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**FACULTY OF AGROBIOTECHNOLOGY**

*Department of Genetics, Breeding and Seed Production of Agricultural Crops*

## **CYTOLOGICAL BASES OF HEREDITY**

**Methodical instructions for practical and self–study work by applicants for the  
first (bachelor`s) level of higher education in the specialties**

**201 “Agronomy”, 205 “Forestry”**

Bila Tserkva

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The guidelines contain the main theoretical provisions, materials necessary for practical classes, control questions to test the knowledge gained, and a list of recommended reading. The proposed methodological guidelines will help to master the theoretical material and practical skills in the study of the cytological basis of heredity.

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## INTRODUCTION

Living organisms are qualitatively different from non-living organisms. Inanimate bodies and living organisms are built of the same chemical elements, but in a living organism there are special forms of connections between these elements and not simple physical and chemical processes take place, but qualitatively different biological laws are carried out – metabolism and energy, or metabolic processes.

The structural organization of living organisms is characterized by the complexity of biochemical processes, special forms of connections between them, which have a certain orderliness at the molecular level.

This orderliness exists not only between molecules and organoids in cells, but also at higher levels of life. In particular, the structural units of tissues that are ordered among themselves are cells, organs – tissues, organisms – organs, species – individuals, populations, biocenosis – species, biosphere – biocenoses.

Environmental conditions always differ from the internal environment in a cell or organism. The processes taking place in a cell or organism are aimed at maintaining the relative stability of the internal environment. This phenomenon is called *homeostasis*.

### 1. CELL THEORY. ORGANIZATION AND FUNCTIONS OF CELLULAR STRUCTURES

The science of cells is called *cytology* (from the greek *kytos* – cell, *logos* – science). The subject of cytology is the cell of multicellular animals and plants, as well as unicellular organisms, including bacteria, protozoa, and unicellular algae. Cytology studies the structure and chemical composition of cells, the functions of intracellular structures and cells in the body of animals and plants, cell reproduction and development, and the adaptation of cells to environmental conditions. Modern cytology is a complex science. It is related to other biological sciences: botany, zoology, physiology, the study of the evolution of the organic world, molecular biology, chemistry, physics, mathematics, genetics.

With the improvement of the microscope and observation techniques, scientific information about animal and plant cells was accumulated. On their basis, an idea of the cellular organization of the organic world was formed. Based on these data and his own research, the German botanist Matthias Schleiden made an important conclusion about the cellular organization of plants. Zoologist Theodor Schwann, based on studies of zoological objects and data from his predecessors, formulated the most important achievement of theoretical biology – *the cell is the elementary unit of structure and development of all plant and animal organisms* (1839).

*Cell theory* is one of the most prominent generalizations of biology of the last century, which became the basis for understanding life and revealing evolutionary connections between organisms.

The cell theory was further developed in the works of scientists in the second half of the nineteenth century. They discovered cell division and formulated the position that each new cell is formed from the same initial cell as a result of its division (Rudolf Virchow, 1855) and proved that the cell is not only a unit of structure, but also a unit of development of all living organisms.

The study of the chemical organization of the cell led to the conclusion that chemical processes underlie its life, and cells of all organisms are similar in chemical composition and are characterized by the same basic metabolic processes. The data on the similarity of the chemical composition of cells once again confirmed the unity of the entire organic world.

*The modern cellular theory substantiates the following provisions:*

1. A cell is the basic unit of structure and development of all living organisms, the smallest unit of life.
2. Cells of all unicellular and multicellular organisms are similar (*homologous*) in their structure, chemical composition, main manifestation of life and metabolism.
3. Cells reproduce by division, and each new cell is formed as a result of the division of the original (mother) cell.
4. In complex multicellular organisms, cells are specialized by the functions they perform and form tissues.

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