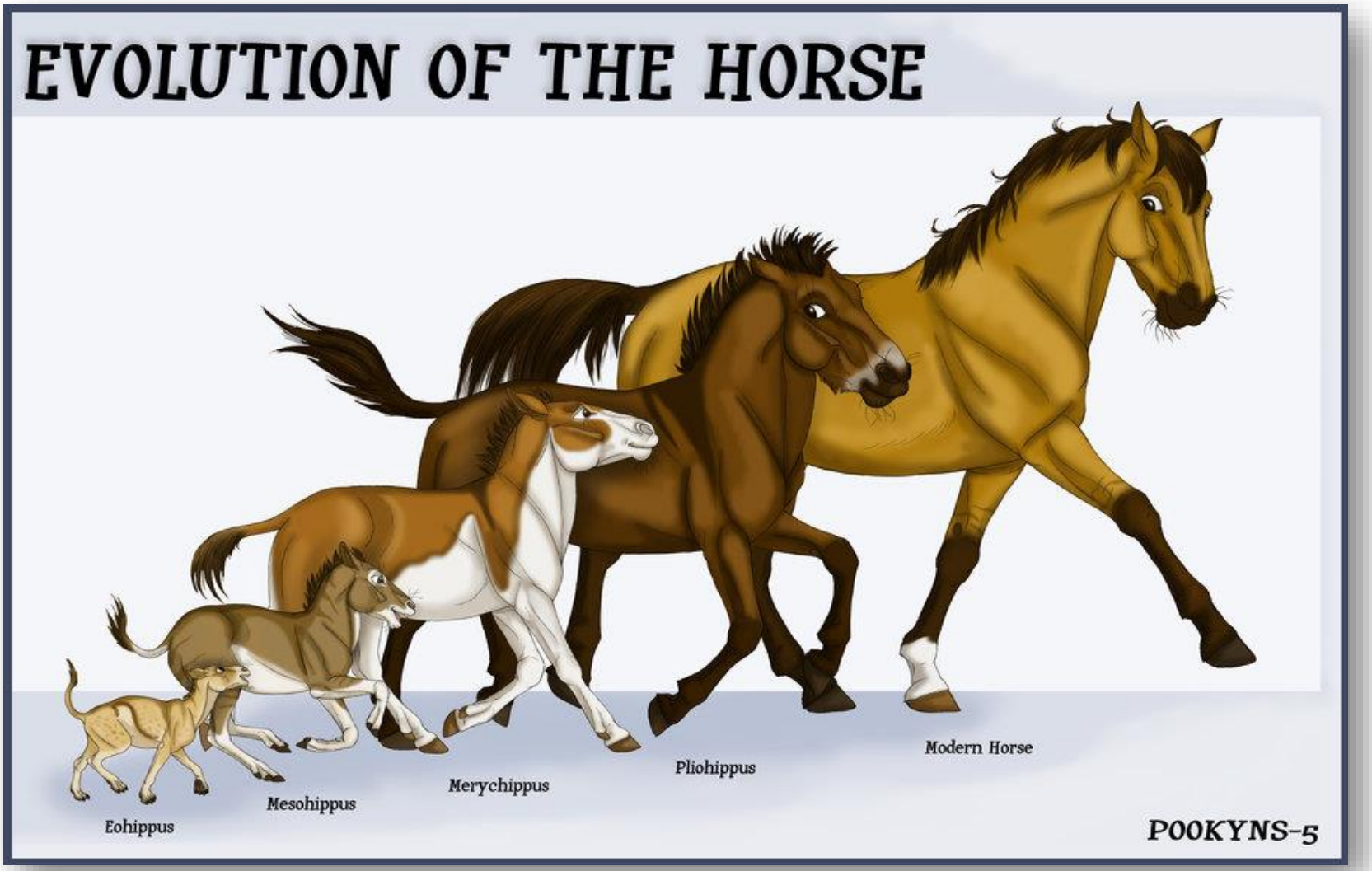
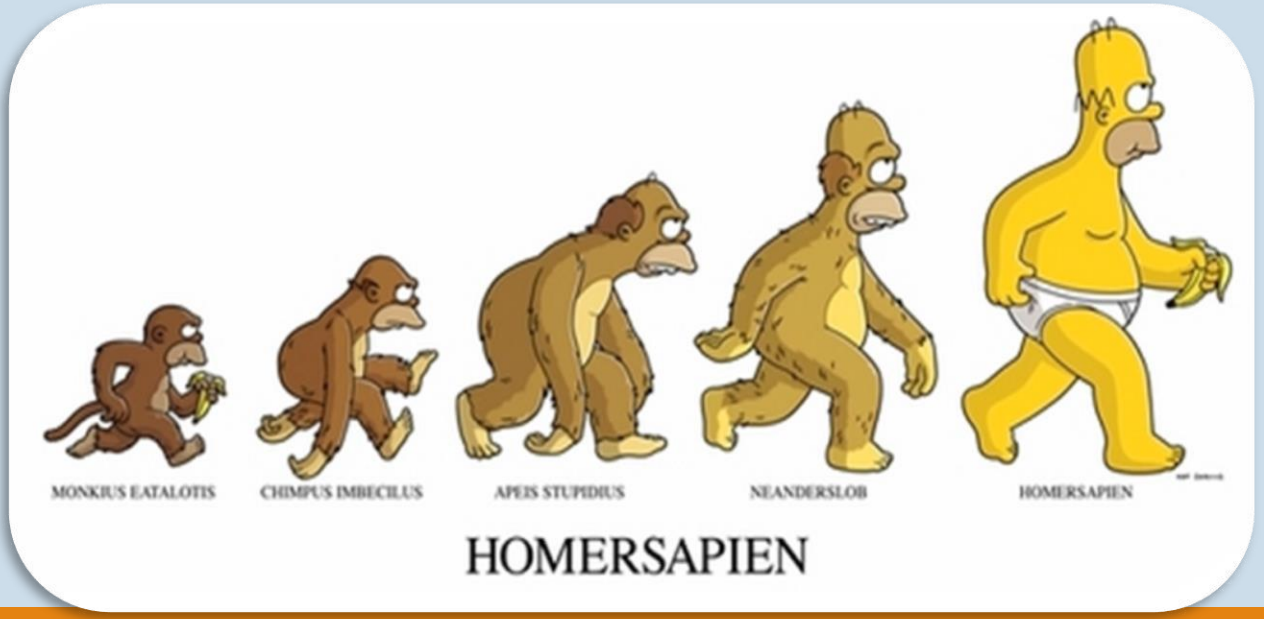
UNIT 2


EVOLUTION OF THE HORSE
Eohippus
Mesohippus
Merychippus
Pliohippus
Modern Horse
POOKYNS-5

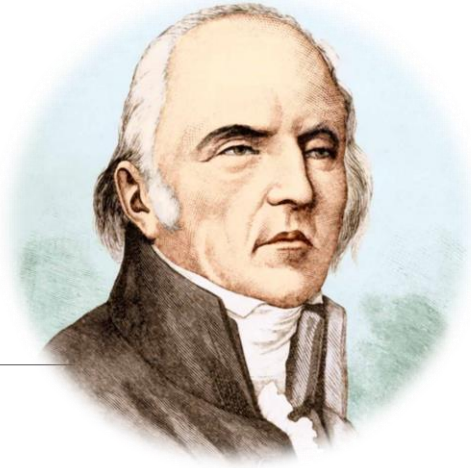
Evolution – *change over time*.

Modern organisms have descended from ancient organisms.

Theory – highly testable explanation and observable explanation of a natural phenomenon



Jean Baptiste Lamarck – proposes ideas that were proven to be <u>incorrect</u>:



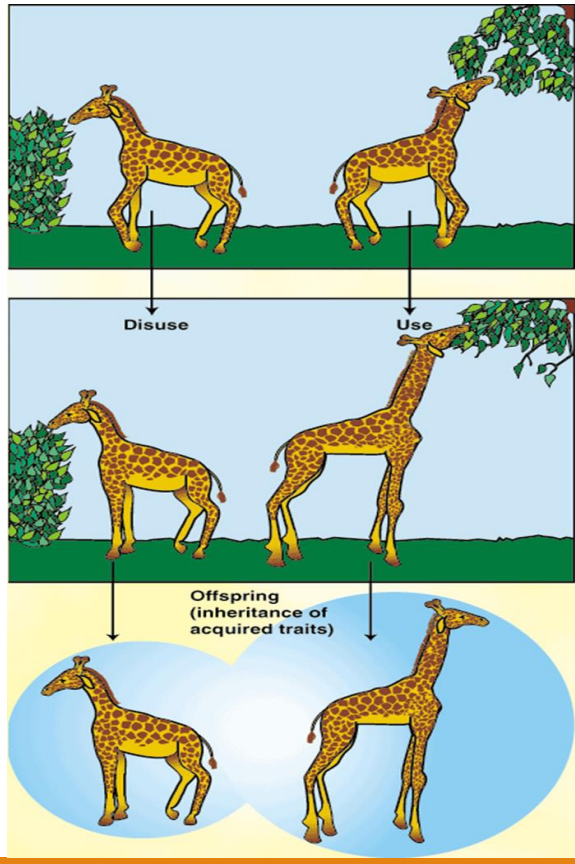
A. <u>Desire</u> to Change

B. Use and <u>Disuse</u> – could alter shape by using their bodies in new and different ways.

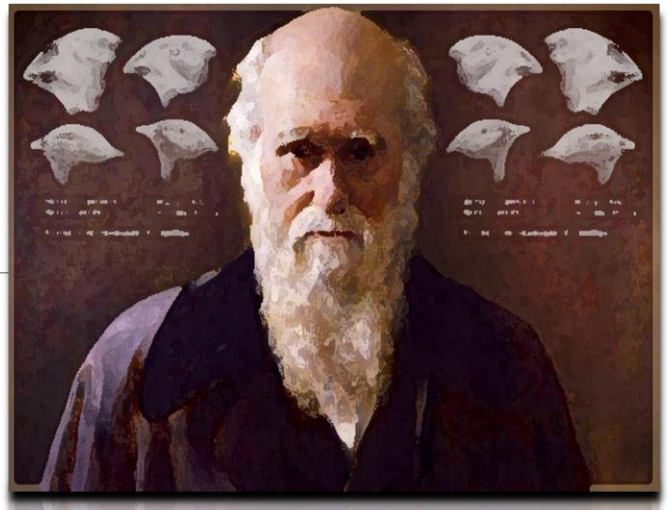
Ex: <u>Necks of giraffe's</u>

C. Inheritance of acquired traits – You pass on traits that you work for or get during your lifetime.

Ex: <u>Body builders having muscular babies</u>



Charles Darwin – considered the father of Natural Selection



Voyage on the "HMS Beagle";

Traveled to the Galapagos Islands;

Wrote *On the Origin of Species*

Based his work on the following observations:

A. Fitness – combination of physical traits and behaviors that help organisms survive and reproduce.

B. Common Descent – through long, slow change organisms have descended or come from common ancestors. Example- Beak shape in finches.

C. Adaptation – inherited characteristic that enables organisms to be better suited to their environment. "More fit". Increases chances of survival.

Galapagos Islands Location

Darwin's Case – Darwin had to back his book with the following ideas:

A. **<u>Artificial</u> Selection –** Nature provides the <u>variation</u> & humans select those variations that they found useful.

Ex: <u>Farmers breed livestock, Hybrid dogs</u>

Labrador Retriever

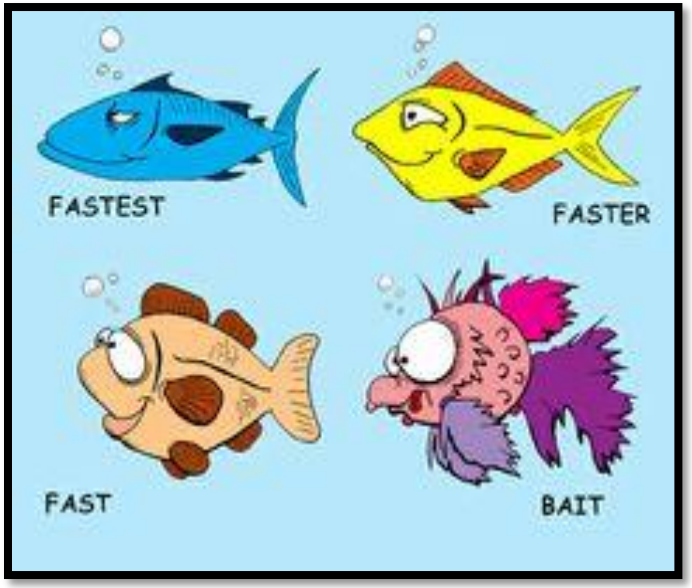
Toy Poodle

Labradoodle

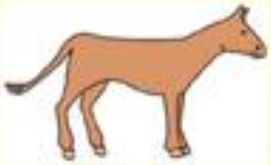
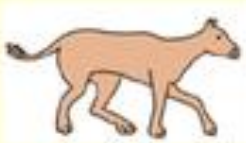
B. Natural Selection

"Survival of the Fittest"

Organisms that are best adapted to their environment survive based on fitness and adaptations and pass their DNA on to their offspring.



<u>Descent</u> with modification – Each living species has descended, with changes, from other species over time.

