ZIAUDDIN UNIVERSITY
EXAMINATION BOARD

RESOURCES FOR

"HSC-IIZOOLOGY

ZUEB EXAMINATIONS 2021

PREFACE:

The ZUEB examination board acknowledges the serious problems encountered by the schools and colleges in smooth execution of the teaching and learning processes due to sudden and prolonged school closures during the covid-19 spread. The board also recognizes the health, psychological and financial issues encountered by students due to the spread of covid-19.

Considering all these problems and issues the ZUEB Board has developed these resources based on the condensed syllabus 2021 to facilitate students in learning the content through quality resource materials.

The schools and students could download these materials from www.zueb.pk to prepare their students for the high quality and standardized ZUEB examinations 2021.

The materials consist of examination syllabus with specific students learning outcomes per topic, Multiple Choice Questions (MCQs) to assess different thinking levels, Constructed Response Questions (CRQs) with possible answers, Extended Response Questions (ERQs) with possible answers and learning materials.

ACADEMIC UNIT ZUEB:

1. **Extended Response Questions (ERQs)**

HOW TO ATTEMPT ERQs:

- Write the answer to each Constructed Response Question/ERQs in the space given below it.
- Use black pen/pencil to write the responses. Do not use glue or pin on the paper.

SECTION C (LONG ANSWER QUESTIONS)

1. DescribethestructureofNephronandexplainthe regulatoryfunctions ofkidney.
   OR DefineSkeletalmuscles anddescribethestructureofSkeletalmusclefiber?

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S. NO	ERQ	ANSWER	CL	DL
1	DefineSkeletalmuscles anddescribethestructureofSkeletal musclefiber	**STRU** **CTUR** **EOFS** **KELE** **TON** **MUSC** **LES** **MUSC** **LEFI** **BRE:** Eachskeletonmuscleisactuallyabundleoflongandparalle lcloselypackedthread like multinucleated cells called the musclefibers. **SIZE:** Skeleton muscle fibers are huge cells. Their diameters are 10 to 100 mm. **STRUCTURE OF MUSCLE FIBRE:** EachmusclefiberisboundedbythinelasticmembranecalledSarc olemma.Similarto plasmamembrane.Insidethesarcolemma,thereisasemifluidcall edSarcoplasm. **MYOFIBRIL:** Eachmusclefibrecontainalargenumberofmanyi ndividual,ultramicroscopic contractile fine thread like structure calledMyofibril. Thediameterofmyofibrilis1-2mmthatruninparallelfashionandextendentire length of thecell. **SARCOMERE:** The myofibrils consist of smaller contractile units called Sarcomere. **STRUCTURE OF SARCOMERE:** Ineachsarcomereaseriesofdarkandlightbandareevidentalongth elengthofeach myofibril. **MICROFILAMENTS:** Themyofibrilcontainsmyofilamentsormocrofilaments. Microfilamentismadeupof two types offilament. i. ThickFilament ii. ThinFilament	U	M

		i. THICKFILAMENT: Thecentralthickfilamentsextendtheentirelengthoftheband.Thethickfilament which is about 16mm in diameter is composed ofmyosin. **STRUCTURE OF MYOSIN:** Eachmyosinmoleculehastailterminatingintwoglobularheads.Myosintailconsists oftwolongpolypeptidechaincoiledtogether.Theheadsare sometimescalledcross bridge because they link the thick and thin myosin filaments together during contraction. **ii. THINFILAMENT:** Thethinfilamentsextendacross.TheI-bandandpathwayintoA-band.Thin filamentsare7-8mmthickandcomposedofchieflyactinmolecule. **STRUCTURE OF ACTIN:** The actiN molecules are arranged in two chains which twist around each other like twisteddoublestrandofpcarls.Twistingaroundthechains aretwostrandsofanother proteintropomyosin.Theothermajorproteininthinfilamentistroponin.Itisactually three polypeptide complex. One bind to actin, another binds to tropomyosin while third binds calciumions. **I-BAND:** The area which appear light and contain only thin filament is called I-Band. **H-BAND:** The area which appear bright and contain only thick filament is called H-Band. **A-BAND:** Theareaofsarcomerewhichappeardarkandcontainboththickandthinfilamentis calledA-Band		
2	Describe the structure and functions of different parts of the human brain. (Diagram is notrequired.)	**PART OF BRAIN:** The brain consists of three parts 1. ForeBrain 2. MidBrain HindBrain FOREBRAIN: Fore brain can be divided into two regions i. Telencephalon ii. Diencephalon **I. TELENCEPHALON:** Thelargestpartoffore-brainwhichisdifferentiatedintotwocerebralhemisphereor cerebrum is calledTelencephalon. **CEREBRUM:** Cerebrumisthelargestpartofthebrainandisdividedintotwohalvescalled C	**R**	**M**

erebral Hemisphes.

