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B.Sc. 2nd year (IVth Sem)

Classification of Receptors

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Classification of Receptors:

Receptors can be classified based on different criteria.

Based on type of stimulus for which they respond, they can be classified into:

I. **Mechanoreceptors (Fig. 9.3**) respond for mechanical energy, like touch, pressure, vibration. These receptors are present in almost all parts

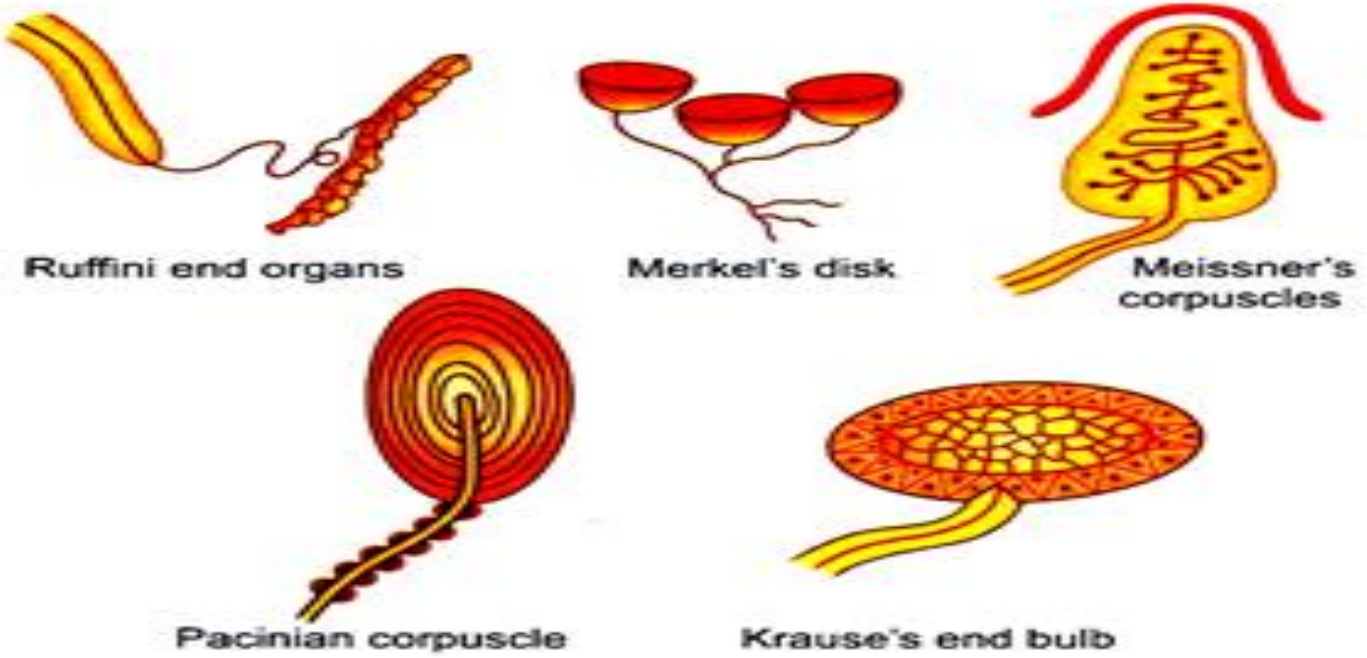

Fig. 9.3: Mechanoreceptors present in the skin

In skin, there are:

Merkel's disk

ii. Meissner's corpuscle (touch receptors)

iii. Pacinian corpuscle, etc.

In visceral regions, are:

i. Barorceptors

ii. Volume receptors

iii. Auditory receptors, etc.

2. Chemoreceptors respond for chemical energy.

Some of the examples for chemo-receptors are:

i. Taste receptors

ii. Olfactory receptors

iii. Carotid and aortic bodies

iv. Osmoreceptors

3. Thetnoreceptors get stimulated by warmth/cold energy. Thermoreceptors are present in skin (peripheral) and in hypothalamus (central).

4. **Nociceptors** respond for painful (noxious) stimulus. Naked nerve endings present in almost all parts of body act as nociceptors. Nociceptors are absent in central nervous system.

5. **Electromagnetic** receptors are present in eye. They respond for light rays (electromagnetic waves), e.g. rods and cones (photoreceptors).

Properties of Receptors:

1. Excitability (Fig)

Since receptors are specialized nerve endings, they are in polarized state when not stimulated. On application of stimulus, change in polarized state occurs. This leads to development of receptor potential or generator potential. Receptor potential is one of the examples of local potential. When this potential reaches a critical value, there will be development of nerve action potential in the afferent fiber.

