INFECTION CONTROL

UNIT II

The body's defenses

NUR 312 TEAM

THE BODY'S DEFENSES

Body Defenses to infection:

A. First line of defense

B. Second line of defense

C. Third line of defense – Immune response

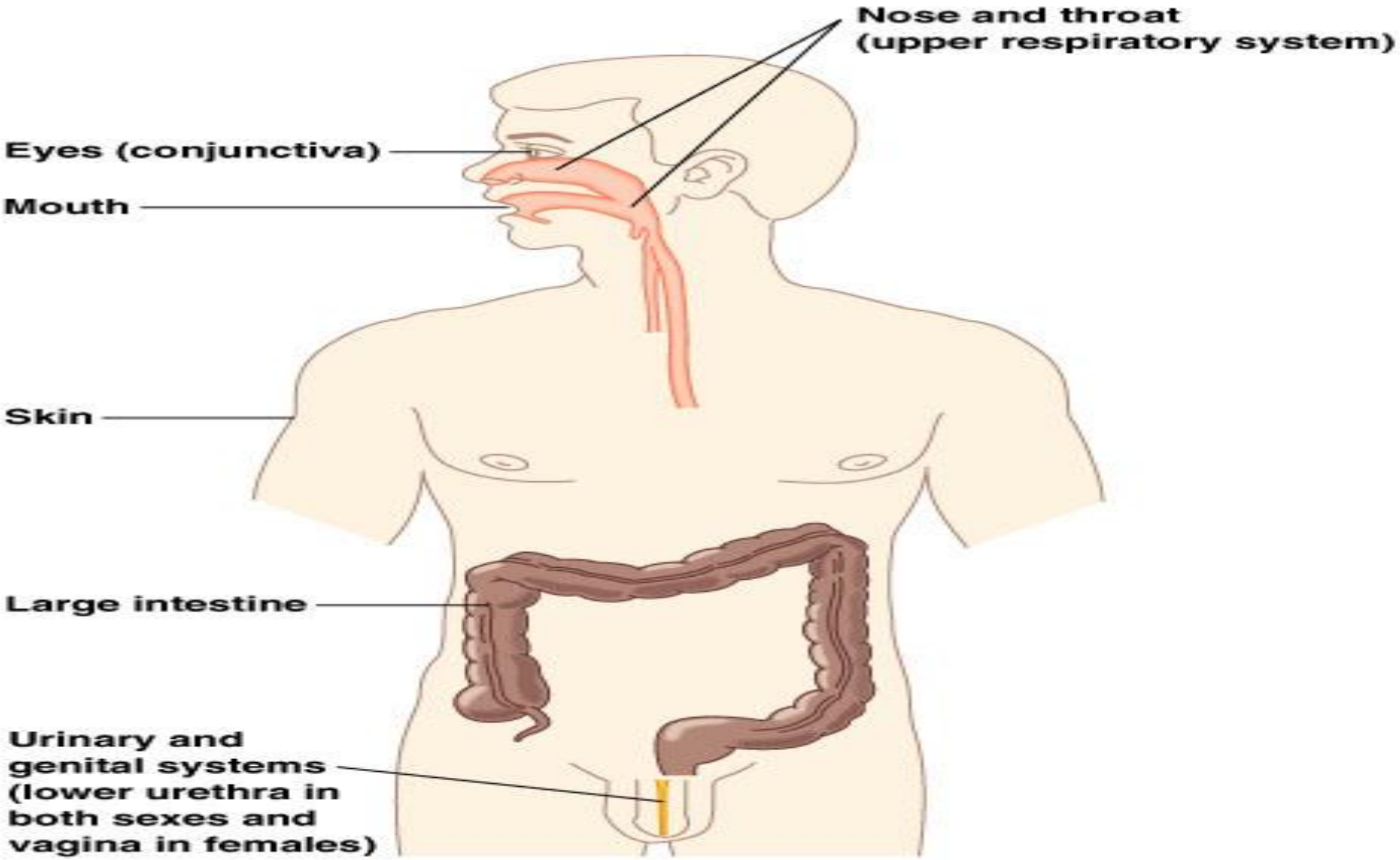
❑ First line of defense:

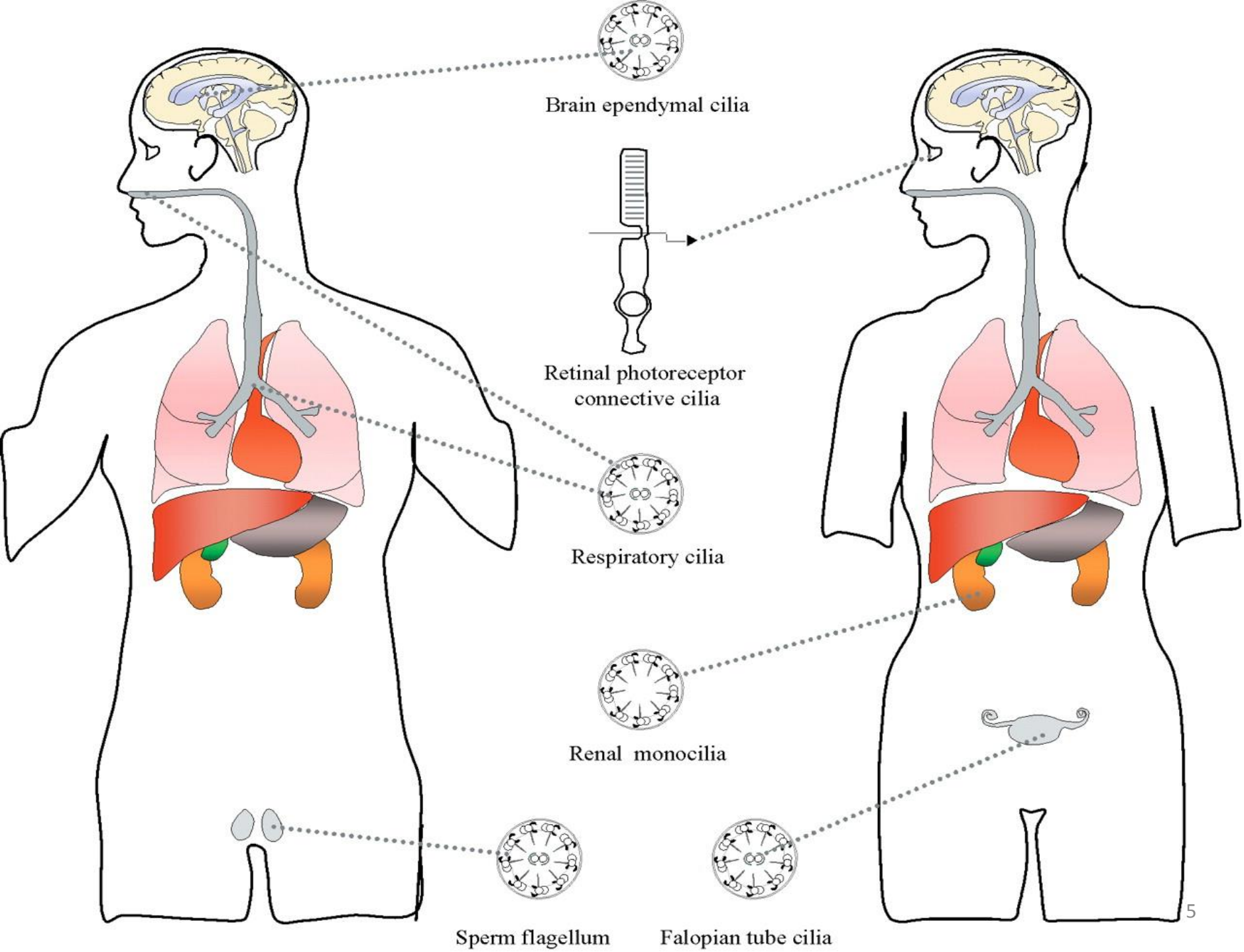
- External and mechanical barriers such as the skin, other body organs, and secretions serve as the body's first line of defense.

- Intact skin, mucous membranes, certain chemical substances, specialized structures such as cilia, and normal flora can stop pathogens from establishing themselves in the body.

- The gag and cough reflexes and gastrointestinal tract peristalsis work to remove pathogens before they can establish.

First line of defense – physical & chemical barriers




Brain ependymal cilia
Retinal photoreceptor connective cilia
Respiratory cilia
Renal monocilia
Sperm flagellum
Falopian tube cilia

