

## Epigenetics: The Revenge of Lamarck?

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### How the Environment Regulates Our Genes

In 1859 the book "On the Origin of Species" by Charles Darwin changed the biology theories and the biblical creationism was replaced by a new vision of the world. From this new perspective, also the theories by Lamarck were considered incorrect, because the adaptations achieved by animals during their life could not be transmitted hereditarily. Moreover, after fifty years, the data collected by Gregor Mendel induced biologists to introduce the concept of gene and hereditary characteristics, underestimating the role of the environment.

Nowadays, all geneticists have reevaluated the environment as a key factor for the regulation of gene expression: external factors as temperature and light may influence the regulation of gene expression in some animals. This mechanism involves epigenetic markers such as histone methylation and/or acetylation that can be transmitted hereditarily. The new approach to genes is very important to understand many pathologies and their therapeutic strategies. The global epidemic of obesity is considered as a multifactorial pathology

that does not only depend on a single gene but on several genes and on their interaction with the environment. Genome-wide association studies (GWAS) highlighted variants in the  $\beta$ 2-adrenergic receptor or in peroxisome proliferator-activated receptor- $\gamma$  (PPAR $\gamma$ ), gene related to overweight and obesity development. Moreover, neuropsychiatric disorders such as schizophrenia, depression and autism showed a multifactorial profile. Many studies have reported as the maternal separation during the neonatal period alters the epigenetic status of the glucocorticoid receptor promoter in rats and mice hippocampus, generating high inheritable changes in social behaviors. For example, recently Dias B.G. et al showed how traumatic olfactory experience influences behavior and brain structure and how these are inherited at behavioral and epigenetic levels in mice models.

In conclusion, despite the Lamarck's theories have been abandoned, modern genetics can no longer solely rely on the "Darwinian determinism" but also on a complex interaction involving environment, genes, and epigenome.