Name

Muhammad Ilyas khan

ID Number 14483

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BASIC MICROBIOLOGY

Q1: Write a detail note on pathogenic action of Bacteria?

Tissue destruction: flesh-eating bacteria:

Clostridium perfrigens a gram-positive anaerobic spore-forming bacteria which is usually present in the intestines of humans and animals (meaning it can expand without oxygen). When consumed in large amounts, it is also a prominent source of food poisoning. This also happens when bacteria-contaminated cooked food is left out (i.e. temperature abuse), which allows for rapid C multiplication. Fringe. Perfringens. Sickness comes from the accumulation of toxins in the intestines. Popular food sources, such as gravy, include meat and poultry dishes, soups and sauces. Clostridium Perfringens are also known to induce other illnesses, such as skin infections and deeper tissue infections. This is referred to as "clostridial myonecrosis" or "chemical gangrene" and often results from C-created toxins. Fringe. Perfringens. Gas gangrene can occur when deep wounds are infected by bacteria containing foreign items.

Obstruction: A progressive, inherited disorder that creates chronic lung infections and reduces the capacity to breathe over time is cystic fibrosis.

Mutations in the cystic fibrosis trans membrane conductance regulator (CFTR) gene cause the protein CFTR to become unstable in individuals with CF. It is unable to help transfer chloride — a part of salt — to the cell surface when the protein is not functioning properly. Without the chloride to bring water to the cell surface, the mucus becomes dense and oily in different tissues. The mucus clogs the airways in the lungs and traps germs, such as bacteria, leading to viruses, inflammation, breathing failure, and other complications.

Toxins: bacterial components that directly harm tissue or trigger disease symptoms are known as toxins. Some microorganisms develop toxins that are the key source of toxins (e.g., Bacillus anthracis). Observed medical signs in patients. Toxins, for example, may be essential parts of the bacterium, Secreted compounds (exotoxins), or lipopolysaccharide (endotoxins). Toxins also take out other toxins. Functions, such as adhesive processing (Tuomanen and Weiss 1985). The secretion of toxins can also be a part of an organized reaction by the bacterium, it is controlled. LPS (Lipopolysaccharide) Inside a microorganism, the substance of pathogenic Gram-negative cell walls is contained and normally. Published as the cell dies (by autolysis or the immune reaction of the host) or is broken down. It is presumed that endotoxins do not have any overt enzymatic action, unlike exotoxins; and it is the portion of lipid A, normally embedded within the bacterial membrane, which is assumed to be the poisonous element. A variety of host molecules are released from the bacterial cell as LPS, Participants in the inflammatory response (e.g. cytokines) are released. The released cytokines are tumor necrosis factor-(TNF-). Normally, this molecule stops the localized virus outbreak. Nevertheless, the rapid stimulation of high TNF- concentrations within the bloodstream results in fever, host tissue damage, metabolism alteration, and Further cytokine production (IL-6 , IL-8, IL-1, and PAF, platelet activating factor). This ones, further damage to host cells and tissue is caused by cytokines, resulting in a drastic drop in Blood pressure and insufficient blood supply to main organs, resulting in chronic organ failure (1993 for Tracey and Cerami, 1996 for Rink and Kirchner).

Endotoxin: Endotoxins are the lipid portions in lipopolysaccharides in gram-negative bacteria that are part of the outer membrane of the cell wall. The "non-specific" inflammation promoters

are endotoxins. For example, the production of cytokines (including interleukin 1 and tumor necrosis factor) is triggered by immune system cells and elsewhere.

LIPID A: induces septic shock including hypotension, disseminated intravascular coagulation and fever (leading to tissue pooling of fluids), and is frequently lethal due to massive system failure. This entails the loss of adequate oxygenation of tissues that are responsive, such as the brain. To counteract the toxic action of lipid A or peptidoglycan in patients, there is no effective treatment. Endotoxins are released as the bacteria are lysed, which is why symptoms will first intensify following antibiotic therapy when the bacteria are destroyed and their endotoxins are released.

Exotoxin: Exotoxins are secreted or released into the external atmosphere as the bacteria die and the cell wall breaks apart. The symptoms of exotoxins are typically seen acutely, although they are sufficiently strong too often result in extreme effects (e.g. death). Botulism, anthrax, cholera, and diphtheria are also examples of this.

Exotoxin types include: Toxins that function on the connective tissue extracellular matrix. e.g. Staphylococcus aureus hyaluronidase, Clostridium perfringens collagenase.

