BIO 101 Dr. Olawuyi

Cell Microbiology

* Protein * carbohydrate * Lipids * Nucleic acids

Nucleic Acids

Nucleic acids are biopolymers or macromolecules that are produced by all cells (animals, plants and microorganisms). They are involved in the preservation, transmission and storage of genetic characters from one generation to the other.

Nucleic acid exists in form of complex, in association with other biomolecules including protein lipids, as well as carbohydrates. When they occur with protein, they are knowns as nucleoprotein. Nucleic acids are made up of nucleotides which are monomeric unit or building blocks of nucleic acids. They are joined together by phosphodiester bonds. Nucleotides are made up of three residues (1) phosphate (orthophosphoric acid H_3PO_4) i It is responsible for the acid nature of nuclei acids. It is a very strong acid with pKa of almost 1 or less than 1 (≤ 1). In phosphate, there are three equivalent hydroxyl group that can act as an acid, at the same time, act as a base

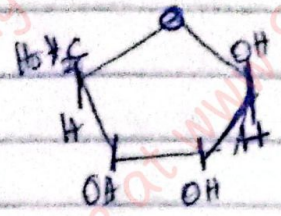
$$H_3PO_4 \longleftrightarrow HO-\underset{\underset{OH}{|}}{\overset{\overset{O}{||}}{P}}-OH$$

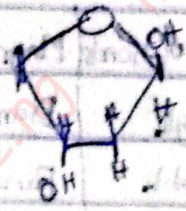
$$H_3PO_4 \rightleftharpoons 3H^+ + PO_4^{3-}$$

$$O^- - \underset{\underset{O^-}{|}}{\overset{\overset{O}{||}}{P}} - O^-$$

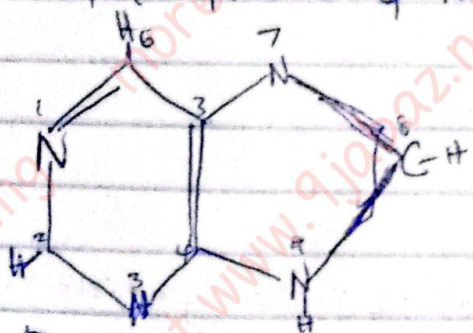
(2) Sugar: There are two types of sugar in nucleic acid. These sugars are 5-carbon sugar, i.e, Pentose. The sugars are ribose and deoxyribose sugar.

Ribose is found in RNA, while deoxyribose are found in DNA. Their carbon is anomeric carbon atom

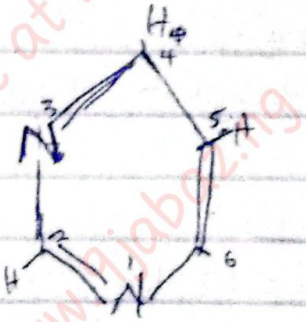




(3) Bases: There are two types of Nitrogenous bases in nucleic acid. They are; Purine bases and pyrimidine bases. They are also called nucleobases, because of the presence of nuclei acids



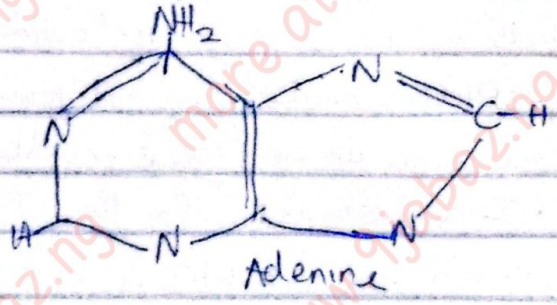
Purine (Contain 9 atoms)



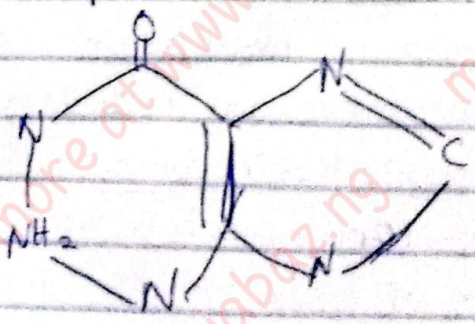
There are two major types of purine bases

(i) Adenine, also known as 6-amino purine

(ii) Guamine, also known as 2-amino, 6-oxo Purine



Adenine



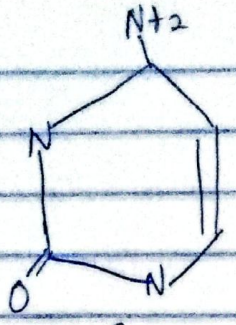
Guamine

Also there are three major bases of Pyrimidine

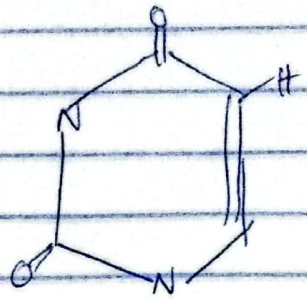
(1) Cytosine (4-amino 2-oxo Pyrimidine)

