AmbujaNeotia

THE NEOTIA UNIVERSITY

ज्ञानम् आत्म प्रदीपाय

SUBJECT: HUMAN ANATOMY & PHYSIOLOGY II

II SEMESTER B.PHARM (1st YEAR)

PRACTICAL LAB MANUAL

EXPERIMENT NO- 1

Recording of Body Temperature

Requirements- Clinical thermometer

Procedure-

Set the lowest reading in the thermometer by holding the end opposite to the mercury bulb firmly & shaking it downwards carefully until it reads 95°F or less.

I. Recording of Mouth temperature:

a. Ask the subject to place the thermometer under the tongue, & close the mouth. Instruct the subject to use the lips & not teeth to hold the thermometer tightly in place.
b. During this, subject shall be instructed to breathe through the nose.
c. After 2 minutes carefully take out thermometer & record the temperature.
d. Take three readings at the interval of 5 minutes & calculate the mean body temperature.

II. Recording of Arm Pit temperature:

a. Ask the subject to place the thermometer in arm pit with arm placed against body.
b. After 5 minutes take it out & note the temperature.
c. Take three readings at the interval of 5 minutes & calculate the mean body temperature.

EXPERIMENT NO- 2

Recording of Basal Mass Index

Requirements- Length measurement tape or height measurement chart, weighing balance

Procedure-

I. Select the healthy subject.
II. Ask the subject to stand in upright position with heels against the wall and without wearing shoes/ chappals/ any footwear.
III. Measure the height in meters (1 feet= 0.3048 m; 1 inch=0.0254 m).
IV. Measure the weight in kg of the subject.
V. Calculate BMI using the following formula:

BMI= Weight (kg)/Height (m^2)

WHO classification for weight status

SL.No.	BMI	Category
1	<18.5	Underweight
2	18.5-24.9	Healthy normal acceptable weight
3	25.0-29.9	Grade 1 overweight
4	30.0- 39.9	Grade 2 overweight
5	≥40	Grade 3 overweight

EXPERIMENT NO- 3

Determination of Tidal Volume & Vital Capacity

Requirements- Spiro- meter

Procedure-

I. Select one healthy subject for the demonstration.
II. Bring the bell to its lowest position by gently pushing it down. Adjust the pointer needle at zero, which indicates that the bell is completely empty.
III. Make the subject to stand comfortably, facing the spirometer to see the movement of the bell.

Measurement of Vital Capacity:

I. After normal breathing for one minute, ask the subject to breathe as deeply & forcibly as possible to fill the lungs.
II. In this position, ask to expel all the air with maximum effort into the spiro meter. The bell moves up & the pulley indicates the volume of expired air (The forced expiration should be deep & quick but without excessive speed.
III. Take two more readings at interval of 5 minutes.
IV. Repeat this procedure in sitting position.

Measurement of Tidal Volume:

I. Ask the subject to breathe normally (quiet breathing) for the period of one minute.
II. In this position, ask him or her to expel the air with normal expiration. The bell moves up & the pointer on the pulley indicates the volume of expired.
III. Take two more readings at interval of 5 minutes.
IV. Repeat this procedure in sitting position.

EXPERIMENT NO- 4

Examination of the different types of taste

Requirements: Sucrose solution (10%), sodium chloride solution (15%), and acetic acid solution (1%), dropper bottles, cotton swab.

Procedure:

I. Select healthy human subject.

II. Ask the subject to produce his tongue. The tip of the tongue may be held with gauze if required.

III. Examine & identify the areas on tongue having large concentrations of papillae & taste buds.

IV. Ask the subject to rinse the mouth with water & dry it with gauze. Moisten a swab with a few drops of sugar solution & apply it to the tip of the tongue. Ask him/her to indicate, the taste experienced the taste & note this.

V. Repeat the procedure with all remaining solutions by applying them one by one, on the sides near the tip, the anterior 2/3rd, & the posterior 1/3rd of the tongue. The care must be taken to avoid spreading of test solution across the midline.

