Immunology 2024
Lecture 1: Introduction and history

Mohammad Altamimi, MD, PhD
Hashemite University
Faculty of Medicine

Immunology- Course Outline

- Course instructor Dr Hafez Almomani, MD, PhD
  Dr Mohammad Altamimi, MD, PhD
- Course coordinator: Dr Hafez Almomani
- Office: Faculty of Medicine, 3rd floor, office 3038
  email: mohammad.altamimi@hu.edu.jo, MS teams
  Office hours: Monday, Tuesday: 12-2 pm,

Lecture:
Sunday 9:20 10:35 am 10:40 – 11.55 am online
Monday 9:20 10:35am 10:40 – 11.55 am at university
Tuesday 9:20 10:35am 10:40 – 11.55 am at university
Wednesday 9:20 10:35am 10:40 – 11.55 am online

- Course outline and objective
- References and textbooks (Abul K Abbas last edition)
- Course assessment: MID 50 MARKS
  Final 50 MARKS

Objectives

- Definition of Immunology
- Importance of Immunology
- Historical background of Immunology
- Modern Immunology
- Outline the major principles of the human immune response (innate immunity, humoral immunity, and adaptive immunity)

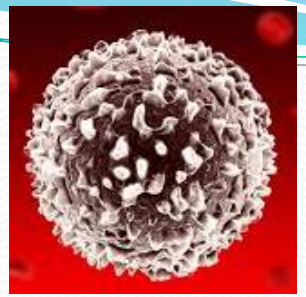
Introduction

- **Immunology** stems from
  - Latin - *immunis* = "exempt;"
  - English = protection from disease
- **Immunology is the study of our protection from foreign macromolecules or invading organisms and our responses to them.**

Functions of Immune System

1. Immune defense: Protection from harmful environmental antigens.
2. Immune homeostasis: Regulate and maintain the steady state of organisms.
3. Immune surveillance: Search and destroy neoplastic cells.

Haematology and blood transfusion



Immune deficiency

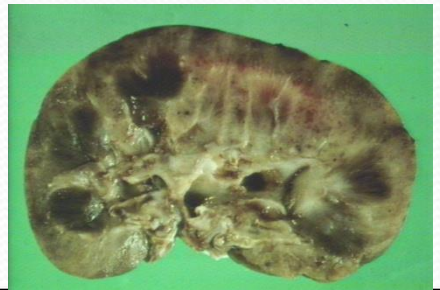
Allergy

Immunology

Infections

Autoimmunity

Transplantation

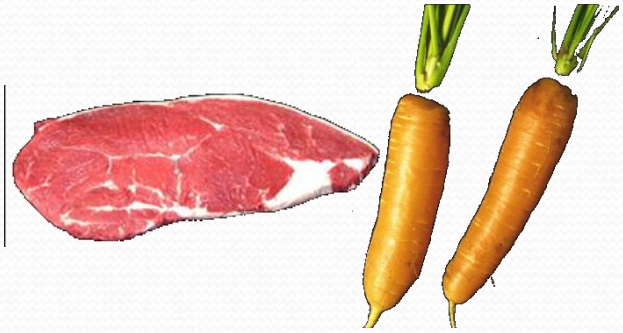


How Does the Immune System Work?

by discriminating between self and non-self proteins

But……

What about the non-self proteins of commensals and symbionts?



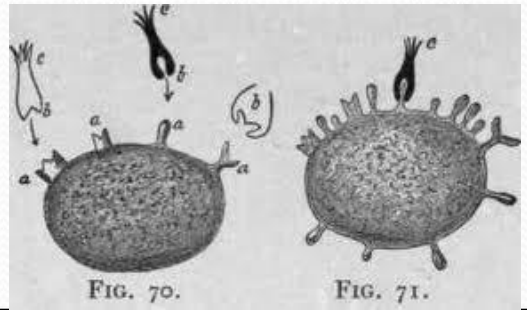
What about the non-self proteins in food?

