# TAXONOMY

FEBRUARY 11TH 2016

# LEARNING OBJECTIVES

- Use  binomial nomenclature to identify organisms
- List the kingdom, phylum (sub-phylum) class, order, family, genus and species
- Identify the characteristics of a good classification system
- Identify the criteria (evolutionary relationships) that are used to classify organisms
- Explain why we use these criteria vs. others

# SHAPE OF THE DAY

- **15 min** – Why classify? Early efforts to classify/Linnaean taxonomy
- **15 min** – Activity
- **15 – 20 min** – How do we classify?
- **Remaining time** – Individual Work time

# WHAT IS TAXONOMY?

"The branch of science concerned with the description, identification, naming and classification of organisms"

# THINK PAIR SHARE

How did you classify?

What were some issues that you faced while classifying yesterday?

# WHY CLASSIFY?

- To make sense of the living world
- To communicate with others (to have a common language)

# WHY CLASSIFY?

1. Specific
2. As clear and objective as possible
3. Descriptive

# EARLY EFFORTS TO CLASSIFY?

*Plantago foliis ovato-lanceolatus pubescentibus, spica cylindrica, scapo tereti*

"Plantain with pubescent ovate-lanceolate leaves, a cylindric spike and a terete scape"

# EARLY EFFORTS TO CLASSIFY?

"I shudder at the sight of most [names] given by modern authorities"

**Carolus Linnaeus** (1707 – 78) invents binomial nomenclature and the taxa!

# LINNAEUS' CLASSIFICATION SYSTEM

**Binomial Nomenclature:** A system where all organisms are given a two part name

All organisms are classed under **taxa (groups)**.

# ACTIVITY

1. Start with a group of seven animals under kingdom Animalia
2. As you move down to phylum, class etc. Cross out one animal that does not seem to belong.
3. Next to the group, write down what you think the group has in common that the excluded member did not have.

