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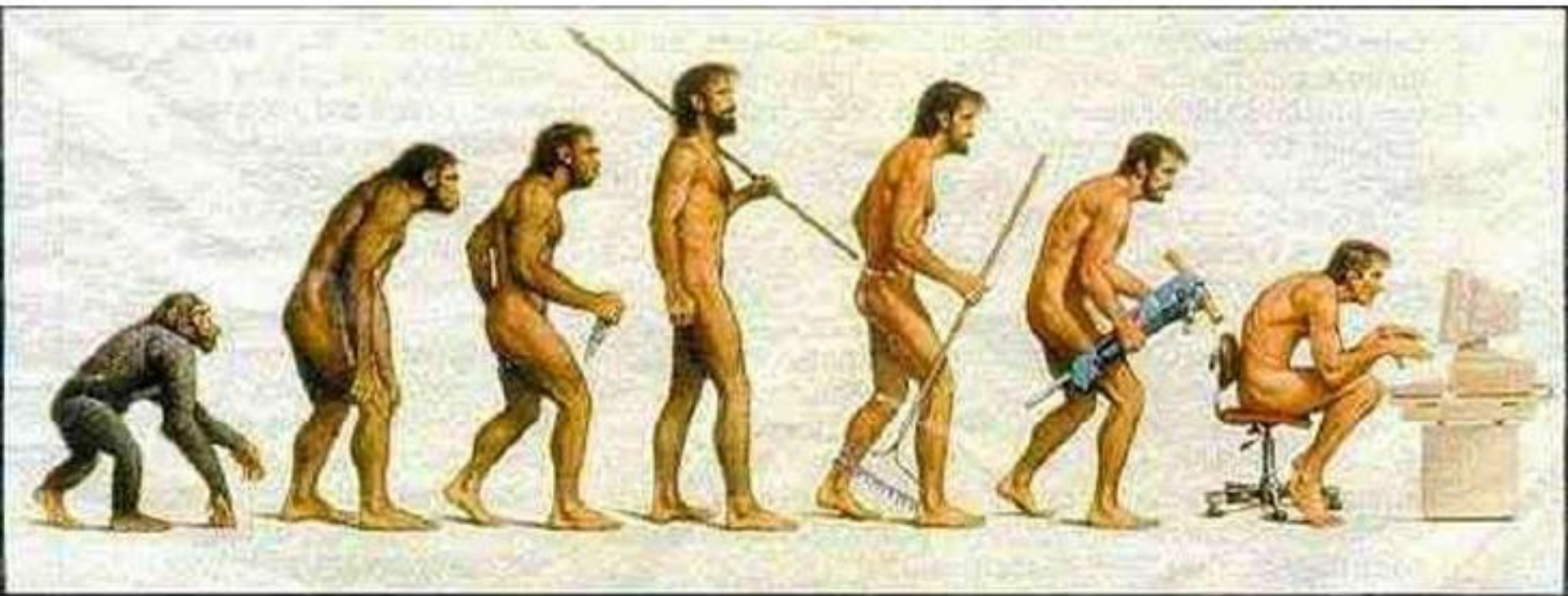
A
PRESENTATION
ON

ORGANIC EVOLUTION

REPRESENTED
BY

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A Quick Review of Evolution



Evolution

- Evolution is the central theme of biology

Nothing in biology makes sense except in the light of evolution

- Theodosius Dobzhansky

Evolution

- **Evolution**: change over time; can be applied to many things, so we use a more specific definition in biology
 - Organic evolution = change in **allele frequencies** over time
 - **Allele** = alternate form of a gene; if one variation of a gene confers some sort of advantage in a particular environment, it is more likely to be passed on.

Evolution

- The term evolution **does not imply a mechanism**
 - many mechanisms have been hypothesized
 - Natural Selection is accepted as the *primary* mechanism of adaptive evolution
 - Other mechanisms include sexual selection, genetic drift, and genetic bottlenecks.
- How does evolution occur?

Speciation

- **Speciation**: the formation of a new species
 - can proceed by many mechanisms
 - results in the **bifurcation** (*separation of 1 into 2*) of a **lineage** (*group of related organisms*)

Speciation

- **Allopatric Speciation**: believed the most common method of speciation (and the method of human speciation).
 - Results primarily from **genetic drift** and **Natural selection**

Genetic Drift

- **Genetic Drift:** random change in allele frequencies over time
 - most common in genes not subject to natural selection
 - Differences accumulate when two populations become separated from each other.