What about the non-self proteins from microrganisms in food

History of Immunology

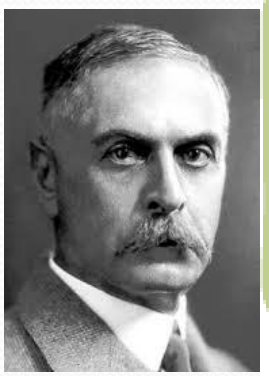
- 430 B.C.: Philosophers noted resistance to plague by those who recovered "Only those who had recovered from plague can nurse for sick people because they would not contract the disease a second time"
- 15th century: Chinese and Turks use dried crusts of smallpox by inhalation or introduction into small cut of skin in order to prevent the disease
- 1796: Edward Jennar discovered that cowpox vaccination protected against smallpox. He inoculated an 8 years boy with fluids from a cowpox pustule and then intentionally infected the boy with smallpox but the child did not develop the disease

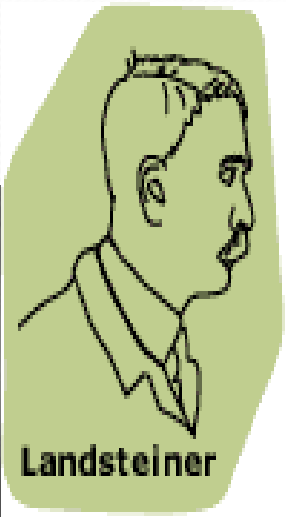
- In 1880: Pasteur discover Anti-cholera live-attenuated vaccine. He noticed that old cultures in his lab did not kill chicken after inoculation and that chicken become immune to cholera. He applies the same principle for anthrax and rabies vaccine
- In 1890: Von Behring and Kitasato discover diphtheriae antitoxin. They notice that serum from animals previously immunized to dipthteria could transfer the immune state to unimmunzed animals
- 1883 Ellie Metchinkoff that cells like phagocytes contribute to the immune state of animals

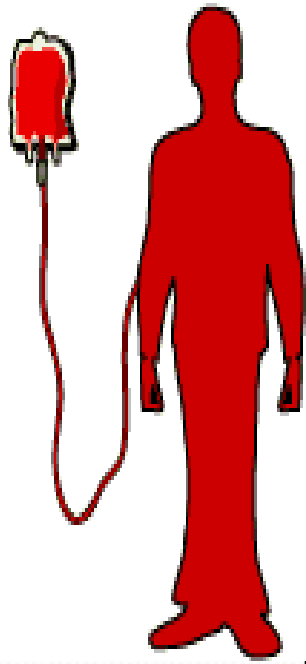


Blood Grouping and Immunology

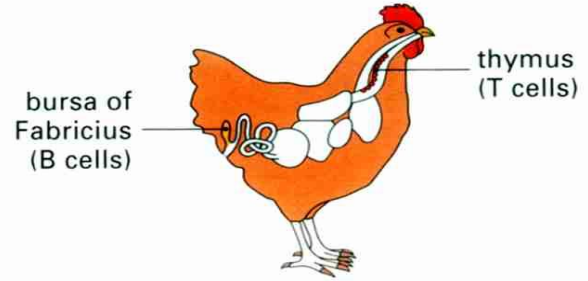
- Experiments with blood transfusions have been carried out for hundreds of years with out any success.
- In 1901, Karl Landsteiner discovered human blood groups, and blood transfusions became safer.
- He found that mixing blood from two individuals can lead to blood clumping. The clumped RBCs can crack and cause toxic reactions. This can be fatal.
- Karl Landsteiner work on blood grouping has discover the fundamental principles of Immunology







Modern Immunology



1. Study on immune system
   - In 1957,Glick Fabricius and Xianguang Zhang: Chicken without bursa can not produce Ab by B cells
   - In 1961,Good and Miller: cell mediated immune of new born mice whose thymus were taken away are defective of T cells
2. Study on monoclonal antibody In 1975, Kohler and Milstein
3. Study on immune genetics In 1978,genetic control of antibody diversity
4. Study on molecular mechanism of T/B lymphocyte activation and signal transduction
5. Study on effective mechanisms of immune cells
6. Clinical and transplantation Immunology

TABLE 1-2 Nobel prizes for immunologic research

Year	Recipient	Country	Research
1901	Emil von Behring	Germany	Serum antitoxins
1905	Robert Koch	Germany	Cellular immunity to tuberculosis
1908	Elie Metchnikoff Paul Ehrlich	Russia Germany	Role of phagocytosis (Metchnikoff) and antitoxins (Ehrlich) in immunity
1913	Charles Richet	France	Anaphylaxis
1919	Jules Bordet	Belgium	Complement-mediated bacteriolysis
1930	Karl Landsteiner	United States	Discovery of human blood groups
1951	Max Theiler	South Africa	Development of yellow fever vaccine
1957	Daniel Bovet	Switzerland	Antihistamines
1960	F. Macfarlane Burnet Peter Medawar	Australia Great Britain	Discovery of acquired immunological tolerance
1972	Rodney R. Porter Gerald M. Edelman	Great Britain United States	Chemical structure of antibodies
1977	Rosalyn R. Yalow	United States	Development of radioimmunoassay
1980	George Snell Jean Dausset Baruj Benacerraf	United States France United States	Major histocompatibility complex
1984	Cesar Milstein Georges E. Köhler Niels K. Jerne	Great Britain Germany Denmark	Monoclonal antibodies Immune regulatory theories
1987	Susumu Tonegawa	Japan	Gene rearrangement in antibody production
1991	E. Donnall Thomas Joseph Murray	United States United States	Transplantation immunology
1996	Peter C. Doherty Rolf M. Zinkernagel	Australia Switzerland	Role of major histocompatibility complex in antigen recognition by T cells
2002	Sydney Brenner H. Robert Horvitz J. E. Sulston	S. Africa United States Great Britain	Genetic regulation of organ development and cell death (apoptosis)