CEREBRAL HEMISPHERE:

Eachhemisphereconsistofanoutergreymatterorcerebralcortexandanin nerwhite matter.

CEREBRAL CORTEX:

Cerebralcortexisthelargestandthemostcomp lexpartofhumanbrain.
Itishighlyconvulatedtooccupythegreaternum berofinterneurons.

CORPUS CALLOSUM:

Thetwocerebralhemispherecommunicatewitheachotherbymean soflargebandof axons called CorpusCallosum.

PART OF CEREBRUM:

Functionally,thecerebrumisdiff erentiatedintofourlobes.
Anterior FrontalLobe
Lowe
rCent
ralTe
mpor
alLob
ePari
etalL
obe
Dors
al
Occip
italLo
be

FUNCTION OF CEREBRUM:

Cerebrumisconcernedwithintelligencememory,learning,resonin gandoverall control of all voluntaryactions.
It involved in all conscious activities.
It co-ordinated different senses together.

2. DIENCEPHALON:

The diencephalons consists of two parts
i. Thalamus
ii. LimbicSystem

I. THALAMUS:

Theclearinghouseforsenso ryimpulsesiscalledThalamu s. Functions
Itreceivesthemfromdifferentpartsofbrainandrelaysthemtoth eappropriatepart of the motorcortex.
It also involves in the perception of pleasure and pain.

II. LIMBICSYSTEM:

Thelimbicsystemislocatedinanarebetweenthethalam usandcerebrum. Parts of LimbicSystem
The limbic system consists of
i. Hypothalamus
ii. Amygdala
iii. Hippocampus

I. HYPOTHALAMUS:

HypothalamusisthepartoflimbicsystemwhichiscalledThermostaloftheb ody. Functions
Thehypothalamusisimportant inregulationofhomeostasis.
It regulates pituitarygland.
Italsoregulatebodytemperature,bloodpressure,hunger,thirst,ag gression,pleasure andpain.

II. AMYGDALA:

Theamygdalaproducessensationofpleasure,punishmentorsexua larousal stimulation.
It also involve in the feelings of fear.

III. HIPPOCAMPUS:

Hippocampus is involved in long term memory.

MID BRAIN:

Inmammalsmidbrainisrelativelyverysmall.Itconsistsoftheopticlobeswhi chare represented by four smallbodies.

FUNCTIONS
Itreceivessensoryinformationlikevision,odouretc.Itreceivessen soryinformation from spinal cord and sends them to the forebrain.

HIND BRAIN:

Hind brain consists of
1. MedullaOblongata
2. Cerebellum
3. Pons
4. ReticularFormation

1. MEDULLAOBLONGATA:

Medulla oblongata lies on the top of spinal cord.

FUNCTION:

Itcontrolsinvoluntaryactionslikebloodpressure,heartbeat,sneez ing,coughing, breathing rate, hicupping, swallowingetc.

2. CEREBELLUM:

Thecerebellumliesdorsallybehindtheopticlobes.Itishighlyconvol

		uted.Itislarge in mammals than otheranimal. **FUNCTIONS:** Thecerebellumplaysanimportantpartincontrollingmuscularco-ordination. Itspeciallymaintainsbalanceandalsopositionofthebodyinspace. **3. PONS:** Ponsregulatesactivitieslikemusculareco-ordination,facialexpressions,breathingand sleeping. **4. RETICULARFORMATION:** Reticular formation lies in pons, medulla and mid brain. **FUNCTIONS:** It monitors the messages to the brain which should be ignored or should be realized. **BRAIN STEM:** Theoldesttissuesformedbythecombinationofmedullaoblongata,ponsandmid brain is called as BrainStem. **FUNCTIONS:** It involved in the control of sleep and wakening.		
3	DefineDevelopment.Explaintheprocess of GastrulationinaChickuptotheformationofthreegerminal layers.Drawlabelleddiagram	**DEVELOPMENT OF CHICKS:** In order to understand the process of development, we will consider the example of chicks **EGG:** A fully formed egg of hen is almost 3 to 4 cm bread and 6cm long. Externally it is protected with hard shell composed of CACO3. Just beneath the shell in a thin two layerer structure is present known as ammin and chorion. Below this membrane album is present a spirally twisted chalazae is present on both the side which keeps the yoek suspended on in the centre. The egg of hen is polyecithal type have huge amounts of yolk. It is released from the ovary as a primary oocyte with a diameter of 3 cm. The protoplasm of egg is restricted to a small area called germinal disc or blastodisc. It is towards the animal pole. Afetr the release from the ovary, the primary oocyte undergoes maturation division to become secondary oocyte, egg or ovum. **FERTILIZATION:** In hen, the fertilization is internal. The sperms	**U**	**M**

