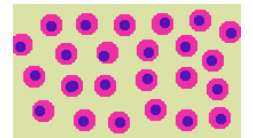


Adaptation

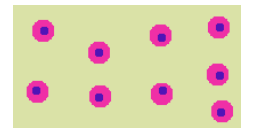
Adaptation is defined as a reaction to persistent stress or to changed environmental conditions. Previously normal tissue changes. The adaptation can be *physiological*, where the cells or tissue adapts to changing physiological demands, or *pathological*, where the tissue adapts to some stress caused by change in the environment or by some disease of other organ or organ systems. This system usually helps to survive various hostile conditions. Sometimes, however, the adaptation itself causes another problem, which can be worse than the initiating stimulus.



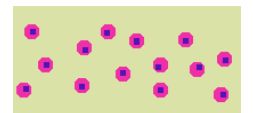
1 Atrophy

Defined as *shrinkage*¹ in the size of the cell by loss of cell substance. Can occur at cellular level or at the level of whole organs (when applied to whole organs, atrophy usually refers to decreased number of cells).

Atrophy can be *numeric*, where the tissue (or organ) size is decreased due to decreases in the number of cells. Typical example is the bone marrow. The space between the cells is filled by some other tissue, like connective tissue or fat.



Another type of atrophy is *simple* atrophy, where decrease in tissue or organ size is caused by decreased size of the cells. Typical example is the striated muscle after decreased workload (e.g. after long lasting immobilization of an extremity). The number of the cells (muscle fibres) remains the same, but the fibres are thinner.

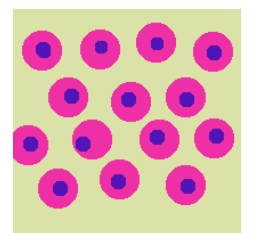


1.1 Causes of atrophy

- decreased energy supply or nutrition
 - diminished blood supply
 - inadequate nutrition
- decreased workload or stimulation
 - loss of neural stimulation
 - loss of endocrine stimulation
- aging

2 Hypertrophy

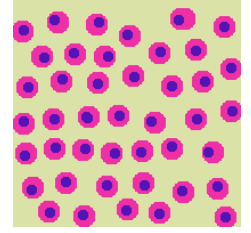
Defined as increased *size* of cells. On organ level the increase in size is achieved by enlarging the cells (but *not* by increased *number* of cells). Usually due to increased workload (compensatory hypertrophy).



¹The size of atrophic tissue is diminished, as opposed to *hypoplasia*, where the tissue never reached its proper size and is small from the beginning

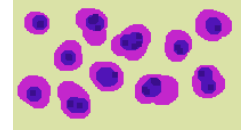
3 Hyperplasia

Defined as increased *number* of cells. Usually due to increased workload or hormonal stimulation. It is a controlled process which stops when the stimulus ceases (in contrast to neoplasia which is not controlled by normal physiologic stimuli).



4 Dysplasia

Cellular (especially nuclear) atypia. The cytoplasm of these cells is more basophilic, the nuclei are larger, irregular, with more chromatin.



Dysplasia occurs in two settings:

Reactive dysplasia: changes are caused by some processes from *outside* of the cells (e.g. inflammation). Such changes disappear if the irritation is removed (the cells return to normal condition or die and are replaced by normal cells).

True (malignant) dysplasia: the change in the cell is irreversible; the changes are actually malignant and without treatment progress into evident neoplastic process

Strictly speaking the term *reactive dysplasia* should not be used. Terms like *cellular irritation* or *irritative changes* are better.

It may be very difficult to decide whether the cells (seen by the microscope, in a biopsy) show reactive or neoplastic changes. The tissue specimens are often small (endoscopic biopsies). Moreover it is known, that prolonged inflammation may lead to malignant transformation (tissue near chronic ulcers, like in the skin or stomach). On the other hand many tumour are surrounded by variable inflammation (sometimes caused by therapy).

Accumulation of cells with signs of dysplasia is usually called *carcinoma in situ*. Typical example is the epithelium, where no other signs of malignancy (namely infiltrative growth) are not found.