# LINNAEUS' CLASSIFICATION SYSTEM

**Kingdom:** Animalia – mult

**Phylum:** Chordata – has a
cord

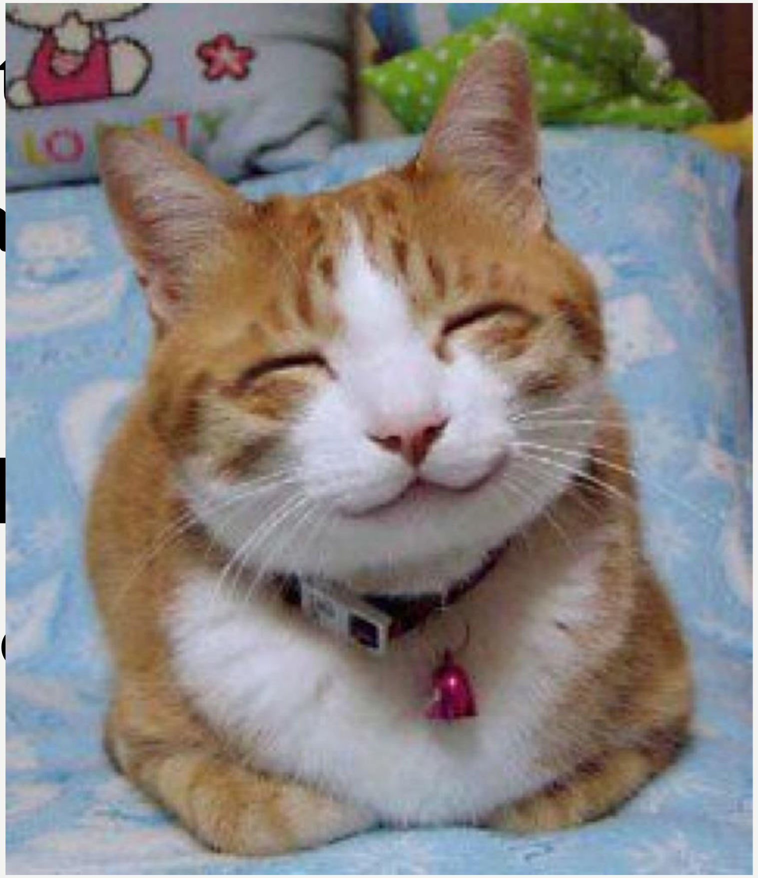
**Class:** Mammalia – fur and

**Order:** Carnivora - carniv

**Family:** Felidae – cat-like

**Genus:** Felis – small cat

**Species:** Catus



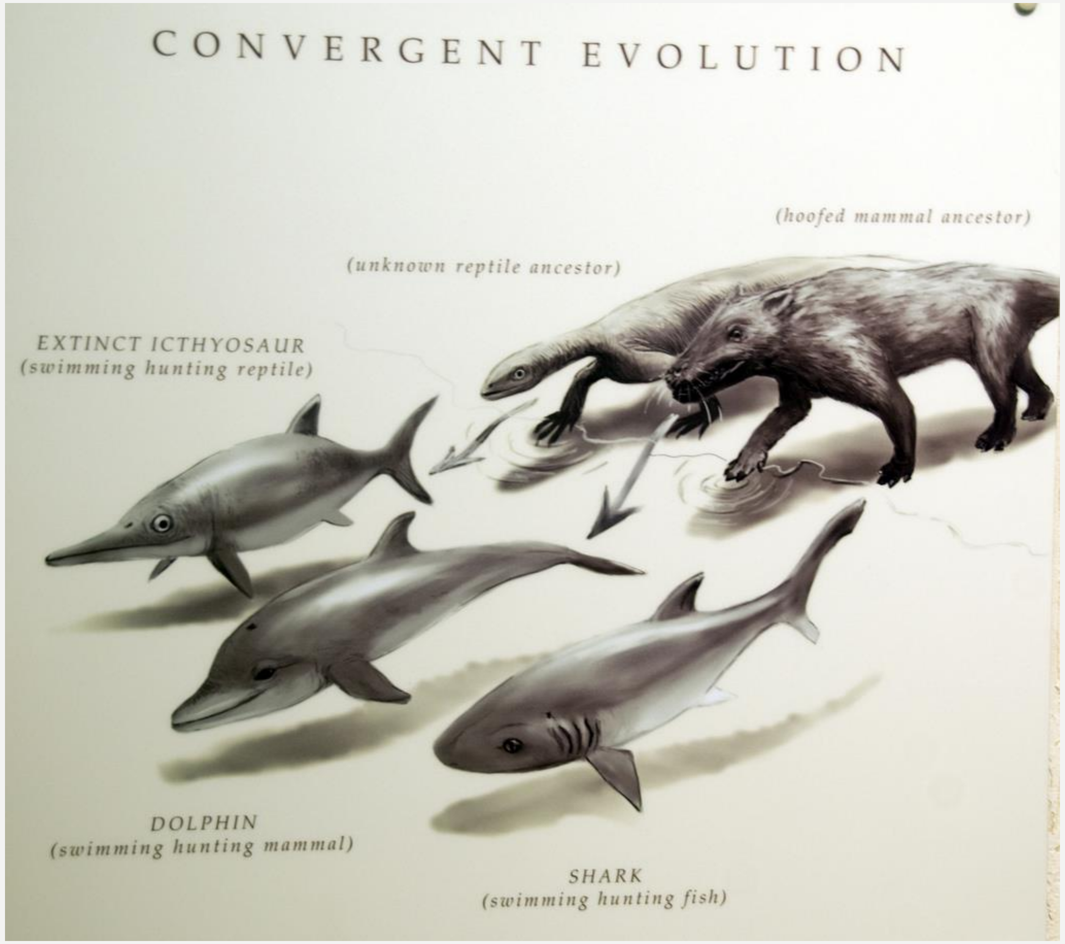
*Felis catus*

# ANALOGY

# HOW DO WE DECIDE ON THE GROUPS?

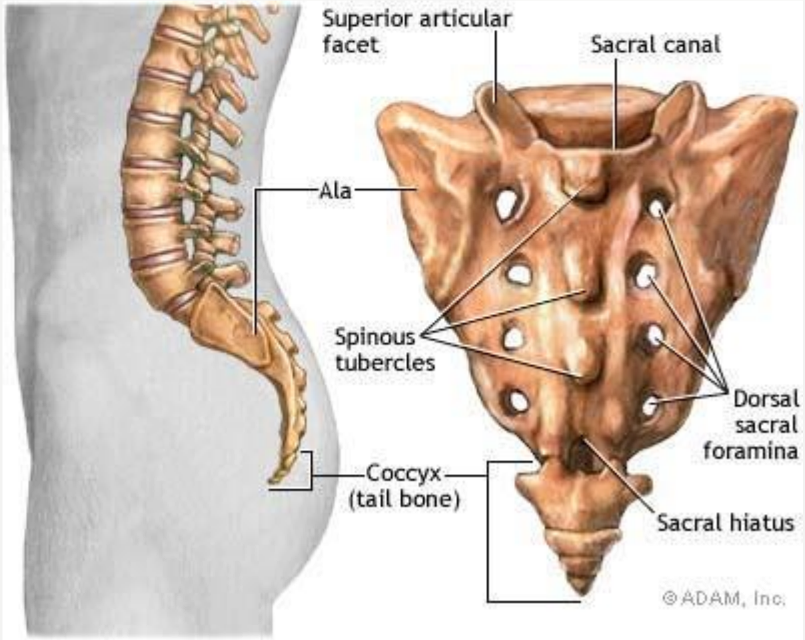
If we base it off of morphology alone, we can run into some problems.

