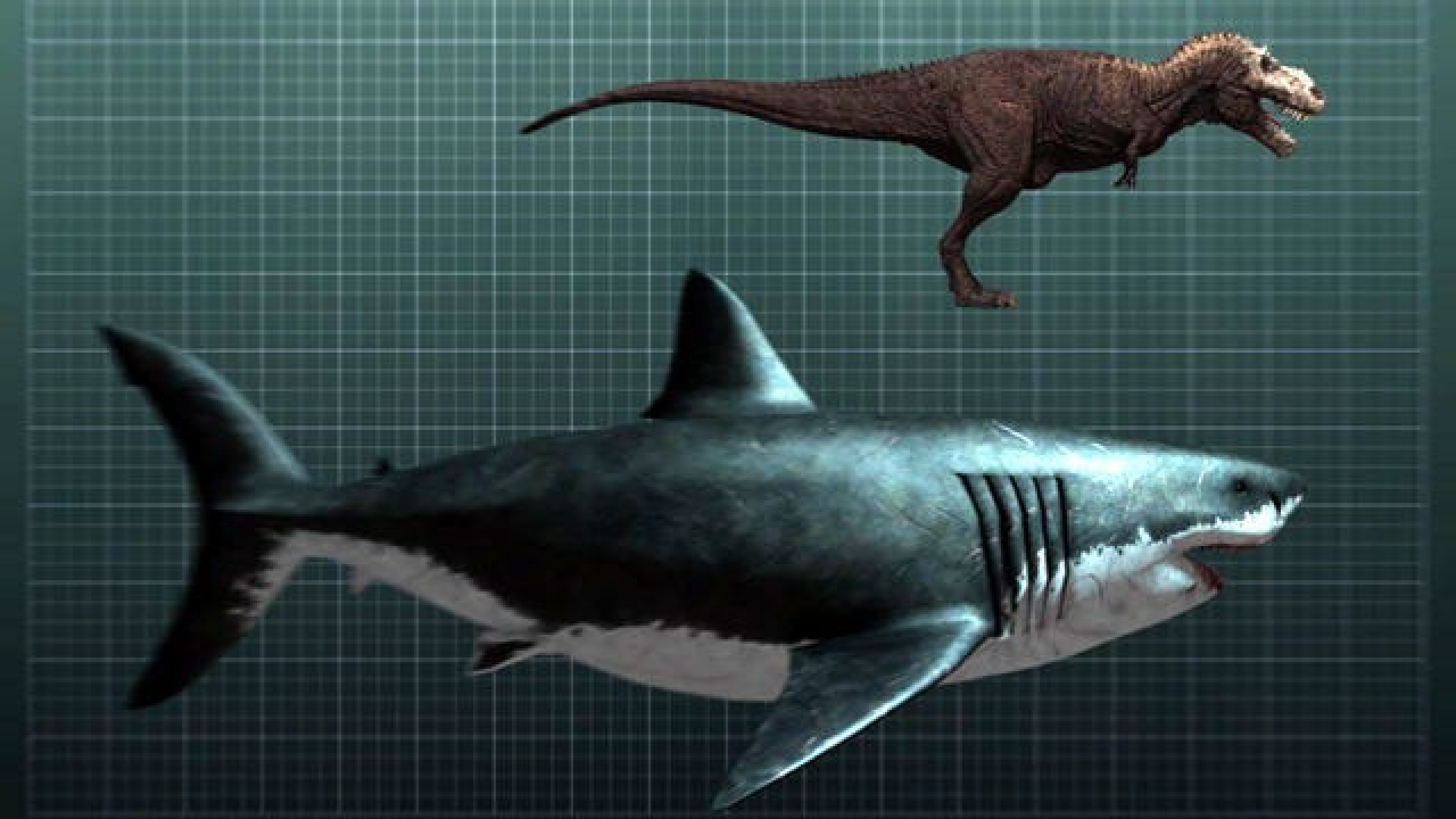
Natural Selection

- **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

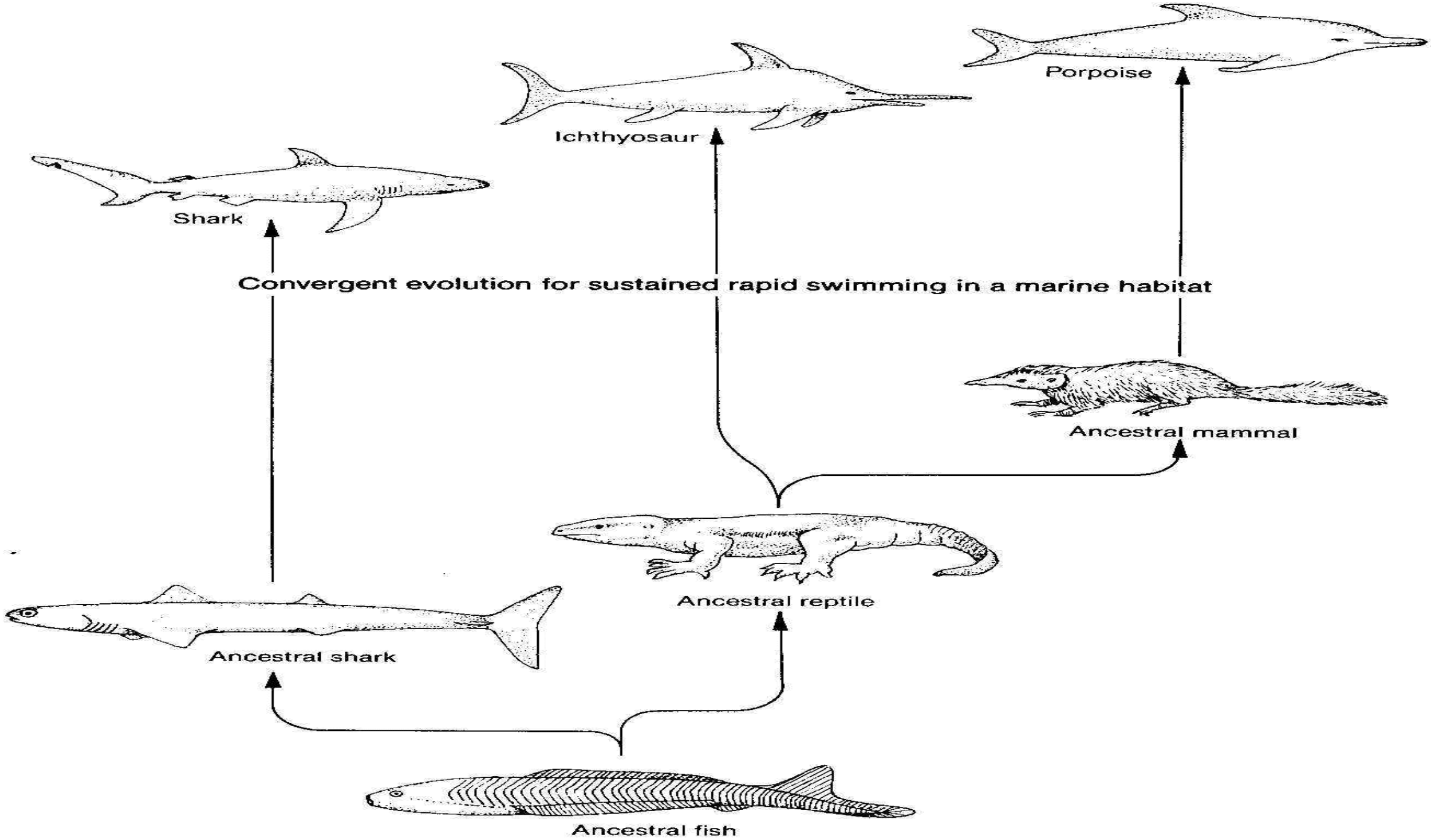
- **Darwin was influenced by observations made during his youthful voyage as naturalist on the survey ship *Beagle*. On the *Galapagos Islands* he noticed the slight variations that made tortoises from different islands recognizably distinct. He also observed a whole array of unique finches, the famous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

