

Introduction to Immunity



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Immune Terminology

Lecture Outlines: 1h30m

- 10-5minutes all settle in the hall, with attendance
- 10-5minutes Quiz

- Clarification through ppt slides
- Open discussion
- Asking questions
- Participation
- For the NEXT lecture, you will get the heading

- For any extra question from the student's side please do email me on:

ON
TIME

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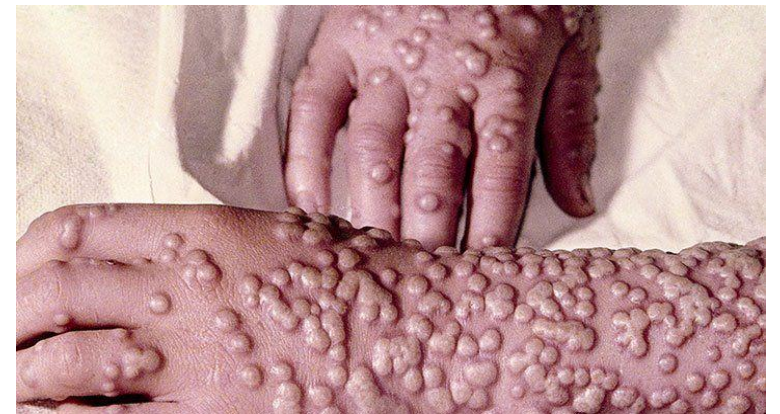
Learning Objectives

By the end of this section, you will be able to:

1. Explain adaptive immunity.
2. Compare and contrast adaptive and innate immunity.
3. Describe cell-mediated immune response and humoral immune response.
4. Describe immune tolerance.

Introduction

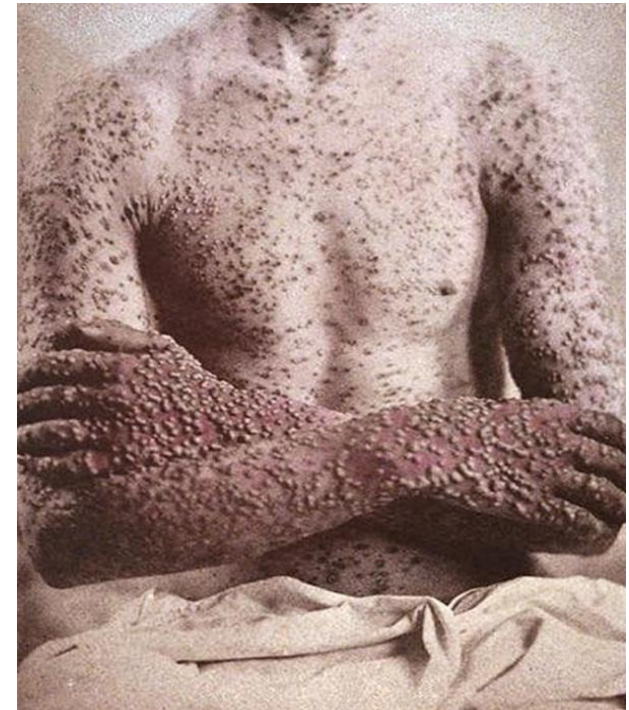
- The term immunity is derived from the Latin word “immunis,” which was originally referred to the protection.
- This term was adopted subsequently to designate the naturally acquired protection against diseases, such as measles or smallpox.
- It indicated that an individual can develop lifelong resistance to a certain disease after having contracted it only once.
- The cells and molecules responsible for immunity constitute the immune system, and their collective and coordinated response to foreign substances is called the immune response.



Smallpox

What is Smallpox?

