Two-Point Discrimination Test (Nervous System Sensitivity)

Human Biology (ANE106)

Year 1/ Spring semester

Lab 2

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Introduction

Nerve receptors, also known as sensory receptors, are specialized cells in the body that detect changes in the environment and convert them into electrical signals for the nervous system.

These receptors are located in the skin, muscles, and internal organs, and they respond to different types of stimuli such as touch, pressure, temperature, and pain.

Types of Nerve Receptors

Nerve receptors are classified based on the type of stimulus they detect:

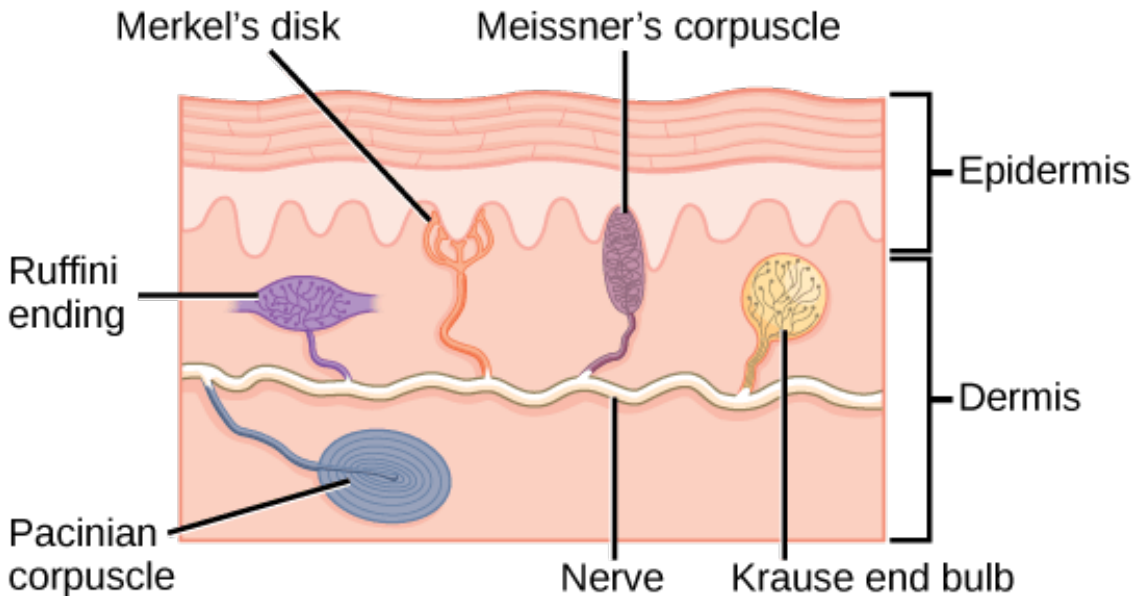
1. Mechanoreceptors
2. Thermoreceptors
3. Nociceptors
4. Photoreceptors
5. Chemoreceptors

Types of Nerve Receptors

1. Mechanoreceptors

Function: Detect touch, pressure, vibration, and stretch.

Location: Found mainly in the skin (e.g., fingertips, palms), also Muscles, tendons and Joints