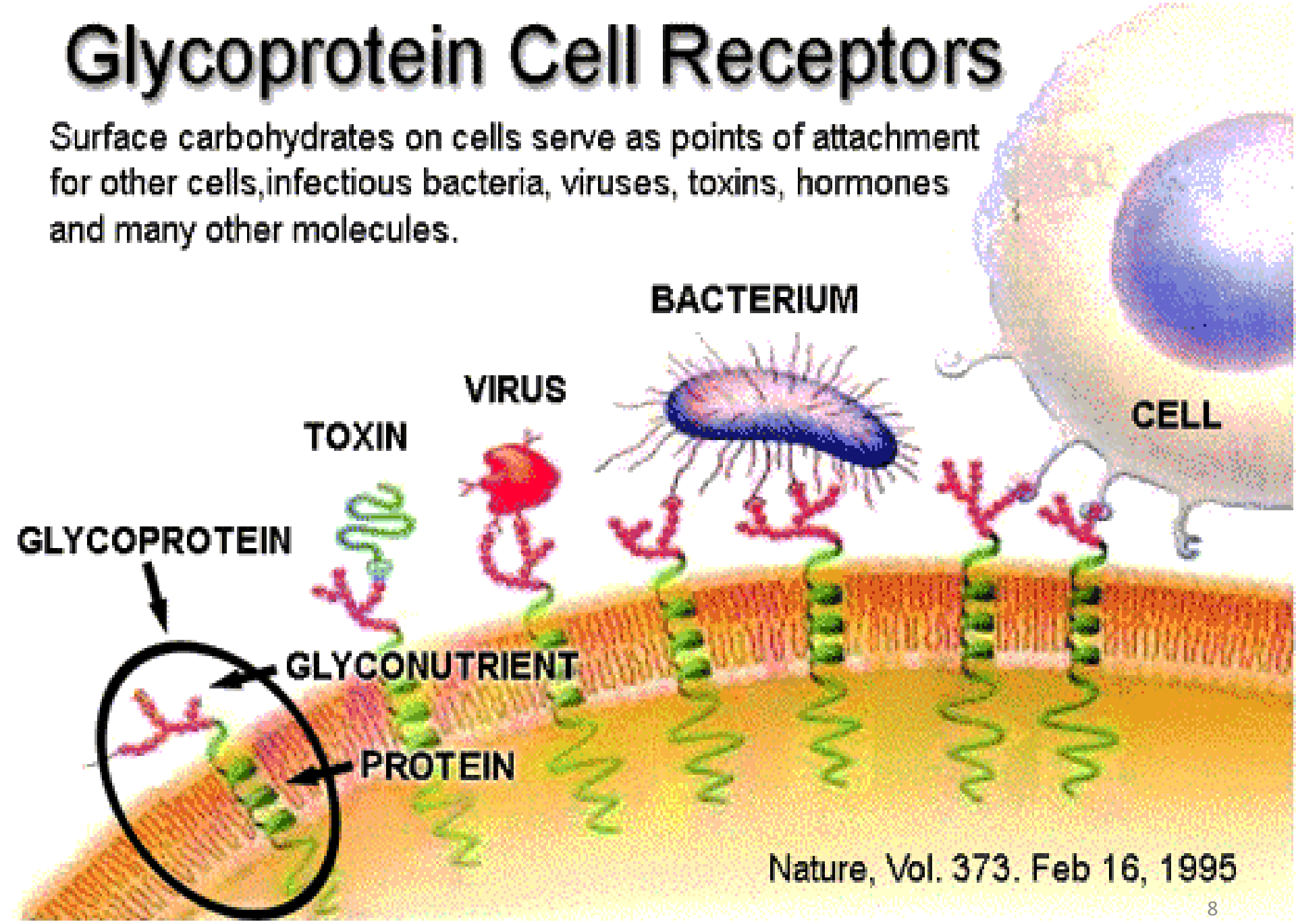
- Chemical substances that help prevent infection or inhibit microbial growth include secretions such as saliva, perspiration, and gastrointestinal and vaginal secretions as well as interferon (a naturally occurring glycoprotein with antiviral properties).

Glycoprotein

- are small molecules found on the outside surface of all body cells.
- Different types of cells have specific, unique types of glycoprotein attached to them.
- Glycoproteins are vital to a number of important biological functions.
- They allow certain types of cell-to-cell communication, help coordinate complicated cellular responses to stimuli, and activate the action of other types of cells.