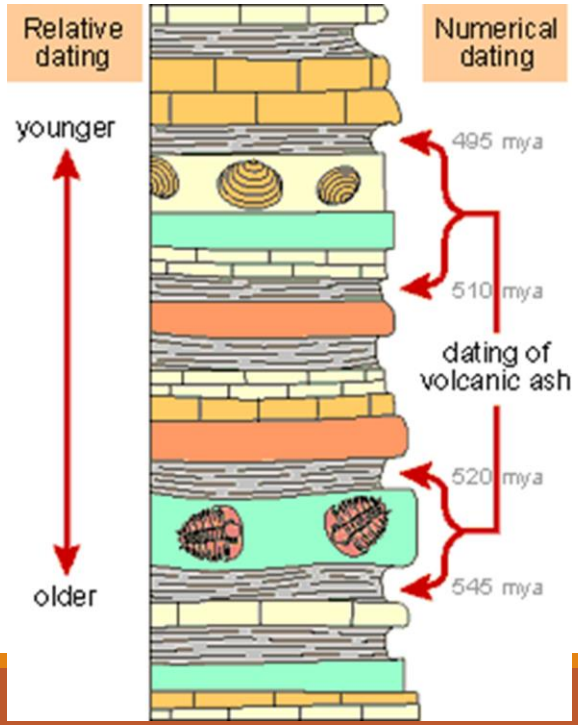
Equus	Pliohippus	Merychippus	Mesohippus	Hyracotherium
				
1 million years ago	10 million years ago	30 million years ago	40 million years ago	60 million years ago
1.6m	1.0m	1.0m	0.6m	0.4m
 Single hoof, runs quickly over hard ground	 Other toes lost as only middle hoof used	 Middle toe developed into a hoof, to run faster	 Toe lost for moving faster over dry ground	 4 toed hoof, well spread for walking on soft ground
				

Evidence of Evolution: 1.) Fossil Record

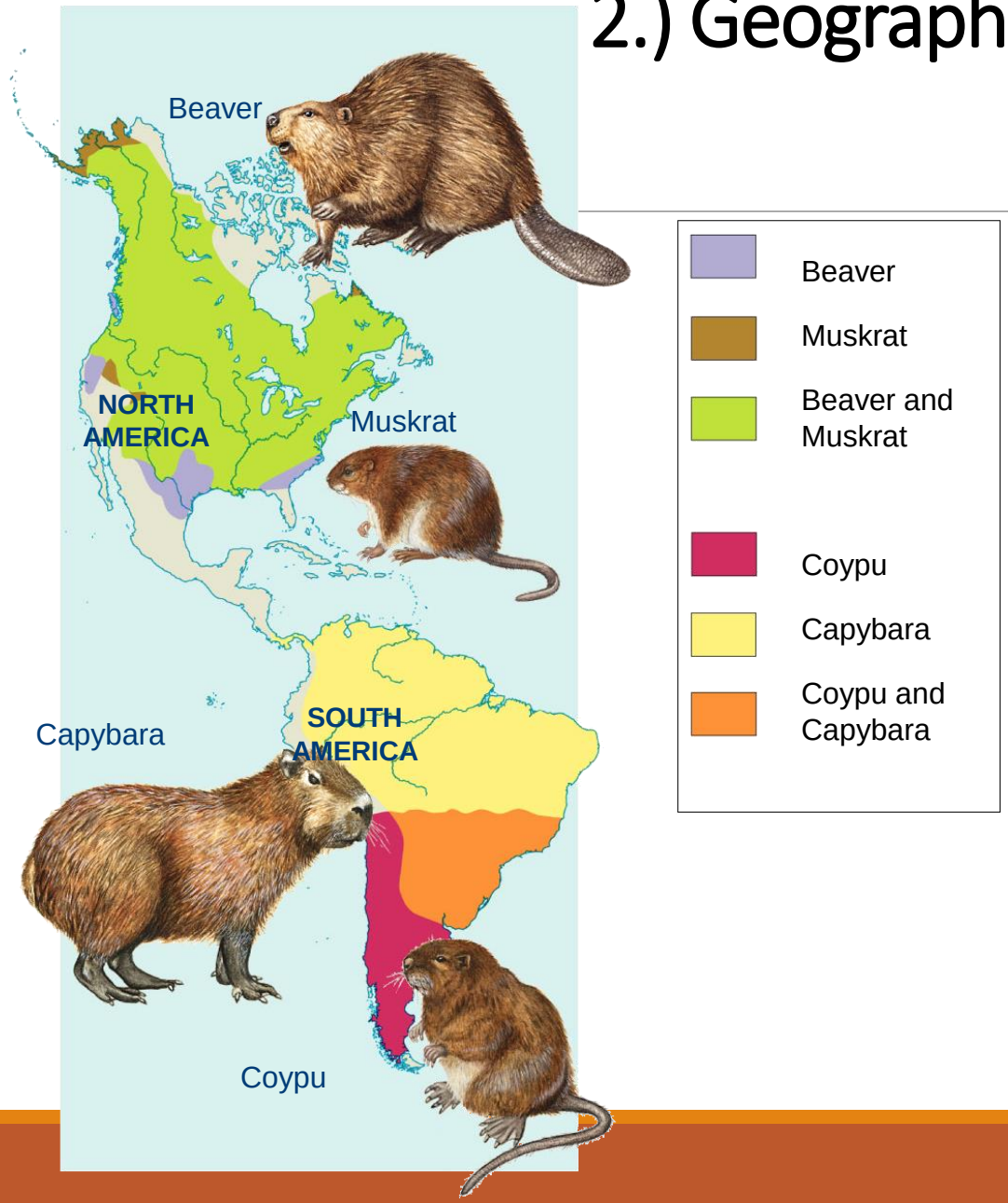
Fossils- Preserved remains of ancient organisms

Fossils show the history of life on earth and how different groups of organisms have changed over time

When comparing fossils found in rock layers, bottom fossils are older.



Evidence of Evolution:
2.) Geographic Distribution

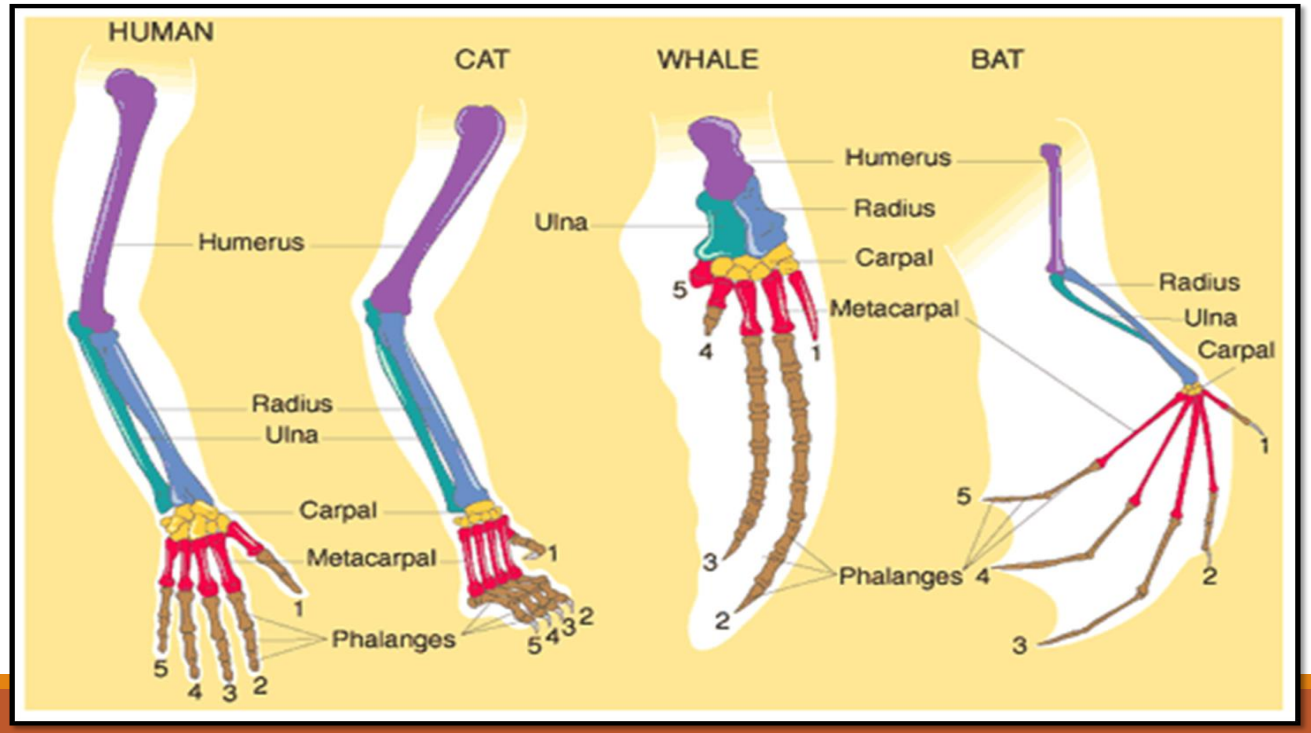


Geographic Distribution- Similar animals in <u>different locations</u> may be the products of different lines of evolutionary development WITH ***NO RECENT COMMON ANCESTOR?***

Evidence of Evolution:
3.) Homologous Structures

Body parts that have the same basic structure (layout), but have different functions---shows comment descent/ancestry

Ex: Bone structures in organisms



Analogous Structures

Body parts that have similar functions, but have different structures in <u>unrelated organisms.</u>

