

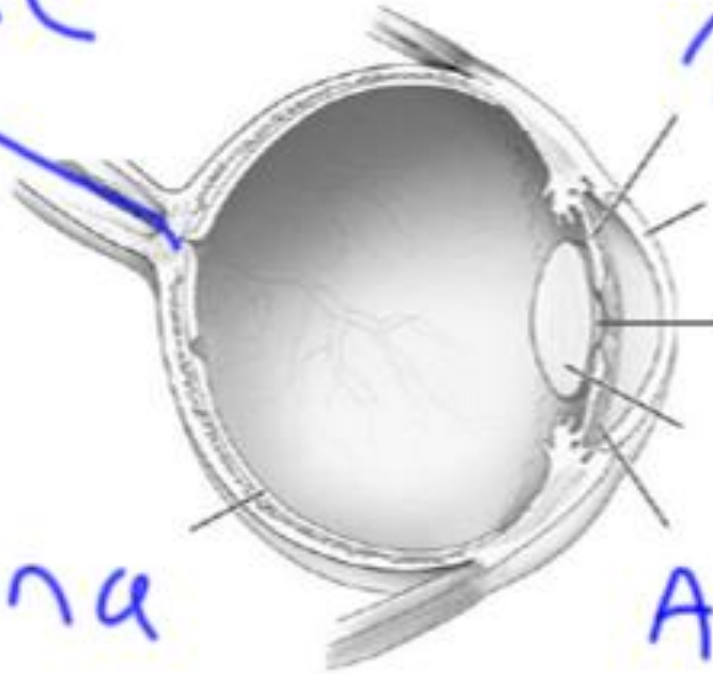
The background is a dark blue gradient. There are several semi-transparent blue circles of various sizes scattered across the page. A solid green rectangle is located in the top right corner.

The sensory system

THE SENSES

The Eye & Our Sense of Sight

brain
Optic Nerve



Aqueous humor

retina

What are the nerve cells?

photoreceptors

Where are the nerve cells located?

What stimuli are needed?

light

Parts of the Eye:

Sclera:	Rigid membrane. Protects eye & gives it shape. "white of the eye"
Choroid:	Middle layer of the eye with blood vessels that nourish it.
Retina:	Located back of the eye. Thin layer covered with millions of nerve cells.
Cornea:	Clear & rigid membrane in front of the eye Slightly dome-shaped.
Iris:	Pigmented membrane with an opening called the pupil to let light in.
Lens:	Flattened sphere that focuses light rays on the retina.
Aqueous humour:	Transparent liquid that fills the space between the cornea and lens.
Vitreous humour:	Transparent jelly-like substance that fills the space between the lens and retina.

How does the brain get the message on what we are seeing?

Sight can be described as the way our __brain__ interprets patterns of __light__ that come in through our eyes.

Light enters the __pupil__, travels through the __lens__, passes through the jelly-like substance called the __vitreous humor__ and finally goes to the __retina__. The information is sent to the brain through the __optic nerve__.

The Retina has two different kinds of light sensitive cells called
__photoreceptors__.

__rods__ register shapes and respond to low levels of light.

__cones__ register colour and only work in bright light.

Pupils adjust depending on the amount of light!

- A lot of light means __small pupil__
- Little or low light mean __large pupil__

Eyesight Problems

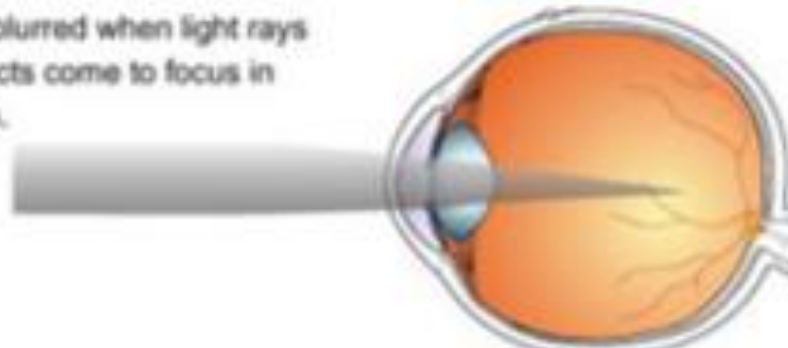
- Sometimes the lenses in people's eyes don't properly focus light on the back of the retina.
- If an eyeball is too short, the image will fall behind the retina. (they are far-sighted because their eyes can focus on things far away but not close up).
- If an eye is too long, people see things nearby but not far off and are called near-sighted.