Glycoprotein Cell Receptors

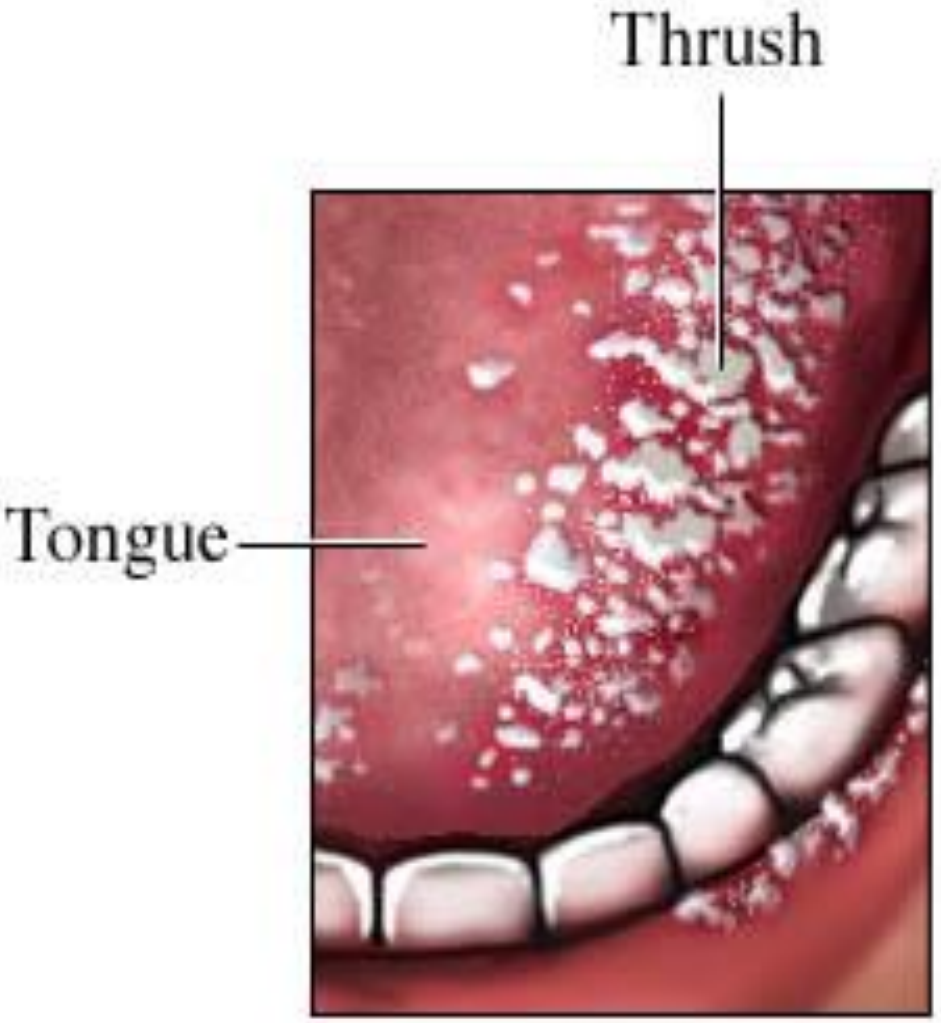
Surface carbohydrates on cells serve as points of attachment for other cells,infectious bacteria, viruses, toxins, hormones and many other molecules.



- Normal microbial flora controls the growth of potential pathogens through a mechanism called microbial antagonism(تضاد). In this mechanism, they use nutrients that pathogens need for growth, compete with pathogens for sites on tissue receptors and secrete naturally antibiotics to kill the pathogens.

- When microbial antagonism is disturbed, such as by prolonged antibiotic therapy, an infection may develop;

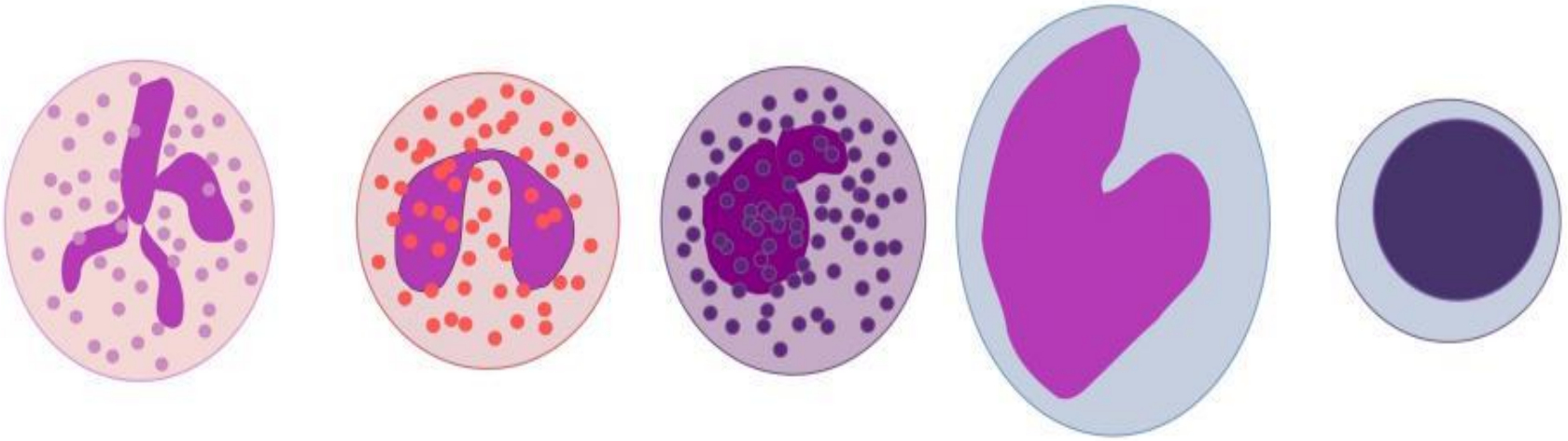
- for example, antibiotic therapy may destroy the normal flora of the mouth, leading to overgrowth of *Candida albicans* and consequent thrush.