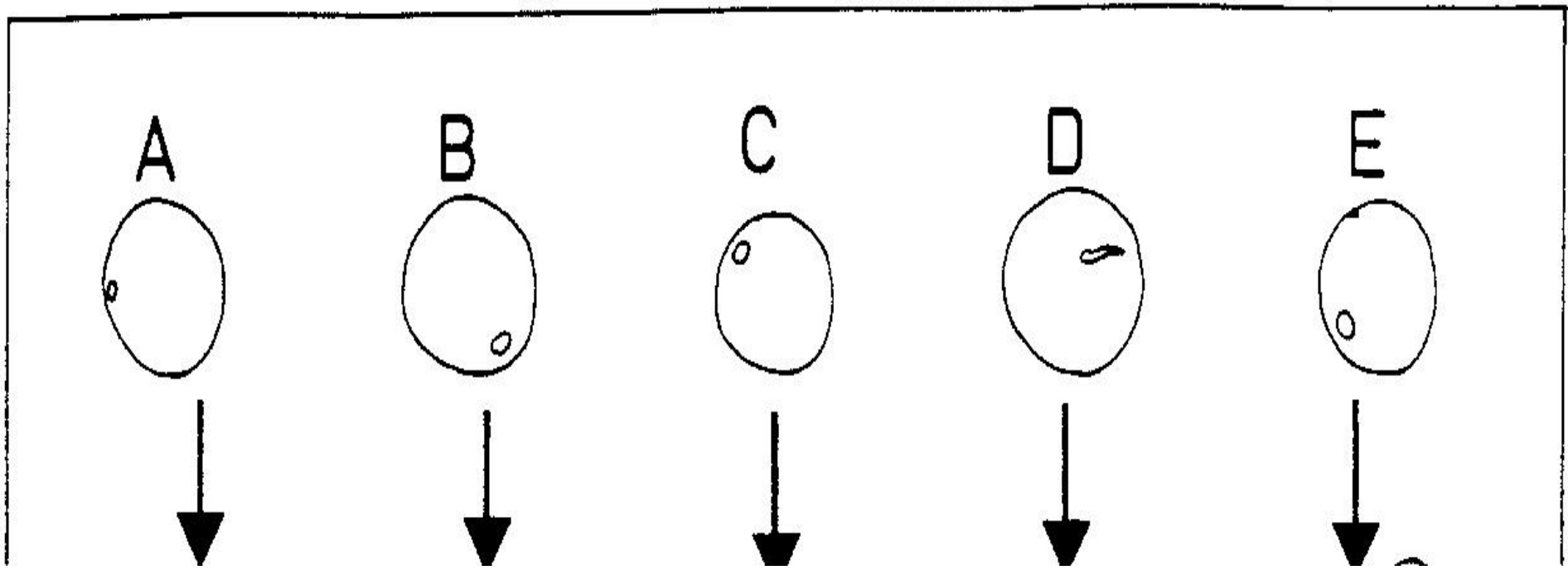
<u>Ex: Wings</u>

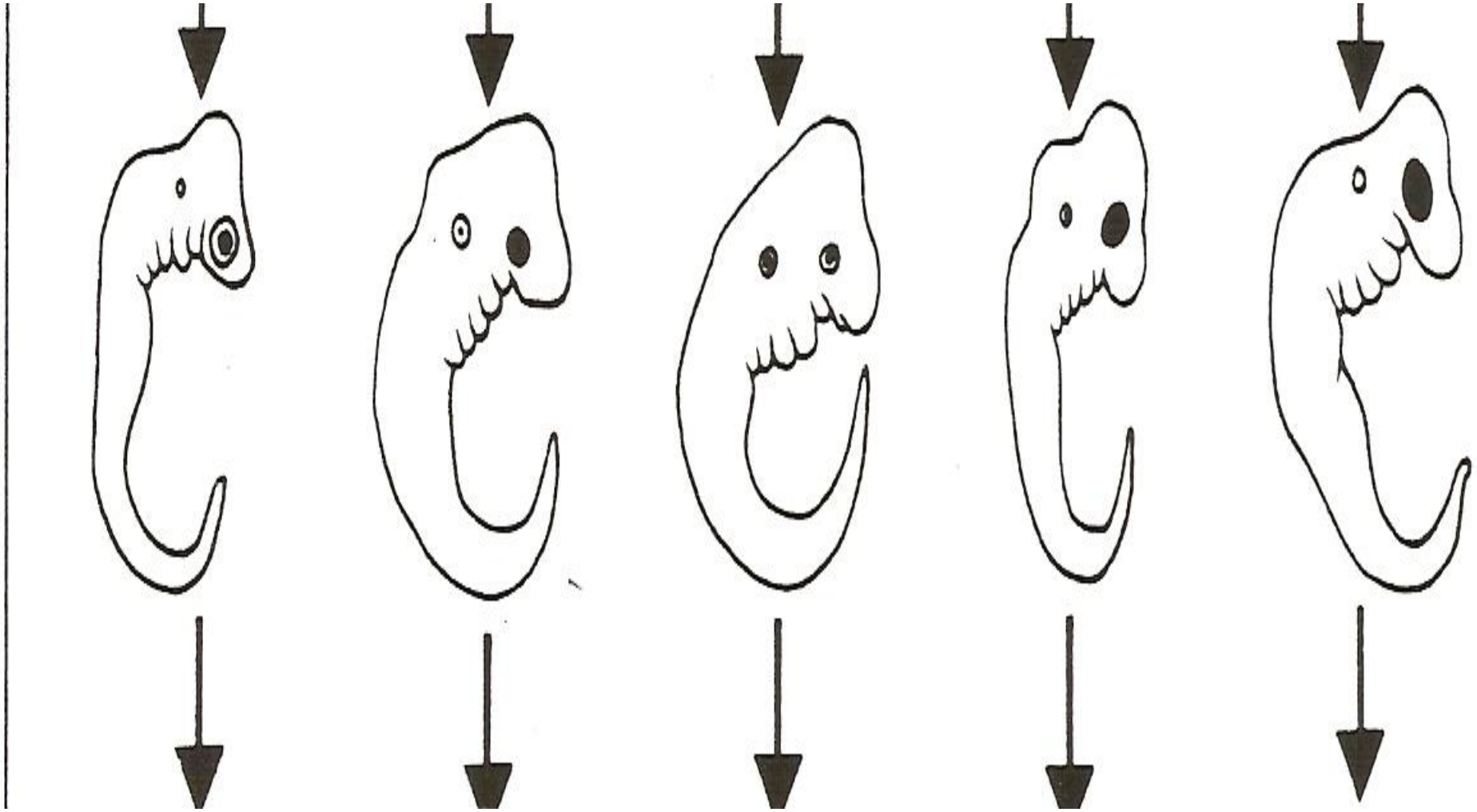
protection

flight

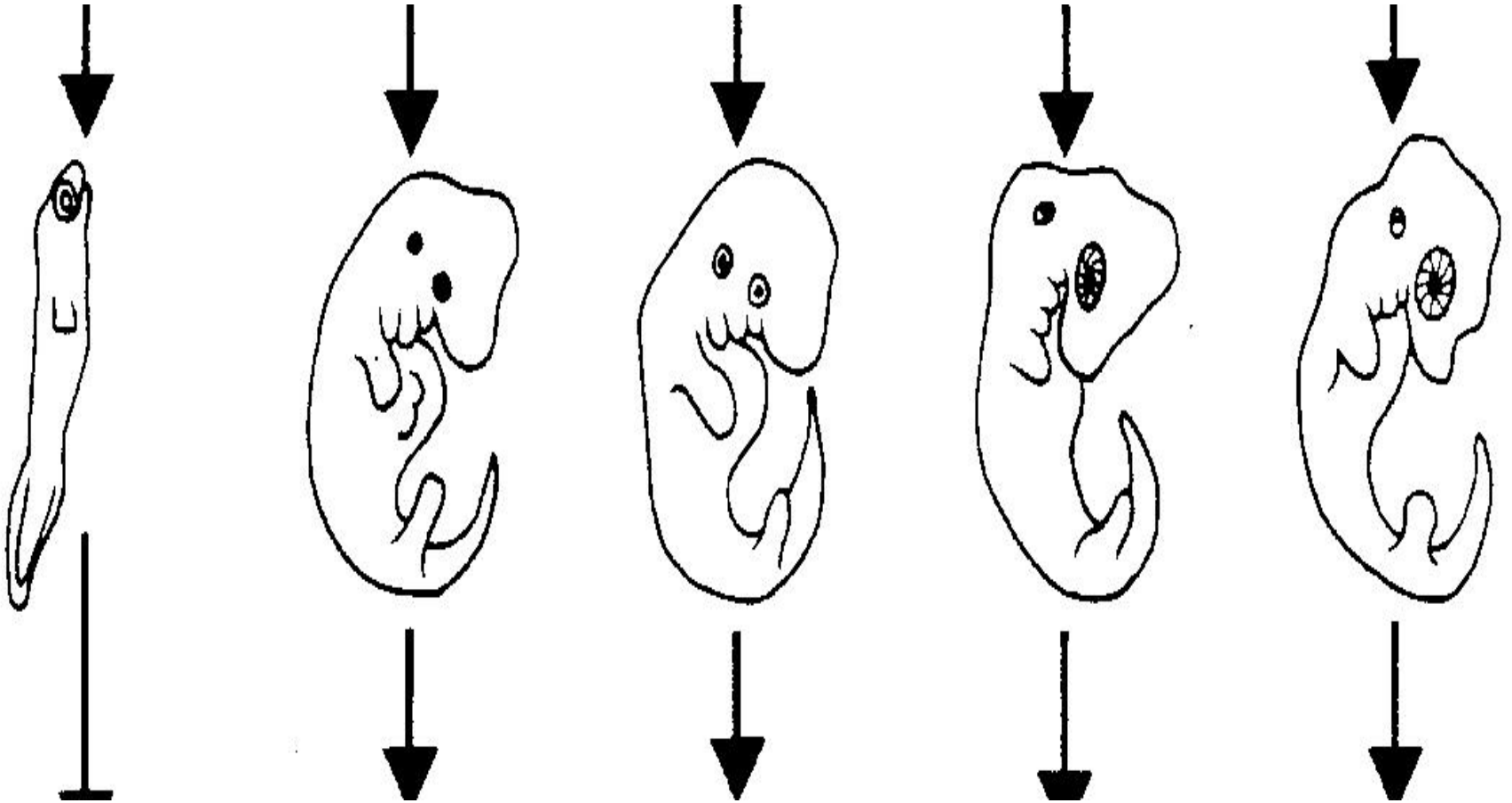
Evidence of Evolution:
4.) Embryological Development

Evidence that uses the <u>embryo</u> pattern of organisms to support common ancestry between them.

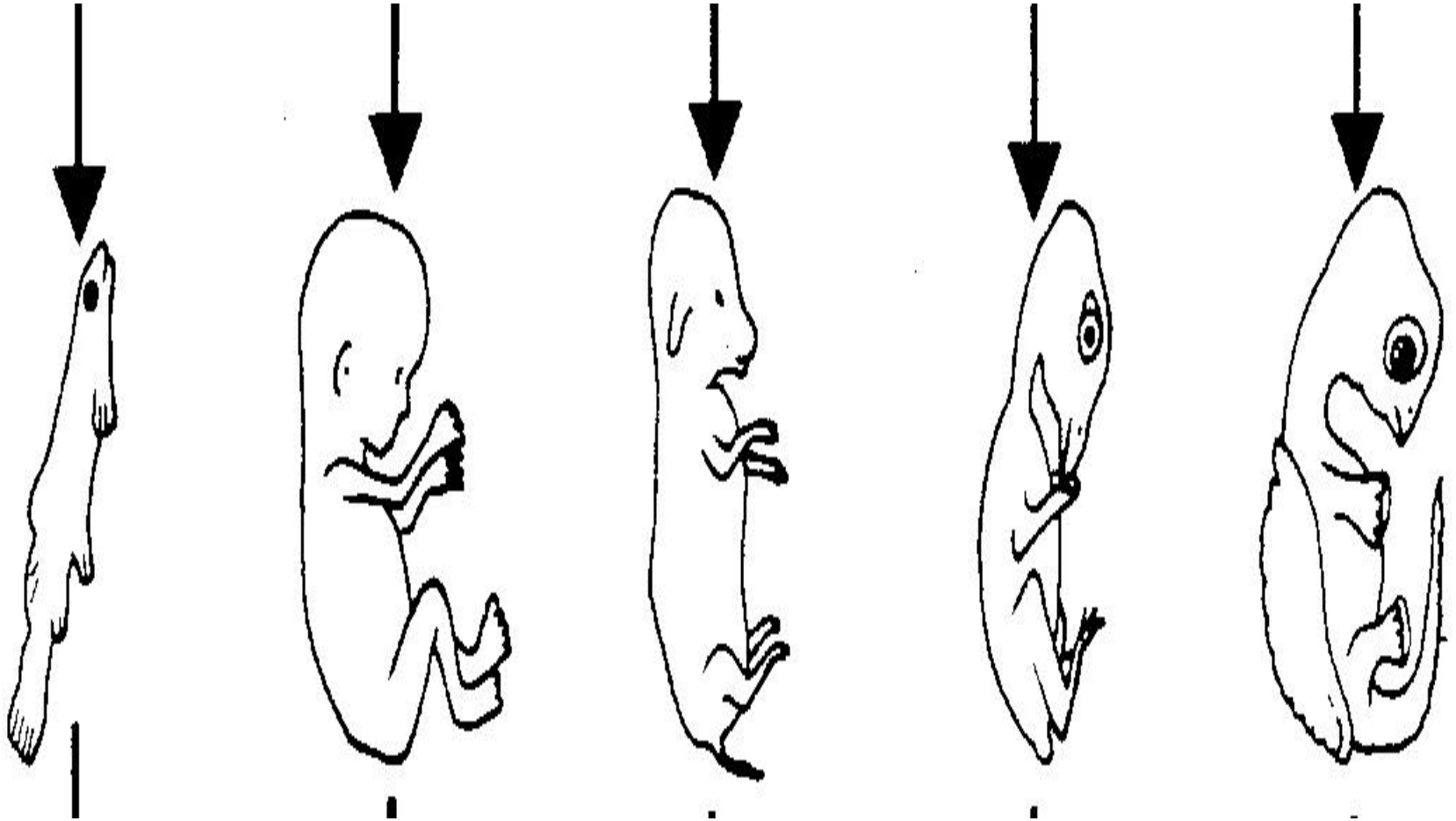




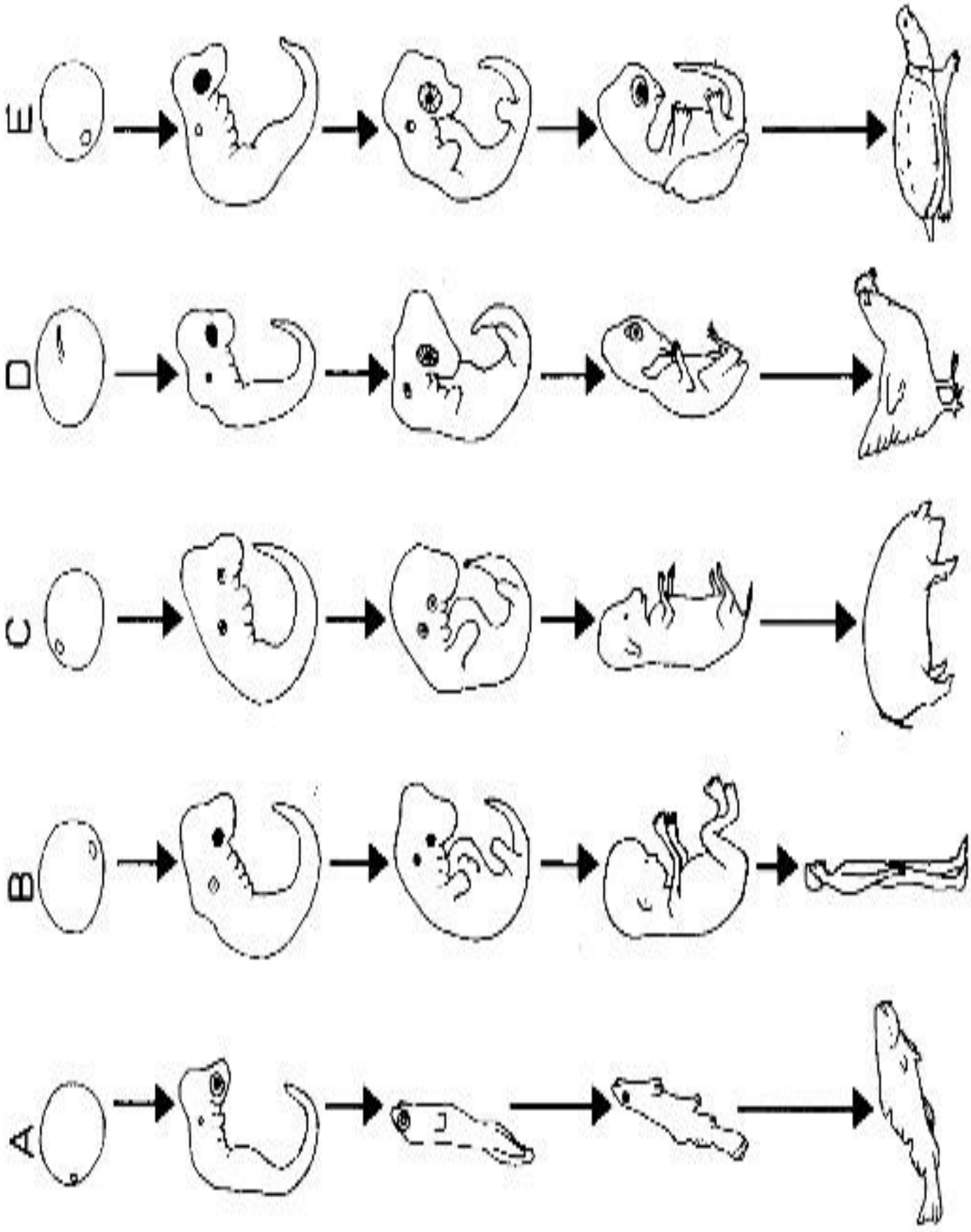
Figured it out yet?

