

Question Bank Biology for Engineers

1. Explain cell membrane with suitable diagram.

The cell membrane, also called the plasma membrane, is found in all cells and separates the interior of the cell from the outside environment. The cell membrane consists of a lipid bilayer that is semipermeable. The cell membrane regulates the transport of materials entering and exiting the cell.

2. Explain Macromolecules

Are very large molecule, usually with a diameter ranging from about 100 to 10,000 angstrom (10^{-8} to 10^{-3} mm)

The molecule is the smallest unit of substance that retain its characteristic properties. Macromolecules are composed of much large numbers of atoms than ordinary molecules.

What is Lipid

Ans It is a chemically defined as a substance that is insoluble in water and soluble in alcohol, ether, and chloroform.

Lipids are important component of living cell.

Explain Protein and Nucleic acid.

Ans Protein is an important part of a healthy diet. Proteins are made up of chemical 'building block' called amino acid to build and repair muscles and bones and to make hormones and enzymes.

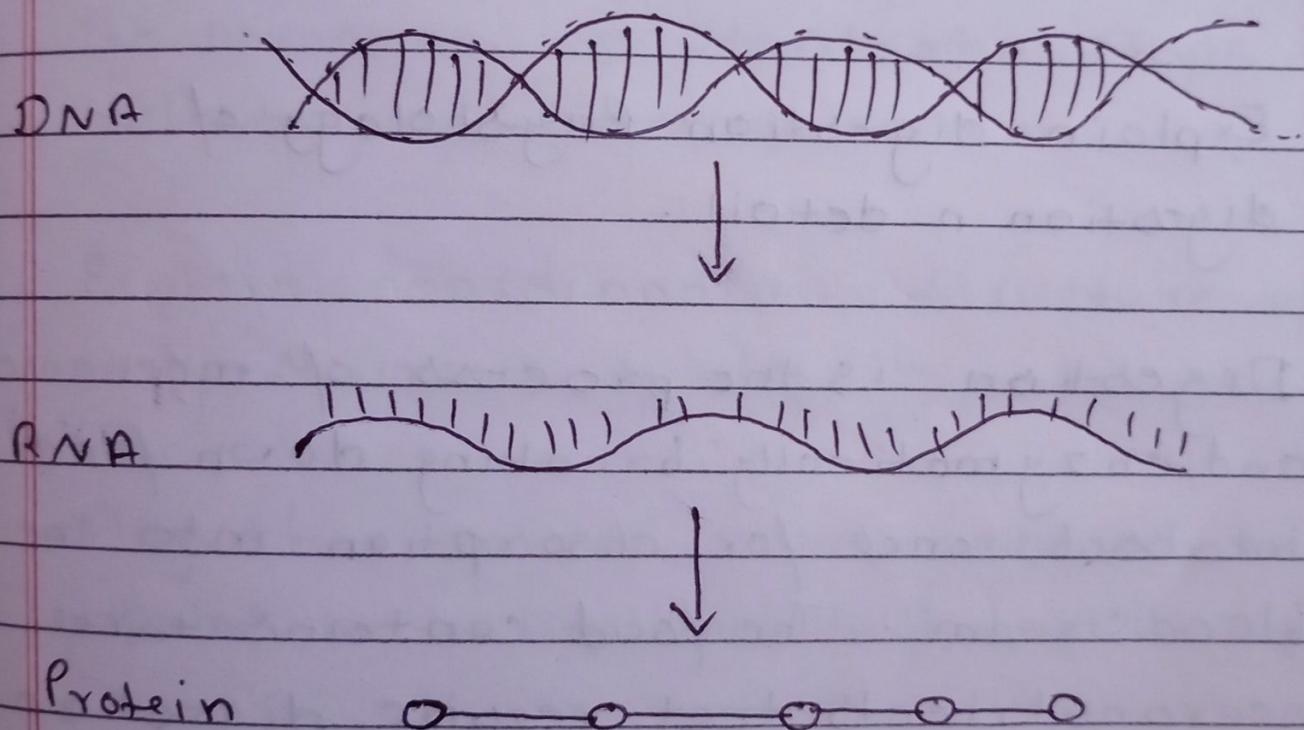
Nucleic acid are biopolymers, macro molecules, essential to all known forms of life.