History of Evolution

- Evolution is an old theory
 - Darwin didn't come up with evolution
 - He did provide evidence for it and therefore popularized it and made possible the scientific discipline called evolutionary biology.
 - He also didn't come up with the phrase "survival of the fittest" that you should probably forget you ever heard.

Darwin

- Charles Darwin used and preferred the phrase **descent with modification**
- Darwin developed the theory of **Natural Selection**
 - It is a *mechanism of evolution*, not an equivalent term to evolution
- Who came up with the idea of natural selection independent of Darwin?
 - **Alfred Russel Wallace**
 - Known as the father of biogeography

Influences

➤ Charles Lyell

- Popularized uniformitarianism, a concept developed by James Hutton.

➤ Thomas Malthus

- Wrote an essay on population that highlighted a struggle for limited resources in a large population.

Inspiration - Geology

- **Uniformitarianism**: the processes which shape the earth today are the **same** and occur at the **same rates** as the processes that have shaped the earth in the past
 - For example, canyons formed over a very long time through the same process of erosion as occurs right now; sand on the beach formed through millenia of waves hitting the shore just like they do now.

Natural Selection - Logical Argument

- 1 Reproduction results in more offspring than the size of the current population
- 2 There is variation in all traits (phenotype)
- 3 Much of the variation is heritable
- 4 There is variation in fitness as a result of having or not having certain variations of traits.

Fitness

- Fitness: average number of offspring left by an individual relative to the number of offspring left by an average member of the population
- You could say $\text{Fitness} = \text{Relative Reproduction}$
- What can influence fitness?

Natural Selection

- If natural selection occurs:
- the **distribution of genotypes** (phenotypes) of the next generation **will reflect** the distribution of the **more fit** members of the previous generation
- Not all traits are under the influence of natural selection

Forms of Selection

- Stabilizing selection
- Directional selection
- Disruptive selection

Definitions

- **Mutation**: any **change** occurring in the **message** that a gene carries
- Provides **variation** upon which natural selection can act
- Usually the result of copy errors during DNA replication in mitosis or meiosis



Definitions

- **Adaptation**: the condition of organisms being
 - **well fit** for life in their environments
 - as resulting from **natural selection**
 - Non-adaptive change?
 - Acclimation

Definitions

- **Exaptation:** a biological trait (adaptation) where the current biological function is different from the function of the original adaptation

Or, you could say

- The selection pressures are now exerted on a different function than those that initially controlled the trait