(2) Uracil (2-4-dioxo Pyrimidine)

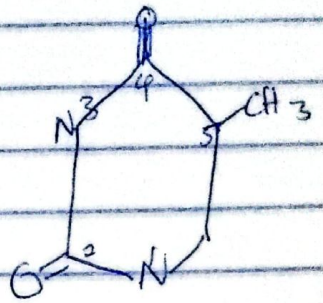
(3) Thymine (2-4-dioxo 5-Methyl Pyrimidine)



Cytosine



Uracil



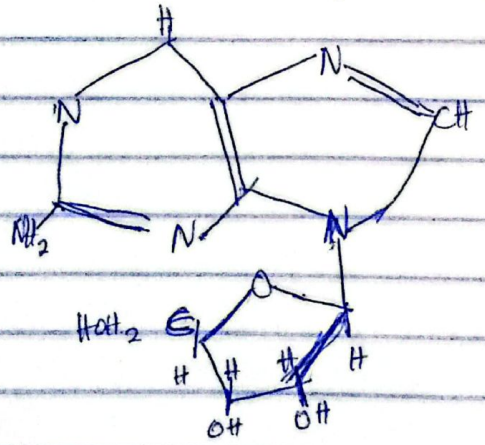
Nucleosides

Nucleosides are defined as glycosides of heterocyclic bases (purine and pyrimidine bases) with either ribose or deoxyribose. There are two types of nucleosides

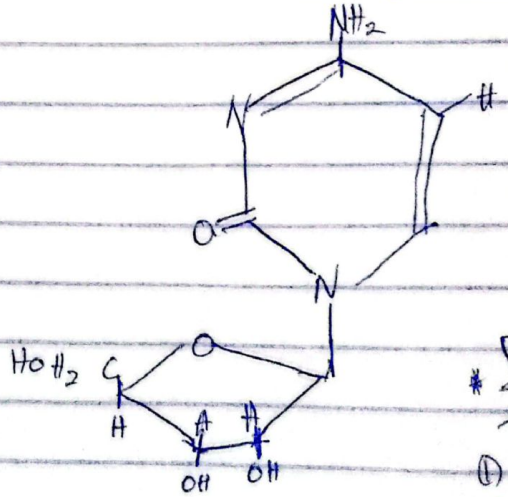
(1) Purine nucleosides in which glycosidic leakage (or bond) is between carbon-1 of the sugar and Nitrogen-9 of the base

(2) Pyrimidine nucleosides: in which glycosidic leakage or bond is between carbon-1 of the sugar and Nitrogen-1 of the base

Nucleosides with ribose sugar are known as ribonucleosides, which nucleosides with deoxyribose sugare are known as deoxyribonucleosides



Ribonucleoside



Deoxyribonucleoside

* Differnce btw RNA and DNA

(i) DNA are single stranded structure RNA are double stranded

(ii) Cytosine and Thymine are present in DNA but uracil is present in RNA

* Thymine is not present in RNA

Bases	Ribose	Deoxyribose
Adenine	Adenosine (A)	Deoxyadenosine (dA)
Guanine	Guanosine (G)	Deoxy guanosine
Cytosine	Cytidine (C)	Deoxy cytosine
Thymine	—	Thymidine (T)
Uracil	Uridine	—
Xanthine	Xanthosine (X)	Deoxyxanthosine (dX)
Hypoxanthine	Inosine (I)	Deoxyinosine (dI)

Class

14th November 2023

Nucleotides

Nucleotides are phosphoric esters of nucleosides. The consist of heterocyclic bases. (Purine and pyrimidine), Sugar (ribose and deoxyribose) and at least one phosphate group.

Nucleotides containing ribose sugar are called ribonucleotide, while the one containing deoxyribose, are called deoxyribonucleotide

Nucleosides	Nucleotides
(1) Adenosine	AMP, ADP, ATP
(2) Guanosine	GMP, GDP, GTP
(3) Cytidine	CMP, CDP, CTP
(4) Thymidine	TMP, TDP, TTP
(5) Uridine	UMP, UDP, UTP

Note: Note that MP means monophosphate, DP - diphosphate and TP - triphosphate.

Types of Nucleotides

(1) Energy rich nucleotides which are constituents of nucleic acid. Example is ATP, GTP

(2) Cyclic Nucleotides: They are Secondary messengers. Examples are; Cyclic AMP (cAMP), cGMP, cTMP

(3) Dinucleotides which are part of Coenzymes, e.g NAD^+, FAD^+

(4) Nucleotides that carries activated groups, e.g UDPG (uridine diphosphate glucose)

(5) Nucleotides that are monomeric unit of nucleic acid DAMP, DGMP, DCMP e.g dAMP, dAMP, dCMP

Deoxyribonucleic Acid

The DNA is a polymer of deoxyribonucleotides which are linked together by phosphodiester bonds between three prime and 5prime position of adjacent deoxyribonucleotides. DNA are located in the nucleus of a cell, mitrochredia as well as chloroplast

DNA contain Adenine and Guanine as purine bases, while Thymine and Cytosine are present as Pyrimidine bases.

