

PHYSIOLOGY (CODE: PY)	
Topic 1: General Physiology	
PY1.1	Describe the structure and functions of a mammalian cell.
PY1.2	Describe and discuss the principles of homeostasis.
PY1.3	Describe intercellular communication.
PY1.4	Describe apoptosis – programmed cell death.
PY1.5	Describe and discuss transport mechanisms across cell membranes.
PY1.6	Describe the fluid compartments of the body, its ionic composition & measurements.
PY1.7	Describe the concept of pH & Buffer systems in the body.
PY1.8	Describe and discuss the molecular basis of resting membrane potential and action potential in excitable tissue. (RMP)
PY1.9	Demonstrate the ability to describe and discuss the methods used to demonstrate the functions of the cells and its products, its communications and their applications in Clinical care and research.

Topic-1- Competency 4- Apoptosis

PY1.4- Describe apoptosis - programmed cell death.

PY1.4.1	Define apoptosis with examples (at least 4)	Core
PY1.4.2	Describe <u>physiological significance</u> (at least 2) and <u>mechanism</u> of apoptosis	Core
PY1.4.3	Enumerate important <u>clinical conditions</u> (at least 2) related to abnormal apoptosis	Core
PY1.4.4	Differentiate apoptosis from necrosis (at least 2)	Non-core

PY1.4.1) Definition-

Apoptosis word comes from Greek word Apo means- away and ptosis means fall. Apoptosis is programmed cell death. For example – RBC's life span is 120 days while WBC's life span is only few days. Majority of the cells show apoptosis. But rate of apoptosis varies from cell to cell. Some cells have very high rate of apoptosis, for example cells in intestine & and in bone marrow.

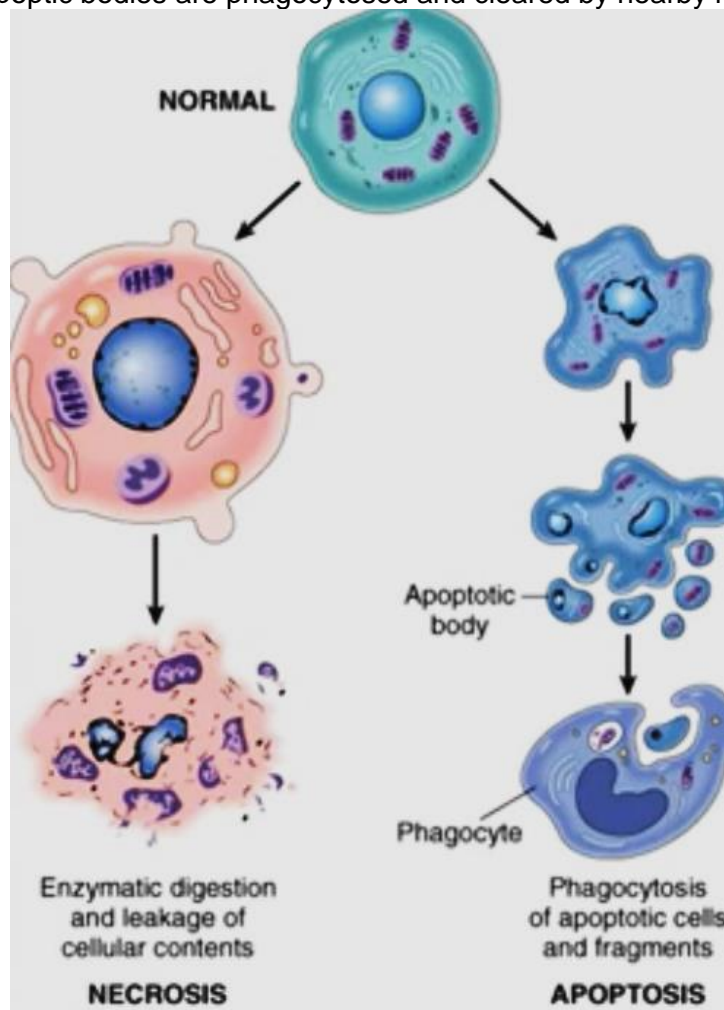
PY1.4.2) Physiological significance & mechanism-

i) During embryogenesis & developmental stage, there is high rate of apoptosis. During embryogenesis degeneration of Mullerian Inhibiting duct in male foetus occur due to apoptosis. Also, webs between fingers and toes are removed due to apoptosis. During developmental brain remodelling and immune system development require apoptosis.

