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JEAN BATISTE LAMARK-CREATOR OF THE EVOLUTIONARY THEORY

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# SUBTOPICS:

- Evolutionary doctrine
- Essence of the natural system
- Species problem
- Principle of gradation
- Direction of evolutionary process
- Influence of external environment





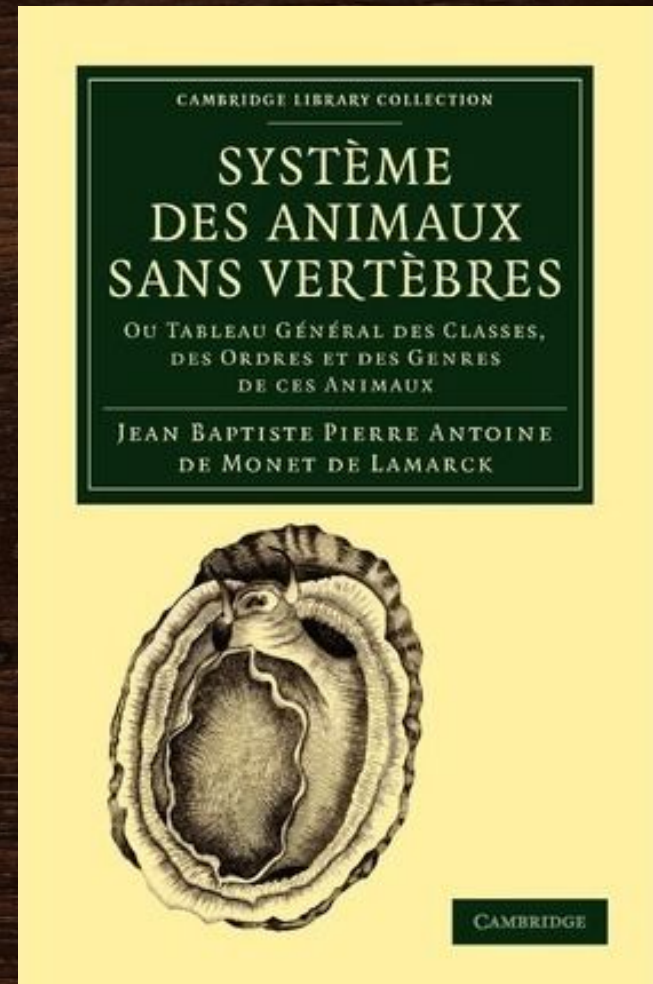
# Lamarck –creator of first evolutionary theory

- In 1801, he published *Système des animaux sans vertèbres*, a major work on the classification of invertebrates, a term he coined. In an 1802 publication, he became one of the first to use the term "biology" in its modern sense.
- Lamarck continued his work as a premier authority on invertebrate zoology. He is remembered, at least in malacology, as a taxonomist of considerable stature.
- The modern era generally remembers Lamarck for a theory of inheritance of acquired characteristics, called Lamarckism (inaccurately named after him), soft inheritance, or use/disuse theory, which he described in his 1809 *Philosophie Zoologique*.





- However, the idea of soft inheritance long antedates him, formed only a small element of his theory of evolution, and was in his time accepted by many natural historians.
- In 1801, he published *Système des Animaux sans Vertèbres*, a major work on the classification of invertebrates. In the work, he introduced definitions of natural groups among invertebrates.
- Lamarck's contribution to evolutionary theory consisted of the first truly cohesive theory of biological evolution, in which an alchemical complexifying force drove organisms up a ladder of complexity, and a second environmental force adapted them to local environments through use and disuse of characteristics, differentiating them from other organisms.
- Scientists have debated whether advances in the field of transgenerational epigenetics mean that Lamarck was to an extent correct, or not.





# EVOLUTIONARY DOCTRINE

## Lamarckism

a theory of evolution based on the principle that physical changes in organisms during their lifetime such as greater development of an organ or a part through increased use could be transmitted to their offsprings.

### 1. LAW OF USE AND DISSUSE

Individual lose characteristics they do not require and develop those which are useful .

