

Section 1: Our Senses

• Why do we need our senses?

All organisms can sense their environment, but animals such as humans have evolved several very sophisticated sensory systems, which allows them to detect changes in their environment rapidly and with precision. This offers huge advantages, such as the ability to detect dangers, find food, and generally exploit the environment to our benefit.

Extension Question

Q1. Can plants sense their environment?

Plants can detect several stimuli. For example, they can detect light and gravity, and respond by growing in particular directions. Many can detect day length, so they know when to flower and when to shed their leaves.

• Suggested Films

- The Senses
- Fight Or Flight

• What can we sense?

We can detect all sorts of stimuli, such as light, sound, heat and pressure, but we often consider our five major senses to be those of sight, hearing, touch, taste and smell.

• Suggested Films

- The Senses
- Synaesthesia
- Why Do I Get Travel Sick?

Extension Question

Q2. What other stimuli can humans detect?

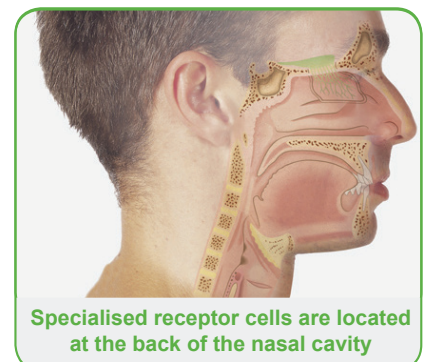
In addition to the major five senses, humans have the ability to detect heat, pain, gravity and movement, such as acceleration.

Section 2: Senses and Our Environment

• How do we sense environmental stimuli?

Specialised neurons, called sensory receptors, are capable of detecting stimuli and transforming them into electrical impulses which can be relayed to the Central Nervous System (CNS). There are four types of sensory receptors in humans: mechanoreceptors, thermoreceptors, chemoreceptors and photoreceptors.

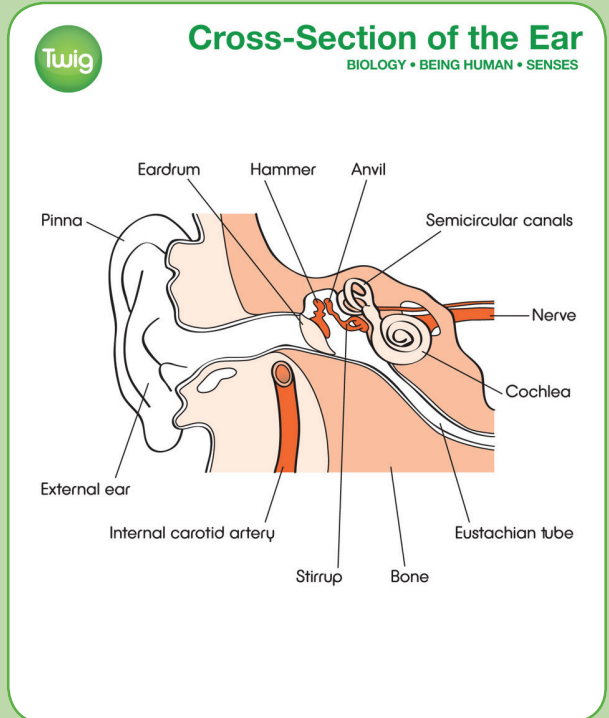
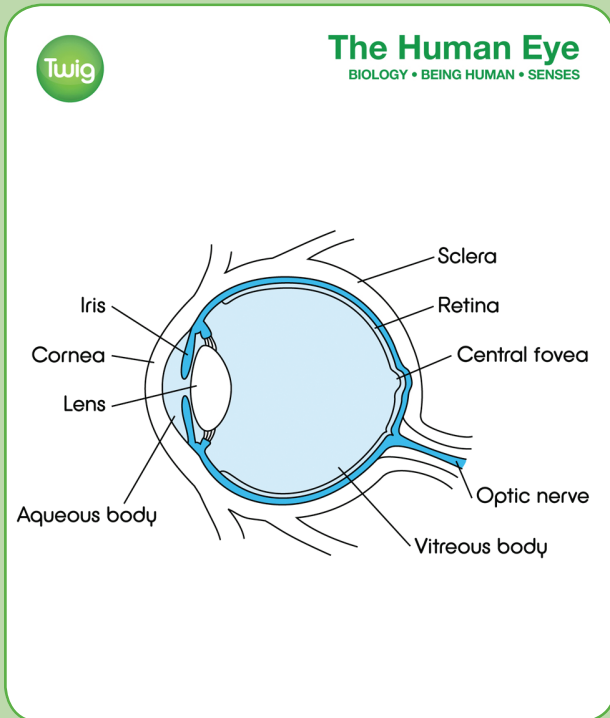
These receptors are usually grouped together in sensory organs, such as the eye (photoreceptors), the ear (mechanoreceptors), and the tongue (chemoreceptors). The skin contains a collection of different receptor types.



