

Monday 25<sup>th</sup> January, 2010

## IMMUNOLOGY

### Cells and Organs of the Immune System

#### Organs

##### Thymus

- It develops in utero and for the 1<sup>st</sup> 8 years of childhood
- It undergoes involution at around puberty
- Its primary function is to '**educate**' **naïve T-lymphocytes to recognize self from non-self**. This is a critical phase of immune system development. Absence of the thymus results in De **George Syndrome** and you succumb within two years

##### Bone Marrow

- This is the location of **hematopoiesis** and therefore all immune cells are dependent directly on a viable bone marrow including T-lymphocytes
- If you don't have a bone marrow you will lack an immune system and is common with those who have undergone bone transplants

##### Lymph Nodes

- Have a cortex, medulla in which are scattered T-lymphocytes, B-lymphocytes, macrophages and dendritic cells which perform the function of **antigen presentation**

##### Spleen

- Its functions are known but in the immune response it functions rather like a large lymph node where it performs the function of **destruction of aged or old immune cells**.
- It can affect the quantity of immune cells.

#### Cells

##### Neutrophils

- Form 40-70% of circulating white cells
- Are involved primarily in **phagocytosis**
- Their cell structure and organization are geared to short life span 5.4 days

## Macrophages

- Are larger cells
- Cytosolic organization permits them to survive for longer periods in tissues where they perform the function of **phagocytosis**
- They can produce **cytokines** (these are fast acting hormones that affect the cell to cell wall communication) which are usefully referred to as chemical mediators of immune responses

## Eosinophils

- Resemble neutrophils in structure but have a prominent place or function in **allergic diseases** (asthma, hypersensitivity reactions) and **parasitic infestations**

## Basophils

- Involved to a lesser degree to **allergic reactions**

## Lymphocytes

- Lifespan averaging 30 days
- We have three types of lymphocytes;
  - T-Lymphocytes
  - B-Lymphocytes
  - Non T and Non B Lymphocytes (Natural Killer Cells)
- There are 6 subsets of T-lymphocytes
  - **t-helper** cells (Th1 and Th2)
  - **Th3-T** regulatory Cells
  - **Tc**-Cytotoxic
  - **Tm (memory)** Cells
  - **Tdth – Delayed hypersensitivity** T-Lymphocytes

## Th1

- Is pro inflammatory

## Th2

- Is pro allergic

## Th3

- Regulate the immune response

## Tc

Destroy cells that are infected by viruses or intracellular bacteria such as *Mycobacteria tuberculosis*

### **Tm**

- Are crucial in remembering past ( prior) exposures with microbes

### **Tdth**

- Involved in type iv hypersensitivity

One special T-lymphocyte subset is Tc. It has a similar function like natural killer cells but they must recognize the cells they destroy unlike the natural killer cells which are cell mediated

### **B-Lymphocytes**

- Are responsible for antibody production
- Antibodies used by B-Cells are specific for the antigen that resulted in their production

### **Definitions**

**Immunogen:** Can provoke an immune response (e.g. like slapping someone to provoke anger) while an

**Antigen:** Can provoke or initiate a response and react with products of that response in this case, an antibody

### **Natural Killer Cells**

- Are large granular lymphocytes
- Constitute 16% of the lymphocytes
- Functions include;
  - **Destroy virally infected cells and tumor cells.** They do not require recognition to kill such cells. This function is thus referred to as cell mediated cytotoxicity

## **Innate and Adaptive Systems**

- The immune system is divided into two; Innate and Adaptive System

### **Innate**

- One is born with it

### **Constituents**

- It involves;
  - Physical barriers like skin, hair and mucosa
  - Protective chemicals like sebum having triglycerides and other chemical components
  - Various mucosa are lined by cilia e.g. respiratory tract
- It also involves chemical barriers having;
  - Saliva
  - Tears containing lysozymes and lactoferrin
  - Nasal fluids
  - Stomach acid with its low pH and enzymes
  - The small intestines which have enzymes as well
  - Genitor-urinary tract where mechanical action of flushing out of urine that sweeps aside or sweeps away bacteria and microbes
  - Vaginal secretions having lactobacillus that prevents the over growth of opportunistic infections
- Phagocytes are also present i.e. neutrophils and macrophages
- Cytokines

### **Adaptive**

- This is basically an arm of the immune system that develops after birth normally around 9 months to 12 years wherein the body is exposed to various microbes and develops specific immune responses (B-lymphocytes and T-lymphocytes)

*Question: Compare and Contrast between the Innate and Adaptive Immune Systems*

	<b>INNATE</b>	<b>ADAPTIVE</b>
<b>Recognition</b>	Has <b>toll receptors</b> that help recognition via neutrophils and macrophages and destroy microbes	T and B Lymphocytes have efficient recognition system – <b>MHC</b> (Major Histocompatibility Complex) and <b>CDs</b>
<b>Specificity</b>	Is non specific	Is very specific
<b>Memory</b>	Has no memory	Has memory
<b>Response</b>	Is rapid	Is slow on the 1 <sup>st</sup> exposure but rapid thereafter
<b>Diversity of Response</b>	Poor in innate, reads general info	Refined in adaptive; reads detailed
<b>Specialization</b>	No specialization	Highly specialized