

Adaptation of tissues and organs

Adaptation is a reversible, functional and structural response of the organism to increased or decreased demands on the organism. It ensures the maintenance of normal homeostasis, which is helped by **adaptation mechanisms**. These enable physiological compensation of the changing demands on metabolism and body functions. Adaptation has its physiological limits, it can be increased to a certain extent by e.g. training the organism. When the physiological limits are exceeded, the organism tries to re-establish the balance, a return to the original state, a transition to permanent changes, or the induction of apoptosis may occur.

The stress of the organism is the main cause that causes increased demands for adaptation. If the stress is adequate, adaptation will allow the setting **of new limits**. An example is the training of the movement and cardiovascular system in sports. If the demands on the organism are too great or sudden, **the function may fail** or the **cells** or part of the organ may die. In extreme cases, the entire organism dies.

Compensatory reactions

If a stressful situation acting on the organism does not have lethal consequences, it leads to various compensatory reactions. These include **hyperplasia**, when cells react by increasing their number, this is especially true for mitotically active tissues. Cells that divide little or not at all undergo **hypertrophy**, i.e. an increase in their volume.

Cells can also undergo **atrophy**, if their metabolism is suppressed (e.g. by hormonal deprivation or old age). There is a shrinking of cells or a decrease in their number, or both. The last compensatory reaction is **metaplasia**, when cells are unable to adapt to the newly created environmental conditions and one cell specialization is replaced by other types.

Tissue regeneration

Cell renewal and death are natural parts of the tissue repair process. In tissues with rapid regeneration, **regeneration** and cell death are in balance. This applies, for example, to the epithelium of the intestines, skin or some mucous membranes. In other tissues, **the death is irreversible** – their death is not followed by replenishment with cells of the same type, this applies to cells with low mitotic activity, such as neurons or cardiomyocytes. The physiological death of cells occurs through a process called **apoptosis**, or **necroptosis**. Cell death can also take the form of **necrosis**, which already falls under pathological processes. This also includes **autophagy**, when parts (compartments) of the cytoplasm of cells disappear, which do not result in the irreversible failure of viable cells.

Regressive changes

When the physiological limits of adaptation are exceeded, either reversible or irreversible damage to cells, tissues and organs occurs. A milder degree of damage can lead, for example, to the accumulation of metabolites that the cell is no longer able to metabolize, e.g. steatosis of cells with lipid retention, glycogenosis of cells with glycogen retention or cholestasis in hepatocytes.

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- Metaplasia
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- ZÁMEČNÍK, Josef. *Pathology*. 1. edition. 2019. 916 pp. ISBN 978-80-270-6457-1.
- POVÝŠIL, Ctibor. *General Pathology*. - edition. 2001. 290 pp. ISBN 9788072627738.