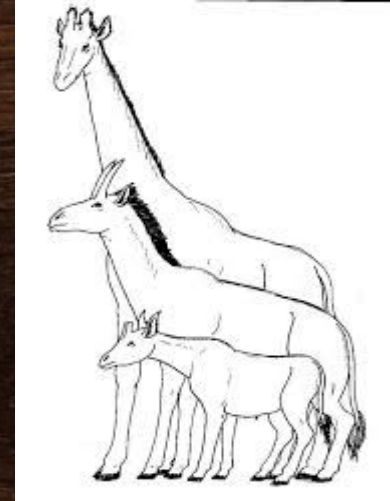
### 2. INHERITENCE OF ACQUIRED TRAITS

Individuals inherit the acquired traits of their ancestors.



# LAMARKISM- EXAMPLES

□ The stretching by giraffes to reach leaves leads to offspring with longer necks.



□ Streching of muscles in a blacksmith's arm leads to son with like musculus development.



THIS THEORY WAS DISPROVED LATER



# ESSENCE OF NATURAL SYSTEM

- Life by its own force, tends to increase the volume of all organs which possess the force of life, and the force of life extends the dimensions of those parts up to an extent that those parts bring to themselves;"
- "The production of a new organ in an animal body, results from a new requirement arising. and which continues to make itself felt, and a new movement which that requirement gives birth to, and its upkeep/maintenance;"
- The development of the organs, and their ability, are constantly a result of the use of those organs.
- All that has been acquired, traced, or changed, in the physiology of individuals, during their life, is conserved through the genesis, reproduction, and transmitted to new individuals who are related to those who have undergone those changes."



# Species problem

- The species problem is the set of questions that arises when biologists attempt to define what a species is. Such a definition is called a species concept; there are at least 26 recognized species concepts. A species concept that works well for sexually reproducing organisms such as birds is useless for species that reproduce asexually, such as bacteria. The scientific study of the species problem has been called microtaxonomy.
- One common, but sometimes difficult, question is how best to decide which species an organism belongs to, because reproductively isolated groups may not be readily recognizable, and cryptic species may be present. There is a continuum from reproductive isolation with no interbreeding, to panmixis, unlimited interbreeding. Populations can move forward or backwards along this continuum, at any point meeting the criteria for one or another species concept, and failing others.



- The current meaning of the phrase "species problem" is quite different from what Charles Darwin and others meant by it during the 19th and early 20th centuries. For Darwin, the species problem was the question of how new species arose. Darwin was however one of the first people to question how well-defined species are, given that they constantly change.

