

Biological antimutation mechanisms

These mechanisms limit the adverse effects of mutations. They can reduce the likelihood of mutations, reduce the biological consequences of mutations, and completely restore the structure of DNA.

Antimutation mechanisms.

1. The presence of two polynucleotide chains in a DNA molecule.

If one chain is damaged, the second can be a matrix to eliminate the mutation.

2. Properties of DNA polymerase.

The enzyme inserts only complementary nucleotides into the new chain. During DNA synthesis, the enzyme performs a self-check of the new chain and can make self-correction (if errors in DNA synthesis are detected).

3. Diploid organisms.

Most organisms have 2 alleles of the same gene. A recessive allele can manifest itself in the phenotype only in recessive homozygotes. Therefore, dominant (unchanged) alleles prevent the manifestation of recessive mutations in the phenotype. As a result, recessive mutant alleles can accumulate in the gene pool of a population, but do not manifest themselves in the phenotype.

4. The degeneracy (redundancy) of the genetic code.

One amino acid can be encoded by several codons. If a mutation causes a new nucleotide to appear, a new codon is created. The new codon can encode the same amino acid (that is, a synonym codon appears). Thus, the DNA changed and a new codon appeared. However, the structure of the protein does not change and its functions do not suffer.

5. The ambiguity of amino acid substitution.

Each amino acid has physico-chemical properties (for example, hydrophilicity and hydrophobicity). As a result of the mutation, a new amino acid appears in the protein. If the properties of the new amino acid are similar to those of the original amino acid, but the properties of the protein change slightly. The functions of the altered protein may vary slightly, and therefore changes in the phenotype will be weakly pronounced.

6. Gene extracopy.

Some genes are present in the genome in a large number of copies. This usually concerns genes that control vital functions. For example, rRNA and tRNA genes have hundreds of copies. When a gene is damaged, there are always normal genes that control the same function. Thus, the phenotype does not suffer.

DNA repair is presented in a separate file.