① Origin and Evolution of life - an outline (2W)

② Viruses. Structure replication and transmission
Plant diseases caused by viruses. & their Control — (8)

③ Bacteria structure, nutrition, reproduction & economic importance. An outline of Plant diseases of crop plants caused by bacteria & their Control.

④ Brief a/c of Archaebacteria, Chlamydia Actinomycetes & Mycoplasma.

⑤ Cyano bacteria Cell structure (with organisms) and their prospecting (uses) - Bio fertilizers (Oscillatoria, Nostoc, Anabaena for Practicals only)

Theories of origin of life

It is a complicated Problem for the biologists
Different views have been forwarded — No agreeable view has been got till Now.

① Theory of special creation Hebrew et. al.
living organisms were formed on our planet by some Supernatural Power called god or creator
living organisms were formed all of sudden and out of Nothing

According to Bible, the Creator formed all living organisms about 4004 BC within 6 days
1st day — Heaven and earth materia prima.
2nd " — Sky was separated from water
3rd " — Dry lands and plants
4th " — The Sun, the moon and the stars
5th " — Fish and fowl
6th " — Animals and human beings

Bible — First man, ADAM formed out of Clay about 6000 years ago.
First woman EVE was formed out of [illegible]
According to Hindu Mythology [illegible]
[illegible]

Theory of Spontaneous generation or abiogenesis

According to this theory life has originated from Non-living organic matter abiogenically (A - not; Bios - life, genesis - origin) from time to time

Greek philosphers of Pre-christian era like Thales, Plato, Aristotle etc & followers of this,

Aristotle described the aphids (insect) arise from dew (ΔΟΞΑ) which falls on plants.

Fleas arise from Putrid decomposed matter mice from dirty hay. Crocodiles from rotting logs at the bottom of water bodies.

Italian Francesco Redi in 1668 Proved that no maggots appeared in meat when no eggs laid on meat.

In 1768 Lazzaro Spallanzani Proved that microbes came from air and could be killed by boiling.

In 1861 Louis Pasteur performed a series of expts & Proved that microorganisms such as Bacteria & fungi arise only from pre-existing cells. This supported Cell theory

Panspermia theory or Cosmozoic theory

According to Richter (1865 AD) life reached the earth in the form of spores & called 'panspermia' with cosmic dust from other planet.

life existed throughout the universe and the spores etc could travel through space from one planet to other in favourable conditions (temp, heat, cosmic radiation)

Modern concepts on the origin of life

Russian biochemist A.I. OPARIN (1920) was the first to suggest that a gradual evolution of Chemical substances occured before life

British biologist Haldane (1928 AD) Proposed the Chemosynthetic theory of evolution called as Oparin - Haldane theory.

It states that Primitive life originated in the oxygen free conditions on the Primitive earth from inanimate matter by chemical synthesis about 4 billion years ago (Pre-cambrian era)

Abiogenic Theory or Chemical Evolution:

It states that life arose by a series of sequential chemical reactions on earth

Origin of Earth

The earth is presumed to have originated about 4,500 - 5,000 million years ago.

Two hypothesis are there.

① Planetesimal hypothesis: It believes that earth is originated as a part of broken off from the molten mass of SUN.

② Nebular hypothesis: According to it earth is originated by gradual condensation of interstellar dust from which the entire Solar System is formed. It is proposed by Kant (1755 AD)

① About 10-20 billion years ago, a highly condensed mass of cosmic material called Primaeval matter or ylem prevailed. It consist of neutrons, protons and electrons like 'particles' of matter and anti-particles of anti matter.

② About 4.5 to 5.0 billion years ago this mass of cosmic material exploded to form numerous pieces called 'nebulae'.

This explosion of cosmic material is called Big-Bang or thermonuclear explosion.

③ One of such nebulae called Solar nebula gave rise to our Solar System.

④ A nebula was a cloudy mass of cosmic dust & gasses, in this cloud most of the mass was concentrated near the centre due to condensation and spinning.

⑤ Due to its own gravity, the nebula finally became a flattened spinning disc of atoms & particles. Its central region heated up and became a star. The Primitive SUN.

⑥ In the periphery, atoms and the dust aggregated to form asteroid size clumps. These clumps finally grew to the planetary size and formed the planets such as Mecury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune and Pluto.

⑦ In the primitive sun due to its high temp

The Primitive Earth

(1) In the beginning the earth was like a fiery spinning ball of hot gasses and vapours of elements. gradually gasses condense into a molten core and different elements get stratified according to their density.

(2) Elements reacted with one another. active Hydrogen reacted with N_2, C and O_2 to form amonia(NH_3) Methane & water vapour respectively.

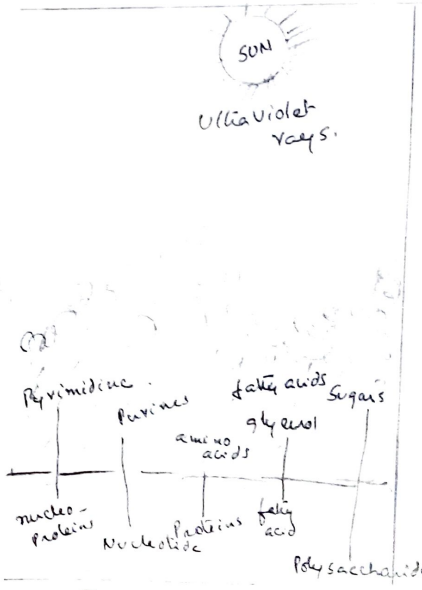
(3) The Primitive earth consist of solid phase the Lithosphere & gaseous envelop surrounding it called the atmosphere — Hydrogen developed later.

(4) Heavy metals like Nickel, iron etc formed the solid core of earth. while lightest elements like Helium, H_2, H_2O vapour N_2 carbon etc. formed the gaseous atmosphere. There was no free oxygen.

(5) Highly energetic UV-radiations around ~~earth~~ in the earths atmosphere.