According to Watson and Crick models, the following properties are peculiar to DNA

(i) DNA is highly ordered and helical consisting of two right handed ellipse that could whine each other around a common axis.

(ii) The two strands of DNA are not identical in base composition, but they are complementary to each other.

(iii) The two strands of DNA are stabilized by hydrogen bond

(iv) There is specific base pairing ~~within the bases of two strands~~ between the two strands A = T and G ≡ C (strong)

(v) The two strands of DNA are at opposite end of the nucleotides. The Phosphate and sugar are on the outside of double ~~stripe~~ helix to form a backbone for the hetocyclic bases inside the helix

The DNA strand follows a uniform left or right handed patterns which are linked for every pitch length of approximately 3.4nm

There are two types of DNA namely
(i) GC type
(ii) AC type

The sum of Purine bases is equal to the sum pyrimidine bases. i.e
A + G = C + T

RNA (Ribonucleic Acid)

RNA is a linear polymer of ribonucleotides. RNA Contain Adenine and Guanine as Purine bases, while Cytosine and Uracil are present as Pyrimidine bases.

RNA are present mainly in the Cytoplasm of the cell and they are associated with ribosome which is the site of protein Synthesis

Type of RNA

(1) Ribosomal RNA (rRNA): It constitute part of ribosome which acts as a hold for messenger RNA while the message is being transcribe into a polypeptide. It constitute about 80% of total Cellular RNA

(2) Transfer RNA (tRNA): This constitute 15% of the total Cellular RNA. It serves as a carrier of activated amino acid

(3) Messenger RNA (mRNA): It is the least of all the RNA. It constitute about 5% of the total cellular RNA. It carries the code for the Synthesis of amino acid.

16th November, 2023

Biological Function of Nucleic Acid

(1) They play a unique role in the storage preservation and transmission of genetic material from on generation to another. This process is called Central Dogma

DNA $\underset{c}{\overset{b}{\rightleftharpoons}}$ RNA $\xrightarrow{d}$ Protein

a = duplication

b = transcription

c = Reverse transcription

d = Traslation

(2) The ribonucleotide and their analogue are active stimulator of anti-viral probes and inhibitors

(3) Nucleotides acts as co-factor

Difference Between DNA and RNA

(1) In terms of structure, DNA is ~~double~~ stranded while RNA is single stranded

(2) ~~In terms of~~

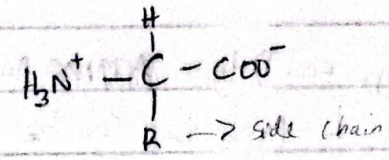
(2) In terms of cellular location, DNA is mainly located in the nucleus of the cell, although chloroplast and mitochondria Contain their own distinct DNA molecule In the case of RNA, it is located in the cytoplasm in association with the Ribosome

(3) There are two types of DNA i.e CTC type and AC type. Whereas there are three different types of RNA, rRNA, mRNA, tRNA

(4) DNA is involved in genetic character, While RNA is involved in Protein Biosynthesis

Protein

The general structure of amino acid;



* The side chain is what make the amino acids different from another

Glycine → H

Alanine → CH_3

Valine → CH_2CH_3

} side chain

Aromatic Amino Acid are three

Phenyl Alanine. .....

Classification of Amino Acid

(i) Essential Amino Acid: The body cannot synthesize them, but are very essential to the body

(ii) Non essential Amion

Amino ~~Acid~~ Reactions

(i) De carboxy

(ii) Deamination

(iii) Trans Amination

~~Peptide~~ / ~~Protein~~ / → Amino

Amino acid → Peptide → Protein

Types of Protein

(1) Primary Structure

(2) Secondary Structure

Glycine → H — G — Gly

Alanine → $-CH_3$ — A — Ala

Valine → CH_2CH_3 — V — Val

- Aliphatic

- Aromatic amino acid : 3

  the side chain is an aromatic group

* Carboxylic – acidic amino acid

* Sulphur containing amino acid

Cysteine come together, linked by disulphide bond to form Cystein

3 different reactions:

Decarboxylation

Deamination

Transa.

* All is only L-type amino acid that are used in forming Protein.

* Amino acid form Peptide, Peptide form protein.

* The bond between amino acid and another is known as Peptide bonds and it is formed between Carboxylic group and amino group.

- We can have a particular amino acid representing different Levels of Protein

- Amin

21st November, 2023

Lipids

Lipids are broadly defined as any fat soluble naturally occuring molecules, such as fat, oils, waxes and fat soluble vitamins (A, B, E & K). They cannot be dissolved in water.

Lipids also encompass the molecules such as fatty acids and their derivatives (diglycerides, monoglycerides and triglycerides)

As well as steroids containing metabolites such as Cholesterol.

