

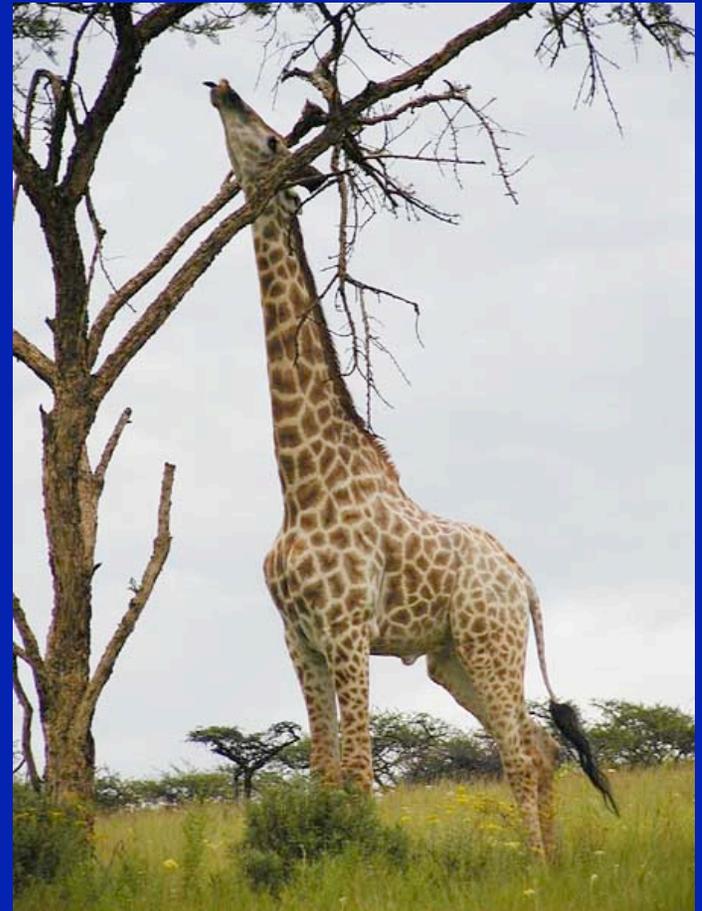
Biol 405/505

**Principles of
Organic Evolution**

Instructor: Dr. Mark Dybdahl

Outline

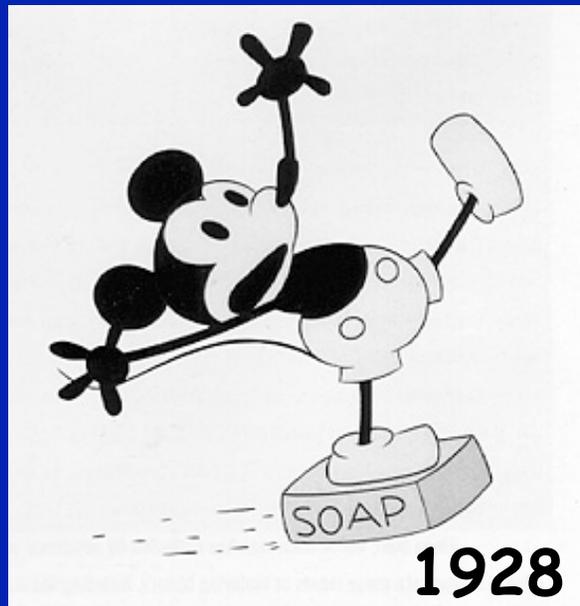
- What is organic evolution?
 - Descent with modification
 - Natural selection
- Darwin's insight
- Evolution of the theory of evolution
- What evolution explains?
- Course logistics & info



What is Organic Evolution?

What is Organic Evolution?