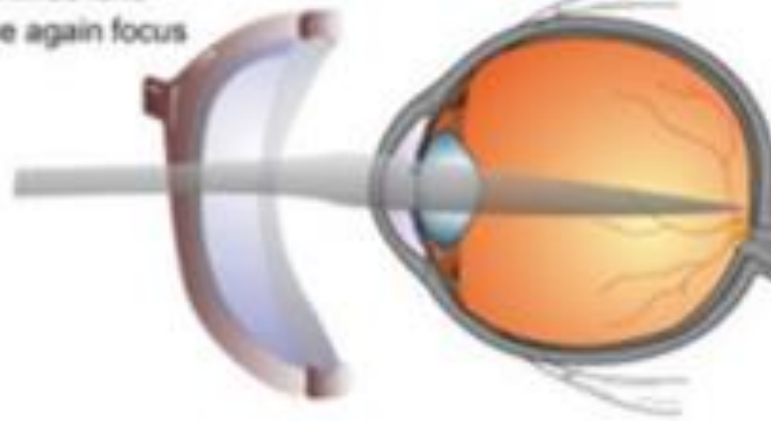
- Nearsightedness = myopia
- Focus of light in front of rena
- Eyeball too long or lens too strong
- Distant objects are blurry



Distant vision is blurred when light rays from distant objects come to focus in front of the retina.



Correction with a minus lens allows light to once again focus on the retina.



Farsightedness = hyperopia

Focus of light beyond the retina

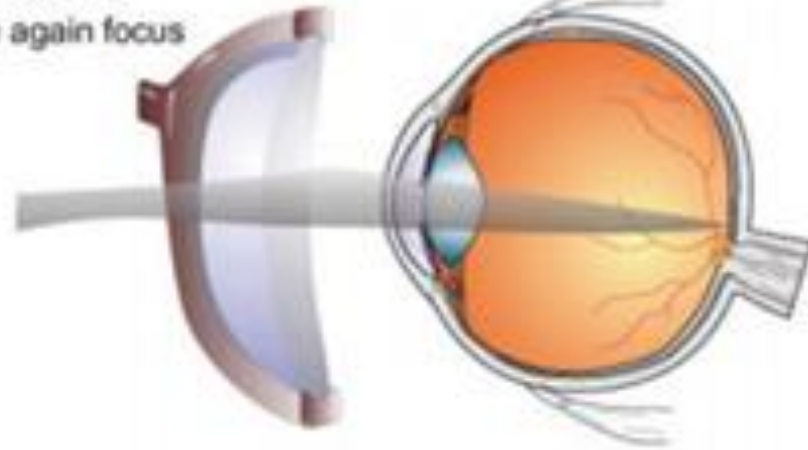
Short eyeball or lazy lens

Near objects are blurry.

