# Immunity

## *Microbial Pathogenesis*

- ✶ Disease terminology
  - – Sign
    - • A characteristic of disease that can be observed or measured by someone other than the patient
  - – Symptom
    - • A characteristic of a disease that can be observed or felt only by the patient
  - – Syndrome
    - • The collection of signs and symptoms that, taken together, describe a particular disease

- ✶ Pathogenicity
  - – Denotes the ability of micro-organisms to cause disease
  - – Defined as the capacity of a micro-organism to:
    - • invade tissues
    - • attach and multiply in tissues
    - • evade immune defences
    - • damage tissues and produce disease symptoms

- ✶ Pathogen
  - – Able to produce disease
  - – Natural or opportunistic
- ✶ Opportunistic pathogen
  - – Does not usually cause disease, but can become pathogenic under certain conditions, eg when the body's defences have been compromised

- ✶ Virulence
  - – Denotes the degree of pathogenicity of an organism
  - – An attribute of a strain not a species
  - – Depends on:
    - • the ability to invade and produce damage
    - • the ability to produce enzymes and toxins

- ✶ Types of Pathogen
  - – Facultative intracellular parasite
    - • Can live either intracellularly or extracellularly
  - – Obligate intracellular parasite
    - • Must live inside a living cell

## *Mechanisms of Microbial Pathogenesis*

- Attachment of the pathogen to the host
  - Attachment to specific receptors on host
  - Adhesions
    - Pili, fimbriae
    - Slime layers/capsules
    - Proteins/polysaccharides
  - Hooks, suckers, barbs or adhesive discs
- Toxins
  - Endotoxins/Exotoxins
  - Toxoids and antitoxins

- Invasion of cells
- Transformation of host cells into tumour cells
- Induction of hypersensitivity reactions
- Physical damage to host

- Evasion Strategies
  - Escape from phagocytes
  - Antigenic variation
    - Antigenic drift
    - Antigenic shift
  - Concealment
    - Inaccessible location
    - Latency
  - Immunosuppression
  - Changing forms in life cycle

## *Bacteria*

- ✶ Uicellular.
- ✶ Reproduce by the Binary Fission.
- ✶ Some are capsulated(Covered of a gelatinous material and they render the bacteria less susceptible to attack from WBC)
- ✶ Rigid cell wall
- ✶ Some have resistant endospores enabling the bacterium to survive under adverse conditions.

- ✶ Favourable environment: Temp 37°C, Moisture, Supply of Food, Slightly Alkaline Meduim.

- ✶ Some require Oxygen (Aerobic), Some require Carbon dioxide (Anaerobic).

- ✶ Some are capsulated(Covered of a gelatinous material and they render the bacteria less susceptible to attack from WBC)

## *Important Characteristics of Bacteria*

- Cell shape
  - Coccus
  - Bacillus/rod
  - Spiral
    - Vibrio
    - Spirochaete
    - Spirillum
    -
- Cell Arrangement
  - Chains
  - Clusters
  - Pairs
  - Cubes

- Gram Reaction
  - Gram positive
  - Gram negative

## *Viruses*

- Smaller than Bacteria (Electron Micrscope)
- Reproduce inside a living cell, which the virus has invaded.
- They are less sensitive to antibiotics.
- They take over the metabolic process of the invading cell.

