

Pathological process

Pathological process-Cellular responses

- **Pathology**-is the **study of disease**.
- Diseases represent spontaneous alterations in the ability of a cell to proliferate and function normally.
- Disease results when external stimuli produce changes in the cell's environment that make it impossible for the cell to maintain homeostasis.
- In such situations, cells must adapt to the new environment.
- These adaptations include **hyperplasia, hypertrophy, atrophy, and metaplasia (4 types of cellular adaptation)**.
- It can be physiologic or pathologic, depending upon whether the stimulus is normal or abnormal.
- A cell can adapt to a certain point, but if the stimulus continues beyond that point, failure of the cell.
- If cells cannot adapt to the pathologic stimulus, they can die.

Hyperplasia

- Increase in the number of cells.
- **Types of hyperplasia:**
 - 1. Physiologic hyperplasia:** Occurs due to a normal stressor.
 - Example: liver growth after partial resection.
 - 2. Pathologic hyperplasia:** Occurs due to an abnormal stressor.
 - For example, growth of adrenal glands due to production of adrenocorticotrophic hormone (ACTH) by a pituitary adenoma.
 - **Note:** Only cells that can divide will undergo hyperplasia; therefore, hyperplasia of the myocytes in the heart and neurons in the brain does *not* occur.

Hypertrophy

- Increase in the size of the cell.
- **Types of hypertrophy**
 - 1. Physiologic hypertrophy:** Occurs due to a normal stressor.
 - For example, enlargement of skeletal muscle with exercise.
 - 2. Pathologic hypertrophy:** Occurs due to an abnormal stressor.
 - For example, increase in the size of the heart due to aortic stenosis.

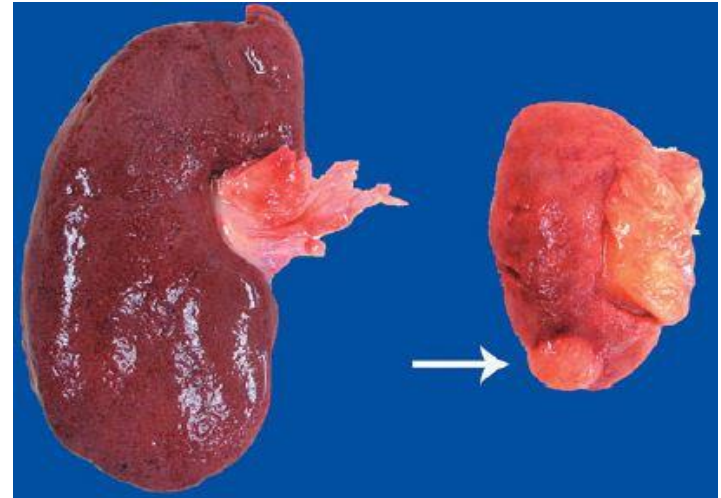
Cell Atrophy

- Decrease in the size of a cell that has at one time been of normal size.
- **Types of atrophy**
 1. **Physiologic atrophy:** Occurs due to a normal stressor.
 - For example, decrease in the size of the uterus after pregnancy.
 2. **Pathologic atrophy:** Occurs due to an abnormal stressor.
 - In general, atrophy is due to the loss of stimulus to the organ.
 - Specific types of loss of stimulus include loss of blood supply or innervation, loss of endocrine stimulus, disuse, mechanical compression, decreased workload, or aging.

- The organ is smaller than usual.
- Atrophy occurs in a once normally developed organ.
- If the organ was never a normal size (i.e., because it did not develop normally), the condition is called **hypoplasia**.

Fig: Kidneys from two different patients.

The kidney on the left is normal in size, whereas the kidney on the right is atrophic.



The kidney on the right was from a patient who had severe atherosclerosis of the renal artery, which led to ischemia (i.e., decreased perfusion) of the organ. Due to an insufficient supply of oxygen and nutrients, the cells of the kidney decreased in size to adapt.

Metaplasia

- Change of epithelium at a site, or location, from one type of epithelium to another type.
- In metaplasia, the epithelium is normal in appearance but in an abnormal location.
- **Mechanism of metaplasia:** The epithelium normally present at a site cannot handle the new environment so it converts to a type of epithelium that can adapt.
- **Examples:** Barrett esophagus is due to reflux of gastric contents into the esophagus, which causes the epithelium type to convert from squamous to columnar cell.
- Squamous metaplasia in the lungs is due to exposure of respiratory epithelium to toxins in cigarette smoke.

Neoplasia

- Neoplasia- presence or formation of new, abnormal growth of tissue.
- Examples: terms **tumor, nodule, and mass** are nonspecific terms that refer to an abnormal proliferation of cells.
- The terms **benign** and **malignant** correlate to the course of the neoplasm.
- **Benign neoplasms** stay localized in one place; **malignant neoplasms** invade surrounding tissue and, in most cases, can metastasize to distant organs.

Nomenclature for general categories of neoplasms

- **Adenoma:** Benign neoplasm derived from glandular cells.
- **Carcinoma:** Malignant neoplasm derived from epithelial cells.
- **Sarcoma:** Malignant neoplasm derived from mesenchymal cells.
- **Lymphoma:** Malignant neoplasm derived from lymphocytes.
- **Melanoma:** Malignant neoplasm derived from melanocytes.
- **Germ cell tumor:** Malignant neoplasm derived from germ cells.
- **Anaplasia:** Lack of differentiation.
- **Dysplasia:** Disordered growth of epithelium. There is a loss of cellular uniformity and architectural orientation.