Change over time



1928

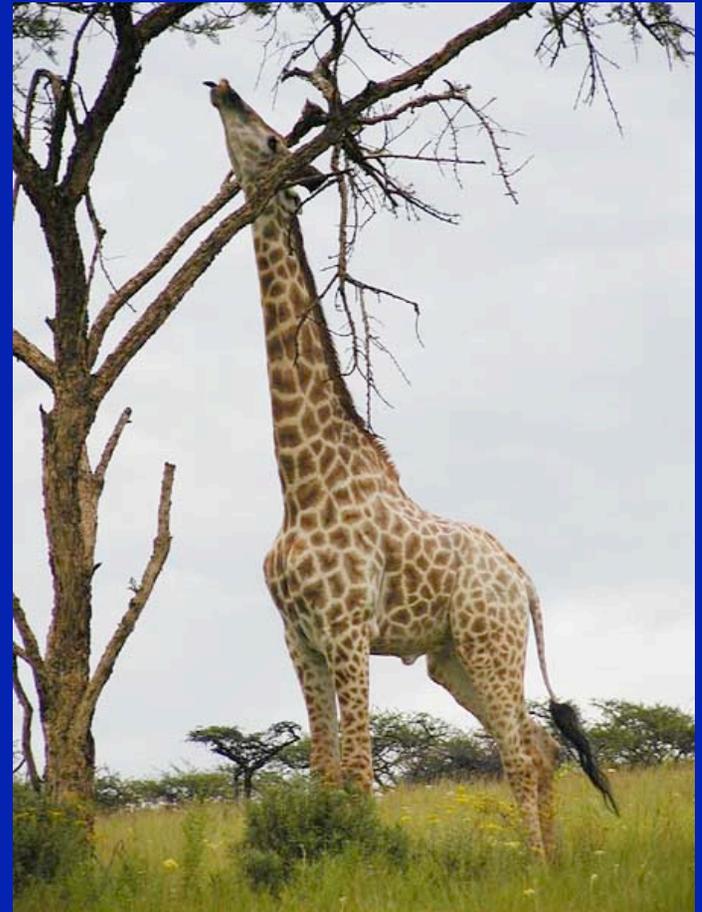


today

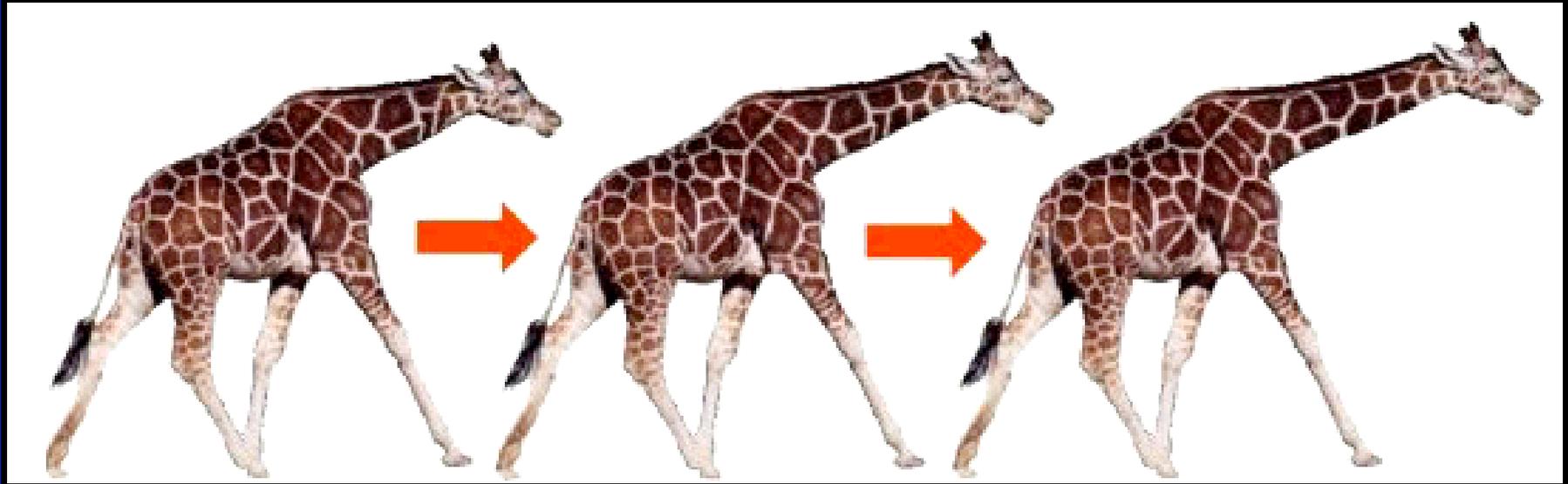
What is Organic Evolution?



Change in the form,
physiology, life-history,
or behavior of organisms
between generations



What is Organic Evolution?



Populations evolve
individuals do not

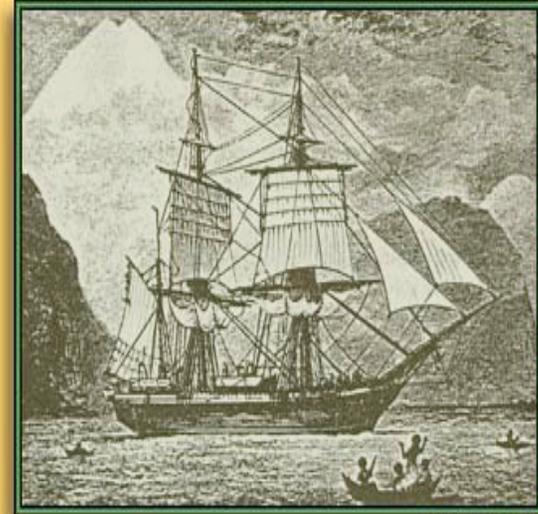
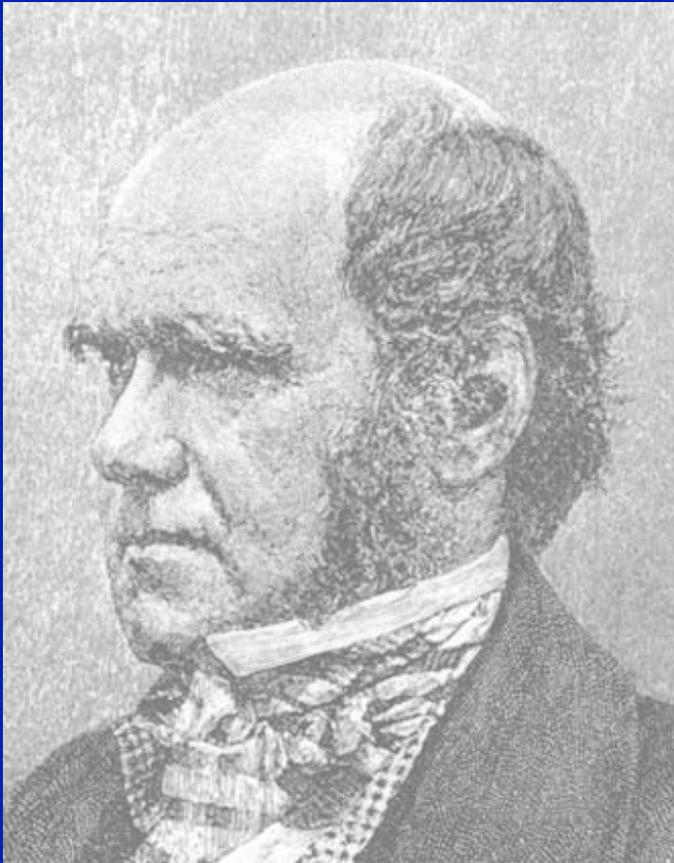
What is Organic Evolution?



Current species are evolved from pre-existing, ancestral species

Darwin's Insight

Charles Darwin
1809-1882

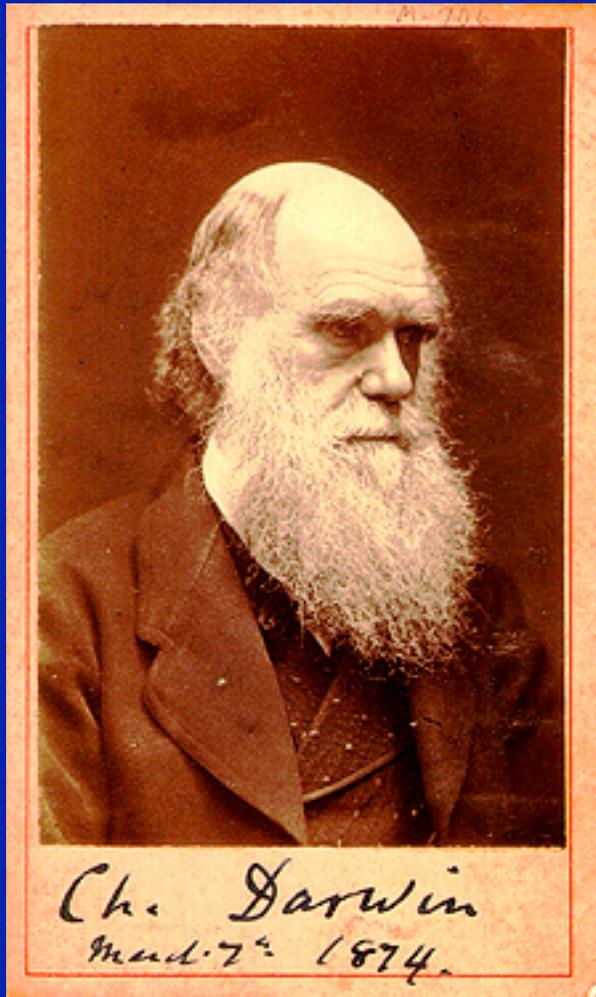


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H.M.S. Beagle
(1831-1836)