## **INVASIVE SPECIES PROBLEMS**



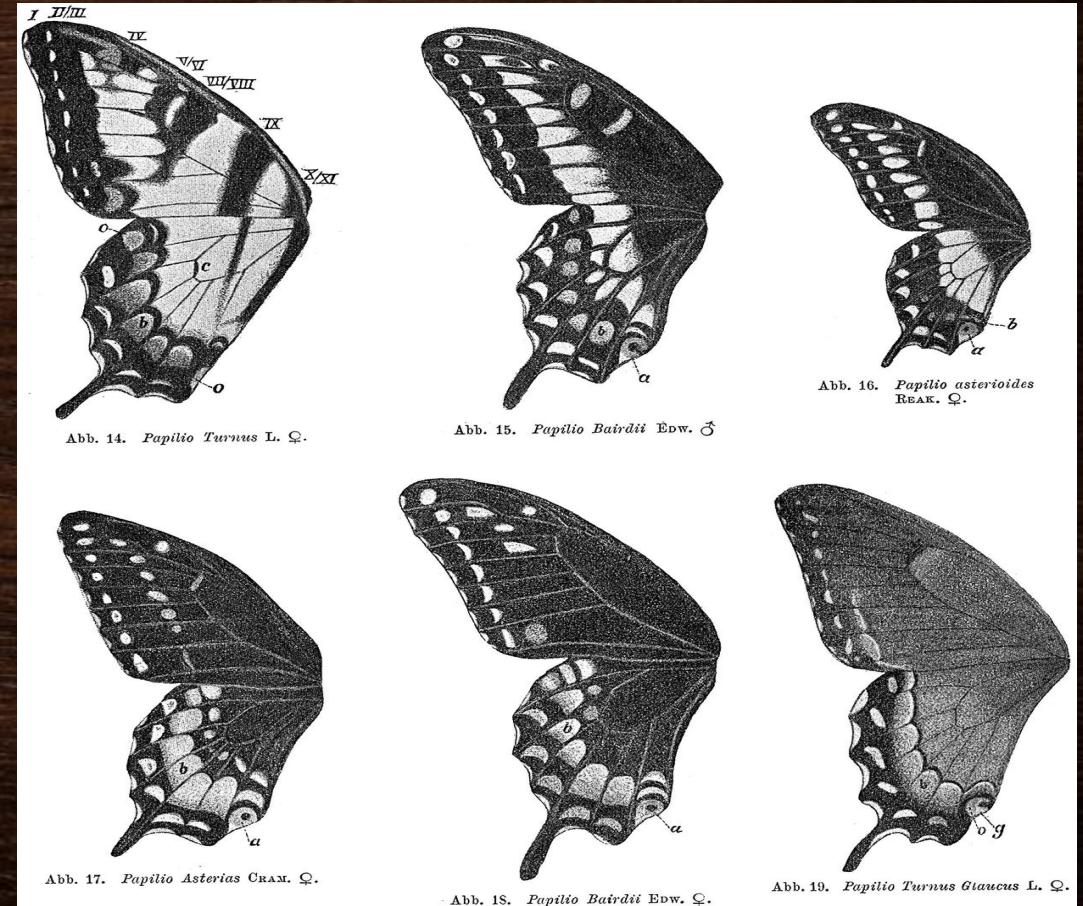
- **World-wide problem**
- **Increase in travel and trade open routes**
- **In U.S. costs \$137 billion dollars per year**
- **Approximately 42% of Threatened or Endangered species are at risk due to non-native, invasive species.**
- **Raise havoc in ecosystems and threaten species diversity**