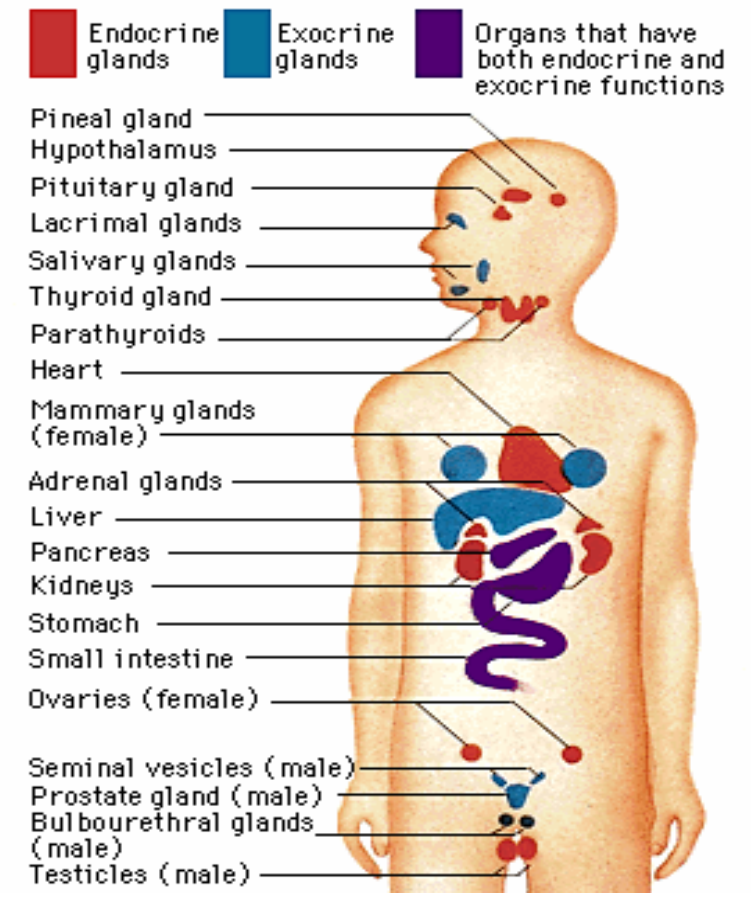
## *Fungi*

- Eukaryotic
- Unicellular --> multicellular
- Non-motile
- Cell wall composed primarily of chitin
- Major types
  - unicellular yeasts
  - filamentous moulds
- Mainly opportunistic pathogens

## *Typical Protozoa*

- Eukaryotic
- Do not possess a cell wall
- Unicellular
- Some are photosynthetic (not human pathogens)
- Most are motile

## *The Human Body's Non Specific Defense System*




## *Natural Defense: First line of defense*

- ✶ **<u>SKIN</u>**
- ✶ ⇒ Intact Continuous Barrier
- ✶ ⇒ Secretions of the Skin (Sweat) – destroys Bacteria
- ✶ ⇒ Micro organism living in Pores and therefore Pathogens may not be able to establish themselves.
- ✶ Micro flora: Fatty Acids in Sweat Glands

- **Respiratory System**

- ⇒ Nose : air is filtered as it travels over the mucous

- ⇒ Mucous secretions entrap organisms, which are then expelled upwards by the action of the hair like structures (the Cilia) by a coughing reflex

- **Digestive System**

- ⇒ Organisms cannot survive:
- a) Strongly acid medium (In the stomach)
- b) an alkaline medium (In the intestine)

- ⇒ Bile and gastric juices help to destroy bacteria
- Microflora : Salvia in the mouth
- Bacteria in the intestines.

- **Eyes**

- ⇒ Blinking Mechanism

- ⇒ Tears containing Lysozyme

- Microflora : Nil

## *Natural Defenses: Second line of defense*

- **Non specific Defence Mechanism:** Succeeds after organisms have entered the tissues of the body

- ⇒ **Fever Production** {Heat, Redness, Swelling, tenderness, Pain, Pus }

- ⇒ **Pus:** It is the accumulation of living and dead Phagocytes, and other Blood and tissue Cells, all Debris and Bacteria.

- **Phagocytosis**

- ⇒ WBC ingest invading organisms and destroy them intracellulalarly by enzymes.

- ⇒ Once engulfed by Phagocytes-- Organisms are exposed to toxic and Destructive enzymes. (but occasionally the situation is reversed and the organism kills the Phagocyte).

## *Normal Microbial Flora*

- Normal Microbial Flora
  - Inhabit the body without causing disease
  - Prevent infection
  - Produce substances of value to the host eg vitamins

- Transient (Colonising) Flora
  - Found on the body for only a short time and do not cause disease
- Contaminants
  - Carried for a brief time and removed by physical means

## *Body Sites with a Normal Microbial Flora*

- Skin and associated mucous membranes
- Upper respiratory tract
- Parts of the GIT
- Outer opening of the urethra
- External genitalia
- Vagina
- External ear canal
- External eye (lids, conjunctiva)

## *Body Sites which are Normally Sterile*

- All internal organs and tissues
- Blood
- Urine
- Cerebrospinal fluid
- Amniotic fluid
- Semen (before urethra)
- Saliva (in glands)

## *Changes to the Normal Flora*

- Normal flora is relatively stable
- Influenced by
  - Age
  - Nutritional status
  - Exposure to (broad spectrum) antibiotics
  - Changes in the local environment

## *Infection and Disease*

- Infection
  - The presence of particular micro-organisms at a site in the body in which it is not normally found
- Infectious Disease
  - Results when a pathogenic micro-organism, or its products (eg toxins), causes physiological or metabolic damage to the host

## *Incidence of Infectious Disease*

- Endemic
  - A disease which is constantly present within a region, involving relatively few people
- Epidemic
  - An outbreak involving large numbers of people in a given area in a short time

## *Microbial Flora and Prevention of Infection*

- Alter the pH
- Excrete chemicals with antibacterial activity
- Compete with potential pathogens for nutrients, space, $O_2$, etc

## *Normal Flora and Disease*

- Results when
  - Normal flora from one site is introduced into another site
  - Host is immunocompromised/natural defence barriers are broken

## *Clinical presentation of Infection*

- Acute
  - Comes on rapidly, with short-lived symptoms
- Subclinical
  - Does not produce any recognisable signs or symptoms, but elicits an immune response
- Persistent
  - Latent
    - The pathogen remains in the host without replicating or producing disease symptoms
  - Chronic
    - Pathogen persists in the body and is continuously shed