(6) The radiations favoured photochemical reactions. H_2O splitted into Hydrogen & oxygen. H_2 (lighter gas) escaped into ~~atom~~ atmosphere O_2 combine with ammonia & methane to form CO_2, H_2O & other oxides. The ozone layer formed

(7) As the Earth further cooled, water vapour condensed and rains came down forming oceans. Subsequent evaporation of water led to more rain, and more wear of rocks as this water found it way the sea, dissolving within dissolved salts. The concentration of these in organic material prevail 3% salt content of sea.



Primitive Sea & formation of Organic molecules

Classification of micro organisms

living organisms

- Animals
- Plants

After the discovery of Bacteria and other unicellular organisms, a third division '<u>Protista</u>' was established in 1866 - Haeckel.

Protista

higher protista	lower protista
resemble plant & animals eukaryotic. Eg. algae Fungi, Protozoa	Bacteria & cyanobacteria Prokaryotes

1969 Whittaker classification includes 5 kingdoms.

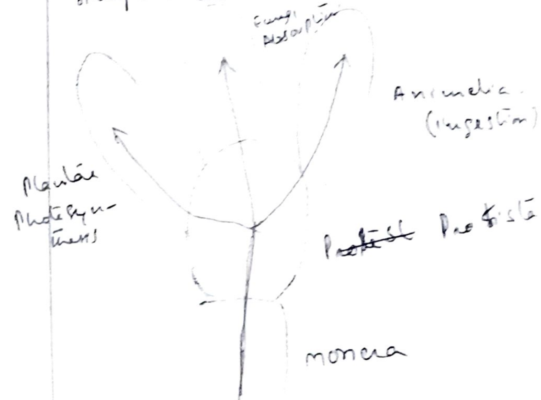
① kingdom Monera or Prokaryotae: <u>Prokaryotic</u> cells Nutrition - absorption. rep - asexual. genetic recombination sometime occur - Bacteria, Cyano bacteria

② kingdom Protista Eukaryotic cell. cells solitary or colonial. aerobic, nutrition - ingestion. absorption. photo autotrophic - Algae - Protozoa. Simpler fungi

③ kingdom - Fungi - Eukaryotic ~~cells~~ multi-nucleate Thallus. septate mycelium - nutrition - absorption Eg mycelial fungi

4 kingdom Animalia Multicellular animal with wall-less ~~or~~ eukaryotic cells. [illegible] ingestion. - Animal

⑤ kingdom plantae autotrophic plant multicellular with walled eukaryotic cells simple - advanced tissue organism.



Kingdom System of R H. Whittaker.

<u>Prokaryotic cell</u>	<u>Eucaryotic cell</u>
① Nuclear membrane absent	N. membrane present
② one chromosome Haploid	More than one chromosome diploid
③ cell-division. binary fission. asexual replication only	cell divide by mitosis
④ genetic information by conjugation, transduction & Transformation	sexual [illegible]

BACTERIA

Bacteria — are very small, microscopic, unicellular organisms. Bacteria were first observed by A. VAN LEEWENHOEK (1676) and named as "animalcules" the name bacteria was used by Ehrenberg (1838) Louis Pasteur and Robert Koch studied about bacteria — fermentation, germ theory of disease etc.

Occurence & Habit:

Occur in all natural habitats, Air, Water on plants, on animals. (E coli in intestine) Soil. decaying organic matter, etc

Size: Very small, microscopic organisms. Their size varies with shape. Cocci - 0.5 - 2.5 µm, Bacillus — 1.4 to 15 µm. diameter.

(1 µm = 0.001 mm)

Shape: fundamentally 3 shapes. Spherical, rods and spiral. uni cellular but a few forms colonies.

Spherical or ellipsoidal — called as Cocci bacteria (Cocci - Greek)

Non-motile, occur in pairs, chains or in clusters of variable size & shape.

in pair — Diplococcus. (Ex- Neisseria) ∞

in chain — Cocci in pairs. ∞
" in chains. ∞∞∞∞∞
Streptococcus.

in grapes — grape of cocci
Staphylococcus.

8 cells to cuboidal — Sarcina.

Bacillus - rod shaped:
Rod shaped or cylindrical may be motile or non-motile.

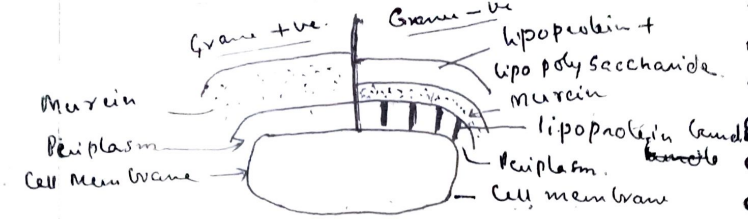
Single — Mono bacillus. Eg. clostridium
Pair — Diplo Bacillus -
Chain — Strepto bacillus. Ex lactobacillus
Spiral or helical bacteria - larger in size.
Vibrioid — Comma bacteria - Comma shaped
Spirillum - have more than one helix.
1.5 cm in length & 1.5 cm in width
motile & have 1 or more than one flagella at each pole occur in small chains.

Other forms:
Pleomorphic: Some bacteria change their shape & size temporarily in response to environment. Eg Acetobacter able to form ...
Trichomes: Cells divide in one plane forming a chain of cells. Surrounded by a sheath
Hyphae: Some bacteria form multicellular thin walled profusely branched filaments called hyphae Ex Actinomycetes

Staining of bacteria
usually stained with Methylene blue Safranin etc.
Dutch physician GRAM (1884) introduced differential staining method (exposed to more than one stain).
Flow chart:
Bacterial smear → Crystal violet (1 min) → Rinse with water → Few drops of Iodine (20 sec) → Rinse with water → wash with 90% alcohol & with water
Bacteria with violet colour — ... +ve.

Colourless bacteria counter stain with Safranin.