# Principle of gradation

□ Lamarck believed that all life was organized in a vertical chain, with gradation between the lowest forms and the highest forms of life, thus demonstrating a path to progressive developments in nature.

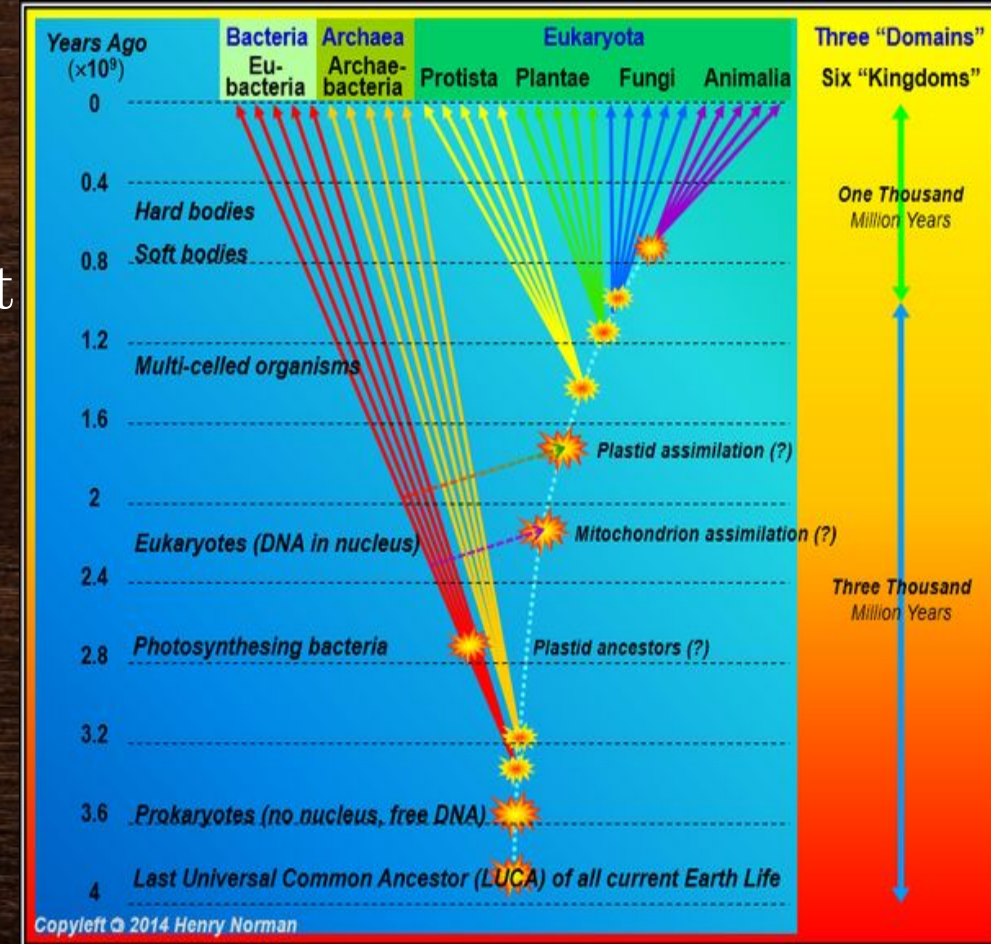
□ In his own work, Lamarck had favored the then-more traditional theory based on the classical four elements.





