

More Evidence for Evolution

The collage includes:

- Two skulls: a modern human skull and a more primitive hominid skull.
- A hominid skeleton with a height scale of 40 inches and 40 cm.
- A diagram titled "Theory of Evolution" with arrows pointing to it from: Anatomical Vestiges, Genetic Code, DNA Homology, Speciation Events, Experimentation, Fossil Record, ERVs, and Transitional Forms.
- Labels for "PREHISTORIC SCENES" and "CRO-MAGNON MAN".

IN: Whales in the Making Activity

1. Arrange the whales in a sequence from oldest to most recent.
2. A new skeleton from 50 mya was discovered, sketch what it would look like.

Whales in the Making

I. Evidence for Evolution: Biogeography

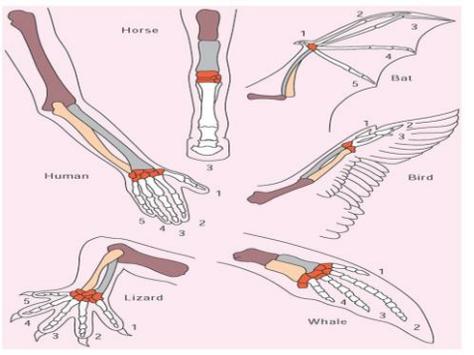
- A. Study of **locations** of organisms and their **distribution** around the world
- B. Shows **origins** and evolutionary **histories** of species over a long time scale

II. Evidence for Evolution: Anatomy

A. Homologous Structures

- a. Similar features that originate in a **shared common ancestor**
- b. Structures may have **different uses** in adult, but come from **same tissue** in embryo.

Homologous Structures



Compare the colored bones.

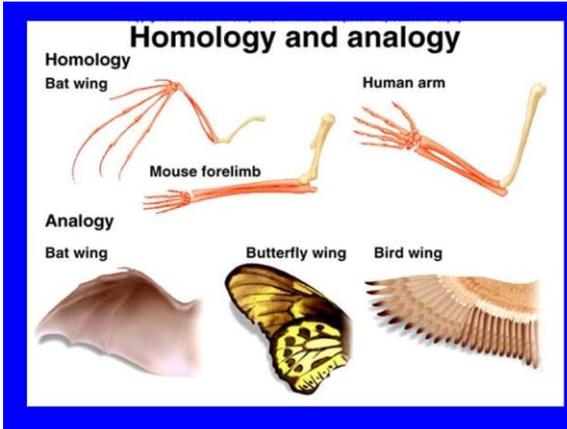
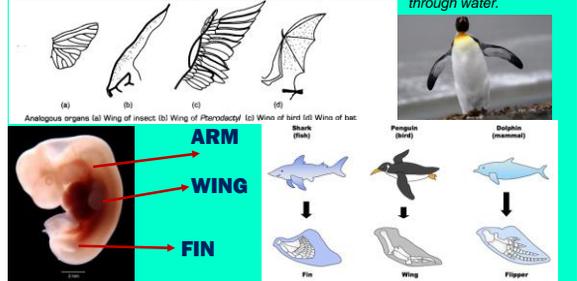
Do these animals all have the same set (s) of bones?

B. Analogous Structures

- a. Identical functions
- b. No embryo tissue in common
- c. Not closely related

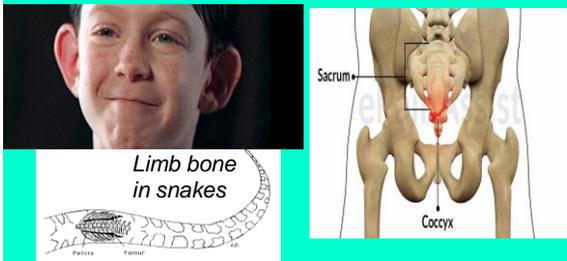


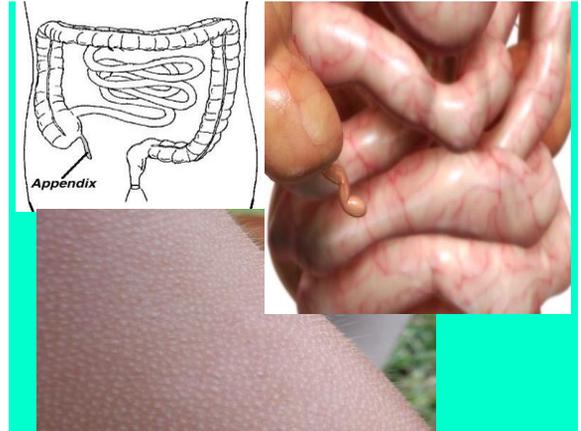
Both have fin-like structures to help navigate through water.



C. Vestigial Organs

- a. Structures that serve **no useful purpose**; resemble structures used in common ancestors
- b. Shows **relationship** to organisms in which the structure is **functional**





All humans are created with a small tail that is later absorbed by the body and developed into the tailbone. In some rare cases, small amounts of tissue are left hanging on the tailbone area of the body. Most often, the small piece of skin contains no bones, but does contain nerves and blood vessels. In some rarer cases, there are up to five vertebrae in the small tail – resulting in a true human tail or vestigial tail.