Specialised receptor cells are located at the back of the nasal cavity

DIAGRAM 01:

DIAGRAM 02:



• Suggested Films

- How We Touch
- How We Hear
- How We See Part 1: Eyes
- How We Taste
- How We See Part 2: Brain

• Suggested Activity

- Ask students to test the sensitivity of skin on different parts of the hand

• Do animals sense the environment differently?

Animals sense the environment in very different ways. For example, some have better vision and much keener senses of smell, while others can detect stimuli which humans cannot. Some snakes can detect infrared light, and several species of fish can sense electric fields.

• Suggested Film

- Animal Senses

Extension Question

Q3. How can sniffer dogs smell substances which humans can't?

Humans have about 5 million olfactory (smell) receptor cells, whereas many dogs have over 100 million. In addition, the region of the brain that processes information from these receptors is much larger in a dog.



Some birds of prey have highly specialised vision

Section 3: Sensory Cells

• What are mechanoreceptors and thermoreceptors?

Mechanoreceptors are sensory cells capable of detecting mechanical stimuli, such as vibration, pressure and gravity. We find them in our inner ear where they are used to detect sound, gravity and movement, thereby allowing us to hear and balance. They can also be found in the skin, where they allow us to feel touch and pressure, and in the muscles where they help coordinate posture, balance and movement.



Touch receptors on the surface of your skin allow you to sense even the slightest physical contact

Thermoreceptors are mostly found in the skin where they can detect temperature. Information from these receptors travels to the CNS where it is used to provide information to the thermoregulatory centres of the brain. These centres then control the amount of heat lost by the body, and maintain the body temperature at about 37°C.

• Suggested Films

- How We Hear
- How We Balance: Part 1
- How We Balance: Part 2
- Can We Control Pain?
- What Are Goosebumps?

Extension Questions

Q4. Why is it harmful to listen to loud music?

Loud music can damage the sensitive membranes and hair cells in your inner ear. It is not uncommon for people to have temporary hearing loss after a concert, but the effect of loud sounds is cumulative, and more young people are showing evidence of hearing loss than in the past.

Q5. How do hearing aids work?

Hearing aids consist of a microphone, which picks up the pitch and intensity of the sound and converts it into an electrical signal, an amplifier, and a receiver, which converts the signal back into sound waves before transmitting them down the ear canal. Hearing aids are set differently because some people need different frequencies to be amplified to different extents.

• What are chemoreceptors?

Chemoreceptors can detect specific chemical substances in the environment, and are very important in feeding, avoidance and other behaviours. They are found mostly on the tongue and the lining of the nasal passages.

Chemoreceptors in the nasal passages are able to detect thousands of different chemicals, giving us our sense of smell. On the tongue, the receptor cells are clustered together as taste buds. In fact, our sense of taste requires not only information from the tongue, but also information coming from the receptors on the nasal passages.

- **Suggested Films**

- How We Smell
- How We Taste

- **Suggested Activities**

- Ask students to test how things taste on different areas of the tongue
- Ask students to test taste sensations while holding their nose

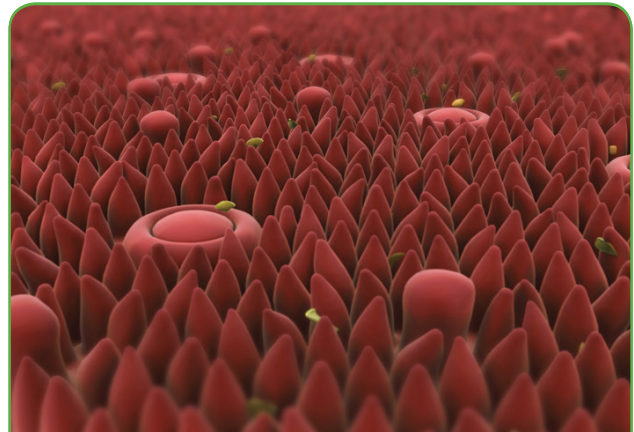


Illustration of the surface and taste buds of the tongue

Extension Questions

Q6. Why do some people have a better sense of smell than others?