which are deposited in female, fertilize the ovum in terminal part of oviduct.
Thus zygote formed is diploid and maturation occurs by the release of two polar bodies which soon degenerate. After fertilization, it is covered by two membranes and hard shell. The shell is secreted by shell glands. The fertilized egg is laid after 24 hours of fertilization.

INCUBATION

The process of development requires 36 C to 378C which either provided naturally by mother or artificially in incubator. The development is completed in 21 days.

CLEAVAGE:

After fertilization, the zygote undergoes a series of mitotic divisions called cleavage. The cleavage is restricted to only blastodisc or germinal disc which is lyring at the top of yolk and this type of cleavage is termed as discoidal cleavage. The first cleavage is vertical and divides the zygote into two cells but the yolk is not divided.

The common macro nutrients present in pond are C, H, O, K, Mg and S and micronutrients are Fe,mn,cu,zn.

MORULA:

The conversion of zygote into a solid ball of cells is called morula. In morula the central cells are smaller called micromeres. While the outer cells are larger called megamers. Morula lies closely to yolk.

BLASTALATION:

The conversion of morula into blastula is called Blastalation. A hollow cavity appears inside morula called blastocoels. These blastocoels are filled with a fluid. The cap of cells above the blastocoels is known as blastoderm. After Blastalation the egg is laid and gastrulations start.

GASTRULATION:

The process by which the blastula become three layered embryo is called gastrulation. During gastrulation the

		blastoderm divides into two layers: **EPIBLAST:** The upper layer of cells is called epiblast. It is the future ectoderm and mesoderm. **HYPOBLAST:** The lower layer of cells is called hypoblast. It is the future endoderm. The central cells of blastoderm is called area pellucid. The peripheral cells of blastoderm are called area opaca. The epiblast cells form a thick central longitudinal band or line called primitive streak. The upper end of primitive streak has a swelling called Hensen's node. In gastrulation the cells are migrated and arranged at suitable places in the embryo. These cells take part in the formation of three layers: (i) ectoderm (ii) endodermand (iii) mesoderm.		
4	DescribeDarwintheoryofNaturalselection andtheobjectionsraised againstit	**THEORYOFNATURALSELECTIONDARWINISM:** It is a matter of common observation that all animals have high rate of reproduction. For example A single codfish lays 5-7 million eggs in a single season. A starfish produces one million eggs in a year. The elephant which is the slowest breeder in its 90 years life time produces six young. **NATURAL SELECTION OR THE SURVIVAL OF THE FITTEST:** Those individuals that posses the most favorable combination of characteristics are most likely to survive and reproduce passing their traits to next generation **FORMATION OF NEW SURVIVAL:** The survivors of one generation becomes the parent of next generation to which they transmit their favorable variations	**R**	**E**

		OBJECTION TO DARWIN'S THEORY: • Darwin's theory was so reasonable and was accepted by many biologists yet some objections wereraised. • Darwin did not clearly differentiate between heritable and non heritable variations • Heemphasizedtheroleofminorvariationswhilemutationplaysan important role inevolution. • Darwin has no explanation for the presence of naturalvariation. • Thetheoryexplains.Thesurvivalofthefit testbutdoesnotexplainthe arrival of thefittest. Darwin could not tell the cause ofvariations		