Origin of Species, 1859

Darwin's Theory of Evolution



Charles Darwin

1. Species evolve over time:
"descent with modification"

← Pattern

2. Adaptations arise by
natural selection

← Mechanism

The Insight

Alfred Russell
Wallace
1823-1913

- Similar ideas
- Less evidence

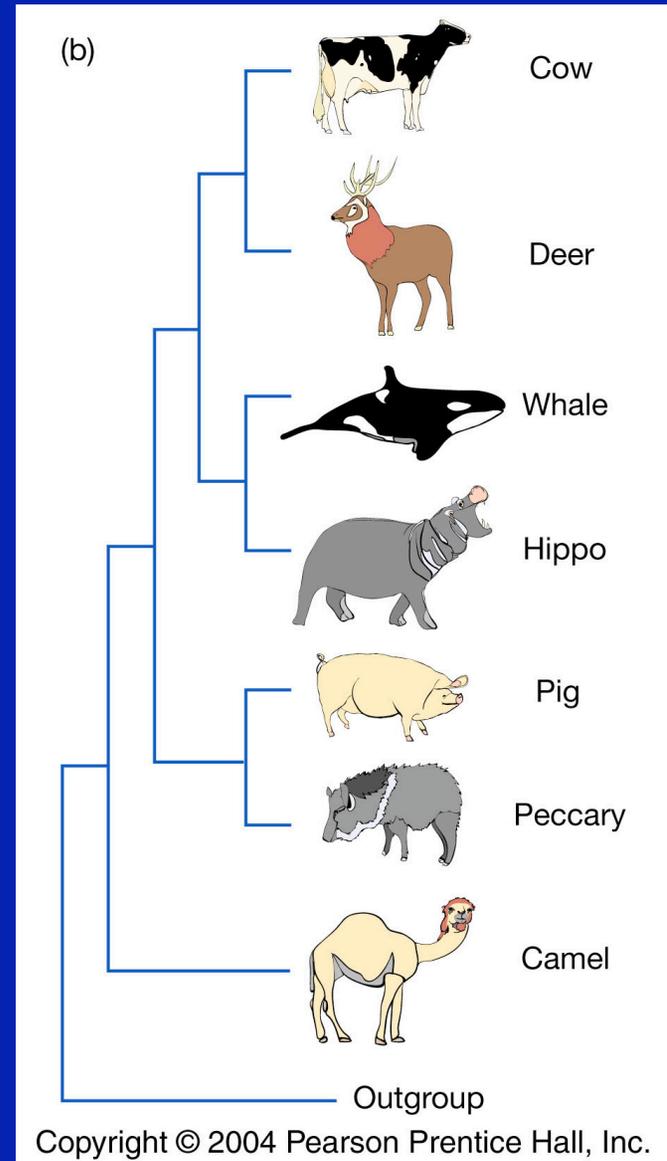


Descent with Modification

Organic Evolution -->
tree-like branching
• splitting, extinction
of lineages

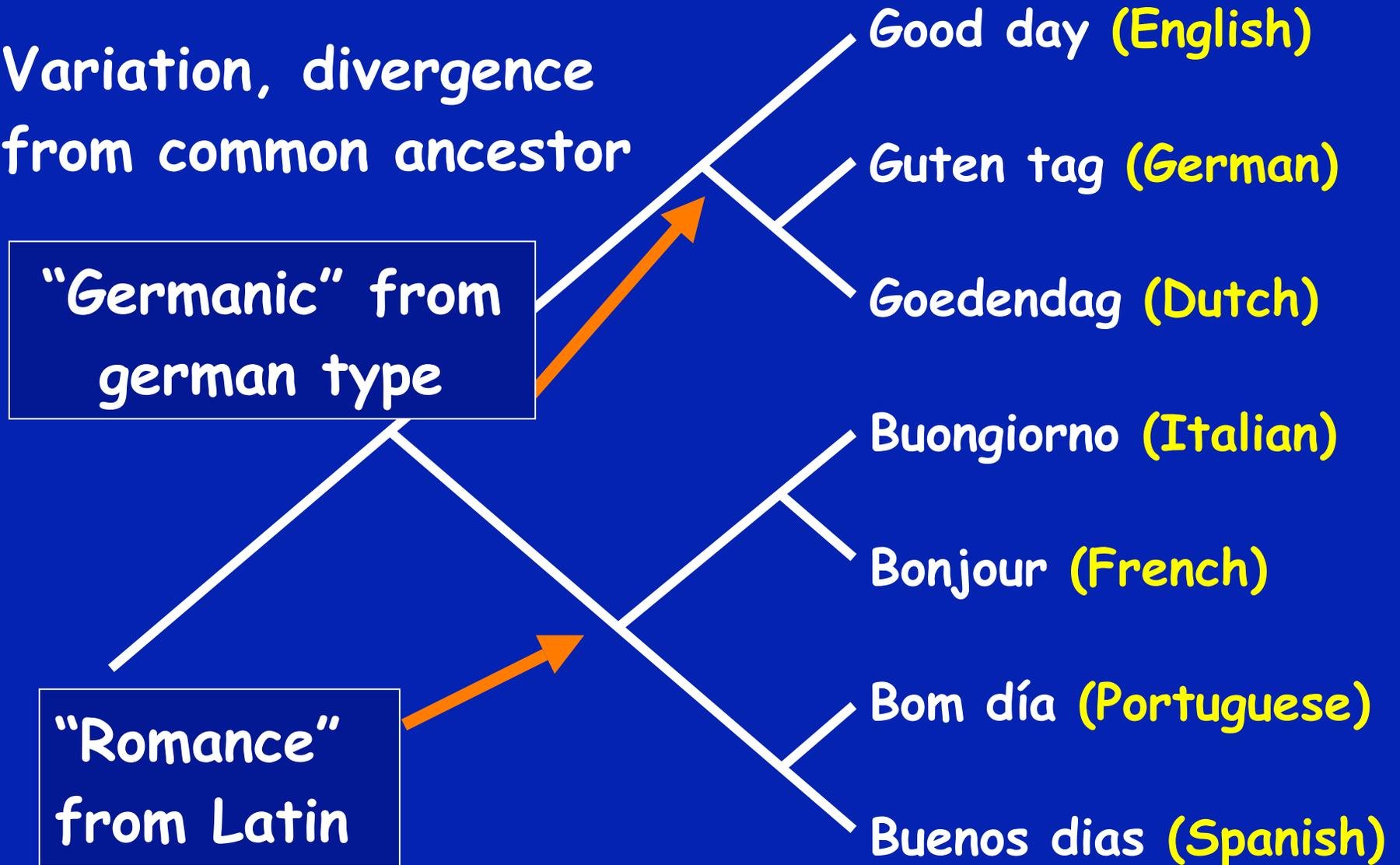
1. Species are Ancestral & Derived
2. Common ancestors

