12/11/2022
~~Wednesday~~
Monday

Marine Microbiology.

DATE
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* Extremophiles :—

- Extremophiles can be divided into two main categories :-
  (i) Extremophilic
  (ii) Extremo tolerant.

- Extremophilic microorganism require one or more condition in order to survive.
- While extremotolerant organism grow at normal condition but are steel able to survive one or more extreme physiochemical views.

• Types :—

- are classified under condition in which they grow.
- The mixed different physiochemical condition get adapt to extremophiles & so they are also known as polyextremophiles.

(1) Acidophiles :—

- at pH value from 1-5 organism survive These group include Eukaryotes bacteria & archae.
- This organisms have specialized mecha-nism i.e. passive & active.
- passive mechanism reinforces cell memb. against external environment & secrete biofilm to control diffusion of molecules into the cells.
- Some acidophiles can also secrete buffer molecules active pH mechanism involve Hydrogen iron pump that expells H_2 ions from cells.

(2) Alkaliphiles :—

- These organisms adapts the condition of pH of 9 & higher than 9.
- They maintain homeostasis by passive and active mechanism.
- In passive mechanism cytoplasmic polyamines are pull inside the cells, the polyamines are reached with positively charged amino groups.
- The passive mechanism also has low permeability due to which movement of protons in & out of cells are in trouble.
- Because of this the active mechanism plays a active role by carrying sodium-iron channel to carry protons inside the cell.

(3) Thermophiles :—

- Thermophiles survive at temp. 132 - 400°C generally found in hydrothermal vents, volcanic sediments and hot springs.
- They are having the ability to acridate extremozeymes.
- The amino acids of this types of enzymes do not loose their shape & size in extreme condition

(4) Psychrophiles :—

- psychrophiles are also known as cryophiles
- psychrophiles microorganism survive at extreme low temperature of 5°C and lower than that.

- These group belongs to three domain bacteria, archae, Eukarea & they are found in the place like cold soil, polar ice & cold ocean water.
- They survive in extreme cold condition by their activity of producing extremozyme.
- Psychrophiles also produce proteins i.e. cold shock proteins and contain large amount of unsaturated fatty acid in their plasma membrane.
- Some psychrophiles also replace the water body with sugar tree halaoes the preventing formation of harmful ice crystals.

(5) Xerophiles :—

- This organism grow in extreme dry condition which can be very hot or very cold.
- They are generally found in places like Antarctica, great besin & dessert
- Xerophiles also replace their waterbodies with tree haloes sugar & protect membrane & other structure of cells from low water availability.

(6) Barophiles :—

- Barophiles are organism grow under high pressure of 400 atm or more.
- They survive by regulating fluidity of phospholipid. This fluidity helps in balancing the pressure gradients between inside & outside of the cells.
- Extreme barophiles optimally grow at 700 atm or higher, it will not grow at lower pressure.

(7) Halophiles :—

- Halophiles are organisms that require high salt concentration.
- These group belongs to three domains but in smaller number.
- The overcoming challenges of hypersaline environment starts with minimizing cellular water loss, Halophiles do this by accumulating solutes in cytoplasm.
- Halophilic archae used a sodium-potassium-iron pump to expells sodium & intake potassium.
- This Halotorelant bacteria balance the osmotic pressure by using glycerol.

* Some examples of extremophiles :—

1) • snottite also known as snottides
- They are made up of colonies of extremophilic single cell bacteria.
- This organism ~~organism~~ survive extremely in ~~toxicity~~ & acidity.

2) • Giant tube worm is deep sea extremophiles found in hydrothermal vents.
- leave in high pressure condition, high heat & no sunlight.

3) • Tardigrades → this tardigrades technically more ~~extremotolerant~~ than extremophilic.
- ~~Egg lays~~ This 8 lakhs microscopic creature is more common organism known to man.
- They have two survival stages :
(i) In case flooding
(ii) In case of freezing / drought.

- tardigrades allocos themselves to float to the surface where they have excess to oxygen.
- In case of freezing condition they replace more than 97% of water body with sugar tree haloes.
- This characteristics needs reduces water & prevent ice crystals.
- This organism also have ability to survive at temp. 458°C and can also survive at high pressure.

* Bioremediation of marine Ecosystem :—
- Bioremediation is a process where microorganism transform organic contaminant in ocean, soil, ground water.
- The good example of bioremediation of marine ecosystem is the natural clean up of oil spills.
- In many ~~cases~~ oil i places oil is clean up by natural processes which takes place in marine ecosystem.
- The residual oil can be further broken down by artificial method called biostimulation
- Biostimulation is an addition of specific nutrients ~~that~~ air, organic substrate & other compounds that affect & normally limit treatment in their absence.
- In this way microorganism clean waste in more efficient & faster.
- Biostimulation is good technique which all bacteria needs cleaning up of waste naturally ocur in environment

- Bioaugmentation → this bioaugmentation is a treatment where you want to achieve control & programme biodegradation.
  - In other words we can also say that Bioaugmentation is the control addition of specially formulated microbial culture that assist those who found naturally in salt.
  - When you considering the ~~aug~~ bioaugmentation we need to change following ~~aspects~~ :- reason of failure :-
    (i) In field substrate conc. may be too low to support growth.
    (ii) The system may contain inhibitory substances.
    (iii) Competition with other microorganism causes inhibition.
    (iv) No. of microorganism may be very few to cause significant change.