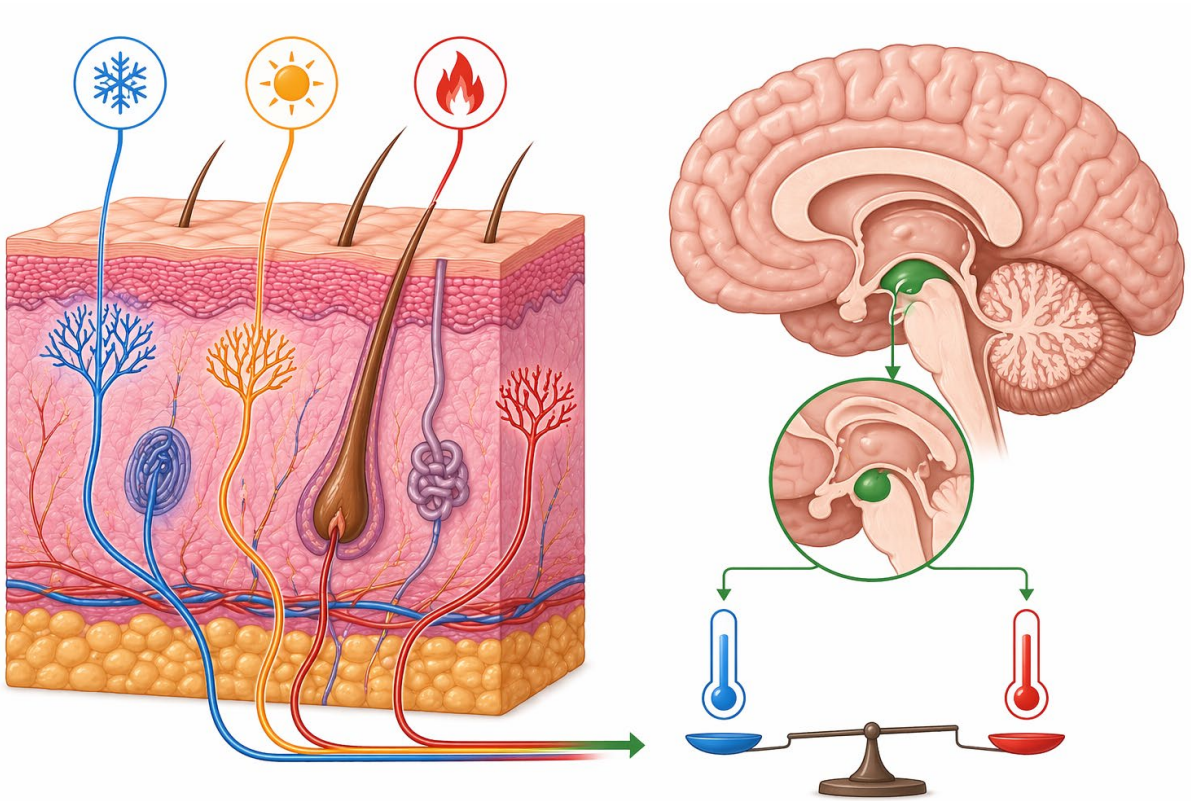


Types of Nerve Receptors

2. Thermoreceptors

Function: Detect temperature changes (hot and cold)

Location: Located in the skin and hypothalamus



THERMORECEPTORS IN THE SKIN

COLD RECEPTORS

Detect cold (decrease in temperature)