Differences between Lipids & Fats (find out)

Functions of Lipids

(i) Energy Storage
(ii) Structural components of cell membrane
(iii) Participating as important signal molecules
(iv) Precursors of biological metabolites

Biological lipids are chemical diversed group of compounds, the common and defining feature of which is their insolubility in water i.e the major characteristics of lipids is that they cannot dissolve in water.

The biological function of lipids are as diverse as their chemistry. Fats and oils are the principal stored forms of energy in many organisms. Other lipids, although present in relatively small quantities, play crucial roles as enzyme cofactors, electron carriers, light absorbing pigment, hydrophobic anchors for proteins (chaperones) to help membranes hold, emulsifying agents in the digestive tracts, hormones and intracellular messengers

phospholipids are steroids are major structural elements of biological membrane

Classes of Lipids

(1) Storage lipids: The fat and oil used almost universally are stored forms of energy in living organisms are derivatives of fatty acid. This fatty acids are hydrocarbon derivatives, at about the same low oxidation state as the hydrocarbons in fossil fuels.

Two types of fatty acids containing compounds are triacylglycerols and waxes.

Fatty acids are carboxylic acids with hydrocarbon chains ranging from 4 to 36 carbon long ($C_4 - C_{36}$)

In some fatty acids, this chain is unbranched and fully saturated (contains no double bonds)

In others, the chain contains one or more double bonds, a few contains 3 carbon rings, hydroxyl groups or methyl group branches. The most commonly occuring fatty acids have even numbers of carbon atoms in an unbranched chain of 12 - 24 carbons

(2) The second class is triacylglycerol

The simplest lipids constructed from fatty acids are triacylglycerol (

also referred to as triglycerides, fats or neutral fats

Triacylglycerol are composed of three fatty acids in ester linkage with a single glycerol.

Because of the polar hydroxyl of glycerol and the polar carboxylate of the fatty acids, triacylglycerol are non polar, hydrophobic molecules, essentially insoluble in water.

The lipids have lower specific gravities than water which explains why mixtures of oil and water have two phases.

Oil with the lower specific gravity floats on the aqueous phase.

There are two significant advantages using triacylglycerol as stored fuel rather than polysaccharides such as glycogen and starch.

The advantages:

(1) Carbon atoms in fatty acids are more reduced than those of sugars

Oxidation of triacylglycerides yields more than twice as much energy, gram for gram as the oxidation of carbohydrate.

(2) Because triacylglycerols are hydrophobic and therefore unhydrated, the organism that carries fat as fuel does not have to carry the extra weight of water that is associated in stored polysaccharide

Sulphodipid

28th November, 2023

(2) Structural Lipids: Membrane lipids are amphipathic, that is, one end of the molecule is hydrophobic, while the other end is hydrophilic. There are 5 general types of membrane lipids:

(a) Glycerophospholipids: In which the hydrophobic regions are composed of two fatty acids joined to glycerol.

(b) Galactolipids: In which one or two galactose residues are connected by a glycosidic linkage to C_3 (carbon 3) of a 1,2-diacylglycerol

(c) Sulfolipids: Which also contains two fatty acid esterified to glycerol but lack the characteristic phosphate of phospholipids.

(d) Sphingolipids: In which a single fatty acid is joined to a fatty amine sphingosine

(e) Sterols: Compounds characterized by a rigid system of four fused hydrocarbon rings.

Sterols

Sterols are structural lipids present in the membrane of most eukaryotic cells. The characteristics structure of this group of membrane lipids is the steroid nucleus consisting of 4 fized rings 3 with 6 carbons, and one with five carbons. The steroid nucleus is almost planar and relatively rigid. The fused ring don't allow rotation about C-C bonds.

Cholesterol, the major sterol in animal lipid is amphipathic with a polar headgroup (the hydroxyl group at carbon 3 (3)) and a non-polar hydrocarbon body Cat (17), as long as a sixteen carbon fatty acid in its extended form

Cholesterol is both a structural component of membrane and a precursor to a wide variety of Steroids

"check structure of Cholesterol"

Lipids with Specific Biological Activities

(1) The carbohydrate moietial of certain spingolipids define the human blood group and therefore, determine the type of blood that individual can safely recieve in blood transfusion.

(2) Phosphatidilonositol biphosphate is hydrolyzed to yield two intracellular messengers, diacyglycol and ~~mositol-1,4,5~~ mositol-1,4,5-triphosphate

(3) Prostglandins, leukotrienes are extremely potent hormones

(4) Steroids hormones serve as powerful biological signals eg sex hormones

(5) The fat soluble vitamins play essential roles in the metabolism of physiology of animals.

(6) Ubiquinones and plastoquinones function as electron carriers in mitochrodrion and chloroplast respectively.

Exercise

(1) How are lipids classified?

(2) What type of lipid is prevalent in the human body?

(3) How many carbon atom are present in oleic acid, lin oleic acid?

(4) Nam some unsaturated fatty acid and saturated fatty acids

(5) The following are saturated fatty acid except ....?