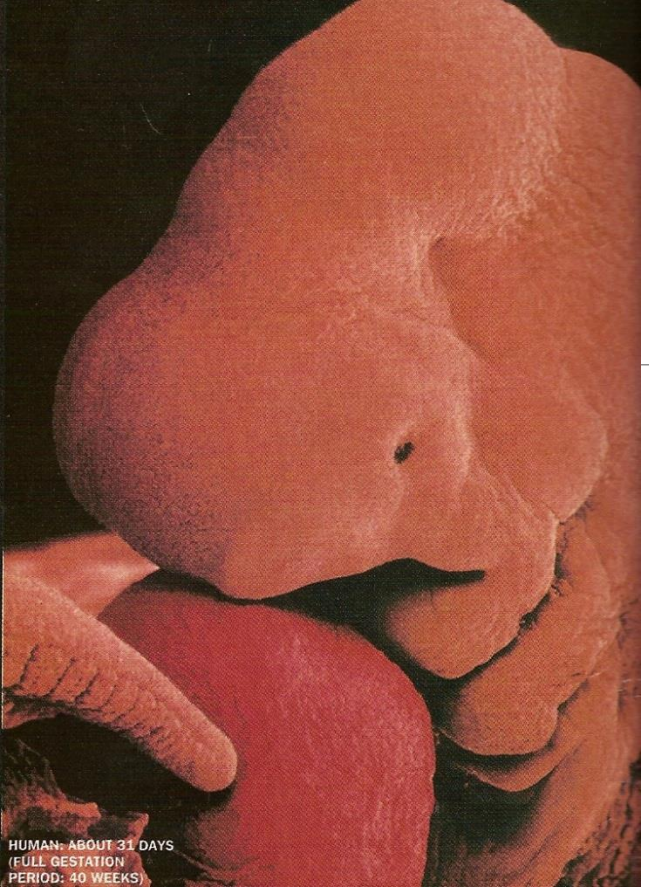


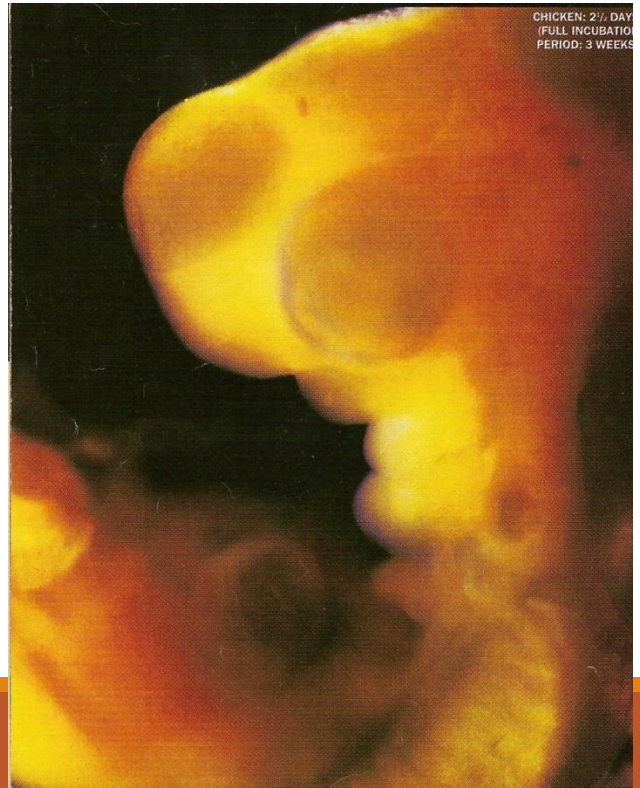
How about now?

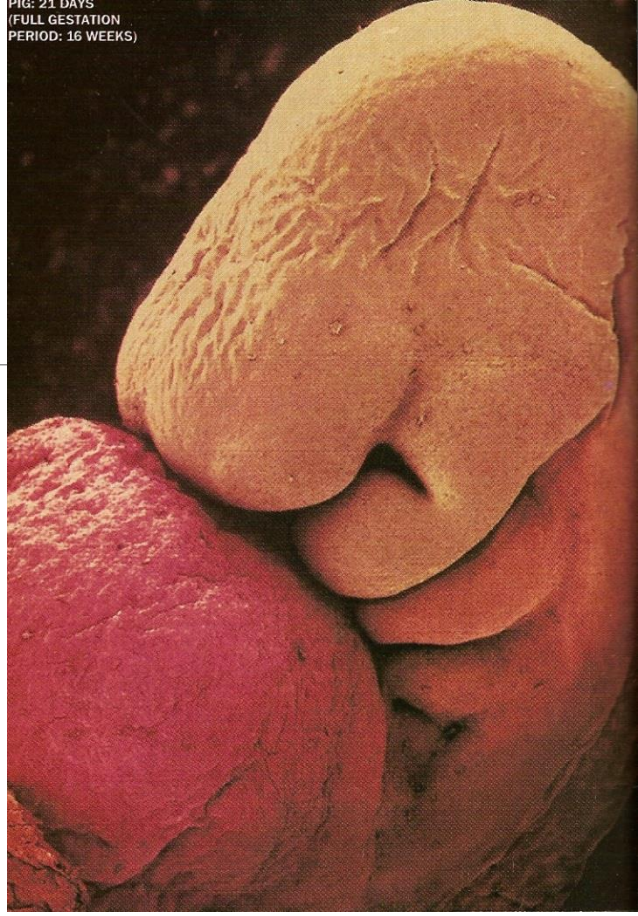


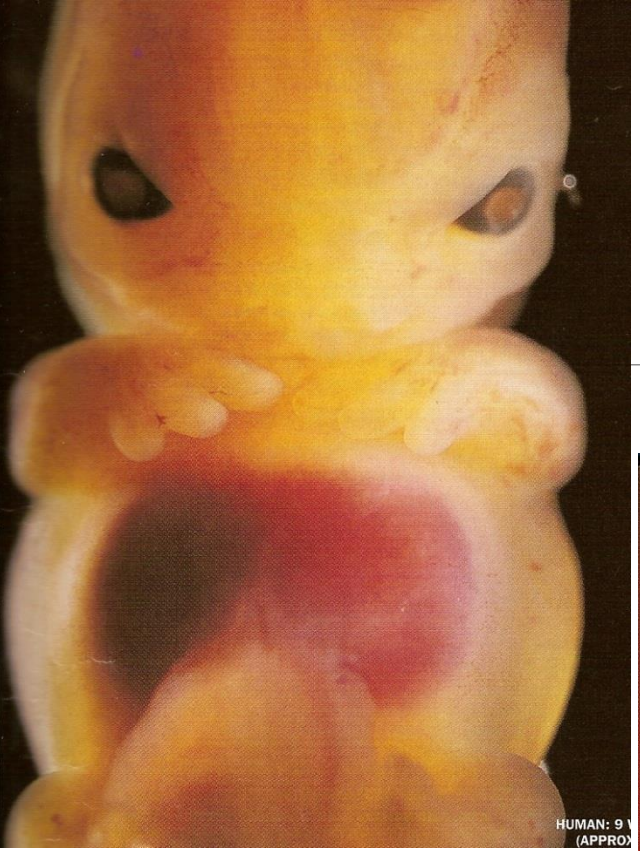
Did you guess correctly?

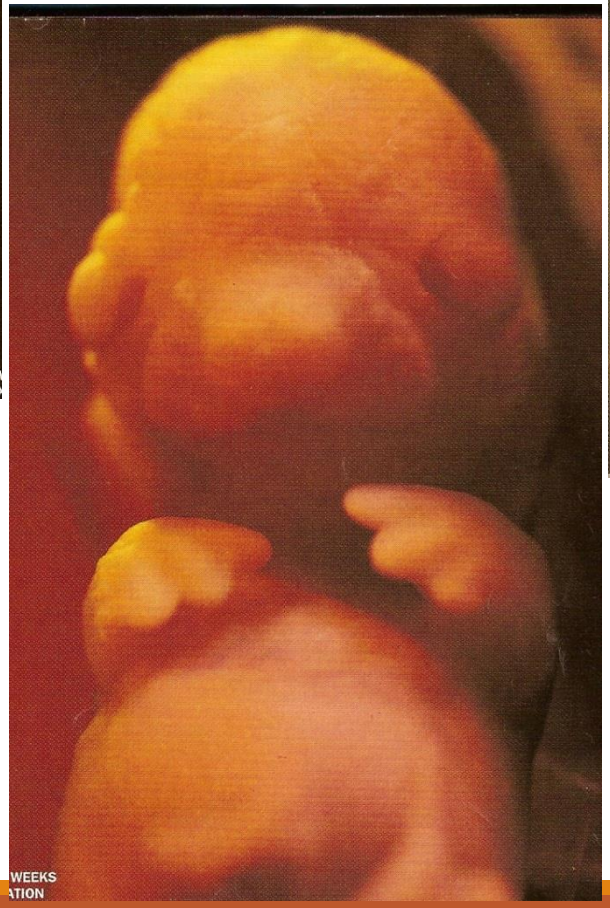

E
D
C
B
A

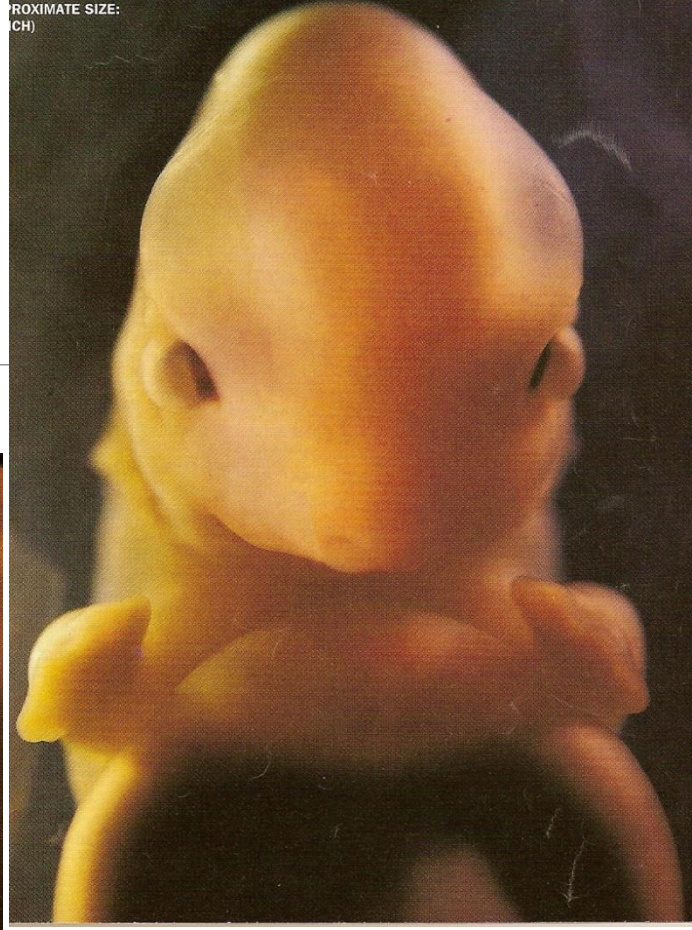

HUMAN: ABOUT 31 DAYS
(FULL GESTATION
PERIOD: 40 WEEKS)


CHICKEN: 2½ DAY
(FULL INCUBATIO
PERIOD: 3 WEEKS

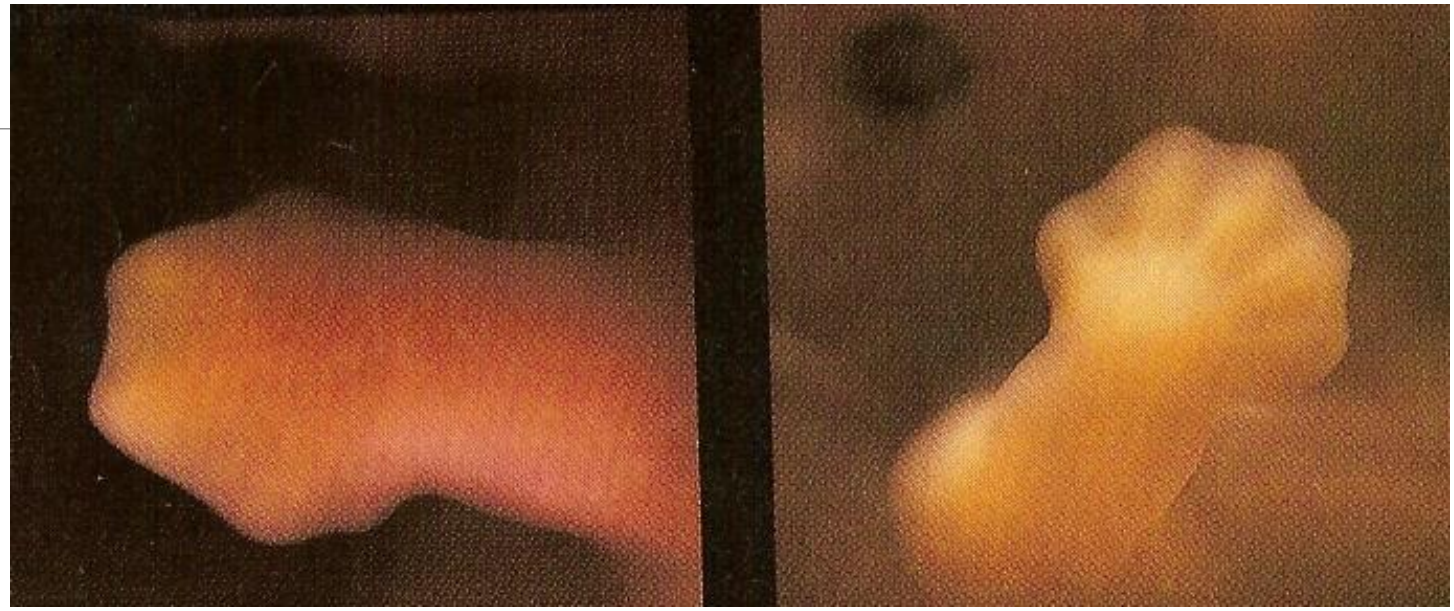

PIG: 21 DAYS
(FULL GESTATION
PERIOD: 16 WEEKS)