Pink colour bacteria — Gram — ve.



Structure of Cell:

Typical Prokaryotic structure has 3 layers. outer covering → Slime (Slime) middle — cell wall and inner → Cytoplasmic membrane.

Capsule: Some bacterial cells are surrounded by a viscous layer called Slime layer or Capsule made up of Polysaccharides or Polypeptides, it Protects the cell, and acts as reservoir of food or waste products.

Capsulated bacteria — infectious

→ Non infectious.

Cell wall:- Beneath the capsule - the rigid cell wall is present. it contains regular polymer - the peptidoglycan or Murein. It gives shape & protection

Gram Positive → traces of lipids & amino acids.

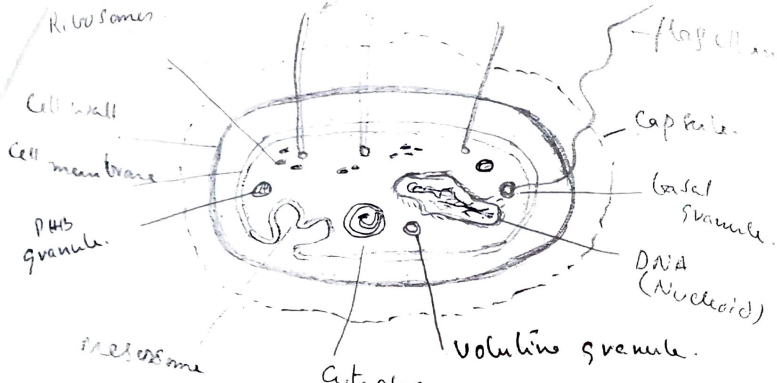
Gram – ve → 20% of lipids & wide range of Amino acids.

Cytoplasmic membrane:

Beneath cell wall, thin membrane around the cytoplasm. It contains Proteins, Phospholipids & Polysaccharide

It is semipermeable & regulate the transport of nutrients & waste Products. respiratory enzymes also Present in it. membrane has infolding called Mesosomes Respiratory enzymes are associated with it.

Cytoplasm: It is an aqueous sol. of Soluble proteins & metabolites. It contains RNA, ribosomes and various food materials. It contains nuclear body or nucleoid.



Nuclear body: nucleoid lacks nuclear envelope. It consists of single molecule of DNA (DNA) It is circular and embeded in cytoplasm.

Ribosomes: occurs freely in cytoplasm in clusters of 4-6 ribosomes. The clusters are called Polysomes. It is 70s Size consists of 50s and 30s particles. (Subunit)

Reserve food materials: fats, Polysaccharides, Volutin etc.

Fats — acids (amino acids)

Volutin — different forms of Phosphates.

granules — Polysaccharides.

Plasmids: a small circular, self replicating and double stranded DNA mol. Present bacterial cell, in addition to bacterial chromosome.

Term plasmid is coined by Lederberg (1952).

a plasmid contains 5-100 genes.

Flagella: hair like, surface appendage emerging from the cell wall. Spiral and bacillus forms has flagella

No & Position:

Monotrichous: one flagella at one end of the cell. Ex. vibrio cholerae

Lophotrichous: group of flagell at one end of the cell. Ex spirillum volutans.

Amphitrichous: one or more flagellae at both ends Ex Nitrosomonas Sp.

Peritrichous: cell surface is evenly surrounded by several flagella.

Eg. Bacillus typhosus.

Each flagella has 3 Parts ① Basal body
② hook and ③ filament

Pili & Fimbriae

Gram – ve bacteria possess minute hair like appendage coming out from cell wall. made up of bacterial. Not for locomotion only for friction

Nutrition in Bacteria

Two groups of bacteria on basis of their mode of Nutrition

① Autotrophic bacteria ② Heterotrophic bacteria.

Autotrophic bacteria:

They can synthesis their own food are called Autotrophic bacteria. They utilise energy from either sunlight or chemical reactions for metabolic activities. They are

Photosynthetic bacteria

Chemosynthetic bacteria.

(A) Photosynthetic bacteria

utilising light energy. They are anaerobic, aerobic and occur in deep layers of pond or lake — they are three type

① Purple Sulphur bacteria: these bacteria contain bacterio chlorophyll and carotene as photosynthetic pigments. they are purple in colour due to presence of yellow and red coloured carotenoids

Eg. Chromatium.

the reaction as follows.

$$2CO_2 + H_2S + 2H_2O \xrightarrow[\text{Bacterio-Chlorophyll}]{\text{light}} 2(CH_2O) + H_2SO_4$$

② Purple Non Sulphur bacteria: contain bacterio chlorophyll and carotenoids as photosynthetic pigments. They utilise molecular H_2 for reduction of CO_2

Eg. Rhodospirillum.

These bacteria do not use Sulphur compounds they use organic acids, alcohols etc.

$CO_2 + 2\,CH_3CH(OH)CH_3 \rightarrow [CH_2O] + 2\,CH_3COCH_3 + H_2O$

Green Sulphur Bacteria: They contain Chloro Green Chlorophyll and carotenoids. They are green colour. These are small, non motile, rod-shaped bacteria — anaerobic. They use H_2S Ex. Chloro Green. Hetch Helio Bacteria.

$6CO_2 + 12H_2S \longrightarrow C_6H_{12}O_6 + 6H_2O + 12S$.

Chemosynthetic Bacteria

These bacteria can capable of synthesising their own food material utilising the chemical energy released during oxidation of certain inorganic substances they are anaerobic, they live in soil and water. Based on substrate they are 4 types. ① Sulphur bacteria, ② Iron bacteria, ③ Hydrogen bacteria ④ Nitrifying bacteria.

Sulphur Bacteria: They occur on sulphide rich water, soil, sewage. They oxidise Hydrogen Sulphide to Sulphur and then Sulphuric acid. The energy released during this oxidation is utilised by the bacteria.

