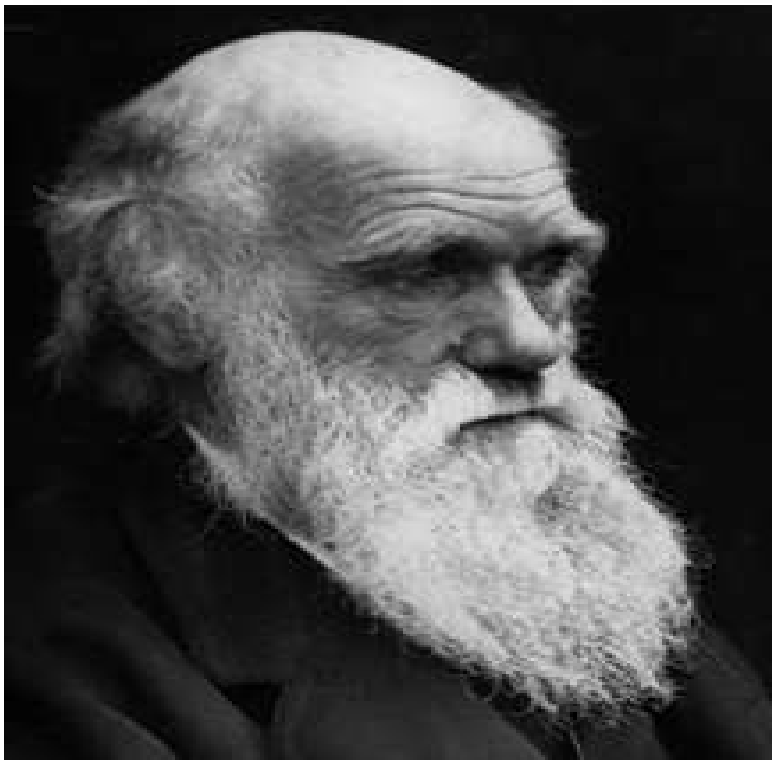
Darwin's Theory of Evolution

Charles Darwin



Darwin's Theory of Evolution

Species change over time as they adapt to their changing environment

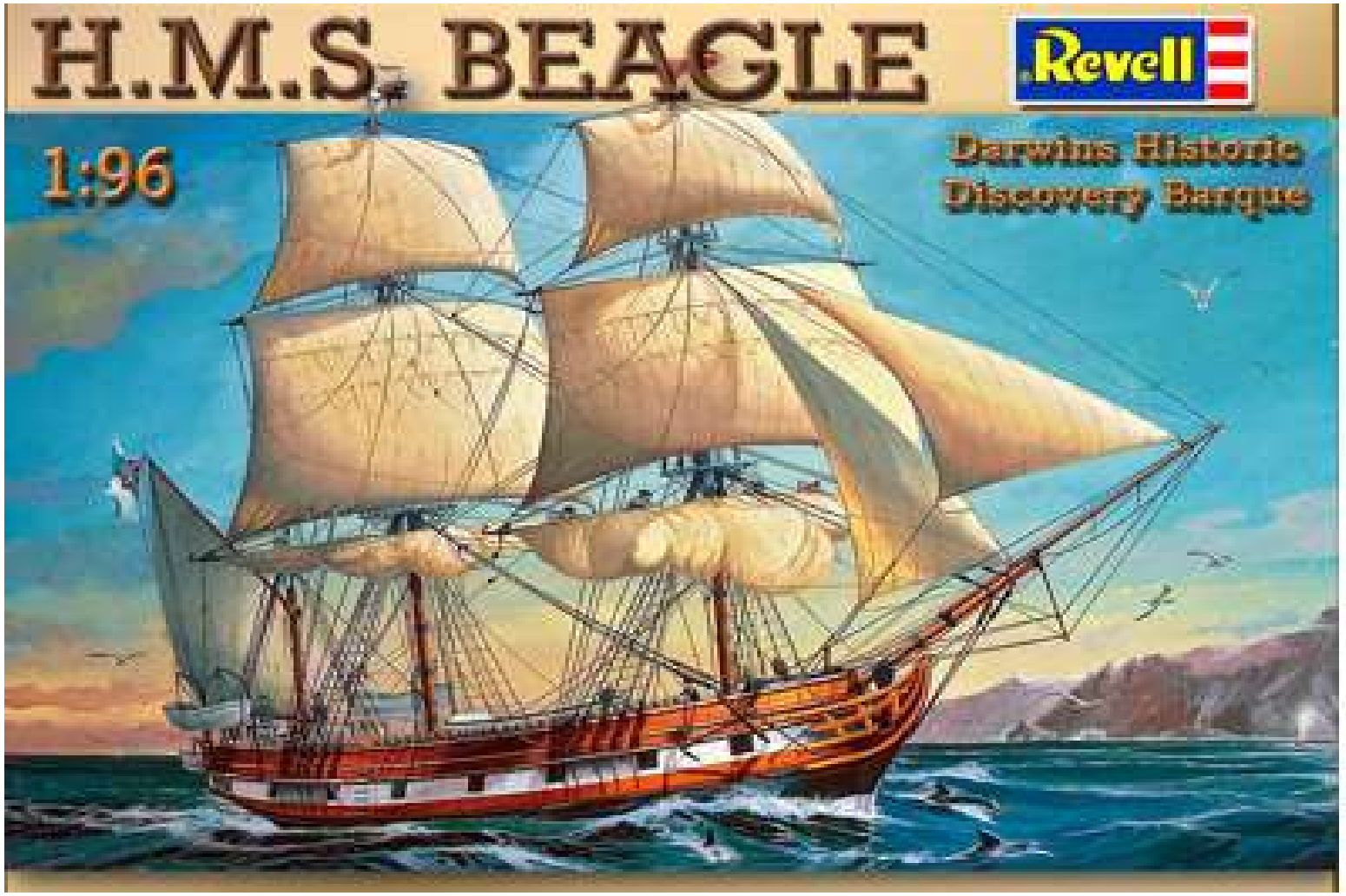
Evolution is the process by which species change over time

