SHRIMATI INDIRA GANDHI COLLEGE

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TIRUCHIRAPPALLI-02

DEPARTMENT OF MICROBIOLOGY

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Microbial Physiology – 2 marks

LACTIC ACID BACTERIA

- Pyruvic acid is reduced to lactic acid, the reaction being catalysed by pyruvate reductase
- Lactic acid fermentation is characteristic of lactic acid bacteria (lactobacillaceae) which cause spoilage of food
- Lactobacilli are divided into two groups
- Homofermentative strains
- Heterofermentative strains

ALCOHOL FERMENTATION

- In alcoholic fermentation pyruvate is converted to ethanol and carbondioxide the process is characterized of Yeast
- It is also found in moulds and in the mucorales, but comparatively rare in bacteria

Glucose

↓EMP

Pyruvate

↓pyruvate decarboxylase

Acetaldehyde + Co2

↓alcohol dehydrogenase

Alcohol

PHYCOBILINS

- Phycobilins are water soluable protein which contain covalently bound linear tetrapyrroles (bilins) as chromophores present inside the granules. They occur on outer surface of thylakoid membrane of cyanobacteria

- Phycobiliprotein are red or blue in colour, contain tetrapyrroles coupled to protein some of the phycoiliproteins are phycocyanin and allophycocyanins, on aggregation, these protein form a structure called phycobilisomes

BAROPHILES

- Barophiles are those bacteria that grow at high pressure at 400-500atm on 2-3°C such conditions exist in Deep-sea habitat about 100m in depth many are barotolerant and do not grow at pressure above 500atm
- Some thermophilic archaea are Barophils Eg. Purococcus spp.
- Barophiles adopt the extreme pressure makes structures more compacts

FLAGELLA

- Flagellum is a hair like, helical and surface appendages emerging from cell wall. The motile bacterium may possess a flagellum. It is 20-30nm in diameter & 15µm long
- It provides various type of motility to the bacterial cell
- Flagella consist of filament, basal body, hook

CAROTENOIDS

- Carotenoids are photosynthetic pigments trap light energy. The most wide spread of these are carotenoids β-carotene is present in prochloron and most division of Algae. Carotenoids are often called accessory pigments because their role in photosynthesis

CHLOROPHYLL

- The most important pigment is chlorophyll several chlorophylls are found in Eukaryotes, the two most important of which are chlorophyll A and chlorophyll B
- Chlorophyll A has light absorption peak at 665nm
- Chlorophyll B is at 645nm
- In addition to absorbing red light chlorophyll also absorbs the blue light strongly

GENERATION TIME

- The time required for a bacterial cell to divide and double its population is called "Generation or doubling time"
- Therefore one cell division produces two cells, two cells produces four cells and so forth. The generation time varies with each organisms and with the environmental conditions that can change such as temperature water
- The generation time of most bacteria is approximately 1-2 hours. Eg: E. Coli- double number every 20mins

SYNCHRONOUS GROWTH

- Synchronous growth is growing microbes in such a way that they are all in same stage of growth phase and all will divide at the same time respect to each other. Synchronous growth of bacteria, same stage is their growth cycle
- Eg: Exponential phase
- Stationary phase

ALKALOPHILES

- Microbes that survive in Higher pH are called Alkaliphiles. These organisms thrive in environment with pH between 10and12, with an optimum growth pH of about 9
- Alkalophiles also have the ability to live in neutral and even acidic environment

SPORULATION

- During unfavorable condion, vegetative cell converts into spore by the process known as sporulation
- Sporulation can be divided into several stages, in Bacillus subtilis, entire process of sporulation takes 8hours to complete from 0to stage vii

GERMINATION

- The activated spore initiated germination after binding of effectors molecules
- Binding of effectors molecules activates autolysis that destroy peptidoglycan of cortex
- after destruction of peptidoglycan, water is taken up and calcium dipicolinic acid is released

PSYCHROPHILES

- Psychrophiles are extremophilic organisms that are capable of growth and reproduction in low temperature ranging from -20°c to +10°c found in places that are permenantly cold such as polar region & deep sea
- Eg. *Arthobacter flavous*

OSMOPHILES

- Osmophilic organisms are adopted to environment with high osmotic pressure, such as higher sugar concentration
- Osmophiles are similar to halophilic organisms because aspect of both types of environment in their low water activity

AUTOTROPHS

- A autotrophs or producer is an organisms that produces complex organic compounds from simple substances present in its surrounding, generally using energy from light (or) inorganic chemical reaction
- Eg. Algae & bacteria

SUBSTRATE LEVEL PHOSPHORYLATION

- It is a metabolic reaction that result in the formation of ATP or GTP, by the direct transfer of a phosphoryl group to ADP or GTP from another phosphorylated compound
- Directly phosphorylating ADP with a phosphate a energy provided form a coupled reaction

- Eg. Phosphoenol pyruvate & ATP

DORMANCY

- Dormancy is a period in an organisms life cycle, when growth, development and physical activity are temporaily stopped
- This minimize metabolic activity & transfore helps an organisms, ensure energy
- Dormancy tends to be closely associated with environment