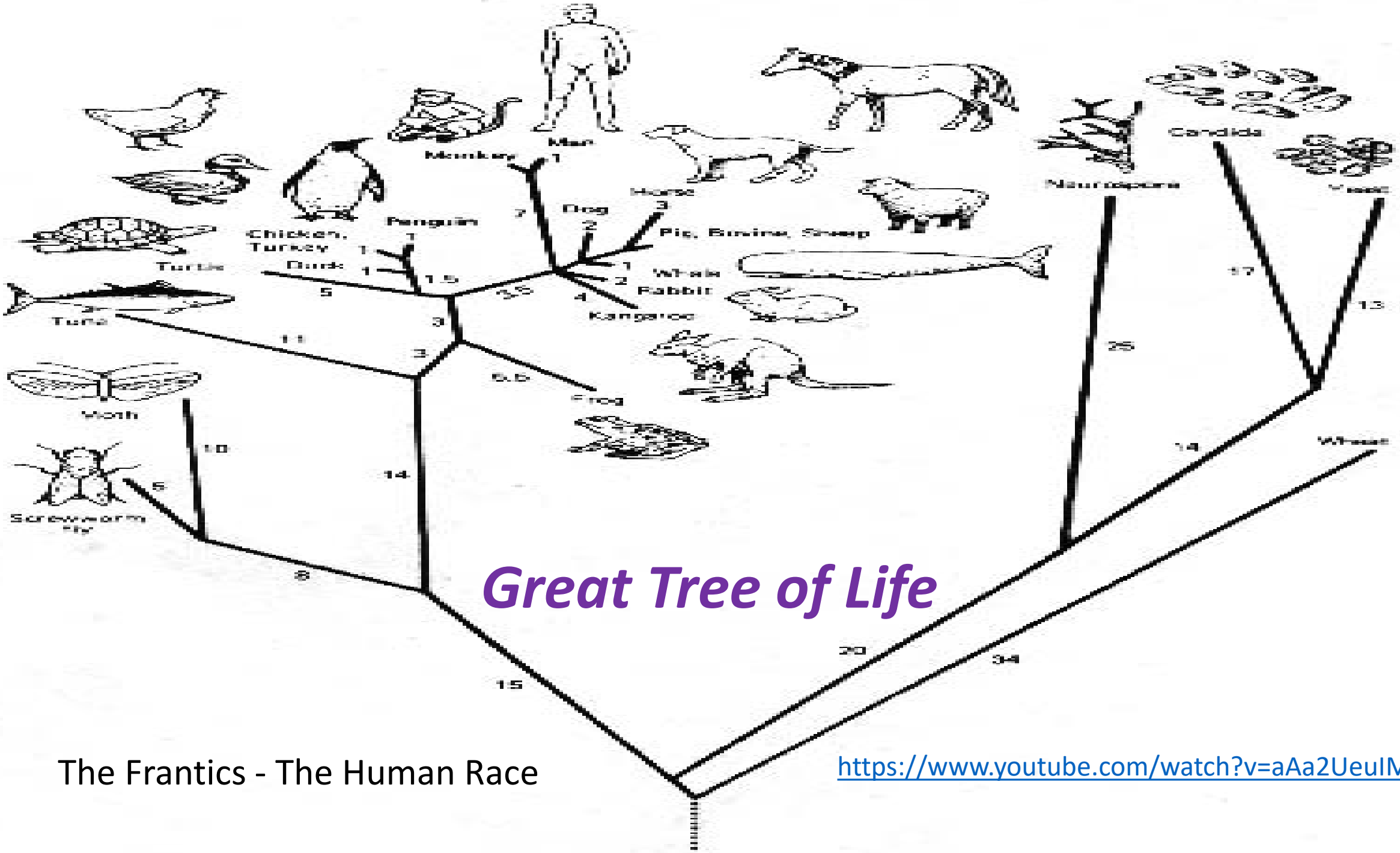
Darwin's Theory

•<u>Species</u> (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

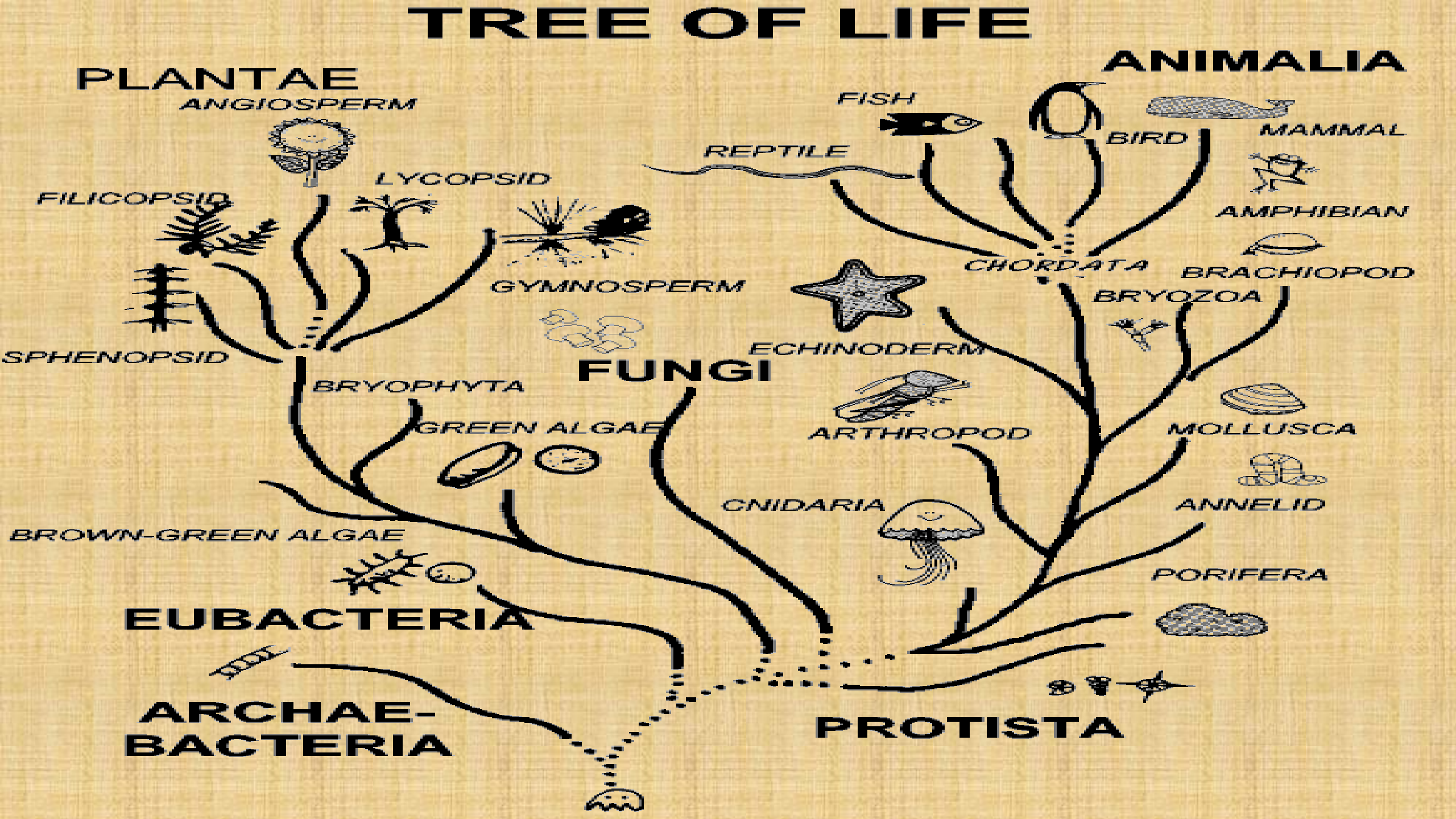
•All organisms share common ancestors with other organisms. Over time, populations may divide into different species, which share a common ancestral population. Far enough back in time, any pair of organisms shares a common ancestor. For example, humans shared a common ancestor with chimpanzees about 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.

