

ch1. Introduction to physiology

→ Gross → whole body

→ Microscope → cells (accurate for cellular)

endoplasmic reticulum → produces lipids and store calcium.

Hormonal cells has alot of endoplasmic reticulum.

Enzymatic cells has alot of endoplasmic reticulum with attached ribosomes.

→ Developmental → the progress of growth.

grow → activation for more cells & the cells are already in the body but they aren't active. When the person get old, more cells will be activated. & which means develop.

→ physiology → connects the structure and the function.

The body composed of atoms.

chemical level produce cellular level.

atoms + molecules = cells

pancreas have alot of beta cells → each beta cell excrete 1 nano insulin → so to cover the body's need for insulin, they co-operate with each other.

Tissue → Magnify the function of the cell.

Each tissue requires another tissue to survive to take O_2 + nutrients and remove wastes).

One tissue by itself can't survive.

Stomach $\rightarrow$ organ.

Digestive system $\rightarrow$ digest and absorption so its more accurate to call it Gastrointestinal system.

Question $\rightarrow$ What is the function of O_2 in the body (why we need it?)

Answer $\rightarrow$ because its the ultimate acceptor for the electrons in the electron transfer cycle so the electrons don't accumulate and the electron transfer cycle and Krebs' cycle don't stop.

organism $\rightarrow$ community $\rightarrow$ ecosystem

* we have 11 system in the body.

* The systems and organs are interrelated together.

$\rightarrow$ urinary system regulate water, vitamins ... etc by kidney + eliminate waste but regulation is the most important (renal system) your kidney aren't aim to remove wastes but it aims to regulates water, nutrients, acid balance. At the same time it requires water, energy, O_2 , control to do its job

everything works in harmony to live in a healthy life.

Skin gives the boundaries of the body, also gives the boundaries of the cell is the cell membrane.

→ Responsiveness → you have receptors that tell you that your temperature is lower than the internal rate

There are 2 responses →

• external → 5

• internal → hundreds

we have hundreds of senses inside the body

// // 5 // // outside // //

every sensation has a specific receptor.

receptors → Transduces from one energy to ^{electrical} energy and it's specific.

Excretion → we need to remove ^{byproduct} that produced from the chemical reaction (to let the body stable).

every chemical reaction is important otherwise we can't live.

→ Reproduction → to repair the damage (cellular and organismal level are both needed).

→ we can identify the cell by its membrane

Movement not only the physical movement where the cell contract it's also the internal movement in and outside the cell or in the tract etc

your body is way intelligent than you, they sense the production of urine, they sense the need of water...

Fear, thirstiness → sensation.

The cell can't survive without water.

The body is full of water but it doesn't go out because of the boundaries (Kitten).

The cells have to contain and surrounded by water.

high temperature for the body make a denatured of proteins (enzymes). So the function will destroy.

The body regulate the temperature by itself (sweat).

The normal body temperature $\rightarrow 37^{\circ}$

$\rightarrow$ decrease pressure can affect the body negatively so we can't breathe properly because the amount of O_2 will be low.

$\rightarrow$ increase pressure can damage so many organs in the body

When I sleep with my mouth open my saliva will dry that's mean that a lot of the cells died because the liquids around it dried.

Homeostasis $\rightarrow$

For example $\rightarrow$ the rate of my heart now is 75 beat per minute

when I run it will be 120 beat per minute

when I sleep it will be 60 beat per minute

Which one of these are the normal rate?

answer $\rightarrow$ all of them are normal in these condition, our body isn't stable it's dynamic to reach equilibrium state.

$\rightarrow$ It's important to keep the atmospheric pressure at limit

$\rightarrow$ It's important to keep the temperature of the body stable at 37° .

Note → We can't say it's normal if we are sleeping and the rate is 100 beat per minute.

Homeostasis is working in each body to make it equilibrium.

To make it equilibrium at everytime we need control systems.

How does that occur →

We need 3 things →

① We need a receptor to sense

The change that happened → So

The receptor will be located

Somewhere near the brain. FOR

THAT SENSE of standing up, the

receptor will tell blood pressure is

dropped, these receptors are

actually located within the carotid

arteries (are the one that supplies

with the blood), they

sense the blood pressure fall

because it has baro receptors

② Sent the information to control

system — they need

some one to adaptate, so it

will be sent to the brain.

Example →

When we suddenly

stand up, for a couple of

seconds you will feel dizzy

because when you stood up,

the blood was drawn

down because of the gravity

your system

within your body will

readjustment quickly

so it will quickly start to

squeeze (contract) in the blood

vessels so many blood will go

up to adjust it and

do equilibrium.

③ Effector → it will

activate certain mechanism

called autonomic nervous

system which will send information squeeze blood vessels in the rest of the body so we'll push blood away.

Example

① Receptor will tell the body that the sugar dropped

We went to the univer without breakfast then the sugar will drop

Note →

Glucagon → breaks down glucose

insulin → build up glucose

③ The pancreas will start releasing glucagon that breaks down glucose in the liver and send it to the blood (sugar increases)

② the information will be sent to the control center (which is the pancreas) and it will sent to the brain

Short term



pancreas

Long term



hunger center

so we start thinking of food.