Immunopathogenesis

It can occur in chronic and acute infections. In the absence of an immune response, excessive stimulation of cytokine output and complement activation by endotoxins can cause tissue injury. Subsequently, continuously produced antigens released from persistent viable microbes can evoke humoral antibodies and immunity mediated by cells, resulting in chronic immunopathology. Some poorly degradable antigens can preserve immunopathology (e.g. pneumococcal polysaccharide and streptococcal cell walls of group A).

Q2: Explain in detail host-parasite relationship

Many microorganisms (normal flora) are usually in contact with the human body, and only a limited number of these microorganisms (primary and opportunistic pathogens) may trigger illness. Host-parasite relationships is marked by the battle against the host by defense measures to attack the body and the body to defend itself.

Host-Parasite Relationship can be discussed under:

As one modifies the behaviours and functions of the other, the relationship between a host and a pathogen is complex. The result of such a relationship depends on the pathogen's virulence and the relative degree of host tolerance or vulnerability, primarily because of the host defence mechanisms' efficacy.

Animals and microbes

Common flora: GI track, skin, upper respiratory track (beneficial or ignored)

(Actively causing disease) virulent bacteria: pathogenic islands

Opportunistic bacteria: Pseudomonas aeruginosa: cystic fibrosis/ fire (when the host has an underlying problem)

TB, Kaposi’s sarcoma (herpesvirus): AIDS

Mechanisms of Bacterial Pathogenicity

Invasiveness: the capacity to invade tissues involves pathways for olonization (adherence and initial multiplication), extracellular material production that promotes invasion (invasions) and the capacity to circumvent or resolve processes of host resistance.

Toxigenesis: Toxigenesis is known as the capacity to generate toxins. Two types of toxins can be produced by bacteria:

i. Exotoxins are extracted by bacterial cells and are capable of functioning at tissue locations separated by bacterial growth sites.
ii. Cell-associated compounds are endotoxins. (The classic definition of endotoxin refers to the lipopolysaccharide portion of Gram-negative bacteria's outer membrane). Endotoxins may be produced as a result of successful host protection (e.g. lysozyme) or the actions of some antibiotics (e.g. penicillin’s and cephalosporins) from developing bacterial cells and cells that are lysed. Bacterial toxins can also be transmitted by blood and lymph, both soluble and cell-associated, and cause cytotoxic effects at tissue sites. Any bacterial toxins can also function and play a role in invasion at the site of colonization.

Common flora: GI track, skin, upper respiratory track (beneficial or ignored)

(Actively causing disease) virulent bacteria: pathogenic islands

Opportunistic bacteria (host with issue underlined)

Pseudomonas aeruginosa: burn/ cystic fibrosis

TB, Sarcoma of Kaposi (herpesvirus): Helps

Q.3 what is the barrier system required for pathogenic action of Bacteria

Barrier systems

Host cell membrane	**Taken up by phagocyte and resist killing**	**Inhibitory molecule**	***Mycobacterium***
Production Of antibody	**Degrade antibody**	**IgA protease**	***Streptococcus***
Antimicrobial cell-mediated response	**Activate T cells non-specifically and Productively**	**Superantigen**	***Staphylococcus***
Antimicrobial immune response	**Vary presenting microbial antigen**	**Switch on production of different antigens**	***Borrelia***
		Genetic recombination	***Streptococcus***

Since the entry of a microbe into the host, micro-organisms are subjected to a series of non-specific barriers to infection. These barriers are part of the adaptive immune system which include skin epithelial cells, the upper respiratory tract and the genitourinary tract, secretion antimicrobials such as lysozyme in tears, low stomach acid pH, blood supply proteins, and blood and tissue leucocytes. The ability of the microbe to withstand these natural immunity threats and proliferate in the host is one prerequisite for a micro-organism to be pathogenic to man. When a pathogenic micro-organism has been inserted into the host, there is a race between the pathogen and the host to achieve the upper hand in creating the pathogen's infection or removing the host's pathogen.

A critical first step in the effective elimination by the innate immune system of a pathogenic microbe depends on the microbe's recognition. The innate immune system has used the presence of such molecular patterns shown by pathogenic micro-organisms to be used to identify the microbe as potentially "dangerous" to the host. Molecular patterns associated with pathogen, or PAMPs, are fairly invariant molecules formed by the pathogen but not the host, and are typically necessary for survival or pathogenicity by the pathogen.