Thrush
Tongue

❑ Second line of defense:

- If a microorganism gets past the first line of defense by entering the body through a break in the skin, white blood cells and the inflammatory response come into play.
- Because these components respond to any type of injury, their response is termed non-specific.
- The main function of the inflammatory response is to bring phagocytic cells (neutrophils and monocytes) to the inflamed area to destroy microorganisms.

White blood cells



neutrophil eosinophil basophil monocyte lymphocyte

wiseGEEK

Fever:

Fever offers powerful protection against infection by interfering with the proper conditions that promote bacterial growth.

Inflammation :

1. Inflammation, a tissue response to a pathogen, is characterized by redness, swelling, heat, and pain.
2. Major actions that occur during an inflammatory response include: dilation of blood vessels; increase of blood volume in affected areas; invasion of white blood cells into the affected area; and appearance of fibroblasts(الخلايا الليفية) and their production of a sac around the area.

Phagocytosis:

The most active phagocytes are neutrophils and monocytes.

Third line of defense:

- If a pathogen gets past non-specific defenses, it confronts specific immune responses, cell-mediated immunity or Humoral immunity.

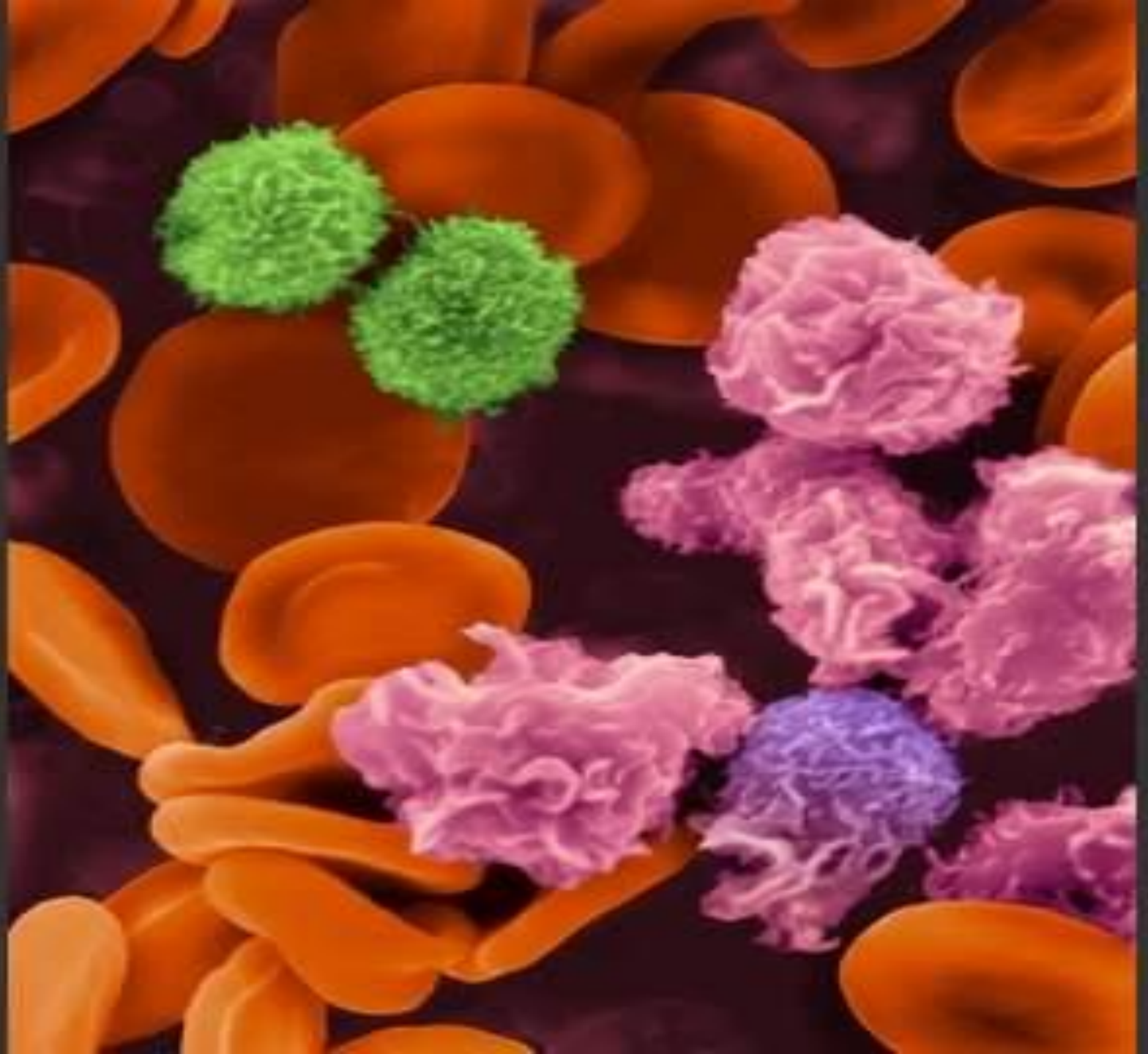
Specific Defenses (Immunity)

