

I

BIOLOGICAL BACKGROUND INFORMATION ON INFUSION THERAPY

This part contains basic information on biological structures and the processes of the body. This basic knowledge is an indispensable prerequisite for comprehending the complex field of infusion therapy. Each infusion means a surgical intervention into the biological mechanisms. That is why comprehension of infusion therapy requires a solid basic knowledge of biology.

Out of the complexity of existing structures in the human organism only those will be explained that directly relate to the topic of infusion therapy. First of all the basic building block of all life – the cell – is described. Beside the basic composition of the cell the most important cell structures will be explained. The following chapter presents information about blood, describing the main tasks of blood, its single components as well as the process of blood coagulation. In the following the cardiovascular system is described including a short explanation of heart and vessels as well as the existing pressure conditions. Further, the most important components and processes of the water balance are described. The first section closes with a chapter about the basic elements of the nutrition of the organism.

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Training Objectives:

- ✓ Knowledge of the general cell components
- ✓ Short description of the most important cell structures

THE CELL

The cell (lat. Cellula = small chamber) is considered to be the basic building block of all life. The organism consists of a number of cells. They are the elementary structural and biological units of the body and are the basis of its functions. Every cell type is specialised for a particular job in the organism. It constantly exchanges energy and substances with the surrounding milieu. It can nourish itself, grow, reproduce and react to stimuli from its surroundings. Following a survey of the general cell components, these lecture notes give details of the most important structures of the cell.

1.1 General Cellular Structure

The basic parts of the cell are A) the cell body (cytoplasm or protoplasm) and B) the cell nucleus. The cell membrane (plasma membrane) separates the cell from its surroundings. The cytoplasm consists of a variety of highly organised bodies, called organelles. Important organelles are, for example, the mitochondria.

PLEASE NOTE:

There are also cells without a nucleus, the erythrocytes (red blood cells); only during the initial state do they have a nucleus, and are called reticulocytes (see 2.2 The Blood)

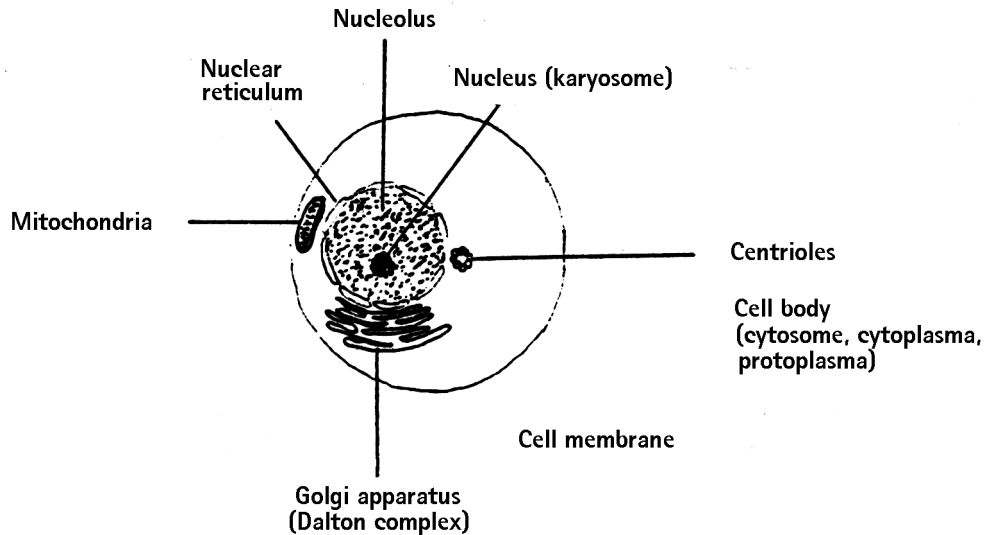


Fig. 1: The cell

1.2 Important Cellular Structures

In the following, the most important cell structures are explained; these can be seen with the help of an electron microscope. Some of the cell structures are also shown in fig. 1.

The cell body

The cell body is also called cytoplasm or protoplasm. It consists of protein, H₂O, salts and metabolites.

The cell membrane

The cell membrane consists of the three outer layers of the cell: The semipermeable cell membrane protects the cytoplasm from damaging influences; it functions as a filter.

Nucleus (or karyosome)

When not being in the state of division, it consists of a nuclear membrane, one or more nucleoli, and an achromatic nuclear reticulum (does not take on dyes) containing the chromatin and the karyolymph.

The nuclear membrane

Forms a definite border between the nuclear substance and the surrounding cytoplasm.

The nuclear reticulum

The interior of the nucleus contains nucleic acids (desoxyribonucleic acid - DNA). DNA contains the chemical substances that characterise the chromosomes (soma = body), the carriers of inherited characteristics (genes).

Karyolymph (nuclear sap)

The gaps between the single parts of the nuclear reticulum are filled with a clear basic mass, the karyolymph. It plays a role in the changes of the nucleus's shape, the transport within the nucleus and between nucleus and cytoplasm.

Nucleoli

They carry metabolic substances and reserve substances for protein synthesis.

The cytological organelles

Cytological organelles are cytocentres that are usually located right near the nucleus. The cytocentres are very important for the process of cell division (mitosis).

The mitochondria

By means of certain enzymes (protein molecules that affect chemical reactions, speeding them up without themselves being changed), the mitochondria are responsible for correct oxidation processes in the cell. They supply the cell with the energy required for metabolism. The mitochondria are located where energy-consuming processes take place.

Golgi's apparatus (Dalton complex)

Golgi's apparatus is also located near the nucleus. It consists of fat and protein substances. It plays an important role in the secretion mechanism of the cell.

1.3 Summary

The cell is considered to be the basic building block of all life.

The cell components are differentiated by the cytoplasm (cell body) and the nucleus (cell nuclear). The cell is protected against its surroundings by means of the cell membrane. However, it is in constant energy- and metabolic interaction with its surroundings.

1.4 Comprehension Questions

- Why is a basic knowledge of biology an indispensable prerequisite for the understanding of infusion therapy?

- What rough differentiation regarding the cell structure can be applied?

- What function does the cell membrane have?

- What function does the mitochondrion have?