VI. Record the results as per taste perceived, & grade the intensity of taste sensation as per the scale.

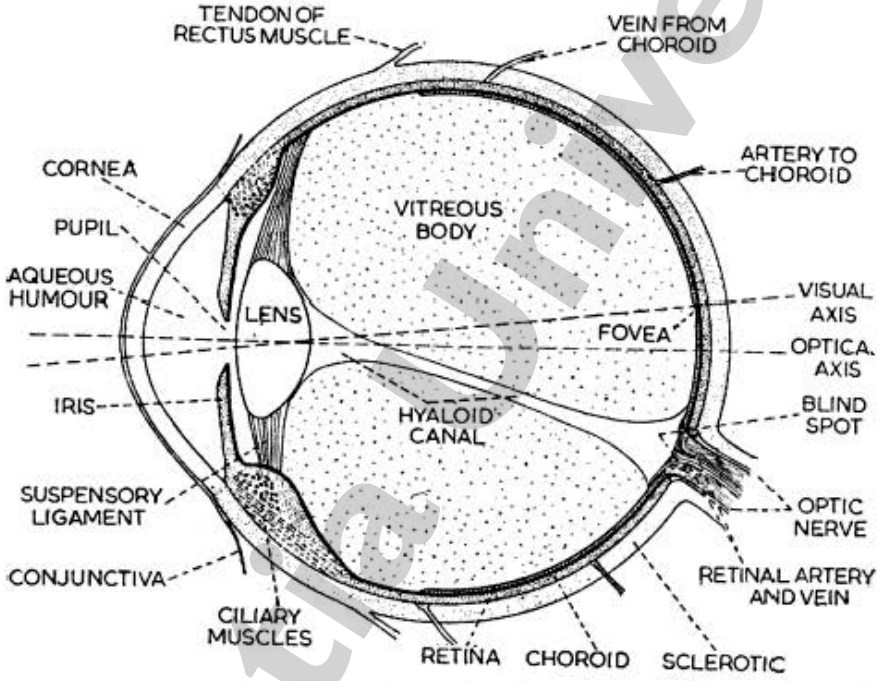
Intense (++++), Moderate (+++), Mild (++), Slight (+), Absent (0)

Sense Organs

EXPERIMENT NO- 5

EYE:

The human eye is not much in use as a professional tool of astronomy. On the other hand, it is of great interest to understand how it works and by doing so we may illustrate many of the principles and problems that we will meet later in the course. The eye and brain work together, and the brain can correct for many of the aberrations suffered by the eye. Thus the



brain compensates for the fact that the image on the retina is inverted and for chromatic aberration.

Cross section of the human eye (left), illustration of the eyes receptor cells; cones, used for color vision with the iodopsin layers arranged to the rigth, and rods with rhodopsin layers. Light enters these cells from the left before being absorbed by either iodopsin or rhodopsin

Light is focussed on the retina, where there are two types of receptors: rods and cones. Cones for color reception, rods for black and white with higher sensitivity.

