Variation and its forms. Mutation. Types.

Variation

- **Variation**, in biology, any difference between cells, individual organisms, or groups of organisms of any species caused either by genetic differences (genotypic variation) or by the effect of environmental factors on the expression of the genetic potentials (phenotypic variation). Variation may be shown in physical appearance, metabolism, fertility, mode of reproduction, behaviour, learning and mental ability.

The forms of variation

- Genotypic variations are caused by differences in number or structure of chromosomes or by differences in the genes carried by the chromosomes. Eye colour, body form, and disease resistance are genotypic variations. Many common plants have two or more times the normal number of chromosomes, and new species may arise by this type of variation. A variation cannot be identified as genotypic by observation of the organism; breeding experiments must be performed under controlled environmental conditions to determine whether or not the alteration is inheritable.

The forms of variation

- Environmentally caused variations may result from one factor or the combined effects of several factors, such as climate, food supply, and actions of other organisms. Phenotypic variations also include stages in an organism's life cycle and seasonal variations in an individual. These variations do not involve any hereditary alteration and in general are not transmitted to future generations; consequently, they are not significant in the process of evolution.

The forms of variation

- Variations are classified either as discontinuous, or qualitative (composed of well-defined classes, as blood groups in man). A discontinuous variation with several classes, none of which is very small, is known as a polymorphic variation. The separation of most higher organisms into males and females and the occurrence of several forms of a butterfly of the same species, each coloured to blend with a different vegetation, are examples of polymorphic variation.

Sources of Variation:

The following factors are the sources for variation:

- Gene mutation
- Chromosomal aberration
- Recombination
- Hybridization
- Isolation
- Natural selection
- Genetic drift
- Founder principle
- Migration and gene flow

1. Gene Mutation:

- Sudden change in the genetic make upon of an individual is called gene mutation. This mutation produces a different phenotype characters. Thus mutation produces variation.

2. Chromosomal Aberration:

- Each cell of a species contains specific number of chromosome and genes are arranged in a specific sequence in the chromosome. The changes occurring in the chromosomes are called chromosomal aberration or chromosomal mutation.

Mutation

A mutation is a change that occurs in our DNA sequence, either due to mistakes when the DNA is copied or as the result of environmental factors such as UV light and smoking and radiation.

Mutations

- However, mutation can also disrupt normal gene activity and cause diseases, like cancer?
- Cancer is the most common human genetic disease; it is caused by mutations occurring in a number of growth-controlling genes. Sometimes faulty, cancer-causing genes can exist from birth, increasing a person's chance of getting cancer.