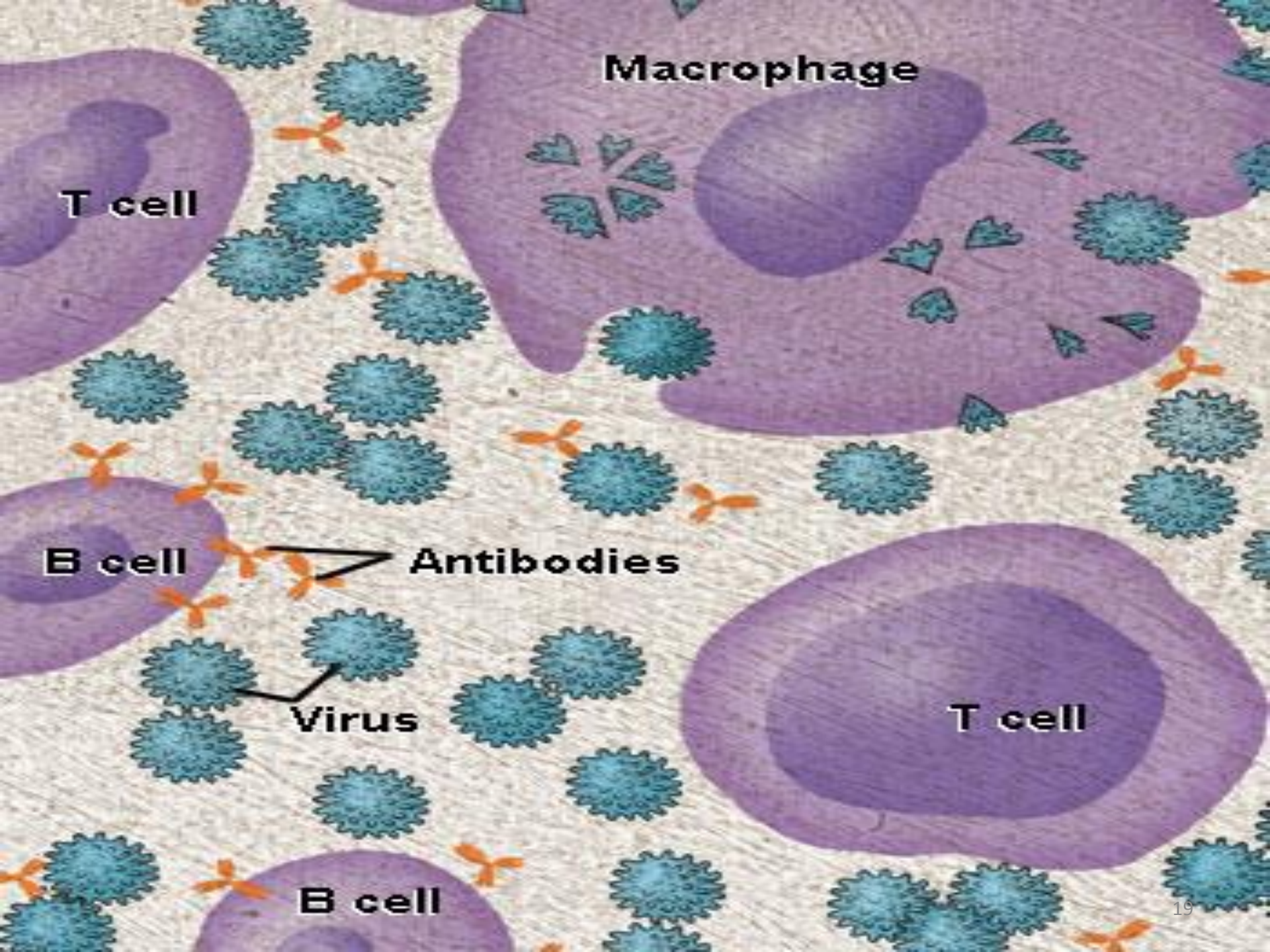
A. Antigens

1. Before birth, the body makes an inventory of "self" proteins and other large molecules.
2. Antigens are generally larger molecules that elicit an immune response.