That is, long chainlike molecules composed of a rise of nearly identical building blocks called nucleotides.

Explain central dogma with suitable diagram

Central dogma is the process by which the instructions in DNA are converted into a functional product.

The first proposed in 1958 by Francis Crick
discovered the structure of DNA



Explain carbohydrates

Ans

Carbohydrates are found in a wide array of both healthy and unhealthy foods - bread, beans, milk.

They also come in a variety of forms.

The most common and abundant forms

are sugar, fibers, and starches.

Explain digestion Physiology of digestion in detail.

Digestion is the process of mechanically and enzymatically breaking down food into substance for absorption into the bloodstream. The food contains three macronutrients that require digestion before they can be absorbed: fats, carbohydrates, and proteins.

Explain regulation of food intake and digestive secretion in detail.

Ans Hormones control the different digestive enzymes that are secreted in the stomach and the intestine during the process of digestion and absorption. For example, the hormone gastrin stimulates stomach acid secretion in response to food intake. The hormone somatostatin stops the release of stomach acid.

Explain coordination - structure of Brain and Neurons in detail.

Any of a set of numbers used to locate a point on a line or surface or in space.

A neuron has three main parts: dendrites, an axon, and a cell body or soma (see image below), which can be represented as the branches, roots and trunk of a tree, respectively. Dendrites branch as they move towards their tips, just like tree branches do,

and they even have leaf-like structures
on them called spines.

Structure of Brain



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Explore cardiovascular system -

Physiology of blood - compositions & structure, coagulation.

The blood circulatory system (cardiovascular system) delivers nutrients and oxygen to all cells in the body.

It consists of the heart and the blood vessels running through the entire body.

Blood is a circulating tissue composed of fluid, plasma, and cells.

The cellular components of blood are erythrocytes (red blood cells, or RBCs), leukocytes (white blood cells, or WBCs) and thrombocytes (platelets)...

Coagulation steps

- 1) constriction of the blood vessel.
- 2) formation of a temporary "platelet plug"
- 3) Activation of the coagulation cascade
- 4) formation of "fibrin plug" or the final clot.

Explain about Heart beat, initiation, conduction and regulation.

A heart beat is a two-part pumping action that takes about a second. As blood collects in the upper chambers (the right and left atria), the heart's natural pacemaker (the SA node) sends out an electrical signal that causes the atria to contract.

The impulse starts in a small bundle of specialized cells located in the right atrium called the SA node.

Conduction and regulation

Sino - Atrial node (SA Node), inter-nodal pathways, atrioventricular node (AV Node), the AV bundle and the bundle of Purkinje fibres

The fibers of SA node has ability of self excitation and control the rate of entire heart beat.

Explain Physiology of circulation.

The circulatory system is the continuous system of tubes through which the blood is pumped around the body ..

Explain Respiration & Physiology of respiration

The organ that are involved in breathing These include the nose , throat , larynx and lungs.

In Physiology respiration is the movement of oxygen from the outside environment to the cells with tissues, and the removal of carbon dioxide in opposite direction .

Explain exchange and transport of gases and its regulation.

Oxygen is passed from the lungs to the bloodstream and carbon dioxide is eliminated from the bloodstream to the lungs .

Exchanges of Gas takes place in lungs between the alveoli and capillaries which are tiny blood vessels , placed at the walls of alveoli.

Explain Physiology of Excretion, fluid and electrolytes balance,

The Physiological process by which an organism disposes of its nitrogenous by-products is called excretion.

Besides carbon dioxide, compounds of nitrogen arise from metabolism and are eliminated, chiefly by the kidney, in the urine (excretion).

Food not digested is eliminated through the anus (defecation).

Electrolytes are minerals in your body that have an electric charge. They are in your blood, urine, tissue, and other body fluids.

Electrolytes are important because they help: Balance the amount of water in your body. Balance your body's acid/base (pH) level.

Explain acid base balance & roles
of kidney in body water regulation

Acid base balance refers to the mechanism the body uses to keep its fluid close to neutral pH (that is, neither basic nor acidic) (the body can function normally).