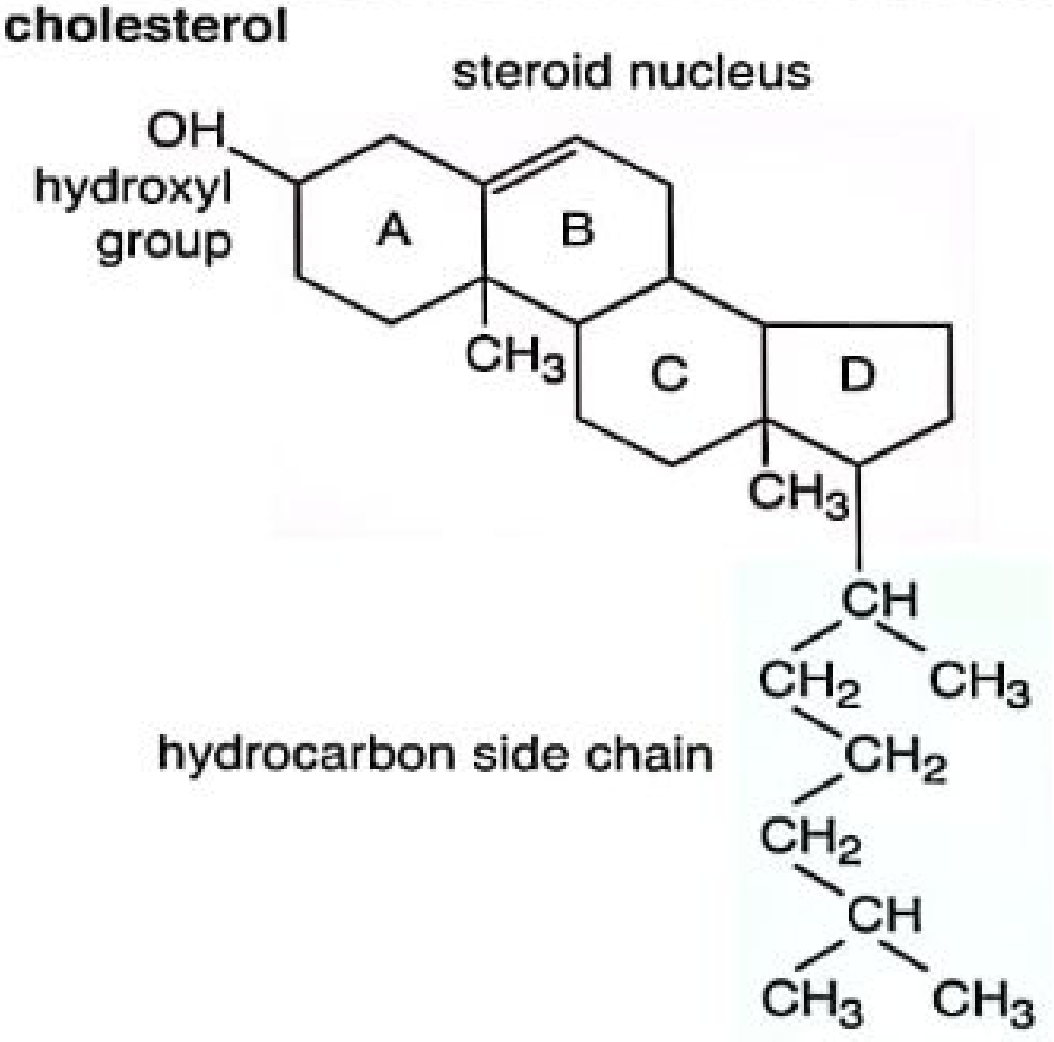
(6) What is the advantage of storing energy as triglycerides in the body?

(6) List the fat soluble vitamins and their functions.

(7) Highlight the biological function of lipids.

(8) Draw the Structure of cholesterol.

Structure of Cholesterol



Cholesterol is a 27 carbon compound with a unique structure with a hydrocarbon tail, a central sterol nucleus made of four hydrocarbon rings, and a hydroxyl group. The center sterol nucleus or ring is a feature of all steroid hormones.

Zoology

The word zoology is derived from the Greek word 'zoo' meaning animals and Logos meaning 'Study of'

From the definitions, it implies that animal would be the main focus.

Zoology is also an area of systematic biology that studies animal kingdom. It can also be said to be a branch of biology concerned with the study of animal kingdom which include interaction of animal in their ecosystem such as classification, habit of behaviour, structure of animal embryology, distribution evaluation, conservation and the study of extinct species, It is also the study of animal in any conceivable environment be it on land, aboreal, fresh water or ocean floor on the soil or below the soil.

As we know that animals are wide range of creatures grouped into vertebrates and invertebrates) In zoology and other scientific discipline, knowledge is obtained by observation, Observation is the authority in science while humans are the observers. Science is a human activity and because one person cannot observe everything, scientist must rely on the observation of others and observation is highly valued in science. However the method used in such observation must give room for objective analysis, These objective process is often called Scientific method.