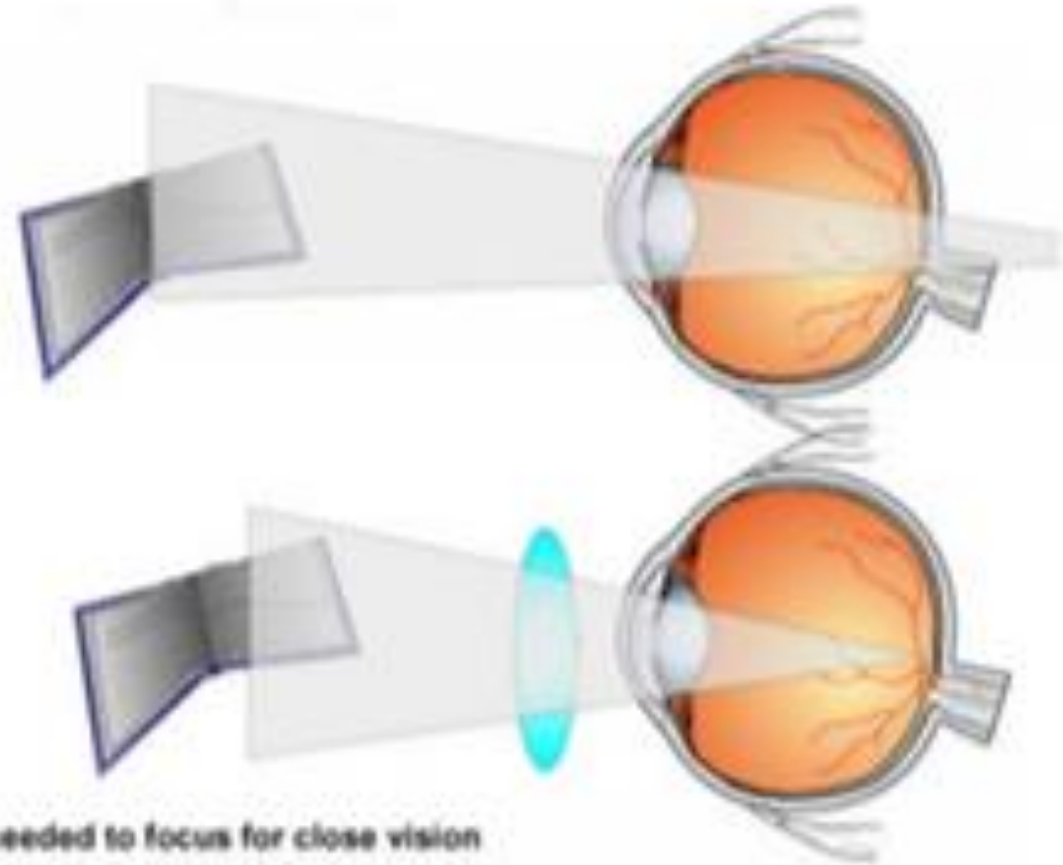
Distance vision is blurred when light rays focus behind the retina.



Correction with a plus lens allows light to once again focus on the retina.



- Difficulty seeing close objects = presbyopia
- Inability of the lens to focus properly at close objects
- Caused by the aging of the eye.
- Special reading glasses needed.



Lens needed to focus for close vision

Colour Blindness

- The term colour blindness is a misconception.
- The following images are a rough comparison of normal vision and the most common form of "blindness";
- red - green colour "blindness".
- In other words, the images on the left are normal vision and the images on the right are an approximation of what a colour "blind" person sees.

Normal Vision:



Colour Blind:



Normal Vision:

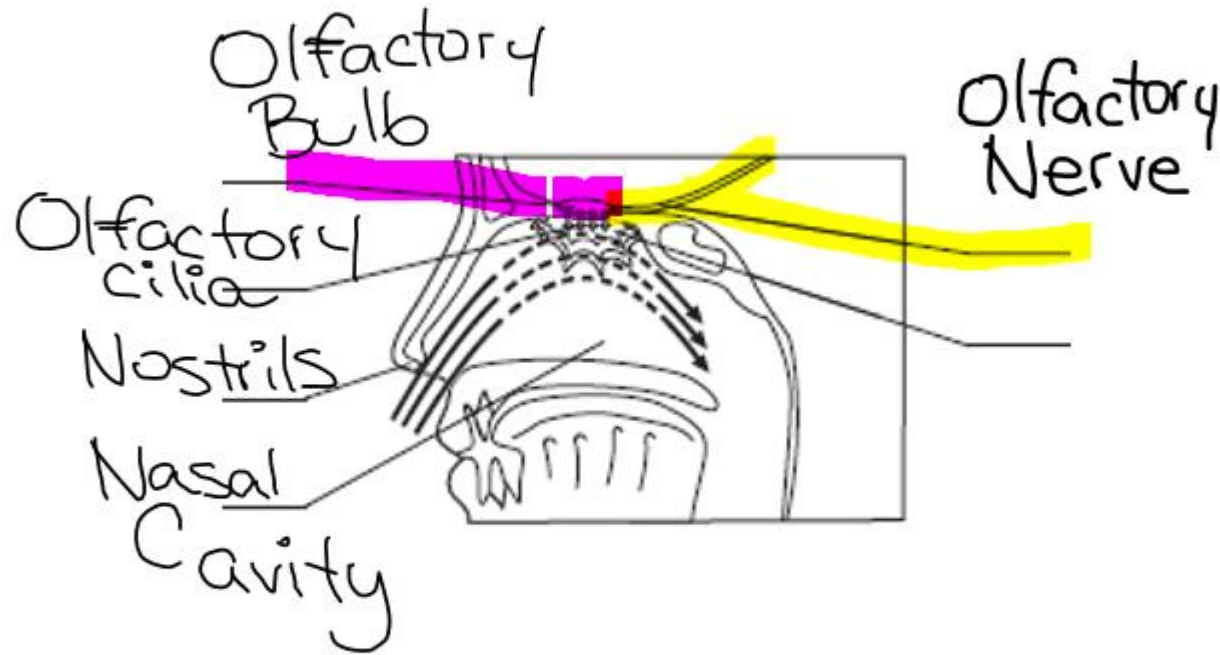


Colour Blind:



The Senses

The Nose & Our Sense of Smell



What are the nerve cells? olfactory receptors

Where are the nerve cells located? nasal cavity

What stimuli are needed? odours

What are odours?

While what's making the smell may be invisible to the naked eye, it doesn't mean there's nothing there! The smell is just made of things too small to see.

Odours are tiny molecules from things like food, or flowers that float through the air. Many odours aren't single scents or single kinds of molecules but a whole mixture of them.



How do we smell something?

Nerve cells sensitive to odours are located in the upper part of the nasal cavity.

The nerve cells are all on a small surface about 5 cm² of the olfactory epithelium.

About 15 million nerve cells are located in the olfactory bulb at the tip of the olfactory nerve.

This nerve transmits impulses produced by the olfactory epithelium cells to the cerebrum/ brain

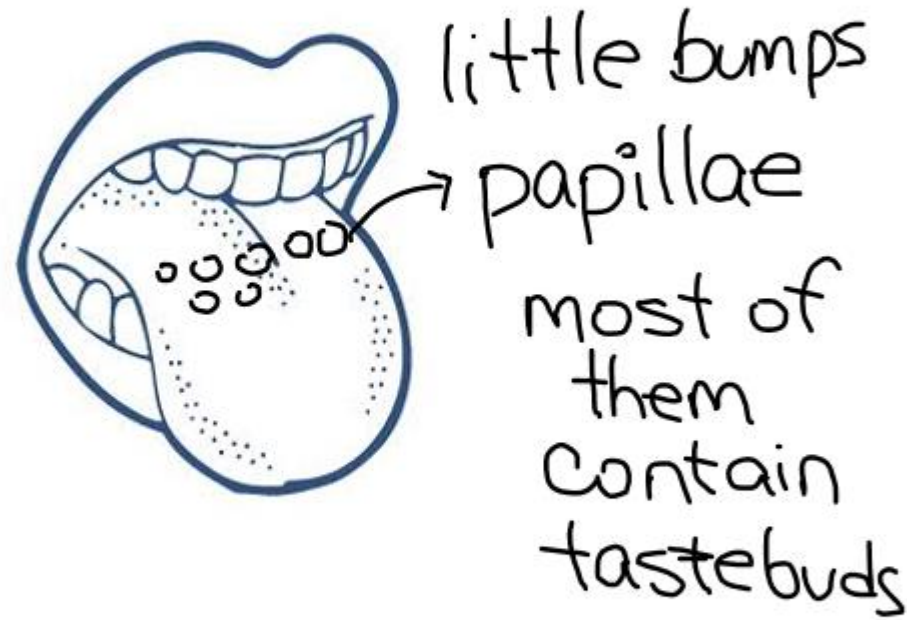
Tongue and Nose

To distinguish most flavours, the brain needs information about both smell and taste