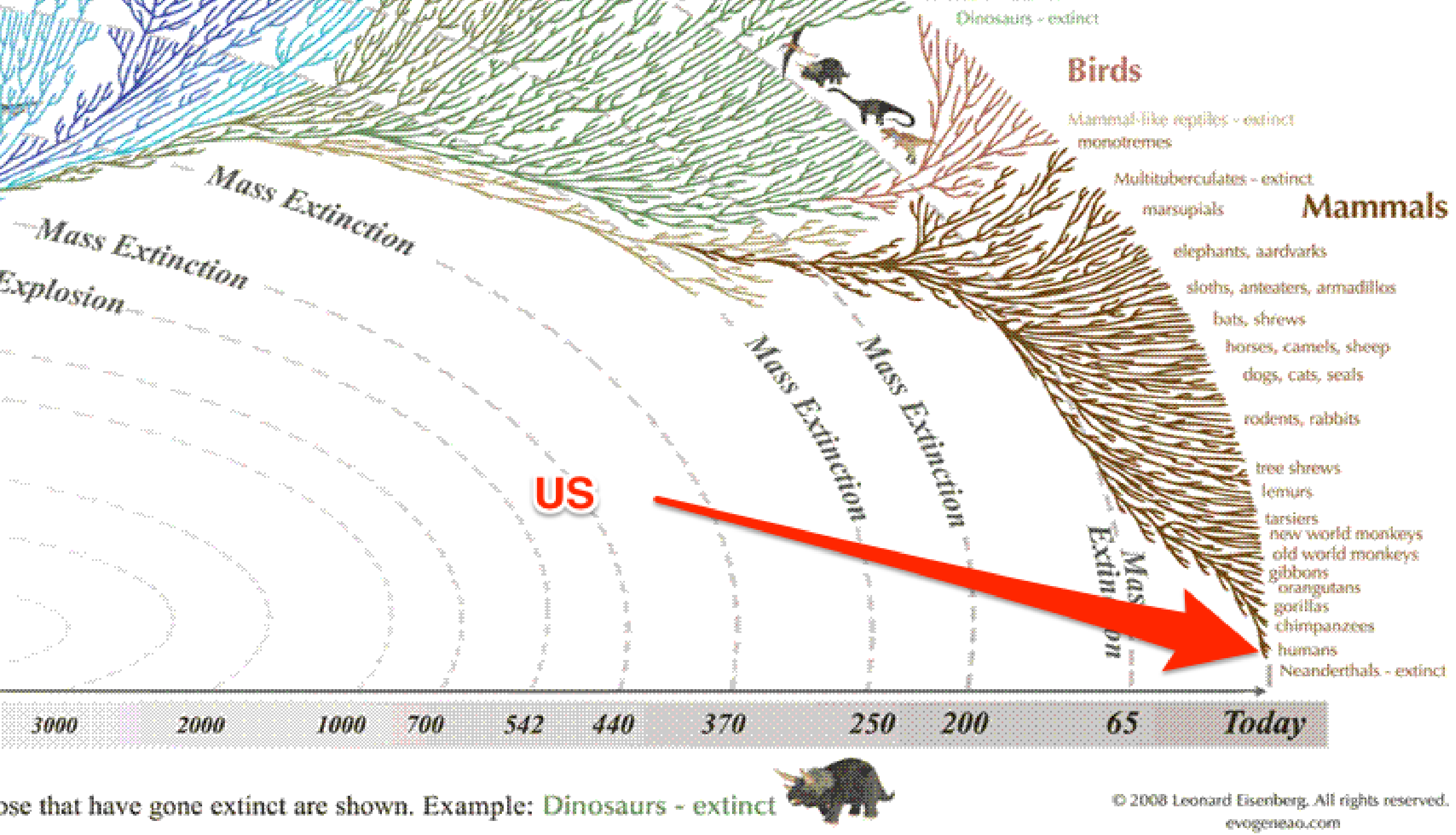


The Frantics - The Human Race

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
ANIMALIA
FISH
REPTILE
BIRD
MAMMAL
AMPHIBIAN
CHORDATA
BRACHIOPOD
BRYOZOA
ECHINODERM
FUNGI
ARTHROPOD
MOLLUSCA
CNIDARIA
ANNELID
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

