Immunology : Innate Immunity

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The Immune System is the Third Line of Defense Against Infection

Nonspecific defense mechanisms		Specific defense mechanisms (immune system)
First line of defense	Second line of defense	Third line of defense
• Skin • Mucous membranes • Secretions of skin and mucous membranes	• Phagocytic white blood cells • Antimicrobial proteins • The inflammatory response	• Lymphocytes • Antibodies

Immunity

Non specific \ Innate\ Non adaptive \natural immunity

1. First and some times second line of defense.
2. Immunity an organism is born with.
3. Genetically determined.
4. No enhancement by repetition

Acquired\ Adaptive \ Specific Immunity

1. Third and some times second line of defense.
2. Immunity that an organism develops during lifetime.
3. Not genetically determined.
4. May be acquired naturally or artificially
5. Get enhanced by repetition

Innate Immunity

Operates through Five main factors:

1.Physical and mechanical barriers.

2. Biochemical barriers

3.Cellular factors

4.Genetic factors

5.Other factors

1.Physical and mechanical barriers.

- ✓ SKIN
- ✓ MUCUS MEMBRANE
- ✓ CILIA
- ✓ COUGHING AND SNEEZING
- ✓ WASHING ACTION OF Saliva AND URINE

(A) PHYSICAL AND MECHANICAL BARRIERS :

(1) Skin :-

- Horny layer called as STRATUM CORNEUM

- Impermeable to micro-organisms & hence acts as good mechanical barriers.
- Lost of skin cause quick occurance of infections.

(2) MUCUS MEMBRANE :-

- Lines various openings & passages of the body & secreates mucus.
- Mucus traps the microbes because of its sticky nature.

③ CILIA :-

→ Epithitial cells of respiratory passage FRIDAY
are lined with cilia

→ Microbes trapped in mucus of respiratory passage are swept away by these cilia.

(4.) COUGHING AND SNEEZING:-

→ These help to drive out the foreign particles that enter the digestive tract & respiratory tract.

(5.) WASHING ACTION of SALIVA, TEAR & URINE :-

— The lacramine secretion namely tears cause the flushing action of the foreign particles in the conjunctiva of the eye.

— Solivary action cause swallowing of the particles that enter the mouth.

— Washing action of urine eliminates microbial organisms from urethra.

2. Biochemical barriers

- ✓ SKIN SECREATIONS
- ✓ DIGESTIVE TRACTSECREATIONS
- ✓ HUMAN MILK
- ✓ LYSOZYME
- ✓ NASAL SECREATIONS AND SALIVA
- ✓ INTERFERONS
- ✓ COMPLEMENT
- ✓ SEMAEN
- ✓ SECREATIONS OF BACTERIAL FLORA

(1) Skin Secreations :-

- Secreations of sebaceous & sweat glands acts as antiseptics as they contain lactic acid & other fatty acids which have fungicidal & bactericidal activities

Notes

The low pH (5.5) of sweat has microbicidal activity

→ Certain areas of the body, namely Soles of the feet are deficient of sebaceous glands & therefore these areas are sometimes referred to as 'ALKALINE GAPS'

(2) DIGESTIVE TRACT SECREATIONS:-

- High acidity of stomach (PH-2.0) has microbicidal activity. This is due to the activity of HCl which is secreated by the OXYNCTIC CELLS, lining the stomach.

(3) HUMAN MILK.

Rich in antimicrobial substances namely lactoferritin and numic acid. These fight against E. Coli & staphylococci.

(4) LYSOZYME :-

→ Tears, Saliva, polymorphonuclear leucocytes, human milk & most tissue fluids (except cerebro spinal fluid, sweat & urine) contains a mucolytic enzyme called N-Acetylmuramidase, known as LYSOZYME

Sunday 19 → Discovered by flemming in 1922.

→ Low mol. wt. proteins.

→ Helps in lysis of many G+ve bacteria by splitting off the sugars from the glycopeptide of the cell wall.

(5) NASAL SECREATION AND SECREATIONS :-

→ contains mucopolysaccharides which inactivates certain Viruses.

(6) INTERFERONS (IFN)

— Small gr. of soluble, non toxic glycoprotein produced in small amounts by activated T-cells.