These sensations are communicated to the brain from the nose and mouth. Several areas of the brain integrate the information, enabling people to recognize and appreciate flavours

The Senses

The Tongue & Our Sense of Taste



What are the nerve cells? tastebuds

Where are the nerve cells located? Papillae

What stimuli are needed? chemicals

Taste buds

are sensory organs that are found on your tongue.

Humans can detect five different tastes which are:

1. Sweet (such as candy)
2. Sour (such as lemon)
3. Salty (such as table salt)
4. Bitter (such as an endive or turnip)
5. Umami (such as ripe tomatoes or fish)

Tastebuds

The bumps on your tongue are called papillae and most of them contain taste buds.

Taste buds have very sensitive microscopic hairs called microvilli. Those tiny hairs send messages to the brain about how something tastes.



The average person has about 10,000 taste buds and they're replaced every 2 weeks or so.

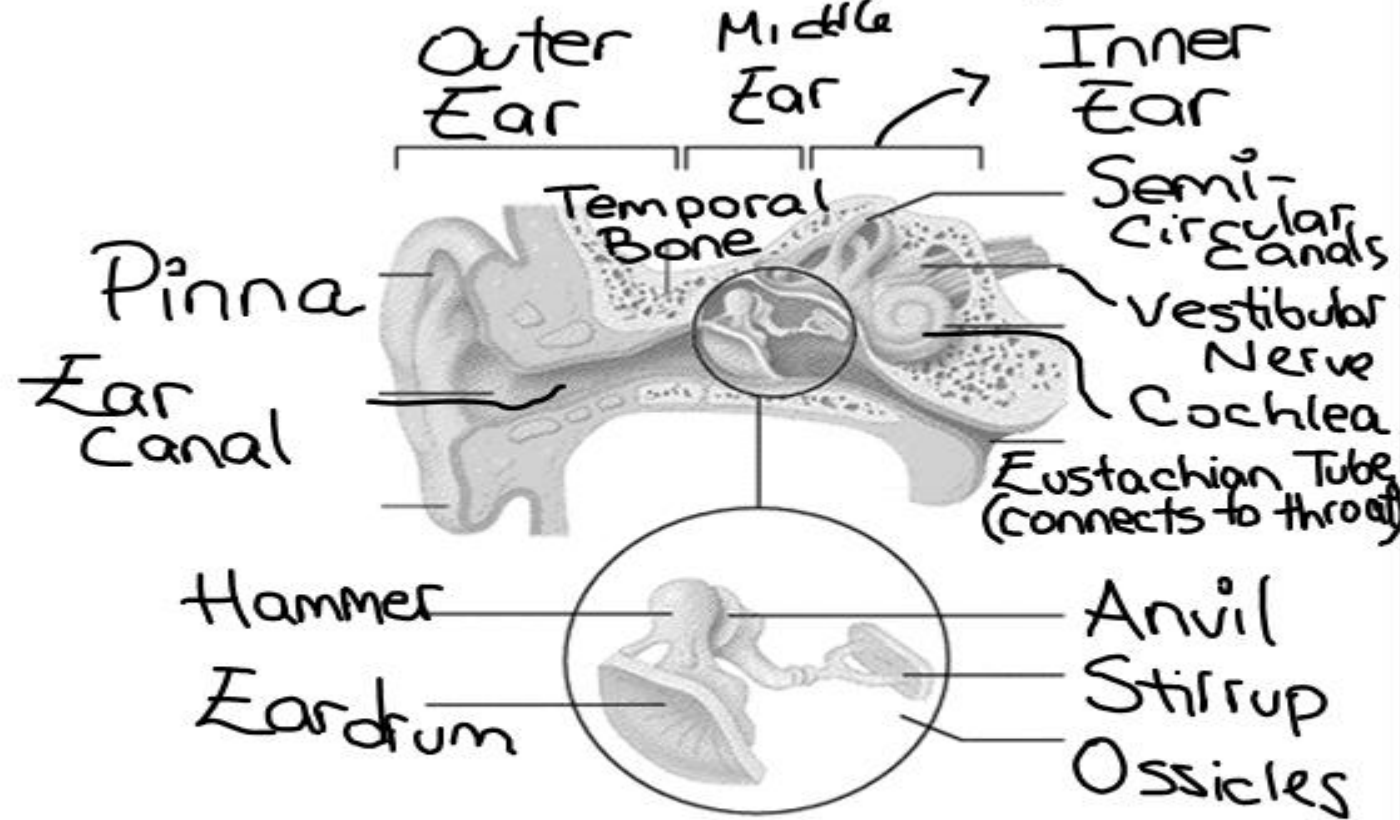
An older person may only have 5000 working taste buds. That's why certain foods may taste stronger to you than they do to adults.