Channel: **TRPM8**

WARM RECEPTORS

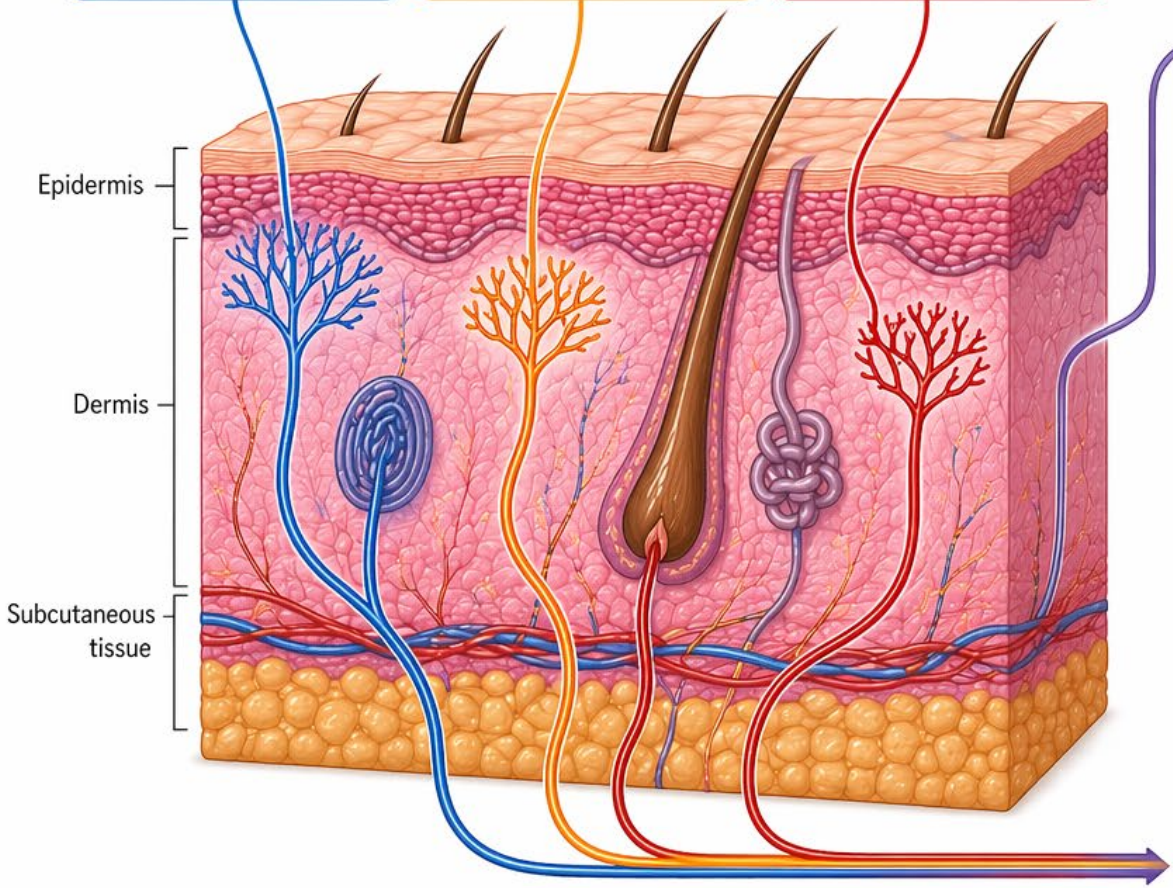
Detect warmth (increase in temperature)

Channels: **TRPV3, TRPV4**

HOT RECEPTORS (PAIN RECEPTORS)

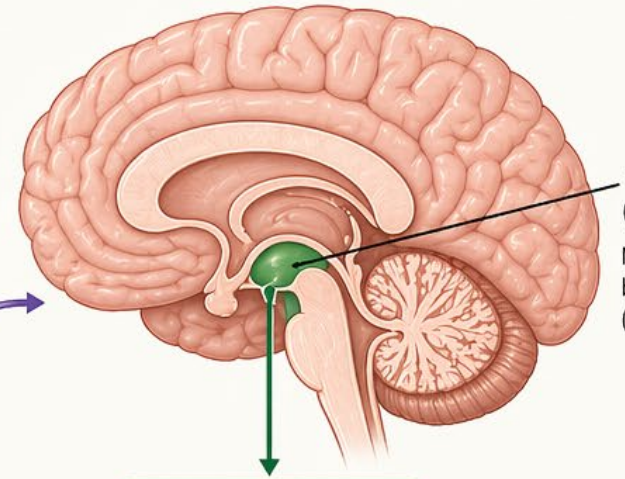
Detect noxious heat (very high temperature that may cause pain)

Channel: **TRPV1**



Signals travel through sensory neurons to the spinal cord and brain.

HYPOTHALAMUS: BODY TEMPERATURE REGULATOR



Hypothalamus (in the brain)

Monitors and regulates body temperature (set point ~37 °C)

Hypothalamus compares information to set point (~37 °C)

If body temperature is TOO HIGH

Sweating

Vasodilation (heat loss)

Body temperature decreases toward set point

If body temperature is TOO LOW

Shivering

Vasoconstriction (heat conservation)

