



University of Jordan
Faculty of Medicine



Medical Committee
The University of Jordan

Introduction to

Microbiology

Title :

Introduction about the bacteria cell

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Slides

Handout

Sheet

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This lecture is an introduction about the bacteria cell.

- Microbiology specially is related to micro-organisms?
We can't observe the microorganisms by our naked eyes but we could culture them in special culture medium in the laboratory to recognize their growth.
- The viruses are hard to be recognized?
The culture is not enough (need very special culture medium)
The electron microscope must be used.
- We can isolate the different type of bacteria and prepare Gram stain to recognize the biochemical reactions of them
- In short the microorganisms or microbes term include viruses (the smallest) then bacteria followed by fungi then algae in relation to water then protozoa.
- There are many branches of microbiology..... (in relation to medicine) types of organisms which reside in our body (our oral cavity , intestine , skin...etc) are commensal (normal body flora) especially bacteria
- Commensal bacteria or normal body flora :live in close contaminants in our body without any harmful effect
- In some conditions this commensal bacteria could convert into opportunistic pathogens >>
Example: if u have injury and the surface of your skin is damaged the bacteria enter the tissue or the blood and cause infection.

PS: the present of organisms in a sterile part in our body like the blood or the inner tissue it means there is infection

- So medical microbiology means to deal with microbes in relation to diseases whether in humans or animals but in our course we are considered mainly with human diseases.
- Not necessarily that every microorganism in our body causes disease ((the normal flora doesn't))
- There is variation in pathogenicity between microorganisms , this means that some organisms are more pathogenic than others>>
Example: if these organisms obtained from our oral cavity or urine they might be pathogens or just contaminants with no diseases
- In general microorganisms are unicellular cells which we can isolate
- Generally speaking the sizes of the different microorganisms vary from 0.1 – 10 Micrometer so we need devices to recognize them
- For bacteria we must use a microscope or use culture medium to recognize their growth or to do certain tests
- Microorganisms are not limited to our bodies , there are microorganisms that are important for agriculture , water , vegetation , animals...etc
- Infection is related to (Clinical microbiology) and the immune response is related to the (immunology) so the both are related with each other because the infection directs the immune response

- Food microbiology is related to microorganisms that are found in food especially the fermentative ones (maybe give flavor) >>
Example: the yoghurt has bacteria called lacto bacillus which contributes in altering milk to yoghurt by enhancing the solidity of the proteins and also enhancing the acidity
- Microbial genetics : these small cells have many genes and have genetics apparatus has importance in : - growth
 - Developing of diseases
 - Developing of microbial resistance
- Biotechnology : how to manipulate a gene , transfer a gene from species to others and it include combination and separation to produce many types of drugs
Like insulin and interferon

Micro organisms are very important part of our life and we can't live without them.

- Our intestinal tract has a huge number of Micro-organisms specially bacteria, the number of bacteria in our tract is higher than the number of our living cells, the number of bacteria cells could reach 10^{14} → they have very important function in our intestine especially in digestion ((they help in breaking down the proteins and other molecules to their end products because some molecules won't reach the final product by the effect of the stomach and intestine))-→ it has very important function as our body is always exposed to huge number of chemicals , many of these chemicals might harm our body and produce malignancy (type of cancer) etc.... due to existence of these intestine flora many of these chemicals will be inactivated due to antioxidants (anti-oxidation) which break down chemicals and make them less harmful , this is a struggle in our body between the oxidation process of chemicals and the anti-oxidation process of Flora's antioxidants.

* The antioxidants of the intestinal Flora are part of our immune system.

- The flora in oral cavity and on skin are important because they produce very useful chemicals, and very useful end products like lactic acid, organic acid and formic acid etc... and these indirectly inhibit the :
 - presence of pathogens
 - prevent the attachment of certain pathogens to reside in our mucosa whether in the nose, throat, larynx and other parts

Classification of Micro-organisms

- living cells in our body are eukaryotic due to the presence of nucleus surrounded by nuclear envelope, where in bacteria and algae there is no true nucleus ((nucleated material surrounded by nuclear envelope))
- Prokaryotes have very simple nuclear material in form of DNA, in form of one single chromosome that is composed of a double strand of DNA multi-coiled within the cytoplasm of the bacteria where as the eukaryotic cells have more differentiated nuclear materials (more than one chromosome).

The Bacteria Cell Structure

- 1- flagellum
 - large appendages longer sometimes than the cell it self
 - Formed from a pure protein called flagellin
 - Important in relation to motion of bacteria especially in liquid medium to direct it toward food (nutrients) or light.
 - Important in relation to infection like E-coli , If it reaches our body the flagella act as a foreign body(antigen) then antibodies are produced (process of disease)
 - So the flagellum enhance the immune-response by acting as antigen
- 2- fimbriae
 - like flagella, it is formed from protein(other types)
 - smaller and spread all over the surface of bacteria
 - typical for E-coli
 - important for adhering to the intestine's mucosa
 - It could participate in the disease process >> as in urinary tract infection .

Urinary tract infection

- E-coli associated with fimbriae can attach firmly to the mucosa of the urethra so when the urethra get infected by this bacteria , the infection spread to the urinary bladder , on the other hand , If the bacteria has no fimbriae it will be washed by the urine flow.
- 90% of urinary infections are caused by E-coli specially in females
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PS: every structure in the bacteria is important in diseases not only in bacteria living

- 3- cell wall (Gram+ & Gram -)
- 4- Cell membrane: important in transferring the fluids from inside to outside, otherwise the bacterium will be filled with fluids and burst.
- 5- Inside the cell we have :
 - 95% water
 - cytosol
 - ribosomes
 - glycogen / protein
 - distributed nuclear material (one chromosome)

- The bacteria might be capsulated. (the capsule is composed of polysaccharides)

 - Capsulated bacteria considered more pathogen than the non-capsulated, because the capsule protect the cell wall and inhibit the phagocytosis process of macrophages.

 - The bacteria's' cell wall has many layers of peptidoglycans to protect them from environmental factors , they are composed mainly of N-acetyl glycosamine and N-acetyl muramic acid

 - Between the cell wall and the plasma membrane there is a space called peri-plasmic space , it has enzymes that is responsible of transferring nutrients

 - The plasma membrane consists of :
 - Phospholipids
 - Proteins
 - Specific enzymes that contribute in the electron transfer system
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