Table 1-2
Kuby IMMUNOLOGY, Sixth Edition
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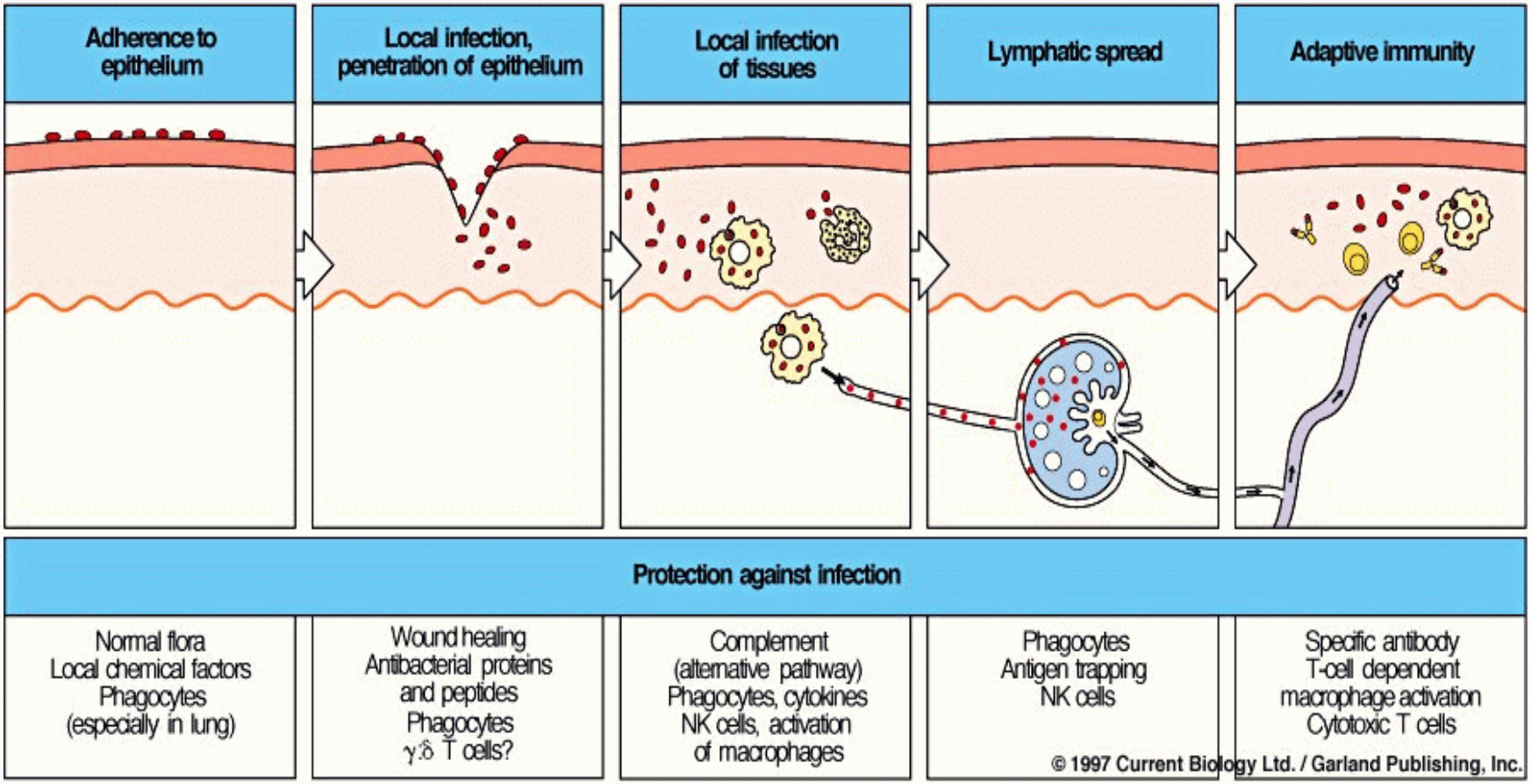
- Immunology act as an independent subject: (In 1971, International Conference of Immunology, in USA)