Body temperature increases toward set point

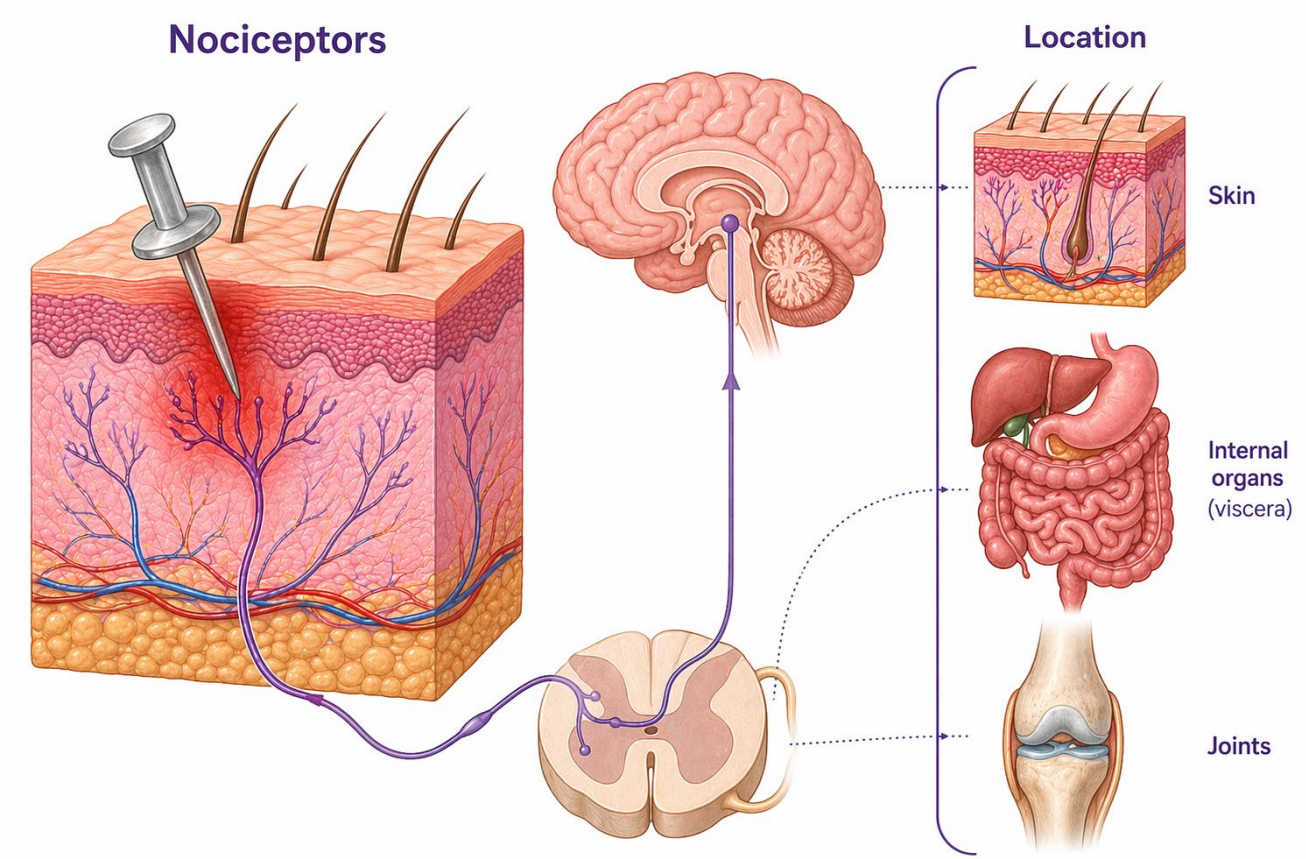
Types of Nerve Receptors

3. Nociceptors

Function: Detect pain caused by injury or damage.

Location:

- Skin
- Internal organs (viscera)
- Joints

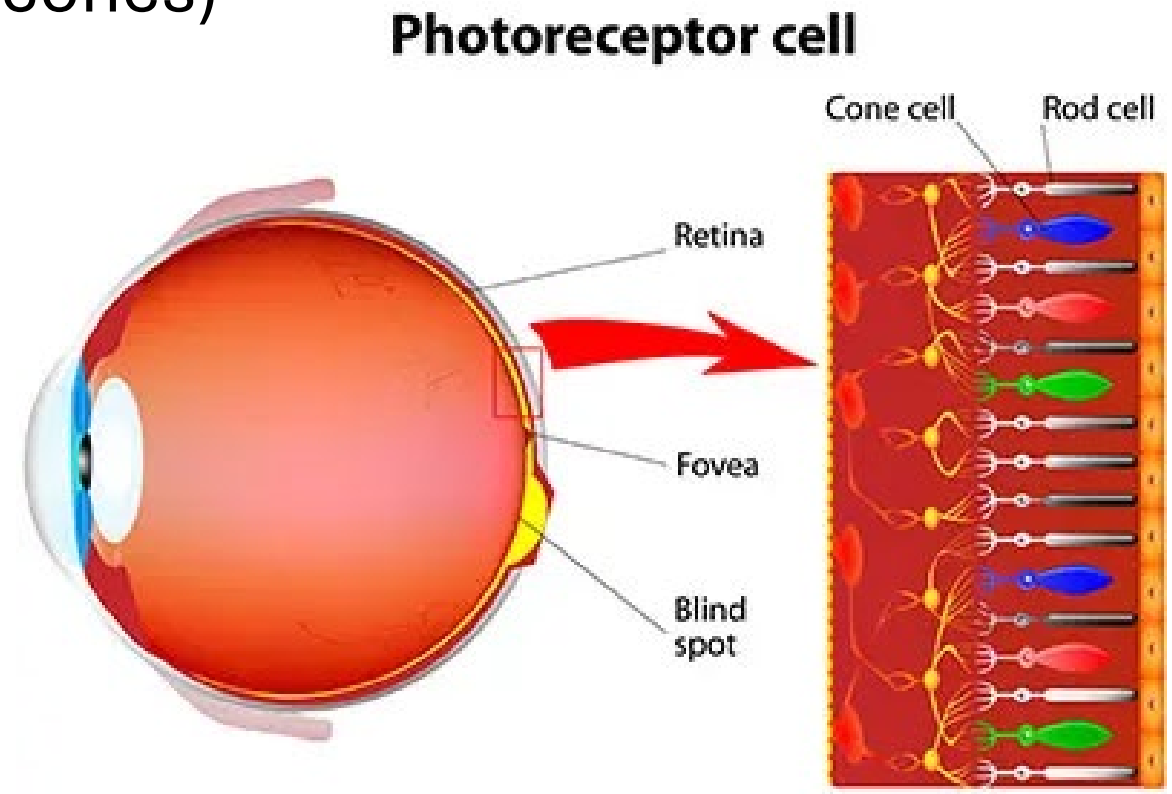


Types of Nerve Receptors

4. Photoreceptors

Function: Detect light for vision

Location: Retina of the eye (rods and cones)



