

Examples of Evolution:



Archeopteryx: A transition fossil between reptiles and birds.

Example #1: Peppered Moths

- A famous example from England that demonstrates natural selection is the Pepper Moth.
- **Two** different species of moths, one **light** colored and one **dark**.
 - **Before** the 1850's the **dark** one was very **rare**, **after** the 1850's the **light** color became **rare**.



Example #1: Peppered Moths

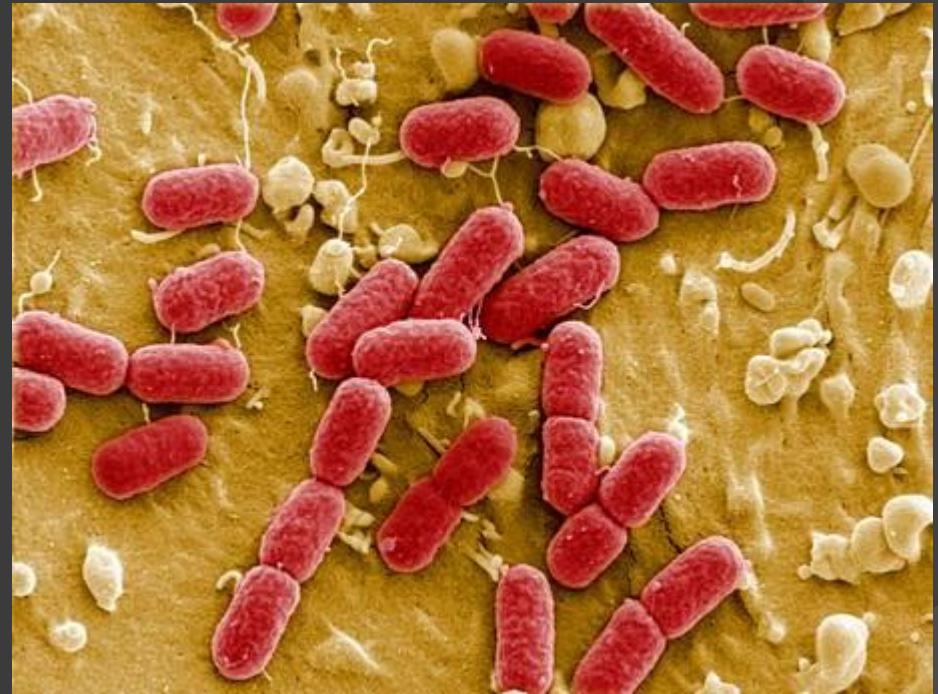
What happened in the 1850's?

INDUSTRIAL REVOLUTION →
Coal fired plants produced lots of soot that covered the trees and buildings, making everything dark. So where once the **birds** preferentially picked off and ate the dark moths, they now saw and ate the light ones instead.



Example #2: Resistance of Bacteria to Antibiotics Through Exposure

- As the use of antibiotics have become widespread
 - many disease-causing bacteria have developed resistance against known antibiotics.
 - Only the resistant bacteria will survive and reproduce



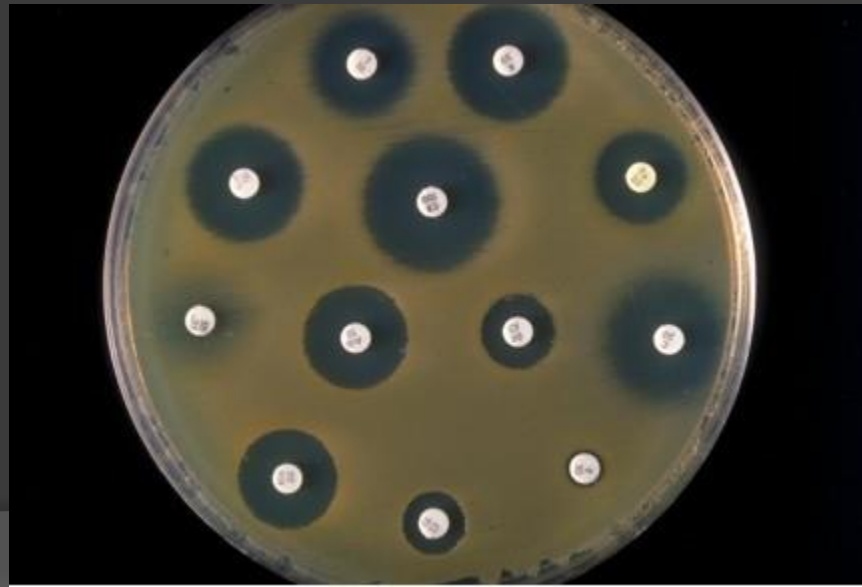
◎ This means that if you become infected with these bacteria, treatment with antibiotics will not cure you and the disease may become fatal.

A cartoon illustration of three orange, round bacteria. The top one has a surprised expression with wide eyes and an open mouth. The bottom-left one has a happy expression with a wide smile. The bottom-right one has a sad expression with a frown. A yellow speech bubble next to the surprised bacterium contains the text "resistance is futile".

resistance is futile

Methicillin-resistant
staphylococcus aureus

- ◎ This is more likely to occur when a small dose of antibiotics is used over a short time.
 - It will kill some of the bacteria but not all.
 - Next time antibiotics are used, these bacteria may be less vulnerable and more survive.
 - Repeated small dosages can produce very resistant strains.



Psst! Hey kid! Wanna be a Superbug...?
Stick some of this into your genome...
Even penicillin won't be able to harm you...!



It was on a short-cut through the hospital kitchens that Albert was first approached by a member of the Antibiotic Resistance.

Example #3: Artificial Selection



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- There are numerous examples of humans performing their own type of selection (hence: artificial) on desired, *heritable* traits belonging to a variety of organisms.

Since we seem to like the #3,
we have...