Stages of Response to Infection



Immune system

Innate (non-specific) immunity

- Anatomic barriers (Skin,mucous membranes)
- Physiological barriers (temperature, pH)
- Phagocytic Barriers (cells that eat invaders)
- Inflammatory barriers (redness, swelling, heat and pain)

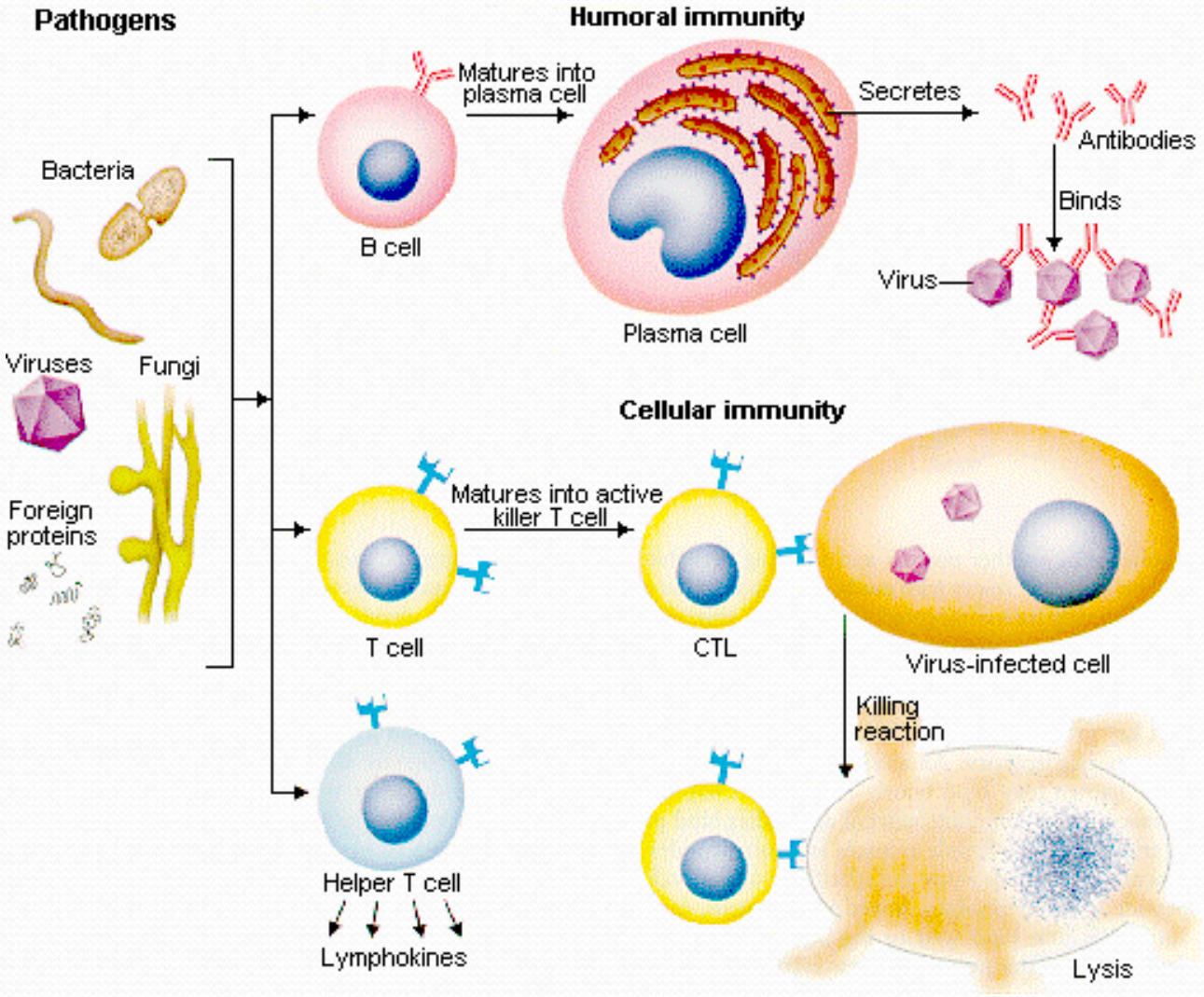
Adaptive (specific) immunity

- Antigen specificity
- Diversity
- Immunological memory
- Self/nonself recognition