- Before smallpox was eradicated, it was a serious infectious disease caused by the variola virus. It was contagious—meaning, it spread from one person to another. People who had smallpox had a fever and a distinctive, progressive skin rash.
- Most people with smallpox recovered, but about 3 out of every 10 people with the disease died. Many smallpox survivors have permanent scars over large areas of their body, especially their faces. Some are left blind.
- Thanks to the success of vaccination, smallpox was eradicated, and no cases of naturally occurring smallpox have happened since 1977. The last natural outbreak of smallpox in the United States occurred in .1949



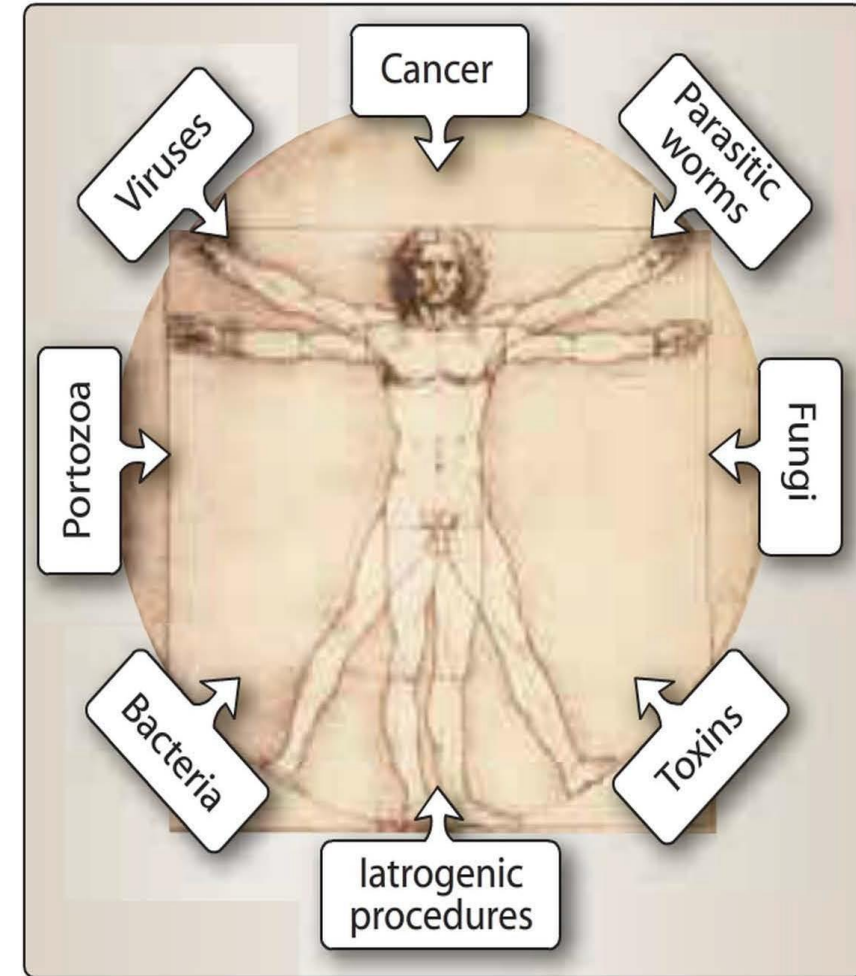
What is the immune system?

- Your immune system is a complex network of cells, tissues, and organs. Together they help the body fight infections and other diseases.
- When germs such as bacteria or viruses invade your body, they attack and multiply. This is called an infection. The infection causes the disease that makes you sick. Your immune system protects you from the disease by fighting off the germs.