"Bacteria have, however, developed surface molecules that are involved in host tissue adherence. These adhesion molecules promote host absorption, and in certain situations minimizes the reactivity of the host to the bacterium. If the host is able to bind via a pattern recognition receptor to the invading bacterium, the host is activated to respond by enhanced

endocytosis / phagocytosis and to induce transcription of immunomodulatory factors by destroying and or signaling to the nucleus.

Exquisite mechanisms for colonizing humans and replicating in the host have emerged from pathogenic bacteria. Likewise, innate immune mechanisms have been established by the host that allow identification of these invading species and differentiation between the host and the pathogen. Thus, when inserted into a host, bacteria face a challenging and potentially aggressive environment and they must conquer the attacks the host throws at them in order to establish and sustain a fruitful infection.

Q4: Describe asexual method of reproduction in Bacteria

Prokaryotic species that replicate asexually are bacteria. Most generally, bacterial replication happens by a sort of division of cells called binary fission. The division of a single cell requires binary fission, which results in the creation of two genetically identical cells. It is helpful to consider the composition of bacterial cells to comprehend the mechanism of binary fission.

- The mechanism by which a single cell splits to create two cells that are genetically similar to one another is binary fission.
- Three popular forms of bacterial cells exist: rod-shaped, circular, and spiral.
- A cell wall, a cellular nucleus, the cytoplasm, flagella, a nucleoid zone, plasmids as well as ribosomes are typical bacterial cell components.
- Binary fission has a variety of advantages as a method of reproduction, primarily the ability to replicate at a very fast pace in large numbers.
- Since binary fission creates similar cells, by recombination, which entails the transition of genes between cells, bacteria may become more genetically varied.

Many bacteria replicate by binary fission, including Salmonella and E.coli. The same DNA molecule replicates during this form of asexual replication and both copies bind, at different stages, to the cell membrane. The distance between the two DNA molecules grows as the cell starts to expand and elongate. The cell membrane starts to pinch inward at the middle until the bacterium just about doubles its initial size. Finally, a cell wall emerges that separates the two DNA molecules and separates the initial cell into two daughter cells that are similar.

Reproduction by binary fission has a range of advantages associated with it. A single bacterium is able to replicate at a fast rate in large numbers. Some bacteria will double their population numbers in a matter of minutes or hours, under ideal conditions. Another advantage is that, because mating is asexual, no time is spent looking for a mate. Furthermore, the binary fission resulting daughter cells are similar to the original one. This suggests that in their climate, they are well prepared for life.

Recombination of Bacteria

Binary fission is a powerful method of reproducing bacteria, but it is not without complications. As the cells formed by this form of replication are similar, all of them are susceptible to the same kinds of threats, such as changes in the environment and antibiotics. A whole colony may be ruined by these risks. Bacteria can become more genetically diverse by recombination in

order to escape certain risks. Recombination entails genes being exchanged between cells. Via conjugation, oxidation, or transduction, bacterial recombination is achieved.

Conjugating

Some bacteria are able to transfer portions of their genomes to other bacteria they come into contact with. One bacterium attaches itself to another during conjugation via a protein tube structure called a pilus. Genes are passed across this tube from one bacterium to the other.

Transformation

Any bacteria have the ability to take DNA from their surroundings. Most commonly, these DNA remnants come from dead bacterial cells. The bacterium absorbs the DNA during transformation and transfers it through the bacterial cell membrane. Then, the fresh DNA is inserted into the DNA of the bacterial cell.

