Quadrant II – Transcript and Related Materials

Programme: Bachelor of Science (Third Year)

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Paper Title: Endocrinology

Unit: III Hormones

Module Name: Types of Chemical Messengers II

Module No: 12

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Notes

Definition:

Chemical messenger is any substance produced by a cell that plays a physiological role in the control of the activity of another cell.

Sources of Chemical messengers:

Glandular sources: Ductless glands like parathyroid, adrenal glands, pituitary, hypothalamus, islets of Langerhans (Pancreas), etc.

Non-glandular sources: Gastrointestinal tract (cholecystokinin), muscle (Insulin like growth factor IGF I), Vascular endothelium of blood vessels (Nitric Oxide, Angiotensin II)

Types of Chemical Messengers:

1. Neurohormone

2. Neurotransmitters
3. Neuropeptides
4. Nonpeptidergic messengers
5. Lumones
6. Chalones
7. Local chemical messengers
8. Hormones
9. Pheromones
10. Growth Factors
11. Eicosanoids

1. Neurohormone: A hormone produced by a nerve cell/neuron.

Neuromodulators: a hormone released by a neuron that modulates the response of a neuron to a neurotransmitter or other hormones. Eg: serotonin

2.Neurotransmitters are chemical messengers released from neurons into the synapse between the nerve and its effector cells, secretory cells, muscle cells, or other neurons.

These chemical messengers reach high concentrations in the synaptic cleft, act quickly, and are actively degraded and recycled. Eg: Acetylcholine

3. Neuropeptides: Some specialized neurons (called neurosecretory cells) secrete neuropeptides (neurohormones). **Neuropeptides** are small proteins produced by neurons that act on G protein-coupled receptors and are responsible for slow-onset, long-lasting modulation of synaptic transmission. Neuropeptides often coexist with each other or with other neurotransmitters in single neurons. The blood or other body fluids transport neuropeptides to nonadjacent target cells, where neuropeptides exert their effects.

In mammals, for example, certain nerve cells in the hypothalamus release a neuropeptide that causes the pituitary gland to release the hormone Oxytocin, which induces powerful uterine contractions during the delivery of offspring.

4. Nonpetidergic neurohormone: Secretion of nerve cell devoid of peptides are nonpeptidergic neurohormones.

Eg: Histamine, acetylcholine, serotonin.

Peptidergic neurons contain neuropeptides, like Substance P and depend on Nerve Growth Factor (NGF) signaling for their survival.

5.Lumones: Chemical messengers released into the lumen of the gastrointestinal tract.

Eg: Include some of the chemicals called lumones that the gut produces and that help regulate digestion.

In a wound, mast cells secrete a substance called histamine that participates in inflammatory response

6. Chalones: These are chemical substances synthesized within the same tissue on which it specifically acts to inhibit mitosis.

7. Local Hormones: Many cells secrete chemicals that alter physiological conditions in the immediate vicinity. Most of these chemicals act on the same cell (autocrine agents) or adjacent cells (paracrine agents) and do not accumulate in the blood.

8. Hormone is any substance elaborated by one cell to regulate another cell and may be delivered in an endocrine, paracrine, autocrine or pheromonal route. Eg: Thyroxine.

9. Pheromones: Pheromone is a volatile chemical messenger synthesized in exocrine (duct) glands and released to the exterior of one animal to stimulate a response in another

member of the same species. They act on other individuals, usually of the same species, through olfactory (smell) or gustatory (taste) receptors and alter behavior (releaser effects) or the neuroendocrine system (primer effects).

10. Growth factors: are mitogenic peptides which may later become known as hormones. Growth factors promote growth and cell division in specific organs.

Eg.: Epidermal growth Factor in skin, Nerve Growth Factor in Neurons, Insulin like growth factor in bone.

11. Eicosanoids: The polyunsaturated arachidonic fatty acid (AFA) is the precursor of eicosanoids. The cyclooxygenase enzyme folds the AFA to form the prostaglandin ring structure. The synthetases (S) convert prostaglandins to thromboxanes and prostacyclins. The lipooxygenase enzyme converts AFA to leukotrienes. They are hydrophobic. They are short-lived chemical messengers that exert autocrine, paracrine, and occasionally endocrine action on their receptors. They are Lipophilic molecules that bind to cell-surface receptors.

Eg.:**Prostaglandins**: They are a diverse group of fatty acids that are produced almost in all organs. They regulate smooth muscle contraction, lung function and inflammation.

The endothelium of blood vessels is a rich source of paracrine regulators.

Nitric oxide (NO) promotes vasodilation, Endothelin stimulates vaso constriction.

Vasodilation promoted by Bradykinin.