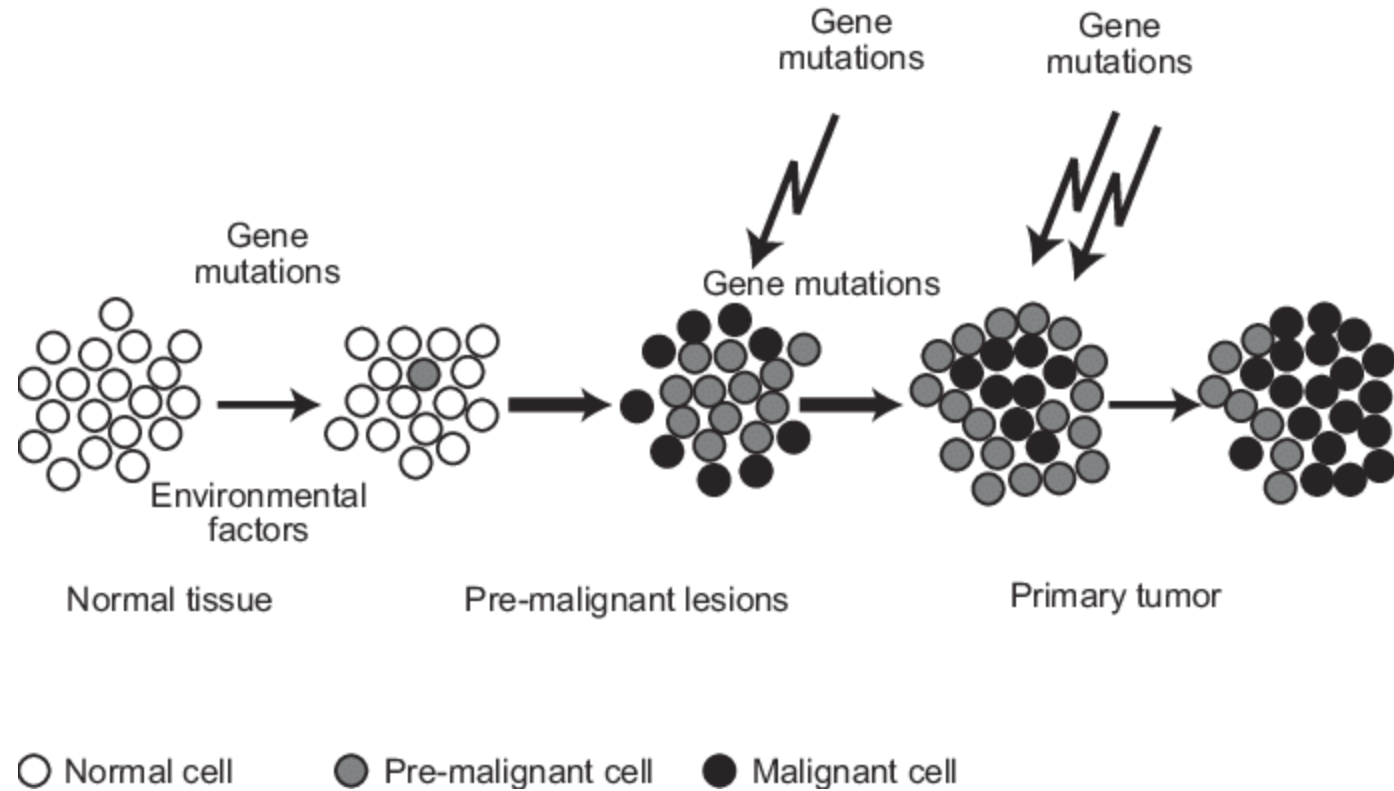


Mandatory Need for Self-Recognition

- The body is continuously exposed to many infectious agents, cancerous cells, toxic molecules, and even therapeutic drugs.
- **The human immune system**-the defensive mechanisms that identify and neutralize the threats- is able to distinguish "nonself" organisms and molecules from "self," that which is part of the body.

