

Genotype and environment

Basic concepts

- **Gene:** a segment of a polynucleotide chain that **encodes the primary structure** of a peptide as a translation product or is transcribed into the primary structure of RNA molecules that are not translated.
- **Allele: a specific form of a gene**, determined by a specific sequence of nucleotides and responsible for a specific form (quality or degree) of the traits encoded by it; different genes exist in the gene pools of populations in different and sometimes significant numbers of alleles; the information carried by most genes manifests itself in more than one trait of the organism = pleiotropic gene effect.
- **Genotype: set of all alleles of an organism**; the genotype collectively determines the extent or degree of the organism's phenotypic possibilities.
- **Phenotype:** the set of all the characteristics of an individual.

Genotype-environment relationship

- **Environmental factors** can either **regulate** or **repress** some parts of an organism's genetic program (through its regulatory systems); however, they can also **modify** it – affect the resulting form of the trait.
- Certain **pathological forms** of some traits of the organism arise mainly on the basis of the action of **external factors**, the genotype affects them only to a small extent.
- **In general, the phenotype is influenced by the genotype and the influence of the environment.**
- The degree to which a given trait is determined heritably in its form is expressed quantitatively as its heridity (heritability).

Monogenically determined traits (i.e. qualitative traits) are much **less influenced** by the environment, on the contrary, environmental factors have the greatest influence on **polygenically inherited** traits (i.e. quantitative)

- with **quantitative traits**, we are often interested in what are **the relative shares** of the hereditary component and environmental factors on **the dispersion** (variation) of the trait's phenotypic values, we then refer to **the relative share** of genetic factors on the total variance of the trait as **heritability**

$$H^2 = V_G/V_P$$

V_G – phenotype variance caused by genetic factors

V_P – total variance of the phenotype value

H^2 can theoretically take on values **from 0 to 1**, if it is equal to 0, the variance of the phenotype is fully dependent on **environmental factors**, with $H^2=1$, on the contrary, environmental factors have **no influence** and all observed variance depends on **genetic factors**

 For more information see *Heritability*.

- Environmental factors generally have the greatest influence on the manifestation of polygenic, i.e. quantitative, traits – they are very plastic and their variability in different individuals therefore has two sources: external (environmental factors) and internal (constitution of the relevant polygenic system in the genotype).

 For more information see *Multifactorial inheritance*.

- **Monogenically** determined traits, i.e. qualitative traits, are much **less influenced** by the environment.

Links

Related Articles

- Alleles
- Genes
- Genotype
- Phenotype
- Multifactorial inheritance
- Traits

References

- ŠTEFÁNEK, Jiří. *Medicína, nemoci, studium na 1. LF UK* [online]. [cit. 11.02.2010]. <<https://www.stefajir.cz/>>.