e.g. analogous structures



# HOW DO WE DECIDE ON THE GROUPS?

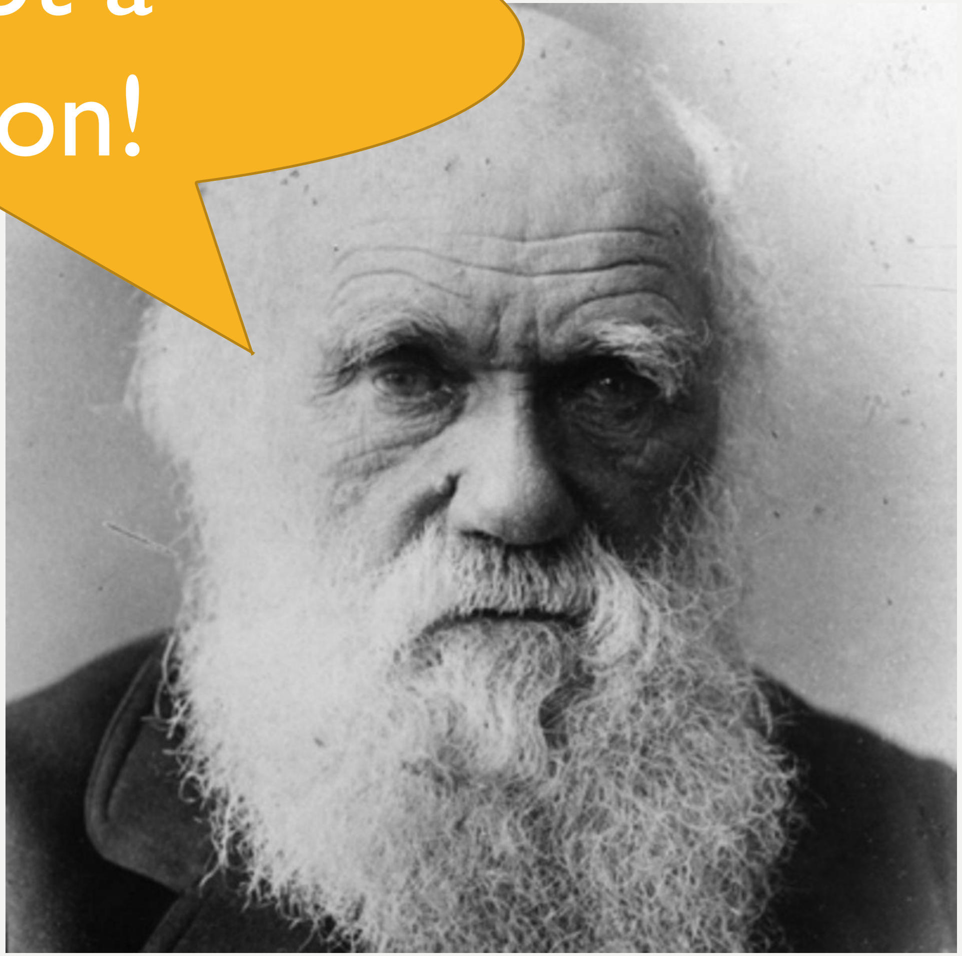
Organisms may also have lost some traits over time. (vestigial traits)



# HOW DO WE DECIDE ON THE GROUPS?

I’ve got a solution!

Darwin’s Theory of Evolution changed the way we organized organisms.



# Evolution: life on Earth is one big extended family

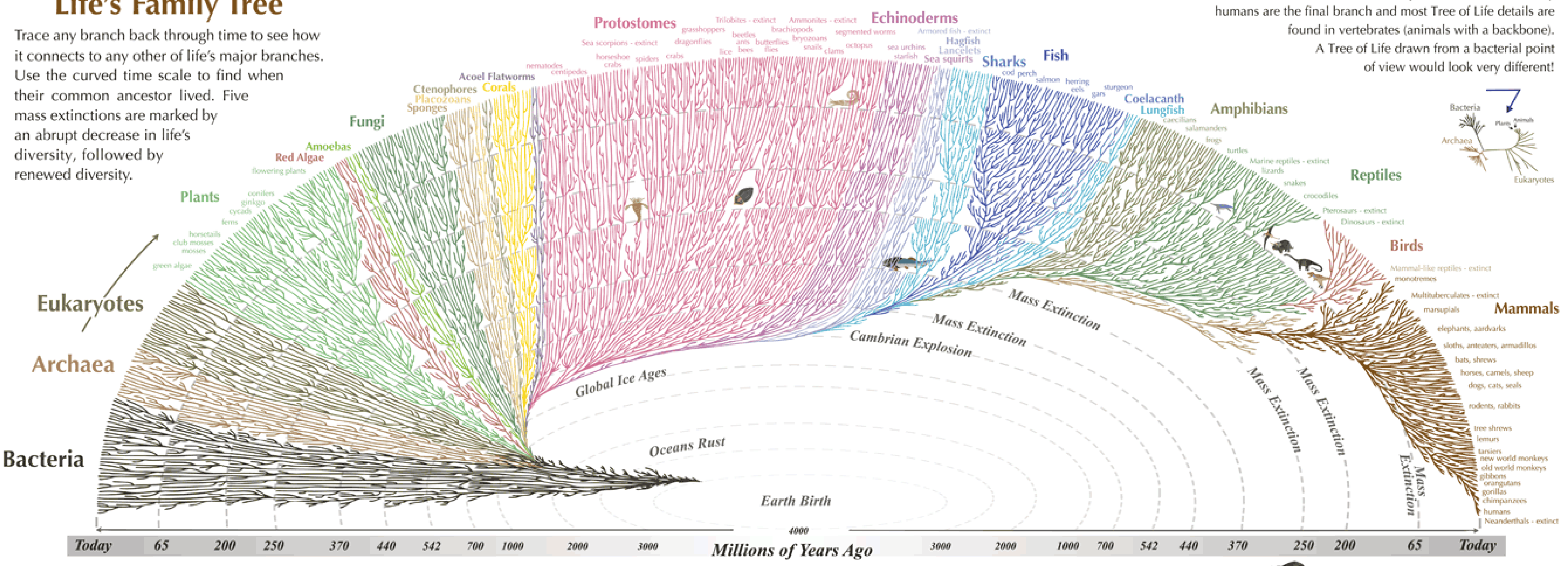
In 1858, Charles Darwin and Alfred Russel Wallace independently proposed a theory of biological evolution to explain the diversity of life on Earth. Since then the fossil record and DNA studies have added, and continue to add, overwhelming support for this view of life's history. Evolution today is one of the best documented and widely accepted principles of modern science.