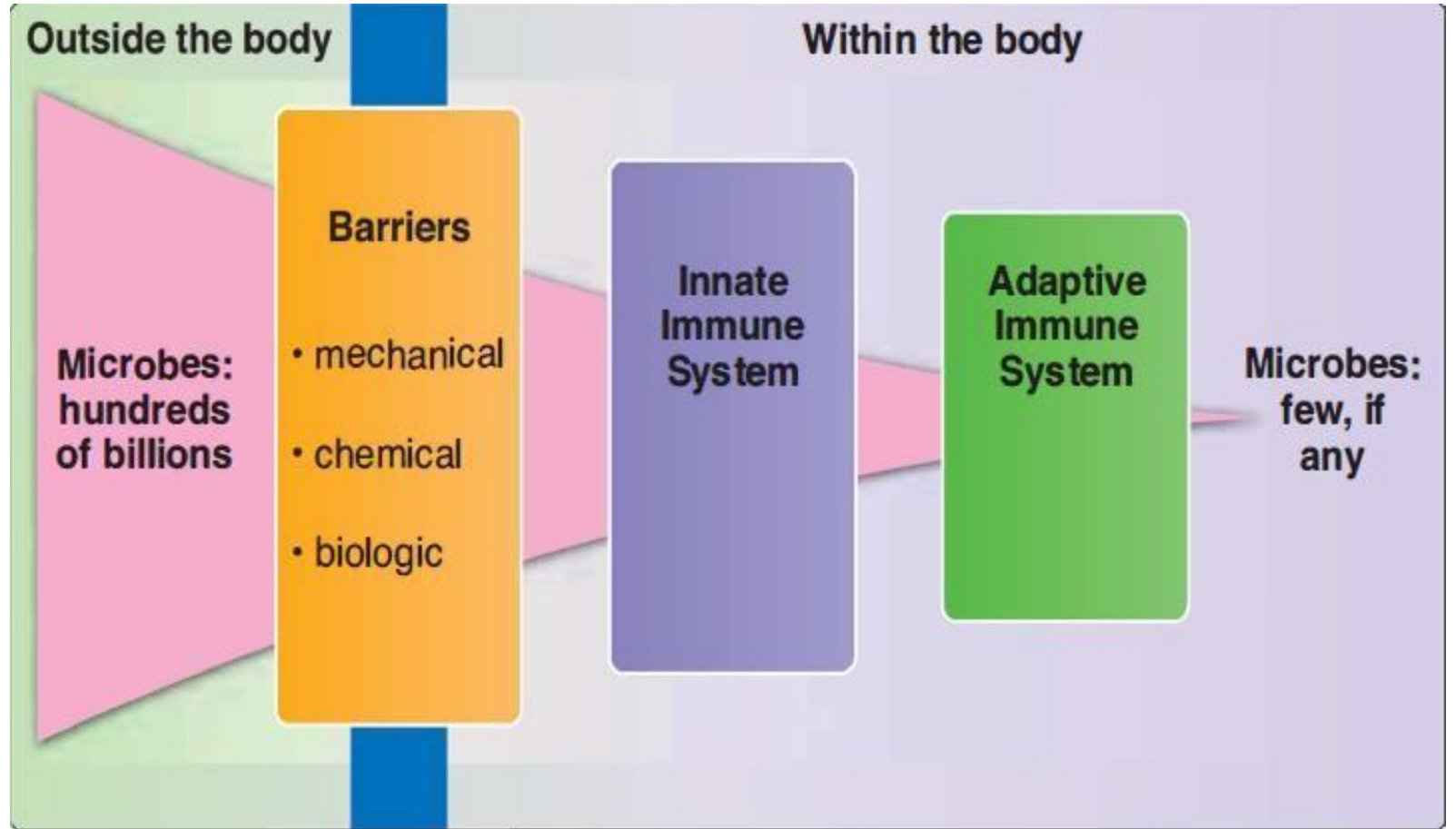


Threats (e.g., infectious organisms or toxic agents) or may arise from potentially harmful changes occurring within the body (e.g., the malignant transformation of a previously normal cell into a cancer cell).