The kidney can regulate water levels in the body they conserve water if you are dehydrated, and they can make urine more dilute to expel excess water if necessary.

Water is lost through the skin through evaporation from the skin surface without overt sweating and from air expelled from the lungs.

Explain the Resting potential, action potential, synaptic potential in details.

Resting potential

The Resting Potential of electrically excitable cells lie in the range of -60 to -95 millivolts (1 millivolt \approx 0.001 volt), with the inside of the cell negatively charged.

(the potential decreases below the resting potential) the process is called depolarization

Action potential :-

is a rapid and subsequent fall in voltage or membrane potential across a cellular membrane with a characteristic pattern.

Example:- of cells that signal via action potentials are neurons and muscle cells.

Synaptic potential

The principal input signals to which a neuron responds, likewise are evoked by changes in the conductance of ion channels in the post-synaptic

Explain the Excitatory Post Synaptic Potential (EPSP)

is a postsynaptic potential that makes the postsynaptic neuron more likely to fire an action potential.

The temporary depolarization of postsynaptic membrane potential, caused by the flow of positively charged ions into the postsynaptic cell, is a result of opening ligand-gated ion channels.

Explain the Inhibitory Post Synaptic Potential (IPSP)

is a kind of synaptic potential that makes a postsynaptic neuron less likely to generate an action potential.

IPSP can take place at all chemical synapses, which use the secretion of neurotransmitter to create cell to cell signalling.

Explain EMG, EEG its generation and propagation in details.

EMG signals is a biomedical signals that measured electrical current generated in muscles during its contraction representing neuromuscular activities.

Bioelectrical signal or electric current produced by differences in bioelectrical potentials along a specialized tissue associated with electrochemical events occurring during the propagation of action potential.

EEG

Is a recording of the electrical activity of the brain from the scalp.

The recorded waveform reflect the cortical electrical activity.

Signal intensity : EEG activity is quite small, microvolt measure (mv)

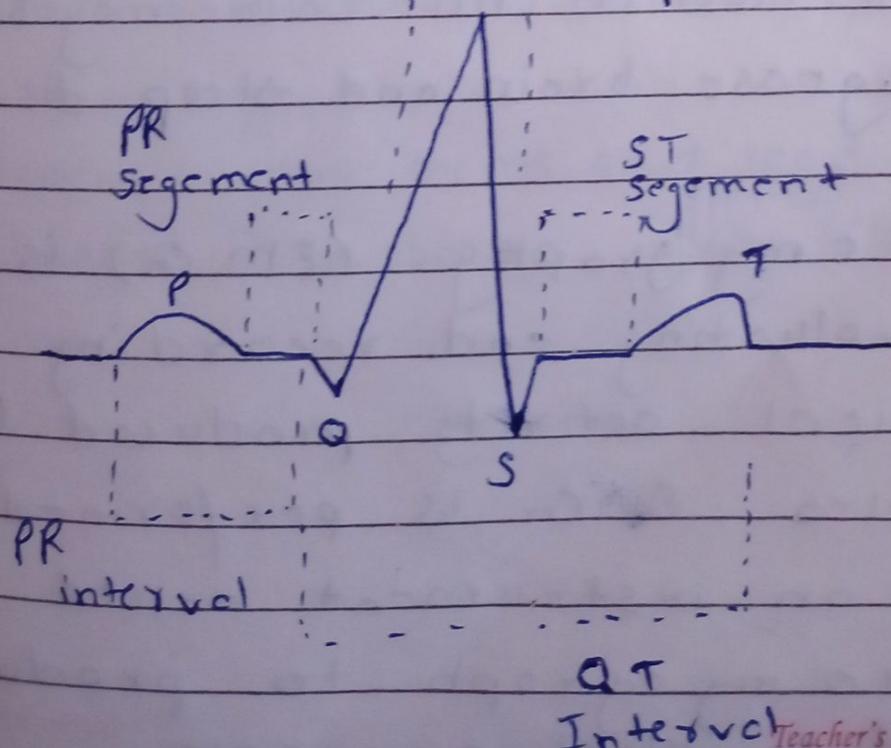
Illustrate Recording Electrodes & Electrocardiograph.

