Multifactorial Inheritance

Definition

Multifacorial inheritance is the type of inheritance followed by traits that are determined by multiple factors both environmental and genetic. Environmental factors interact with many genes to generate a normally distributed susceptibiity.

Concept

- According to this theory, individuals are "affected" if they lie in the wrong end of the distribution curve. A mutation resulting in disease is often recessive, and this follows that both alleles must be mutated for the disease to be expressed phenotypically. However, a disease may also be the result of the expression of mutant alleles at more then one locus. When more than one gene is involved (with or without the presence of environmental factors, or better, triggers), we conclude that the diseases is the outcome of multifactorial inheritance.
- Some diseases for example myocardial infarction, congenital birth defects, cancer, diabetes, mental illnesses and Alzheimer diseases cause along with morbidity, premature mortality in two out of three individuals during their lifetime. Many show clustering among families. However their inheritance pattern does not follow that of single gene disorders (Mendelian pattern of inheritance). These kind of diseases are thought to result from complex interactions between genetic and environmental factors, i.e. multifactorial inheritance pattern.
- The reason reason why these diseases show this kind of clustering among families is that family members share a significant portion of their genetic information and further more, they are exposed to the same environmental triggers (most of the times).

We can therefore conclude that family members experience the same gene-gene interactions and gene-environment interactions that may trigger, accelerate or exacerbate or even protect against the disease process.

Characteristics

1. There is no notable pattern of inheritance within family.
2. The lower the incidence of the disease within a population the greater the relative increase in risk for 1st degree relatives.
3. The risk is much lower for 2nd degree relatives, but it decreases less sharply for more remote relatives. This characteristic distinguishes MI from AD I, in which the risk drops by ½.
4. The recurrence risk is higher when more than one family member is affected. As opposed to single gene trait that the risk to the next child remains unchanged.
5. The more severe the malformation the greater the recurrence risk.
6. If an MI trait is more frequent in one sex than in the other, the risk is higher for relatives of patients of the less susceptible sex.
7. An increased recurrence risk when the parents are consanguineous suggests that multiple factors with additive effects may be involved, as oppposed to AR I (25%).
8. If the concordance rate in DZ twins is less than ½ the rate in MZ twins, the trait cannot be AD and if it is less than ¼ of the MZ twins rate, it cannot be AR .

Links

Related articles

- Polygenic Inheritance

Bibliography

- NUSSBAUM, Robert L – MCINNES, Roderick R – WILLARD, Huntington F. *Genetics in Medicine.* 7th edition. Philadelphia : Saunders Elsevier, 2007. 585 pp. ISBN 9781416030805.