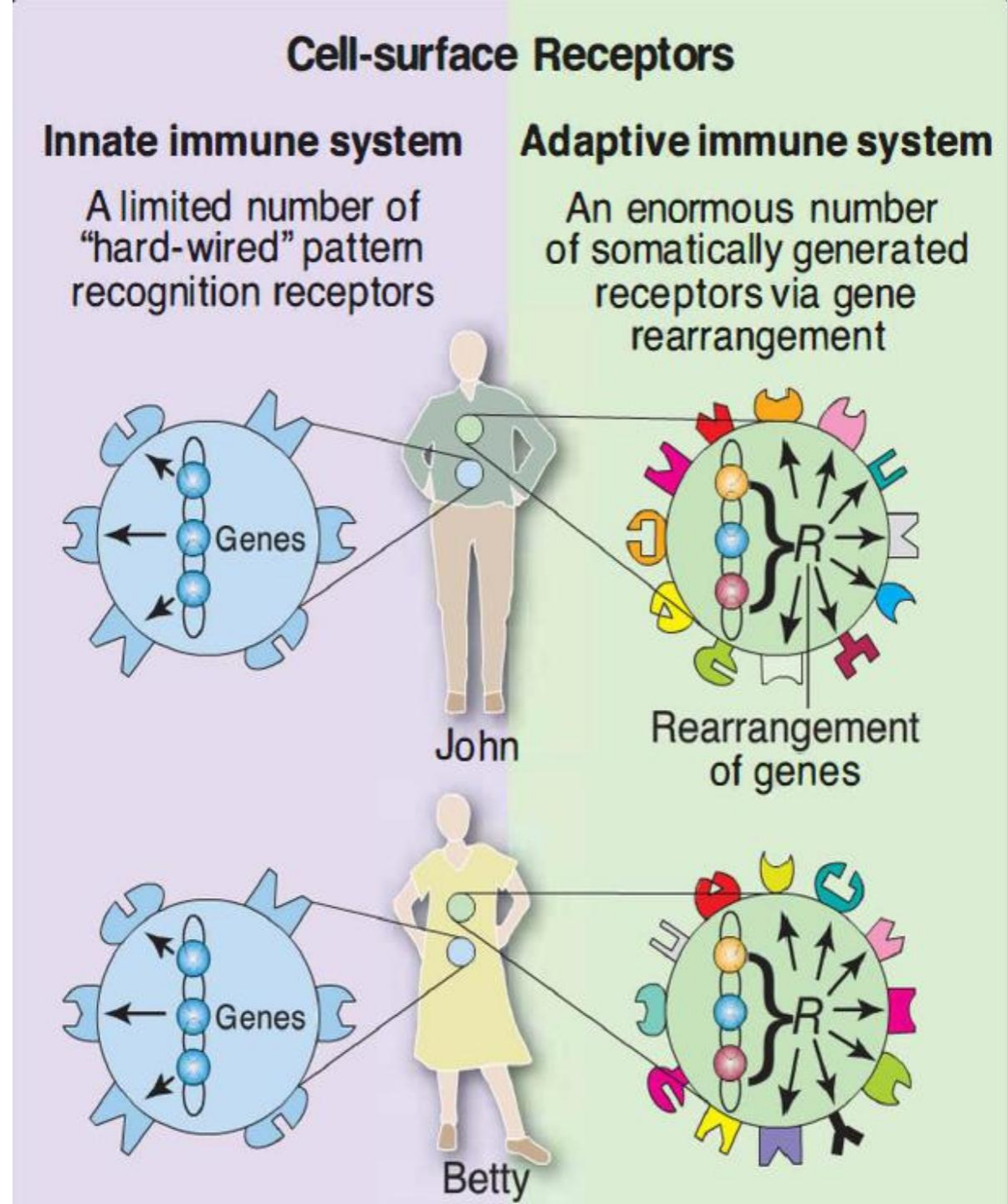
Protection from and response to microbial invasion.

-Initial protection is provided by a set of barriers. When breached, invading microbes trigger the innate immune system and, if necessary, the adaptive immune system.



- **The immune system consists of three layers of defense:**
- The first line of defence is provided by a set of mechanical (e. g . , skin(,chemical (e . g . , acidic environment of stomach) , and biologic (e. g. , commensal microbes) barriers that protect the body.
- If these barriers are breached, the second and third lines of protective systems are activated : **first the innate immune system** and then the **adaptive immune system**.
- The innate and adaptive immune systems use **cell-surface** and **soluble receptors** to sense potential threats.
- These receptors of the **innate** and **adaptive** systems are generated in different ways.

-Innate pattern recognition receptors and adaptive somatically generated receptors.
-Each individual expresses pattern recognition receptors (innate immune system) and somatically generated receptors (adaptive immune system).



- Some receptors recognize and bind to self molecules.
- Other receptors recognize and bind to nonself molecules.
- Some receptors for nonself are limited in number and are "hard-wired" in the genome, common to all normal individuals.

receptors (PRRs) , number perhaps a hundred or so and

- part of the innate immune system , the second line of defense.