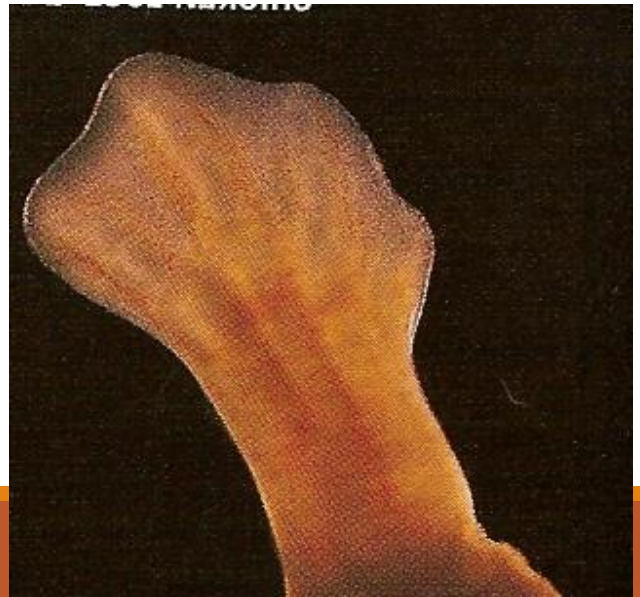

HUMAN: 9
(APPROX


WEEKS
ATION


ROXIMATE SIZE:
CH)

Limb Buds





Evidence of Evolution: 5.) Vestigial Organs

Organs that no longer serve a purpose, but were believed to be important in the past.

Ex:

A. Human appendix

B. Human ear muscles

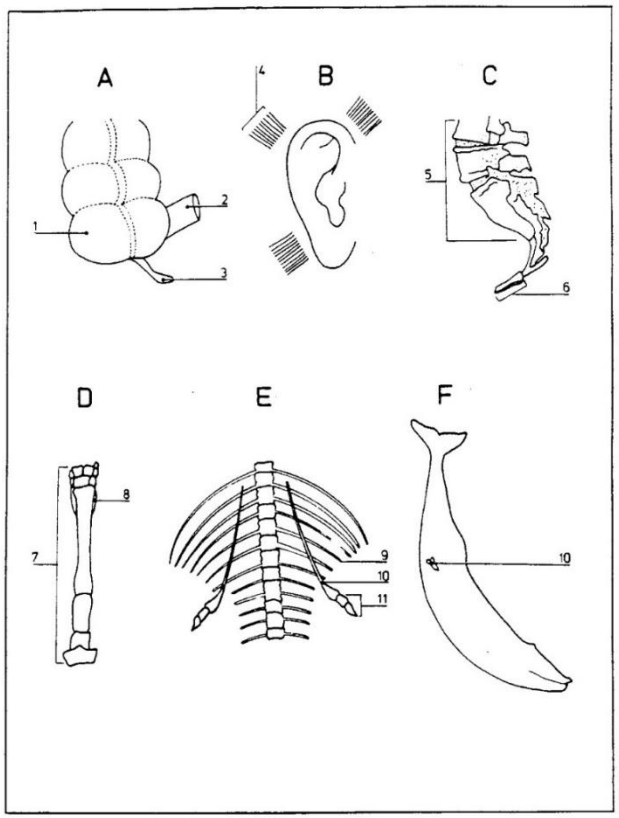
C. Human tailbone

D. Extra bones in horse's leg

E. Leg bones in snakes

F. Hip bones in whales

G. Wisdom Teeth



G.

Evidence of Evolution:
6.) DNA Similarities

The same 4 DNA bases are found in all living organisms.

It has been shown that the more closely related the species, the more similar their DNA sequences are.

A comparison of part of the mouse and fly genes (identical regions are highlighted)

mouse gene: GTATCCAACGGTTGTGTGAGTAAAATTCTGGGCAGGTATTACGAGACTGGCTCCATCAGA

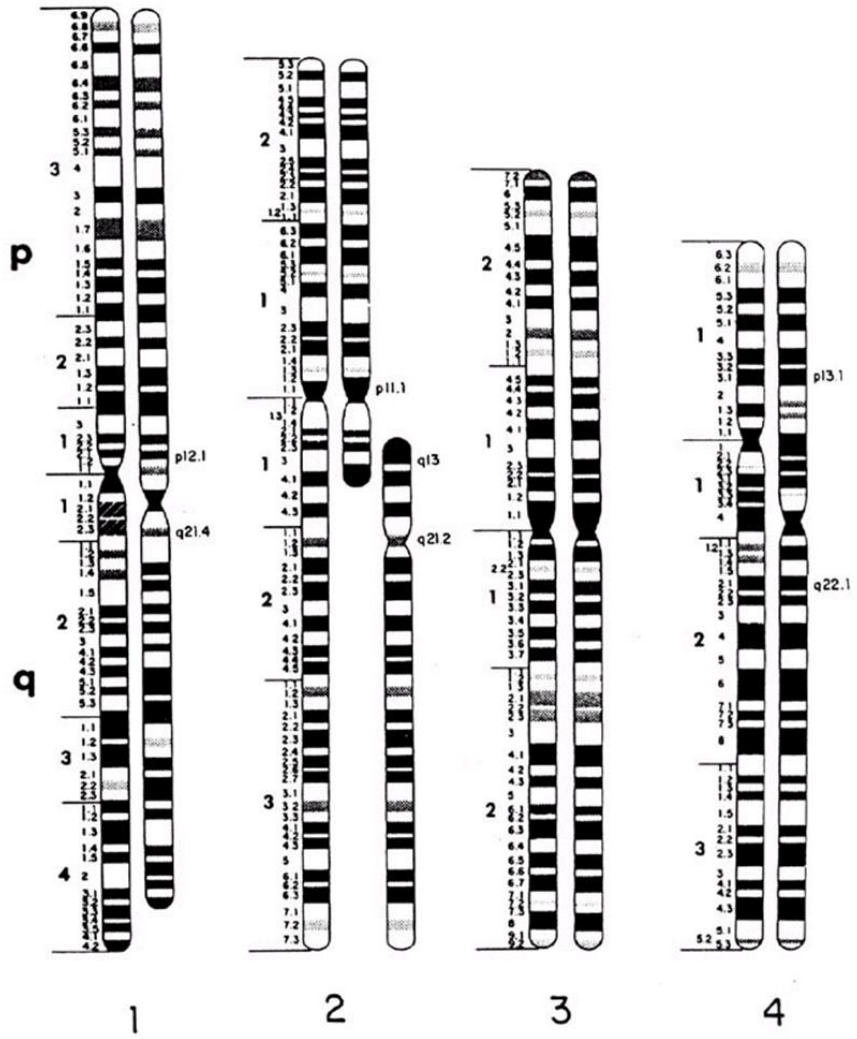
fly gene: GTATCAAATGGATGTGTGAGCAAAATTCTCGGGAGGTATTATGAAACAGGAAGCATACGA

These gene sequences are 76.66% similar.

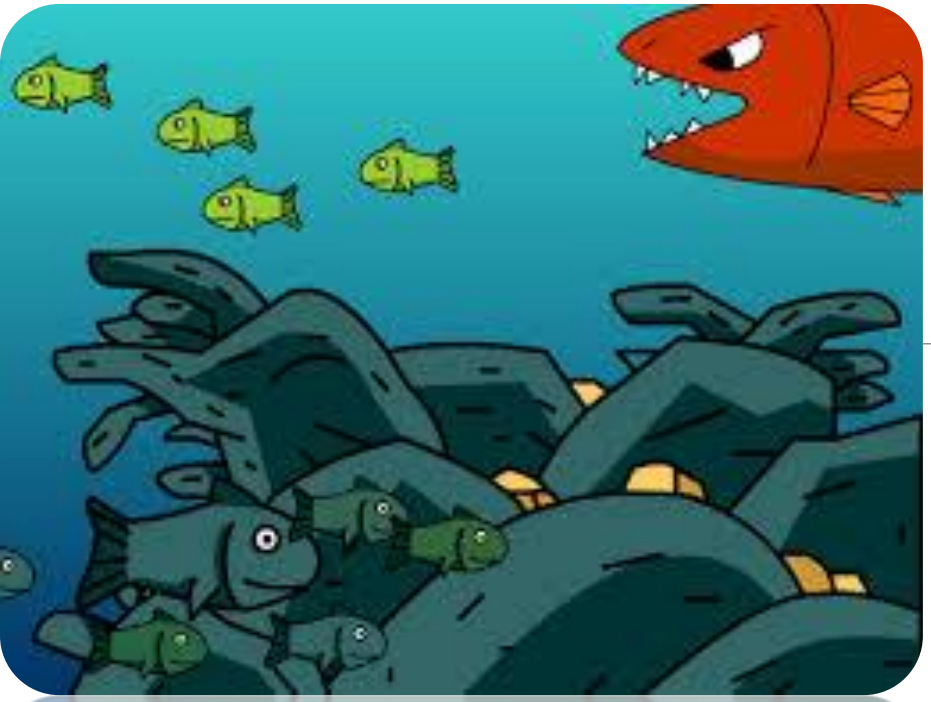
The proteins corresponding to these regions are 100% similar.

Comparing Chromosomes -

The banding patterns on stained chromosomes can be used to infer genetic similarity



- Human chromosomes are on the left — Chimp's are on the right



What is Natural Selection?

Individuals that are better suited to their environment can produce more offspring!

"Survival of the Fittest"

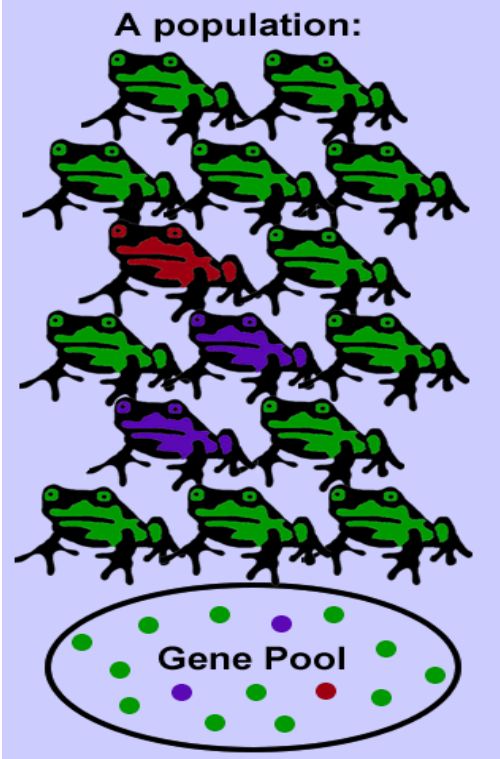
I. Evolution – any change in the frequency of genes in a population.

A. **Gene Pool –** combined genetic information of all members in a population

B. **Genetic Variation**- Variation in alleles (traits) of genes

C. **Relative Gene Frequency**

number (#) of times that a gene occurs in a gene pool



D. **Genetic Drift –** random change in gene frequency – this usually occurs in small populations

D. **Genetic equilibrium(=)**– gene frequency remains the same

II. Sources of Genetic Variation

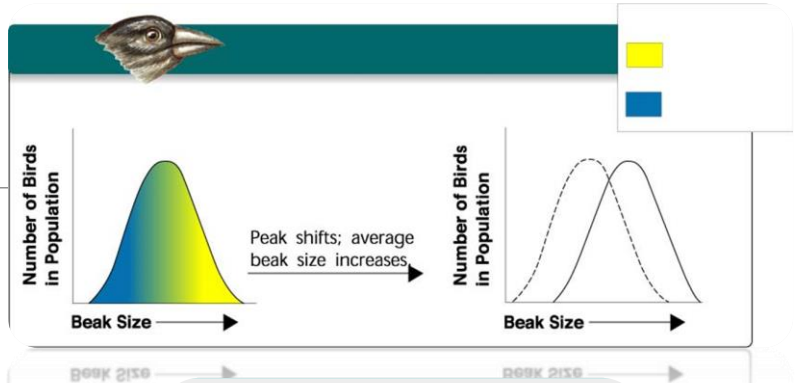
A. **Mutations –** changes in a sequence of DNA.

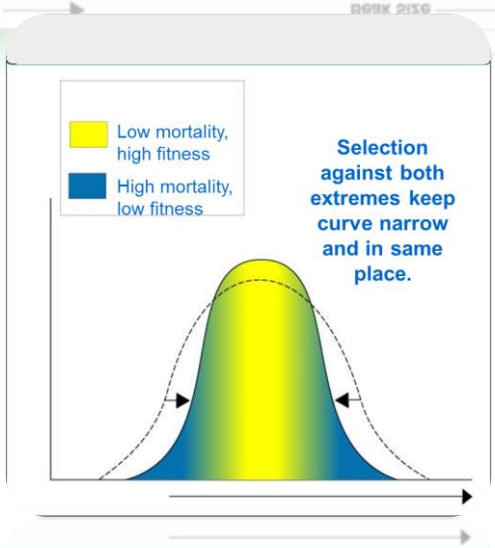
B. **Gene shuffling** – mixing of chromosomes during meiosis (sperm or egg production). Mostly results in inheritable differences.