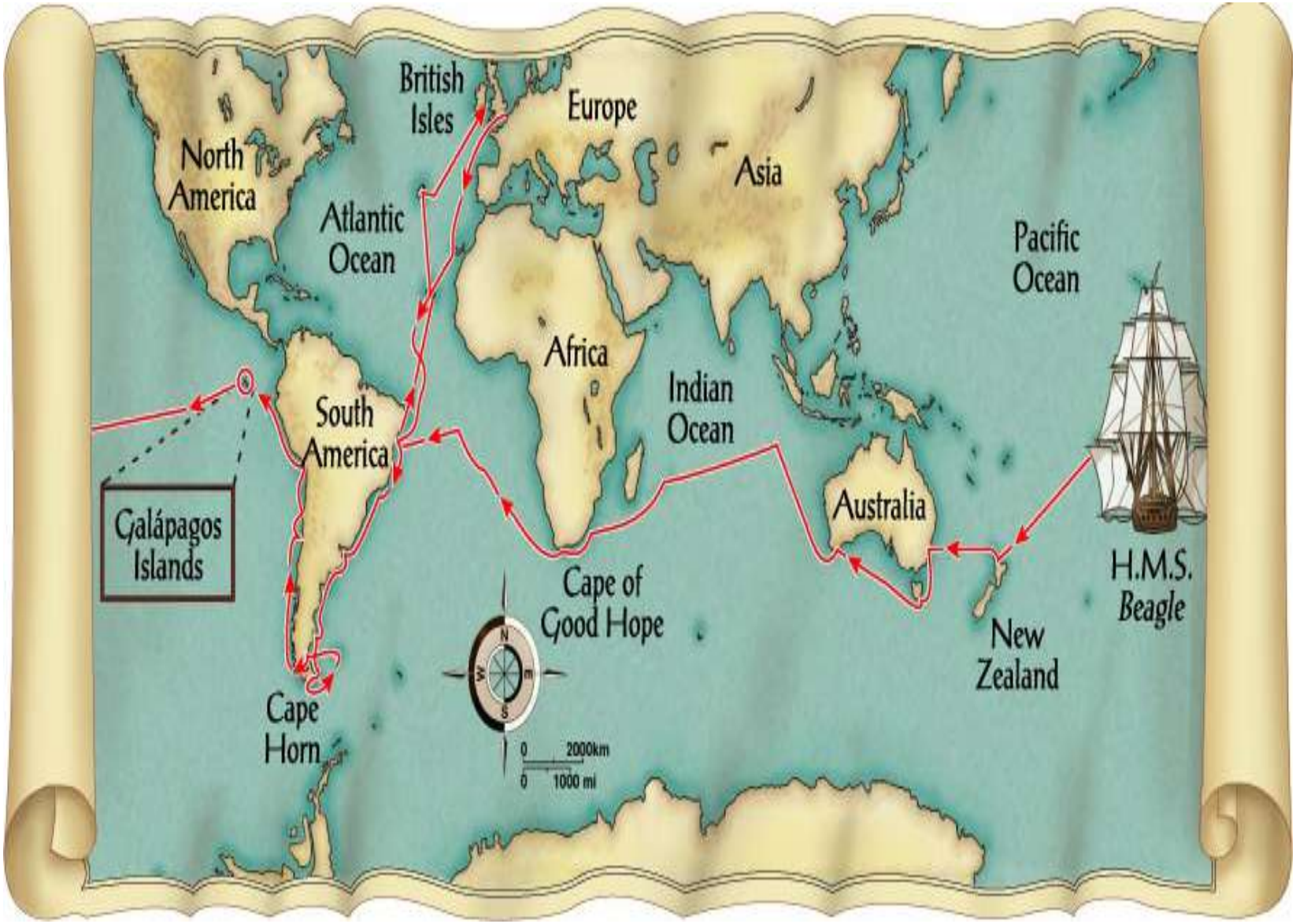
- Charles Darwin's theory of evolution most commonly accepted
- First set out in his book On the Origin of Species (1859).