ii) During adult life too, apoptosis plays an important role by removing old and less functioning cells. These cells are replaced by to better functioning young cells

Mechanism- Procaspases activated to Caspases, which is a protease enzyme. Cells own gene (specially p53) and mitochondria play an important role in the activation of Caspases.

Caspases will lead cells to shrink, condense, fragment & finally cells are broken down into apoptotic bodies. Apoptotic bodies are phagocytosed and cleared by nearby macrophages.



PY1.4.3) Clinical significance-

- 1) Lack of apoptosis can lead to Cancer due to accumulation of cells.
- 2) Excess apoptosis to neurodegenerative diseases like Alzheimer’s disease.

PY1.4.4) Difference between apoptosis and necrosis.

Both the conditions eventually lead cell death- but following are the differences

S. No.	Apoptosis (cell suicide)	Narcosis (cell murder)
i)	Can be Physiological or Pathological in which cell shrinks & die	Always Pathological (injury or diseases) in which cell swells & die
ii)	Plasma membrane remains Intact, so cells contents do not spill out	Plasma membrane becomes leaky, so cells contents can spill out
iii)	Neighbouring cells are normal or healthy	Neighbouring cells may be inflamed due to spilled our cell contents

Note- Key Apoptosis can be remembered by - 3 Cs- Cell death (programmed) for definition, Caspases (protease which degrade cells) for mechanism and Cancer (lack of apoptosis cause cancer) for clinical significance.

Topic-1- Competency 3- Intercellular communication.

PY1.3 - Describe intercellular communication.

PY1.3.1	Enumerate 1 direct & 4 indirect types of intercellular communications.	Core
PY1.3.2	Describe briefly all the 5 important types of intercellular communications with at least 2 examples each.	Core

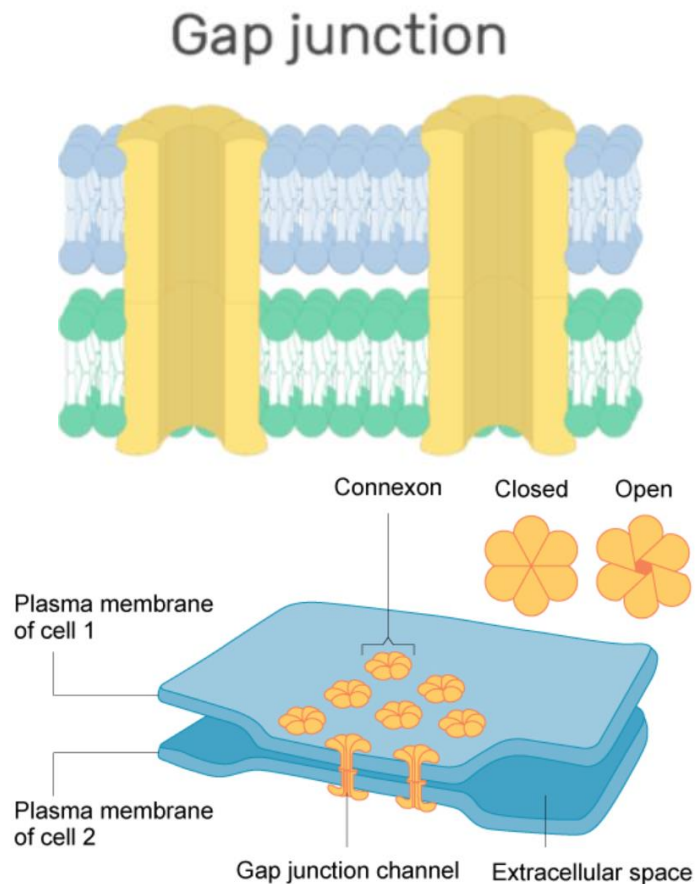
PY1.3.1) Types of intercellular communication-