$2H_2S + O_2 \xrightarrow{\text{Beggiatoa}} 2S + H_2O + \text{energy}$.

$2S + H_2O + 3O_2 \xrightarrow{\text{Thio Bacillus.}} 2H_2SO_4 + \text{energy}$

Iron Bacteria They occur in iron-rich waters (iron pyrites (FeS_2)) They oxidise ferrous ions to ferric ions they utilise the chemical energy released during this oxidation.

$Fe^{2+} \xrightarrow{\text{Ferro bacillus.}} Fe^{3+} + e^-$

Hydrogen Bacteria: These occur in soils. They oxidise molecular H_2 to water. They utilise the chemical energy released during this oxidation.

$2H_2 + O_2 \xrightarrow{\text{Bacillus pantotrophus}} H_2O + \text{energy}$.

Ex Rhizobium. Gram + ve bacteria

Nitrifying Bacteria: These are Soil borne obligate autotrophes. They oxidise ammonia to Nitrate and play an important role in N_2-cycle. The Conversion of $NH_3 \rightarrow HNO_2$ is known as nitrification. Process occurs in 2 steps.

$2NH_3 + 3O_2 \xrightarrow{\text{Nitrosomonas}} 2HNO_2 + 2H_2O +$ 78 K.cal energy.

$2HNO_2 + O_2 \xrightarrow{\text{Nitrobacter}} 2HNO_3 + 21.6$ K. energy.

(gram -ve bacteria)

Heterotrophic Bacteria:

These bacteria do not Synthesize their food materials. They obtain their food from either living organisms or dead and decaying organisms. If they get food from living organisms they are called Parasites. If they get food from dead and decaying organism they are called Saprophytes.

the parasites get from living organism alone — Obligate Parasites.

If they get food from living organisms, and may get food from dead organism under certain conditions They are called facultative parasites.

The Parasitic bacteria live in animals and plants, and cause diseases in the host — Pathogen bacteria.

animal (human) — TB, cholera, plague etc

Plants — cabbage rot, wilt of tomato etc

The Saprophytic bacteria live on dead and decaying organism and cause decomposition of dead plants & animals.

Several bacteria are useful in fermentation, tanning of leather, retting of fibre.

Symbiotic bacteria: They live in close association with other organisms (plants & animals) in such a way that both the concerned organisms receive mutual benifit from this association. Ex Rhizobium

the bacteria inhabitating intestine of man and animals. the enzymes secreated by bacteria are helpful in the digestion of cellulose & in return obtain their food from the host.

Ex. E. coli, Lactobacilli, Clostridium

Nutrition

- Autotrophic Bacteria
  - Photosynthetic Bacteria
    1. Purple Sulphur Bacteria
    2. Purple Non-Sulphur bacteria
    3. Green Sulphur Bacteria
  - Chemosynthetic Bacteria
    1. Sulphur Bacteria
    2. Iron Bacteria
    3. Hydrogen "
    4. Nitrifying.
- Heterotrophic Bacteria
  - Parasitic
  - Saprophytic
  - Symbiotic Bacteria

Hyphomicrobium

Reproduction in Bacteria:

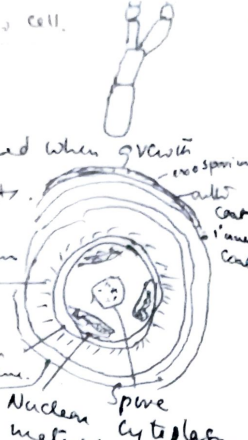
reproduce mainly by asexual methods, therefore they have dominant haploid phase in their life cycle. they do not have sex-organs, gametes but they show genetic recombination i.e exchange of genetic material

1. **Binary fission.** It is an asexual process in which the bacterial cell divides and produce two daughter cells. During the cell division the cell elongates and there is division of nuclear material (DNA) It is followed by the distribution of DNA, then the cyto-plasmic membrane grows into the centre of the cell resulting a transverse septum. the cells may separate or remain together and continue to divide to the formation of a chain of cells.

Budding: Some bacteria like Hypho microbium reproduce by budding. under favourable conditions a small bud develops from parent present cell it enlarges in size nuclear material and cytoplasm enters it. it separate from the

Parent cell and becomes a new cell.

Endospores: Endospores are intracellular resting cells formed when growth ceases due to lack of nutrients.



Rods — Bacillus. Clostridium

endospores are tough enough to last for years.

Bacillus — 50–100 years old.

Sexual Reproduction: (genetic recombination)

3 methods. ① Transformation ② Conjugation ③ Transduction.

Transformation:

- the transfer of small segment of naked DNA from donor cell to recipient cell through the medium in which they are growing is known as Transformation.

Here cell to cell contact is not required.

It was first observed by Griffith (1928) "Streptococcus pneumoniae" it causes pneumonia in mice and man.

Griffith's Expt: in Streptococcus pneumoniae 2 strains of cell are present.

① Strain with gelatinous capsule — Virulent (S) & cause death

② Strain without capsule — Non-virulent (R) & do not cause death in mice.

③ heat killed cells of capsulated strain also non virulent, and do not cause death in mice.

When heat killed S strain cell are mixed with living R strain cell injected into mice they cause death of mice.

The dead mice showed in presence of capsulated virulent cells.