3 examples:



Example #3: Artificial Selection

#1:

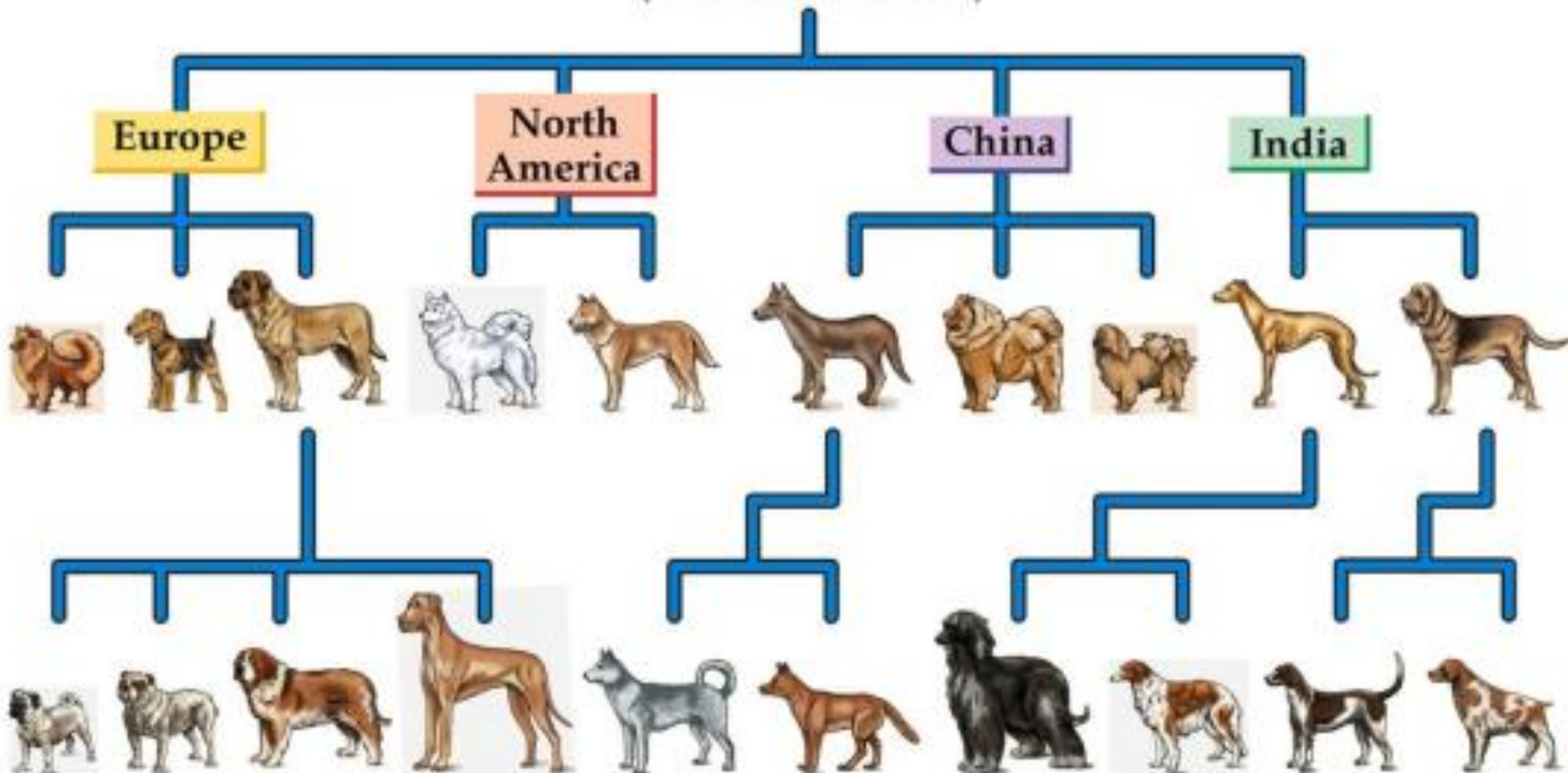
The domestication of the wolf (or domestication of any animal) is a good example:

Further selection of favored traits resulted in the varied amount of dog breeds we have today.





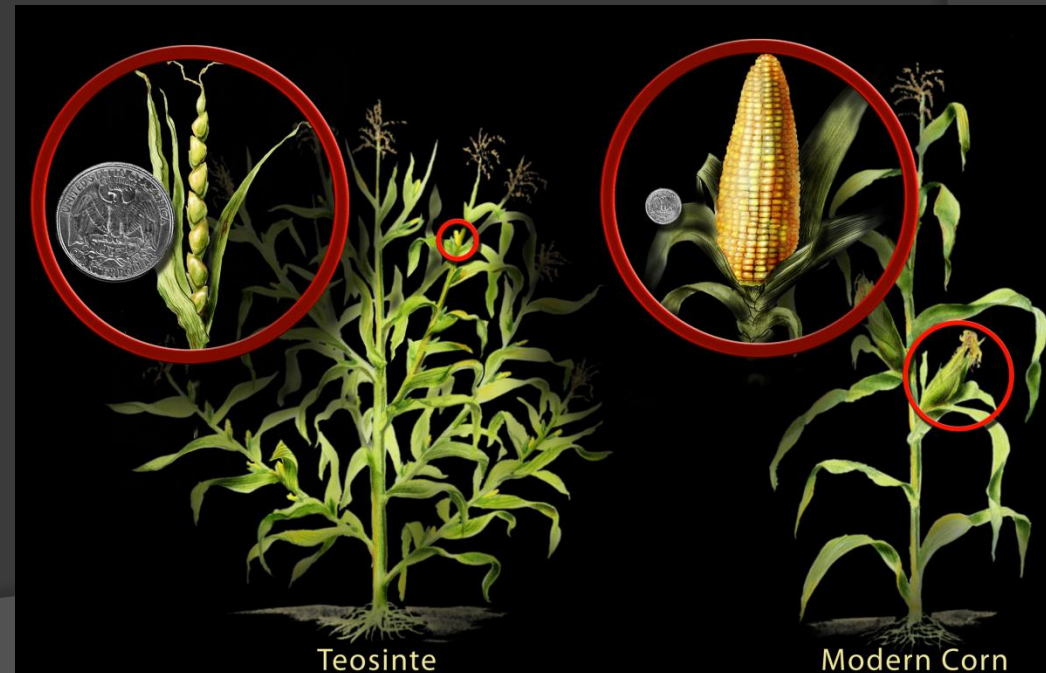
Gray wolf
(Common ancestor)