Direct intercellular communication	Indirect intercellular communication
Gap junction	Synaptic communication Endocrine communication Paracrine communication Autocrine communication

PY1.3.2) Describe of 5 important types of intercellular communications with examples-

Gap Junction-

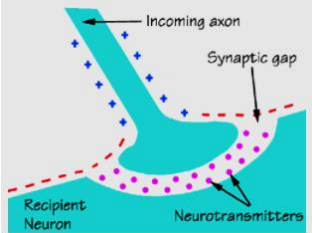
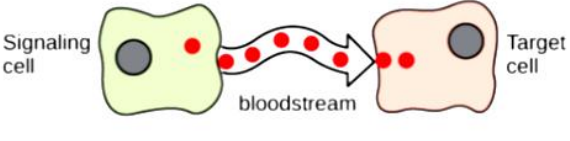
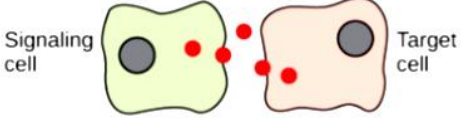
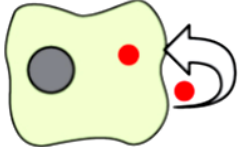
Gap junctions is one of the inter cellular junctions and also direct intercellular communication electrical union



Gap junctions are low resistance bridges between adjacent cells through which ions and small molecules pass from one cell to the next with ease

Examples of gap junctions- Cardiac muscles, single unit smooth muscles etc.

Indirect intercellular communications

<p>Synaptic Communication</p>	<p>Axonal endings of neuron release NTs (Ach, Glutamate, GABA etc) on other neurons or skeletal muscles</p> 		
<p>Endocrine Communication</p>	<p>Ductless endocrine glands directly pore chemicals called hormones which act on target cells and produce response. (Growth Hormone, T3/T4, Oxytocin etc)</p> <table border="1" data-bbox="451 976 1369 1016"> <tr> <td style="background-color: #cccccc;">Endocrine</td> <td>A cell targets a distant cell through the bloodstream.</td> </tr> </table> 	Endocrine	A cell targets a distant cell through the bloodstream.
Endocrine	A cell targets a distant cell through the bloodstream.		
<p>Paracrine Communication</p>	<p>Chemicals release from a cell into extracellular fluid (ECF) and act on neighbouring cells (Histamine, Insulin, Glucagon etc)</p> <table border="1" data-bbox="451 1323 1377 1364"> <tr> <td style="background-color: #cccccc;">Paracrine</td> <td>A cell targets a nearby cell.</td> </tr> </table> 	Paracrine	A cell targets a nearby cell.
Paracrine	A cell targets a nearby cell.		
<p>Autocrine Communication</p>	<p>Chemicals release from a cell into extracellular fluid ECF and act on the same cell (Insulin act on B cells which release it and inhibits it, IL-2 act on Helper T- Lymphocytes which release it and stimulates it)</p> <table border="1" data-bbox="451 1713 1377 1753"> <tr> <td style="background-color: #cccccc;">Autocrine</td> <td>A cell targets itself.</td> </tr> </table> 	Autocrine	A cell targets itself.
Autocrine	A cell targets itself.		

Prepared by

Dr Neeraj Mahajan (MD, DNB) & Dr Kartik Patel (MD)

(Complete topic will soon be available on our mobile app- Physiology Solution)