Definitions

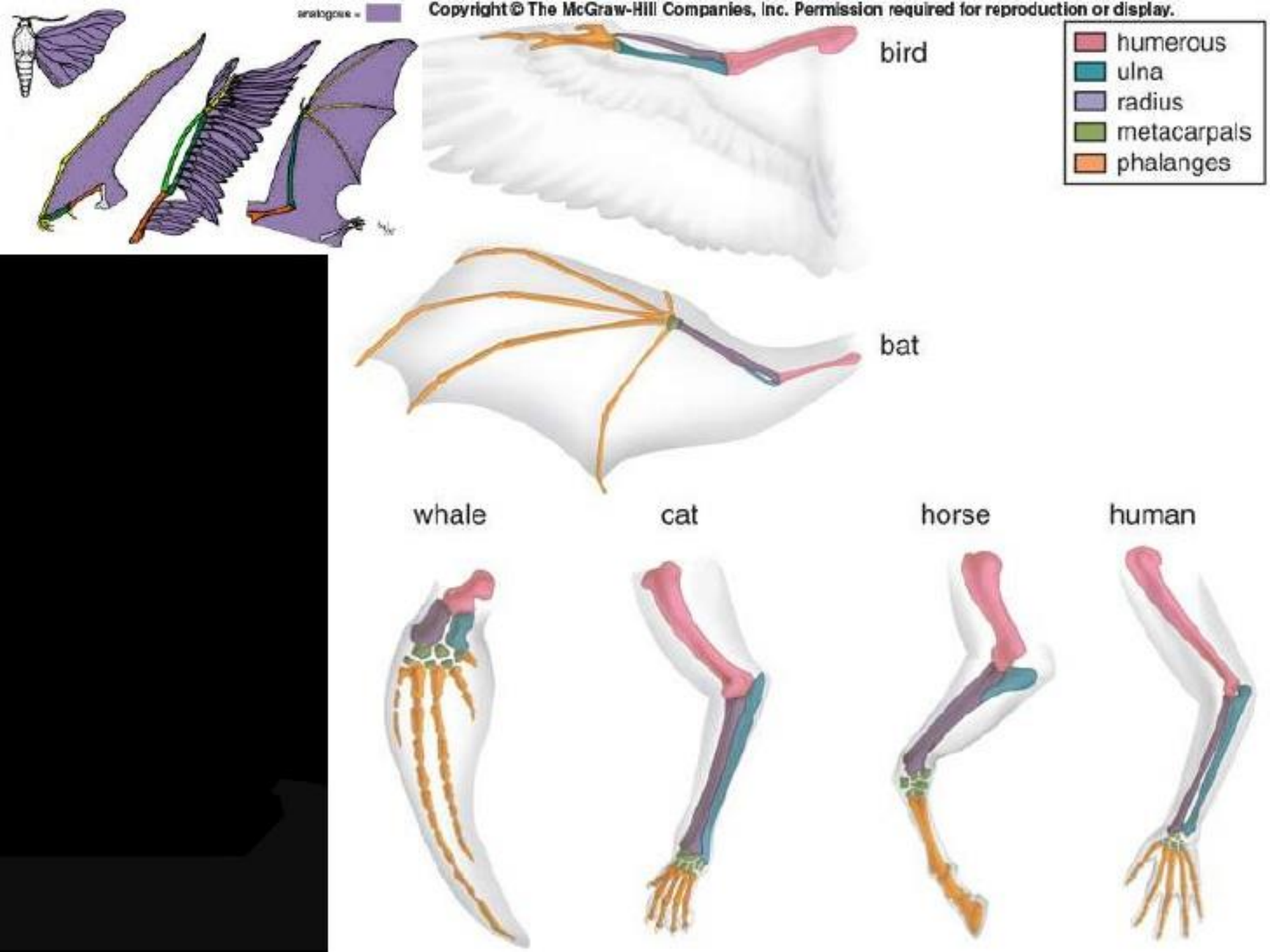
- Phenotypic plasticity: sometimes the same genotype is expressed as a different phenotype in different environments
 - The organism has not adapted
 - Acclimation

Units of Evolution and Natural Selection

- Unit of evolution=Species
- can change over time based on the differential representation of genes in each generation caused by natural selection
 - It is often more proper to view the population as the unit of evolution
 - When are a species and population not equivalent?

Units of Evolution and Natural Selection

- Unit of selection=An individual
- the unit that survives or does not, breeds or does not, passes on genes to the next generation or does not
 - Individuals do not evolve



➤ Imperfections of nature

Why?

Conflicts between selection pressures and limitations of descent

Humans:

increased brain size

requires large pelvic outlet

bipedal locomotion

requires narrow pelvic outlet

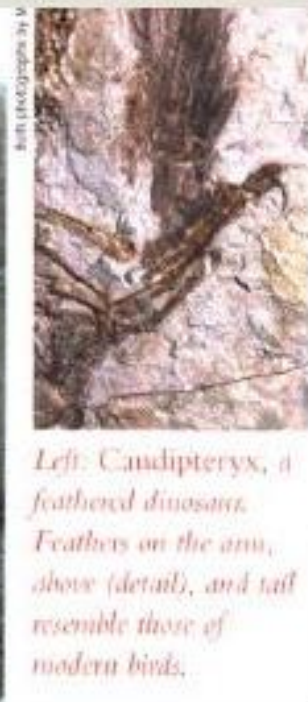
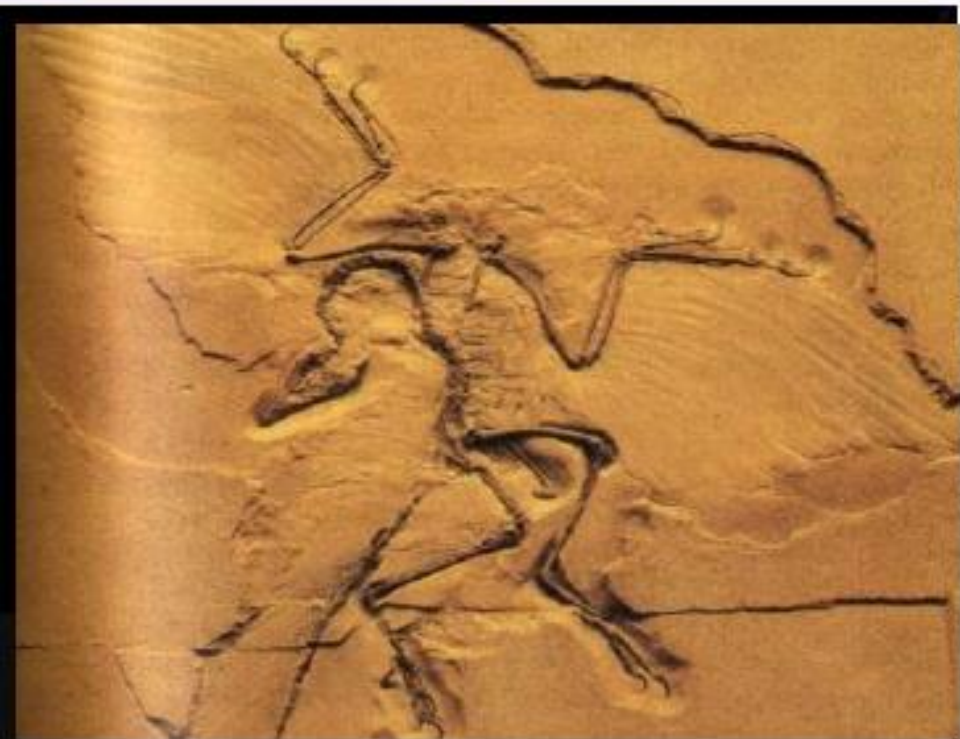
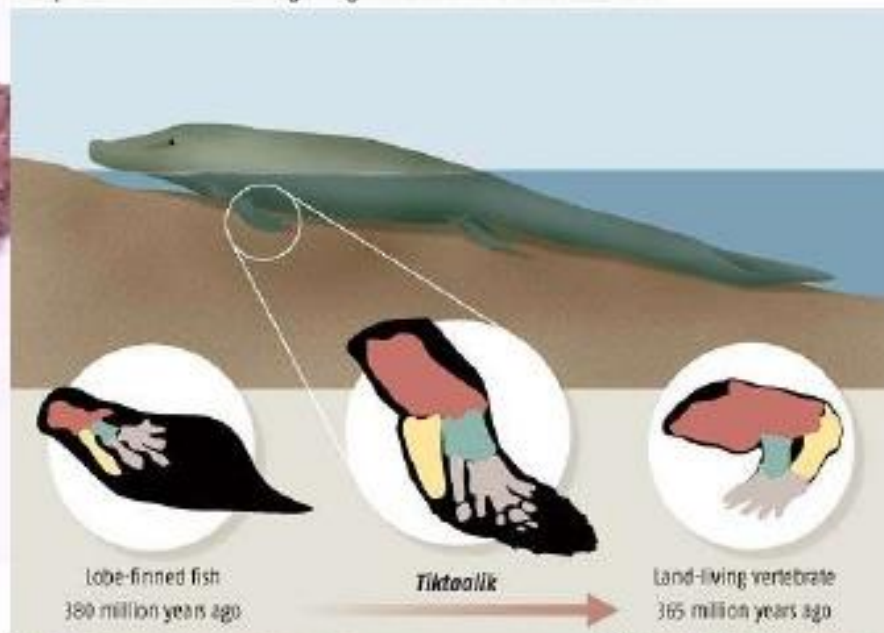


➤ Transition fossils



MISSING LINK

Tiktoalik is the first complete transitional specimen between fish and land-dwelling tetrapods. Its fins show the beginnings of elbow and wrist-like features



Left: Caudipteryx, a feathered dinosaur. Feathers on the arm, above (detail), and tail resemble those of modern birds.