

3 lecture 6-10-2021

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**Microbiology /Third stage /1 lecture**

**prof.Dr. Payman A.Hamaseed**

# Microbial Interaction

. Biological interactions are the effects that the organisms in a community have on one another.

- There are completely different kinds of microbial interactions , Plant-Germ interactions promoting plant growth, interaction with animals, interaction with humans, and interaction with water, etc.

# Microbial Interaction

- The most common cooperative interactions seen in microbial systems are mutually beneficial. The interactions between the two populations are classified according to whether both populations and one of them benefit from the associations, or one or both populations are negatively affected.
- There are many sorts of symbiotic relationship such as mutualism, parasitism, amensalism, commensalism and competition, predation, protocoooperation between the organisms.

Microorganisms interact with each other and can be physically associated with another organism in a variety of ways.

One organism can be located on the surface of another organism as an **ectobiont** or located within another organism as **endobiont**.

Microbial interaction may be **Positive interaction**: Mutualism, Syntrophism, Proto-cooperation, Commensalism

**Negative interaction**: Ammensalism, parasitism, predation, competition, antagonism)

# Types of microbial interaction

1-Mutualism: It is defined as the relationship in which each organism in interaction gets **benefits** from association. It is an obligatory relationship in which mutualist and host are metabolically dependent on each other.

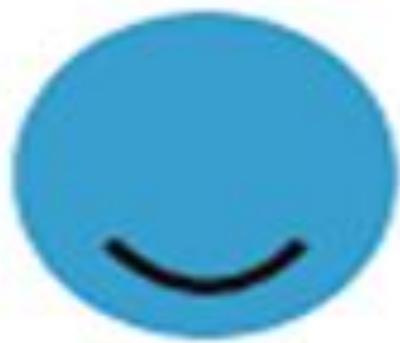
Mutualistic relationship is very specific where one member of association **cannot be replaced by another species**. Mutualism require close physical contact between interacting organisms.

Mutualistic relationship between organisms allows them to act as a **single organism**. **This relationship enables each to tolerate harsh conditions where neither could survive**

# Types of microbial interaction

Examples of mutualism:

a-Lichens are excellent example of mutualism. the association of specific fungi + algae. In lichen, fungal partner is called **mycobiont** and algal partner is called **Phycobiont** is member of cyanobacteria green algae (Trabauxua). Because phycobionts are photoautotrophs, the fungus get its organic carbon directly from algal partner, in turn fungi protects the phycobiont from extreme conditions and also provide water and minerals to algae.



**commensal**



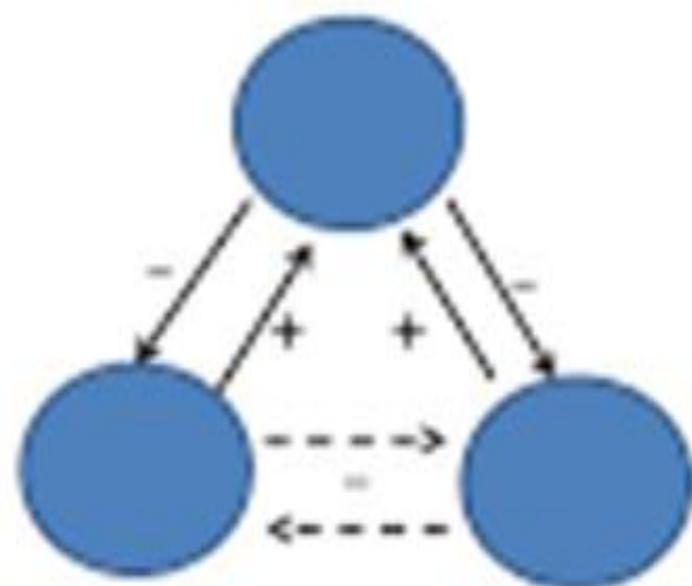
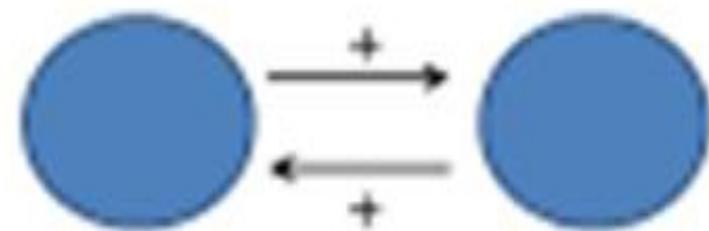
**parasitic**



**mutualistic**

# Mutualisms and Indirect Effects

- Positive – Positive interactions
- Interactions through third parties (trophic cascades, apparent competition, indirect mutualism, etc)







**2-Syntrophism:** it is an association in which the growth of one organism either depends on or is improved by the substrate provided by another organism. In syntrophism both organisms in association get benefits.

Compound A : Utilized by population 1

Compound B : Utilized by population 2

Compound C : Utilized by both Population 1+2

Products

In this theoretical example of syntrophism, population 1 is able to utilize and metabolize compound A, forming compound B but cannot metabolize beyond compound B without the co-operation of population 2. Population 2 is unable to utilize compound A but it can metabolize compound B forming compound C. Then both population 1 and 2 are able to carry out metabolic reactions which lead to the formation of an end product that neither population could produce alone. Examples of syntrophism:

### 3- Commensalism:

It is a relationship in which one organism (commensal) in the association is benefited while other organism (host) of the association is neither benefited nor harmed .It is an **unidirectional association** and if the commensal is separated from the host, **it can survive**. Examples of commensalism:

-Association of Nitrosomonas (host) and Nitrobacter (commensal) in Nitrification:

Nitrosomonas oxidize Ammonia into Nitrite and finally Nitrobacter uses nitrite to obtain energy and oxidize it into Nitrate.

## 4- Amensalism (antagonism): Negative

When one microbial population produces substances that is inhibitory to other microbial population then this inter population relationship is known as Ammensalism or Antagonism.

It is a negative relationship. The first population which produces inhibitory substances are unaffected or may gain a competition and survive in the habitat while other population get inhibited. This chemical inhibition is known as antibiosis.

Examples of antagonism (amensalism):

a- Lactic acid produced by lactic acid bacteria in vaginal tract: Lactic acid produced by many normal floras in vaginal tract is inhibitory to many pathogenic organisms such as *Candida albicans*.

## 5- Competition: Negative

The competition represents a negative relationship between two microbial population in which both the population are **adversely affected with respect to their survival and growth.**

Competition occurs when both population uses same resources such as same space or same nutrition.

Microbial population competes for any growth limiting resources such as carbon source, nitrogen source, phosphorus, vitamins, growth factors etc.

Competition inhibits both population from occupying exactly same ecological niche because one will win the competition and the other one is eliminated.: Examples of competition:

a- Competition between *Paramecium cadatum* and *Paramecium aurelia*:

Both species of *Paramecium* feeds on same bacteria population when these protozoa are placed together.

## 6-Parasitism:Negative

It is a relationship in which one population (parasite) get benefited and derive its nutrition from other population (host) in the association which is harmed.

Some parasite lives outside host cell, known as ectoparasite while other parasite lives inside host cell, known as endoparasite. Examples of parasitism:

Viruses are obligate intracellular parasite that exhibit great host specificity.

There are many viruses that are parasite to bacteria (bacteriophage), fungi, algae, protozoa etc.

## **7- Predation:Negative**

**It is a wide spread phenomenon when one organism (predator) engulf or attack other organism (prey).**

**The prey can be larger or smaller than predator and this normally results in death of prey.**

**Normally predator-prey interaction is of short duration.**



Any Questions or  
Comments