Phylogeny

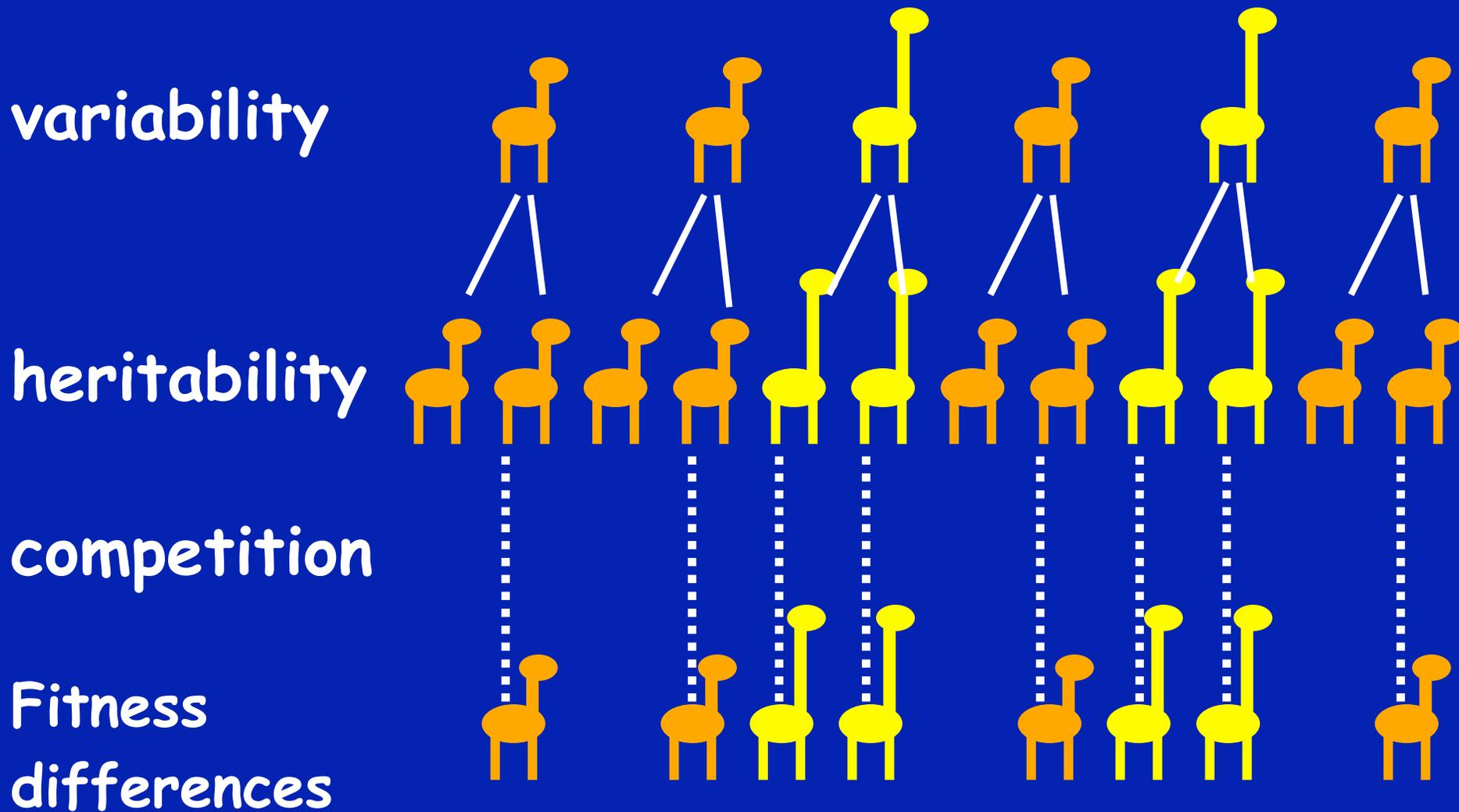


Descent with Modification

Variation, divergence
from common ancestor



Natural selection



Freq. of long necks increases

Before Darwin

Two views:

1. Species were immutable, fixed
2. Species changed but there was no mechanism

2. Species change



- Aristotle's "Great Chain of Being"
- Evolutionary "ladder"
- Progressive
- Mechanism = Supernatural force