5	Explain the female menstrual cycle with all its phases.	**(1) MENSTRUALCYCLE:** The periodic discharge of blood, broken tissues and unfertilized egg through vagina is called menstrual cycle. During one cycle only one egg is released. The first menstrual cycl is called Menarche. It starts at the age of 12, 13, 14 years. The stoppage of menstrual cycle at old age (45 – 55) is called Menopause. **DURATION:** The average duration is about 28 days. But it may very from 20 – 45 days from person to person. **(i) FOLLICULAR STAGE:** (1 – 5day) This stage starts from the end of the previous menstruation period till the beginning of ovulation. Duration this stage one or more egg start to develop. Follicle cells around the developing egg are arranges in layers forming a cavity. Some follicle cells starts secretion of a hormone called estrogen. Estrogen causes thethicknessandvascularizationofuterus.Thusuterusbecomessoftandspongy because of increase bloodsupply. **(ii) OVALATION:** ThereleaseofmatureovumfromGraafianfollicleiscalledovulation.Theovum enterstheoviductforfertilization.Thisreleaseofeggoccursonthe14thdayof menstrualcycle.Pituitaryglandsecretesluteinizinghormonewhichhelpsinthe release of egg from thefollicle. **(iii) LUTEALSTAGE:** This stage continues from the 14th – 28th days of the cycle. After ovulation graafian follicles are converted into a yellow body called corpus lustrum.	**U**	**D**

		This corpus lustrum secretes a hormone called progesterone. Progesterone perform the following functions. (i) Progesterone increase thickness ofuterus. (ii) It prepare the uterus for implantation ofzygote. (iii) Prevent contraction of uterinewall (iv) Suppressesovulation. **MENSTRUAL STAGE:** When ovum is not fertilized, corpus lustrum degenerates and stops progesterone secretion. It results in the breakdown of thickened spongy part of the uterus. The broken tissues along with blood and unfertilized egg are discharged. This is called menstruation.		
6	Define Meiotic errors. Describe the defects caused in human beings due to abnormal number of chromosom es.	**Errors** can occur during **meiosis** producing gametes with an extra or missing chromosome.This is known as meiotic error. **DOWN'S SYNDROME:** Down's Syndrome which was discovered in 1866 by Langdon Down also called Mongolism. This name given due to epicanthic fold in the eyelid which is a phenotypic character of the member of Mongoloid race. **CAUSE:** Down's Syndrome is the only human. Autosomal trisomy. The chromosome 21 is one of the smallest chromosome in the human cell. A person who inherits three instead of two is categorized as trisomic 21 and shows Dow's Syndrome. **SYMPTOMS:** ➢ They are short and may have small roundedhead.. ➢ Theyhaveprotrudingfurrowedtonguewhichcausethemouthtor emain partiallyopen. ➢ Theyarepronetorespiratorydiseaseandheartmalformationandsho wan incidence ofleukemia. ➢ Muscles and muscle reflexes areweak. ➢ Development of speech and motor function ishampered. ➢ Mental retardation with low IQ in 20-50range. ➢ Broad flatface. ➢ Short hands andfeet. ➢ Female,maybefertileandmayproducenormalortrisomicpr ogeny (Down'sSyndrome).	**K**	**M**

- Male neverreproduce.
- Life span is about 17 years only 8% can survive upto 40 orabove.
- The defect is one in700.
- Older women above the age of 30-40 Show increasedrisk.

KLINE FILTER AND TURNER'S SYNDROMES:

Around 1940 two human Sex abnormalities were discovered.

KLINEFILTER'S SYNDROME:

Individual with klinefilter's Syndrome most often have XXY i.e inheritance of two X and Y chromosomes which is a trisomic condition.

SYMPTOMS:

- XXY male are taller thenaverage.
- They are sterile or lessfertile.
- Their testis are much smaller although penis and scrotum are normal but testis fail to producesperms.
- Facial hairs are oftenspars.
- There may be some breastenlargement.
- Some XXY shows mild mentalimpairment.
- It effects 1-500 to 2000persons.
- Injections of hormones can reserve the famined trait but cannot increase thefertility.

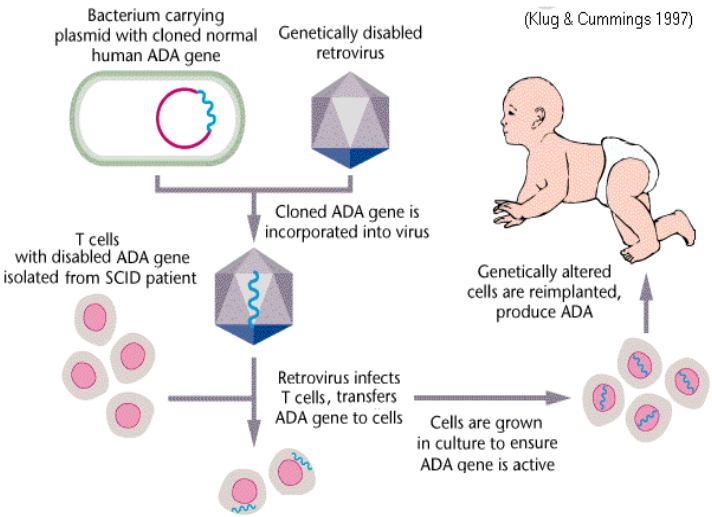
TURNER SYNDROME:

Turner Syndrome is due to monosomic condition i.e they have 45 chromosomes i.e inheritance of one X without a partner X or Y. It is a female sexual defect and occurs one in 2500 to 10000.