Smoking also can reduce the number of taste buds a person has.

We cannot give taste buds all of the credit for our favourite flavours because another sense plays a large role in how we taste things and that is smell.

The Senses

The Ear & Our Sense of Hearing



What are the nerve receptors? Sensory receptors

Where are the nerve receptors located? Cochlea

What stimuli are needed? Sound waves

Your ears are in charge of:

- 1) Collecting and processing Sounds
- 2) Sending sound signals to your brain
- 3) Keeping your balance

Balance

- In the inner ear, there are three small loops above the cochlea called Semicircular canals like the cochlea, they are also filled with liquid and have thousands of microscopic hairs.
- When you move your head, the liquid in the semicircular canals moves, too. The liquid moves the tiny hairs, which send a nerve message to your brain about the position of your head. In less than a second, your brain sends messages to the muscles so that you keep your balance.
- Sometimes the liquid in your semicircular canals keeps moving after you've stopped moving which leads to dizziness.

- Once the fluid in the semicircular canals stops moving, your brain gets the right message and you regain your balance.

The Outer Ear

- The outer ear is called the Pinna
- The main job of the outer ear is to collect sounds whether they're your friend's whispers or a barking dog.
- The outer ear also includes the ear canal, where ear wax is produced.
- Earwax contains chemicals that fight off infections that could hurt the skin inside the ear canal. It also collects dirt to help keep the ear canal clean

The Middle Ear

- The middle ear's main job is to take those sound waves and turn them into vibrations that are delivered to the inner ear.
- To do this, it needs the eardrum, which is a thin piece of skin stretched tight like a drum.
- When sound waves reach the eardrum, they cause the eardrum to vibrate. When the eardrum vibrates, it moves the ossicles (the tiniest bones in your body, from the hammer to the anvil and then to the stirrup).

