F16-063

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Hyperplasia

Cell Injury SGD

Cellular Adaptations

Hyperplasia

1. After the birth of her first child, a 19 year old woman breast fed the infant for about one year. Which of the following processes that occurred in the breast during pregnancy allowed her to breast feed the infant.

a) What is the process going on in the above scenario?

b) Define the process.

c) Name organs where this process can occur.

d) Write down mechanism for this process.

Key:

a) Hyperplasia

b) Hyperplasia is defined as the increase in the number of cells in an organ or tissue in response to a stimulus which leads to increase in the size of the organ. It can be physiologic or pathologic.

c) Breast, endometrium of uterus, prostate, liver

d) There are 2 types of cells. Dividing and non-dividing. Hyperplasia occurs in dividing cells under the influence of growth factors and certain hormones. It occurs as the result of growth factor driven proliferation of mature cells and in some cases by increased out put of new cells from tissue stem cells.

2) A 52 years old man suffering from hepatocellular carcinoma, underwent surgical lobectomy of his liver

a) What will happen to his remaining part of liver after surgery?

b) Define the process.

c) Name organs where this process can occur.

d) Write down mechanism for this process in this scenario.

due to → Activate ← α-AR → Surface of Myocytes
↑ Expression of gene
for contractile protein)

Key:

a) Hyperplasia

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d) After partial hepatectomy, growth factors are produced in the liver that engage receptors on the surviving cells and activate signaling pathways that stimulate cell proliferation. But if the proliferative capacity of the liver cells is compromised, as in some forms of hepatitis causing cell injury, hepatocytes can instead regenerate from intrahepatic stem cells.

↑ CP, (MS through SR)

HYPERTROPHY

1) A 25 years old, 32 weeks pregnant lady had ultrasound abdomen done on which her uterus was enlarged.
   (a) What mechanism is responsible for her enlarged uterus?
   (b) Define the process.
   (c) Write down its mechanism.

Key:

a) Hypertrophy

b) It refers to an increase in the size of the cells that results in increase in the size of the affected organ.

c) It is the result of increased production of cellular proteins. It occurs by mechanical stress through stretch receptors (which are soluble mediators that stimulate cell growth). They trigger RNA synthesis and protein production that cause hypertrophy. Increase in expression of genes for contractile protein as a result of activation of alpha adrenergic receptors on the surface of myocytes.

2) A body builder develops his arm muscles by doing exercise.
   (a) What type of adaptation is this? → Hypertrophy
   (b) Define the process.
   (c) Write down its mechanism.
   (d) Give 3 pathologic examples of this process.

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a) Hypertrophy

b) it refers to an increase in the size of the cells that results in increase in the size of the affected organ.

c) it is the result of increased production of cellular proteins. It occurs by mechanical stress through stretch receptors (which are soluble mediators that stimulate cell growth). They trigger RNA synthesis and protein production that cause hypertrophy. Increase in expression of genes for contractile protein as a result of activation of alpha adrenergic receptors on the surface of myocytes

d) (1) Hypertrophy of cardiac muscles and hypertension. (2) Hypertrophy of heart valves. (3) Hypertrophy of uterine smooth muscles. (Pathologic Examples).

ATROPHY

1) Gross examination of the brain on autopsy of a 90 years old man with a long history of atherosclerotic disease reveals shrunken brain with loss of brain substance, narrowed gyri & widened sulci.
   (a) Which process of cellular adaptation has occurred? → Atrophy
   (b) Define the process.
   (c) Write down its mechanism.
   (d) Give any two other causes of this cellular adaptation with examples.