2. Species change



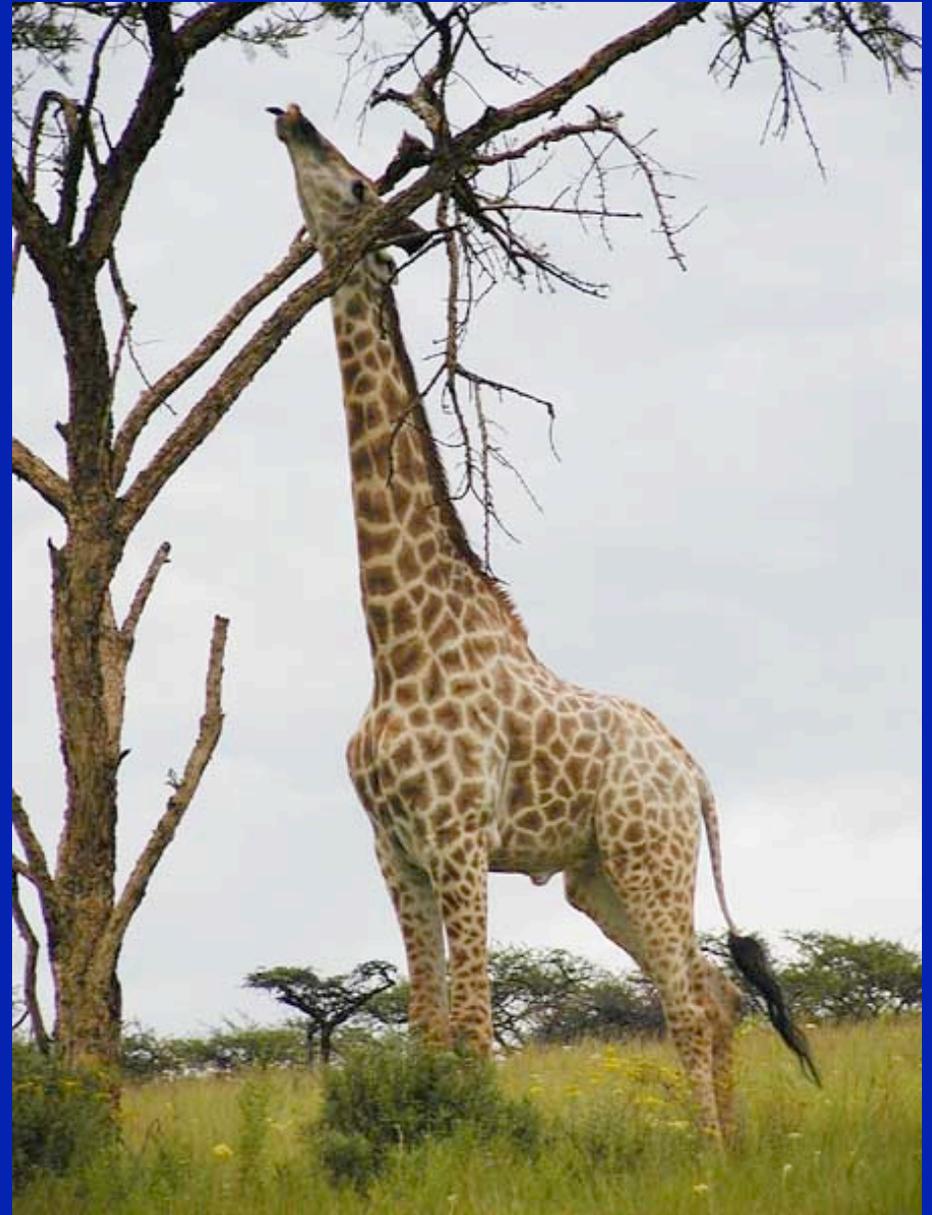
Jean-Baptiste
Lamarck

Mechanism of species
Change:

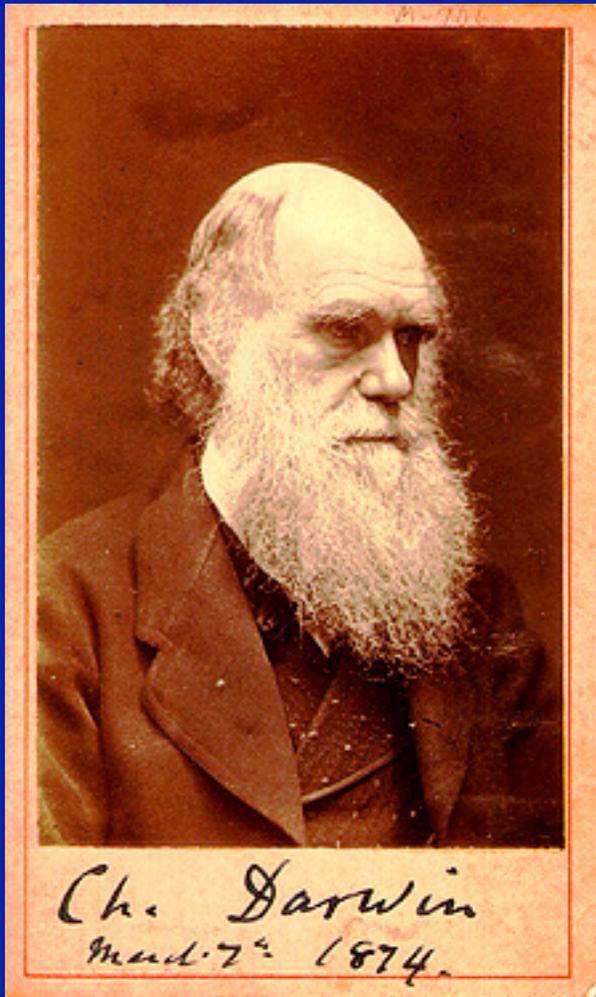
Inheritance of
acquired characters

1744-1829

Lamarckian Evolution

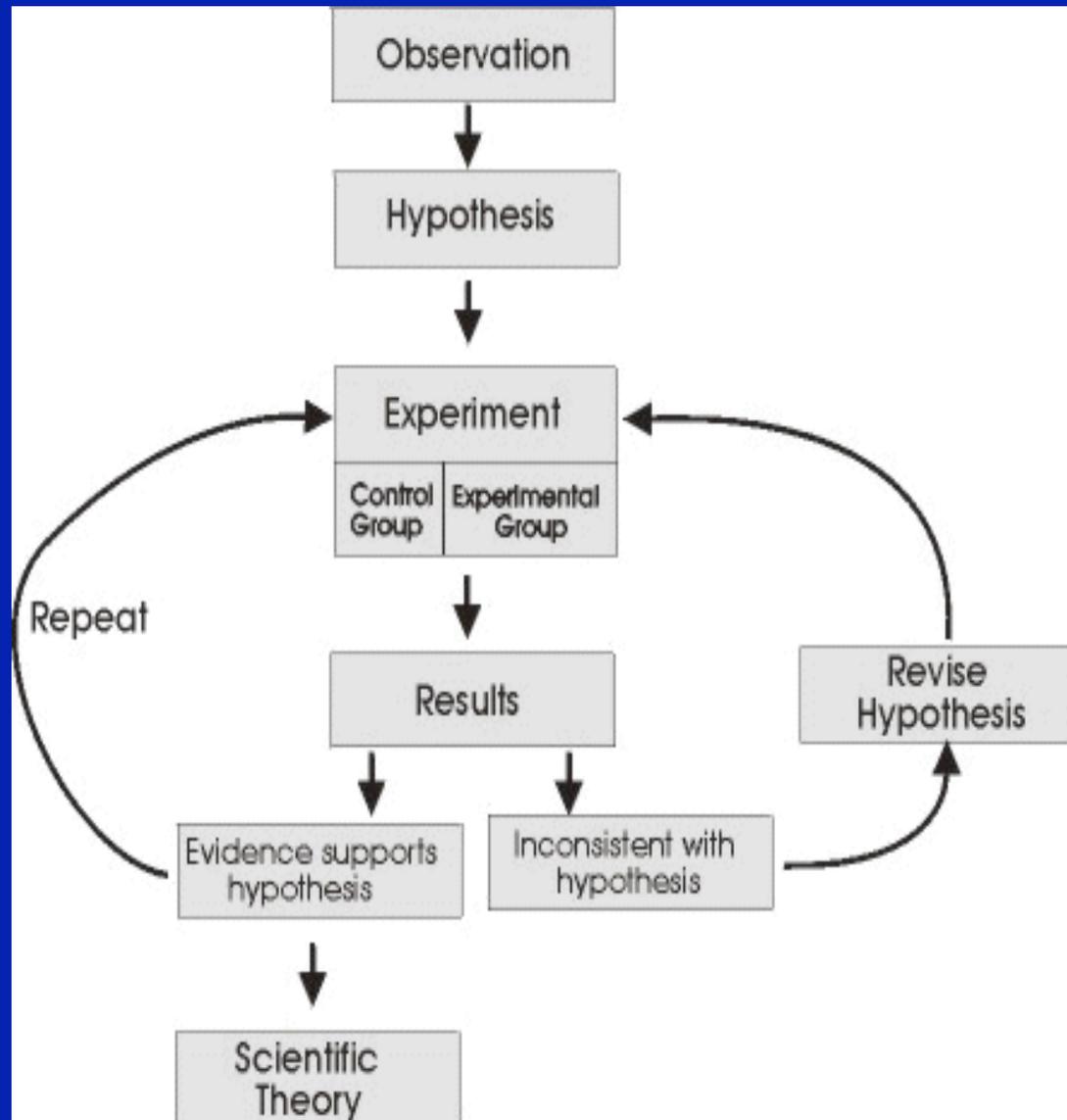


After Darwin: 'Evolution' of the theory of evolution

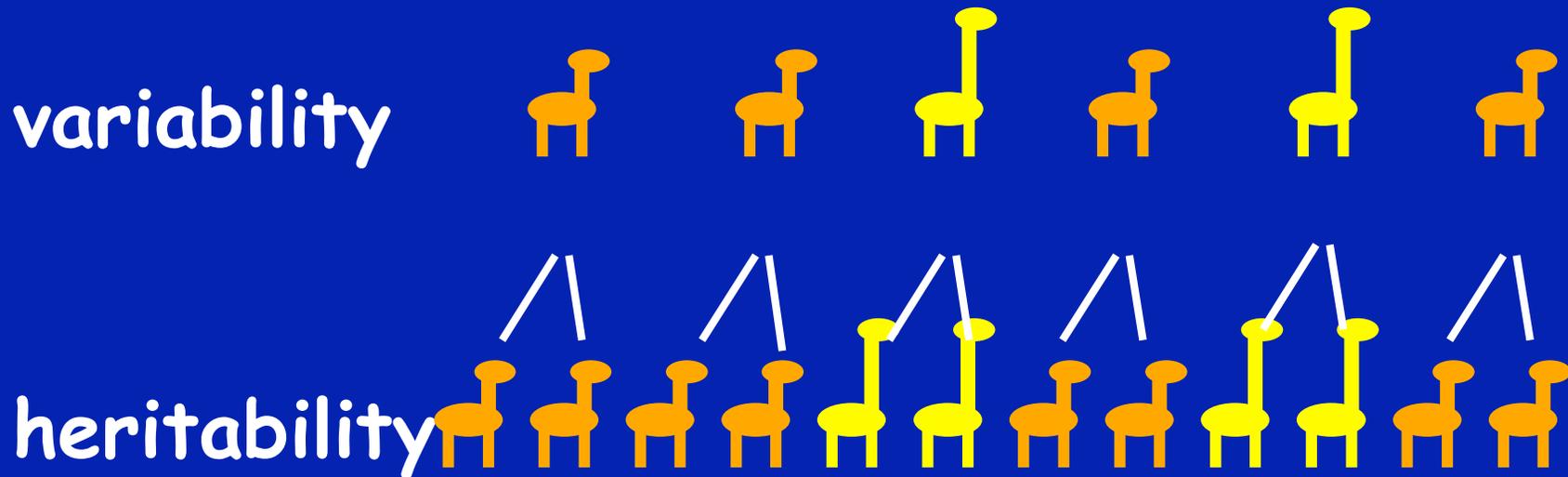


1. Species evolution:
 - Quickly accepted
2. Natural selection:
 - **Controversial until 1920s**
 - No mechanism of inheritance

"Evolution of a theory"



Natural selection?



Problem: No mechanism of inheritance

- Darwin accepted Lamarckian heredity
- A. Weissman 1880's: acquired characters are not inherited!

After Darwin

- 1900-1920 Mendelian genetics rediscovered
- 1940's Modern Synthesis

Evolution: Changes in gene frequencies of populations over time

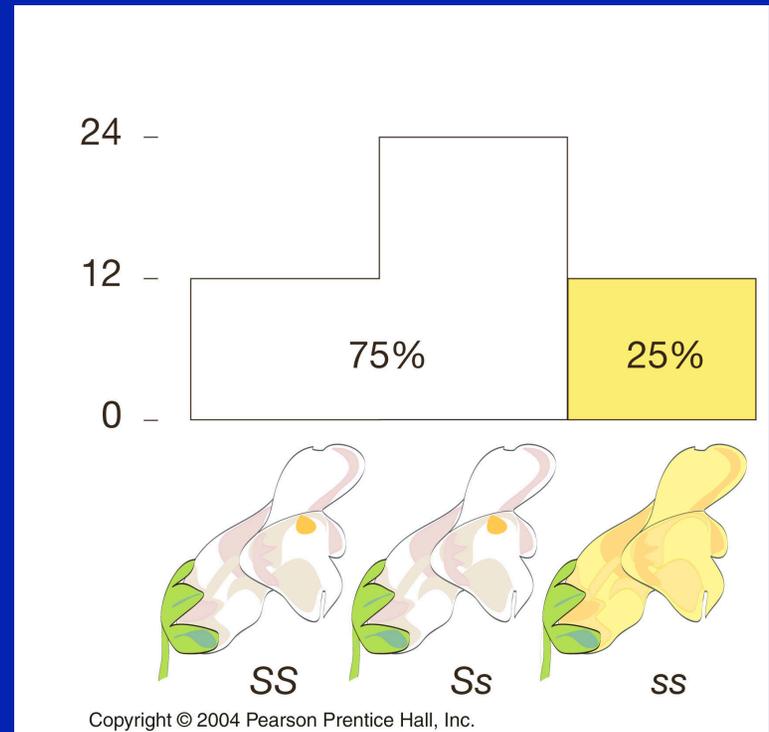


Fig 3.3a

"Evolution is *just* a theory"

Oxford English Dictionary: 2. "a hypothesis that has been confirmed or established by observation or experiment, and is propounded or accepted as accounting for the known facts."