Darwin's Trip to Galapagos Islands

- On HMS Beagle (1831)
- Islands in Pacific Ocean off coast of South America
- Darwin made observations that led to theory.

Voyage of the Beagle




British Isles
Europe
North America
Asia
Atlantic Ocean
Pacific Ocean
Africa
Indian Ocean
South America
Australia
Galápagos Islands
H.M.S. Beagle
Cape of Good Hope
New Zealand
Cape Horn
N
W
E
S
0 2000km
0 1000 mi


Pacific Ocean
Pinta
N 0 20 Kilometers
0 20 Miles
city
volcano caldera
Marchena
Genovesa
Equator
San Salvador
Fernandina
Bartolome
Rabida
Seymore Baltra
Santa Rosa
Pinzon
Plazas Islets
San Christobal
Santa Cruz
Isla Isabela
Puerto Ayora
Santa Fe
El Junco
Puerto Baquerizo Moreno
El Progreso
Puerto Villamil
Post Office Bay
Puerto Velasco Ibarra
Floreana
Espanola
Galapagos Islands -
Charles Darwin Research Station
Province of Ecuador
COSTA RICA
PANAMA
VENEZUELA
GUYANA
SURINAME
COLOMBIA
ECUADOR
PERU
BRAZIL
BOLIVIA
SOUTH PACIFIC OCEAN
CHILE
ARGENTINA
URUGUAY
SOUTH ATLANTIC OCEAN
Cape Horn
Scale 1:67,000,000
Azimuthal Equal-Area Projection

