Translocation

The Genetic Basis for Down Syndrome

Approximately 4% of cases of Down syndrome are due to chromosomal translocations. This means that a third copy of chromosome 21 is fused to another chromosome. The most common translocation involves 14 and 21.

Most translocations are sporadic and occur de novo during meiosis of either the egg or sperm. The chance for de novo translocations does not increase with a mother's age.

In about one-third of cases of translocation Down syndrome one parent is a carrier of the translocated chromosome. Translocation carriers do not have Down syndrome themselves as they do not have a significant loss or gain of chromosome material. Translocation Down syndrome is usually associated with a Robertsonian translocation, which involves the fusion of the long arms of two acrocentric chromosomes, but the loss of the short arms does not have a deleterious effect.

Translocation carriers appear to have 45 chromosomes in each cell, as two are fused together. As detailed below, translocation carriers can produce unbalanced gametes. Some of the gametes lead to non-viable combinations and some have the normal chromosome compliment. Fertilization of a gamete with a lone 21 plus a translocation leads to an offspring with Down syndrome.

When the father is a carrier of a translocation there is about a 3% chance for Down syndrome with each pregnancy. When the mother is the carrier the chance is 10-15%. Genetic counseling is recommended as testing can determine the origin of translocation.

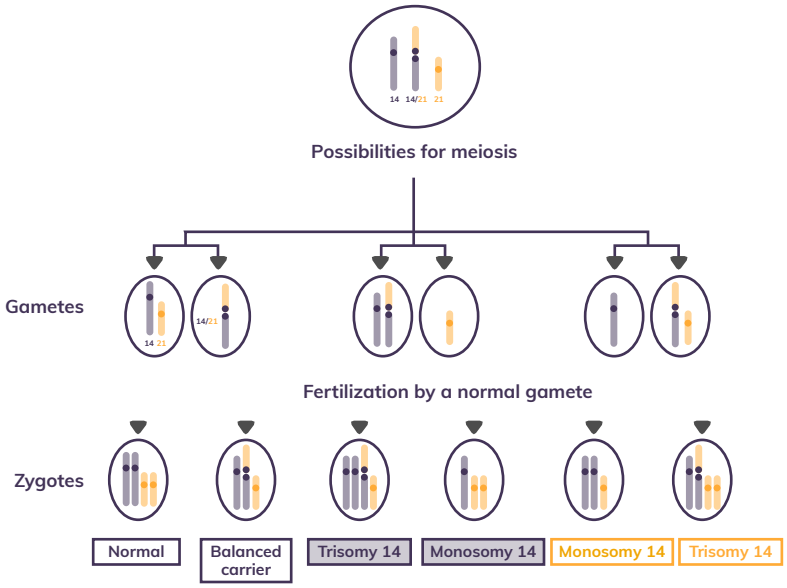

Figure 1: Results of meiosis in a carrier of a Robertsonian translocation [5]

5 Strachan, T., and Andrew P. Read. Human Molecular Genetics / Tom Strachan and Andrew P. Read. Fifth edition. Boca Raton, Florida: CRC Press, Taylor & Francis Group, 2019. Print.