The electrodes directly record the firing of action, resting and postsynaptic potentials. When neuron fires, current flows in and out through excitable region in the axons and cell body of the neuron. This creates potential field around the neuron.

main types of electrodes record

- microelectrodes
- Needle electrodes
- Body surface electrodes

Electrocardiograph



Teacher's Signature.....

Also known as an electrocardiogram or an EKG, an ECG is a test that detects and records the strength and timing of the electrical activity in your heart.

This information is record on a graph that shows each phase of the electric signal and it travel through your heart.

Illustrate Electroencephalograph, Electromyograph Patient monitoring system

The electroencephalograph

A recording of electrical activity in the brain. It is made by placing electrodes on the scalp (the skin covering the top of the head) and impulses are sent to a special machine. An EEG may be used to diagnose brain and sleep disorders.

Electromyography (EMG) is a technique for evaluating and recording the electrical activity produced by skeletal muscles. EMG is performed using ~~and~~ an instrument called electromyograph to produce a record called a electromyogram.

Illustrate fetal monitoring Instruments & Oximeter

External fetal heart rate monitoring uses a device to listen to or record the fetal heartbeat through the mother's abdomen. A fetoscope (a type of stethoscope) is the most basic type of external monitor. Another type of monitor is a hand-held electronic Doppler ultrasound device.

Oximeter

Pulse oximeter is a noninvasive test that measures the oxygen saturation level of your blood ... These levels show how efficiently blood is carrying oxygen to the extremities furthest from your heart, including your arms and legs. The pulse oximeter is a small, clip-like device.

Explain Blood flowmeter , Pulmonary function analyzers.

Blood flow-meters are the devices that monitor the blood flow in various blood vessels and measure the cardiac output. In the blood vessels, the blood flow rate is maximum along the axis of the vessel and decreases with the square of the distance from axis, reaching zero at the wall of the vessel.

Pulmonary function analyzers measure the performance of a patient's respiratory system, especially for outpatient or presurgical screening.

These systems measure the ventilation, diffusion, and distribution of gases in the lungs.

Explain Gas Analyzers, Blood cell counters

Gas Analyzers are analytical device that measure the concentration or quality of a specific gaseous compound within a mixture of multiple gases.

Blood is collected by inserting a needle into a vein and allowing the blood to flow into a tube.

The blood sample is sent to the laboratory and the red blood cells, white blood cells, and platelets are counted.

The CBC is used to test for, diagnose, and monitor many different conditions.

Explain x-ray computed Tomography in detail.

X-Ray computed Tomography

X-Ray computed tomography is based on differential absorption of X-Rays by different tissues to enables distinction between different anatomical structures.

X-Ray absorbing heavy metals such as iodine, barium and bromine are employed as contrast agents for high spatial and temporal resolution.

Explain Nuclear Medical Imaging System in detail.

Nuclear medicine imaging is a method of producing images by detecting radiation from different parts of the body after a radioactive tracer is given to the patient.

The image are digitally generated on a computer and transferred to a nuclear medicine physician, who interprets the image to make a diagnosis.

* Explain Magnetic Resonance Imaging System.

Magnetic resonance imaging (MRI) is a medical imaging technique that uses a magnetic field and computer generated radio wave to create detailed image of the organs and tissue in your body.

most MRI machine are large tube-shaped magnets

of the body use a powerful magnetic field, radio wave and a computer to produce detailed pictures of inside of your body. It may be used to help diagnose or monitor treatment for variety of condition with the chest, abdomen, and pelvis

Explain Ultrasonic Imaging System in detail

An Ultrasonic Imaging system is a medical diagnostic tool that uses high frequency sound wave to capture live images from the inside of the body. The instrument has become increasingly important in medicine and has taken its place along with X-rays for imaging internal body structures.

Sound wave to produce pictures of the inside of the body. It helps diagnose the causes of pain, swelling and infection in the body's internal organs and to examine an unborn child (fetus) in pregnant women. In infants, doctors commonly use ultrasonic to evaluate the brain, hips, and spine.