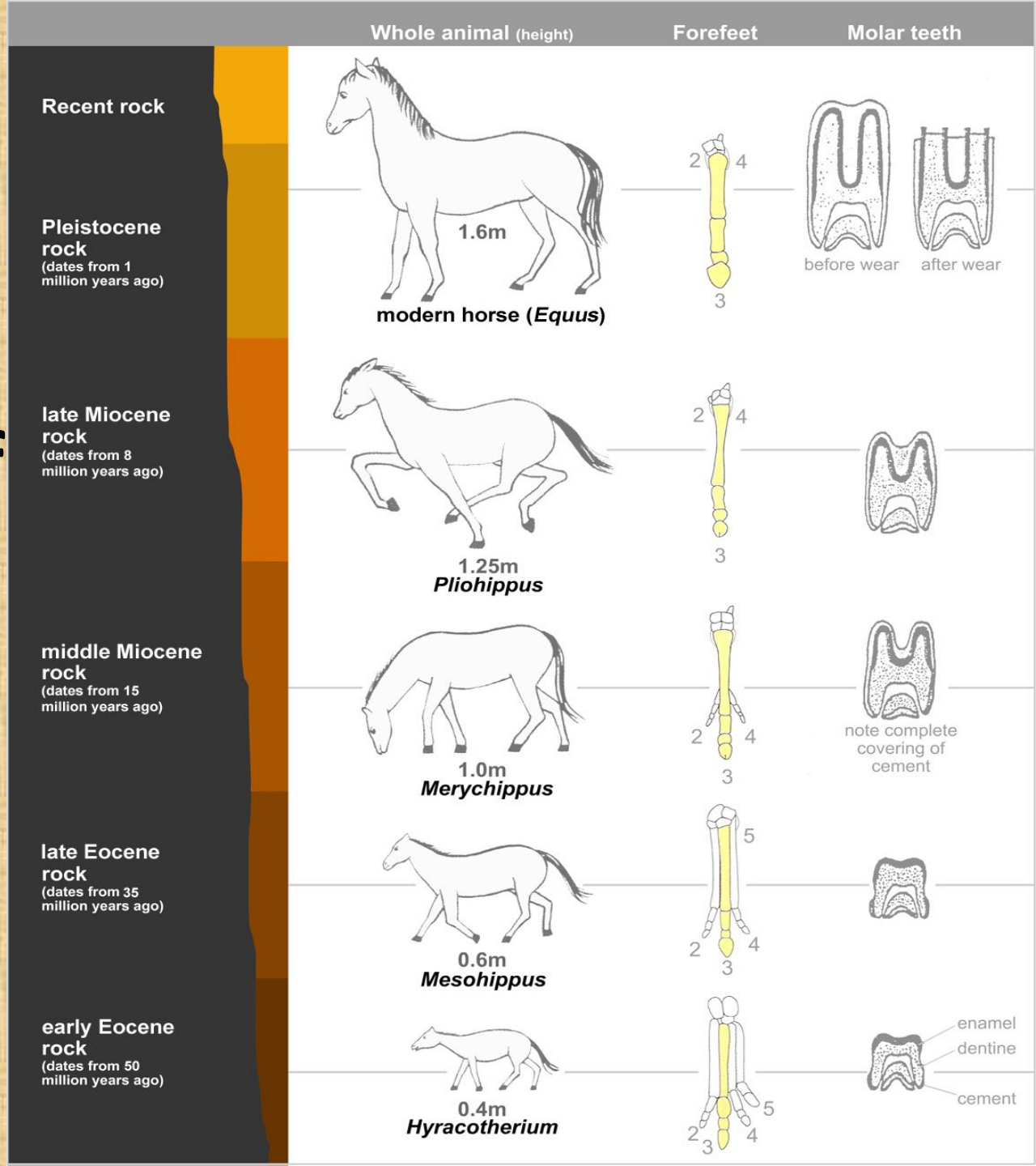
From one generation to the next, the struggle for resources (what Darwin called the "struggle for existence") will favor individuals with some variations over others and thereby change the frequency of traits within the population. This process is natural selection. The traits that confer an advantage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