# DIRECTION OF EVOLUTIONARY PROCESS

- On the conceptual side, unlike for molecular, cellular, and developmental biology, there is no basic mechanism that evolutionists are attempting to elucidate.
- There is no single cause of the evolutionary change in the properties of members of a species. Natural selection may be involved but so are random events, patterns of migration and interbreeding, mutational events, and horizontal transfer of genes across species bounds.

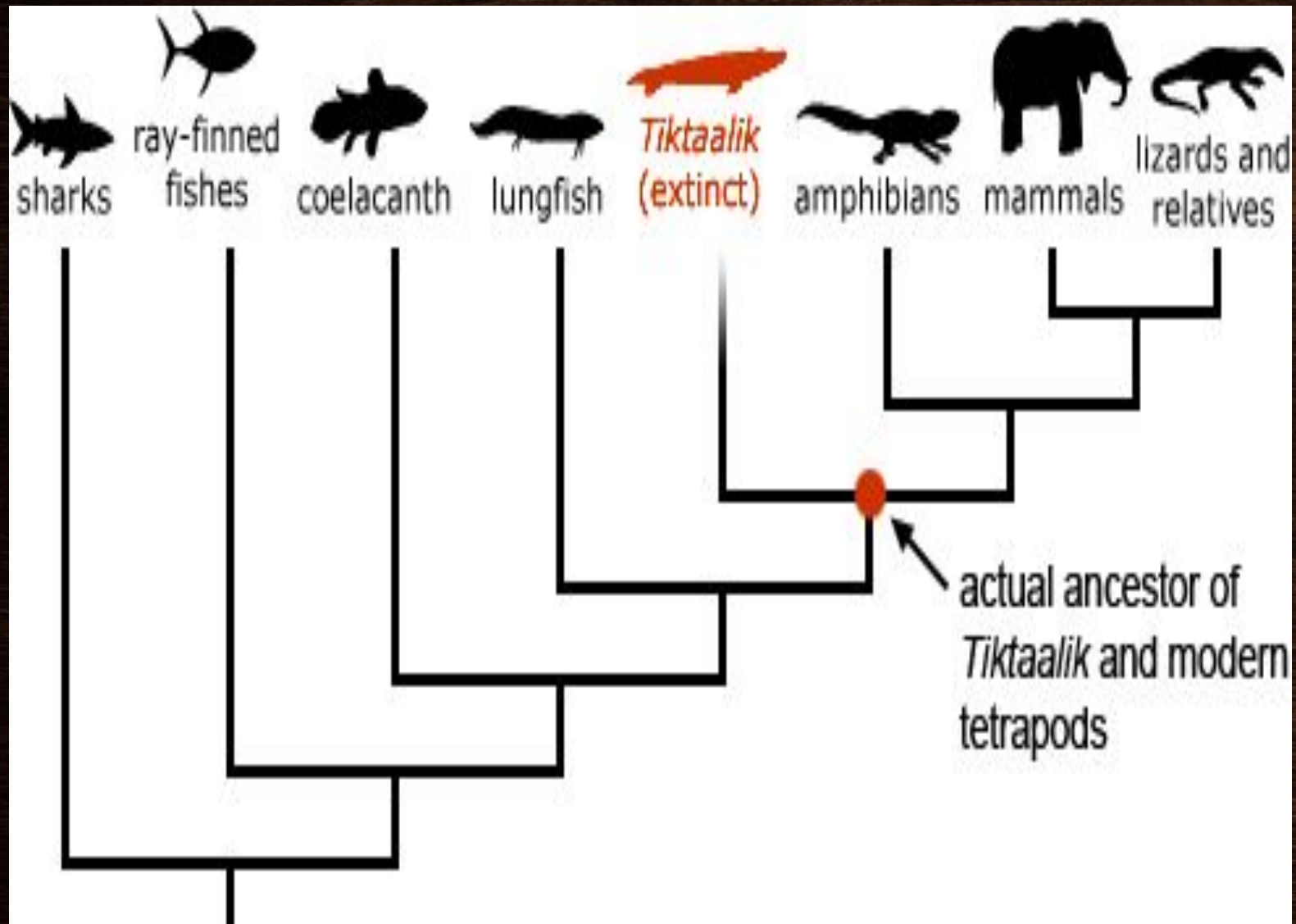




# EVOLUTIONARY PROCESS

- Charles Darwin identified three ingredients necessary for natural selection to occur. Individuals must be different, so there is variation in the population. They must also be able to pass this variation on to offspring. Finally, individuals must compete for resources that limit the number of offspring they can produce. Individuals with variations that allow them to obtain more resources are likely to produce more offspring like themselves.
- Evolution also depends on context and environment, which notoriously change constantly in unpredictable ways. For example, fishes who start living and evolving in unlit caves often lose their eyes, because the costs of developing them outweigh their advantages.