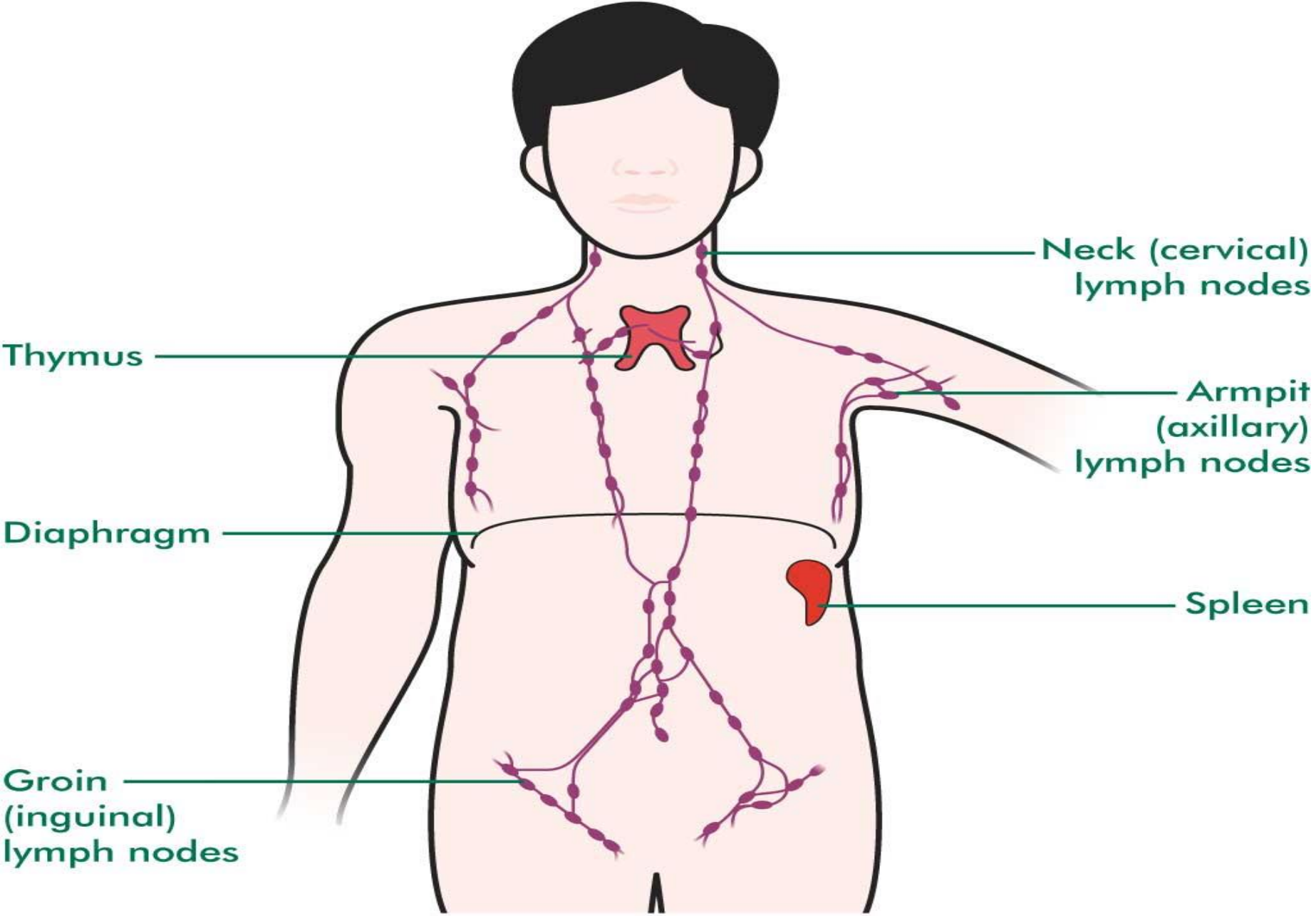
B. Lymphocyte Origins

1. During fetal development, **red bone marrow releases lymphocytes** into circulation, 70-80% of which become T lymphocytes (T cells) and the remainder of which become B lymphocytes (B cells).