What does evolution explain?

Why study Evolution?

1. The processes that create biodiversity
 - Macroevolution
 - Lineage branching
 - Extinction

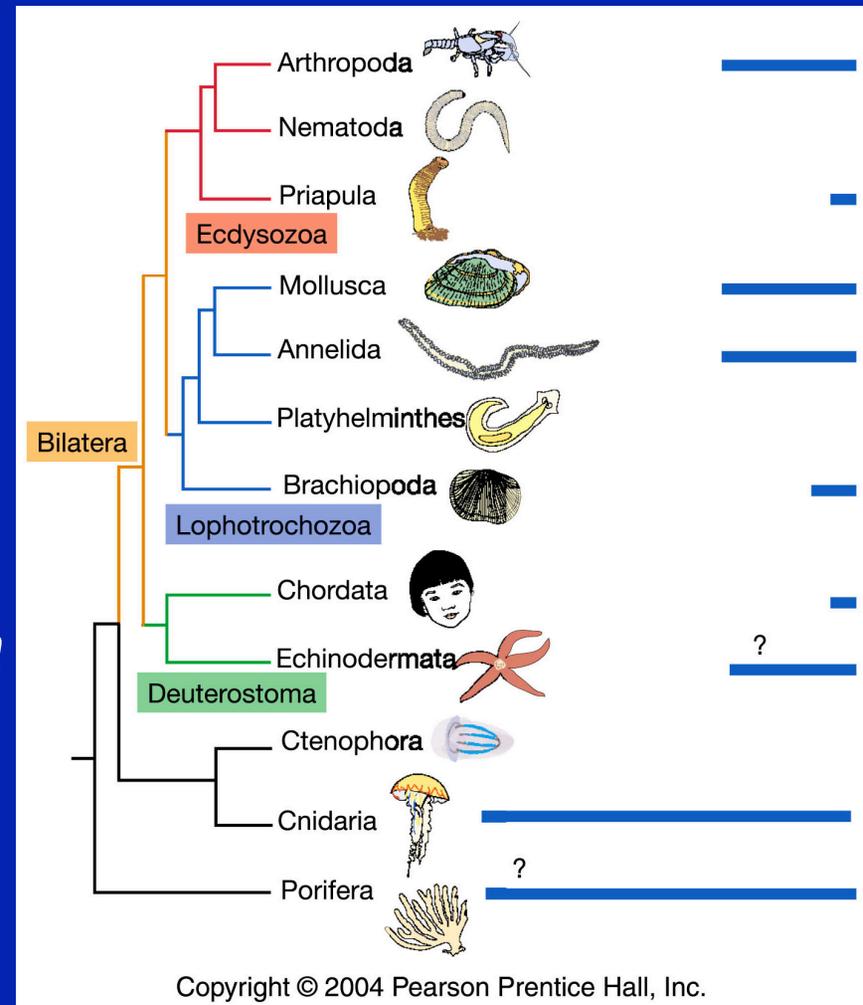
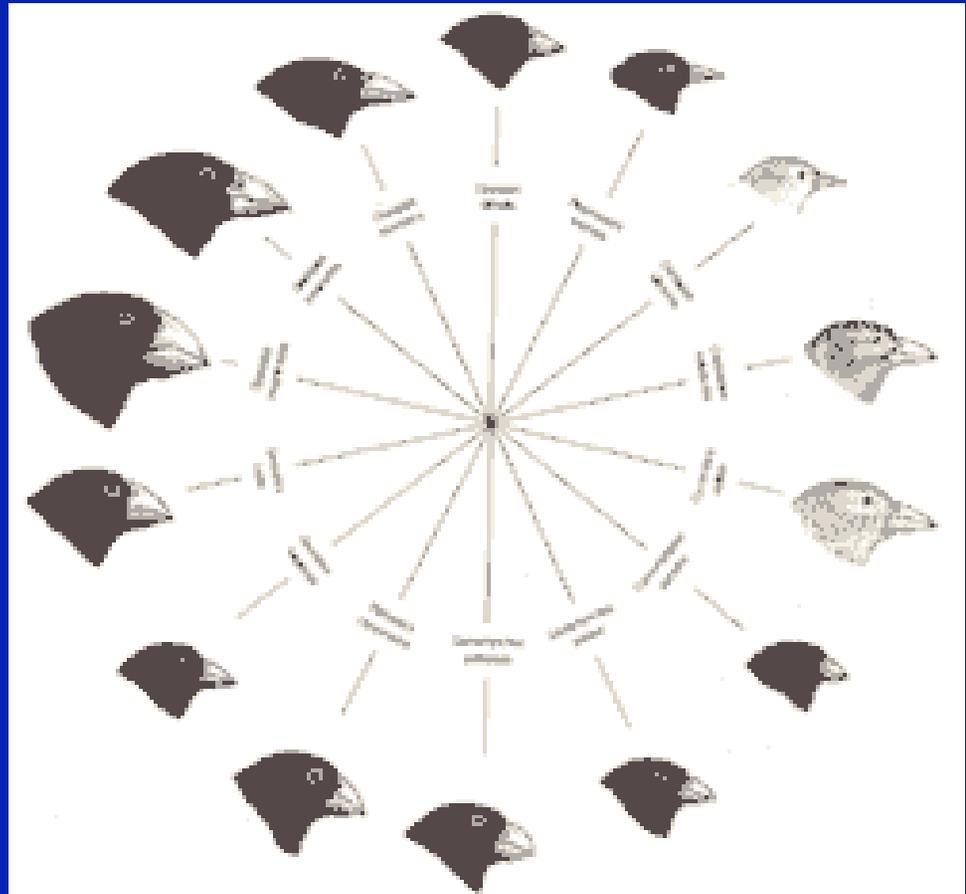