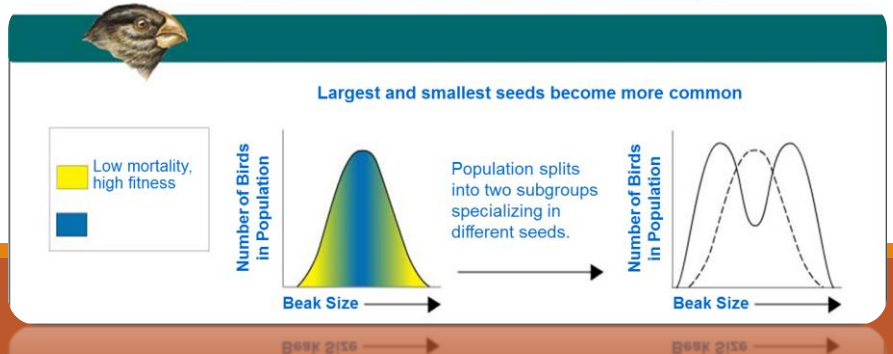
III. Evolution as Genetic Change

A. Natural selection can lead to changes in <u>frequencies</u> and thus to evolution.

B. <u>Natural</u> selection can affect the <u>distribution of physical</u> characteristics in any of three ways:

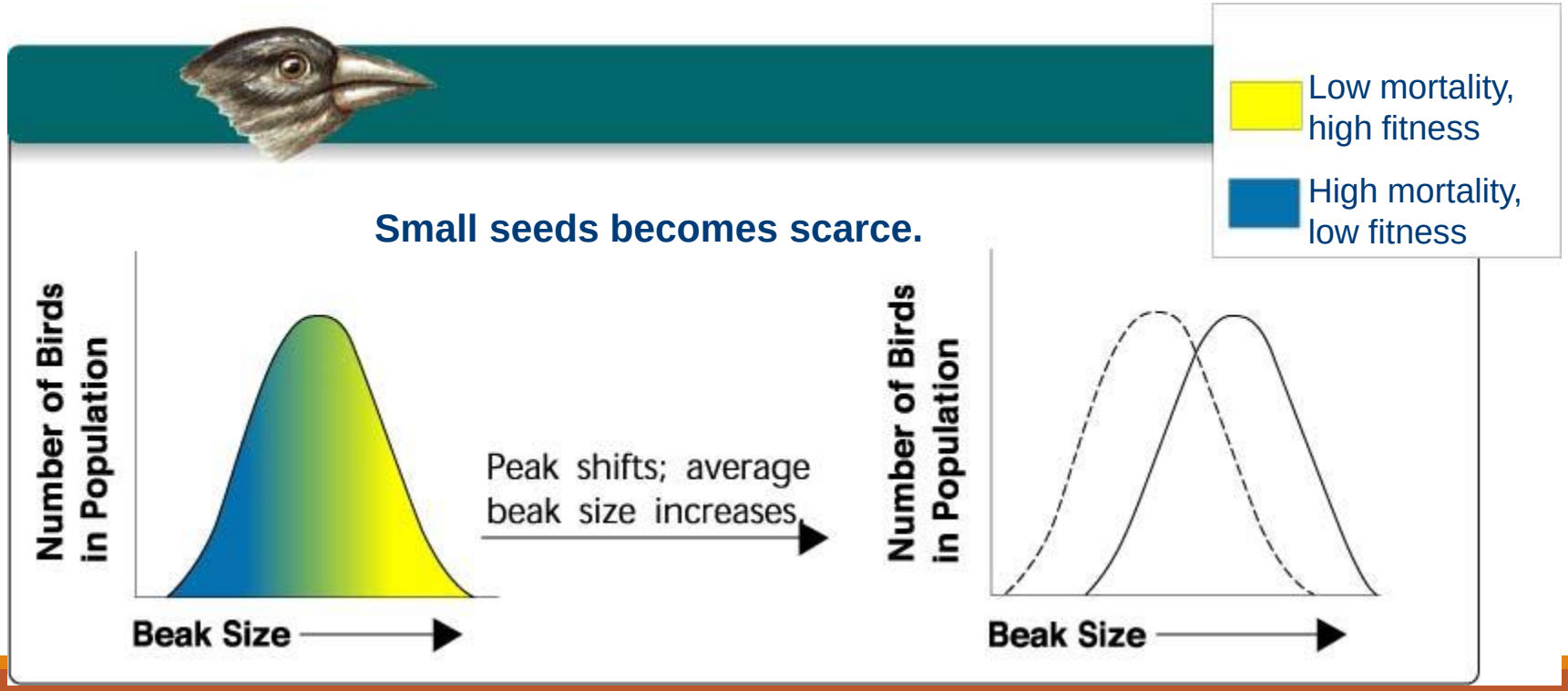






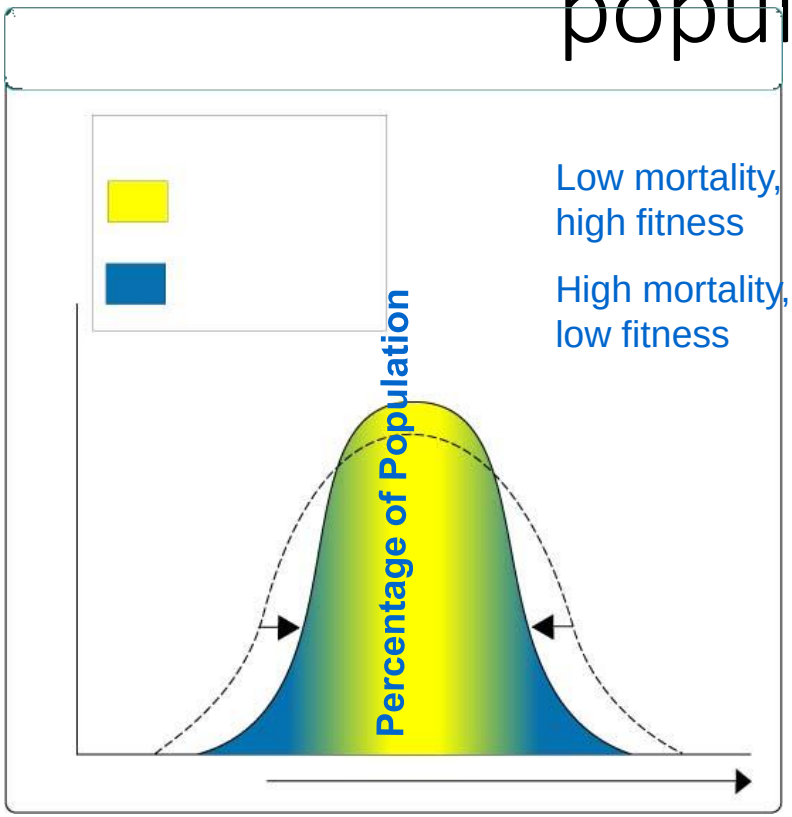
Directional Selection (One Direction)

When individuals at one end of the curve have a higher fitness than the others in the population



Stabilizing Selection

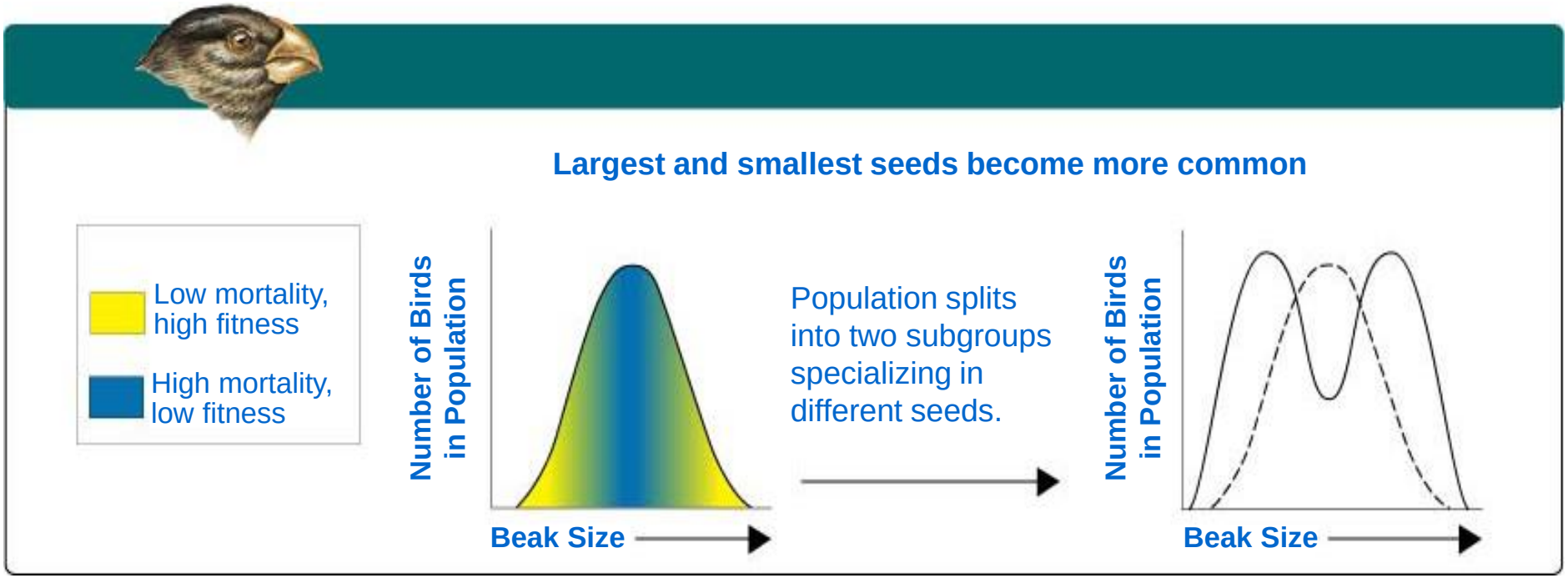
When individuals near the center of the curve have a higher fitness than the others in the population



Selection against both extremes keep curve narrow and in same place.

Disruptive Selection

When individuals at each end of the curve have higher fitness than individuals near the center



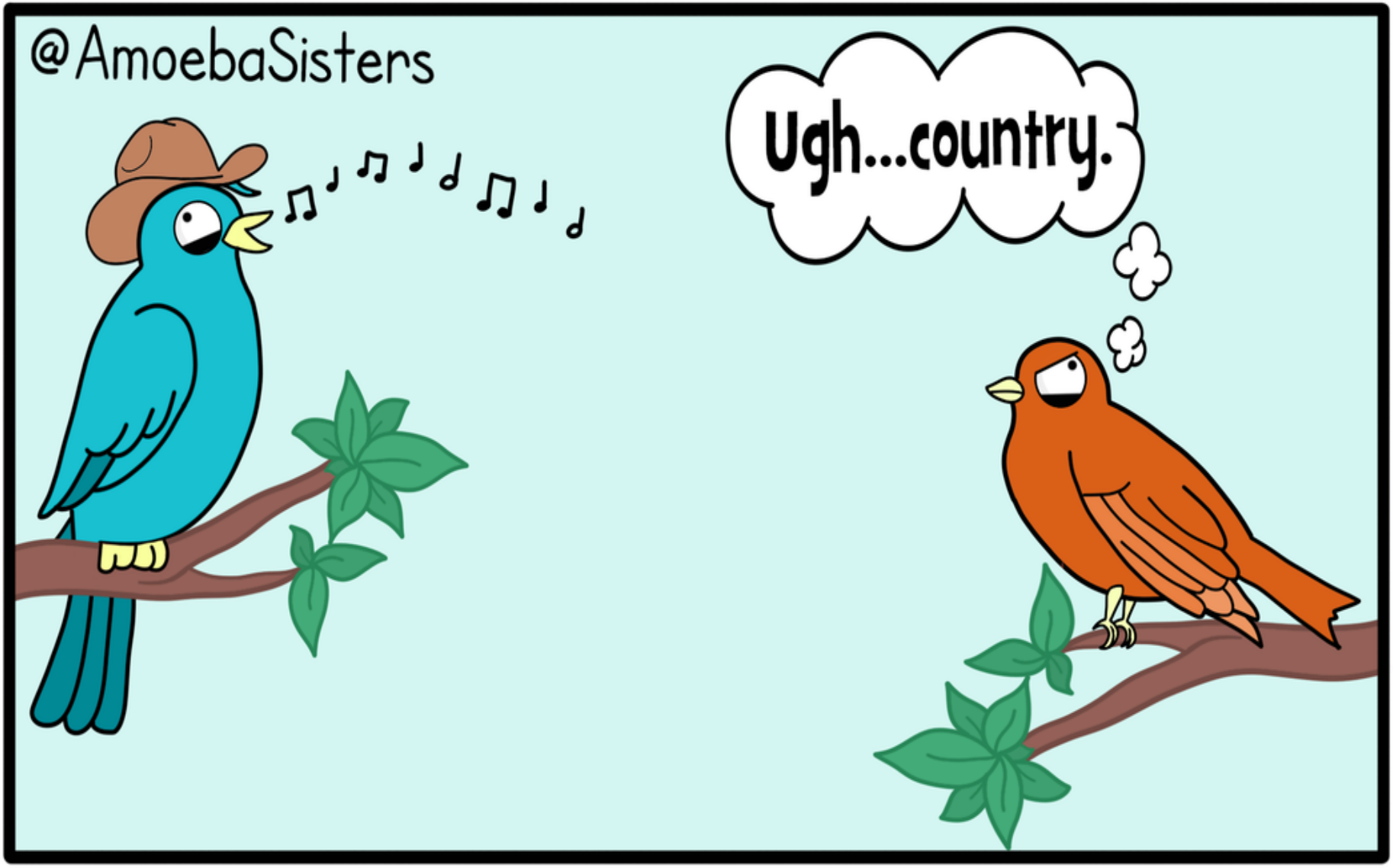
IV. The Process of Speciation – Formation of new species.

