EPIGENETIC MECHANISMS: POSSIBLE IMPLICATIONS IN REPRODUCTIVE BIOLOGY

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Real life in Biomedical Sciences confronts us with many cases where Genetics falls short of expectations. One of the most obvious cases are monozygotic twins. These people are "natural" clones and thus, they share the same DNA sequence. However, the penetrance of disease in these individual can be quite different and discordant twins for a particular sickness have always been a puzzling situation for the biomedical researchers and physicians. One example can be two monozygotic twin sisters carrying the same penetrant germline mutation for the breast cancer hereditary gene BRCA1, but one develops breast cancer at thirty-five years old, whilst the other does it at sixty-five years old. Of course, that the environment plays a role. But the question is how it does so. It seems easier to change the epigenetic setting of a cell than its genetic material. In this regard, epigenetics has also been proposed as a translator between the environment and genetics. We provided one of the small pieces of this jigsaw by showing that monozygotic twins presented an epigenetic drift in their epigenetic modifications that was accentuated with the age, less lifetime shared together and more different life styles (including smoking). This study was confimed by others and now the challenge that lies ahead is the identification of epigenetic changes in particular genes that could explain monozygotic discordance for a particular disease, where we have now focused our attention in cancer, diabetes and autoimmune disorders. But monozygotic twins are just the tip of the iceberg: there are many more cases where epigenetics might explain how it is possible than the same genotype produce different phenotypes. Another interesting setting are cloned animals. In this case, these beings are originated using the same DNA than the original donor: thus, if they have the same DNA sequence, they should be the same. But they are not. Cloned mice, cats, sheeps are not identical to their unique "parent": they develop diseases with different penetrance and they show disrupted epigenetic patterns. Another polemic area relates to in vitro fertilization (IVF): epidemiological data seems to suggest that kids born using these techniques might have a higher likehood to present imprinting disorders, an a distinct DNA methylation profile could be involved. There is not any aim to question IVF, it is a wonderful methodology that has helped many families, but several researchers have suggested a call for future research, particularly thinking in the next generation.