Sensory & Motor Mechanisms

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http://education-portal.com/academy/lesson/the-sensory-system-definition-parts-functions.html

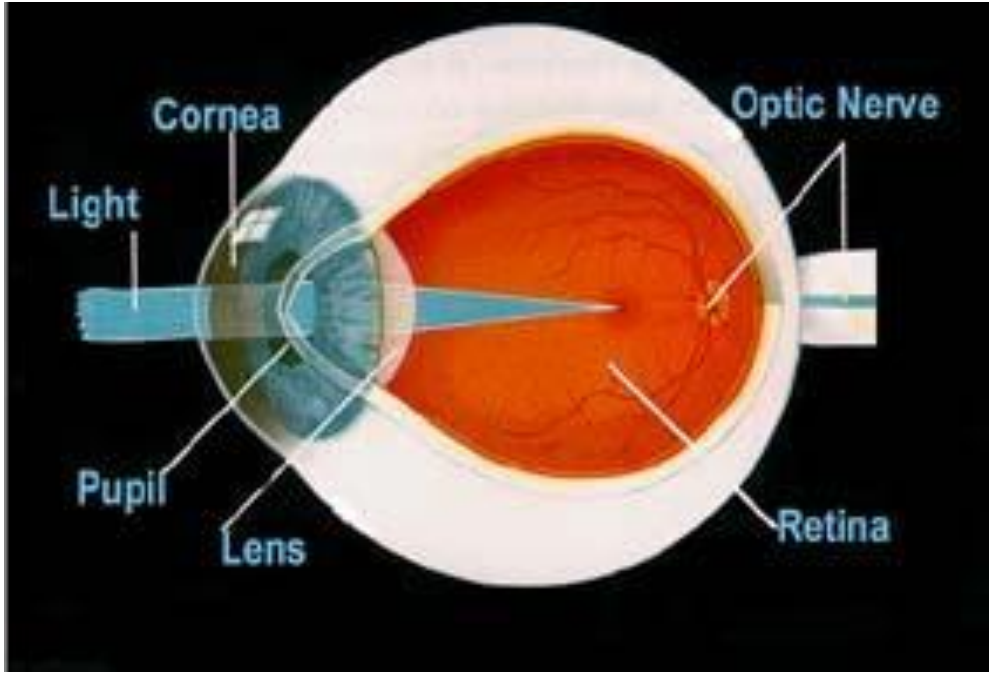
3:24 video

Sight

Vision has evolved independently several times, giving mammals, birds, fish, molluscs, and many more classifications of animals unique eyesight. Many animals have complicated eyes, like humans, whereas some have simple eyes, like scallops, which have 100 simple eyes. Mantis Shrimp also have the most complex color eyesight.

Animals acquired eyesight about 600 million years ago. About 540 million years ago, organs like eyes began evolving rapidly.

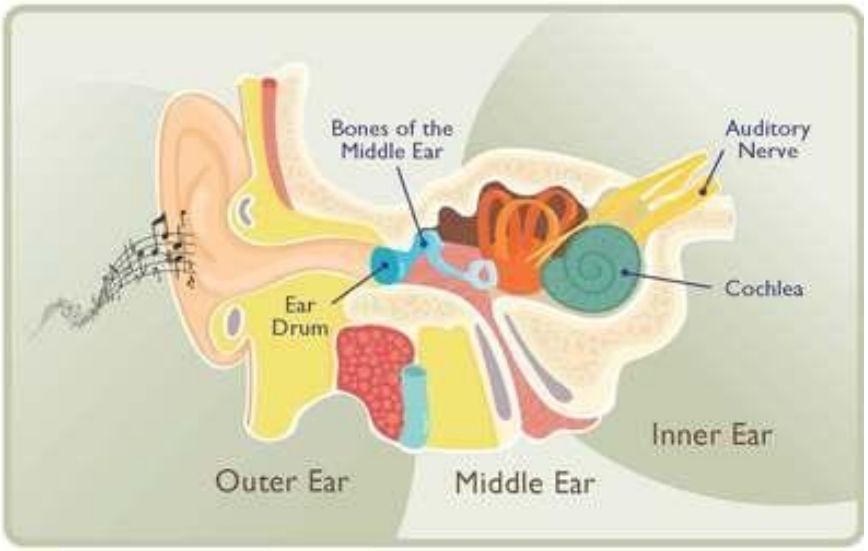
The eyes of humans and most other vertebrates work by letting light enter the eye through the pupil. The pupil is controlled by the iris. The light then makes contact with the retinas, which send signals along the optic nerve to the brain, identifying what colors are where.



Hearing

Hearing is a common sense among animals that allows the organism to process soundwaves.
All mammals, birds, and reptiles are evolved from amphibians, who evolve from fish.

Sound waves travel through a medium. The medium in question is usually gases in the air in the situation of hearing for most animals. The sound waves enter the ear canal, causing the eardrum to vibrate. Several small bones in the middle ear will move around in a chain reaction. This reaction interacts with a membrane of the cochlea and moves fluid within the cochlea. The fluid movement causes a response in the hearing nerve.