Life on Earth has changed dramatically through time. The theory of evolution proposes that through the process of natural selection and other natural events stretching over millions of generations, living things diversify, branching from one species into many. This means that all living things are related to one another through common ancestry with earlier, different life forms. In other words, if you follow your family tree far enough back in time, you will find a common ancestor not only with every other living thing, but with every thing that ever lived.

## Life's Family Tree

Trace any branch back through time to see how it connects to any other of life's major branches. Use the curved time scale to find when their common ancestor lived. Five mass extinctions are marked by an abrupt decrease in life's diversity, followed by renewed diversity.

This Tree of Life is drawn from the human point of view. That is why humans are the final branch and most Tree of Life details are found in vertebrates (animals with a backbone). A Tree of Life drawn from a bacterial point of view would look very different!




All the major and many of the minor living branches of life are shown on this diagram, but only a few of those that have gone extinct are shown. Example: Dinosaurs - extinct

# HOW DO WE DECIDE ON THE GROUPS?

Today we organize organisms based on their **evolutionary relationships with each other.**

Analogy: human families

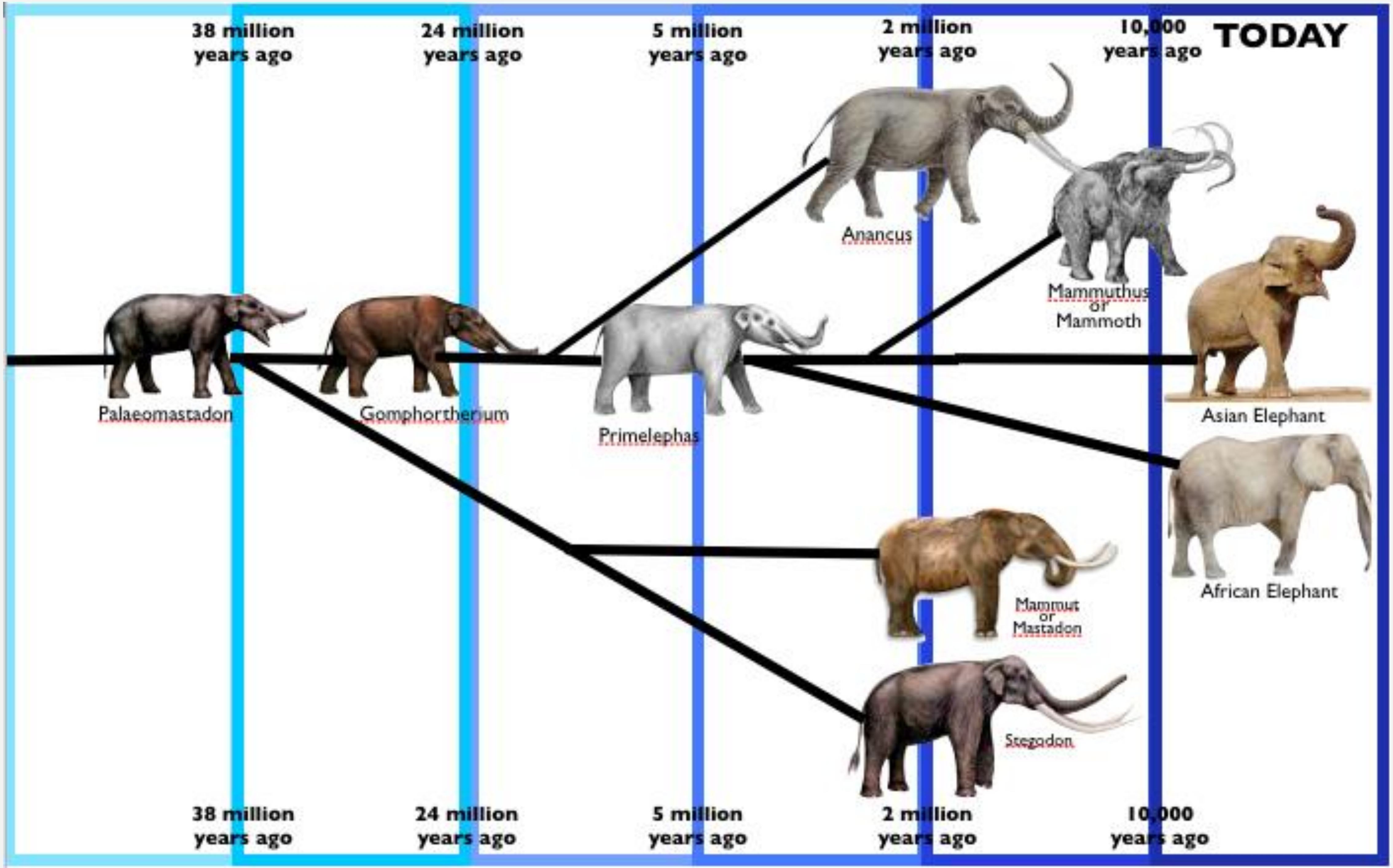
# HOW DO WE DECIDE ON THE GROUPS?