It means in non-capsulated cell are changed to capsulated cell and this phenomenon is called Transformation

① capsulated virulent S strain → mice death (S)

② non capsulated non-virulent R strain → mice do not die (R)

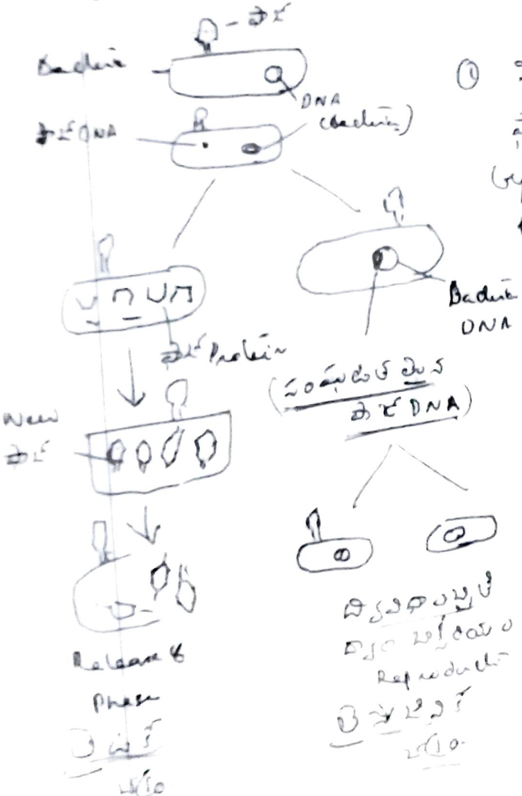
③ heat killed capsulated S strain → (N)

④ heat killed capsule + non-capsulated → cause death

Transduction

The Process of transfer of genetic material from one cell to another cell by temperate bacteriophage is called as transduction.

It was discovered by Zinder & Lederberg (1952) in Salmonella sps.



1. [illegible] ఫేజ్ [illegible] Bacteria by [illegible]
2. ఫేజ్ [illegible] DNA Bacteria [illegible]
3. ఫేజ్ DNA Bacteria [illegible]
4. ఫేజ్ Proteins ఫేజ్ DNA [illegible]
5. [illegible] ఫేజ్ [illegible]
6. Bacteria [illegible] ఫేజ్ [illegible]

Bacterial Sex. Conjugation.

The Process of transfer of genetic material from one cell to another cell through some kind of Bridge (Pili) is called conjugation. demonstrated by Lederberg & Tatum (1946) in E. Coli

Two mating types. ① Donor male.
② recipient.

F factor

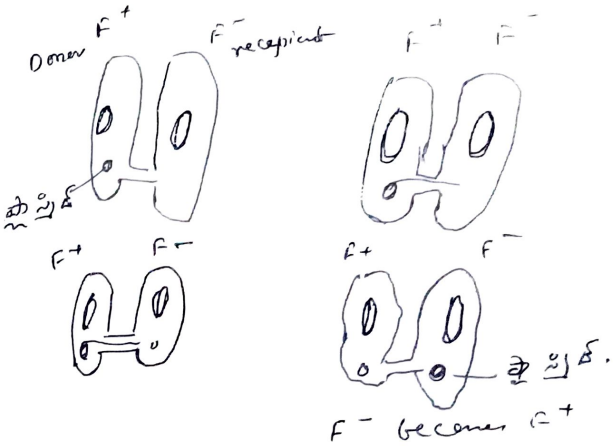
Donor contain F' factor (fertility factor) (episome) plasmid
episome attached to cell membrane.
Donor has pili.

Sex pili (conjugation tube)

During conjugation the Donor cell attached to the cell wall of recipient cell through Sex pili. The donor cell transmitted a copy of its genome into recepient cell through Sex pili (conjugation tube) only a copy of genome

The complete genome is not transmitted only a few male genes are transmitted As a result of transfer of F' factor the recipient cell becomes male.

It is also reported in Salmonella. pseudomonas.



Economic importance (Bacteria)

Bacteria influence us man in several ways. Their association with our daily life and life activities is so intimate. Some bacteria are useful to us and some other are harmful to us. Thus, it may be considered as our "friends and foes" to mean

Useful bacteria

① Decomposition: Several saprophytic bacteria acts as scavangers of nature by decaying dead bodies of animals and plant debris.

Sewage disposal: The sewage contain human wastes, food wastes and industrial waste. Sewage contains 1-2% of organic solids and 99.98% of water. Micro organisms converts sewage from organic to inorganic salt by a process called mineralisation or stabilisation. In this process aerobic and anaerobic bacteria take part.

Aerobic bacteria: Flavo bacterium, Pseudomonas.

Sewage treated water is let out into rivers and lakes. The sludge containing harmless organic & inorganic matter it is dried and used as fertilizers.

Fertilizers

③ Soil fertility: Bacteria play an important role in maintaining of soil fertility. Otherwise soil looses its nitrogen content by continuous agriculture. Fixation of Nitrogen by bacteria is called 'biological nitrogen fixation.

3ⓐ Nitrogen fixation by free living bacteria: Many free living soil bacteria such as Azato bacter (aerobic) clostridium (anaerobic) have a capacity to fix atmospheric nitrogen into ammonia. (ammonification) The ammonia & ammonium salt are oxidised by Nitromonas & Nitrobacter into nitrates. (Nitrification).

N- NH_3
NH_3 - NO_3

3ⓑ Symbiotic Nitrogen fixation: It is done by nitrogen fixation bacteria - Rhizobium lodged in root nodules of leguminous pla

1 Industrial uses:

a) Fermentation of dairy Products:

Bacterial fermentation of milk yields various dairy Products like Butter milk Chees, cream & butter. Eg. Lactic acid bacteria. Cream is soured by Streptococcus lactis; chees by combined action of Staphylococcus and Lacto Bacillus. Yogurt by fermenting milk with Lacto Bacillus bulgaricus.

② Vinegar: It is obtained by fermentation of cane juice, molasses and fruit juices.

Sugar $\xrightarrow{\text{yeast}}$ Alcohol.

Alcohol $\xrightarrow{\text{Acetobacter}}$ acetic acid

Vinegar used in the preservation of meat & vegetables.

③ Retting of fibres. It is controlled bacterial decomposition of plant material to separate the fibres.

Eg anaerobic bacteria — Clostridium butylicum
C. felsineum

④ Curing of Tobacco & tea:

Curing due to fermenting action of certain bacteria

⑤ Leather tanning: It is used in tanning of hides, skin etc. the leather becomes soft.