Turner Syndrome is not common as 98% with XO zygote get aborted early in pregnancy. The survivals shows following abnormalities.

- Theygrowwellproportionedbutabitshortat4feet8inchesinheight.
- Individuals have female external genitalia and internal ducts but ovaries arenotfunctionalthereforetheydonotproduceovaorhormones.
- Without sex hormones breast and other secondary sex characters do not appear.

		➢ They have webbed neck and shield likechest. ➢ Some patients are benefitted from hormone therapy and corrective surgery.		
7	Describe the different steps in DNA recombinant technology in detail.	**RECOMBINANT DNA AND GENE CLONING:** The introduction of genes from one organism into the genome of another organism is called Recombinant DNA technology. Recombinant DNA is artificially produced. Recombinant DNA is artificially produced with the help of: Gene of interest which is to be cloned. Restriction enzyme or molecularscissor. Ligase enzyme or molecular glue. Vector Expression system **ISOLATION OF DNA OR OBTAINING GENE OF CHOICE:** The first step in gen cloning is to obtain a gene of interest from a healthy organism. DNA isolated directly from laboratory from an organism. DNA made in the laboratory fro mRNA. **RESTRICTION ENZYME:** Gene can isolated from the DNA by using restriction enzymes. These enzymes cut the DNA into many small fragments. One of these fragments carries the gene of interest. The restriction enzyme creates sticky ends on the DNA fragments. These enzymes are specific in their recognition and cutting action. These enzymes cut specific base sequence in DNA molecule. In 1970 Hamilton D.Smith isolated the first restriction enzyme. They are called restriction enzymes because they restrict the growth of viruses. These enzymes protect bacteria from viral infection. About 400 different such enzymes have been isolated out from bacteria. **VECTOR:** The body which transfers the DNA molecule into another living body or host cell is called Vector. The isolated gene is then transferred into the vector. The vector may be of different kinds e.g. plasmid, pheges etc. The most common vectors are plasmids. Plasmids are small circular DNA ring present in bacteria. The plasmid ring is cut open by restriction enzyme. The DNA fragment is mixed with the open plasmid ring. The gene of choice attaches itself to the sticky end of plasmid. **LIGASE ENZYME:** This enzyme joins the DNA fragment with open ends of plasmid by covalent bonds and closing the ring again. This form recombinant DNA or chimaeras DNA.	**U**	**M**

		EXPRESSION SYSTEM OR VECTOR: When bacteria are kept with calcium chloride (CaCl2) they absorb recombinant DNA. This bacteria is called expression vector. Both bacterial cell and rDNA multiply by cell division. The gene of choice will express itself by producing the desired protein in the bacterial cell. For example; a bacterium containing human insulin gen it will synthesize human insulin hormone.		
8	What is gene therapy? Explain gene therapy in SCID and Cystic fibrosis.	Theintroductionofnormalgeneisplaceofdefectivegeneinthepatientbodyis calledgenetherapy.ORAtechniqueinwhichanabnormalordefectivegeneis replaced by a healthy and dominant in the patient body is called gene therapy. The first gene therapy experiment was done in 1990 in a four year old girl suffering form sever immunodeficiency disease called adenosine deaminase deficiency. The main goal of gene therapy is to cure all genetic disease. It can also be used to study cell functions. **Severe Combined Immunodeficiency Disease** (**SCID**) is due to a defective gene for **Adenosine Deaminase** (**ADA**). A **retrovirus**, which is capable of transferring it's **DNA** into normal eukaryotic cells (**transfection**), is engineered to contain the normal human **ADA** gene. Isolated **T-cell stem line cells** from the patient are exposed to the retrovirus in cell culture, and take up the **ADA** gene. Reimplantation of the transgenic cells into the patient's bone marrow establishes a line of cells with functional **ADA**, which effecitvely treats **SCID**.  Gene therapy is also done to treat cystic fibrosis. Main steps in this gene therapy: Normal gene is mixed with liposome. This mixture is sprayed over the surface of defective organ. Liposome widens pore size of the cell membrane. The gene in liposome enters the body cells and gets expressed.	**U**	**M**
9	Describe locomotion	**1. LOCOMOTION IN STARFISH:** **ORGANS OF LOCOMOTION:**	**R**	**E**