How can we figure out evolutionary relationships?

# HOW DO WE FIGURE OUT THE EVOLUTIONARY RELATIONSHIPS?

1. **Homologous structures**
2. Biochemical relationships
3. Embryological relationships

Parts of different organisms, often quite dissimilar that developed from the same ancestral parts.


38 million years ago
24 million years ago
5 million years ago
2 million years ago
10,000 years ago
TODAY
Anancus
Mammuthus or Mammoth
Asian Elephant
Palaeomastadon
Gomphortherium
Primelephas
African Elephant
Mammut or Mastadon
Stegodon
38 million years ago
24 million years ago
5 million years ago
2 million years ago
10,000 years ago

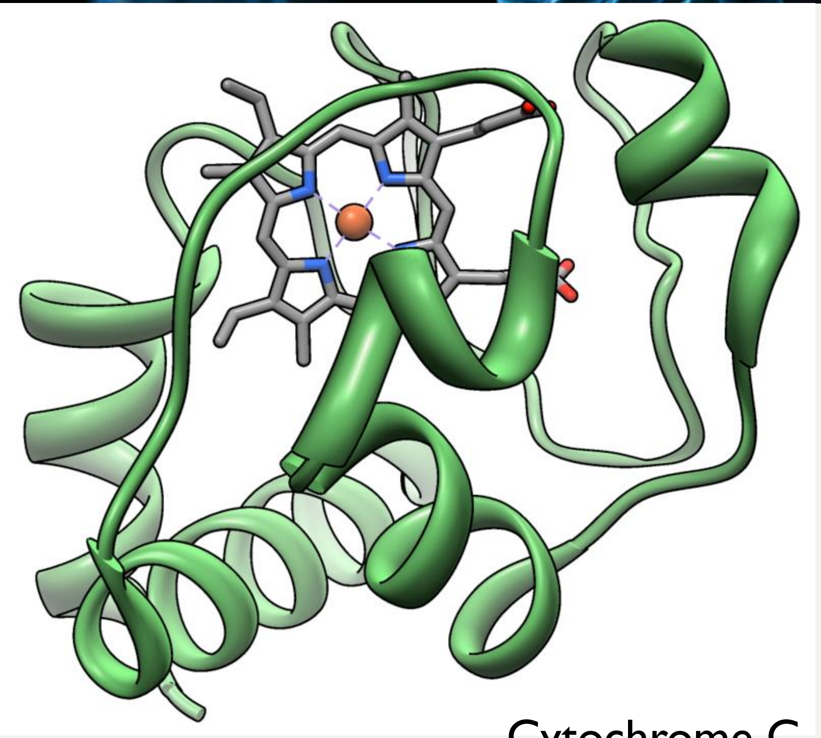
# HOW DO WE FIGURE OUT THE EVOLUTIONARY RELATIONSHIPS?

1. Homologous structures
2. Biochemical relationships
3. Embryological relationships

“bio-” – life

-chemical

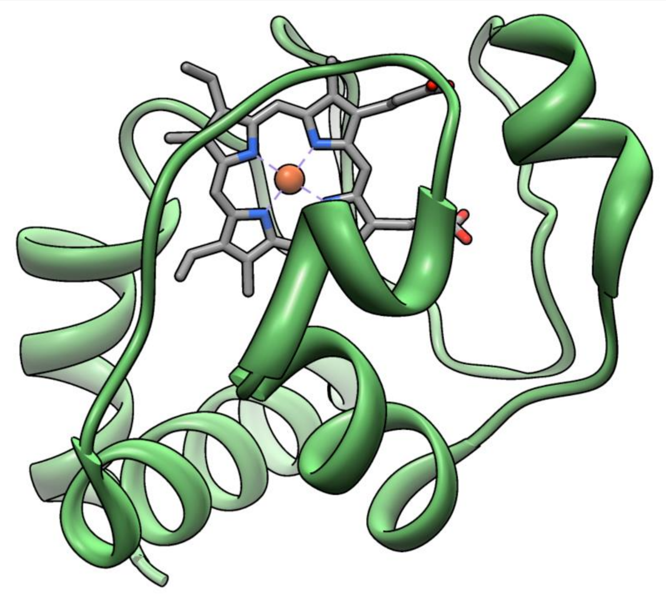
Chemical substances vital to living organisms.