The basic content of Scientific method are as follows:-
The result of any observation must be testable, tentative, Must be guided by natural Law
-A Scientific study begins with a hypothesis or a question.
From the hypothesis, Prediction about future observation are made so that they can be Supported or falsified by collection of data. When a hypothesis is supported by Large no. of observation. It may be evaluated as a theory.

Science is a broad discipline which can be subdivided into Specialised field.

Some classification of categorisation could rank geology as being under biological Sciences
Zoology is one of the broadcast field on all of Science.

The diversity of animals as well as various subdiscipline with the field of zoology reflects its breadth. It is estimated that animals account for over a million approximately half of (1.7–1.8 million) organisms so far described on the planet earth.

The following are some examples of Specialisation is zoology. based on Taxonomy (Scientific classification of Organisms).

1) Protozoology :- IS the Study of Protozoans
2) Malacology :- Study of Mollusc (Snail) with or without shells, Squid, Octopous
3) Entomology :- Study of Insects. terrestal & aquatic insect
4) Fishery - Study of fishes
5) Herpetology :- Study of Amphibians & Reptiles

4.6)

1) Ornithology: Study of birds.
2) Mammalogy: Study of mammals
3) Helminthology: Study of helminths i.e. worms

Zoology can also be divided into other sub disciplines based on some other reasons other than taxonomy. e.g

Anatomy - Study of structure of animals body and their part.
Morbid : Study of structure of dead body.
Cytology Study of structure & functions of cells
Ecology : Study of inter relation of animals with their environment
Embryology: Study of the development of an animals from the fertilized egg to birth or hatching.
Genetics study of mechanisms of transmission of trait from parent to offsprings.

Hydrology: Study of water
Histology: Study of tissues
Molecular biology: Study of sub cellular details or organisms
Parasitology - Study of animals that live in or on other animals at the expense of the host
Physiology Study of function of animals and their part
Systematic Study of the classification of and the evolutionary interrelationship among animal group.

Zoologist are biological scientist that study animals. They observe animal both in their natural habitat and in their Laboratory. In other to learn as much as possible about animals Life. They study the Origin and development of animal species, habits and behaviour and inter relations

lp

between animals & their environment. They carry out research to learn how animals diseases develop, their reproduction & how traits are passed from generation to the other.

Some fields of Study Pursued by Zoologist

1) Cell biologist - Study animals cells and their function,

Ecologist: Study animals and their interaction in environment

Physiologists - Study how animals functions and how they are adapted

Conservation biologist Study animals & manage animal populations in their habitat.

Systematics Study evolution any relationships between fossils and Living animals & also categorised animals.

Palentologist Study evolutionary relationships between fossils animals.

Taxonomists discover and describe new species and animal growth

Entomologist Study insects including their control

Herpetologist - Study amphibians & reptiles

Ornithologists - Study birds

Mammalogist Study mammals

Parasitologist - Study parasites

Epidemiologist - Study Spread of diseases

Aquaculturist - Study the ways of growing fish

Geneticist - Study the genetics of animals

Animal nutritionist - Study diets and digestive capabilities of animals -

Animal Photographers and Illustrators: They produces photos and drawings of animals for books and films.

Job Opportunities for Zoologist: Employment is available in virtually all research institutes in Nigeria

Zoological gardens

Ecological Consultant.

In Universities / colleges.

Pharmaceutical industries.

Petroleum industries

Bank & insurance companies

Federal & State ministry of environment, health, Agriculture.

Careers in Zoology

1) Aquatic biology & behavioural ecology
2) Zoology
3) Physiology & Ecophysiology
4) Medical & Veternary zoology
5) Museum Science
6) Molecular & Cell biology
7) Science Journalism, Publishing, Illustrating & keeping of books related to biology
8) Teaching

MicroBiology Section

Man And The World

* Man is influenced by some complex conditions which could be classified into abotic and abotic components
* Abotic => Includes physical, Chemical and materials, objects which affect developmental growth, life, and death of man. } Physical world
* Biotic => They are living organisms that affects or influences man. Includes plants, animals and microorganisms. } Biological world.

* Living Organism are initially classified into two group (plants and animal.)

Microorganism was later incidentally discovered to be recognized as a third group of living organisms.

* Each component of the biological world does not only influence man, but interact with each other and also, they interact with the physical world to influence man in diverse ways.

Microbiology

It is the study of microganisms and Other agents that, are too small to be seen by an uncaided eye.

* Microorganism include fungi, viruses, bacteria, algae and protozoans.

(Some microorganisms are visible to the naked eyes)

They found in ocean depths to coldest arctic ice to every Persons skin

Milestones

Microbiologists have made great progress in three areas that profoundly affect microbial classification.

(1) Detailed structure of microbial cells from the use of electron microscope

(2) They have determined the biochemical and physiological characteristics of many different microorganisms

(3) The sequence of nucleic acids and proteins from a wide variety of organism have been compared.