	in Jelly fish, Star fish and Earthworm.	Starfishmoveswiththehelpoftubefeet.Thetubefeetarepresentonbothsides of radial canal that extends up to the tip ofarm. **STRUCTUREOFTUBEFEET:** Thetubefeetarehollowmuscularandarelikerubberbulbofthemedicinedropper. The tube feet consist of threeparts Ampula Podia Sucker **MECHANISM:** In starfish locomotion is controlled by a special water vascular system. Water is drawn into the body through a small opening and is passed through a ring canal to large number of hollow muscular tube feet. The tube feet extend when water is pumpedintothemthentheyfixthemselvesbysuctioncup(sucker)withsome object. Whensuckermusclecontractthewaterispushedbackintotheampullae,making the tubefeetflaccidlosingthegripandthestarfishispulledforwards. **2. LOCOMOTION IN JELLYFISH:** Jellyfishhasumbrellalikebodywhichfloatsonthesurfaceofwateratthemercy of waves. However it can swim slowly by muscularcontraction. **MECHANISM:** Injellyfishthewaterentersintheumbrellalikebody(Bell).Thenthemuscleofthe bodycontractandwaterisforcedoutinajet,asaresultanimalmovementisknown as "Jet Propulsion". The jelly fish moves in jerks in the direction opposite to the expelledwater. 3.**LOCOMOTION IN EARTHWORM** An earthworm moves using circular and longitudinal muscles, as well as bristles called setae. The earthworm can push the setae out of its body to grab the soil around it. To move forward, the worm uses its setae to anchor the front of its body and contracts the longitudinal muscles to shorten its body. Then the worm anchors the back of its body with setae and contracts the circular muscles to lengthen its body. The result is that the worm inches forward. In this lesson, you will use servo motors to model this movement.		
10	Explainthe regulatoryfunctions ofkidney.	**1) Ultra Filtration.** In renal physiology, ultrafiltration occurs at the barrier between the blood and the filtrate in the glomerular capsule (Bowman's capsule) The Bowman's capsule contains a dense capillary network called the glomerulus. Blood flows into these capillaries through the afferent arterioles and leaves through the efferent arterioles. The high hydrostatic pressure forces small molecules in the tubular fluid such as water, glucose, amino acids, sodium chloride and urea through the filter, from the blood in the glomerular capsule across the basement membrane of the Bowman's capsule and into the renal tubules. This process is called ultrafiltration; the resulting fluid, virtually free of large proteins and blood cells, is referred to as glomerular filtrate, or ultrafiltrate.[1] Further modification of ultrafiltrate, by reabsorption and secretion, transforms it into urine. **2) Reabsorption.** In renal physiology, reabsorption or tubular reabsorption is the process by which the nephron removes water and solutes from the tubular fluid (pre-urine) and returns them to the circulating blood. It is called reabsorption (and not absorption) both because these substances have already been absorbed once (particularly in	**U**	**M**

the intestines) and because the body is reclaiming them from a postglomerular fluid stream that is well on its way to becoming urine (that is, they will soon be lost to the urine unless they are reclaimed). Substances are reabsorbed from the tubule into the peritubular capillaries. This happens as a result of sodium transport from the lumen into the blood by the Na+/K+ATPase in the basolateral membrane of the epithelial cells. Thus, the glomerular filtrate becomes more concentrated, which is one of the steps in forming urine. Reabsorption allows many
useful solutes (primarily glucose and amino acids), salts and water that have passed through Bowman's capsule, to return to the circulation.

3) Tubular Secretions.

- Tubular secretion is the transfer of materials from peritubular capillaries to the renal tubular lumen and occurs mainly by active transport and passive diffusion.
- It is the tubular secretion of H+ and NH_4+ from the blood into the tubular fluid that helps to keep blood pH at its normal level—this is also a respiratory process.
- Urine leaves the kidney though the ureter following secretion.

4) Counter current mechanisms

- Countercurrent multiplication in the kidneys is the process of using energy to generate an *osmotic gradient* that enables you to reabsorb water from the tubular fluid and produce concentrated urine. This mechanism prevents you from producing litres and litres of dilute urine every day, and is the reason why you don't need to be continually drinking in order to stay hydrated. The other Counter current system is composed of vasa recta.