

HOST-PARASITE RELATION

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Interactions between Bacteria Humans

There are many more bacterial cells on the surface of a human (including the gastrointestinal tract) than there are human cells that make up the animal. The bacteria and other microbes that are consistently associated with an animal are called the normal flora, or more properly the "indigenous microbiota", of the animal.

In biology, symbiosis is defined as "life together", i.e., that two organisms live in an association with one another. Thus, there are at least three types of relationships based on the quality of the relationship for each member of the symbiotic association.

Types of Symbiotic Associations

1. Mutualism. Both members of the association benefit.

For humans, one classic mutualistic association is that of the lactic acid bacteria that live on the vaginal epithelium of a woman. The bacteria are provided habitat with a constant temperature and supply of nutrients (glycogen) in exchange for the production of lactic acid, which protects the vagina from colonization and disease caused by yeast and other potentially harmful microbes.

Ex:Lactobacilli in association with a vaginal epithelial cell

2. Commensalism. There is no apparent benefit or harm to either member of the association. A problem with commensal relationships is that if you look at one long enough and hard enough, you often discover that at least one member is being helped or harmed during the association.

Consider our relationship with *Staphylococcus epidermidis*, a consistent inhabitant of the skin of humans. Probably, the bacterium produces lactic acid that protects the skin from colonization by harmful microbes that are less acid tolerant.

But it has been suggested that other metabolites that are produced by the bacteria are an important cause of body odors (good or bad, depending on your personal point of view) and possibly associated with certain skin cancers.

"Commensalism" best works when the relationship between two organisms is unknown and not obvious.

3. Parasitism. In biology, the term parasite refers to an organism that grows, feeds and is sheltered on or in a different organism while contributing nothing to the survival of its host. In microbiology, the mode of existence of a parasite implies that the parasite is capable of causing damage to the host. This type of a symbiotic association draws our attention because a parasite may become pathogenic if the damage to the host results in disease.

Some parasitic bacteria live as normal flora of humans while waiting for an opportunity to cause disease.

Bacterial Pathogenesis

A pathogen is a microorganism (or virus) that is able to produce disease. Pathogenicity is the ability of a microorganism to cause disease in another organism, namely the host for the pathogen.

In humans, some of the normal bacterial flora (e.g. *Staphylococcus aureus*, *Streptococcus pneumoniae*, *Haemophilus influenzae*) are potential pathogens that live in a commensal or parasitic relationship without producing disease.

There are some pathogens that do not associate with their host except in the case of disease.

Opportunistic Pathogens

Bacteria which cause a disease in a compromised host which typically would not occur in a healthy (noncompromised) host are acting as opportunistic pathogens. A member of the normal flora can such as *Staphylococcus aureus* or *E. coli* can cause an opportunistic infection, but so can an environmental organism such as *Pseudomonas aeruginosa*.

Infection

The normal flora, as well as any "contaminating" bacteria from the environment, are all found on the body surfaces of the animal; the blood and internal tissues are sterile. If a bacterium, whether or not a component of the normal flora, breaches one of these surfaces, an infection is said to have occurred. Infection does not necessarily lead to infectious disease.

Determinants of Virulence

Pathogenic bacteria are able to produce disease because they possess certain structural or biochemical or genetic traits that render them pathogenic or virulent. (The term virulence is best interpreted as referring to the degree of pathogenicity.)

Properties of the Host

The host in a host-parasite interaction is the animal that maintains the parasite. The host and parasite are in a dynamic interaction, the outcome of which depends upon the properties of the parasite and of the host. The bacterial parasite has its determinants of virulence that allow it to invade and damage the host and to resist the defenses of the host.

Host Defenses

A healthy animal can defend itself against pathogens at different stages in the infectious disease process. The host defenses may be of such a degree that infection can be prevented entirely. Or, if infection does occur, the defenses may stop the process before disease is apparent.

Typically the host defense mechanisms are divided into two groups:

1. Constitutive Defenses. Defenses common to all healthy animals. These defenses provide general protection against invasion by normal flora, or colonization, infection, and infectious disease caused by pathogens. The constitutive defenses have also been referred to as "natural" or "innate" resistance, since they are inherent to the host.
2. Inducible Defenses. Defense mechanisms that must be induced or turned on by host exposure to a pathogen (as during an infection). Unlike the constitutive defenses, they are not immediately ready to come into play until after the host is appropriately exposed to

the parasite. The inducible defenses involve the immunological responses to a pathogen causing an infection.