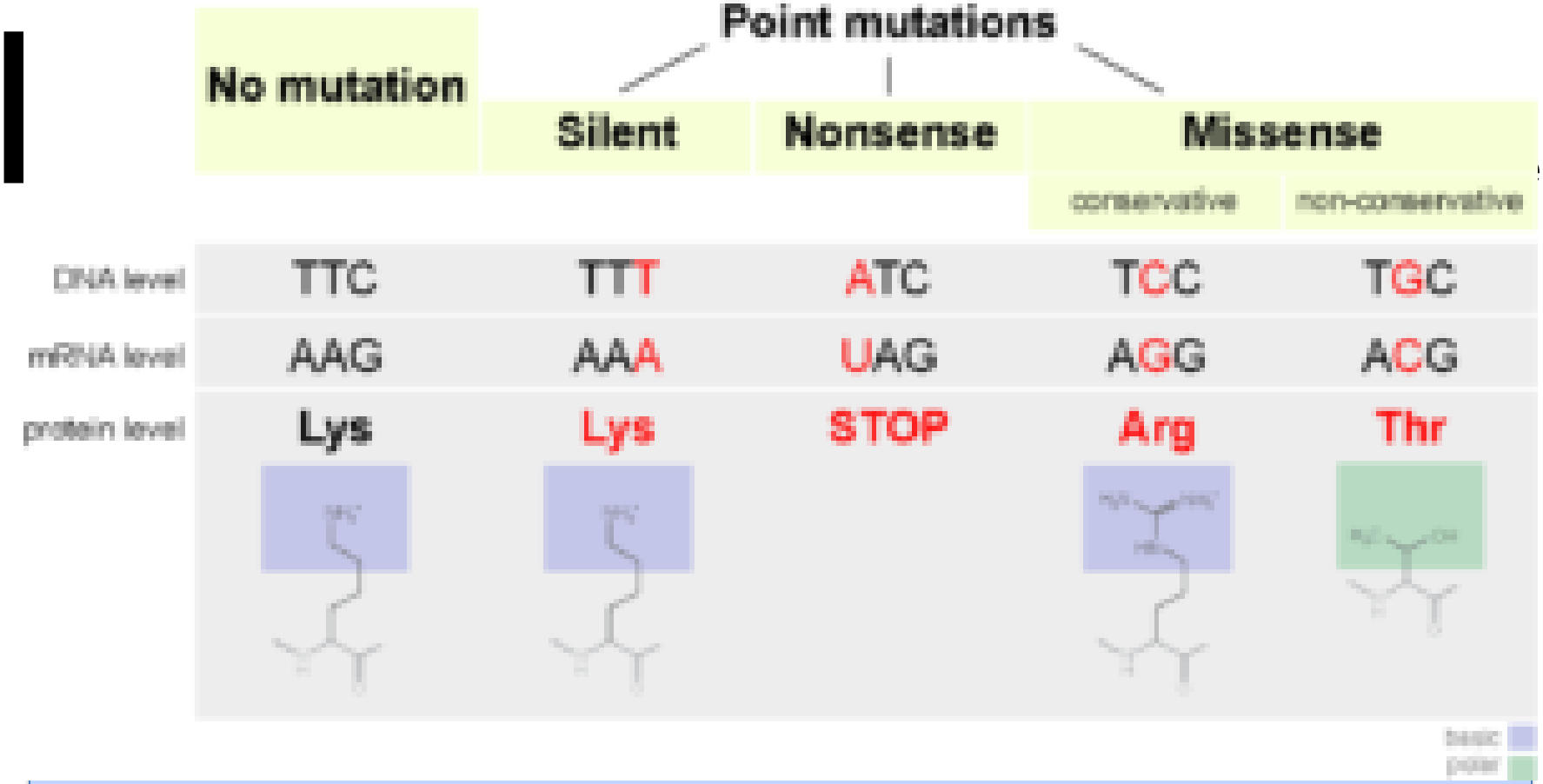
Mutations

- Mutations can also be inherited, particularly if they have a positive effect.
- For example, the disorder sickle cell anaemia is caused by a mutation in the gene that instructs the building of a protein called haemoglobin. This causes the red blood cells to become an abnormal, rigid, sickle shape. However, in African populations, having this mutation also protects against malaria.

Types of mutations

- The DNA sequence of a gene can be altered in a number of ways. Gene mutations have varying effects on health, depending on where they occur and whether they alter the function of essential proteins. The types of mutations include:

- **Silent mutation:** Silent mutations cause a change in the sequence of bases in a DNA molecule, but do not result in a change in the amino acid sequence of a protein (Figure 1).
- **Missense mutation:** This type of mutation is a change in one DNA base pair that results in the substitution of one amino acid for another in the protein made by a gene (Figure 1).
- **Nonsense mutation:** A nonsense mutation is also a change in one DNA base pair. Instead of substituting one amino acid for another, however, the altered DNA sequence prematurely signals the cell to stop building a protein (Figure 1). This type of mutation results in a shortened protein that may function improperly or not at all.



- *Figure: Some mutations do not change the sequence of amino acids in a protein. Some swap one amino acid for another. Others introduce an early stop codon into the sequence causing the protein to be truncated.*