— Antiviral agents Inhibits intracellular viral replications in the cells infected with Viruses.

- Appear in the cell before any detectable Ab for the virus could appear.

- They block viral m. RNA transcription, thereby disrupting the viral life cycle.

- Enhances NK cell activity — hence offers immunity against cancer.

- On the basis of electrophoretic mobilities, interferons are grouped into :-

  (1) α- interferon (IFN-α)
  (2) β- interferon (IFN-β)
  (3) IFN-γ

- Commercially prepared for viral & cancer treatment.

(7) **COMPLEMENT:-**

Complex system of enzymatic proteins found in the serum & is activated characteristically by Ag - Ab complexes.

- Complement activation increases phagocytosis & destruction of microbial organisms.
- operates by two mechanisms → Classical Pathway
  → Lectin pathway
  → Alternate pathway.
  Are included in innate immunity

(8) **SEMEN:-** Contains bactericidal components viz Spermine & Zinc.

(9) SECREATION OF BACTERIAL FLORA

- Bacterial flora of skin produces antimicrobial substances like Bacteriocins & Acids.

- Bacterial gut flora of human gut live as Commensals. They secretes COLICINS And ACIDS which do not allow entry of other microbes into the body.

- Vaginal Wall has Lactobacilli which produce antibacterial acids.

3.Cellular factors

- ✓ NEUTROPHILES
- ✓ BASOPHILES
- ✓ EOSINOPHILES
- ✓ MONOICYTES
- ✓ MACROPHAGES
- ✓ NK CELLS

(C) CELLULAR FACTORS :-

* PHAGOCYTOSIS :- Process of cell eating

Cells of Phagocytosis :-

(A) Microphages :- Includes Polymorphonuclear leucocytes (neutrophils, basophils & eosinophils)

(B) Macrophages :- cells of mononuclear phagocytic system

Monocytes → Macrophages.

- Free
  - eg. Alveolar, peritoneal. Free macrophages in lymph & other tissues.
- ~~Alveolar~~ fixed.
  - → Kupffer cells (Liver)
  - → osteoclasts (Bones)
  - → fixed lymphocytes of lymphoid tissues.

Notes

JANUARY
WEDNESDAY 22

Process of phagocytosis :-

Chemotaxis → Attachment → Ingestion → Intracellular killing.

Digestion ↑ ←┘

(c) NK cells :- Non specifically kills virus infected & tumor cells.

4.Genetic factors

- ✓ SPECIES IMMUNITY
- ✓ RACIAL IMMUNITY
- ✓ INDIVIDUAL IMMUNITY

(2) Genetic Effect / Factors :-

Natural Immunity is also due to the genetic factors, their by it differs at the level of specie, races & individuals.

(1) Species Immunity :- Refers to the resistance to pathogens exhibited by all the members of a species.

eg. (a) Rats are insusceptible to diptheria while guinea pigs & human beings are highly susceptible to the same.

(b) Human beings are highly susceptible to the common cold but dogs are not.

(2) Racial Immunity :- Within a species, different races may show differences in susceptibility to infections which is known as racial Immunity.

eg. In U.S.A Negroes are more susceptible to T.B. than whites.

(3) Individual Immunity :- The differences in innate immunity shown by different individuals of same race is known as individual immunity.

otes

5.Other factors

- ✓ TEMPERATURE
- ✓ INFLAMATION
- ✓ FEVER

(E) OTHER FACTORS :-

(a) Temperature :- Important in determining innate immunity.

eg Tubercule bacilli are pathogenic to mammals (warm blooded), but will not infect the cold blooded animals

Hens (body temperature 40°C) are naturally immune to anthrax. But can be infected if body temp. is low.

(B) INFLAMMATION :-

- Injury to tissues and irritation caused by the entry of pathogens leads to the cellular & vascular changes known as Inflammation

- characterized by four important features :-

(a) heat (b) Pain (c) Redness & (d) swelling.

(c) FEVER:-

- A rise in body temperature (Pyrexia) following injection.
- Natural defence mechanism.
- Rise in body temp. helps to accelerate the physiological process & may also destroy the pathogen itself.