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The genes of antagonistic pleiotropy

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Antagonistic pleiotropy theory is a theory that indicates certain genes have the ability to control more than one trait, hence it can be beneficial to an individual at a young age while becoming harmful at an older age. There are many antagonistic pleiotropy genes including spermatogenesis-associated protein 31 (SPATA31), tumour protein 53 (TP53), apolipoprotein E (APOE), and breast cancer genes (BRCA1/BRCA2). Some of the genes are involved in DNA-damage repair and even high fertility in women early in life but lead to increased mortality later on. In this case, the BRCA1/BRCA2 genes are an example of antagonistic pleiotropy, as they are tumour suppressor genes and can repair DNA damage in addition to increasing reproductive fitness at a young age. However, studies have proposed that naturally occurring mutations associated with ageing are observed in these specific genes and can cause cancerous characteristics in normal cells due to the accumulation of mutations, thereby transforming healthy cells into cancer cells. This eventually leads to malignant tumours causing ovarian or breast cancer. The genes involved in antagonistic pleiotropy could be the reason for better fitness at a young age; however, these same genes decrease the lifespan of individuals due to the progression of non-communicable diseases with age. Therefore, the mutation frequency of these genes can be studied to predict their occurrence in populations as well as lower the risk of mutation through a controlled diet.

Keywords: Breast cancer genes, Antagonistic pleiotropy, Ageing, Tumour suppressor, Reproductive fitness

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