

# The French Evolution: Lamarck meets Darwin



**Tim Jones** reports on epigenetics and the potential role of acquired characteristics in evolution.

**W**e celebrate 150th anniversary of Darwin's theory of evolution by natural selection this year. But before Darwin, Jean-Baptiste Lamarck came up with his theory of evolution by transmutation of species: characteristics acquired during an individual's life-time are passed on to its offspring. Largely discredited and ignored since Darwin, Lamarck's theory might not be all wrong.

Forty years before Darwin published *On the Origin of Species*, Jean-Baptiste Lamarck proposed his theory for the 'transmutation of species'. Organisms, he said, adapted to their environment through a mechanism by which their tissues and organs developed into a more fit-for-purpose form, dependent upon their use or dis-use during life. The improvements passed to, and cumulatively built up in, subsequent generations.

It followed that an animal required to run fast would build up stronger leg muscles. And giraffes' long necks could be put down to their ancestors' craning for ever-higher food stocks. Darwin conceded a lesser role for these so-called 'acquired characteristics' alongside his natural selection, suggesting modifications passed down the generations via information-rich 'gemmules' produced by the body's cells. By

the twentieth century however, Lamarck's ideas, and Darwin's gemmules (despite a superficial resemblance to genes) proved inconsistent with the concept of Mendelian genetics, bound with natural selection to form the so-called Modern Evolutionary Synthesis.

Yet the idea of heritable adaptation resulting from processes other than the commonly accepted mutation of DNA is far from dead. The field of study known as epigenetics recognises that the form of an organism (its phenotype) is both an expression of the DNA blueprint it carries, but also the influence of chemical factors controlling how the blueprint is used. The result is an epigenetic code that overlays the genetic code: a kind of instructions for the instructions.

Inheritance thus comprises the gene's state of expression, coded by chemical markers attached to the DNA, rather than the gene alone. The biologist P. Z. Meyers has helpfully described epigenetics in terms of 'cellular memory... sufficient to reconstitute the state of gene activity between generations.'

Epigenetic effects appear as eye colour difference between genetically identical fruit flies, as inherited modification to disease susceptibility in mice, and as physical differences between human identical twins. Epigenetics is key to understanding how

environment and lifestyle might impact present and future generations' well-being, and also pokes the fire of the nature versus nurture debate. Following the successful coding of the human genome, the priority for much current research and funding is a full characterisation of the even more complex epigenetic code.

Perhaps one day we will see Lamarck as one of the fathers of the modern evolutionary theory, alongside Darwin and Wallace. But there is still a lot to be done in study of epigenetics.



Some acquired characteristics can be transmitted to offspring epigenetically.