

Microbiology

By: Aniket - Bhardwaj and Mr. Gaurav

Explain by: Aniket Bhardwaj

Symbiosis and Antibiosis among microbial populations:- Many micro-organisms live much of their lives in a special ecological relationship.



→ An important part of their environment is as organisms of other species.

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→ Any organism that spends a portion of its complete life in association with another organism of different species is called "Symbiont"; and the relationship is designated as Symbiosis (Greek 'sym' means together and Biosis means life)



→ In other words, Symbiosis is the living-together in close association of two or more dis-similar organisms.



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Explain By:-

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⇒ There are also types of symbiotic association, namely ectosymbiosis and endosymbiosis.



⇒ In Ectosymbiosis, one symbiont remains outside the other organism, while in Endosymbiosis one Symbiont is present within the other.



⇒ There are also types of Symbiotic relationship namely Commensalism and mutualism.

* Commensalism (Latin 'Com = together and mensi = Table) :- It is a relationship in which one organism, the Commensal benefits while the other the host is neither harmed nor benefited.



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⇒ The Commensal is not directly dependent on the Host metabolically and causes it no particular harm.



⇒ When the Commensal is separated from its host experimentally, it can survive without being provided any factors of host origin.



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⇒ For e.g., the bacterium *E. coli* lives in the Human Colon and benefits from the host-nutrients, warmth and shelter found there, but usually causes no disease or discomfort.



*) mutualism (Latin "mutus" means borrowed or Reciprocal):- It defines the relationship in which some reciprocal benefit occurs to both partners.



⇒ In this relationship, the mutualist and the host are metabolically dependent on each other.



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*) Rhizobium:- one of the best examples of Endosymbiosis is symbiotic nitrogen fixing like Rhizobium, Azospirillum, Acetobacter etc.



⇒ The genus Rhizobium is estimated to fix around 200 million tons of nitrogen globally per year.



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⇒ The term rhizobium originates from Greek
"Rhizo" meaning root.



⇒ Rhizobium is an endosymbiont, which lives in
the root nodules of legumes.



⇒ Rhizobium is Gram negative, motile, aerobic,
non-spore forming rod shaped bacteria.



⇒ When rhizobium is isolated from nodules a
variety of morphological shapes are observed.



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⇒ Rhizobium contains nitrogen fixing gene, also
called nif gene which produces enzyme
nitrogenase.

⇒ mycorrhizae - It is another good example of
organism which fixes nitrogen symbiotically.



⇒ The term mycorrhizae is derived from the
Greek word "mykas" meaning fungus and
Rhize meaning root.

⇒ It occurs in different plant roots like -
ginger, Black-pepper, tomato, maize, wheat,
chickpea and many species of medicinal plants.

⇓
⇒ The degree of interaction of fungus with root,
there are ~~three~~ ^{different} types of mycorrhizal associations
as mentioned below:-

(a) Ectomycorrhizae:- In ectomycorrhizae, the
fungal cells form an extensive sheath around the
outside of the root with very little penetration
into the root tissue. It is mainly found on forest
tree roots.

⇓
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⇒ (b) Endomycorrhizae:- The fungal hyphae enter
the root cells of the host plant and thus penetrate
the host tissue.

⇓
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⇒ It is found in the root of orchids.

(c) Peduncular mycorrhizae:- In this form of
mycorrhizal interaction, fungi form clusters of
hyphae around the roots, but the hyphae do not

⇓

⇓

→ regulate the epidemics of the root.

* Antagonism:- Among microbial interactions, when one species adversely affects the other species it is called Antagonism or negative interactions.

⇓

→ It is a mechanism which controls population densities.

⇓

→ In some cases, antagonism totally eliminates a population of a species which is not well adapted for continued existence within the community in a given habitat.

⇓

→ It provides self regulatory mechanism, which prevents over population and destruction of the habitat's resources.

⇓

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→ Broadly, there are four different types of negative interaction, namely Competition, Amensalism, Allelopathy and Predation.

⇓

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⇒ (1) Competition: Competition among micro-organisms occurs when the population of two or more species are mutually limited because of their joint dependence on a common nutritional factor.



⇒ In other words, it can be defined as that the two species for a limiting factor in the environment.



⇒ In competition, the less active species is suppressed and the more active species is not affected.



⇒ (2) Antibiosis (Amensalism): - In Antibiosis, population of one species produces an antagonistic substance that inhibit or kill susceptible species sharing same habitat.

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⇒ Experiment of Alexander Fleming is the classical example of antibiosis in which the strain of *Penicillium notatum* inhibits the growth of *S. aureus*. Some eg. of antibiosis are: -



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(4)



→ The production of lactic acid by lactobacillus and lacticocci eliminates pathogens.



→ The lactococci produces nisin, an antiseptic which inhibits the growth of coliforms in milk.



(5) An antibiotic penicillin, which is produced by penicillium species, suppressed the growth of most Gram +ve bacteria.

(5) Parasitism: - when one species feeds or lives at the expense of another organism it is a parasitic organism and the relationship is called parasitism.

Parasitism. ⇓

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→ Some of the eg. of parasitism among microorganisms are:-

(a) Rhizoctonia parasitizes other fungi

(b) Bacteriophages

(4) Predation: - In predation, one organism totally engulfs and digests another organism. The organism which engulfs is called predator, and the organism which is engulfed is called prey.



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Generally predator is larger than prey.