Some people have a much better sense of smell than others. Wine tasters can tell the grape type, the region the grapes were grown and even the year the grapes grew. This is probably more to do with training, however, than an inherently better sense of smell. Sometimes people just don't concentrate on smells and with conscious practice it is possible to improve your perception of different smells.

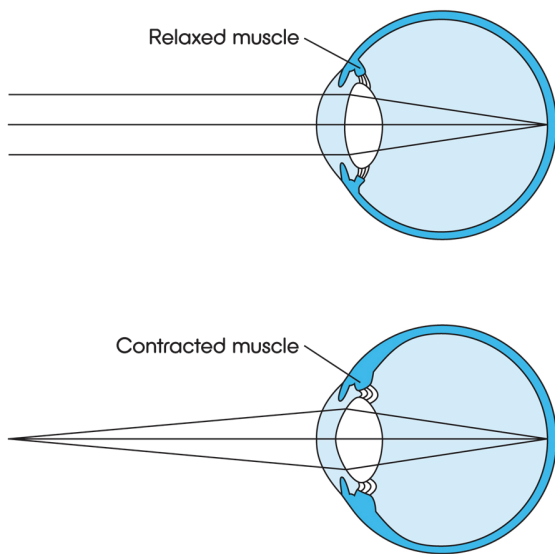
Q7. Why can't you smell when you have a cold?

When you have a heavy cold, the lining of the nasal passages become inflamed and covered with mucus. This makes it difficult for the smell particles to reach the olfactory (smell) receptors and stimulate them. In addition, because you need a sense of smell to taste properly, you also lose your sense of taste.

• What are photoreceptors?

DIAGRAM 03:

Light Travelling Through the Eye
BIOLOGY • BEING HUMAN • SENSES



Photoreceptors convert light of different wavelengths into electrical impulses which travel to the visual centres of the brain. In humans, the photoreceptors are clustered together in a layer of tissue at the back of the eye called the retina. There are two types of photosensitive cell – rods and cones. Rods are the more sensitive and by far the most numerous. They cannot detect colour and are mostly used for peripheral and night vision. Cones, which can detect colour, are mainly packed tightly in a region of the retina called the fovea (or macula).

• **Suggested Films**

- How We See 1: Eyes
- How We See 2: Brain
- Synaesthesia
- Test Your Vision
- Looking into the Future

• **Suggested Activities**

- Ask students to test their blind spot
- Ask students to try out some optical illusions

Extension Questions

Q8. What is the blind spot?

Impulses from the photoreceptors at the back of the eye are transmitted down sensory neurons, which together make up the optic nerve. Where the optic nerves leaves the eye there are no rods and cones, so it is not possible to detect light which falls on this region of the retina. Usually people are not aware of the blind spot in their vision, because the blind spot of the other eye is in a different position and the brain fills in the missing information.

Q9. What is synaesthesia?

Synaesthesia is a condition in which the stimulation of one of the senses causes an automatic stimulation in one of the other senses. For example, some synaesthetes hear sounds when given particular visual cues, while others smell things in response to certain words.

• Quizzes

Senses

Basic

• Which of the following is correct?

- A – the tongue detects smell
- B – the ears detect sound
- C – the eyes detect balance
- D – the brain detects sounds

• What do we call the cells which detect light?

- A – photoreceptors
- B – olfactory receptors
- C – light cells
- D – hair cells

• What system of the body is in control of our senses?

- A – the circulatory system
- B – the nervous system
- C – the hormone system
- D – the brain

• What organ in the body perceives the sensory messages?

- A – the skin
- B – the heart
- C – the nerves
- D – the brain

Advanced

• Which of the following correctly matches the organ with the stimulus it detects?

- A – brain/smell
- B – brain/touch
- C – skin/touch
- D – tongue/smell

• What is the scientific name for cells which can detect stimuli?

- A – neurons
- B – sensory receptors
- C – brain cells
- D – nerve cells

• What name do we give cells which can detect light waves?

- A – photoreceptors
- B – olfactory receptors
- C – light cells
- D – hair cells

• What name do we give cells in the nose that can detect smells?

- A – photoreceptors
- B – olfactory receptors
- C – light cells
- D – hair cells

• Where in your body are the sensory messages actually perceived?

- A – the skin
- B – the eye
- C – the nerves
- D – the brain

• Answers

Senses

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