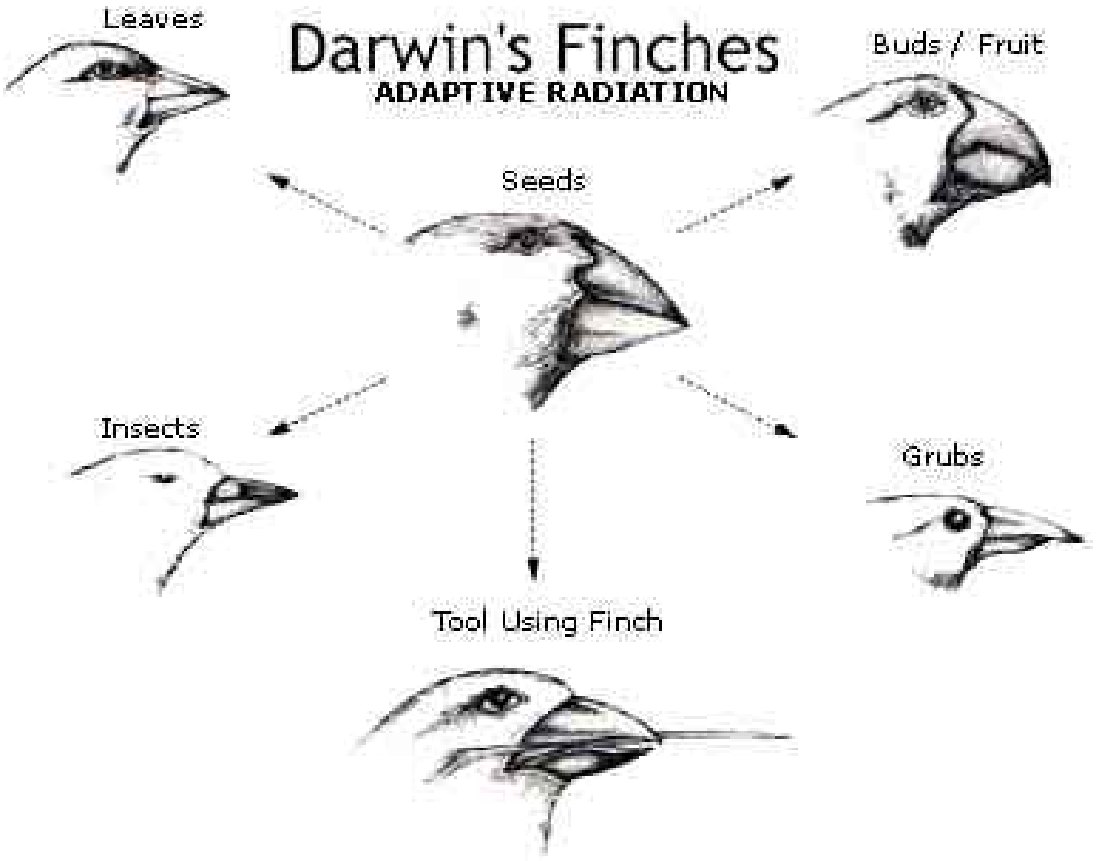
Darwin's Observations

- Animals/Plants are very well adapted to environment
- Some fossils look like present day animals- some looked like nothing seen before

Darwin's Observations

- Even though they were all very close, the different islands of Galapagos had very different climates and habitats
- Had different animals as well

Darwin's Finches- adapted for different environments/niches



New Ideas in Science that lead to Darwin's Theory:

- Earth is millions or even billions of years old
- Features of earth have changed

Darwin's Theory

- Species have natural variation- not all look the same
- Members of species compete for food, water, etc.
- Survival of the fittest (Natural Selection).

Darwin's Theory

- Natural Selection leads to changes in the way a population looks.
- Populations change over time as they adapt to their changing environment

HOW DOES EVOLUTION HAPPEN?

- Evolution occurs by Natural Selection
- Natural Selection is a process in which organisms with favorable traits survive and reproduce at a higher rate than those without the favorable trait.

NATURAL SELECTION

- Natural Selection determines the survival of groups of organisms

HOW?

- Desirable traits are passed-on to offspring
- Traits that make organisms better equipped to survive the environment, will survive to reproduce and pass these traits on to their offspring. This is Charles Darwin's

"Survival of the Fittest"

Descent with Modification

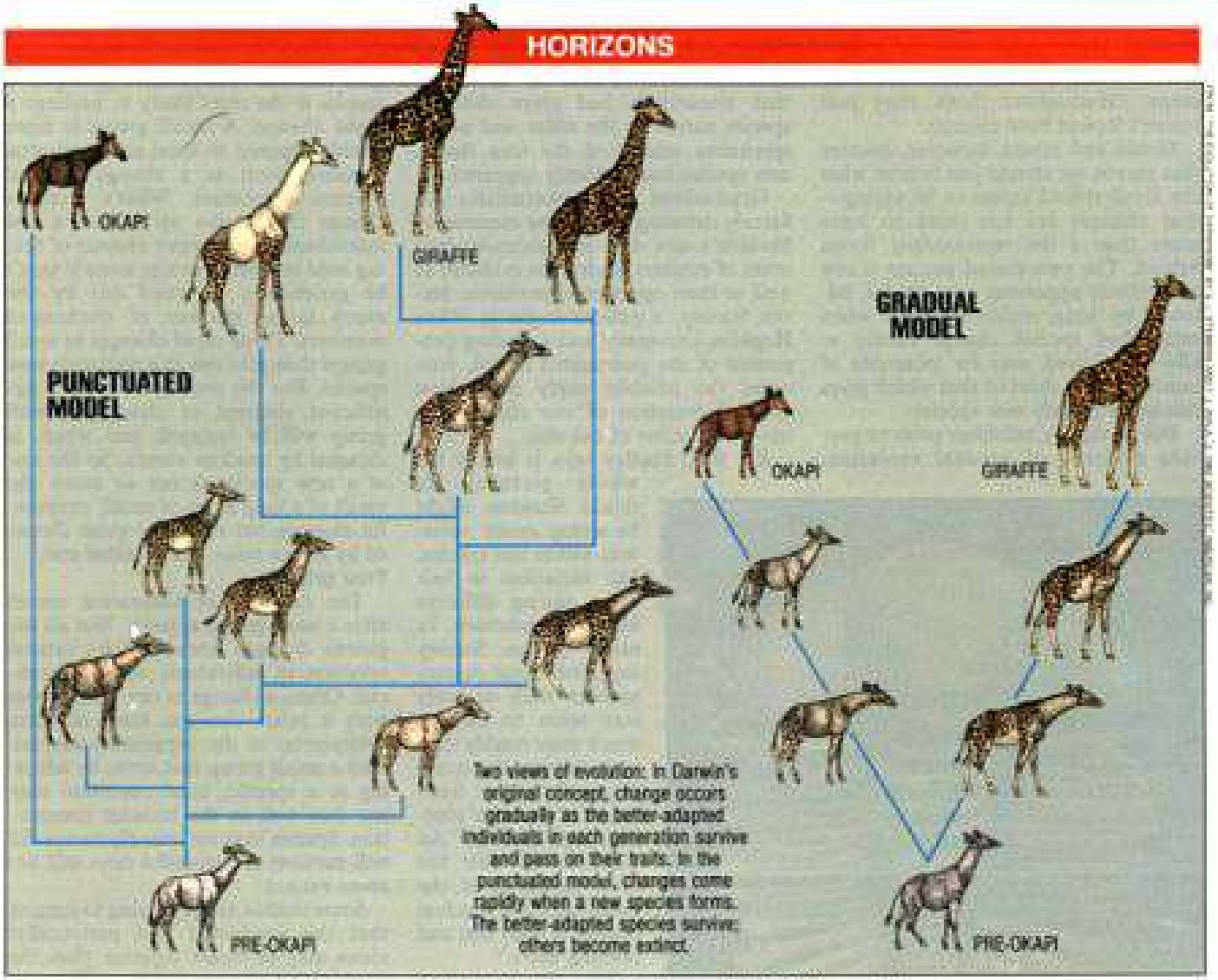
- Natural selection changes what a population looks like.
- As a result, species today look different than their ancestors.