Cytochrome C

Many of the chemical substances in our bodies (e.g. proteins) are produced from the DNA.

As species evolve and the DNA changes (mutations), the differences become greater.



If we study the differences of some chemicals (such as cytochrome c) in organisms, we can retrace the evolutionary history!

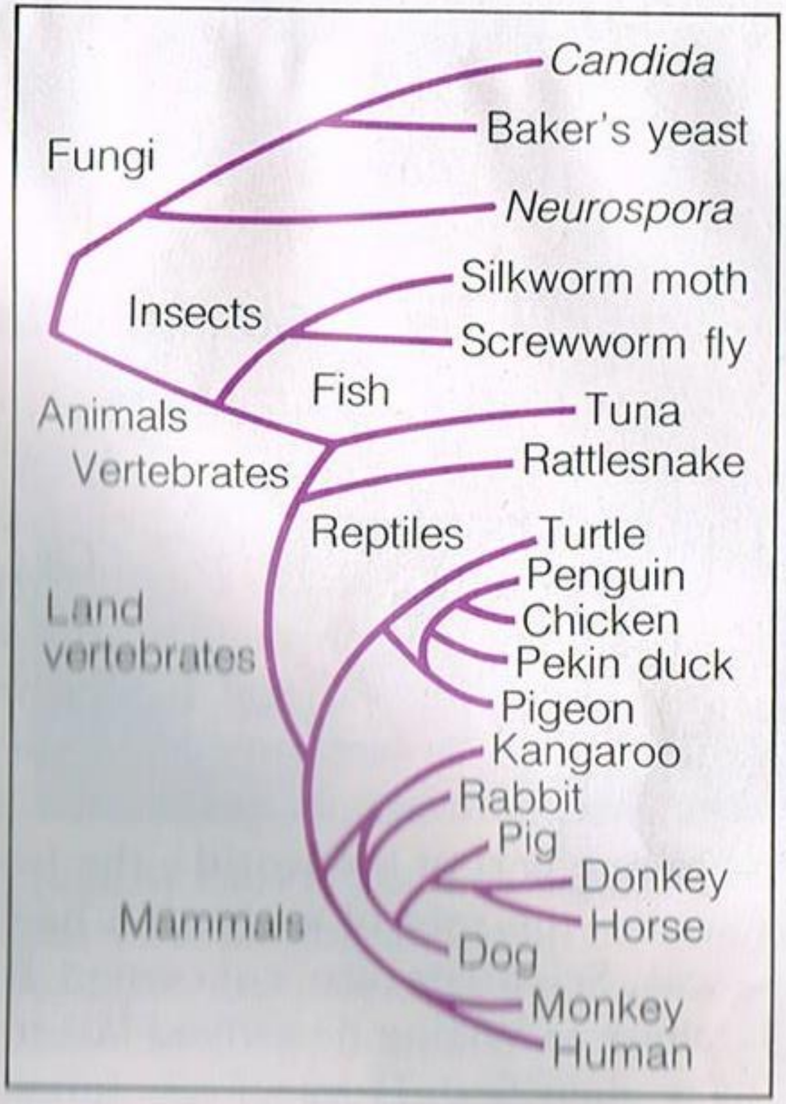