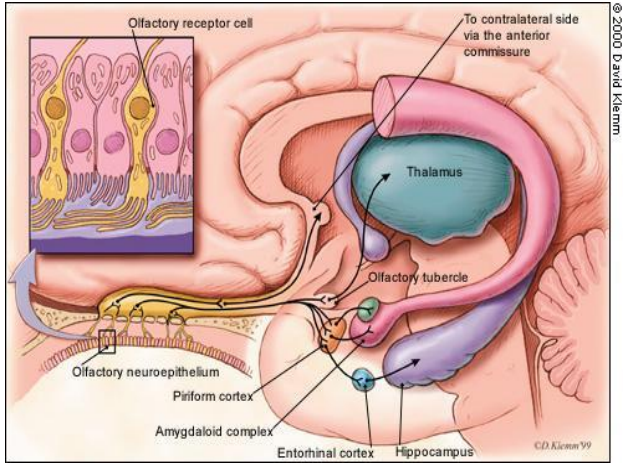


Smell (Olfaction)

Animals use smell to communicate, feed, recognize their location, recognize territory and find mates.

The receptive ends of cells contain cilia that extend into the layer of mucus within the nasal cavity. When an odorant diffuses into this region, it binds to a GPCR protein, called an odorant receptor located on the plasma membrane. cAMP opens channels in the plasma membrane, and these ions flow into the receptor cell, sending impulses along their axons to the olfactory bulb of the brain.

Homing pigeons have been known to use smell in order to find their nest.
Silk moths react to pheromones using their sense of smell.
Ants and bees use chemical senses to communicate.
Humans can distinguish thousands of different odors, caused by a structurally distinct odorant.
Each olfactory receptor cell expresses one odorant receptor gene.

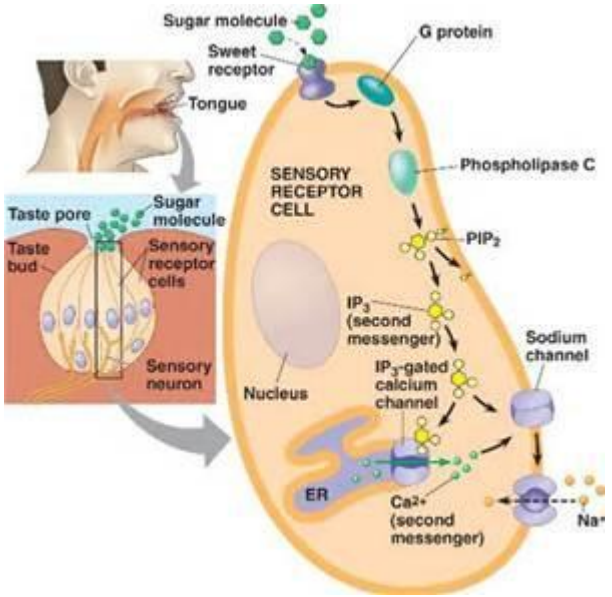


Taste (gustation)

Taste is used in order to select safe food, by using 5 types of tastants: sweet, sour, salty, bitter and umami. Any region of the tongue can detect any of the types of taste. The receptor cells for taste are modified epithelial cells, organized into taste buds.

Sweet, umami and bitter tastes require a G-protein coupled receptor. Humans have one type of sweet receptor, one type of umami receptor and 30 types of bitter receptors. Once a tastant molecule binds to a receptor, it triggers a signal transduction pathway, allowing for the opening of an ion channel, resulting in an influx of Na^+ .
The sour receptor belongs to the transient receptor potential family. The TRP proteins assemble into a channel in the plasma membrane. Binding of an acid/sour molecule results in a change in the ion channel, resulting in the activation of a sensory neuron.

Plant toxins in the diet of humans and animals resulted in the evolution of taste in animals. The ability to recognize bitter tastes allows humans and animals to detect toxins that may be too acidic or unfit for consumption.



Feeling

Feeling allows animals to react to stimuli in the environment, and detect physical deformation such as pressure, touch, stretch and motion. These receptors include mechanoreceptors, chemoreceptors, electromagnetic receptor, thermoreceptors, and pain receptors.

Sensory pathways begin with sensory receptors and transduction. Sensory information is transmitted through the nervous system through nerve impulses.

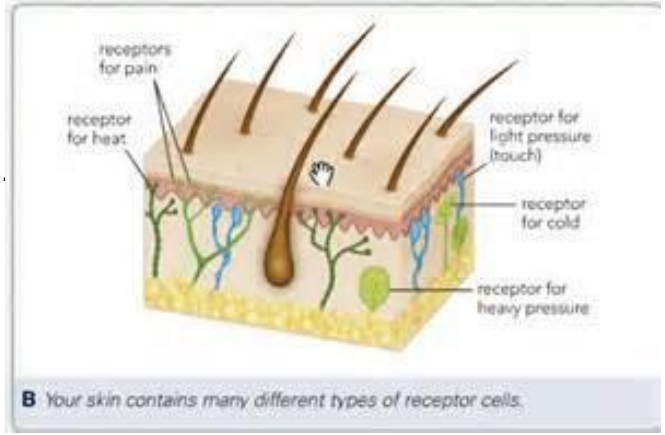
Mechanoreceptors sense physical deformation caused by pressure, touch, stretch and motion. They consist of ion channels linked to cilia, that extend outside the cell. When they bend or stretch, it alters the permeability of the ion channels.