Evidence of Evolution

- Fossils- shows change in species over time
- Geographic distribution- animals in different places look different, but animals in same types of environment look similar (convergent evolution)

Which is Dingo? Which is Dog?

Fossil Evidence



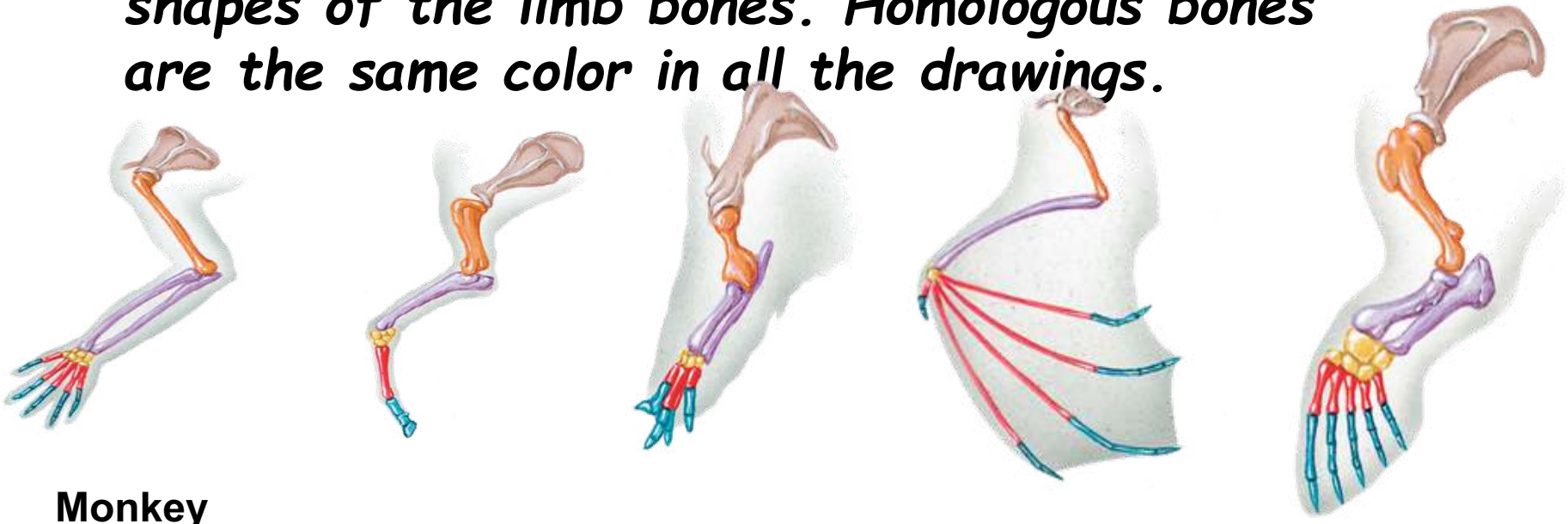
U.S. News & World Report, Jan. 11, 1988, p. 51.