The Inner Ear

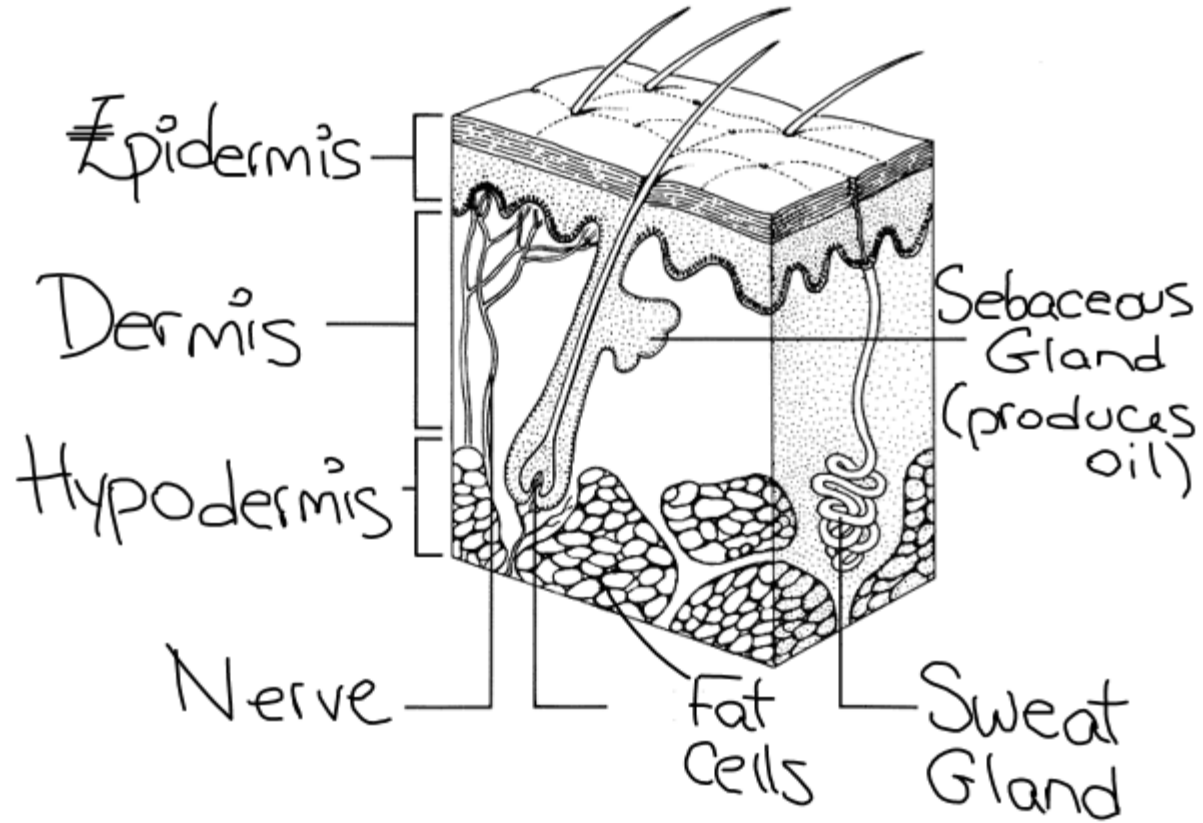
- Sound comes into the inner ear as vibrations and enters the Cochlea, a small, curled tube in the inner ear.

- The cochlea is filled with liquid, which is set into motion, like a wave, when the ossicles vibrate.
- When sound reaches the cochlea, the vibrations (sound) cause the hair on the cells to move, creating nerve signals that the brain understands as sound.

◦ Message sent to brain through vestibular nerve

The Senses

The Skin & Our Sense of Touch



What are the nerve cells? Sensory Receptors

Where are the nerve cells located? Dermis

What stimuli are needed? Pressure, Temperature,

Three Layers of the Skin

➤ Epidermis includes the dead layer of skin and the living layer of skin. In the living layer, new cells push old cells to the surface.

