

COMPARISON OF EVOLUTION MECHANISMS: SUMMARY

Lamarck's Hypothesis: The Inheritance of Acquired Characteristics

1. A changing environment creates a need for certain features to be developed in order to survive.*
2. "Acquired Characteristics": Through use and/or non-use, those features needed for survival are developed in each individual.
3. Inheritance: Those characteristics developed ("acquired") by individuals are somehow passed on to their offspring, who can continue that development...
4. New Species: Eventually, over many generations, enough differences have developed that we can say we have a new species.

Darwin's Hypothesis: Natural Selection

1. Overproduction: More offspring produced than will ultimately survive and reproduce
2. Variation: Inheritable features vary from individual to individual.
3. Change in environment: Changes in climate, topography, food supply, predators, etc.
4. "Struggle for existence": Mainly competition within the species, for food, habitat, survival from being eaten
5. "Survival of the fit" (not necessarily the strongest): Those with more adaptive traits tend to survive longer and/or produce the most offspring; these are the "naturally selected".
6. Inheritance of "selected" features: Traits involved are already inheritable, but may involve new combinations.
7. New Species, better adapted to the new environment: When the collective traits of the population differ significantly from the earlier population, and can no longer reproduce with the earlier population.

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QUICK COMPARISON

<u>LAMARCK</u>	<u>DARWIN</u>
1. <u>Environment</u> changes, thus creating a "need" to change	1. <u>Variations</u> of inheritable features which already normally exist
2. Development of new features, " <u>in order to</u> survive."* or " <u>so that</u> one can survive."*	2. Environment "screens out" (or SELECTS) features contributing to survival, and tends to eliminate the others.
3. Newly acquired traits somehow get passed down to offspring	3. Those with traits which help survival tend to survive and have more offspring, who inherit those traits.
4. New Species, eventually	4. New Species, eventually

* Note the Anthropomorphic wording here ("something non-human having human motivations or attributes"). This could also be referred to as the "Mickey Mouse" syndrome. Be sure to avoid this kind of wording or implication in any explanations of Natural Selection.

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COMMON MISCONCEPTIONS TO AVOID

1. Only groups of organisms can evolve (populations or species); individuals never evolve.
2. Adaptations, in the evolutionary sense, as properly used in class and text, can only "develop" as characteristics of a species, generally over a long period of time, involving many generations; these must not be confused with the "adjustments" an individual might make, consciously or otherwise, enabling it to survive better (such as "developing resistance to a disease" or "adapting to higher altitudes", etc.).

EVOLUTION MECHANISMS: COMPARISON SAMPLES

Consider the long legs of wading birds such as herons and egrets, birds that are common around rivers and marshes. How could such a bird evolve such long legs? Read the following scenarios and discuss each with your partner. Use the questions at the bottom to help in this discussion.

Assume that the species ancestral to these birds had short legs, and could only wade into very shallow water along the shoreline, eating snails and small fish.

SCENARIO A. A change in the environment increased competition between the birds, and resulted in a depletion of the food supply in the shallow waters. This created a need for the short-legged birds to wade into deeper water in order to survive, which forced them to stretch their legs, because they didn't want to get knocked over by the little waves. This stretching caused their legs to get a little longer.

When these birds produced chicks, the baby birds grew up with the slightly longer legs inherited from their parents. These offspring birds needed to wade out even further, so they stretched their legs even more, and made them a little bit longer yet. And their chicks grew up with even longer legs inherited from their parents. And so on...

Eventually, after many generations of this, the legs of these birds were so much longer than the ancestral birds that the new birds could be described as a new species.

SCENARIO B. Within the species of ancestral short-legged shore birds, there is a range of leg lengths, from a little bit shorter to a little bit longer than the average leg length, and these leg lengths tended to run in families (i.e., leg length was hereditary).

A change in the environment increased competition between the birds, depleting the food supply in the shallow waters. The birds with slightly longer legs, of course, could wade out a little farther. As a result, they got more food, lived a little longer, and therefore produced more chicks. Those with the shorter legs would tend to starve to death. Since the tendency for leg length was already inheritable, the surviving "long-leggers" tended to have more long-legged chicks, which likewise tended to get more food and produce more chicks. And so on...

Eventually, after many generations of this, the average leg length of these birds was so much longer than in the ancestral birds (along with other connected changes) that the new birds could be described as a new species.

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DISCUSSION:

1. Which scenario sounds like an explanation Darwin might give?_____ Why?
2. Which scenario sounds like an explanation Lamarck might give?_____ Why?
3. What are the specific clues which most clearly distinguish a Darwinian explanation from a Lamarckian explanation
4. Which explanation is most likely correct (in terms of the relative evidence between Darwin's hypothesis and Lamarck's hypothesis)?
5. Write a similar pair of scenarios describing how some particular species evolved, with a particularly conspicuous feature, (e.g. a tiger, an elephant, a hawk, a frog, etc.); do one scenario the way Lamarck might explain it, and one the way Darwin might explain it. Be sure to say which is which.

KEY: Types of answers to be expected

1. Scenario B. Contains the elements of Darwin's natural selection process: 1) inheritable variations, 2) an environmental change, and 3) survival and reproduction of those with traits enabling survival in the changing environment. No mention of "need" nor individual efforts to make physical changes "in order to survive".
2. Scenario A. Contains the elements of Lamarck's hypothesis: 1) environmental change creates "need" for individuals to change, 2) by individual effort, physical changes were produced, and 3) newly acquired physical changes somehow became genetic, and were passed on to offspring.
3. See answers to 1 and 2.
4. Darwin's. Studies based on both hypotheses have repeatedly confirmed Darwin's hypothesis and refuted Lamarck's hypothesis.
5. [Have students exchange scenarios, and look for signs of wording or content which are not consistent with the expressed hypothesis, marking these, then discussing with each other, followed by class discussion...questions raised, responded to by others, with teacher providing guidance as necessary.]