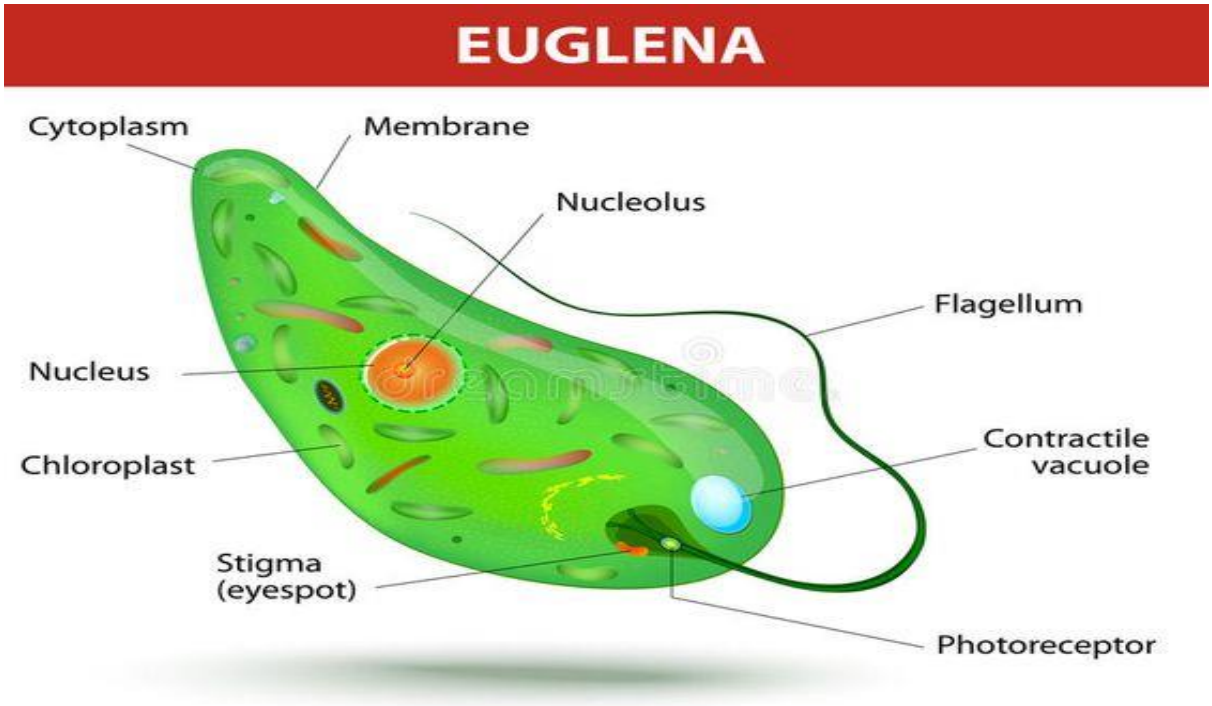
Transduction

A method of recombination involving the exchange of bacterial DNA by bacteriophages is transduction. Bacteriophages are bacteria-infecting viruses. Two kinds of transduction are available: generalized and advanced transduction.

Q5: Draw a labeled structure of the following

a) Euglena

b) Paramecium



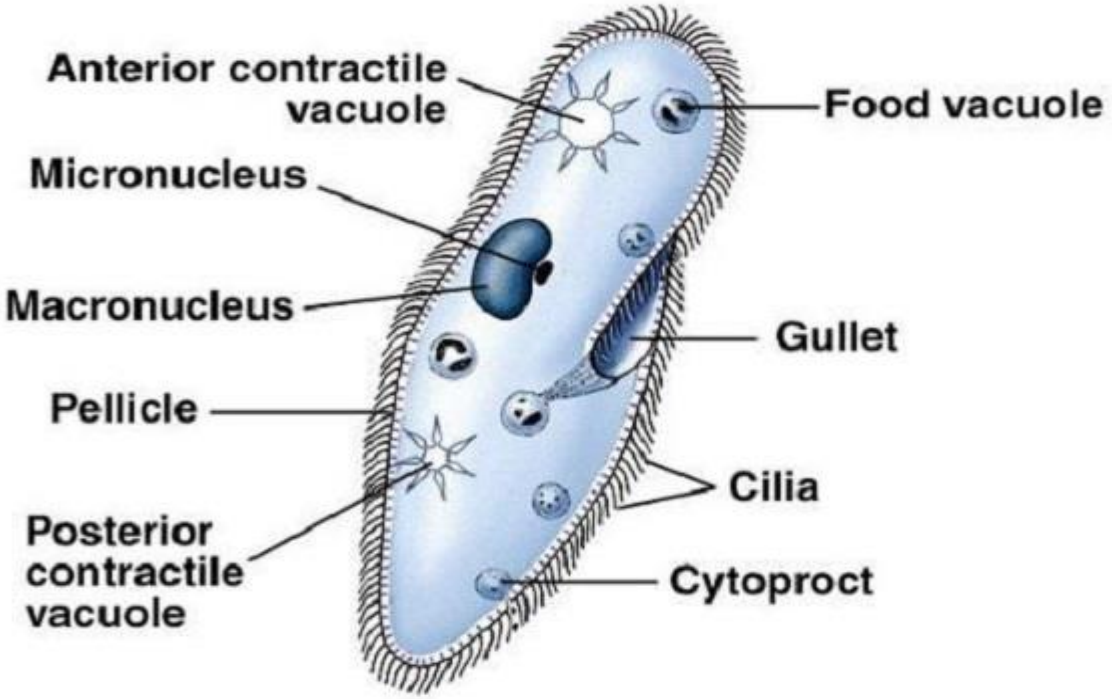


Fig. *Paramecium*