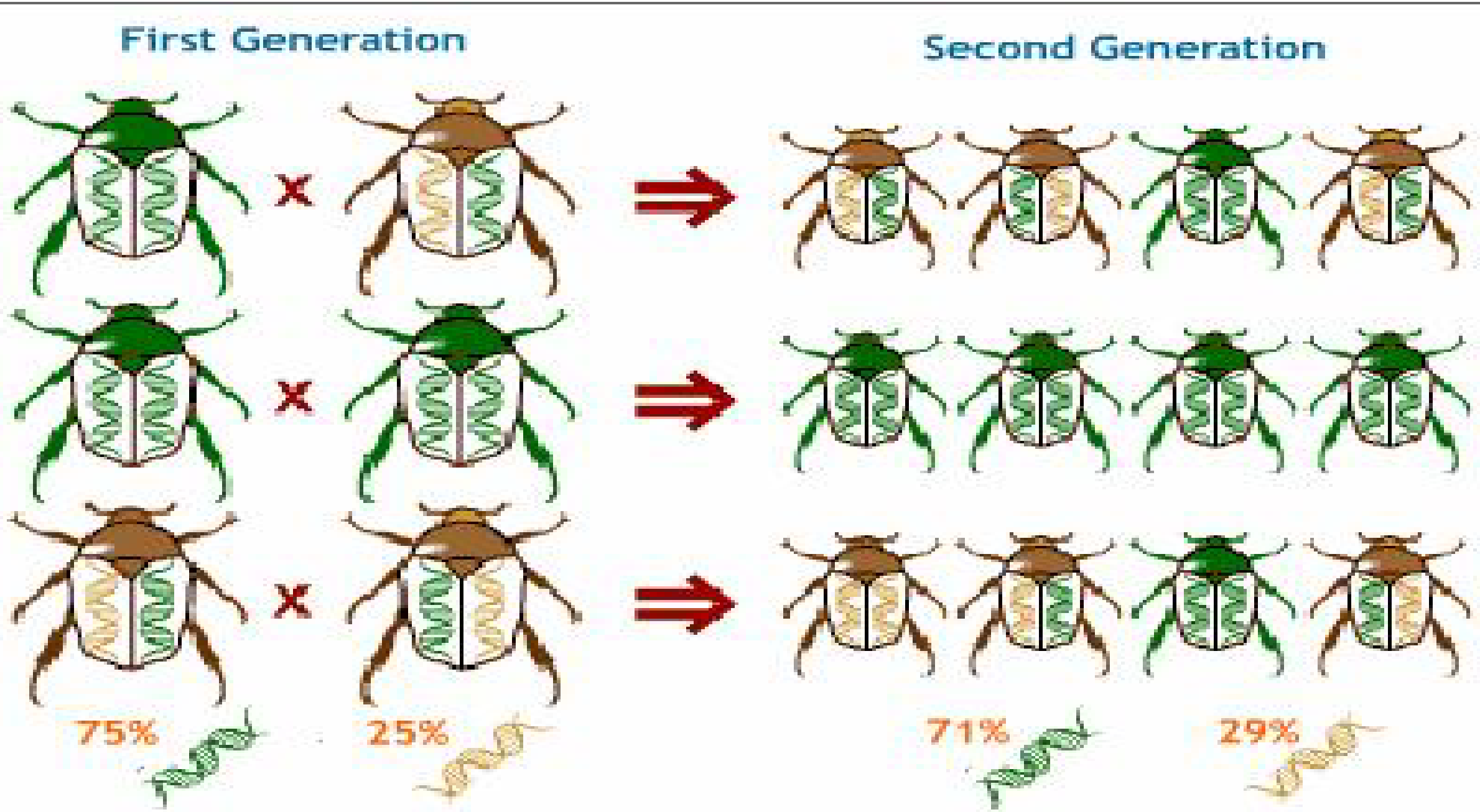
During the twentieth century, genetics was integrated with Darwin's mechanism, allowing us to evaluate natural selection as the differential survival and reproduction of genotypes, corresponding to particular phenotypes.