Evidence of Evolution

- Homologous structures- structures that look different, but have same origins
- Similarities in early development

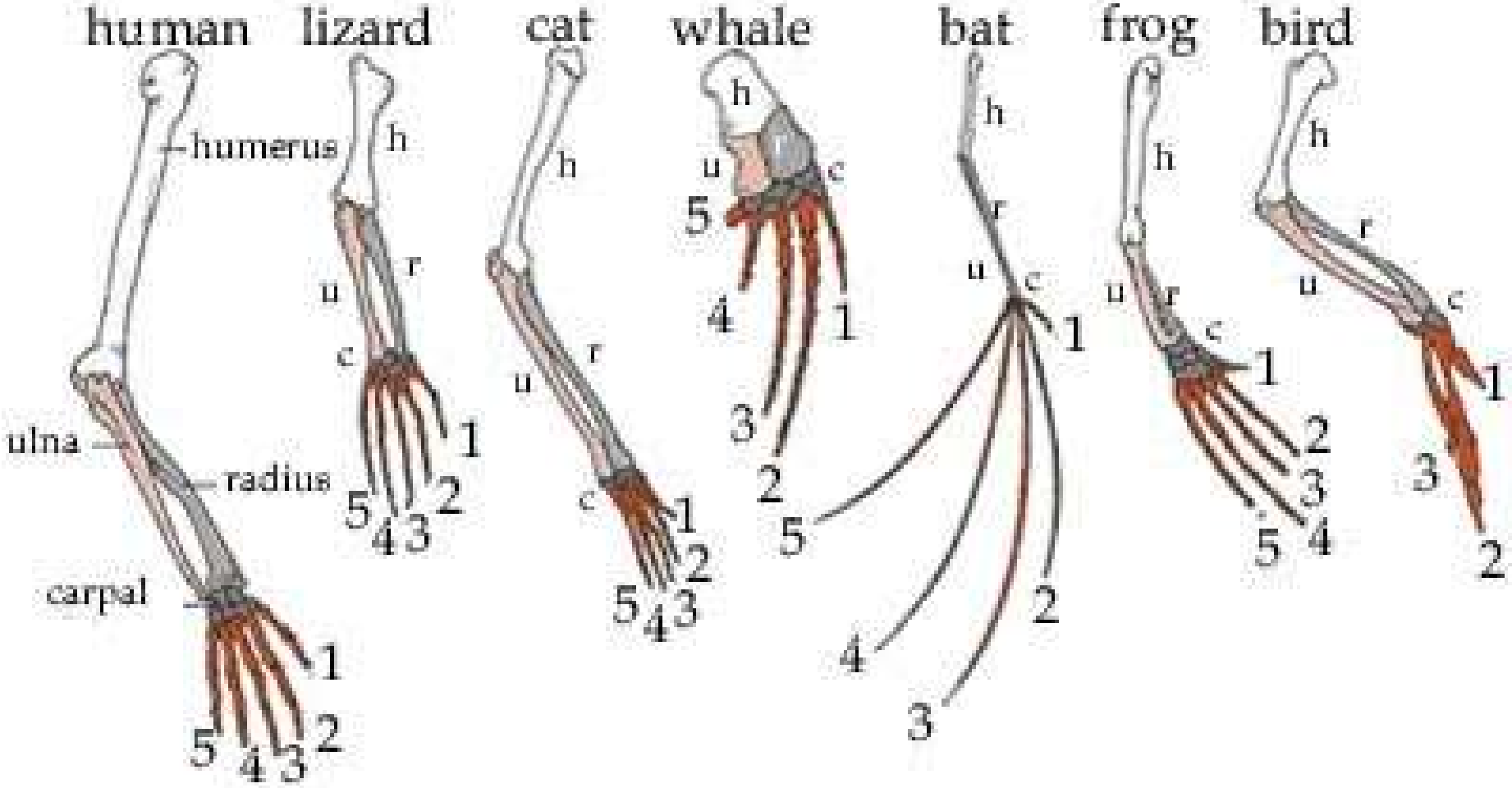
Homologous Body Structures

The limbs and digits (fingers and toes) of many mammals are adapted to their particular way of life. Note the variety of lengths and shapes of the limb bones. Homologous bones are the same color in all the drawings.