Example #3: Artificial Selection

#2:

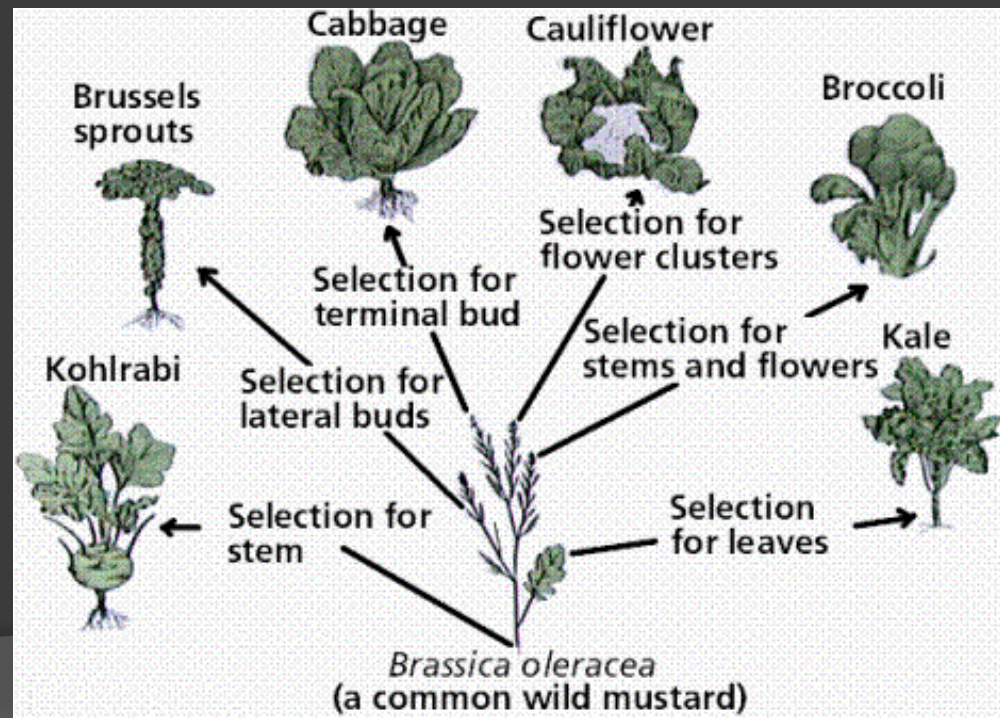
Selective breeding transformed teosinte's few fruitcases into modern corn's rows of kernels.



Example #3: Artificial Selection

#3:

By selecting various traits of the common wild mustard plant to breed for, we have created many common vegetables we use today such as broccoli, cauliflower and brussels sprouts.



Artificial selection is also important as it acts as an *experiment* on natural selection.

Experimentation is the ultimate test of a scientific hypothesis, without it you can never be sure that a correlation (i.e. the environment selecting for traits) you observe is significant.

Example #3: Artificial Selection

In artificial selection, humans are the manipulators (we are the environment)- we choose which individuals get to reproduce.

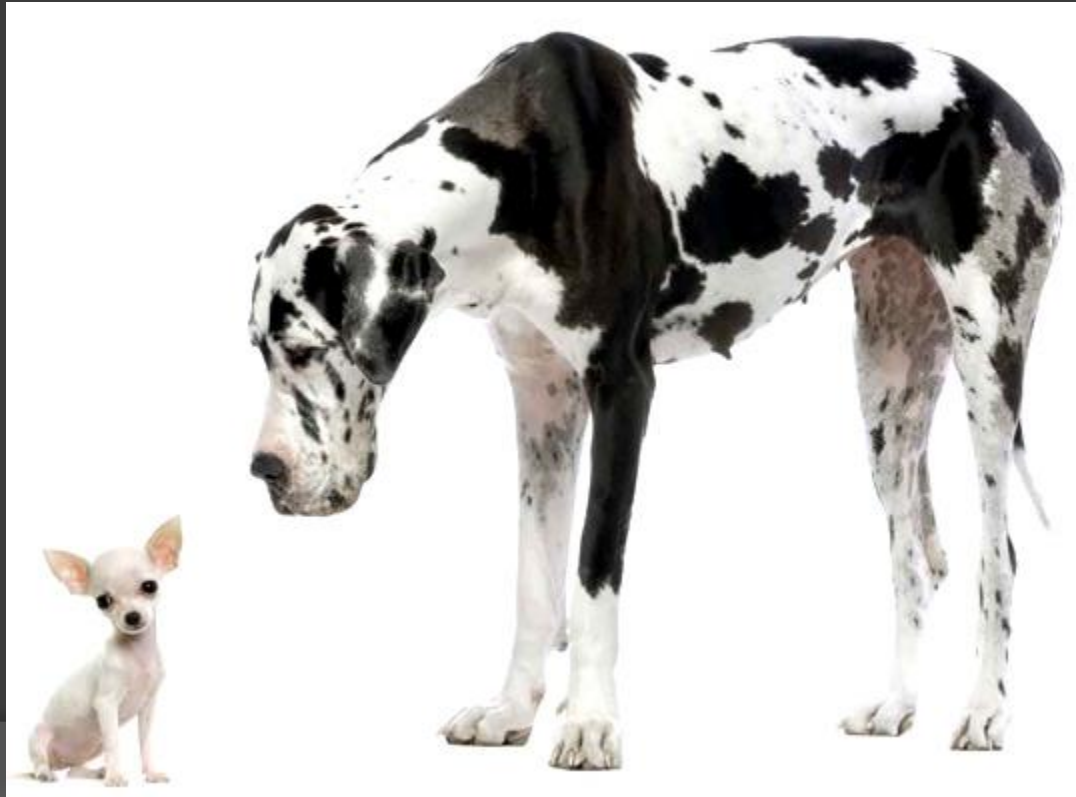
We would expect to see what is found in nature- that the individuals who reproduce pass on their genes/traits, and that is exactly what we see.



