***Mendel and Darwin***

***the birth of modern biology***

In the nineteenth century, seven years apart, two of the greatest theories in the history of science came to light; certainly those that have most influenced our understanding of life on Earth.

The theory of **Evolution by Random Mutation and Natural Selection** by ***Charles Darwin*** in 1858 and that of the principles that regulate the **Transmission of Hereditary Characters**, by **Gregor Mendel** in 1865.

Darwin and Mendel lived in the same years, but never met.

Darwin ignored the mechanism of transmission of hereditary characteristics and this constituted a weak point in his theory.

Much has been written about Darwin, very little about Mendel.

Probably because people were (and still are) strongly interested in the place that we humans occupy in the universe, and therefore the topic Darwin raised was fascinating.

Instead, Mendel's discovery, however important, seemed only a question of mechanisms.

Yet Mendel, as already mentioned, with his discoveries gave Darwin an essential piece for his theory of evolution.

In his final years, Darwin was tormented by critics who found his explanations of the origin of biological variability, the foundation of evolutionary theory, insufficient.

Furthermore, Darwin was unable to describe the mechanism through which the characteristics rewarded by natural selection were transmitted to the next generation.

The key to inheritance, but also to the origin of variability, was to be found in Mendel's work.

The central point of Mendel's theory is that **genetic information is inherited in the form of separate elements, which will later be called genes**.

This vision was different from the one, currently accepted at the time, that the characters of the parents merged and mixed in their children.

The **theory of admixture** created great embarrassment for the supporter of natural selection because it involves a decrease in genetic variability with the passing of generations. And if the variability decreases, the material on which the selection acts is missing. In contrast, **Mendel's particle theory** offered an excellent explanation for the maintenance of genetic variability.

Mendel's idea was there for all to see: when a male and a female give birth to a child, it is either male or female, not a mixture of the two sexes.

Inherited sex is not the result of the fusion of the characters present in the parents. As we know today, the same thing happens for any hereditary character.

Darwin's theory, however, predicted that in any population, of any living organism, there would be a certain variability (mutations) and that selection would act by promoting the reproduction of one variant in preference to another.

Without mutations, there would be no variability and without variability there would be nothing to select.

But if this were the case, and hereditary characteristics were mixed as they passed from one generation to another, as was believed in Darwin's time, the variability would inexorably and progressively be reduced.

*Let's take a very simple example:*

*on a shelf there are two cans, one of black paint and one of white paint. We can say that there is variability, albeit minimal, as it is reduced to just two different colours. Now let's mix the contents of the two jars; we will naturally obtain a gray paint, therefore of an intermediate shade. Let's put these cans on a second shelf, take two of them and mix them: we will still obtain the same gray paint. We can continue with the experiment as long as we want and the result will no longer change, we will certainly never see the two starting colors, white and black, reappear: the initial variability has been lost forever.*

*Now let's put men in place of jars and generations in place of shelves. From a black-skinned father and a white-skinned mother, mulatto children will be born, with skin color tones that will not necessarily be the same in everyone, which is to say that the variability has not been lost, indeed perhaps it has increased; every now and then, rarely, a decidedly black or decidedly white child may even be born. And we will find variability in subsequent generations too. What is going on? Why doesn't skin color behave like paint color?* ***Precisely because of the difference between inheriting characters mixed together and separate characters.***

*The children of that couple inherit not "intermediate" genes, all the same, but genes for black skin and genes for white skin.*

*To really understand, an important element is missing:*

*Skin color is determined by seven genes. Each child will inherit a certain number of paternal genes and a certain number of maternal genes, up to a total of seven. Those who inherit four paternal and three maternal ones will have a slightly darker shade of color than those who inherit three paternal and four maternal ones; those who inherit six from their mother and one from their father will have almost white skin, and so on. A result like this, which is what is observed in reality, cannot be explained unless we admit that Mendel was right and the supporters of the mixing theory were wrong.*

His work was overshadowed by Darwin's work. The consciences of the time, completely pervaded by Darwin's ideas, were not willing to make room for the profound and peculiar ideas of Mendel.

The Origin of Species was a resounding editorial success: the first edition sold out in just one day.

Mendel's work, however, remained ignored for 35 years.

The mathematician Ronald Fisher put things back into perspective and demonstrated that Mendel's particle theory was functional, indeed indispensable to Darwinism. We are now in the 1930s, the process of fusion between genetics and evolutionism, the so-called **"modern synthesis"**, began, and on the occasion of the centenary of the release of Darwin's work (1959), the synthesis was now complete and stainless.