Microorganisms
- bacteria
- Archaea
- Eucarya

Importance of Microorganisms

* The Importance of micro organisms cannot be overemphasized.
* It is estimated that microbes contain 50% of the biological carbon and 90% of biological nitrogen on earth. Which greatly exceed all groups of organisms on the planet
* Microorganism are Ubiquitous in nature, they are everywhere
* They are major contributors to the biosphere, been indispensable for the cycling of elemental essential of life.
* They are a source of nutrients

* Most importantly, certain microorganisms carry out photosynthesis.
* Microorganism that inhabit human help in some important roles like helping in the digestion of food and production of essential vitamins such as B and K.
* Society also benefit from microbes as they are necessary to produce bread cheese, yaughurt, beer, antibiotics, vaccines vitamins, enzyme etc.
* Although, majority of microbes play beneficial roles, some harm humans (pathogenic)
* Diseases cause by microorganism play a major role in historical events
e.g The 1918 influenza pandemic (Spanish flu.) was the mose severe pandemic in recent history
Ebola virus disease discovered in 1976
Covid-19; (Black death in Europe)

Class

8th January, 2024

Beneficial Importance of Microorganism

(1) They help us to recycle nutrients
(2) They help in improving agricultural yield.
(3) They help to prevent pest infestation
(4) They involve in bio control
(5) They are used to produce anti-biotics

* Pathogenic microorganisms are organisms that cause diseases.
* When we talk about the beneficial importance of microorganisms, we are taking about non-pathogenic organism.
* Microorganism are ubiquitous (i.e they are widely available, you can find them everywere).
* They are source of nutrient
* Microorganism also carry out photosynthesis
* They produce enzymes
* They are used to produce vaccines
* They are used to produce yeast, yoghurt
* They help us to degrade our waste
* Microorganism can be genetically engineered to suit a specific purpose
* Green energy (i.e energy that are biodegradable)
* Microorganism are used in biogas
* They help to reduce the effect of climate change.
* The help us to remediate or clean up our environment.

MicroBiology and BioTerrorism

Use of biological agent to cause harm/kill. It is an unlawful use of microorganism of toxins to produce death, disease or fear

Bio

Microbiology and Bioterrorism

Bioterrorism: It is an intentional release of biological agents for the purpose of harming or killing civilians or

* Bioterrorism is the premeditated, unlawful use or threat of microorganism or toxins derived from microorganisms to cause death or disease in humans, animals or plants which is intended to create fear or intimidate government or society in the pursuit of political, religious or ideological goals.

* Biological Agent: microorganisms or toxins that can cause disease, damage or death to humans, animals, plants.

Biological Weapons

* Biological weapons: It is a weapon system that intentionally used bacterial, virus or toxins to cause death or disease in people, animals or plants

* Biological weapons is a combination of biological agents and the means of keeping the agents alive, and transporting it to where it will be dispatched

Agents of Bioterrorism

Some agents:

Agents	Diseased Cause
Bacillus anthracis	Anthrax
Yersinia pestis	Plague
Francisella tularensis	Tularaemia
Coxiella burnetiid	Q-fever
Variola major (virus)	Small pox
Clostridium botulinum	Botulinum toxin (botulism)

Control of Bioterrorism

* Control bioterrorism is centered on biodefense research
* Current defensive research includes
  1. vaccines development
  2. Treatment of diseases
  3. Rapid detection of biological attachment

* The most sophisticated detector currently available is the Biological Integrated Detection System (CBIDS)

BIDS is a mobile laboratory which can be placed on a battlefield.

It takes air samples, determine whether they contain particles of a size which can be inhaled and exposed these samples to antibodies which react with particular agents.

18th January, 2024

Botany

Botany is a natural science concerned with the study of plants structure, functions and relationship. It is a branch of biology. The study of plant is vital because they undertake almost all animal life on earth by generating a large proportion of oxygen and food that provide human and other organisms with aerobic respiration with the chemical energy they need to exist. In addition, plant carry out certain other activities which may be valuable or dangerous for man. Eg wood, food, spoilage and, fermentation etc particularly among saprophyte e.g fungi.

The function of plants include, nutrition, growth, movement, reproduction, respiration and excretion

Branches of Botany: Mophology

This involves the study of forms and features of different plants

Branches of Botany

(1) Maphology: This involves the study of forms and features of different part of plants ee e.g roots, stems, leaves, flower, seeds and fruits

(2) Anatomy: This is the study of the gross internal structure of a plant organ

(3) Physiology: It Study the various function of plants, this function may be vital or mechanical. Vital functions are performed by living matter while the mechanical functions are carried out by certain dead bodies without the intervention e.g bark and cork protect the plant body and certain hard body strengthening it

(4) Ecology: It involves the inter-relationship between plants and their environment.

(5) Taxonomy or Systematic Study: It studies the description and classification of plant and their classification into similar groups based on morphology similarity and differences.

(6) Genetics: This studies the variation, organization and transmission of variation from one generation to another. It also involves the laws and fact that govern their inheritence.