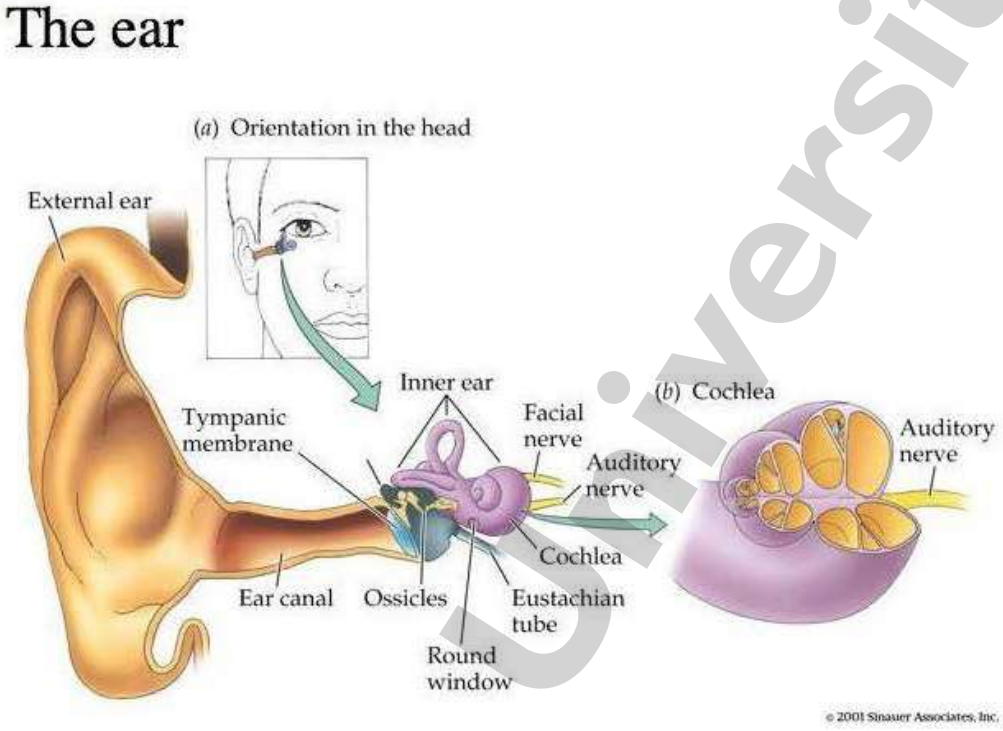
In the rods a pigment known as rhodopsin absorbs radiation. A protein with a weight of some 40,000 amu, arranged in layers 20 nm thick and 500 nm wide. Under influence of light a small fragment, a chromophore, will split off. The chromophore is a vitamin A derivative called retinal (or retinaldehyde) with a molecular weight of 286 amu. The portion left behind is a colorless protein called opsin. The moment of visual excitation occurs during this break off process as the cell's electrical potential changes. This

change in potential can then propagate along nerve cells to the brain. The rhodopsin molecule is then (slowly) regenerated.

The response of cones is similar, but in this case the pigment is known as iodopsin which also contains the retinaldehyde group. Cone cells come in three varieties with different spectral sensitivities.
In bright light much of the rhodopsin is broken up into opsin and retinalde- hyde, and the rod sensitivity is much reduced so that vision is primarly provided by the cones, even though their light sensitivity is only of order 1% of the rods.
The three varieties of cones combine to give color vision. At low light levels only rods are triggered by the ambient radiation and vision is then in black and white.
Upon entering the dark from a brightly lit region rhodopsin will build up over a period of roughly 30 min, thus dark-adaptation takes this long and is base on rod cells. Somewhere between1–10 photons are necessary to trigger an individual rod. However, several rods must be triggered in order to result in a pulse being sent to the brain as many rods can be connected to a single nerve fibre. The total number of rods is of order 10^8, of cones 6×10^6, these must share some 10^6 nerve fibres. Thus there are roughly 100 visual receptors per nerve fibre, note that there can be many cross connections between groups of receptors. Cones are concentrated towards the fovea centralis which is the region of most acute vision, while rods are most plentiful towards the periphery of the field of view. Weak objects are thus most easily visible with averted vision, ie when it is not looked at directly. In sum with all these effects the eye is usable over a range of illuminations differing by a factor $10^9 - 10^{10}$.
The Rayleigh limit of the eye, roughly given by λ/D where λ is the wave-length of the observed light and D is the size of the observing aperture, is of order 20 arcsec when the iris has its maximum diameter of 5–7 mm. However, for two separate images to be distinguished, they must be separated by at least one unexcited receptor cell, so even on the fovea centralis resolution is limited in practice to between 1 arcmin and 2 arcmin. This is much better than elsewhere on the retina, since the fovea centralis is populated by small, tightly packed, singly connected cones. The average resolution of the eye lies between 5 arcmin and 10 arcmin. The effect of granularity of the retina is countered by rapid oscillations of the eye through a few 10 arcsec with a frequency of a few Hz, so that several receptors are involved in the detection when averaged over time.