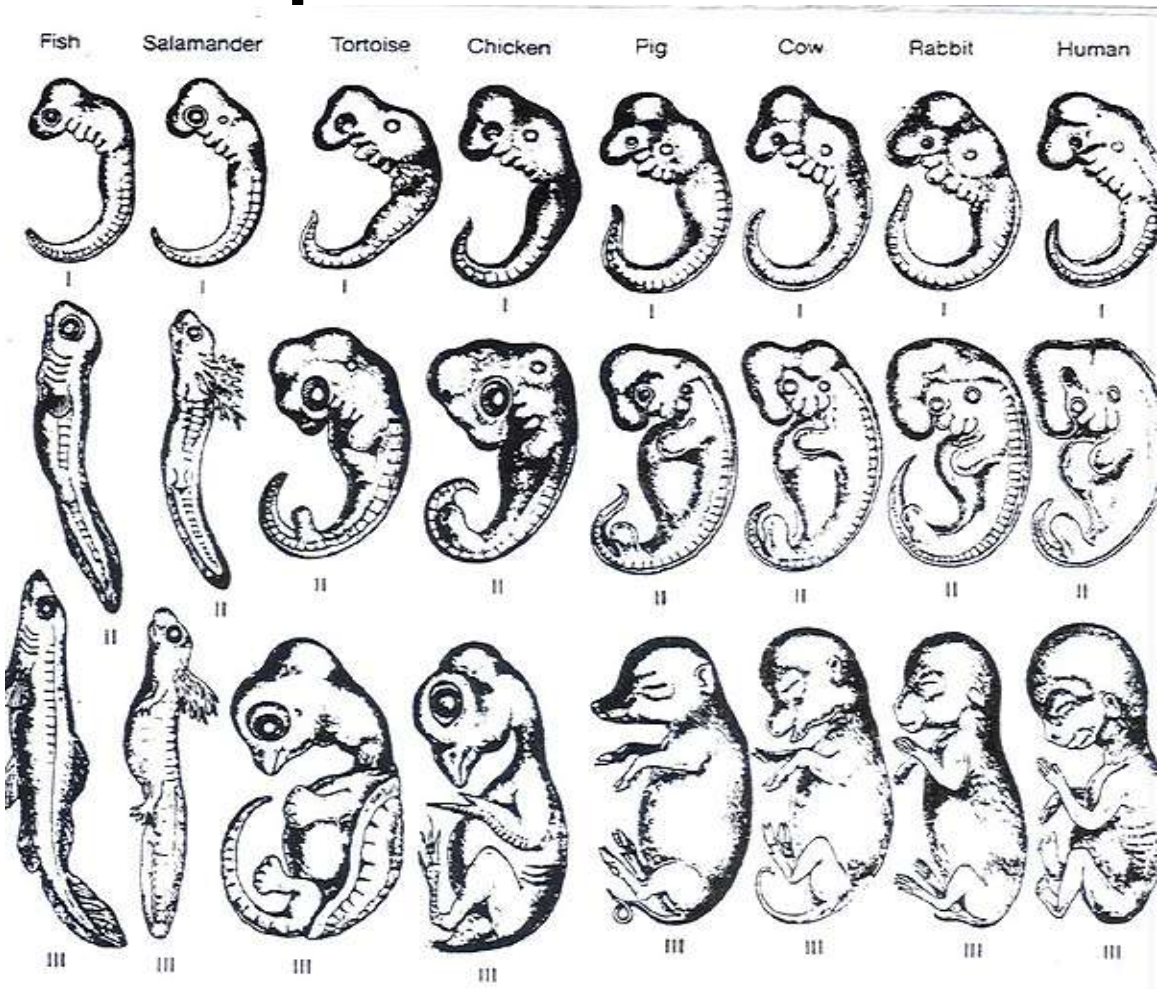
Monkey Horse Mole Bat Seal

Homologous Structures:



Similarities in early development

- *Embryos of vertebrates are similar*

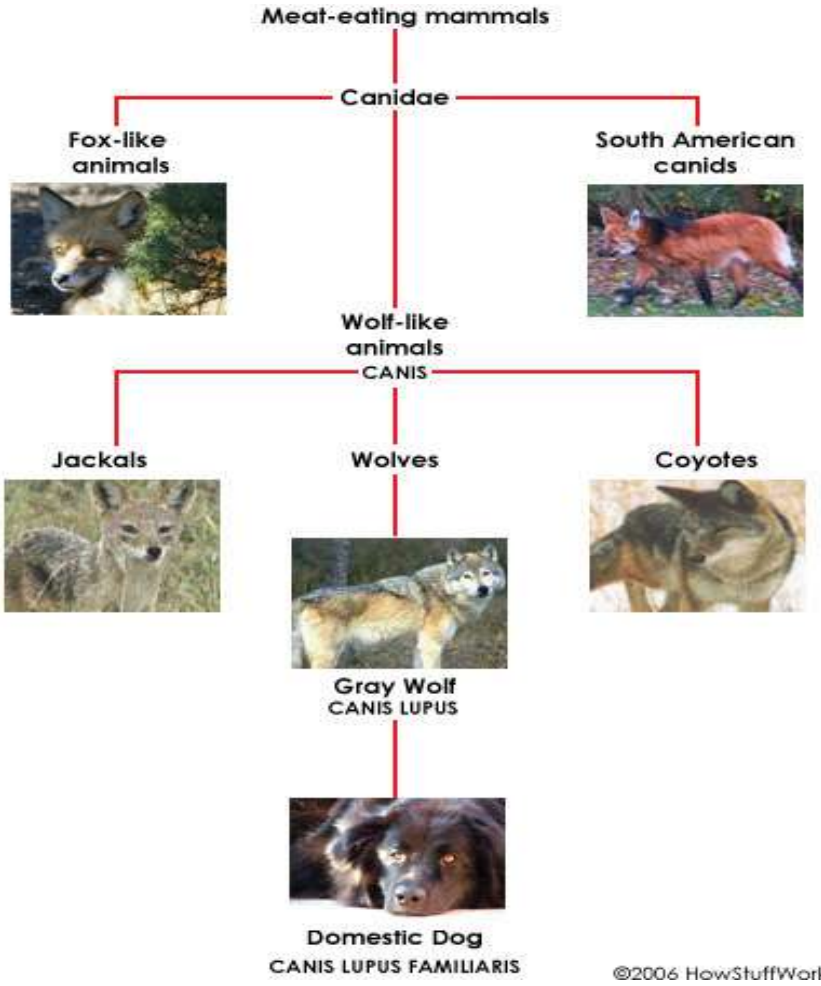


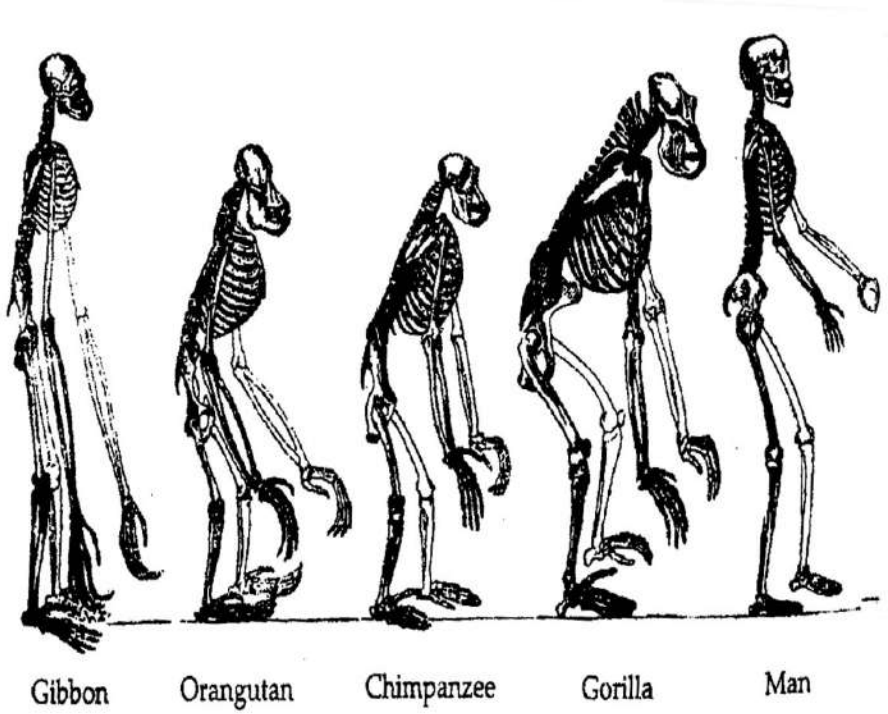
Mouse and Chicken Embryos

Similarities in DNA

- *DNA from closely related species have greater similarities in their DNA than species that appear to be distant relatives*

Similarities in DNA





Quiz

1. How did the fossils Darwin observed compare with the living organisms he studied?
    1. Some fossils look like present day animals- some looked like nothing seen before
2. What are three important observations Darwin made while on his voyage of the world and the Galapagos?
    1. Plants & animals were well adapted to their environment
    2. Some fossils look like present day animals- some looked like nothing seen before.
    3. The islands of the Galapagos all had different climates & habitats.
    4. The islands also had different animals.