Negative Feedback →

When the sugar increases we asked the pancreas to produce insulin to reduce it. Then, we asked pancreas to produce glucagon to increase it both are Negative Feedback. The same thing for blood pressure, hormones

positive Feedback →

birth process → First, it will be a contraction in the uterus then it will send a message to the pituitary gland to release the oxytocin hormone then the contraction will increase so the oxytocin will increase and the contraction will increase too.

Also, when we cut our fingers a tissue factor will be released. The damaged tissue will release a certain chemicals called tissue factors which will will active the neighborhood platelets, More activated for the platelets, More platelets will be contracted to form a plug

Feed Forward → V. important

When we go down the stairs, we put the first leg down and then the another without looking that's because the body (brain) calculate the rate contraction muscle by itself and you move down the stairs or up

Feed back $\rightarrow$ when the event occur

Feed forward $\rightarrow$ before // // // (Skawronus)

question $\rightarrow$ What happens if the homeostasis failed?

answer $\rightarrow$ An illness

Note $\rightarrow$ Illness is not always related to infection

It related to disorders in the body

$\rightarrow$ Kosiac model $\rightarrow$ bilayer of phospholipids and proteins embedded in it

(2 Types of transport)

passive

Small, hydrophobic chemicals (non polar)

(Simple diffusion)

They dissolve in

Lipid

Facilitated diffusion

we need a channels to move chemicals

through (they are specific) they can

be open (leaky)

or regulated

if need molecules

and concentration

ingradient.

Also we have a voltage-gated channel that need the voltage to be changed from a certain voltage facilitated to a higher voltage.

Mechanically gated channels $\rightarrow$ certain chemical compounds will open Mechanically to allow it to pass

passive $\rightarrow$ ideal simple diffusion through the bilayer directly
 $\rightarrow$ or with facilitation $\rightarrow$ we required protein so that allows pass of what going through the channel or carrier (to allow chemical compounds specially the electrolytes to pass across the membrane) so we can get chemicals to pass through because of what is known as the gradient.

chemical compounds needs $\rightarrow$ chemical gradient
to pass the open channel $\rightarrow$ charge $\rightarrow$ electrochemical gradient

Theres some cases that doesn't apply the passing of chemical compounds why?
due to the electrochemical gradient

we have a high concentration of potassium inside the cell and a low concentration of potassium outside the cell and we have a channel of potassium so the potassium will go outside the cell from the higher concentration to the low concentration, but if we have inside the cell proteins which are large in size and has a high negative charge so the negative charge will attract the positive charge in potassium so the chemical gradient will push the potassium outside the cell while the electrical gradient try to hold in potassium to stay inside the cell so this means we have 2 forces → chemical gradient pushing to the outside
→ electrical gradient pushing to the inside

so the potassium in this case is lying under 2 forces and those forces are against each other so it doesn't move inside or outside so it's in equilibrium. So we have potassium channel and chemical gradient but the potassium didn't go outside due to the electrochemical gradient

so its important to know what's factors affect the movement of ions or electrolytes across the membrane and it's not always necessarily to be only the chemical gradient we can get with else like the electrical gradient

if we get one single cell and we insert an electrode inside the cell and have another electrode outside the cell (we left the cell inside an aqueous solution) this is called earthing and then we connect them to a voltmeter we will find that there is a voltage difference between the inside and the outside (usually found in epithelial cells)

The active transport $\rightarrow$ direct $\rightarrow$ primary active transport like in nerve cells we have a pump called sodium-potassium pump

we have a high conc. of sodium ^{up} and a low conc of sodium down so we need to move sodium from the low conc. to the high conc. down conc. gradient (from high to low) this is passive but against conc. gradient (from low to high) this is active which requires energy and pumps. I'm going to move sodium from inside to the outside the cell against the conc. ingradient and I'm going to move the potassium from outside to the inside the cell against the conc. ingradient it's usually active in nerve cells (primary active)

→ secondary active transport
we give the sodium the energy to pass but during its movement it take another thing and make it enter with it like glucose. Glucose was meant to have the energy for Glucose. The energy was utilized by the Na but this enter due to the activation and the channel of glucose was opened (indirectly enter). Sometimes the sodium enter the cell and the urine goes outside due to the extrusion of the Na^+ (antiport) (Secondary active)

S port → entering 2 molecules in the same direction
antiport → " " " " " " opposite "

S port → glucose + Na^+
antiport → urine + Na^+

Calcium pump requires energy to move calcium against its conc. ingradient.

Sodium-potassium ~~both~~ both are against the conc. ingradient in the same carrier & sodium-potassium pump

→ cytolysis → we have a large Molecule that the channel are not able to allow to cross the channel. So we physicalize

that chemical compound and
we force it in or out

Figure 3.13 →

3.13b

The cell membrane is moving around and then
it will connect and this connect that vesicle.
This vesicle become part of the cell membrane.
This is called phagocytosis or endocytosis.

3.13a

we have chemicals, we put it in vesicle and
the vesicle started to approach the cell membrane.
then its connect to the cell membrane and there
will be a cut or split for the cell membrane
and the vesicle and the vesicle itself become a
part of the plasma membrane and the compound will
exist the cell (exocytosis).