EXPERIMENT NO- 6

EAR



Outer ear, middle ear, inner ear
Outer ear: Pinna - external part, Auditory canal

Middle ear: Eardrum - hard membrane, Ossicles

Inner ear: Oval window, Cochlea, Auditory nerve
The Pinna's function is to help in direction finding at high frequencies and helps funnel high frequencies into the auditory canal. The auditory canal acts as a resonant cavity in the range of 3,400 Hz, and causes our hearing to be more sensitive in this range.

Middle ear: Eardrum - hard membrane, Ossicles
The eardrum is a little more then 0.5 cm in diameter. Its function, along with the ossicles (hammer, anvil, stirrup), is to convert the sound waves into mechanical vibrations.
Remember that sound is pressure waves and that pressure is force/area. The mechanical vibrations carried through the lever action of the ossicles presses on the oval window in the cochlea. The cochlea is very small, in

part, to be able to detect very small vibrations. The middle ear enhances the sound wave energy two ways.
First, through a reduction in size of the oval window relative to the size of the eardrum, the area of the oval window is 20-25 times smaller than the eardrum,
Second, through a level action of the ossicles, this increases the force imparted on the oval window by 30%. The net effect is to increase the pressure up to 30 times on the much smaller oval window of the cochlea.

Eardrum - changes pressure fluctuations into mechanical vibrations.
Ossicles - transfer these vibrations to the oval window of the cochlea.
hammer, anvil and stirrup

The function of the inner ear

Cochlea - tapered, coiled tube, snail shaped, size of a pea! Stretched out it would be about 3 cm long. The cochlea is a very complex, very small device that converts the mechanical vibrations into neural impulses.

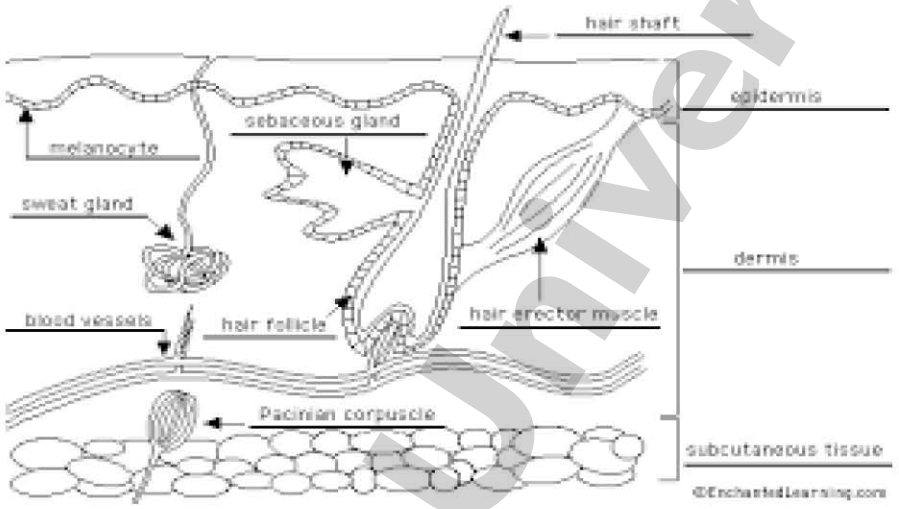
How the Cochlea works

Two tubes connected at the end of the cochlea (scala vestubuli and scala timpani) are filled with fluid called perilymph. Vibrations pass from the oval window to the round window, when the oval window pushes in the round window pushes out and vice-versa. The basilar membrane and related structures (cochlear duct, organ of corti), vary along the channel from thin and stiff to thick and loose. The cochlear duct is filled with viscous fluid called endolymph that is like spinal fluid. This causes the cochlear duct to be acoustically inactive. The vibrations of the basilar membrane primarily determine what we hear. The organ of corti rides along as the basilar membrane vibrates and senses its motion. High frequencies tend to vibrate the front end of the basilar membrane and low frequencies vibrate the back end.