ENDOSPORE

- Endospore is a dormant, tough and non reproductive structure produced by certain bacteria from the phylum firmicutes
- The name endospore is suggestive of a spore or seed like form, but it is not a true spore
- It is a stripped down dormant form to which bacterium can reduce it self

HETEROTROPHS

- Heterotrophs is an organisms that cannot produce it own food, recycling instead on the intake of nutrition from other source of organic carbon, mainly plant or animal matter
- In food chain, heterotrophs are primary, secondary, tertiary consumers, but not producers

ORGANOTROPHS

- An organotrophs is an organisms that obtain hydrogen (or) electron from organic substrate
- Classify and describe organisms based on flow they obtain electron for their respiration processes. Some organotrophs such as animals and many bacteria are also heterotrophs

S- LAYER (OR) SLIME LAYER

- An s-layer is a part of the cell envelope found in almost all Archaea, as well as in many types of bacteria consist of monomolecular layer composed of identical proteins or glycoproteins
- Structure is built via self assembly and encloses the whole cell surface

PASSIVE TRANSPORT

- The movement of ions & other atomic or molecular substances across cell membrane without need of energy input
- Unlike active transport, it does not Require an input of energy because it is instead driven by the tendency of the system to grow in entropy
- Eg. Diffusion area of high concentration to an area of low concentration

ARTIFICIAL ELECTRON DONOR

- An electron donor is a chemical entity that donates electron to another compound
- It is a reducing agent by donating electrons, is itself oxidized in the process
- Microorganisms such as bacteria obtain energy in the electron transfer process

UNCOUPLERS

- Uncouplers of oxidative phosphorylation in mitochondria inhibit the coupling between the Electron transport and phosphorylation reaction and thus inhibit ATP synthesis without affecting the respiratory chain & ATP synthase

OXIDATIVE PHOSPHORYLATION

- Oxidative phosphorylation is the metabolic pathway in which cells use enzyme to oxidize nutrient there by releasing energy which is used to produce adenine triphosphate
- In most eukaryotes this takes place inside mitochondria
- Almost Aerobic organisms carryout oxidative phosphorylation

ACTIVE TRANSPORT

- The movement of ions (or) molecules across a cell membrane into a region of higher concentration, associated by enzymes of requiring energy. In cellular biology, active transport is the movement of molecules across a membrane from a region of their lower concentration to be a region of shell higher concentration against the concentration gradient

EXOPOLYSACCHARIDES

- Extracellular polymeric substances are natural polymer of high molecular weight secreted by microorganism in their environment
- Exopolysaccharides are estabilishing the function and structural entegrity of Biofilms.& are considered as the fundamental component that determines the physiochemical properties of a biofilm

TEICHOIC ACID

- Teichoic acid are Bacterial copolymers of glycerol phosphate (or) ribitol phosphate and carbohydrate linked via phosphodiester bonds found within the cellwall of most Gram Positive bacteria, such as Staphylococcus, Streptococcus, Bacillus, Clostridium, Corynebacterium, etc,. appears to the extend to the surface of the peptidoglycan layer

PLASMA MEMBRANE (OR) CYTOPLASMIC MEMBRANE

- Cell membrance also known as the plasma membrance (or) cytoplasmic membrance historically reffered to as plasmamembrane Biological membrane that separate the interior of all cells from outside environment, (the extracellular space) which protects the cell from its environment consisting of a lipid bilayer with embedded proteins

PEPTIDOGLYCAN

- It is also known as murein is a polymer consisting of sugar and aminoacid that forms a mesh-like layer outside the plasma membrane of most bacteria, forming the cell wall
- The sugar component consist of alternating of residue β-linked N-acetyl glucosamine and N-acetyl muramic acid

NAG

- N-acetyl glucosamine is a monosaccharide and a derivative of glucose. It is an amide between glucosamine and acetic acid. It has an molecular formula of $C_8H_{15}NO_6$, a molar mass of 221.21g/mol, it is significant in several biological system used as remedy for Osteoarthritis

NAM

- N-acetyl muramic acid (or) MurNAC is the either of lacticacid and N-acetyl glucosamine with a chemical formula of C11H19NO8 Biopolymer in bacterial cell wall

ANABOLISM

- The synthesis of complex molecules in living organisms from simpler ones together with the storage of energy, constructive metabolism
- Anabolism is the set of metabolic pathway that construct molecules from smaller units

CATABOLISM

- Set of metabolic pathway that breaks down molecules into smaller units that are either oxidized to release energy used in other Anabolic reaction
- Eg. Glycolysis, citric acid cycle

DARK REACTION

- The light independent reaction (or) dark reaction of photosynthesis are chemical reaction that convert Co2 and other compounds into glucose
- These reactions occur in the stroma, the fluid-filled area of a chloroplast outside the thylakoid membrane

ATP

- Adenosine Triphosphate, is a energy currency of life
- ATP is a high energy molecule found in every cell

