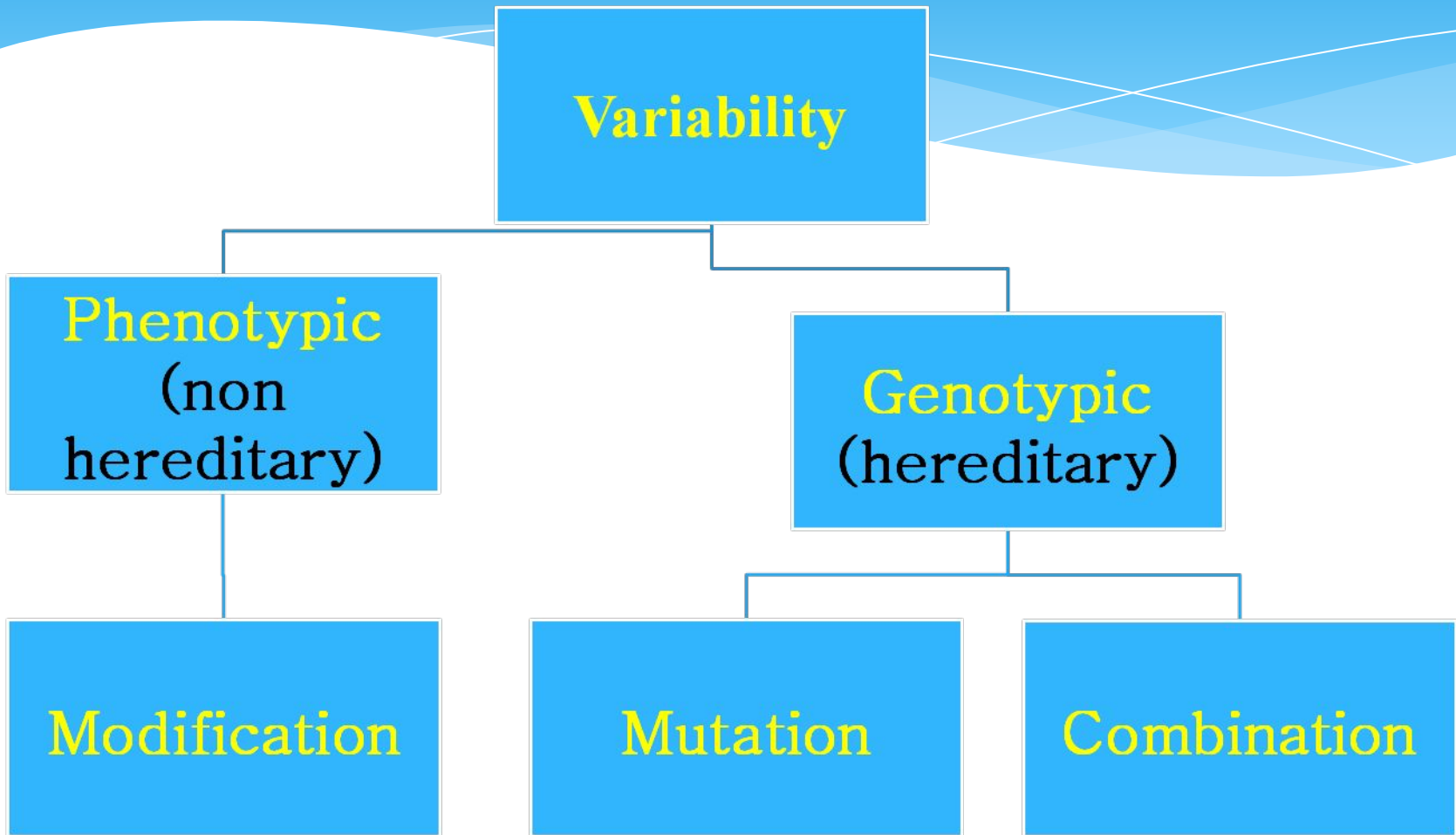


Variability is the ability of living organisms to acquire new marks.



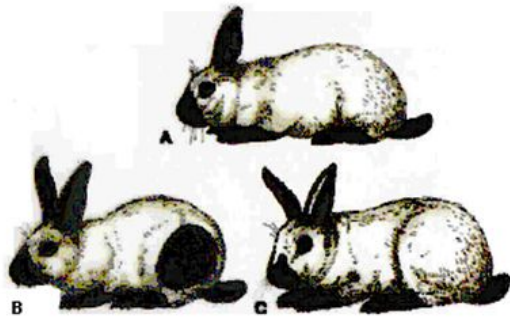
# *Phenotypic variability (modification).*

- **due to changes in phenotype under the direct influence of factors of the external environment without genotype change**
- **these signs are not inherited**
- **to the organism's adaptation to the living environment.**

# *Importance of modification changes.*

- ◎ Ensures adaptation of the organism to the habitats environment
- ◎ Knowledge of the laws of phenotypic behavior is crucial for medical practice, which allows to determine the role of factors in the formation of phenotype of the environment or their aggregates.
- ◎ Knowledge of the phenocopies to the doctor:
- ◎ a) make a correct diagnosis;
- ◎ b) to give a more accurate forecast of the condition of the disease and to determine the possibility of future illness in the same family.