Hair cells (approx. 24,000) sense the vibration of the basilar membrane and excite nerve cells that send nerve impulses down the individual fibers of the auditory nerve. The nerve cells fire more frequently when the vibrations are large amplitude. In fact, the hairs themselves vibrate when stimulated causing a positive feedback mechanism (this is a fairly recent research result). The location of the vibrations and the associated nerve impulses crudely determines the frequency of the sound. The auditory cortex in the brain does much more "signal processing," helping us to better distinguish musical sounds.

EXPERIMENT NO- 7

SKIN



The first, topmost, or superficial, layer of the skin the sun's rays hit is called the **epidermis**. Again, the **epidermis** is the outermost layer of the skin. The epidermis is itself made up of several layers. From outer to innermost, they are the:

- Stratum corneum
- Stratum lucidum
- Stratum granulosum
- Stratum spinosum
- Stratum basale

Do note, however, that the stratum lucidum is typically only found in places like the soles of your feet or the palms of your hand. Regardless, it's pretty easy to remember the exact order of the layers of the epidermis. Since we're on the topic of possible sunburns, the coolest mnemonic to remember the layers of the epidermis from top to bottom, or superficial to deepest, is:

'Come, Let's Get Sun Burn'.

Each word's first letter represents the first letter of each layer. In case you were wondering, the **epidermis** is actually the layer of skin that is primarily affected in most cases of sunburn and begins to peel off if damaged by the light's dangerous UV rays.

Types of Skin Cells

However, your skin isn't a weakling, and does have a defense mechanism that tries to fight off dangerous ultraviolet rays found in sunlight. In the deepest layer of the epidermis, the stratum basale, which is also sometimes called the basal layer, are cells called **melanocytes**. These are cells that produce the pigment melanin. It is this substance, melanin, which determines the skin color of an individual. Those with larger amounts of melanin in their skin have darker skin, or their skin darkens with more exposure to sunlight.
Melanocytes in the basal layer of the epidermis produce the pigment melanin, basically, as the sunlight hits your skin, the light rays stimulate the production of melanin by melanocytes. Since the majority of melanin is called eumelanin, which is a brownish black color, your skin begins to darken as more melanin is produced. Keep in mind that this melanin isn't produced to give you a nice tan for aesthetic reasons, but instead, helps protect you from cancer-causing ultraviolet radiation found in the sunlight that is baking and peeling your skin off at the beach. At least the pale vampires who come out after twilight don't have to worry about this.

Pale vampires' aside, your epidermis has other cells that are quite important. One of these cells is called **keratinocytes**. **Keratinocytes** are cells that eventually die in order to comprise the majority of the stratum corneum. The keratinocytes actually originate in the stratum basale, but as they mature and age, they move from the deepest to the most superficial layer of the epidermis.

Once the really old keratinocytes reach the stratum corneum they are known as 'corneocytes'. The corneocytes are basically the cells that are shed off your skin and become part of the dust floating around you. Disgusting, isn't it? When you inhale dust, you also inhale dead human skin cells.

As yucky as that might sound, the keratinocytes do play a lot of important roles. One of these roles actually involves the melanin produced by melanocytes. The keratinocytes take up and store some of the melanin

produced by the melanocytes, and this gives your skin an extra layer of protection from the damaging ultraviolet radiation of the sun's light rays.