Isolation Mechanisms

Reproductive Isolation – when 2 populations cannot interbreed and reproduce

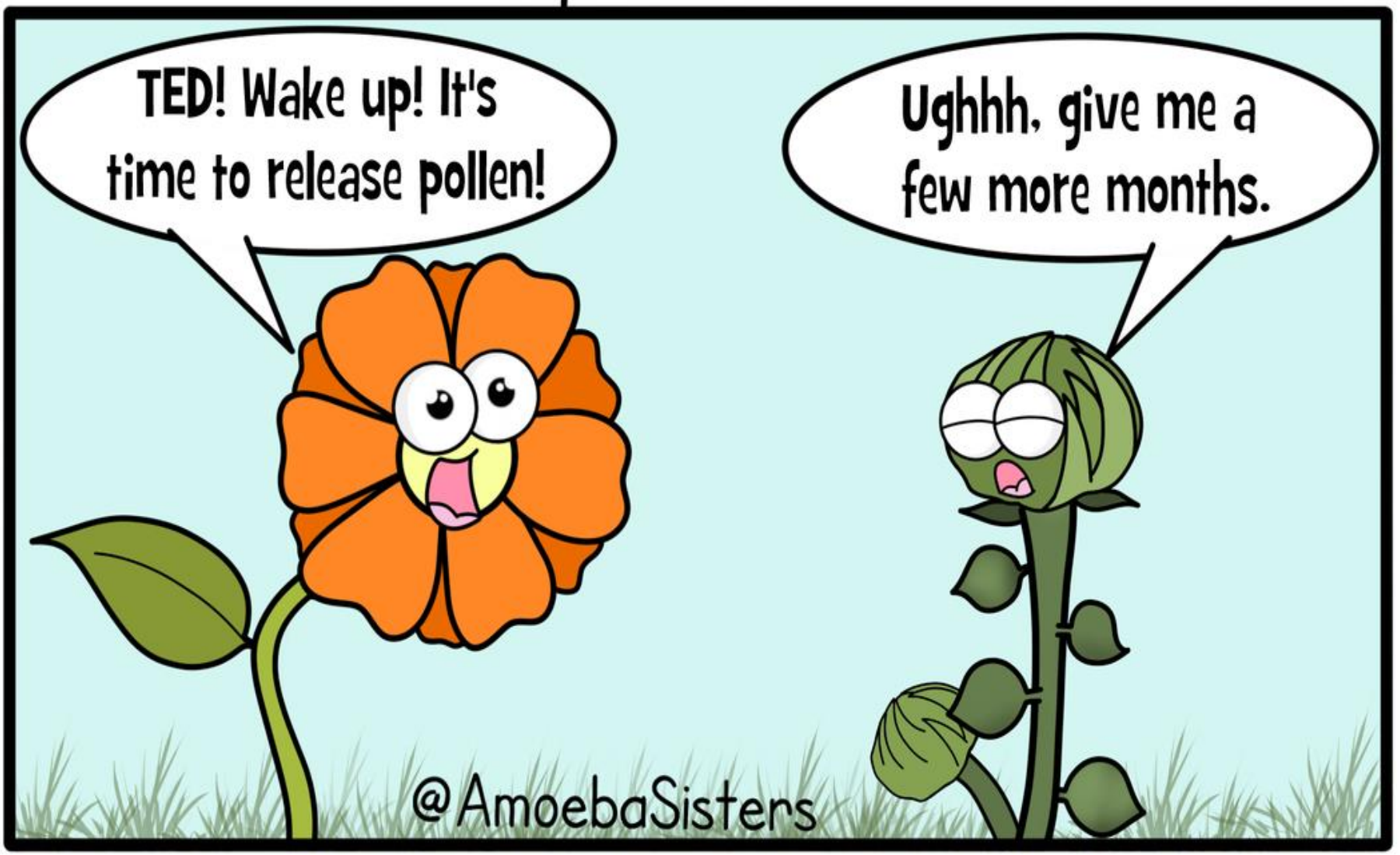
a. Behavioral Isolation – mating ritual changes
b. Geographic Isolation – separation by barriers, rivers, mountains….etc.
c. Temporal Isolation – time of season

Behavioral Isolation



Geographic Isolation

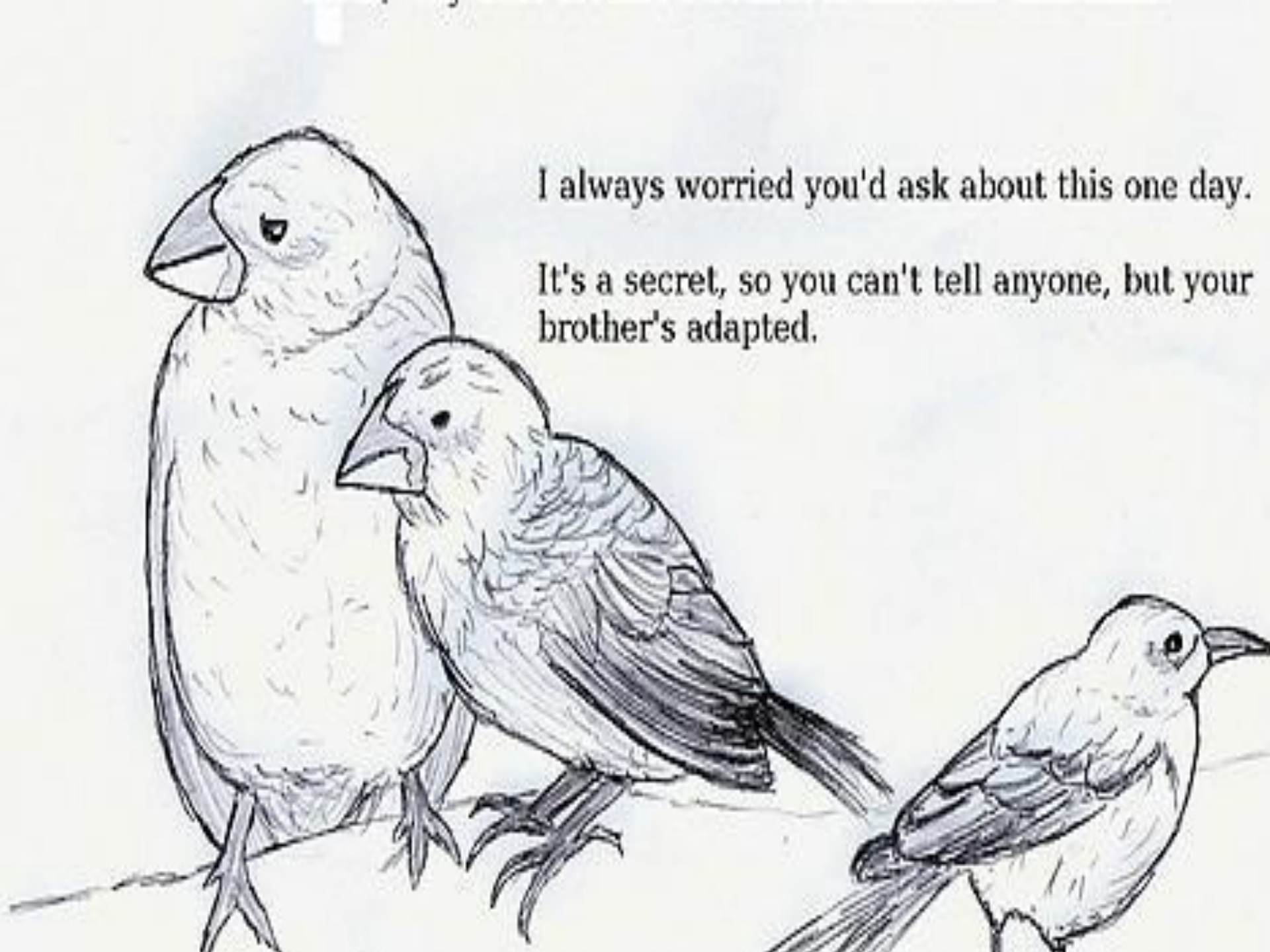
Temporal Isolation



V. Adaptation

Physical or behavioral trait that help the individual survive and reproduce in their environment.

*Makes them more “fit”.

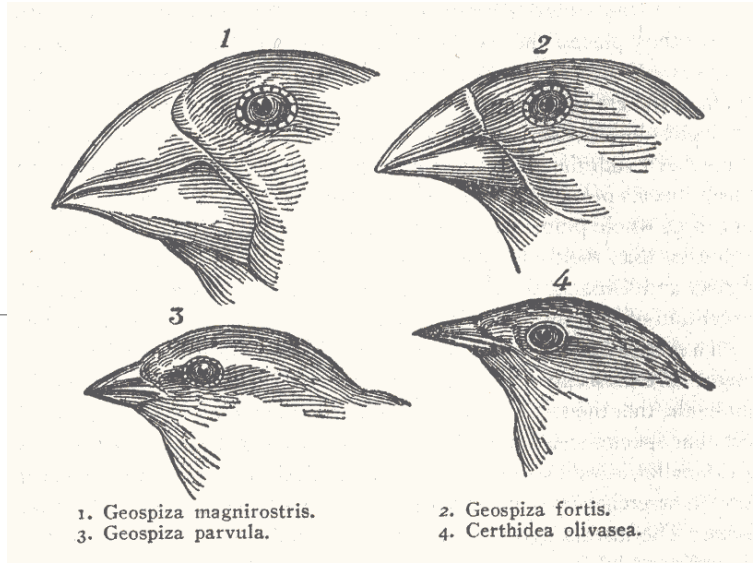

I always worried you'd ask about this one day.
It's a secret, so you can't tell anyone, but your brother's adapted.

Adaptations also include:

Mimicry- copying the appearance of another species or object for protection or other advantage

Camouflage – body covering or coloring that helps them blend into the environment

VI. Darwin's Finches



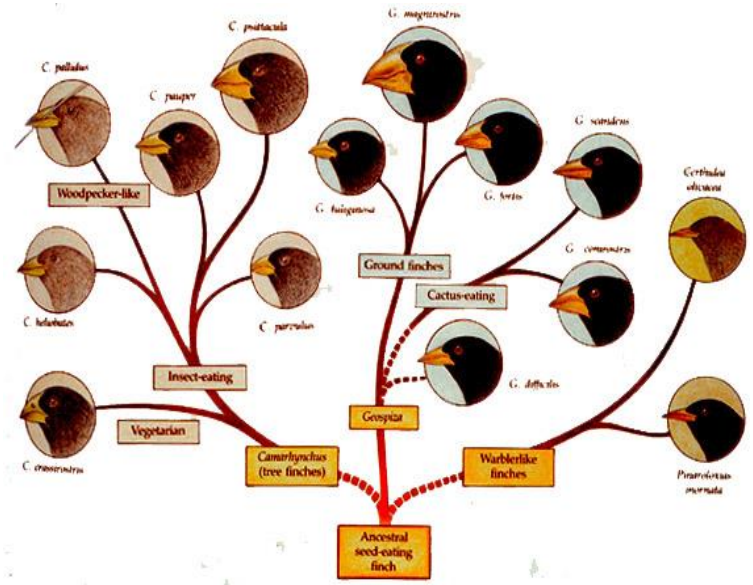
Based on the adaptations Charles Darwin observed in finches on the Galápagos, he wondered if species living on different islands had once been members of the same species.

What adaptations did he observe?