Explain Tissue engineering as
therapeutics & electro magnetic therapy

Tissue engineering (TE) is a rapidly evolving discipline that seeks to repair, replace or regenerate tissue or organs by translating fundamental knowledge in physics, chemistry and biology into practical and effective materials, or devices and clinical strategies.

Stem cells can develop into many different types of cell and may help repair areas of the body. The field of tissue engineering allows researchers to create models to study various diseases, such as cancer and heart disease.

Electromagnetic field therapy refers to therapy involving the use of magnets or electromagnets. Types include Bioelectromagnetics, the study of how electromagnetic fields interact with and influence biological processes.

Magnets for maintaining health and treat illness.

The human body and the earth naturally produce electric and magnetic fields.

Explain bio ceramics, microbots and nanobots.

⇒ Bioceramics is a class of material that is used for repairing or replacing damaged bone tissues. Depending on the application, bioceramics can directly interact with the surrounding tissue, either supporting growth or inducing new tissue regeneration for bioactive ceramics.

Types of Bioceramics

- (i) bioinert ceramics (ii) biocactive ceramics (iii) biodegradable ceramics

Mode

Calcium Phosphate material containing tiny pores.

⇒ Microbot

A microbot is a very small robot built to do specific tasks. In general a microrobot is just a bit larger than a nanorobot, which is created on the nanoscale. Micro robots are usually visible, whereas some nanobots are not immediately visible visible to the human eye.

⇒ Nanobots

Are robots that carry out very specific function and are 50-100 nm wide. They can be used very effectively for drug delivery.

Normally, drug work through the entire body before they

reach the diseased affected area.

Explain about Bio materials & Radiotherapy in detail.

A material intended to interface with biological system to evaluate, treat, augment or replace any tissue, organ or function of the body" and biocompatibility has been defined as "the study and knowledge of the interaction b/w living and nonliving materials"

Example:-

metals, ceramics, glass, polymers can be found thing such as contact lenses, pacemakers, heart valves, orthopedic devices, and much more.

Radiotherapy

is a cancer treatment that use high doses of radiation to kill cancer cell and shrink tumors. At low doses, radiation is used in x-rays to see inside your body,

os with x-rays of your teeth or broken bones.

Explain Automated Drug Delivery System

"Automated drug delivery system" (ADDs) means a mechanical system that performs operations or activities other than compounding or administration, relative to the storage, dispersive, or distribution of drugs.

An ADDS shall collect, control, and maintain all transaction information to accurately track the movement of drugs into and out of the system for security, accuracy, and accountability.

Explain Ultrasound Enhanced Nano medicine & target drug delivery in detail.

In a summary, ultrasound enables the disruption of drug carrying nanoparticles and release of drug locally at tumor sites. Therefore, the combination of ultrasound and ultrasound-sensitive nanoparticles can enhance delivery of drug from nanoparticles and selectively release drug within the focal point of ultrasound.

It can synergistically reduce the amount of dosage required and facilitate selective tumor targeted drug delivery to avoid undesirable side effects on healthy cells.

Targeted drug delivery is a system of specifying the drug moiety directly into its targeted body area (organ, cellular, and subcellular level of specific tissue) to overcome the specific toxic effect of conventional drug delivery, thereby reducing the amount of drug required for therapeutic efficacy.

Explain about Artificial skin, limb, advancement in prosthetics.

Artificial skin is a collagen scaffold that induces regeneration of skin in mammals such as humans. The term was used in the late 1970s and early 1980s to describe a new treatment for massive burns.

Used

and using materials like silicone polymers, Polyesters, polylactic acid and their copolymers, and other conventional material which are heavier in density, porosity and costly.

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Limb

A limb is nothing but one of the jointed appendages found either on the human body or on the body of an animals.

There are two type limb

(i) human limb

(ii) upper limb

which are attached to the upper body and lower limbs,

which are attached to the lower limb.

Explain ~~the~~ advancement in prosthetic Biocompatibility of artificial organs.

Biocompatibility is generally defined as compatibility with living tissue or on living system by assuring that the product poses minimal toxicity, injury potential or

Physiology / immunological reactivity.
From: Encyclopaedia of Tissue Engineering and Regenerative Medicine,
2019

They open up the possibility of mass production and patient are less likely to experience organ rejection