➤ Dermis includes

Sensory receptors
blood vessels, hair,
Sebaceous glands
Sweat glands

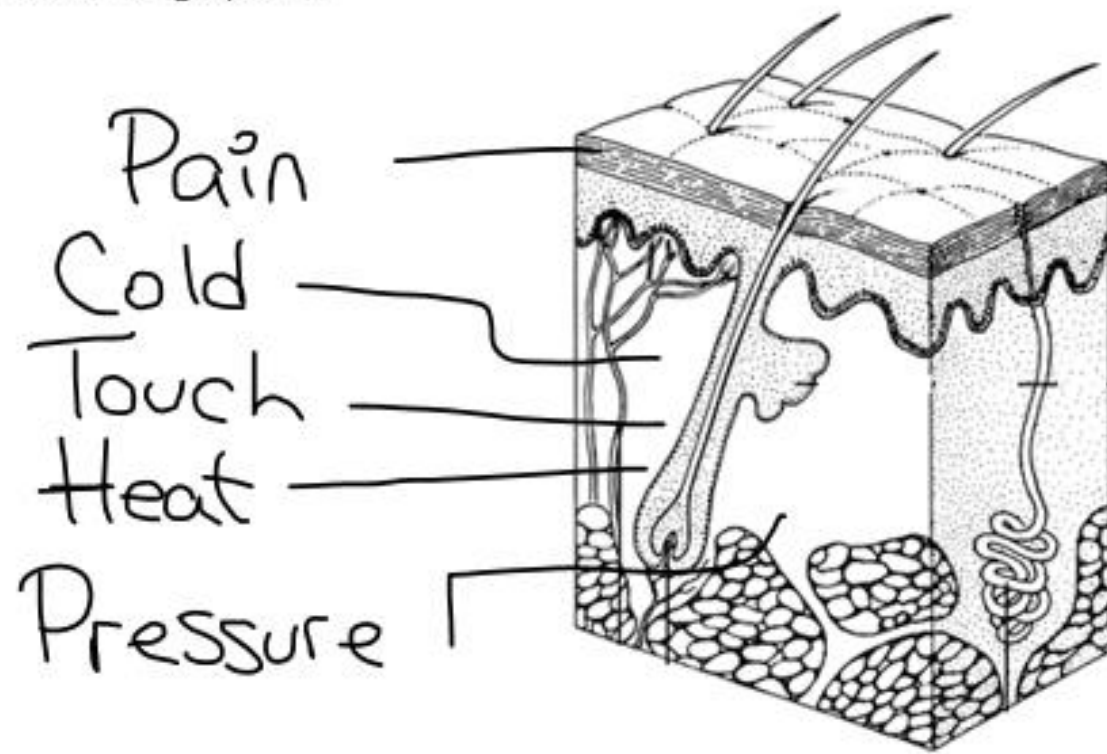
➤ Hypodermis includes fat cells

Sensory Receptors

Sensory Receptors in the skin allow us to experience the sensations of:

- Tactile sensations (such as touch and pressure)
- Thermal sensations (such as hot and cold)
- Painful sensations (such as pain)

Different receptors to feel each sensation are located in the following spots:



Musculoskeletal system

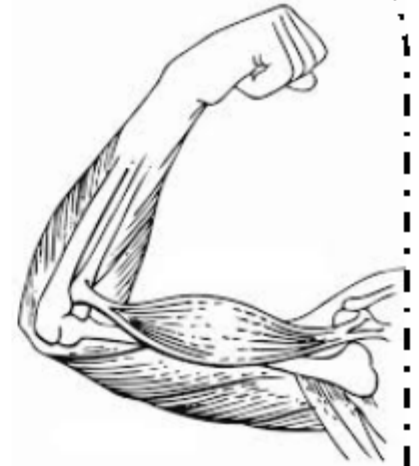
Muscles

Muscles

Muscles are found on bones and various organs. They help to shape our figure. They have the ability to contract causing our bodies (or our internal organs) to move.

Muscles have the following functions:

- Movement – Muscles make the mobility of the body's limbs and organs possible
- Posture Maintenance – Even non-moving, our muscles contract and release
- Joint Stabilization - Muscle movement supports and stabilizes joints.
- Heat Release – Helps maintain body temperature



There are three types of muscles:

- **Skeletal Muscle:** The only voluntary muscles. They are attached to the bones of skeletons and contract and move with the bones.

Tendons are what attach muscles to bones.

Skeletal muscles have little endurance, they tire easily.

- **Smooth Muscle:** Smooth muscle makes up the walls of certain internal organs (such as bladder, stomach and uterus). They are involuntary (they work without us thinking about it).

They are weaker than skeletal muscle but have more endurance (they work slowly but tirelessly).

- **Cardiac Muscle:** Only found in the heart. It is involuntary and has great strength and endurance.