Example #3: Artificial Selection

Artificial Selection can also be used as evidence of evolution.

We will discuss more forms of evidence next.



Scientific Evidence for Evolution

“Those who cavalierly reject the Theory of Evolution, as not adequately supported by facts, seem quite to forget that their own theory is supported by no facts at all”

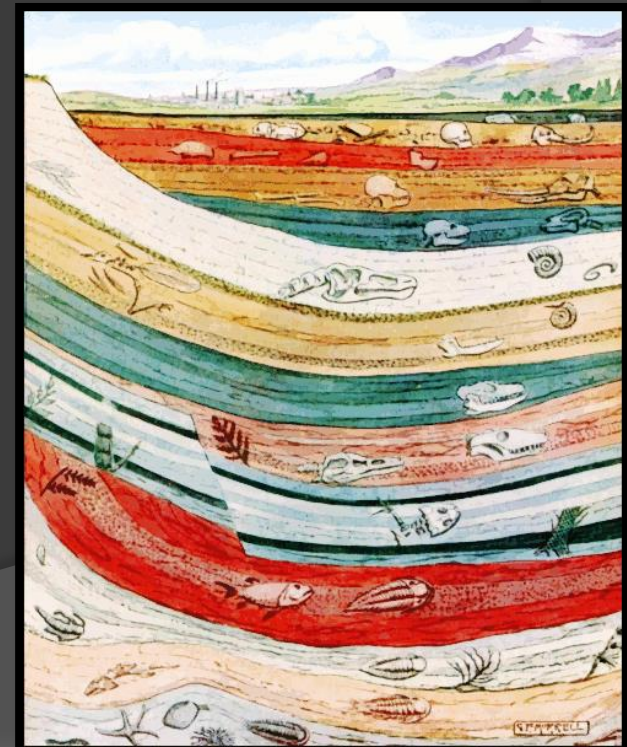
-Herbert Spencer, *Essay Scientific, Political and Speculative*, 1891.

1) Fossils!

Fossils do show intermediate stages, despite their rarity.

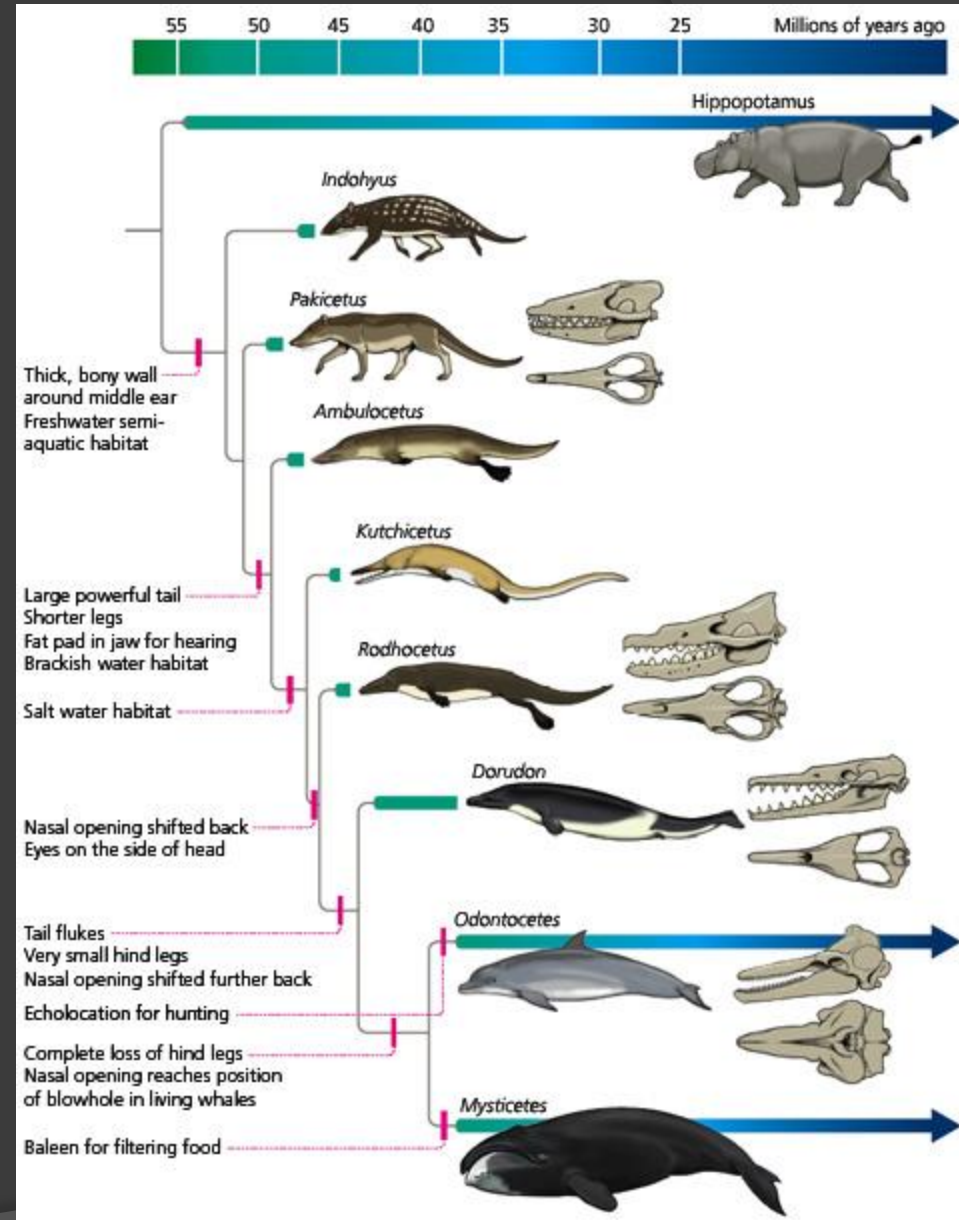
And geological strata consistently reveal the same sequence of fossils!