Key:

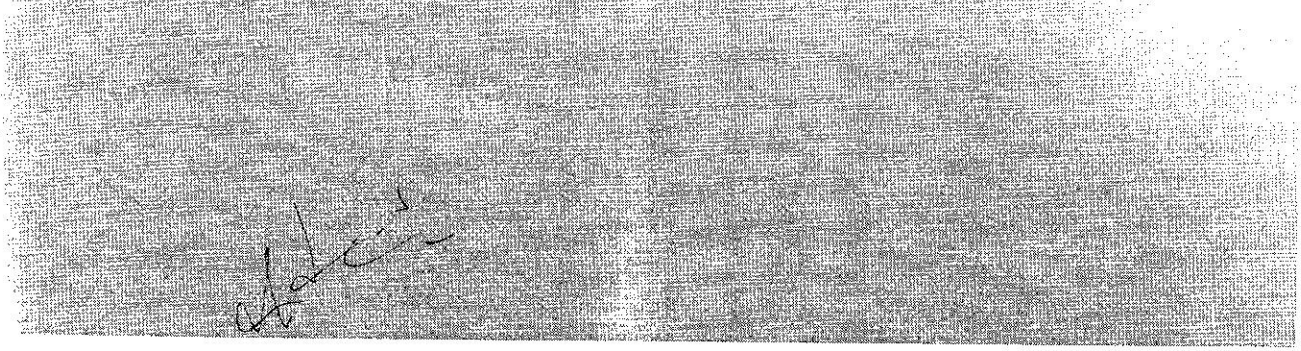
a) Atrophy

b) it is defined as a reduction in the size of an organ or tissue due to a decrease in cell size and number. It can be physiological or pathological.

c) the mechanism of atrophy consist of a combination of decrease protein synthesis and increased protein degradation in cells. Protein synthesis decreases because of reduced metabolic activity. The degradation of cellular proteins occurs by ubiquitin-proteasome pathway.

d) Decreased work load e.g. immobilization of a limb, loss of endocrine stimulation e.g. loss of hormone stimulation in menopause

2) A 45 years old woman was investigated for hypertension and was found to have enlargement of the left kidney. The right kidney was smaller than normal. Contrast studies revealed stenosis of right renal artery.
   (a) The size change in the right kidney is an example of which of the adaptive changes?
   (b) Define the process.
   (c) Write down its mechanism.



Key

a) Atrophy

b) It is defined as a reduction in the size of an organ or tissue due to a decrease in cell size and number. It can be physiological or pathological.

c) The mechanism of atrophy consists of a combination of decrease protein synthesis and increased protein degradation in cells. Protein synthesis decreases because of reduced metabolic activity. The degradation of cellular proteins occurs by ubiquitin-proteasome pathway. Atrophy is also accompanied with increased autophagy.

Metaplasia

1) A 32 Year old man experiences heartburn and gastric reflux after eating a large meal. After many months of symptoms he undergoes upper gastrointestinal endoscopy, and a biopsy specimen of the esophageal epithelium is obtained showing intestinal metaplasia and goblet cells.
   a) What is the process going on in the above scenario? MP
   b) Define the process. 1CT ⇔ A. CT.
   c) Name organs where this process can occur. E, UB, L, C
   d) Write down mechanism for this process.

   Key
   a) metaplasia
   b) it is a reversible change in which one differentiated cell type (epithelial or mesenchyme) is replaced by another cell type.
   c) Esophagus, cervix, urinary bladder, lung
   d) it is a reversible change in which one adult cell type is replaced by another cell type. In this type of cellular adaptation, a cell type sensitive to a particular stress is replaced by another cell type better able to withstand the adverse environment. Metaplasa is thought to arise by reprogramming of stem cells to differentiate along a new pathway rather than a phenotypic change of already differentiated cells.

2) A chronic cigarette smoker underwent a change in the normal lining epithelium of the respiratory tract from ciliated columnar epithelium to squamous epithelium.

   (a) What is the process going on in this person?
   (b) Define the process.

(c) Write down its mechanism.

Key:

a) metaplasia

b) It is a reversible change in which one differentiated cell type (epithelial or mesenchyme) is replaced by another cell type.

c) It is a reversible change in which one adult cell type is replaced by another cell type. In this type of cellular adaptation, a cell type sensitive to a particular stress is replaced by another cell type better able to withstand the adverse environment. Metaplasa is thought to arise by reprogramming of stem cells to differentiate along a new pathway rather than a phenotypic change of already differentiated cells.