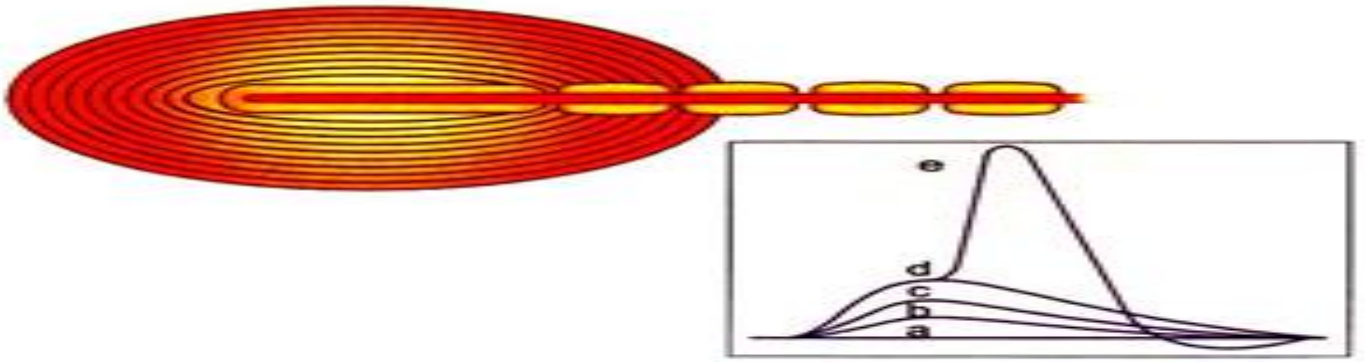

Fig. 9.4: Relatioship between intensity of stimulus and receptor potential in Pacinian corpuscle

2. Adequate stimulus is just enough strength of stimulus to excite receptor for production of receptor potential which is sufficient enough to bring about development of an action potential in afferent fiber.

3. Specificity:

Each group of receptor is specialized to respond for a particular type of stimulus very easily. However, the same receptors can get stimulated for some other type of stimulus provided; the strength of stimulus is very strong, e.g. photoreceptors are most sensitive to light but application of pressure on eyeball can also stimulate them.

Muller's law of specific nerve energy:

Whenever receptor is stimulated with adequate strength of stimulus, there is development of action potential in afferent nerve fibers. This action potential reaches brain, and particular sensation is perceived. However, configuration and amplitude of action potential whether coming from mechanoceptor or chemoreceptor, remains the same and reach the brain.

How is brain able to interpret when a person is feeling touch, or heat sensations, etc.?

There is some sort of conditioning taking place in CNS. For example, whenever touch receptor is stimulated, afferent impulse reaches cerebral cortex, sensation of touch is felt.

When impulse comes along a particular nerve fiber for months or years, the sensation brain is going to perceive is touch in case receptor stimulated is for touch sensation. If afferent pathway for this sensation is stimulated directly by any type of stimulus, still we always feel touch only. This is known as conditioning.

According to Muller's law, when afferent pathway is stimulated directly (by any type of stimulus that is mechanical or chemical or thermal in nature) sensation that is going to be felt is specific of the receptor from where it carries impulse. This is the basis to explain carpal tunnel syndrome, spondylitis, phantom limb, etc.

4. Intensity discrimination:

Strength of stimulus applied can be assessed by magnitude of response from receptors which is in form of increased amplitude of receptor potential. An increased amplitude of receptor potential, increases the number of action potentials generated in afferent nerve fiber in unit time, as per Weber-Fechner law (as per this law, frequency of action potential produced in nerve fiber is directly proportional to log intensity of stimulus).

Another way by which intensity discrimination can be made out is, as the strength of stimulus is increased, number of receptors stimulated will also increase (recruitment of receptors/recruitment of sensory units). This is because receptors also have different threshold for excitation.

5. Adaptation:

When applied stimulus acts for a prolonged duration, some of receptors may stop responding in the course of time. So there will not be production of action potential in nerve fiber. There are some receptors that get adapted fast, e.g. olfactory receptors, and touch receptors in skin. Pain receptors will never ever get adapted.

The property of adaptation of receptor whether beneficial to body, depends on type of receptor that has got adapted. Baroreceptor adaptation is detrimental to body function as blood pressure cannot be restored to normal value during sustained hypertension.

Sensory unit is number of sensory receptors from which a particular afferent nerve fiber carries impulse. Recruitment of sensory units also helps for intensity discrimination.