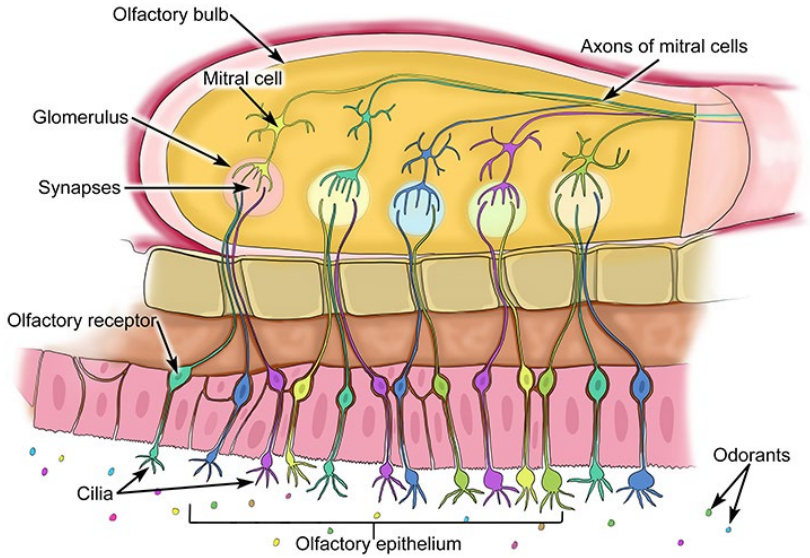
Types of Nerve Receptors

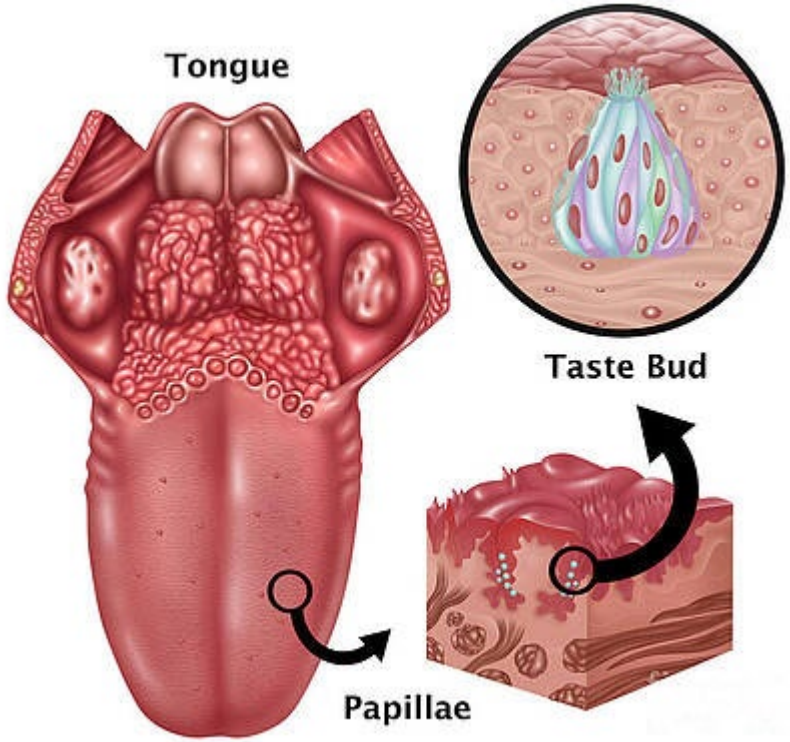
5. Chemoreceptors

Function: Detect chemicals (taste, smell, blood chemistry)

Location:

- Taste buds on the tongue
- Olfactory receptors in the nose
- Blood vessels (monitor oxygen, carbon dioxide, pH)





Mechanoreceptors

Mechanoreceptors in the skin detect touch and pressure and transmit signals through sensory neurons to the brain for interpretation. Their distribution varies across different parts of the body, with some areas having a higher density of receptors than others.

Regions like the fingertips contain many receptors, making them highly sensitive and able to detect fine details, while areas such as the back have fewer receptors and are therefore less sensitive.

Mechanoreceptors

This variation in receptor density explains why some parts of the body can detect two closely spaced points as separate, while others cannot.

Practical Session

Two-Point Discrimination Test (Nervous System Sensitivity)

Objective

The aim of this experiment is to investigate how sensitive different parts of the human body are to touch by measuring the minimum distance at which two separate points can be distinguished. This helps demonstrate how nerve receptor density varies across body regions.

Hypothesis

If a body region has a higher density of sensory receptors,
then it will detect two points at a smaller distance,
because more neurons are present to transmit separate signals to the brain.

Materials

- Ruler (with centimeter scale)
- Paperclip (can be bent into a “U” shape)
- Paper (for recording data)
- Pencil or pen

Procedure

1. Bend a paperclip into a “U” shape and set the ends 4 cm apart using a ruler.
2. Gently touch both ends with the fingertip.
3. Record whether the subject feels **one point (1)** or **two points (2)**.
4. Repeat the test on the Forearm and Neck/back of hand.
5. Decrease the distance between the paperclip ends by 0.5 cm each time.
6. Continue testing until the ends are touching.
7. Record all observations in a data table.

Distance between paperclip ends	Fingertip	arm	Neck/back of hand
4 cm			
3.5 cm			
3 cm			
2.5 cm			
2 cm			
1.5 cm			
1 cm			
0.5 cm			
End touching			