- **Modifications - non-genetic changes in phenotype, develop under the influence of environmental factors, adapt to the environment, but they will come back when the effect of the reversible environmental factor is eliminated. For example: Reduction of erythrocytes in the blood when oxygen content is reduced.**



# *Modification variability (reaction rate)*

- Label modifications create a variation line that varies within a range of reaction rates from a minimum to a maximum. The explicit threshold of the modification variability with the genotype is called the reaction rate. The reaction rate is controlled by genetic factors and is inherited.

**For example: the size of wooden leaves**

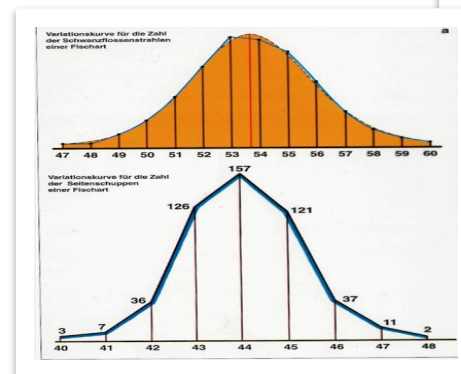
**Changes in human digital symbols.**

**Digital Signs:**

**Intensity of skin color**

**Blood pressure, erythrocytes in the blood**

**Weight e.t.c.**



Genotypic variability - depending on the change in genotype (genetic material), the variability is inherited and independent of the factors in the external environment .

### **Genotypic variability**

```
graph TD; A[Genotypic variability] --> B[Combinative variability]; A --> C[Mutation variability];
```

Combinative variability

Mutation variability

## *Mechanisms of combinative variability*

Combinative variability - variability due to recombination (combination) of parental genes. In combinative variability, the combination of parent gametes results in new combinations of genes, but these genes and chromosomes do not change.

A random addition of gametes during fertilization

Provides diversity of biological species, diversity of species and their viability.

For example: diversity of people, diversity of children in one family



# *Mutation variability*

- ⊙ Mutations (Latin mutatio) - change of genetic material under influence of external and internal factors.
- ⊙ The mutation is accompanied by the change in the genotype of the phenotype and is transmitted from generation to generation.
- ⊙ Mutations develop suddenly and leap.
- ⊙ This term was introduced in science. De Frise (1901)

# *Mutation variability*

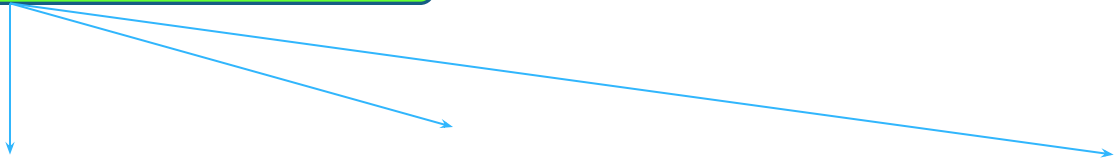
- ◎ The process of mutation formation is called **mutagenesis**.
- ◎ Factors causing mutations are called **mutagenic factors**.

## **Mutagenic factors**

Physical Factors

Chemical Factors

Biological Factors



# Mutagenic factors

- ◎ **Physical: Different types of rays, temperature, humidity, etc.**
- ◎ **Chemical: a) natural organic and inorganic substances (nitrates, alkaloids, hormones, enzymes, etc.);**
- ◎ **b) Production products of natural compounds (oil);**
- ◎ **c) synthetic substances (medicines, pesticides, food preservatives, insecticides, paints) and so on.**
- ◎ **Biological: a) viruses (measles, rubella, influenza) b) parasitic agents (bacteria, rickettsia, simple, gelments).**

# *Classification of mutations*

## *1.1. Depending on the causes*

*Spontaneous or natural mutations - develop under the influence of natural mutagenic factors without the presence of human beings;*

*Induction or artificial mutations - develop under the influence of known mutagenic factors (with human participation).*

# *Classification of mutations*

## *1. Depending on the vitality of the organism*

*Harmful mutations - leading to hereditary diseases.*

*lethal mutations (deadly)*

*sublethal mutations (reduces vitality)*

*Neutral mutations do not affect their survival, such as eye color, blood group.*

*Useful mutations increase the vitality, for example, the formation of resistance of cockroaches to toxic chemicals.*