



Lamarckian Inheritance and Epigenetics Evolution

[Source: TH](#)

The recent discovery of **heritable cold tolerance** in **rice plants** through **epigenetic changes** marks a historic validation of **Jean-Baptiste Lamarck's theory** that **environmental influences** can affect **heredity** — a concept once dismissed but now supported by **modern science**.

- **Epigenetics** refers to **heritable changes in gene expression** caused by **external factors** that switch genes on or off **without altering the DNA sequence**.
- **Lamarck's Theory (1809)**: It proposed that **traits acquired** during an organism's lifetime through **use, disuse, or environment could be inherited**.
 - It was dominant until [Darwin's natural selection \(1859\)](#) and [Mendel's laws of inheritance](#) disproved it.
 - A study showed that **exposing rice plants to cold triggered epigenetic changes in the gene**, which conferred **cold tolerance and was heritable** for five generations.
- **Scientific Challenges to Lamarck**:
 - **Darwin's Natural Selection (1859)**: It argued **genetic variations** (not **acquired traits**) drive **evolution** via "survival of the fittest."
 - **Weismann's Experiment (1890s)**: **Tailless mice** produced **normal-tailed offspring**, disproving **inheritance of acquired traits**.
 - **Gregor-Johann Mendel**: It showed [genes \(DNA\)](#) are the **stable units of heredity**, not **environmental adaptations**.
- **Epigenetics Emerges**:
 - **Royal Brink's Maize Study (1956)**: It revealed that **gene expression**, not just **DNA sequence**, could be **heritable**, demonstrating **non-DNA-based inheritance**.
 - **Arthur Riggs' Hypothesis (1975)**: It **proposed epigenetic marks** (chemical tags on **DNA**) could pass **traits** across **generations** without changing their DNA sequence. It is **easier** to change **epigenetic marks** than to **mutate DNA**.

THEORIES OF EVOLUTION

The modification of living organisms during their descent, generation by generation from common ancestors.

Oparin-Haldane Theory of Origin of Life

- ↳ Also known as Materialistic theory
- ↳ Describes process of origin of life on early Earth as:

Physio-chemical processes of atoms → Organic compounds → Macromolecules → First living system or cells

Theory of Inheritance of Acquired Character (Lamarckism)

- ↳ First theory of organic evolution
- ↳ **Evolutionary ideas:**
 - ↳ Internal forces of life increase the size of organism
 - ↳ New structures appear because of an 'inner want'
 - ↳ Direct environmental effect over living organisms
 - ↳ Inheritance of acquired character
- ↳ **E.g.:** Long neck of giraffe due to gradual lack of surface vegetation

Theory of Natural Selection (Darwinism)

- ↳ Foundation of evolutionary biology
- ↳ **Elements:**
 - ↳ Universal occurrence of variation
 - ↳ Rapid multiplication
 - ↳ **The struggle for existence** - Intraspecific and interspecific
 - ↳ **Survival of the fittest (Natural Selection)**
 - ↳ Inheritance of useful variations; Elimination of non-useful variations
- ↳ **E.g.:** Survival of more dark-winged moths than white-winged ones in post-industrialisation period

Neo-Darwinism

Integration of Darwin's theory of evolution with Gregor Mendel's theory of genetics

Modern Synthetic Theory

- One of the proven theories of organic evolution
- Includes factors such as – Mutation, Variation /Recombination, Heredity, Natural Selection and Isolation

Mutation Theory (Hugo de Vries)

- ↳ Describes evolution as a jerky process where new varieties of species are formed by mutations (discontinuous variations)
- ↳ **Salient features:**
 - ↳ Mutation appears all of a sudden and becomes operational immediately
 - ↳ Same type of mutation in several individuals of a species
 - ↳ All mutations are inheritable
 - ↳ Useful mutations are selected and lethal ones are eliminated by nature



Drishti IAS

Read More: [eDNA Challenging Genetics Principles](https://www.drishtiias.com/printpdf/lamarckian-inheritance-and-epigenetics-evolution)

PDF Reference URL: <https://www.drishtiias.com/printpdf/lamarckian-inheritance-and-epigenetics-evolution>