A quick and simple way to debunk the theory of evolution would be to find a fossil horse in the same stratum as a trilobite.



1) Fossils!

For example, there are now at least eight intermediate fossil stages identified in the evolution of whales.



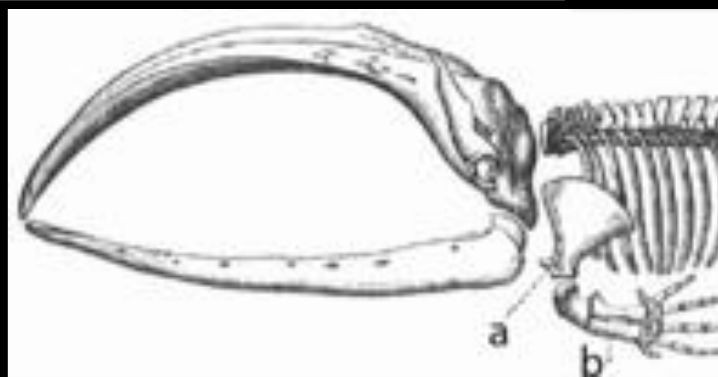
2) Vestigial Structures



- An organ present in the organism but either reduced in size or has no use.

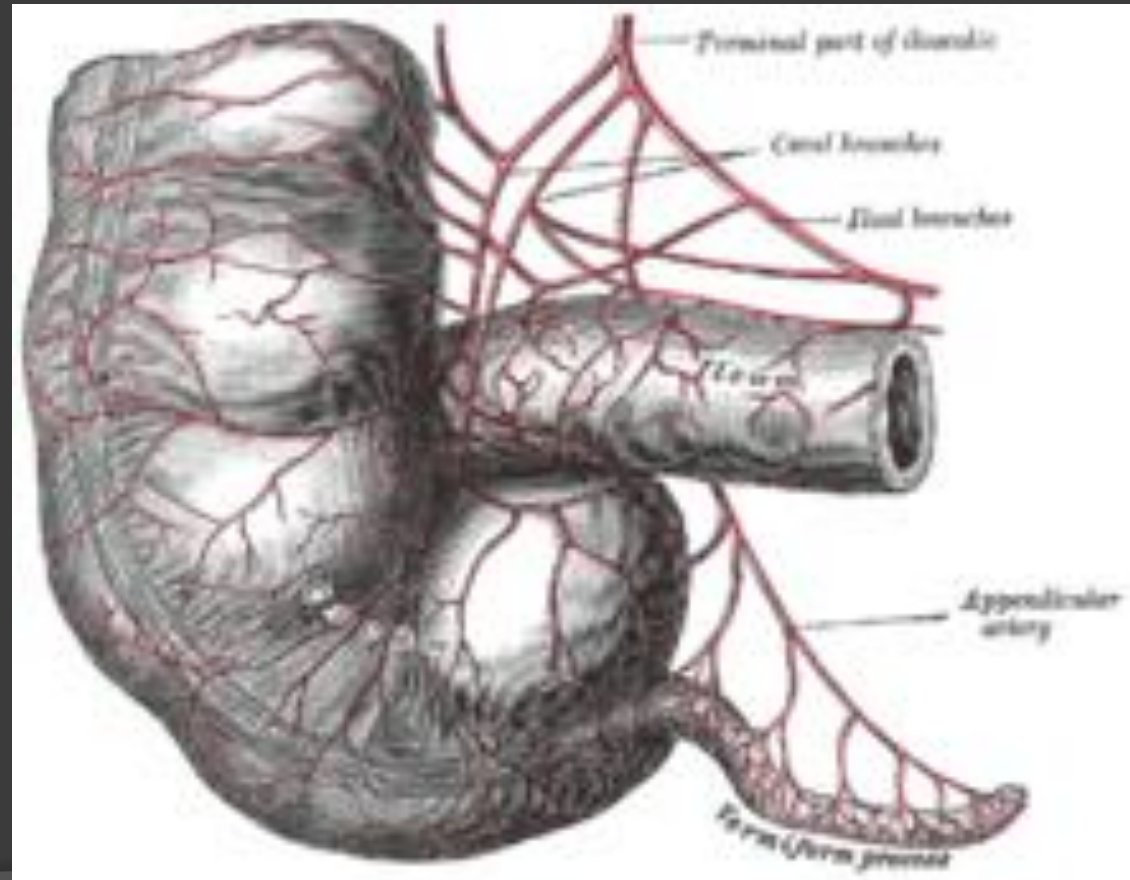
Ex.