Beaks came in all <u>shapes/sizes</u> based upon <u>diet & environment</u>

What conclusions did he draw? –

All finches came from a <u>common ancestor!</u>



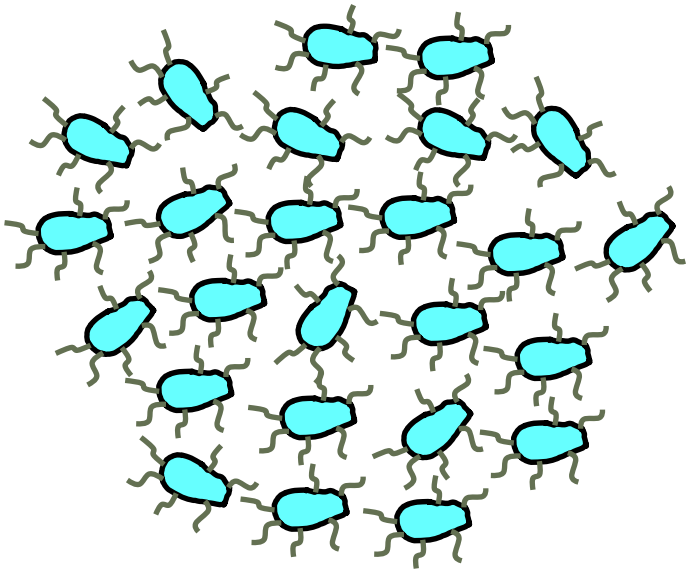
VII. Antibiotic Resistance =

mutations occur and/or genes are transferred from one bacterium to another, reproduce quickly

1.00 not resistant

0.00 resistant

How Natural Selection works



1.00 not resistant

0.00 resistant

How Natural Selection works

1.00 not resistant

0.00 resistant

0.96 not resistant

0.04 resistant

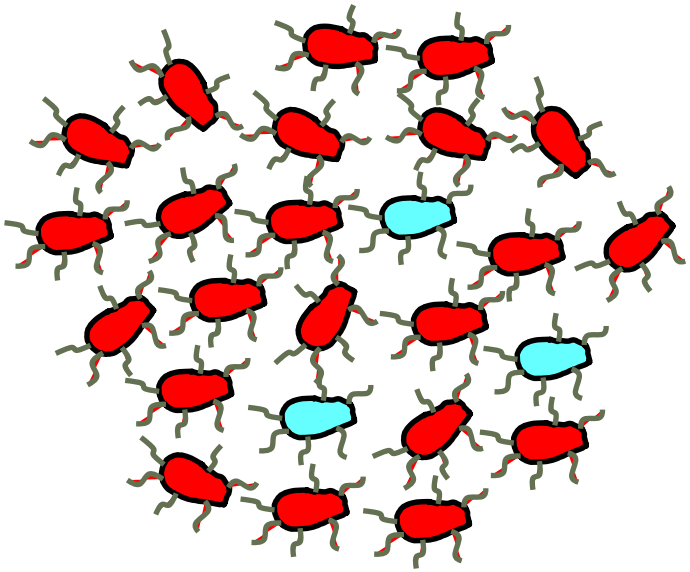
How Natural Selection works

1.00 not resistant
0.00 resistant

0.96 not resistant
0.04 resistant

0.76 not resistant
0.24 resistant

How Natural Selection works



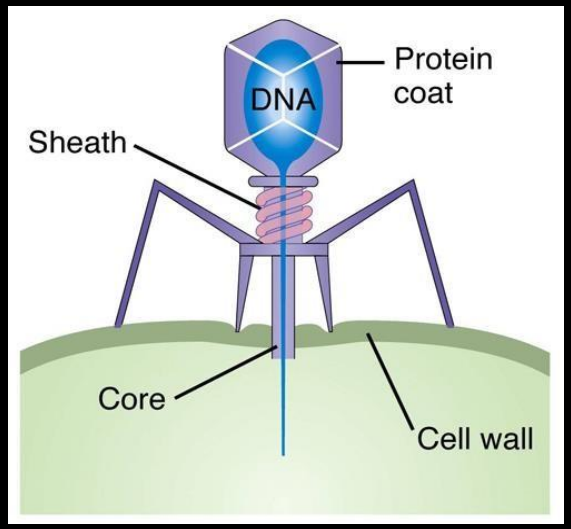
1.00 not resistant
0.00 resistant

0.96 not resistant
0.04 resistant

0.76 not resistant
0.24 resistant

0.12 not resistant
0.88 resistant

VIII .Viruses:

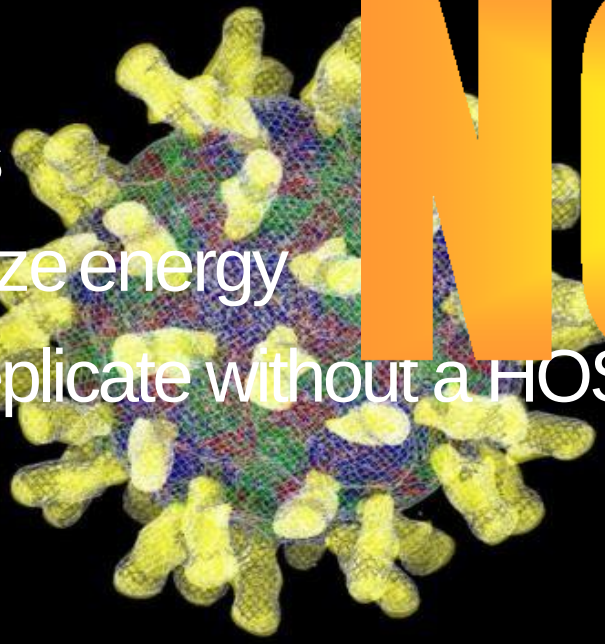


HAVE:

1. Have genetic info (DNA/RNA)
2. Have a capsid/protein coat
3. Have the ability to <u>evolve</u>/change/respond

Do NOT Have:

1. Do not have cells
2. Do NOT metabolize energy
3. Do not grow or replicate without a HOST



NO!!!

Evolution – The History of Life

I. The Fossil Record

A. **Paleontologists –** Scientists who study fossils and arrange them from oldest to most recent.

B. **Fossil Record –** indicates that groups of organisms have changed over time.

C. More than 99% of all species that have ever lived on Earth have become **extinct.**

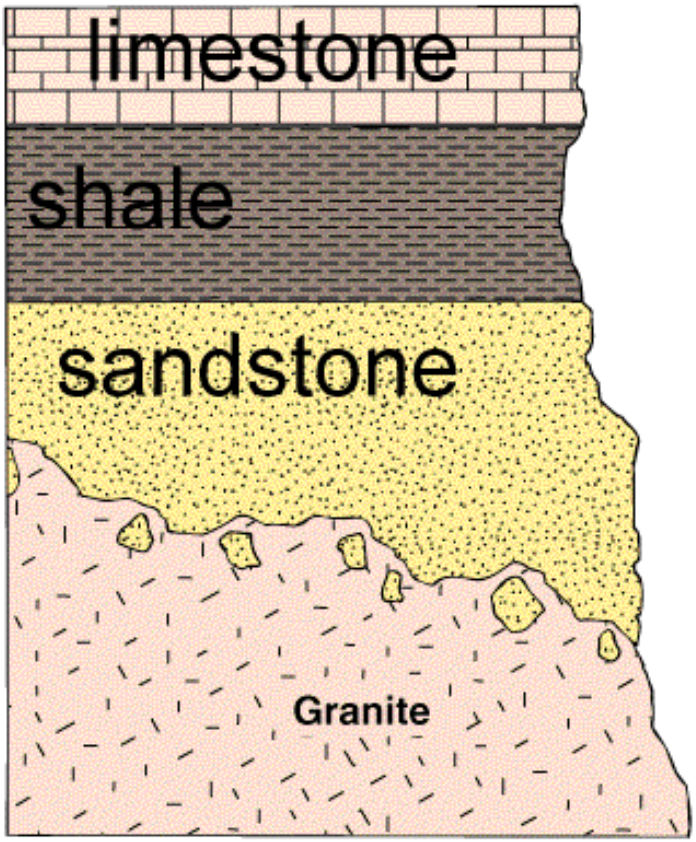
Chinese River Dolphin 2006

Dodo 1681

D. Relative Dating – Rock layers form in order of age, oldest on bottom.

E. Index fossils – distinctive fossil used to compare ages.

F. Radioactive dating - Older fossils have less carbon-14. Half life of radioactivity.



II. Evolution of Multicellular Life

A. Precambrian time - mostly unicellular prokaryotic organisms. First forms of life.

B. When oxygen levels rose…

1.) Some life became extinct

2.) Some survived in airless habitats

3.) Some evolved metabolic pathways that use oxygen

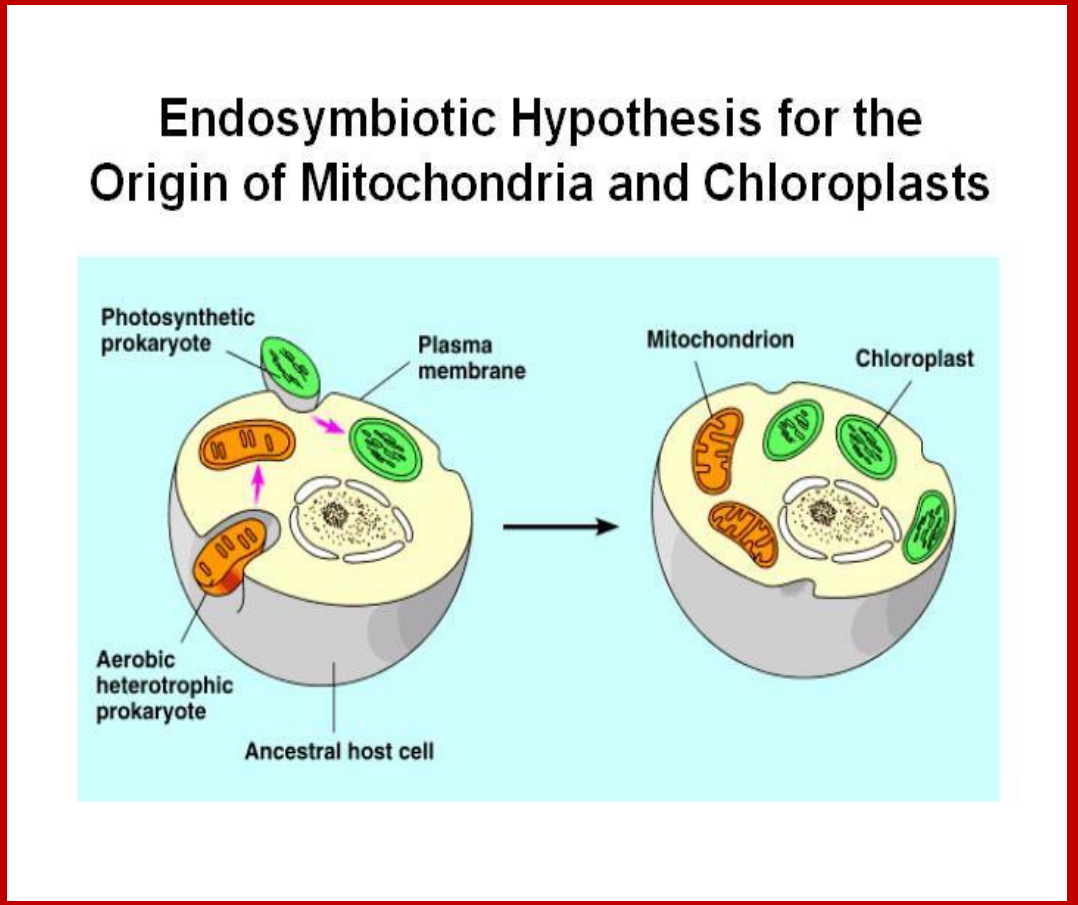
III. Endosymbiotic Theory :

Lynn Margulis

A. Eukaryotes evolved from the symbiosis of several cells

B. Mitochondria and chloroplasts may be descended from small aerobic and photosynthetic prokaryotes

C. Prokaryotes began to live inside larger cells



IV. Patterns of Evolution

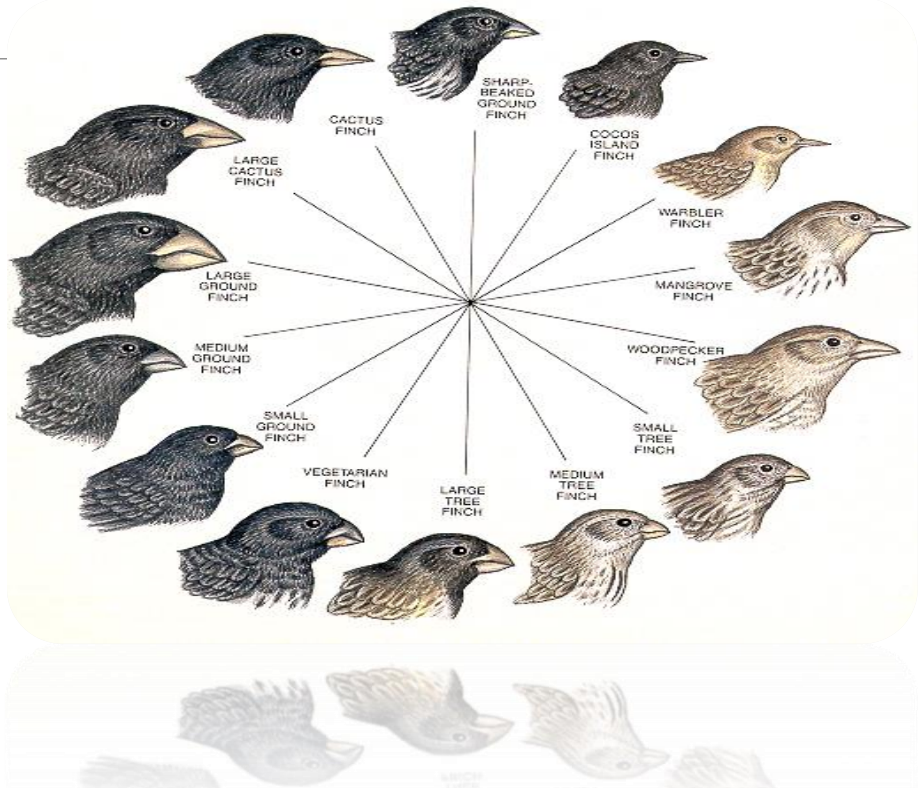
A. **Mass extinctions** (wipe out entire ecosystems) can occur for several reasons - meteorite impact…????
- Often leads to a burst of evolution for other species by making new habitats
- How did life continue? A wide diversity of species existed before the event.

B. **Extinction by natural selection** – Can happen with only 1 food source, live in rare habitats or reproduce slowly. Giant panda!

V. Types of Evolution

A. Adaptive Radiation – a single species or small group of species evolves into several different forms that live in different ways.

Ex: Darwin's finches – a dozen species evolved from a single species (common ancestor)



(Also called **Divergent Evolution**)

B. Convergent Evolution

– unrelated organisms come to resemble one another due to a (common environment)

Ex: Body shape of sharks, penguins, and dolphins

C. <u>Coevolution</u> – Two species evolve in <u>response</u> to changes in each other over time.

Ex: Orchid and Madagascar moth