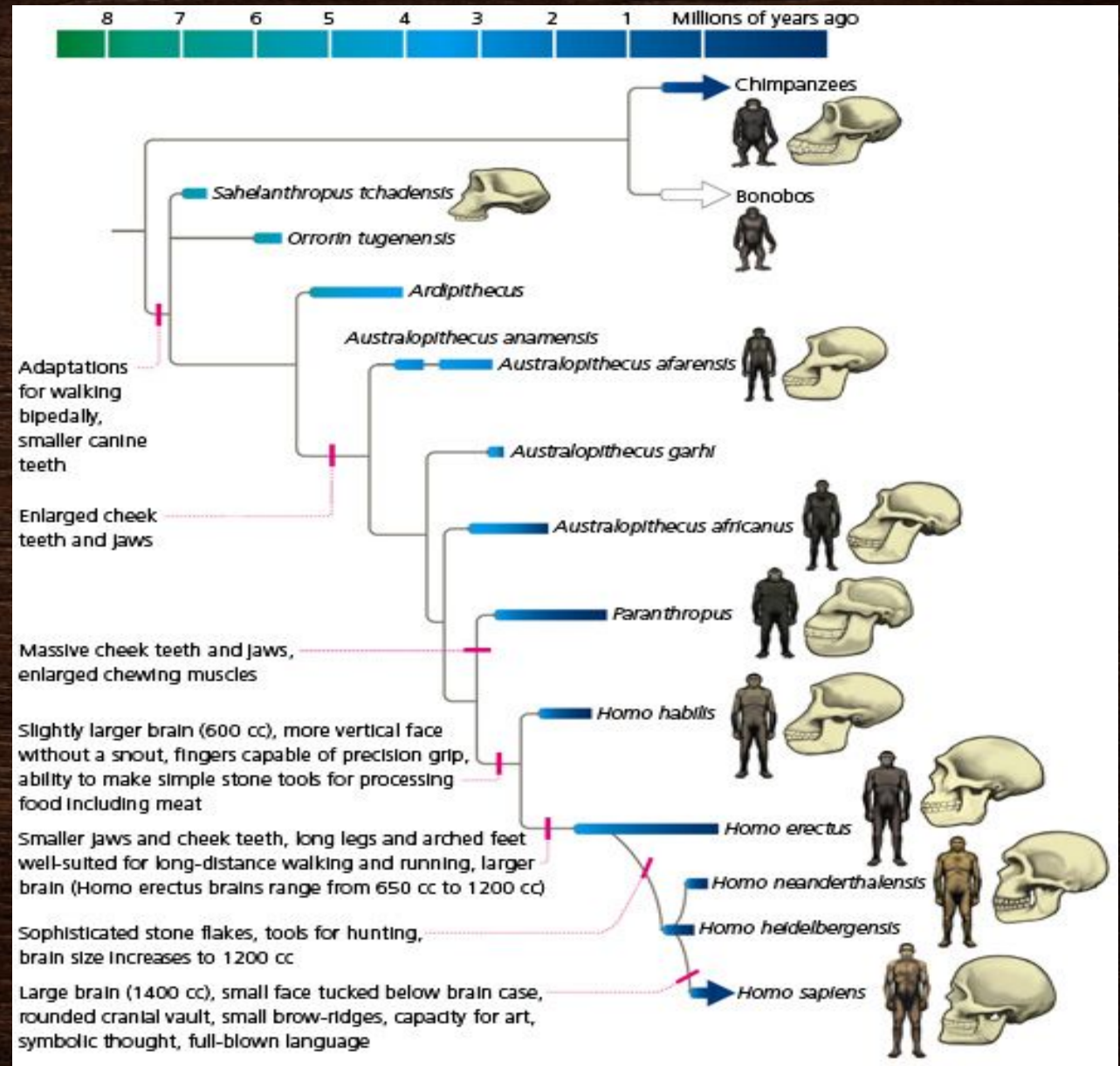




DIRECTION  
OF  
EVOLUTION  
PROCESS



# Human evolutionary direction





# EXTERNAL ENVIRONMENT

- The external environment interacts with the internal environment to influence fetal development with both immediate and life-long consequences. Such environmentally-induced changes can occur at all levels of biological organization.
- Ultimately, these influences may be epigenetic in nature, inducing mitotically heritable alterations in gene expression without changing the DNA. Epigenetics can be studied in a reductionist manner (Molecular) to understand the manner in which gene expression is altered.
- Alternatively, epigenetic modifications can be examined as consequences (Molar) amplifying through higher levels of biological organization. For example, these alterations can bring about functional differences in brain and behavior that result in changes in the phenotype