- Femur in some whales
- Dewclaw in dogs
- Eyes in blind mole rats
- Fake sex in virgin Whiptail lizard
- Wings on flightless birds



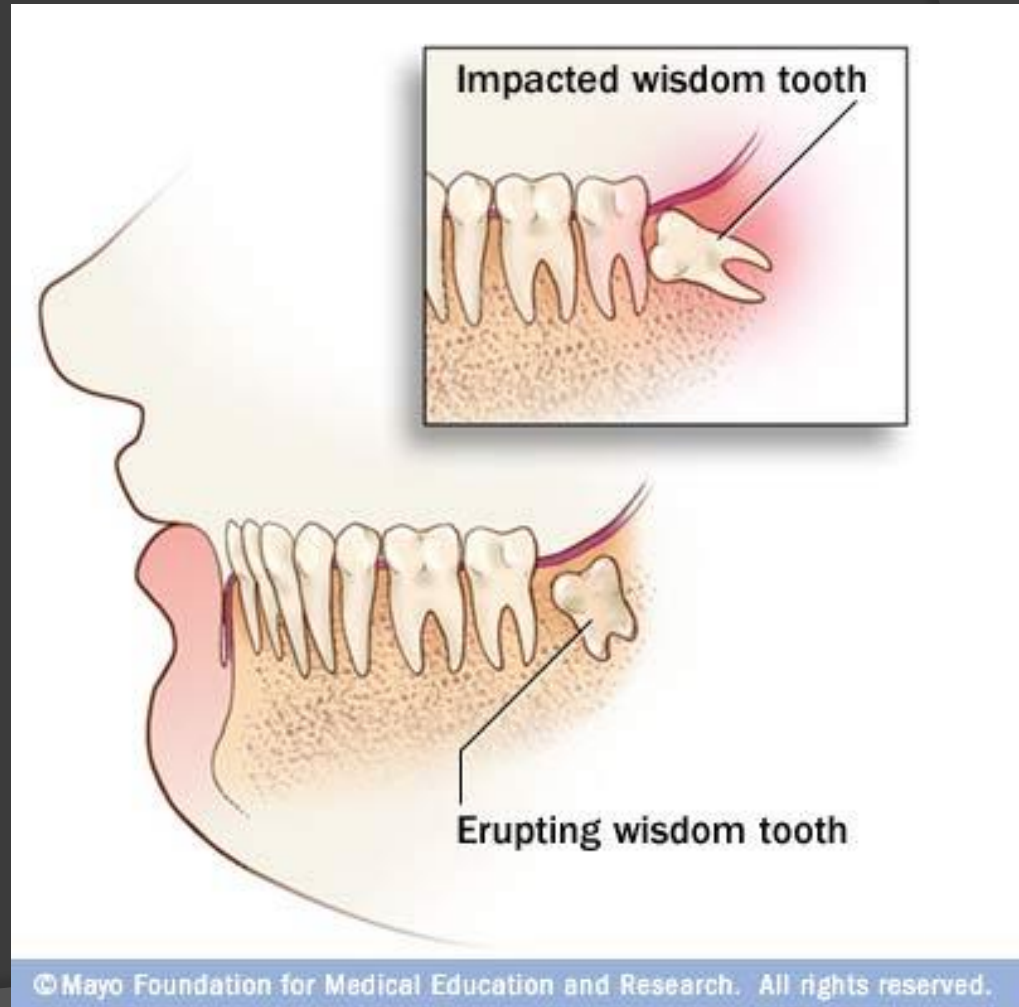
Human Vestigial Organs

The Appendix



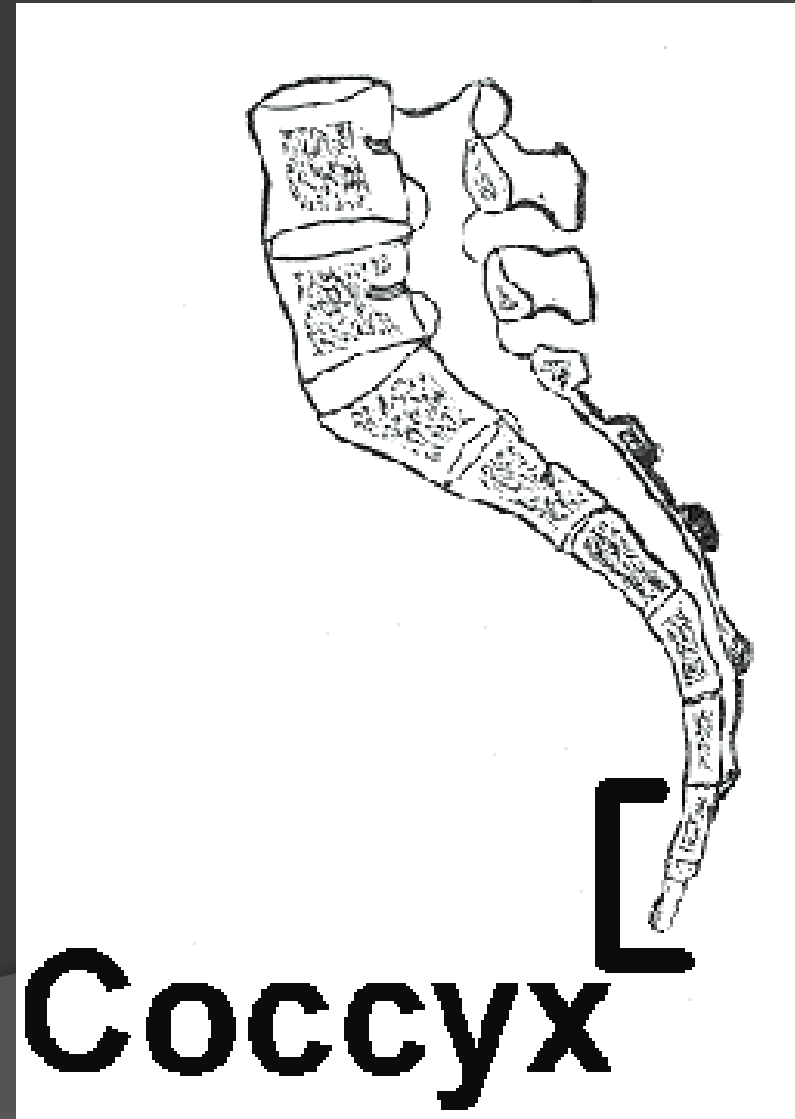
Human Vestigial Organs

Wisdom Teeth



Human Vestigial Organs

Human Coccyx (Tailbone)