III. Evidence for Evolution: Embryology

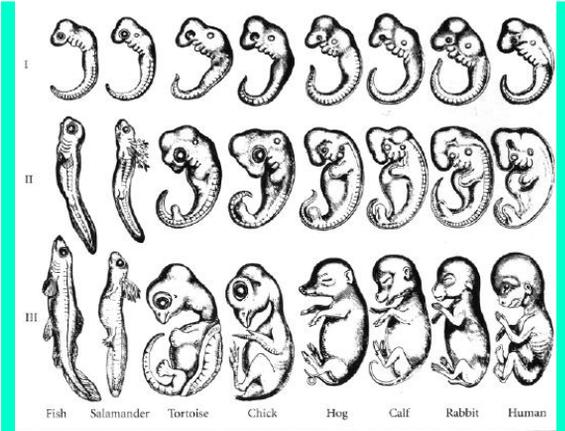
- A. Study of the **formation, development,** and **structures of early** stages after fertilization
- B. Embryos in different species **very similar**
- C. Embryo development **repeats** over evolutionary **history**

Human embryo, 38 mm, 8-9 weeks

Here are embryo pictures of the following vertebrates: Calf, Chick, Fish, Hog, Human, Rabbit, Salamander and Tortoise.

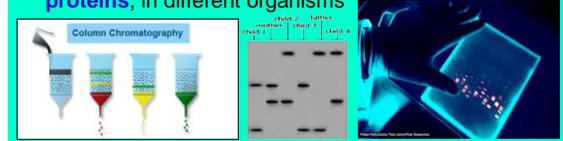
Can you tell which one is which?

How about now??



IV. Evidence for Evolution: Biochemistry

A. Have the technology to **compare DNA, RNA, and proteins**, in different organisms



B. Organisms that have the **least amount of differences** in these molecules are **closely related** by a **common ancestor**.

C. Enzymes, proteins and organelles for important **biological pathways** are **universal** (aerobic and photosynthesis)



D. The more **similar the amino acid sequence** (protein), the **more closely related** the species.
 E. Genetic code is **universal** for all organisms.

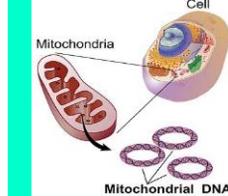
Species	Sequence of Amino Acids in the Same Part of the Hemoglobin Molecules
Human	Lys-Glu-His-Iso
Horse	Arg-Lys-His-Lys
Gorilla	Lys-Glu-His-Lys
Chimpanzee	Lys-Glu-His-Iso
Zebra	Arg-Lys-His-Arg

Genetic Code	
U	C
UUU Phe	UCU Ser
UUC Phe	UCC Ser
UUA Leu	UCA Ser
UUG Leu	UCG Ser
CUU Leu	CCU Pro
CUC Leu	CCC Pro
CUA Leu	CCA Pro
CUG Leu	CCG Pro
AUU Ile	AAU Asn
AUC Ile	AAC Asn
AUA Ile	AAA Lys
AUG Met	AAG Lys
GUU Val	GCU Ala
GUC Val	GCC Ala
GUA Val	GCA Ala
GUG Val	GCG Ala

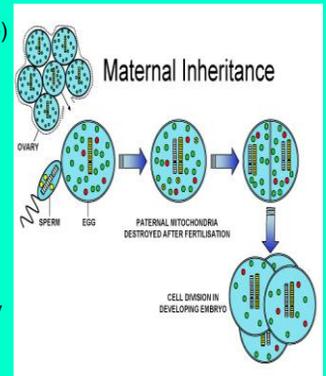
Mammalian	1	*	10	20	23
Human	G	S	F	L	S
Rhesus Monkey	G	S	F	L	S
Mouse	G	S	F	L	S
Mongolian Gerbil	G	S	F	L	S
Rat	G	S	F	L	S
Dog	G	S	F	L	S
Porcine	G	S	F	L	S
Sheep	G	S	F	L	S
Bovine	G	S	F	L	S

V. Mitochondrial DNA (maternal DNA)

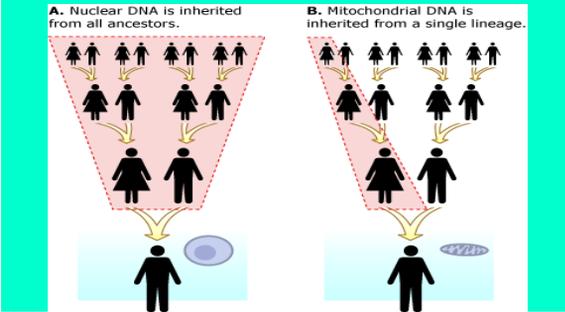
A. Mitochondria have their **own DNA** (genome) that exists **outside** of the **cell nucleus**.



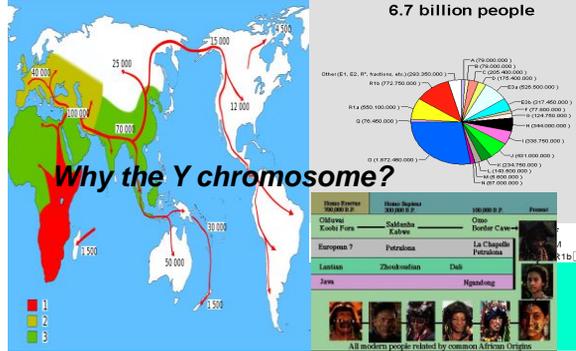
B. Mitochondria are only inherited from the **mother's egg**.



C. DNA in the **nucleus recombines** during meiosis, so the **genetic history** of two people is **mixed-up**.
 D. Mitochondrial DNA from the mother shows a more **direct line of evolutionary history**.



E. Origin and migration of modern humans can be traced based on mutations in **mitochondrial DNA** and the **Y chromosome**.



Mitochondrial DNA



OUT: List 3 new facts you learned about mitochondrial DNA. Why is mtDNA important?