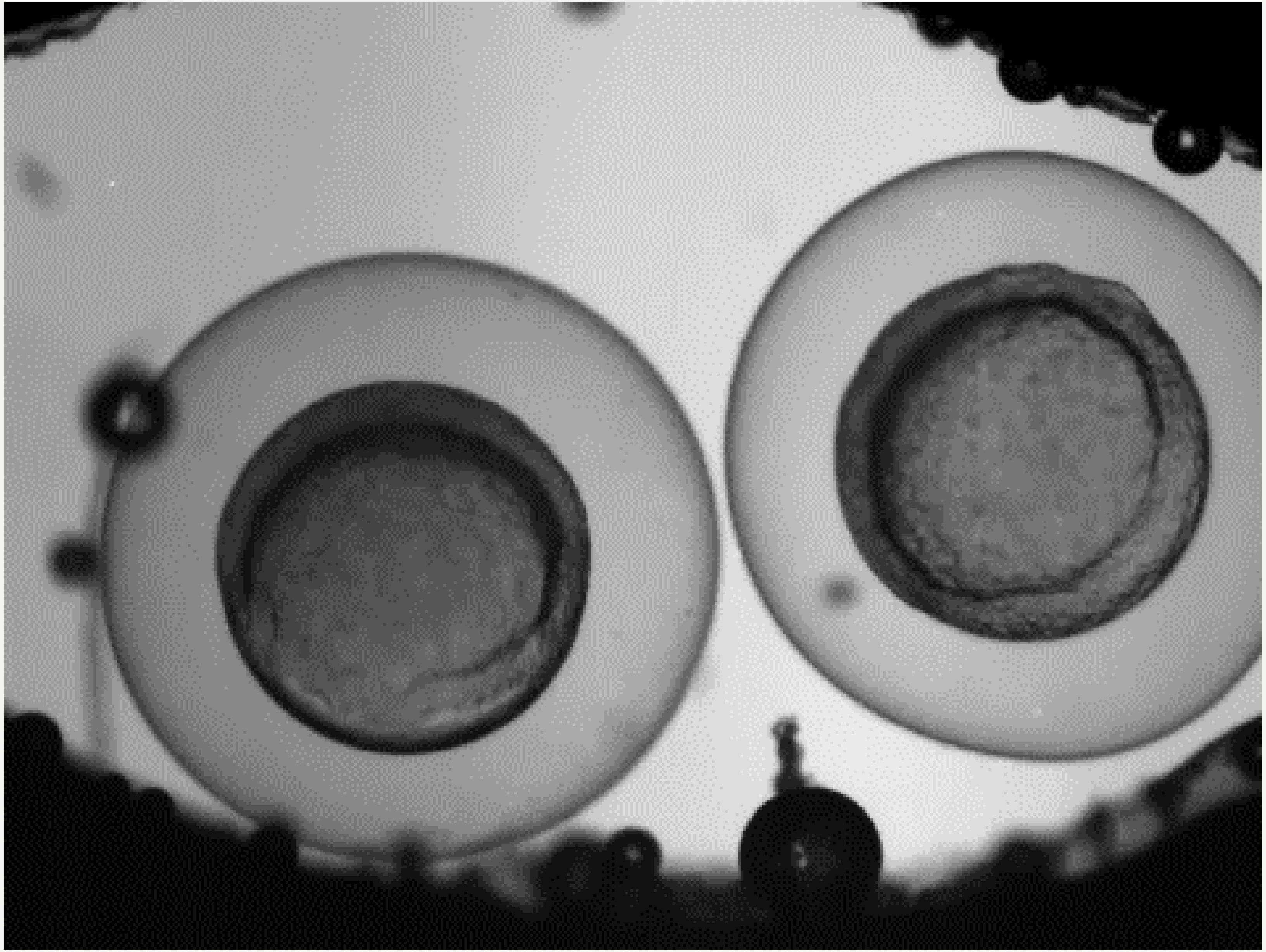

***Figure 15–9*** *This diagram groups organisms according to the similarities and differences in the versions of cytochrome c that they possess.*

# HOW DO WE FIGURE OUT THE EVOLUTIONARY RELATIONSHIPS?

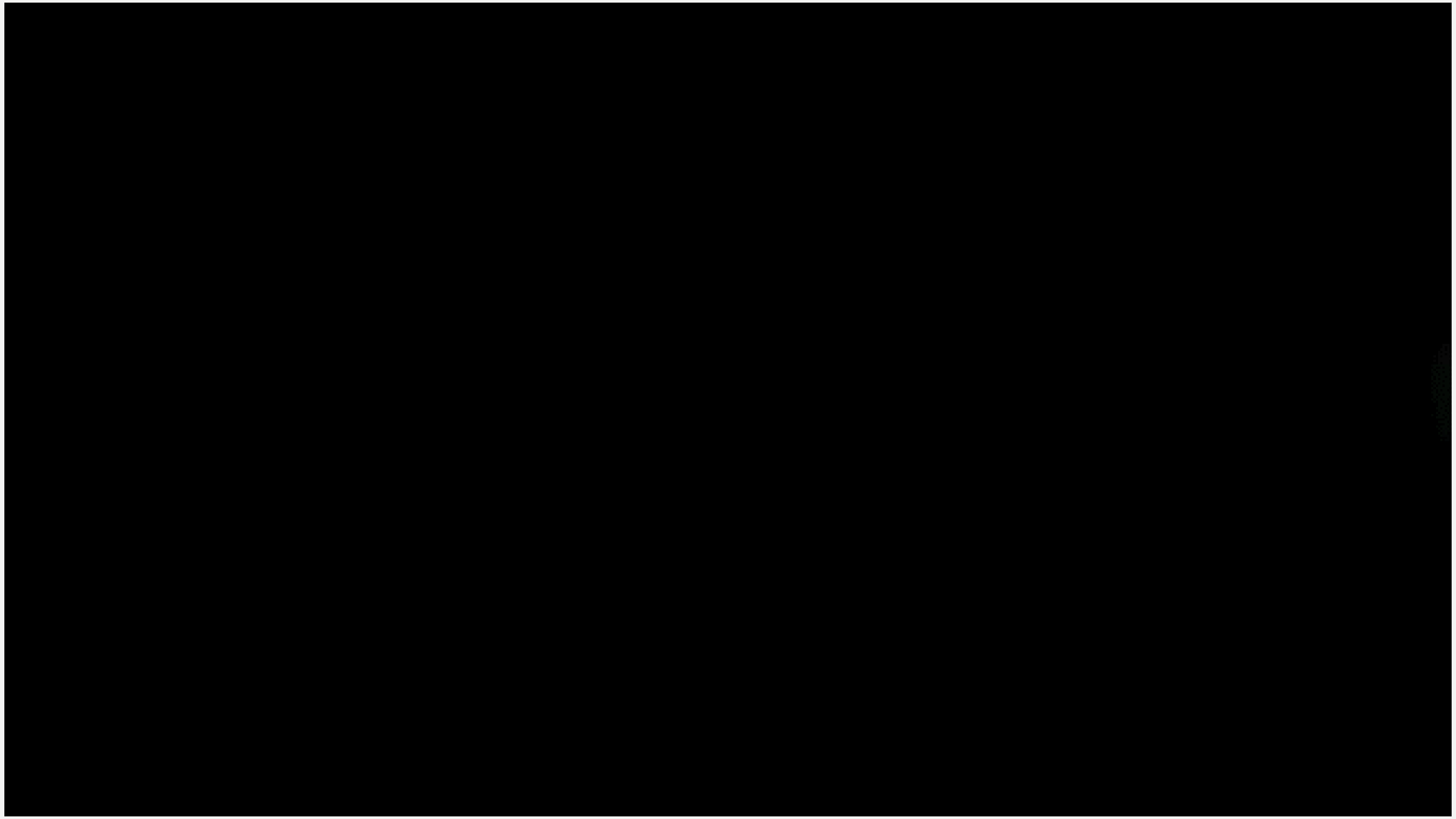
1. Homologous structures
2. Biochemical relationships
3. Embryological relationships