They specifically detect molecules produced by a wide variety of other organisms (e. g . , molecules commonly found on bacterial cells but not on human cells. (

These "common" receptors, called pattern recognition

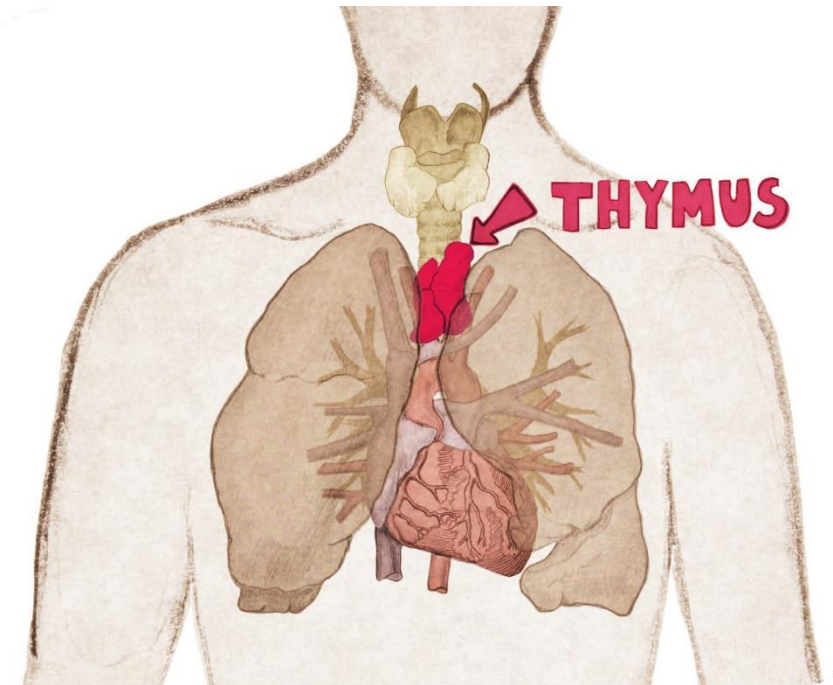
What are the parts of the immune system?

The immune system has many different parts, including:

- Your skin, which can help prevent germs from getting into the body
- Mucous membranes, which are the moist, inner linings of some organs and body cavities. They make mucus and other substances which can trap and fight germs.
- White blood cells, which fight germs
- Organs and tissues of the lymph system, such as the thymus, spleen, tonsils, lymph nodes, lymph vessels, and bone marrow. They produce, store, and carry white blood cells.



Skin



The thymus produces progenitor (ancestor) cells, which mature into T-cells (thymus-derived cells). The body uses T-cells help destroy infected or cancerous cells.

How does the immune system work?

- Your immune system defends your body against substances it sees as harmful or foreign. These substances are called antigens. They may be germs such as bacteria and viruses. They might be chemicals or toxins. They could also be cells that are damaged from things like *cancer*.
- When your immune system recognizes an antigen, it attacks it. This is called an immune response. Part of this response is to make antibodies. Antibodies are proteins that work to *attack, weaken, and destroy* antigens. Your body also makes other cells to fight the antigen.
- Afterwards, your immune system remembers the antigen. If it sees the antigen again, it can recognize it. It will quickly send out the right antibodies, so in most cases, you don't get sick. This protection against a certain disease is called immunity.



Immune Terminology



Chronic health condition:

A health-related state that lasts for a long period of time (e.g. cancer, asthma).

Booster shots:

Additional doses of a vaccine needed periodically to "boost" the immune system.

Bacteria:

Tiny one-celled organisms present throughout the environment that require a microscope to be seen. While not all bacteria are harmful, some cause disease.

Asymptomatic infection:

The presence of infection without symptoms.

Antigens:

Foreign substances (e.g. bacteria or viruses) in the body are capable of causing disease. The presence of antigens in the body triggers an immune response, usually the production of antibodies.