Example of Qualitative Character: Tongue rolling, eye colour, blood group

(7) Economic Botany: This deals with the uses of plants and plant products. It addresses how plant can be used for the use of man

(8) Histology: It is the study of the detailed structure of tissure

(9) Cytology: It is the cell structure with special reference to nucleus

(10) Cyanic revolution: Sequence of descent from more complex, more recent and more advanced site of plants of animals from singular and more primitive one over successive stages over a Century

(11) Paleobotany: This deals with ancient forms of plants reserved in form of fossils

Agronomy: This deals with the cultivation of food crops

(12) Horticulture: Cultivation of garden plants from flowers and fruits

Plant Pathology: Diagnosis, cure and prevention of plant diseases

(13) Pharmacognosis: It is the study of medicinal Plants

(14) Forestry: It is to study and utilization of forest plants for timber and other forest product

(15) Plant Breeding: Cross breeding of plants for improved size in desired characteristics

22nd January, 2024

In an attempt to organize unordered organismal world by human, there's limitation of categories under which smaller categories are all included, that limitation of this are orderly, the greater the affinity among a collection of organisms, the lower the category they belong to due to the loss of subjectivity arises in, the limitation of heirarchy categories. There were agreements internationally to itemize and standardize taxonomy heirachy. The commonly adopted taxonomy category of angiosperm employed today is derived from International Code of Botanical Nomenclature (ICBN). However, there are a number of categories like sub-genus sub-section succession, sub-series, sub-varieties and certain, some sub-varietal categories that are omitted from the proposal of the code.

Also, there are certain unusual endings, that have been conserved the convention and usage, such as

Asteraceae - Compositae

Poaceae - Graminaceae

The taxonomy heeracky of group of plant may change though the relationship hierachy relationship / sequence may not change.

Identification:

This is the process of assigning and unknown entity to a group that was already established.

Taxonomy: It is the science of classification and identification.

Systematic: This is the wider subject of taxonomy, namely gathering and assessment of classification data

Nomenclature: It is the system of naming that botanist require a system of naming plants which enables them to standardize not only the terms that denote taxonomy ranks but also the specific names which refers to refers to the taxonomy groups among plants

The guidelines for plant classification and nomenclature are provided in form of a code (ICBN)

The problem of naming are usually addressed and resolved in international congresses and through publications

General rules guiding nomenclature of the plants are:

(1) Each organism is assigned to two latin names, a generic name and a specific name

(2) The name is accompanied by the name of the person who first describe the organism

(3) The scientific name are always underlined or italized.

(4) Sometime a varietal name can be included Some have 2 names & some have one
The idea of two names, i.e the binomial system is established by Carolus' Linnaeus eg Cowpea:

Vigna unguiculata Var. Unguiculata

Musa paradisica Linn.

Musa sapientum Linn.

Boerhavia Coccinea Mill.

Imperata cylindrica (Linn) Raeusch.

Oryza Sativa
Zea mays
> Check for the authority

Classification: Grouping of organisms based on their use to man, habitat and biological attributes

Classification of plants

Plants can be divided into three main division

(1) Cryptogams — thallophyta, bryophyta, pteridophyta
(2) Gymnosperm
(3) Angiosperm } spermatophyta

(1) Cryptogams are flowerless and seedless plants. They are lower and more primitive plants.

They can be divided into three main groups

(i) thallophyta (ii) Bryophyta (iii) pteridophyta

Thallophyta consists of algae, fungi, bacteria and lechen

Bryophyta consists of liverwort, horned liverwort and mosses

Pteridophyta includes ferns and allies

(ii) Gymnosperms

They are flowering plants with unenclosed seeds located on the upper surface of scales which are

usually part of cones. They form intermediate group between higher cryptogams and Angiosperms.
Examples are; cacads, conifers and ginkgo

(ii) Angiosperms
They are flowering plants and produce seeds that are enclosed within the Ovary. This include, herbacious plants, shrubs, glasses and moulds

Difference Between plants and Animals
There are three main differences:
(i) Food manufacture
(ii) Cell wall
(iii) Unlimited growth

(1) Food manufacture: Most plants can synthesize complex food from simple substances such as CO_2, water and minerals provided Chlorophill and light are present
But fungi and bacteria cannot

While animals require ready made food in form of plant or other animals that have eaten plants.
However, fungi are simple non green plants that cannot manufacture their own food rather obtain it from external sources

(2) Cell wall: Most plants have rigid cell walls of cellulose, a carbohydrate material which gives them the stiff and sturdy framework and lack of motility of plants
Animal cells are generally flexible because they lack cell wall.
Occasionally, some plants, euglena are motile (they can move) and some do not have Cellulose cell wall. (what make the plant immovable is the cellulose cell wall).
While many animal have rigid internal or external skeleton which do not involve cellulose.

(3) Unlimited Growth: Most plants have indeterminate or unlimited growth due to the fact that meristematic tissue remains active throughout the plant's life, except in some plants organs. Such as leaveas and petals which exhibit determinate growth. While the growth in animals is limited, ie determinate