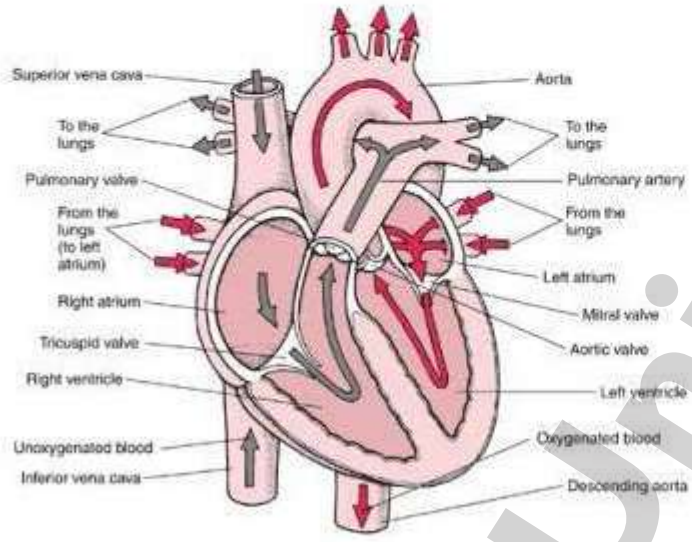
Keratinocytes store melanin, giving skin an extra layer of protection from UV rays
In addition to housing young keratinocytes and melanocytes, the basal layer of your skin also contains other cells, such as **Merkel cells**, which are cells that are important in the sensation of touch.

With all of that in mind, I do have an important point to make. The topmost layer of your skin we are going over, the epidermis, is made up of something called 'squamous' cells, which are basically a bunch of really flat cells. Bearing those squamous cells in mind, the 'basal' layer of the epidermis where the 'Merkel' cells and 'melanocytes' are located, it should come as absolutely no shocker that:

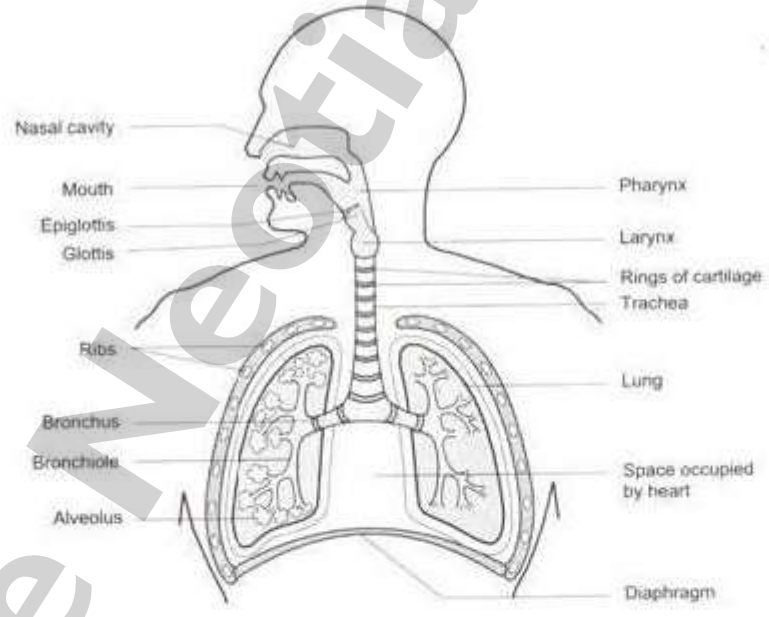
- Squamous cell carcinoma
- Basal cell carcinoma
- Merkel cell carcinoma
- Melanoma

are just some of the types of skin cancer you can get due to overexposure to damaging ultraviolet radiation from the sun's light rays. The next time you're frying at the beach, remember, your tan may be pretty, but skin cancer looks really nasty.