ETC

- Electron transport chain is a series of complexes that transfer electron from electron donors to electron acceptors via redox reaction and couples, this electron transfer with the transfer of proton across a membrane

NADH

- Nicotinamide adenine dinucleotide is a cofactor found in all living cell. The compound is called a Dinucleotide joined through their phosphate group
- In metabolism, NADH is involved in redox reaction, carrying electron from one reaction to another

ELECTRON CARRIERS

- A number of molecules can act as electron carriers in biological systems
- In cellular respiration, there are 2 important electron carriers, Nicotinamide adenine dinucleotide (NAD+) and flavin adenine dinucleotide(FAD)
- High energy electron move through the electron

FERMENTATION

- Fermentation is a metabolic process that produces chemical changes in organic substrate through the action of enzyme. In biochemistry it is defined as the extraction of energy from carbohydrates in the absence of oxygen

BINARY FISSION

- Fission, in biology, is the division of a single entity into 2 or more parts and the regeneration of those parts into separate resembling the original
- The object experiencing fission, is usually a cell, but the term may also refer to how organisms bodies, population (or) species split discrete parts
- Occur in some single celled eukaryotes like the amoeba and paramecium

CELL DIVISION

- Cell division is the process by which a parent cell divides into 2 or more daughter cell
- Cell division usually occurs as a part of a larger cell cycle

CELL WALL

- A rigid layer of polysaccharides lying outside the plasma membrane of the cells of plant, fungi and bacteria. In the algae and higher plants it consists mainly of cellulose. Cell

wall is the structural layer, surrounding some types of cells just outside the cell membrane. It can be tough, flexible & sometimes rigid

BACTERIAL CHLOROPHYLL

- Bacterial chlorophylls are photosynthetic pigments that occur in various phototrophic bacteria. They were discovered by C.B.Ran Niel in 1932.
- They are related to chlorophyll which are the primary pigment in plants, algae and cyanobacteria

BGA

- Blue green algae also known as cyanobacteria are a group of photosynthetic bacteria that many people refer to as "Pond Scum"
- Blue green algae are most often blue green in colour but can also to be blue, green, reddish, purple or brown

MIXOTROPHS

- A mixotroph is an organisms that can use a mix of different sources of energy and carbon instead of having a single trophic mode on the continuum from complete autotrophy at one end to heterophy at the other
- Eg. *Euglena*

LITHOTROPHS

- Lithotrophs are a diverse group of organisms using inorganic substrate to obtain reducing requivalents for use in biosynthesis Eg. Carbondioxide fixation (or) energy conservation some lithotrophs are facultative lithotrophs and belong to either the domain bacteria (or) the domain archae

EXTREMOPHILES

- Extremophiles are organisms, that thrives in physically (or) geochemically extreme conditions that are delyrimental to most life on earth

- These extreme environment include intense heat, highly acidic Environment, extreme pressure and Extreme cold

PILI

- A pili is a hair like appendage found on the surface of many bacteria
- The term pilus for the appendage required for bacterial conjugation
- All pili are primarly composed of pilin proteins, which are digomeric

FIMBRIAE

- Also referred to as an attachment pilus, is an appendage that can be found on many gram positive &gram negative bacteria that is thinner & shorter than a flagellum Range 3-10nanometer in diameter

FLUORESCENCE

- Fluorescence is the emission of light by a substances that has absorbed light or other Electron magnetic radiation. It is a form of luminescence
- The emitted light has a longer wavelength and therefore lower energy, than obsorbed Radiation

PHOSPHORESCENCE

- Phosphorescence is a type of photoluminescence related to fluorescence, unlike fluorescence a phosphorescent material does not immediately reemit the radiation it absorbs

RHODOPSIN

- Rhodopsin is a light sensitive receptor protein involved in visual photo transduction
- It is named after ancient Greek rose, due to its pinkish colour and sight
- Rhodopsin is a Biological pigment found in the nods of the retina and is a G-Protein-Coupled receptor

OXYGENIC PHOTOSYNTHESIS

- Oxygenic photosynthesis is a non-cyclic photo synthetic electron chain where the Initial electron Donor is a water and as a unsequence, molecular oxygen is liberated as a by products
- Photosynthesis occurs in eukaryotic microorganisms like algae and bacteria such as cyanobacteria

ANOXYGENIC PHOTOSYNTHESIS

- Bacterial anoxygenic photosynthesis from the more familiar terrestrial plant oxygen photosynthesis by the nature of the terminal reductant and in the by products generated
- Anoxygenic photosynthesis does not produce oxygen as a by products of the reaction only bacteria are capable of anoxygenic photo synthesis

THERMOPHILES

- Organisms survives in high temperature are called Thermophiles. Eg. Thermoplasma sulfolobus
- It is a temperature optimum is around 70-80°C, Their cell wall contains lipoprotein and carbohydrate but lacks peptidoglycan. They grow lithotrophically on surfur granules in hot acid springs and soils
- Thermophiles can grow in both Terrestrial and marine environments