Immune Terminology



Antibody_

A protein found in the blood that is produced in response to foreign substances (e.g. bacteria or viruses) invading the body. Antibodies protect the body from disease by binding to these organisms and destroying them.

Active immunity_

The production of antibodies against a specific disease by the immune system.

Acute_

A short-term, intense health effect.

Allergy_

A condition in which the body has an exaggerated response to a substance (e.g. food or drug).
Also known as hypersensitivity.

Communicable_

Capable of spreading disease. Also known as infectious.

Immune Terminology



Disease: _

Sickness, illness, or loss of health.

Etiology:

The cause of.

Exposure _

Contact with infectious agents (bacteria or viruses) in a manner that promotes transmission and increases the likelihood of disease.

Immune globulin _

A protein found in the blood that fights infection. Also known as gamma globulin.

Immune system _

The complex system in the body responsible for fighting disease. Its primary function is to identify foreign substances in the body (bacteria, viruses, fungi, or parasites) and develop a defense against them. This defense is known as the immune response. It involves the production of protein molecules called antibodies to eliminate foreign organisms that invade the body.

Immune Terminology



Immunity:

Protection against a disease.

Immunization:

The process by which a person or animal becomes protected against a disease. This term is often used interchangeably with vaccination or inoculation.

Immunosuppression_

When the immune system is unable to protect the body from disease. This condition can be caused by disease (like HIV infection or cancer) or by certain drugs (like those used in Chemotherapy.)

Immune Tolerance

Immune tolerance is the state of unresponsiveness of the immune system to substances or tissues that have the potential to induce an immune response.

Incubation period:

The time from contact with infectious agents (bacteria or viruses) to onset of disease.

Infectious agents:

Organisms capable of spreading disease (e.g. bacteria or viruses).

Immune Terminology



Inflammation:

Redness, swelling, heat and pain resulting from injury to tissue (parts of the body underneath the Skin).

Microbes:

Tiny organisms (including viruses and bacteria) that can only be seen with a microscope.

Macrophage:

A large cell that helps the body defend itself against disease by surrounding and destroying foreign organisms (viruses or bacteria.)

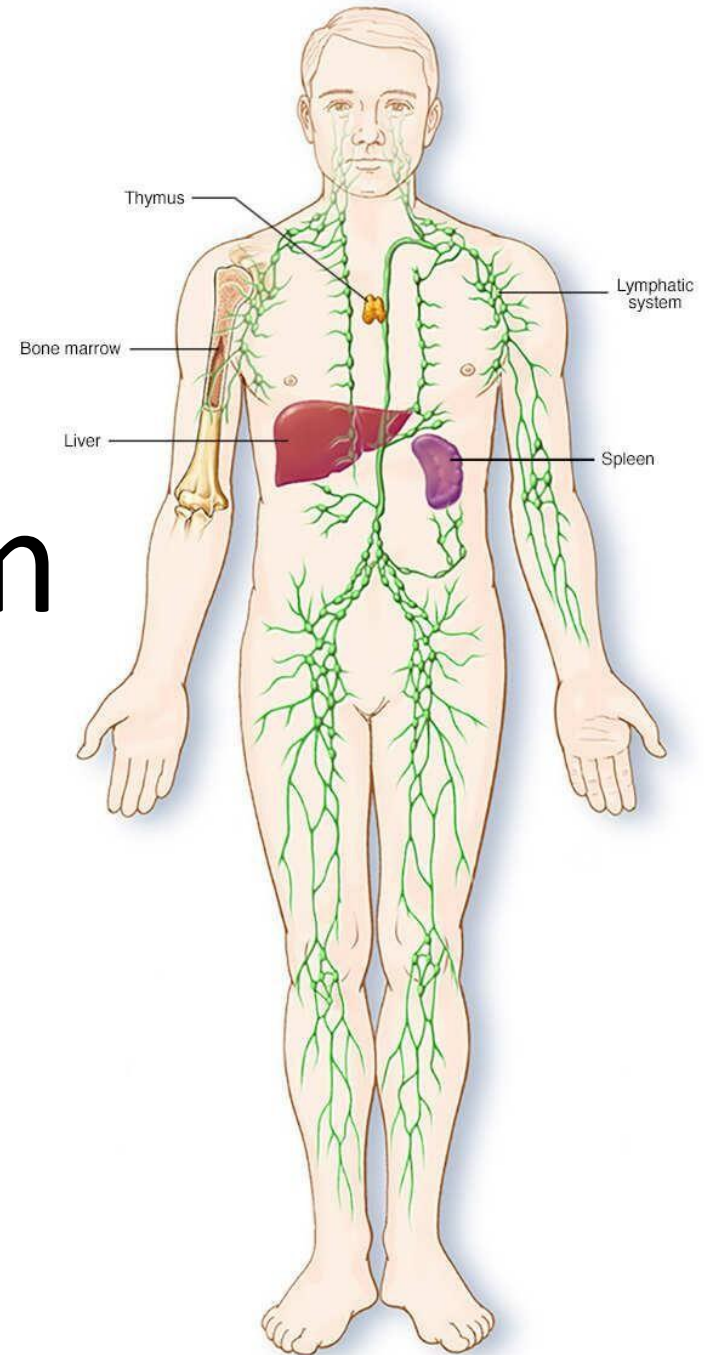
Memory Cell:

A group of cells that help the body defend itself against disease by remembering prior exposure to specific organisms (e.g. viruses or bacteria). Therefore these cells are able to respond quickly when these organisms repeatedly threaten the body.

Phagocyte:

An immune cell that is able to ingest and destroy microbes and other foreign matter.

Lymphatic System



Immune Terminology



Lymph:

A transparent, slightly yellow fluid that carries lymphocytes, bathes the body tissues and drains into the lymphatic vessels.

Lymph Nodes:

Small bean-shaped organs of the immune system, distributed widely throughout the body and linked by lymphatic vessels. Lymph nodes are gathering sites of B, T, and other immune cells.

Lymphatic Vessels:

A body wide network of channels, similar to blood vessels, that transport lymph to the immune organs and into the bloodstream.

Lymphocytes:

Small white blood cells help the body defend itself against infection. These cells are produced in the bone marrow and develop into plasma cells that produce antibodies. Also known as B cells.

Placebo:

A substance or treatment that has no effect on human beings.

Immune Terminology



Outbreak:

The sudden appearance of a disease in a specific geographic area (e.g. neighborhood or community) or population (e.g. adolescents).

Pandemic:

An epidemic occurring over a very large area.

Quarantine:

The isolation of a person or animal who has a disease (or is suspected of having a disease) in order to prevent further spread of the disease.

Risk:

The likelihood that an individual will experience a certain event.

Susceptible:

Unprotected against disease.

Immune Terminology



Vaccination:

Injection of a killed or weakened infectious organism in order to prevent the disease.

Vaccine:

A product that produces immunity, therefore, protecting the body from the disease. Vaccines are administered through needle injections, and by mouth.

Virus:

A tiny organism that multiplies within cells and causes disease. Viruses are not affected by antibiotics, the drugs used to kill bacteria.

Mucosal membranes:

The soft, wet tissue that lines body openings specifically the mouth, and nose.

Herd immunity: Community immunity:

Having a large percentage of the population vaccinated in order to prevent the spread of certain infectious diseases. Even individuals not vaccinated (such as newborns and those with chronic illnesses) are offered some protection because the disease has little opportunity to spread within the community.

- References:

- Introductory Immunology, .2014
- IMMUNOLOGY: A Short Course, 7th Edition, .2015
- Lippincott's Illustrated Reviews: Immunology, Second Edition. .2013
- Textbook of Microbiology and Immunology, 2nd Edition, 2012
- Clinical immunology: principles and practice, Fifth edition .2019

Student



Positive
Attitude

Passion
for Subject

Hardworking
Teamwork

Language

Next Lecture

- Quiz!
- What is the immune system?
- What are the parts of the immune system?
- How does the immune system work?
- What are the types of immunity?

Thanks