Cardio Vascular System

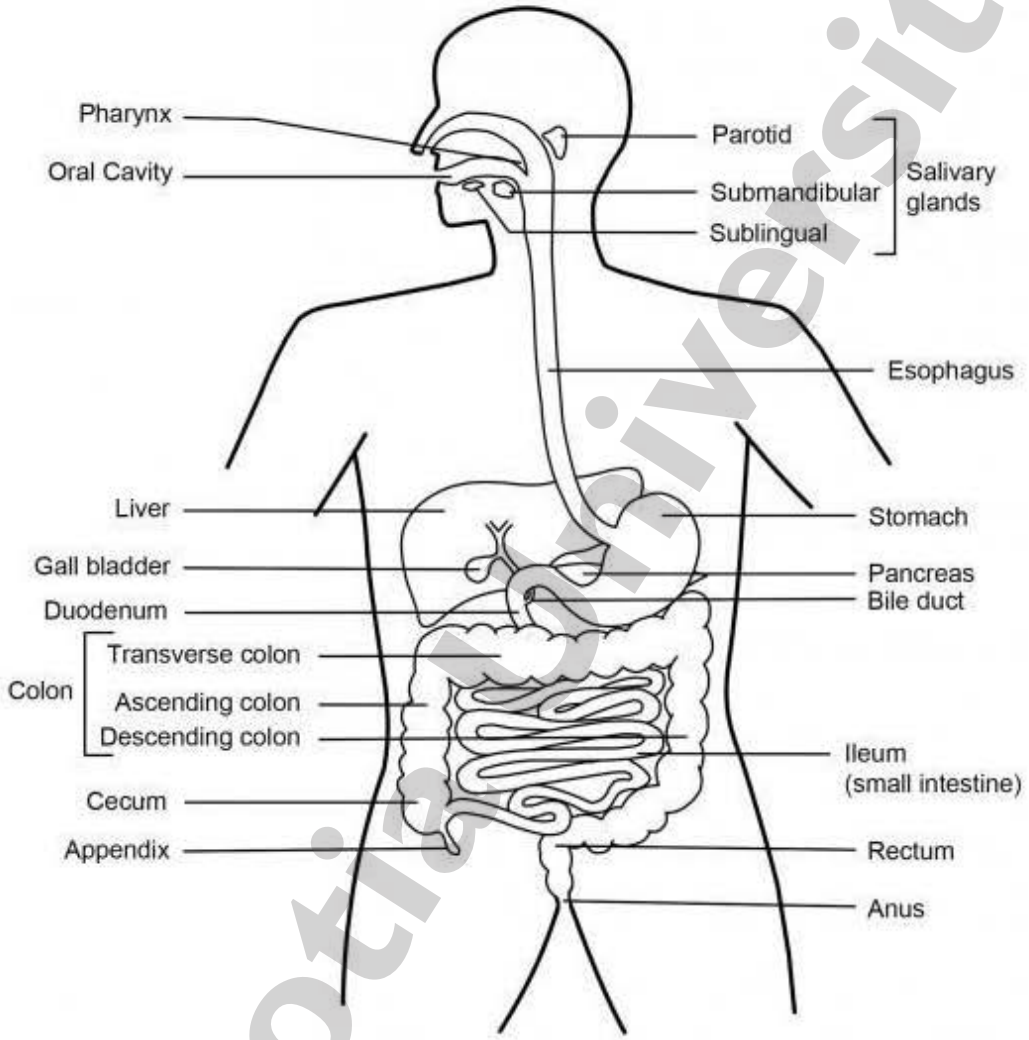


Respiratory System

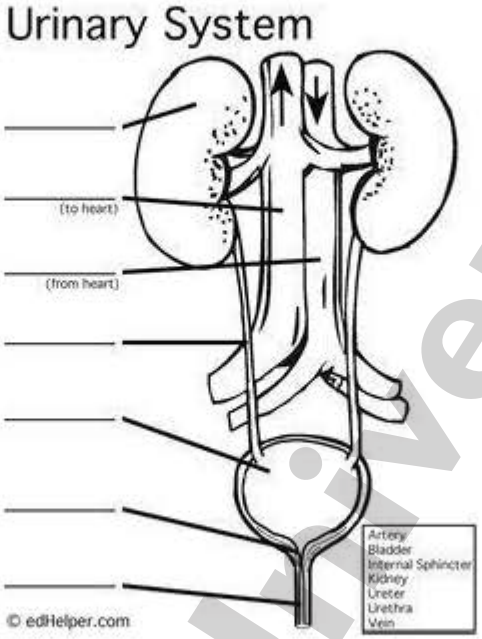


Human respiratory system

Digestive System



Urinary System



Brain