Human Vestigial Organs

Body Hair and Erector Pili (Goosebumps)



Human Vestigial Organs

Ear Muscles



Human Vestigial Organs

Third Eyelid

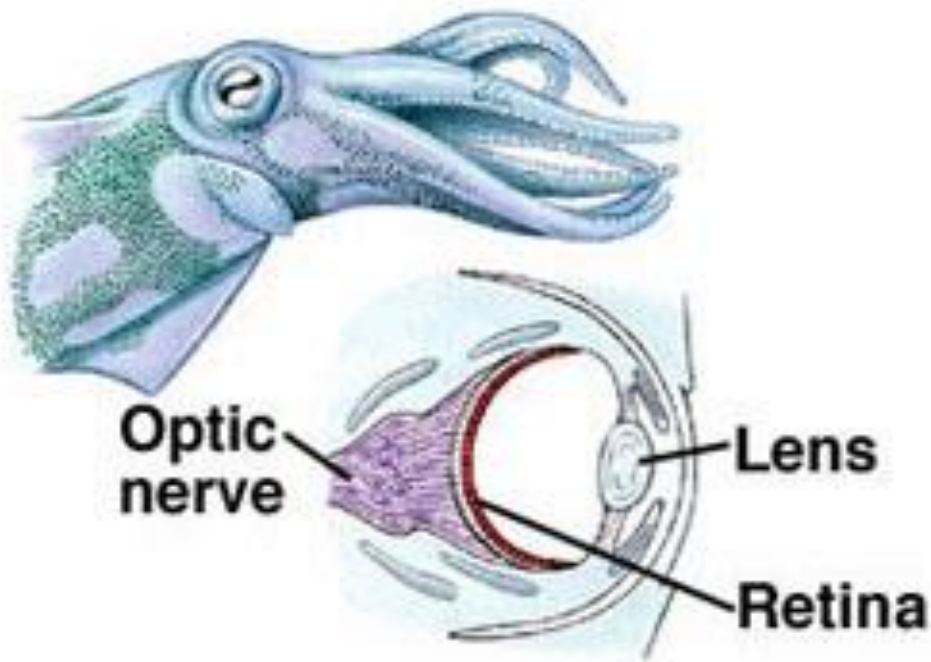


Image: COURTESY OF PAUL MILLER

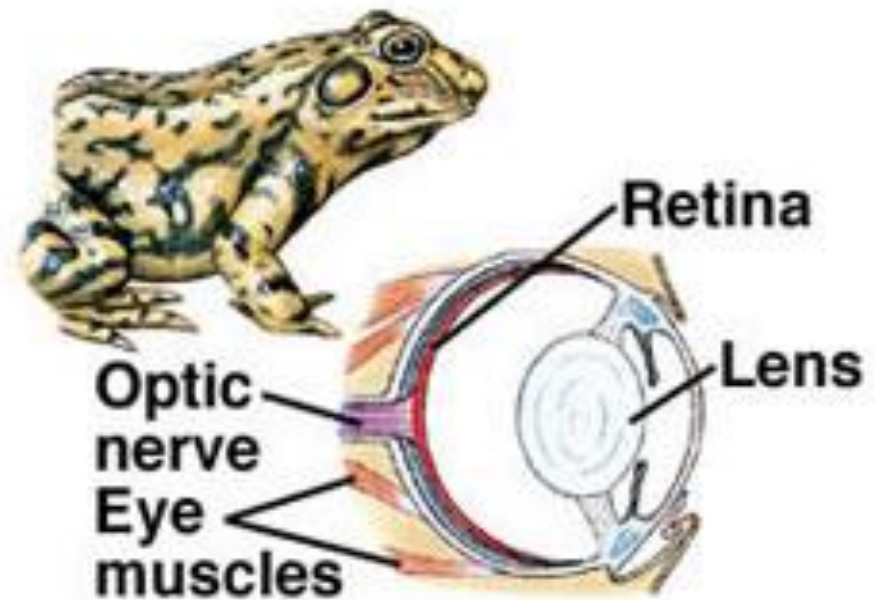
THIRD EYELID: Cats--and most other animals--have a third eyelid that comes in from the side to further protect their eyes from harm.

3) Homologous Structures

- Similar structures in very different organisms is evidence of a common ancestor.