Bacteria are used in the production of organic acids (acetic acid, lactic acid)

Enzymes Eg Protease from Bacillus subtilis
Pectinase, clostridium
Amylase — Bacillus diastaticus

Antibiotics: These are produced by micro organisms which inhibit or kill other microorganisms (bacteria).

(TB, dysentry) ① Streptomycin — Streptomyces griseus
(Typhoid Rickettsiae) ② Chloromycetin — S. venezuelae
(Rickettsiae) ③ Tetracyclin — S. aurefaciens.
(Diphtheria W. cough) ④ Erythromycin — S. erythreus
⑤ Bacitracin — Bacillus subtilis

Vitamins
riboflavin (vit B2) — Clostridium butylicum

Biogas: Methane gas (fuel) obtained by anaerobic action of Methano bacillus on (Cattle dung)

(5) Bacterial Pesticides: These are currently investigated as alternative Pesticides. Eg. Bacillus, clostridium. ~~Hsp~~ Pseudomonas, Enterobacter etc. Mosquito larvae can be destroyed by Bacillus sps.

(6) Biodegradation of insecticide and herbicides.

Eg. 2,4-D is decomposed by ~~Aerobacter~~ Achromobacter.
DDT " " Aerobacter.

Genetic Engineering: G.E may be defined as an manipulation of DNA. out side an organism for the purpose of constructing new strains with altered properties.

II Harmful aspects

① Spoilage of food: many bacteria grow on food stuffs and produce toxic substances which cause food poisoning.

② Botulism: food poisoning is caused by the toxins produced by clostridium botulinum.

It causes Paralysis of pharynx and diaphram.

③ Staphylococcus Poisoning: It is characterised by nausea, Vomiting, Chills

④ Salmonella Poisoning: - typhoid.
They are caused by faecal contamination of foods

② Spoilage of Paper: In paper mills, Contamination of bacteria causes destroy of Cellulose

③ Destruction of wood: decay of wood (Rot)

④ water Pollution: Pathogenic bacteria Vibrio Cholerae, Salmonella typhi cause diseases

Biological warfare: Pathogenic bacteria that spread infectious diseases are kept as a kind of weapons and used on enemy country.

Diseases in human body:

Pathogenic bacteria cause diseases in human being and animals

①	Typhoid	Salmonella typhi
②	Pneumonia	Streptococcus pneumoniae
③	Cholera	Vibrio cholerae
④	Tetanus	Clostridium tetani
⑤	T.B.	Mycobacterium tuberculosis
⑥	Leprosy	" leprae

Animal diseases: Bacteria causes diseases like T.B. to cattle, anthrax of sheep, glanders in sheep, horse & goats.

Plant Diseases: Bacteria causes many plant diseases of cultivated plants (crops) vegetables & fruit yielding trees. The diseases symptoms are — wilts, blights, rots, etc

① Bacteria blight of Paddy — Xanthomonas oryzae
② Red Stripe of sugarcane. — Pseudomonas rubrilineans
③ Soft rot of Potato & Carrot — Erwinia carotovora
④ Fire blight of apple. — Erwinia amylovora

Control of Bacterial diseases:

① Eradication & burning of diseased plants
② Maintaining field sanitation
③ Growing resistant varieties
④ Spraying of Bordeaux
⑤ Application of antibiotics. &
⑥ Crop rotation

VIRUSES

Viruses are obligate intra cellular Parasites which can be viewed with electron microscope they are small and can pass through the Pores of Bacteriological filters.
They possess only one type of nucleic acid either DNA or RNA.

Adolf Meyer (1883) and D.J. Iwanowski (1892) recognized that viruses are the Causative agents of MOSAIC Disease of Tobacco. These agents are designated as filterable Viruses ie Poisnous fluids.

An American Chemist M Stanley 1935 Crystalized the virus causing mosaic disease on Tobacco plant and got NOBEL Prize in 1946 for this.

Outside the host cell they are essentially non-living Particles, whereas within the host cells they exhibit Characteristic of living Systems.

Feature of living organism

1. they are obligate parasite
2. they contain either DNA or RNA. (genetic material)

(3) They can multiply inside a living cell.
(4) They exhibit variation due to Mutations.
(5) They show irritability & respond to environment conditions such as heat UV-rays humidity drought, alcohol, etc.

Features of Non-living Objects.

(1) Have no cell wall.
(2) Do not show cellular metabolism.
(3) They remain as inert Particles outside the host cell.
(4) They can be precipitated like chemical substances.

Viruses are in transition (bridge) forms between living & Non living so they are called as acellular microbes.

Size: The size of viruses vary from 20 nm to 300 nm in diameter (1mm = 1000 microns) Parvo viruses are smallest (<20 nm)

Shape: different shapes of viruses.

(1) Rod Shaped (TMV)
(2) Polyhedral (Polio virus)

(3) rectangular (Vaccinia virus)
(4) Spherical (Adeno virus)
(5) Tadpole (Bacteriophage)



Structure: Complete assembly of the viruses Particle is known as virion. It consists of a nucleic acid core surrounded by a Protein coat or capsid. This complete set of virion is known as nucleo capsid. The capsid is composed of large number of subunits called capsomeres. Some viruses have an additional layer around the nucleocapsid called envelop. The envelop is made up of lipids, Proteins & glycoproteins.

Nucleic Acid: Viruses contain either single or double stranded DNA or RNA

DNA containing viruses are called Deoxy Virus
RNA Ribo Virus

Plant viruses have single stranded RNA except the cauliflower mosaic virus

ii) Animal viruses have Single or Double Stranded DNA. (~~ds DNA~~) except in Polio virus. (contain RNA)

iii Bacteriophages contain double Stranded DNA.

iv Insect viruses contain RNA (mostly)

Protein coat: This coat is called Capsid. The capsid consists of several sub units known as Capsomere. This coat Protects the viral genetic material & helps in transfer of genetic material to host cells.

Holmes ~~data~~ classification. 3 orders.

