Microbiology

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Dr.Saja Ebdah

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Introduction

- **Microbiology:**
  - Micro small /bio Life/ logy Science
  - The organisms are widely distributed in nature.

- **Medical Microbiology:**
  - It is a science of studying micro-organisms (too small to be seen by naked eye) which associated with *human disease*, their activities and their influences on different aspects of life.
  - Medical microbiology deals with pathogenic organism that is capable of causing disease in its host.

- **The effects of Microorganisms :**
  - *Some* of them are beneficial to human and *some* are harmful.
  - **Beneficial:**
    - ✓ *Food industry*: Fermentation of some products; *Bread*, *Wine*, *Cheese*, *Yoghurt*, *Vinegar*
    - ✓ *Industrial applications*: Bacteria is used in modern biotechnology
      - **Such as:** genetic engineering, insulin, Enzymes, Amino acids, Vitamins, Antibiotics, Vaccines, Pharmaceutical industries.
    - ✓ *Sewage treatment:* recycling water
    - ✓ *Recycling vital elements in the environment of elements:*
      - **Such as** *nitrogen*, *carbon*, *oxygen*, *sulfur*, *phosphorus*, etc.
    - ✓ **Harmful:**
    - ✓ Food spoilage and Diseases (pathogenic microorganism).

- **Portals of entry for pathogens:**
  - *Respiratory***:** Inhalation
  - *Alimentary (GIT):* Ingestion
  - *Genital Tract:* Sexual contact
  - *Skin:* abrasions or bites
  - *Others:*
    - ✓ Conjunctiva, blood transfusion, injections, organ transplants
    - ✓ *Congenital Infections:* vertical transmission from mother ***to*** fetus

- **Classification of Microorganisms:**
  - ***Prokaryotes****:*
    - ✓ (Pro: Primitive karyotic: Nucleus)
    - ✓ Not true nucleus
    - ✓ **Single** chromosome suspended (**Nucleoid**)
  - ***Eukaryotes****:*
    - ✓ (Eu: True karyotic: Nucleus)
    - ✓ True nucleus

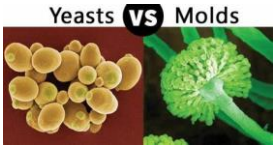
Characteristic	Eukaryotic	Prokaryotic
Nucleus	Yes	No
Nuclear membrane	Yes (Nucleus)	No (Nucleoid)
Size	**10-100µm**	**0.05-10µm**
Membrane-bound organelles Mitochondria Golgi apparatus Endoplasmic reticulum	Present	Absent
Chromosome Number	Multiple (linear)	One (circular)
Ribosome	**80S** (40S -60S)	**70S** (30S-50S)
Cell wall	Absent Except Fungi (Chitin)	Present Except Mycoplasma
Cell membrane	Has sterols	No sterols Except in mycoplasma
Division	Mitosis	Binary fission
Include	Fungi Protozoa Algae	Bacteria

- **Viruses***:* not classified as prokaryotes or eukaryotes
  - ✓ *Acellular* (Infectious agent)
  - ✓ One of the *smallest* infectious agent
  - ✓ They replicate *only* in living cells
  - ✓ *No* cell structure
  - ✓ *Obligate Intracellular* directed host cell for replication

- **Viroid's**
  - ✓ ssRNA, circular *Without* protein coat
  - ✓ *Smaller* than virus
  - ✓ Infect Plants

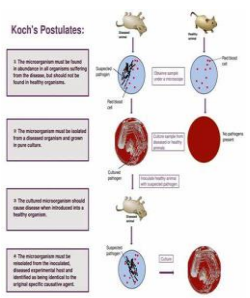
- **Prion**
  - ✓ Protein *without* nucleic acid (Infectious)
  - ✓ *Misfolded* protein
  - ✓ Mechanism: Aggregation of Prion in CNS Spongiform in the brain
  - ✓ infectious particle causing diseases like:
    - Creutzfeldt-Jakob disease (CJD) seen in humans
    - Mad cow disease Bovine spongiform encephalopathy (BSE or mad cow disease) seen in cattle

- There are 4 classes of organism that can cause disease:
  - *Viruses*
  - *Bacteria*
  - *Fungi*



    - ✓ Yeasts: unicellular (Uni: One / cellular: Cell)
    - ✓ Molds: *large*, multicellular organisms
  - *Parasites**:** these can be of two classes:*
    - ✓ Protozoa: unicellular, varying in ***size:***
      - *small* causing *intracellular* infections
      - *large* causing *extracellular* infections
    - ✓ Helminths(worms): multicellular, can grow up to *several meters* in length

- Contribution of the scientist in the field of Microbiology
  - Antony van Leeuwenhoek 17thc:
    - ✓ Father of microbiology
    - ✓ Dutch microscopist who was the *first to observe live microorganisms* in water mud and saliva.
  - John Hunter 18thc:
    - ✓ Scottish surgeon he was considered the leading *authority on venereal diseases*, and believed that Syphilis and Gonorrhea were caused by a single pathogen.
  - Edward Jenner 18th-19th c:
    - ✓ An English physician and scientist who pioneered the concept of *vaccines* including creating the smallpox vaccine, the world's first vaccine.
  - John Snow 19thc:
    - ✓ An English physician,
    - ✓ Known for *locating source of cholera outbreak* in London (thus establishing the disease as water-borne),also he is considered one of the founders of modern epidemiology.
  - Ignaz Semmelweis 19thc:
    - ✓ A Hungarian physician and scientist, known as early pioneer of antiseptic procedures. Described as the "savior of mothers", he discovered that the incidence of Puerperal sepsis can be prevented if the attending nurses apply hygienic measures. *Hand washing stops infections*
  - Louis Pasteur 19thc:
    - ✓ French biologist,
    - ✓ Microbiologist, and chemist.
    - ✓ Discovered the principle of *Fermentation* of alcohol by microorganisms and a process called *pasteurization*
    - ✓ Created the first Vaccines of rabies, *Bacillus anthrax*
  - Robert Koch 19th c:
    - ✓ Developed *microbiological media* & streak plates for pure culture.
    - ✓ *Germ theory* (Koch's postulates):
      - Microorganism must be present in every case of the disease.
      - Organism must be grown in pure culture from the diseased host.
      - Inoculation of above into host must give same disease
      - Organism must be recovered from experimentally infected host.



- Alexander Fleming – 1928 :
  - ✓ A Scottish physician and microbiologist, his best known discovery the world's first broadly effective antibiotic (*Penicillin* G) from the mould Penicillium rubens in 1928.
- Kary Mullis 1986:
  - ✓ An American biochemist , invent Polymerase Chin Reaction (*PCR*) technique.
- Zur Hausen :
  - ✓ A German virologist, He has done research on cancer of the cervix, where he discovered the role of papilloma viruses, This research directly made possible the development of a vaccine *HPV*

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+962 790408805