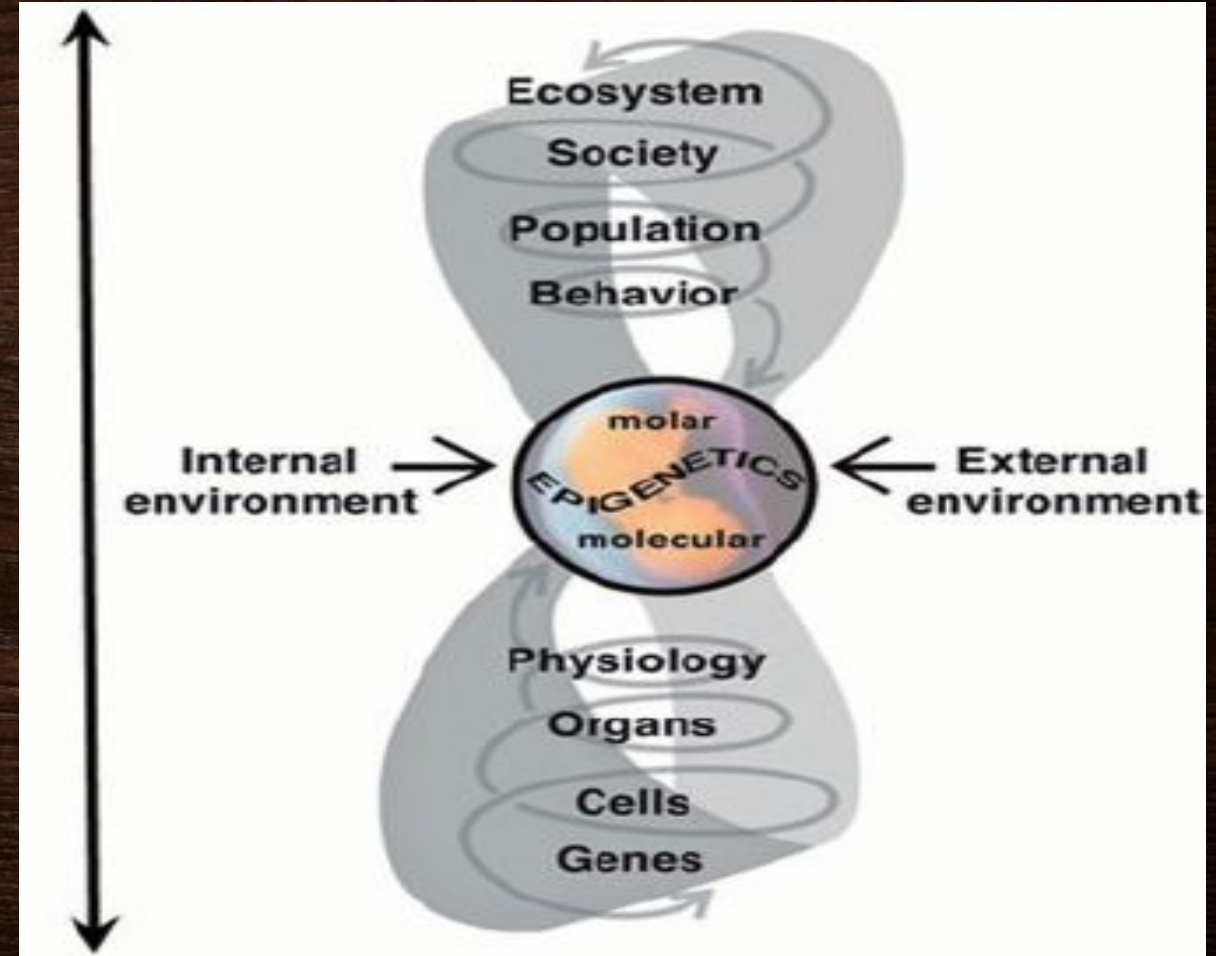
## A. Rate of Environmental Change

- Rapid environmental change = rapid change in species
- Rapid change
  - Ex. Modern horse: many changes over past million years
- Slow change
  - Ex. Horseshoe crab: nearly identical to ancestors from 300 mya





# LEVELS OF BIOLOGICAL ORGANIZATION





# INFLUENCE OF EXTERNAL ENVIRONMENT

- For example, these alterations can bring about functional differences in brain and behavior that result in changes in the phenotype
- Behavior is the product of brain activity and is an emergent property. Behavior becomes an externalized signal that changes the social environment; in essence the individual's behavior creates its own niche space and modifies how individuals respond to conspecifics and their environment. The evolutionary impact of such questions is still an open question. What is known is that human society has changed the ecosystem in a manner that has had demonstrable impact on the health of humans and wildlife.



# Five different forces have influenced human evolution:

- natural selection,
- random genetic drift,
- mutation,
- population mating structure, and
- culture.



# Reference links

- [https://en.wikipedia.org/wiki/File:Weismann%27s Germ Plasm.svg](https://en.wikipedia.org/wiki/File:Weismann%27s_Germ_Plasm.svg)
- [https://en.wikipedia.org/wiki/File:Lamarck%27s Two-Factor Theory.svg](https://en.wikipedia.org/wiki/File:Lamarck%27s_Two-Factor_Theory.svg)
- [https://en.wikipedia.org/wiki/File:Jean-Baptiste Lamarck.jpg](https://en.wikipedia.org/wiki/File:Jean-Baptiste_Lamarck.jpg)



Thank  
you!