Bacteriophagineae — attacks Bacteria.
Phytophagineae — " Plants.
Zoophagineae — " Animals.

LHT (Lwoff. Horne & Tournier (1962)
System of classification
Depends on ① type of Nucleic acid, ② mol. wt of virus, ③ Shape & Size, ④ Symmetry, ⑤ No of Sub unit in capsid. ⑥ Diameter of Nucleic acid coil. ⑦ Presence of envelope.

Symptoms of Virus on the host plant

Phylum Viro

Sub phyla I
DEOXYVIRA.
DNA viruses

① Deoxy helica (helical symmetry)
② Deoxy cubica (cubical symmetry)
③ Deoxy binala. (with head & tail)

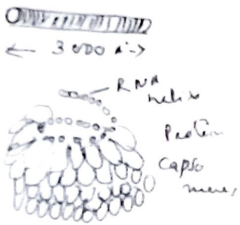
RIBOVIRA
RNA viruses

① Ribo helica
② Ribo cubica

TMV Virus: More than 100 types are there
It was discovered by Iwanowski in 1892
It is crystallised by WM. Stanley 1935
Its chemical nature by Bawden & Pirie – 1938
Fraenkel, Singer & Williams 1956 Confirmed the genetic material of TMV is RNA.

Structure: Fraenkel et al. (1957) described the structure of TMV Particle. The Particles appear as bundle of Rods or needles under Electron microscope. Each rod is approximately 3000 A (300 nm) in length & 170 A (17 nm) in diameter. Its mole. wt of 39×10^6 dallons.
These Particles have a Protein coat (Capsid) and a nucleic acid core

the Protein Coat is made up of approximately 2130 identical subunit called capsomer. Each capsomere consist of single polypeptide of 158 amino acids. The capsomeres are helically arranged around a single stranded RNA which is also spirally coiled to form helix. The total length of each rod has about 130 helicals (turns)



Structure of T_4 Bacteriophage

It is tadpole shaped virus and consists of 5 imp. structure ① Head ② Collar ③ tail ④ Tail plate, ⑤ tail fibres.

The Particle is naked icosahedral & tail 200 - 280 nm length, the head's length is 12.5 nm & 8 nm width. The capsid is made up of 2000 capsomeres

DNA molecule is about 50 nm. is tightly packed inside the head like a ball of yarn. The DNA is about 1000 times longer than the phage itself. It is about 5000 nm long & consist of 1530 nucleotides

The phage consist of long helical tail which is connected to head with a connector leaving a collar. At the proximal end of the tail, a hexagonal base plate (tail plate) is present. This basal plate consist of six spikes & tail fibres at its six corners. The tail fibre has 2 main function

① help to attach bacteria
② Secrete enzyme

Replication of viruses in the bacteriophage T_2

which attacks the bacteria E.coli

5 steps. Attachment or Adsorption

Penetration & uncoating or injection.

Biochemical replication or synthesis

Assemblage

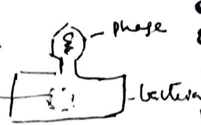
Release

[illegible]

① **Attachment** or **Adsorption**: The phage attaches to the wall of bacterium by tail & tail fibres. The attachment is only at specific sites on the host cell. These sites are called receptor sites. The attachment is by ionic bonds.

receptor site

ionic bond



② ప్రవేశం

Penetration or **injection**: The phage form a small pore on the wall of bacterium mechanically or by secreting lysozyme. The tail fibers attach to virion and hold it firmly. The tail sheath contracts and drives the core of tail tube into bacteria. The DNA of the phage is injected in the host cell. The protein coat & tail remain as ghost

mechanically & lysozyme

inject

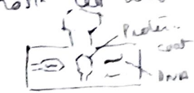
(గ్రహణ దశ (Eclipse phase))

③ **Synthesis**: Immediately after entering the bacterial cell, viral DNA takes charge of the host's metabolic machinery. The bacterium stops synthesizing bacterial proteins & bacterial nucleic acids. Instead it synthesizes viral proteins and viral DNA.

Protein & Nucleic acid

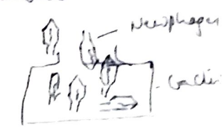
సంశ్లేషణ దశ (Synthetic phase)

④ **Assemblage**: The viral protein coats and viral DNA assemble together within host cell and produce several mature virions.



విచ్ఛిన్న దశ (Lytic phase)

⑤ **Release**: When the no of phages reaches 900/200 the bacterial cell bursts releasing the new phages. The new phages infect E.coli and begin another cycle. The entire process from infection to lysis takes about 25 minutes.



Transmission of Plant Viruses:-

① Mechanical transmission: The Process of transmission of viruses from one plant to another by transfer of Sap through contact is called as mechanical transmission. It takes place between closely spaced plants.
Eg. TMV.

② Transmission by Vegitative Propagation: the Process of Transmission of viruses from mother plant to its Progeny through organs of Vegetative propagation (grafting, cutting, tuber rhizome) is called Transmission by Vegetative Propagation. Eg. Potato, rose.

③ Seed Transmission: The Process of Transmission of viruses through seeds is called Seed Transmission. It occur very rarely because viruses do not reach the seeds. Eg. Bean mosaic virus. Spot virus

④ Pollen Transmission: The Process of Transmission of viruses from infected plant to healthy plant through pollen is called P.T. fertilized flower into the plant
Eg. ring spot virus in cherry, Elm fruit.

⑤ Insect Transmission: The Process of Transmission of viruses from infected plant to healthy plant through insect is called insect Transmission. most ~~common~~ of the insect vectors are aphides, leaf hopper, white flies, grasshoppers bugs etc. they have piercing & sucking mouth part. Eg. Potato yellow dwarf virus.

vectors grasshopper leaf hopper aphids

⑥ Nematode transmission: The Process of Transmission of viruses from plant to plant through nematode is called nematode Transmission. Nematode feeding on root of infected plants and then moving to healthy plant roots
Eg. Tomato black ring virus. Cherry leaf roll virus, tobacco rattle virus

⑦ Fungus Transmission: the Process of transmission of viruses from plant to plant through fungus is called fungus transmission. the viruses are borne internally in zoospores or resting spores. when zoospores infect a new host plant, the viruses are introduced into new plant. Eg. Tobacco stunt viruses, lettuce big vein virus, etc.