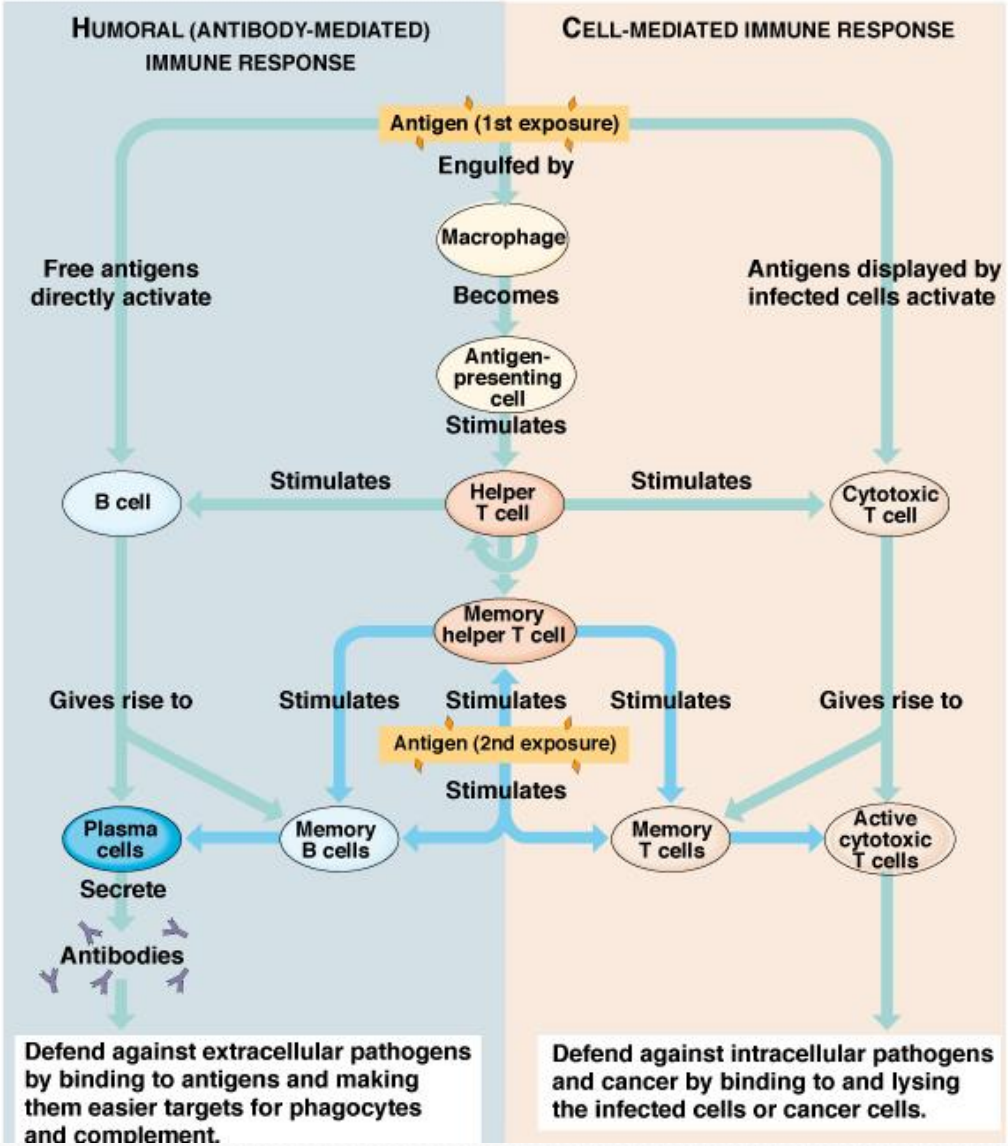
Humoral

Cellular

Humoral and Cellular Immunity



Overview of Immune Response



Innate Versus Adaptive Immunity

	Innate	Adaptive
Response time	Hours	Days
Specificity	Limited and fixed	Highly diverse, improves during the course of immune response
Response to repeat infection	Identical to primary response	Much more rapid than primary response

Immunology- The Balance

Hyporeactive Immunodeficiency

Hyperreactive Immunopathology

Health

Neutrophil Disorders
Antibody Deficiency
Complement Deficiency
T & B Cells Dysfunction

Systemic Autoimmunity
Organ-Specific Autoimmunity
Allergies and Asthma