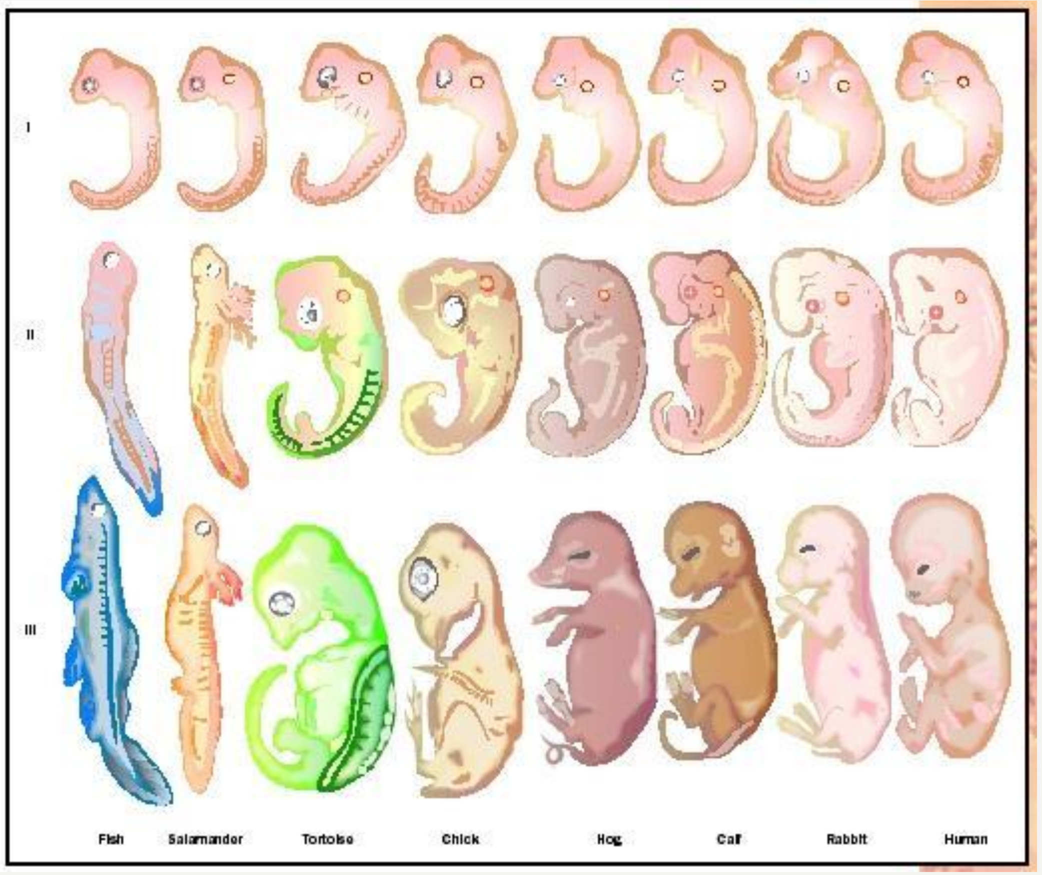
Just like the similarities and differences of chemicals can be racked up over time, so can differences in embryological development.

# Fish embryo development



# Mouse embryo development






In the early stages, organisms from fish to humans have a very similar embryonic stage, suggesting similar genes are being expressed.

This suggests these organisms are derived from a common ancestor.

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