Cuscuta transmission: The Process of Transmission of virus from one plant to another plant through parasitic cuscuta (dodder) is called cuscuta or dodder transmission. The dodder twines the stem of host plant and draws the nourishment through haustoria. If the host plant is infected with viruses the viruses enter cuscuta passively along with food. The viruses introduced into new plant by new haustoria produced by cuscuta.

Control of Plant viruses.

1. insect vectors should be eradicated by spraying insecticides.
2. The sources of infection should be removed Plant debris should be burnt. Tubers should not be used for cultivation. Weeds should be destroyed.
3. Resistant varieties must be cultivated.
4. immunization of Plant with mild virus strain gives protection to the plant from severe effect of certain virus strains.
5. Rotation of crop is useful in avoiding the host to a particular virus.

MYCOPLASMAS

Nocard Roux

Mycoplasmas were studied for the first time by two French Scientist - Nocard and Roux in 1898. It was isolated from the Pleural fluid of cattle suffering from a disease called Pleuropneumonia. The bodies of this member were thin, spherical, filamentous and stellate in morphology. So they named them as Asterococcus mycoides (Now known as mycoplasma mycoides) the name Mycoplasmas genus was first coined by Nowark (1929)

Nowark

Characters of mycoplasmas.

animal human

1. Common in animals (Cattle, Sheep dogs rats, mice) and also in humans. associated with rheumatic arthritic diseases. Respiratory tract, & urino genital system.

Saprophyte soil decaying organic matter

2. Some members occur as Saprobes in the soil, decaying organic matter, & in human oral cavity.
3. mycoplasma - like organisms (MLOS) cause plant diseases such as Sandal Spike, mulberry dwarf & Potato witches

(4) The cell devoid of cell wall and consists of only a plasma membrane. They vary in size from 300 nm to about 0.2 µm in diameter.

(5) These are resistant to antibiotics such as Penicillins, Amphicillin, Methicillin etc.

(6) Both DNA and RNA are present

(7) Cells are non-motile, but some show gliding movement in liquid surfaces.

(8) They are gram-negative, most sps require sterols and fatty acids in their growth media for growth.

(9) Pathogenic mycoplasmas affect the respiratory organs, central nervous system, cardiovascular system, & urinogenital system in human beings

(10) Dwarfness, loss of apical dominance, enlargement of floral buds etc in plants

(11) Causes pleuropneumonia in cattle, inflamation of genitals in animals.

No spore formation

Reproduce by budding & fission

Actinomycetes:

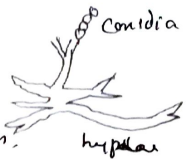
(1) Actinomycetes are aerobic, gram-positive bacteria that form branching filaments or hyphae.

(2) They are predominant in soil and can easily isolated.

(3) They play a major role in the mineralisation of organic matter

(4) They are the Primary Source of most naturally synthesized antibiotics

(5) They reproduce by unicellular specialised spores. Ex. Actinoplanes, Streptomyces, Thermoactinomycetes.



they reproduce primarily by fragmentation into short rod shaped cells. Ex Mycobacterium

(6) Cell wall has some peptidoglycan as in gram +ve Prokaryotes

(7) It is divided into 7 Sections based on Properties like cell wall, Conidia arrangements etc.

(8) Mycetoma: "Actinomycetes, "Actinomycetes with multilocular Sporangia", "Actinoplanetes streptomyces & related genera.

Chlamydia.

(1) These are intracellular parasites of animals and arthropoda.

(2) they are rigid tiny cells and closely related to gram -ve bacteria.

(3) They measure about 0.25 μ in diameter and are the smallest recognized bacteria which were formely considered as Viruses

(4) Chlamydia differ from Viruses in the following characters.

(a) Like bacteria they possess both RNA & DNA

(b) multiply by binary fission.

(c) cell wall with peptidoglycan.

(5) It stain purple with Giemsa stain and red with machia well's stain in contrast to blue colour of host cell cytoplasm

(6) It can be distinguished from rickettsias

(7) Its sps is mainly a pathogen of birds & domestic & wild animals.

Archaebacteria:

Archaios – ancient.
bakterion – a small rod.

① Heterogeneous group bacteria with Prokaryotic cell structure – aquatic or terrestrial habitats occur in anaerobic, hypersaline or high temperature environment.

② Shape – spherical, rod-shaped, spiral or irregularly shaped. Single cells, filaments or aggregati. Size – 0.1 to 15 u (microns)

③ Gram –ve or gram +ve multiply by ~~fiss~~ binary fission, budding, fragmentation

④ The cell wall do not contain peptidoglycan but a range of other unique polysaccharide

⑤ The 16 s RNA molecules are similar to each other but differ with other bacteria.

⑥ The ribosomes of these organisms are insensitive to Chloramphenical (antibiotic

⑦ These organisms inhabit extreme environment they include methane-producers (methanogens) the rap extreme haplophiles and thermo acidophiles.

Economic importance:

① [illegible] జీవ శాస్త్ర పరిశోధనలలో ప్రత్యేకంగా DNA [illegible] క్లోనింగ్ ప్రక్రియకు సాంకేతికంగా. [illegible] [illegible] [illegible] ఉపయోగపడుతున్నాయి.

② పాల ఉత్పత్తి పరిశ్రమలో [illegible]

③ పరిశోధనలలో [illegible] [illegible] ఉపయోగపడుతున్నాయి

④ [illegible] [illegible] [illegible] తయారు చేస్తాయి.

⑤ N_2 fixation లో ప్రముఖపాత్ర వహిస్తాయి.