Mollusk

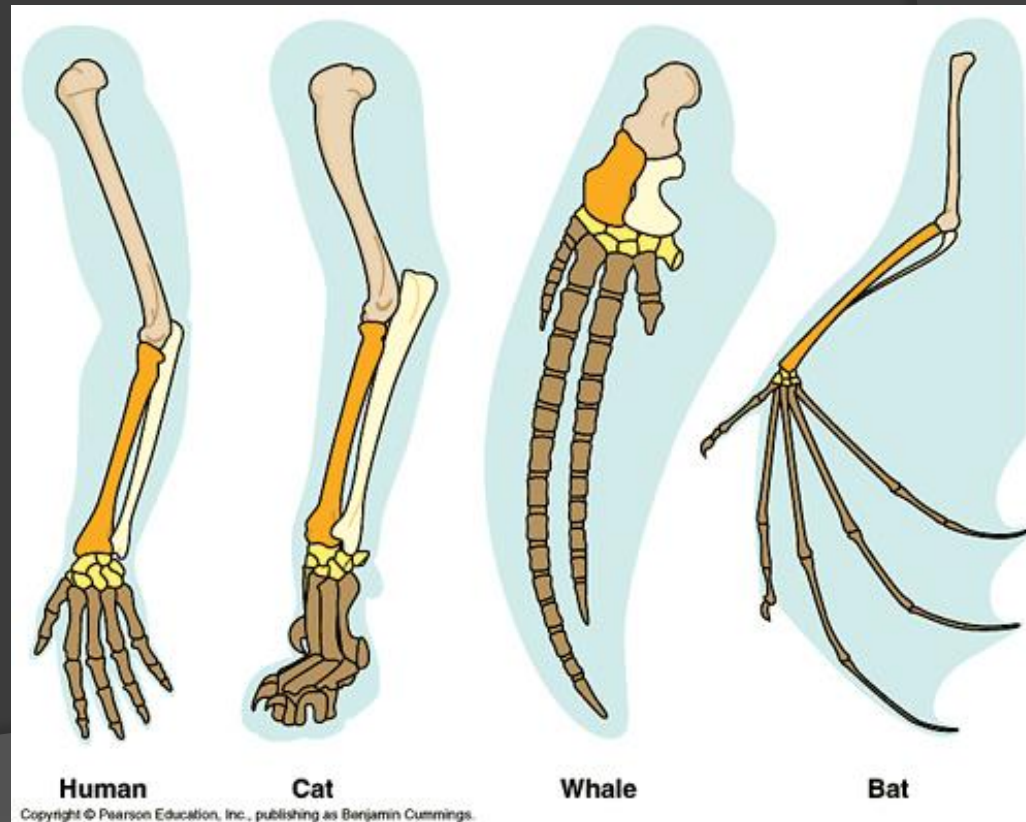


Vertebrate

3) Homologous Structures

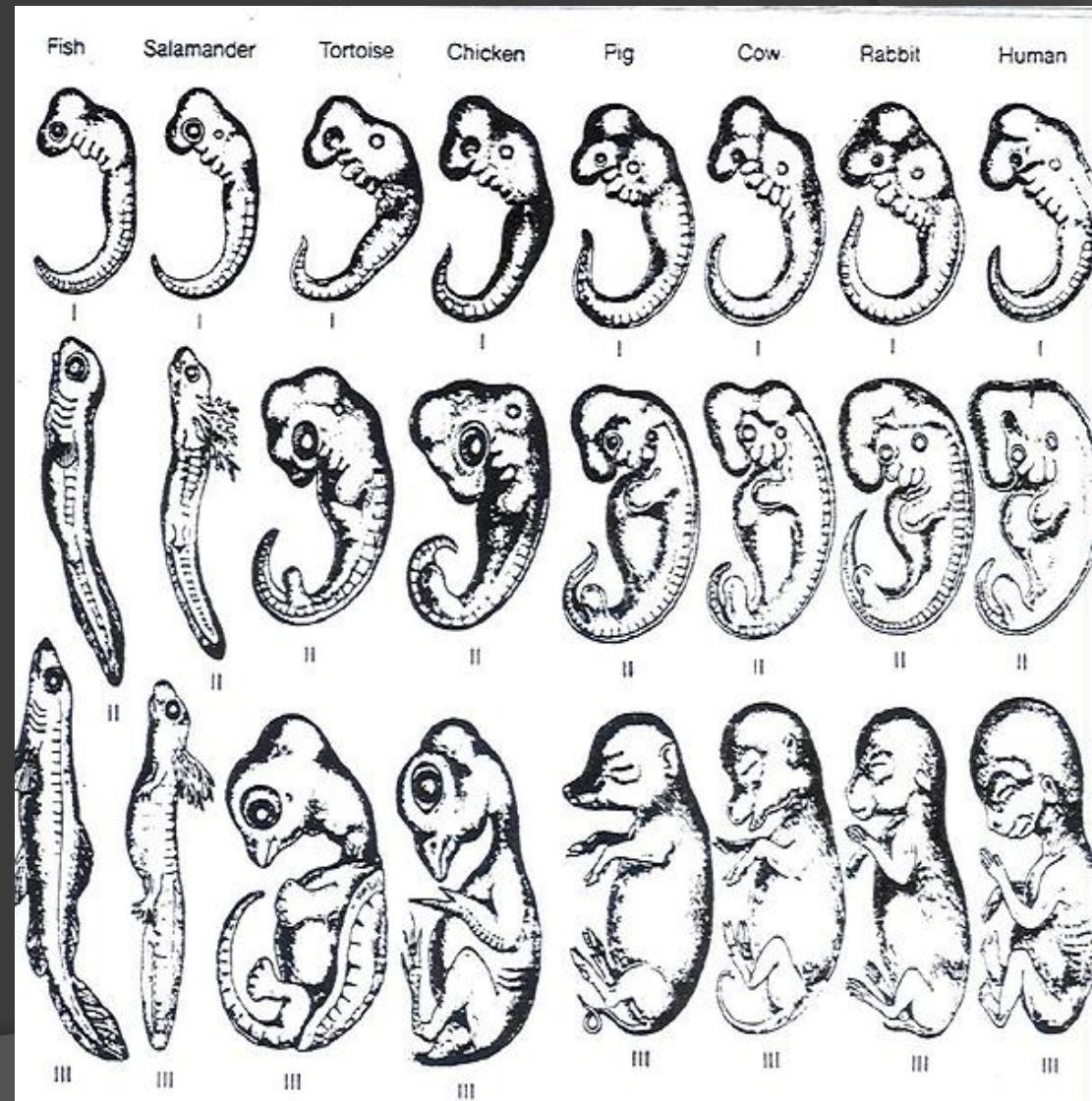
An example of this is the similarity of the skeleton between all mammals.

Every bone in a bat has its own identifiable counterpart in a human. Identifiable, because of the order in which they join up. Only the proportions are different.



4) Embryonic Development

- Physical similarities between embryos of different species at different stages.



4) Embryonic Development

Though humans share common ancestors with other animals, stages of human embryonic development are not functionally equivalent to the adults of these shared ancestors.



In other words, just because we develop a tail and gill slits embryonically does not mean that they are functional like they are in fish.

5) Universality of the Genetic Code

- All organisms share the same genetic code, based on the series of bases: A, T, G, and C.
- The more similar two species are the more alike the sequence of bases in their DNA are.