Chemoreceptors detect changes in the total solute concentration of the blood and stimulate thirst.

Electromagnetic receptors detect various forms of electromagnetic energy.

Thermoreceptors detect heat and cold, and includes 5 types of TRP-type receptors.

Pain receptors allow animals to detect extreme pressure or temperature, and trigger defensive reactions.



B Your skin contains many different types of receptor cells.

Feeling 2

For crayfish, the bending of body muscle stimulates stretch-sensitive dendrites to open ion channels.

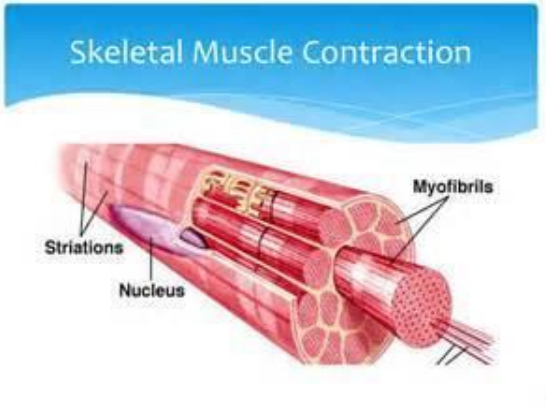
Cats and rodents have sensitive mechanoreceptors at the base of their whiskers to provide detailed information about objects nearby.

The platypus has electroreceptors that detect electric fields generated by the muscles of prey.

Muscle Systems

Muscle cells transform muscle contraction into locomotion in animals.
Muscle cells rely on microfilaments, powered by chemical energy to cause muscle contraction.
Skeletal muscle contains a bundle of myofibrils, composed of thick and thin filaments. Skeletal muscle is a striated muscle, meaning that there is a pattern of light and dark bands of filaments.
Muscle contraction occurs by the sliding-filament model. The myosin and actin molecules that make up the thick and thin filaments contain a long tail region and a globular head region. The tail adheres to the tails of other myosin molecules in the thick filament, and the head binds ATP, hydrolyzes it into ADP and an inorganic phosphate. The sliding-filament model means that neither the thick or thin filaments change in length, but rather just slide past each other longitudinally.

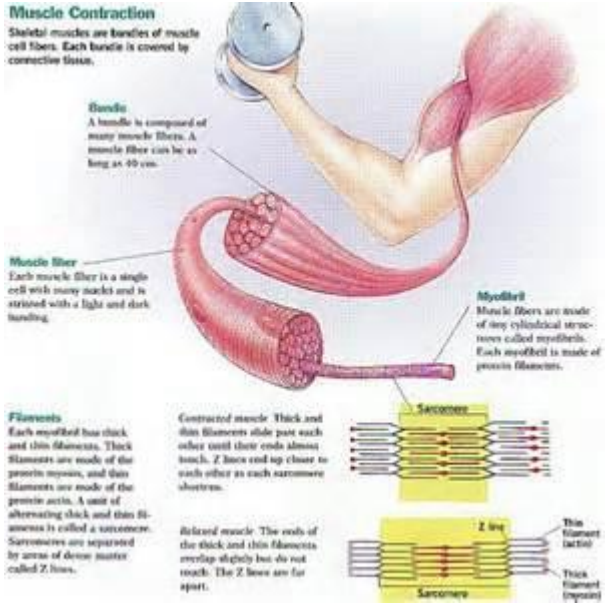
There are distinct types of muscle fibers. These include oxidative and glycolytic fibers, which enable them to use a steady supply of energy.



Types of muscle systems

There are distinct types of muscle fibers.
Oxidative and glycolytic fibers enable them to use a steady supply of energy.
Fast-twitch fibers and slow-twitch fibers allow animals to control the speed in which their muscles contract.
Cardiac muscle is found in the heart, and does not require a stimulus in order to contract, they routinely contract.
Smooth muscle lacks striation.

The rattlesnake's rattle is due to fast-twitch muscles, allowing it to contract and relax every 10 milliseconds.



Diseases

Central Pain Syndrome affects pain receptors in the body, and stimulates constant pain. Treatment includes pain medication to dull the pain and block neuroreceptors.

Usher syndrome affects both sight and hearing, resulting in deafness and tunnel vision. It is a hereditary disease.

Some people claim that cilantro tastes like soap. This is due to OR6A2, an olfactory receptor, which is overly sensitive to aldehyde chemicals, also prevalent in lye soap.

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