* Bioremediation :-
* Hydrocarbon & oil spill degradation by bacteria mainly by Pseudomonas putida.

Marine ecology & Sampling.

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* Marine Habitats —

1) Estuaries
2) Mangroves
3) Coral reefs
4) salt marshes
5) Coastal ecosystems
6) Deep sea
7) Hydrothermal vent.

1) Estuaries —

- An area in which fresh water from a river mixes with salt water from the ocean, a transition area from the land to the ocean.
- Estuaries includes high variety of animals like Blue crab, stone crab, fiddler crab, Horseshoe crab, Mosquito, Lobster, Crane, famingo, sea gull, otters & many more.
- It is a semi-enclosed coastal body of water which has a free connection with open sea.
- Within it sea water mixed with fresh water.
- An estuary may also be called a bay, lagoon, sound or slough.

2) Deep sea —

- The deep sea is defined as the lowest layer in the ocean, below the thermocline, at a depth of 1000 fathoms or more.
- This extreme environment is characterized by low temperature (2-4°C), hydrothermal vents with temperature up to 37°C occur occasionally.
- Additionally characterized by high hydrostatic pressure & absence of solar radiation.
- Nutrient availability is low., There is high content of dissolved oxygen.

3) Mangroves → Mangroves grow in sheltered tropical and subtropical coastal areas across the globe.
- There is geographical limits are highly variable depending upon the area of the world & local climate
- Mangroves are found in the intertidal zones of tropical, subtropical & protected temperate coastal rivers, estuaries and bays where they grow in fine sediments deposited by rivers & tides.
- Mangrove trees have a characteristic growth form, including aerial structural roots and exposed breathing roots.
- Mangroves are the trees & shrubs that live in intertidal zones.
- Mangroves provide natural infrastructure and protection to nearby populated areas by preventing erosion & from storms during extreme whether conditions like hurricanes.

4) Coral reefs → Coral reefs provide habitat for a large variety of marine life, including various sponges, oysters, clams, crabs, sea stars & many species of fish.
- Coral reefs are also linked ecologically to nearby seagrass, mangrove & mudflat communities.
- A coral reef is an underwater ecosystem characterized by reef building corals. Reefs are formed of colonies of coral polyps & held together by calcium carbonate.

5) Salt Marshes → Salt marshes are coastal wetlands that are flooded & drained by salt water brought in by the tides.
- They are marshy because the soil may be composed of deep mud & peat.
- Peat is made of decomposing plant matter that is often several feet thick. Peat is waterlogged & very spongy.

- They provide shelter, food & nursery grounds for more than 75% of coastal fisheries including shrimp, crabs & many finfish.
- salt marshes also protect shorelines from erosion by creating a buffer against wave action & trapping soils.
- salt marshes provide good habitat for waterfowl, crabs, oysters and many species of fish.
- salt marshes form in shallow inlets, where tidal flooding & stream currents deposit suspended sediments, gradually forming base of the marsh.
- salt marshes are highly productive ecosystems that help filter polluted water from land while protecting our shorelines from flooding and erosion.

6) Coastal Ecosystems → The coastal ecosystems occur where the land meets the sea & that includes a diverse set of habitat types like the mangroves, coral reefs, seagrass beds, estuaries, etc.
- There are 4 types of coastal ecosystems:
  ① Mangroves ② salt marshes
  ③ Seagrass meadows ④ Coral reefs.
- Coastal ecosystems act as a natural defense against high tides, tsunami & cyclones that have a large destructive potential & provide no. of goods & services that contribute & support human needs.
- Biotic factors → plants, animals & microbes.
- Abiotic factors → amount of sunlight in ecosystem, amount of oxygen & nutrients dissolved in water, depth & temperature.
- sunlight is most important abiotic factor for marine ecosystem.
- Eg. ① bays ② Estuaries ③ Mangroves ④ salt marshes.
- Coastal areas help prevent erosion, filter pollutants & provide food shelter, breeding areas & nursery grounds for wide variety of organisms.

7) Hydrothermal vents → A hydrothermal vent is a fissure on the seabed from which geothermally heated water discharges.

- They are commonly found near volcanically active places.
- scientists first discovered hydrothermal vents in 1977.
- Hydrothermal vent structures are characterized by different physical & chemical factors, including the minerals, temperatures & flow levels of their plumes.
- Animals such as scaly-foot gastropods & yeti-crabs have only been recorded at hydrothermal vents.
- large colonies of vent mussels & tube worms can also be found living there.
- The conversion of mineral rich hydrothermal fluid into energy is a key aspect of these unique ecosystems.
- Through the process of chemosynthesis, bacteria provide energy & nutrients to vent species without the need for sunlight.