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

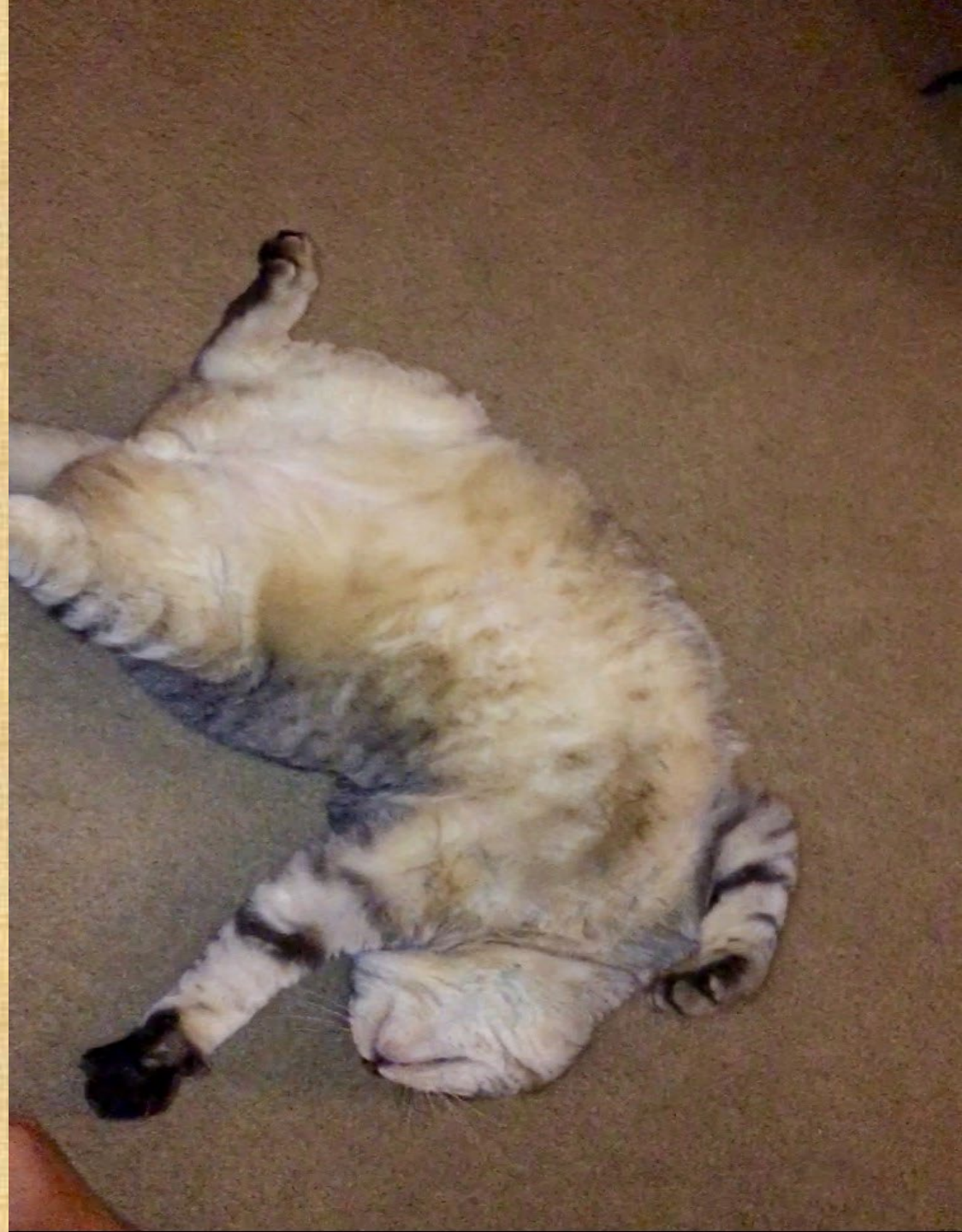
Natural Selection

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

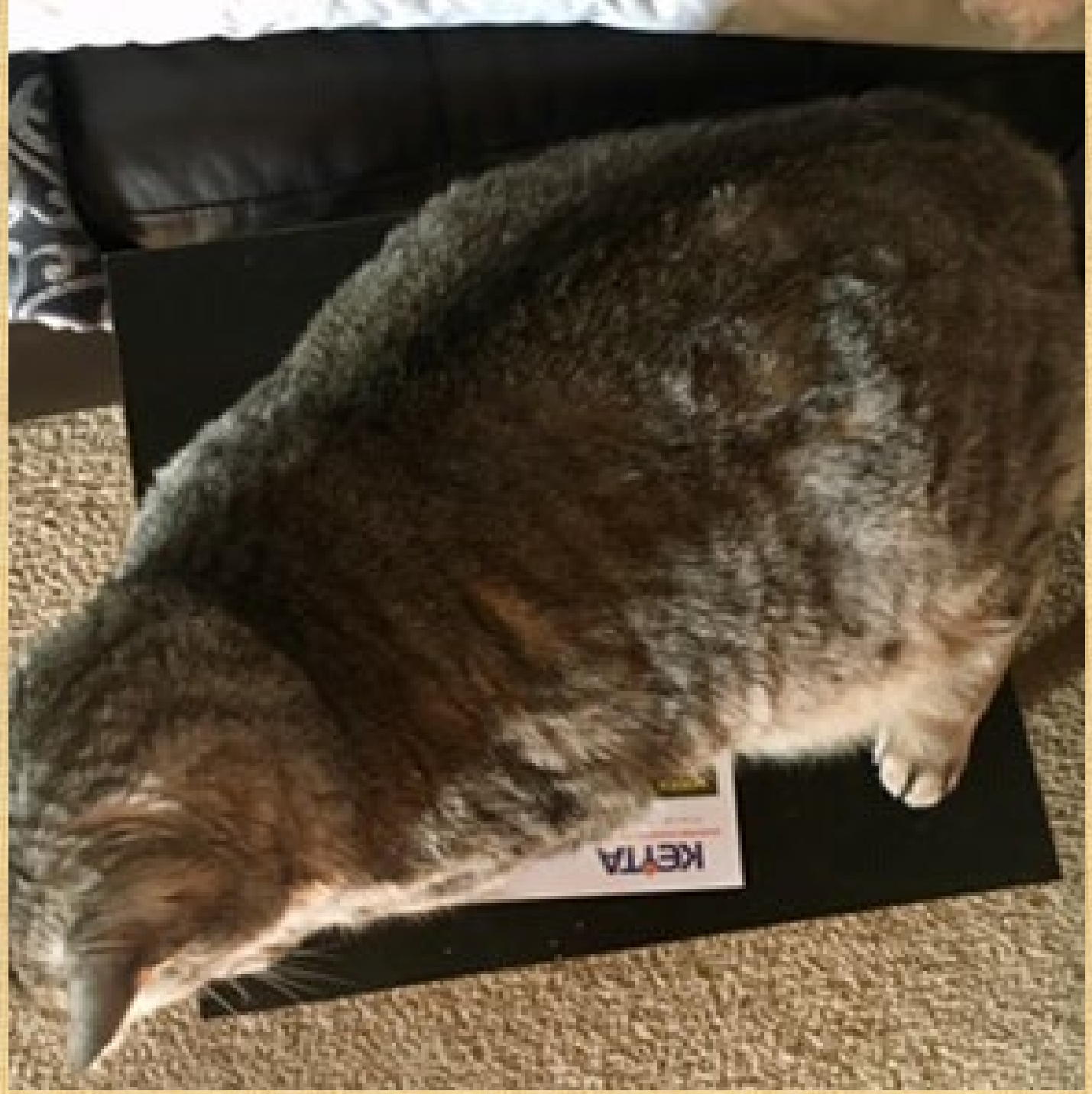
Natural Selection

Natural Selection