Fig 17.12

- Microevolution and speciation
- Darwin's finches, Galapagos: divergence



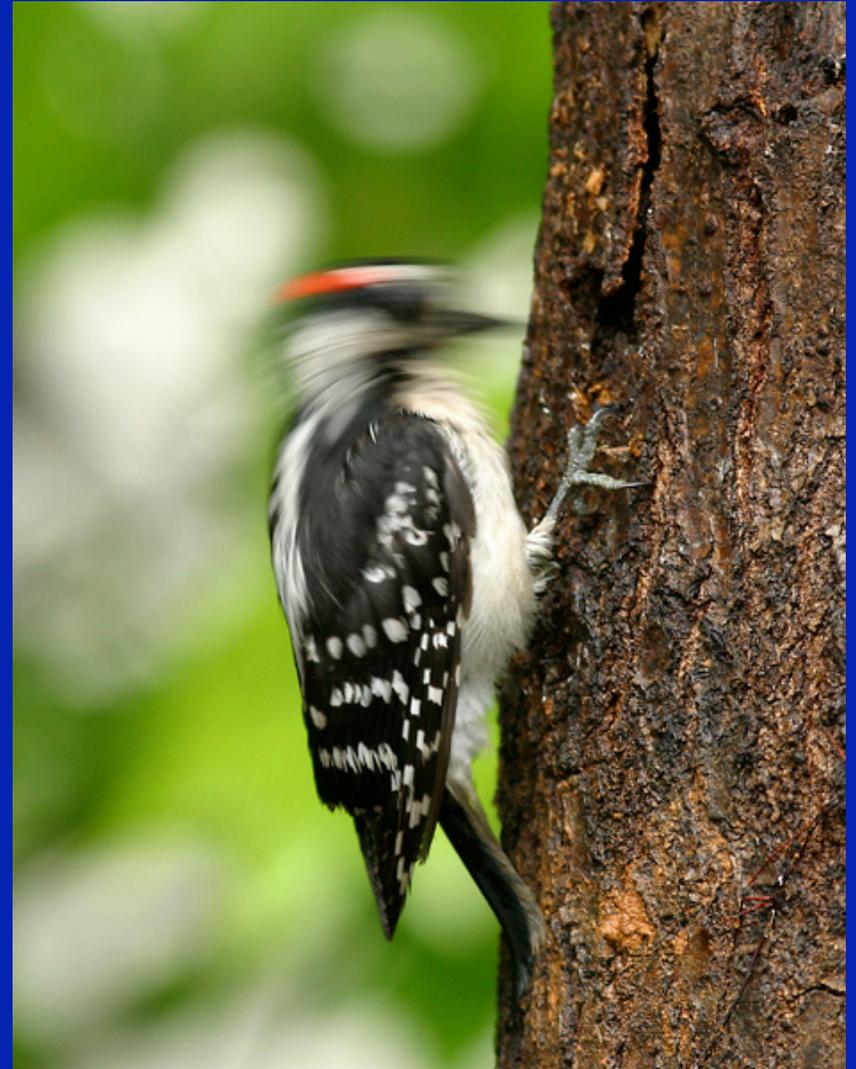
Adaptive radiation of 14 species of Darwin's finches. *Figure from Grant, 1986.*

What does evolution explain?

2. The shape of life: mechanisms of adaptations

Darwin (1859)

'how the innumerable species inhabiting this world have been modified, so as to acquire that perfection of structure and coadaptation that most justly excites our admiration.'

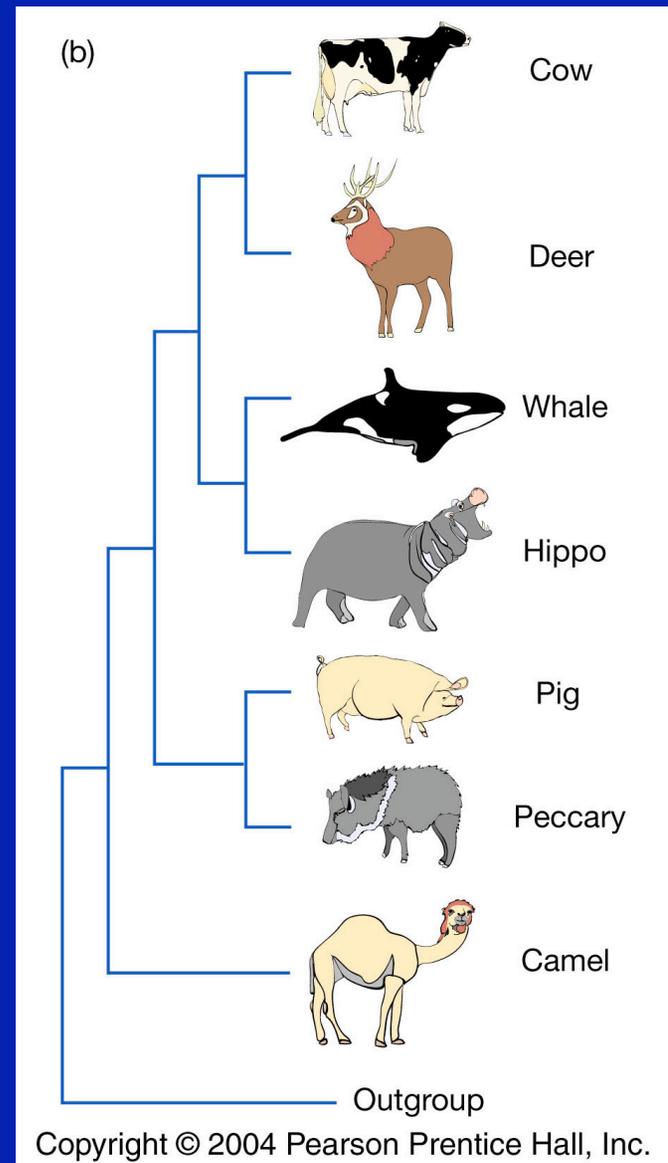


What does evolution explain?

3. The history of life

- Ancestor of whales?
- Ancestor of modern humans?

Fig. 14.4



What does evolution explain?

4. Evolution and society: The management of...

- infectious disease
- crop pests
- endangered species
- fisheries
- etc...

What does evolution explain?

“Nothing in biology makes sense
except in the light of evolution”

T. Dobzhansky, 1900-1975

There are two main features of Darwin's theory:
Organisms evolve, and natural selection leads to
Adaptation

Natural selection was controversial, and Darwin
Agreed with Lamarckian inheritance

The rediscovery of Mendel's laws of inheritance
And its incorporation into Darwin's theory lead to
The Modern Synthesis.

The theory of evolution underwent important changes
Until it was universally accepted, and continues to
Change today.