- **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.

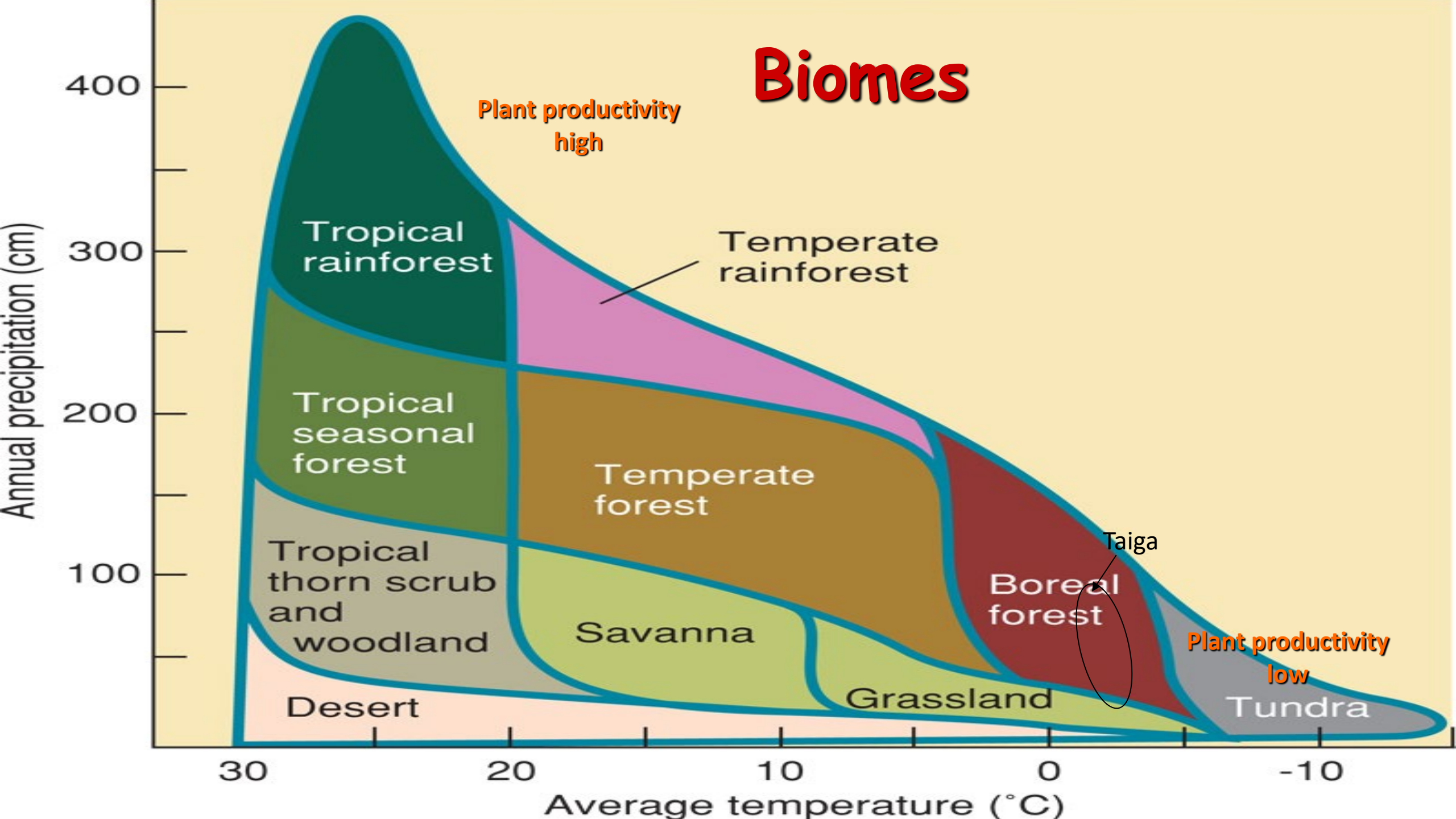
Selection acts on the frequency of traits, and can take the form of stabilizing, directional, or diversifying selection

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)