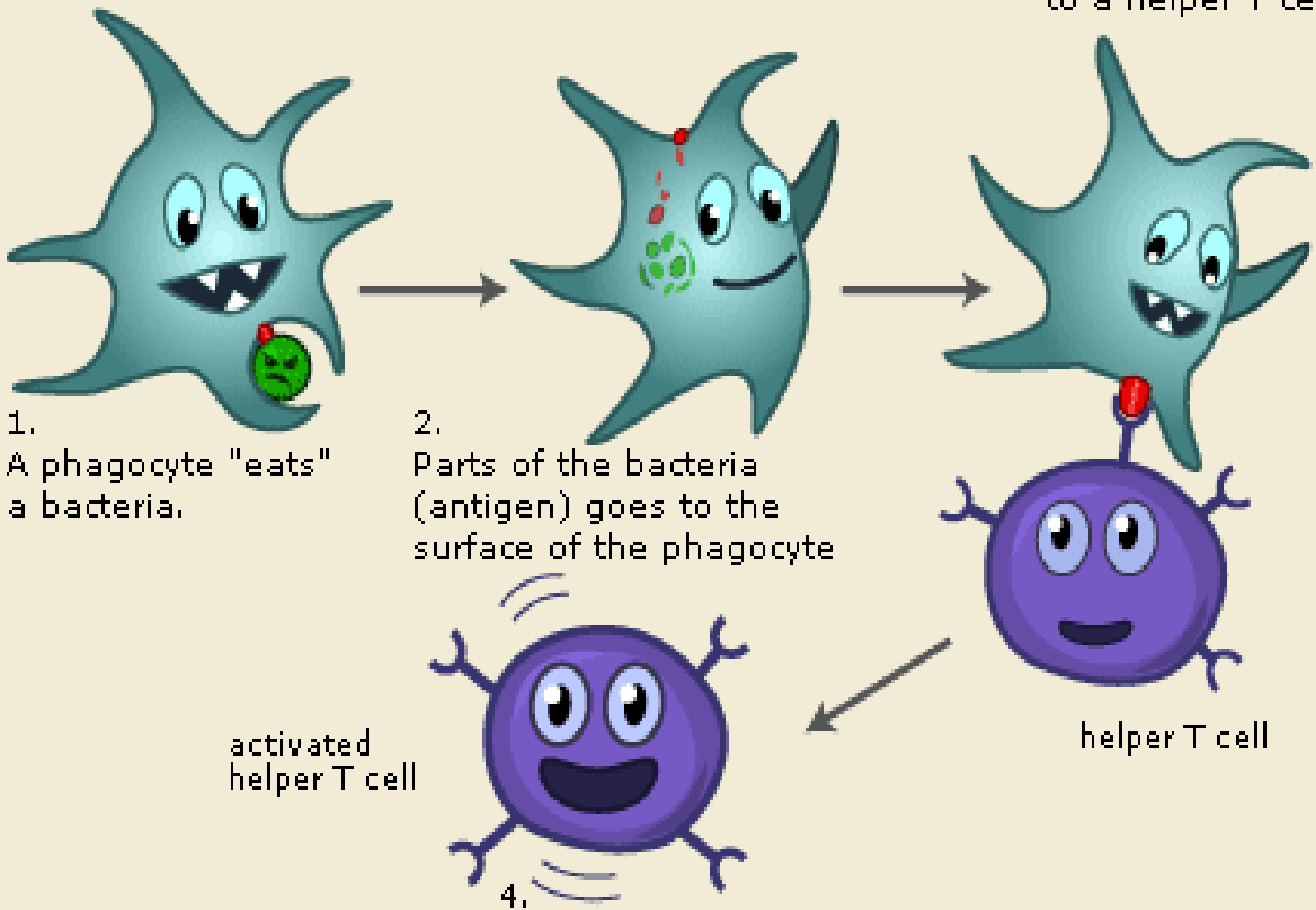



Macrophage
T cell
B cell
Antibodies
Virus
T cell
B cell

2. Undifferentiated lymphocytes that reach the thymus become T cells; B cells are thought to mature in the bone marrow.
3. Both B and T cells reside تكمن فى in lymphatic organs.


Neck (cervical) lymph nodes
Thymus
Armpit (axillary) lymph nodes
Diaphragm
Spleen
Groin (inguinal) lymph nodes

Antigen Presentation



C. Lymphocyte Functions

1. T cells attack foreign, antigen-bearing cells, such as bacteria, by direct cell-to-cell contact,.
2. T cells also secrete cytokines (lymphokines) that enhance cellular response to antigens.

T cells may also secrete toxins that kill target cells, or produce growth-inhibiting factors or interferon to interfere with viruses and tumor cells.

4. B cells attack pathogens by differentiating into plasma cells that secrete antibodies (immunoglobulins).
5. Body fluids attack and destroy specific antigens or antigen-bearing particles through antibody-mediated immunity.

D. Types of Antibodies

There are **five** major types of antibodies (immunoglobulins) that constitute the gamma globulin fraction of the plasma.

a. IgG is in tissue fluid and plasma and defends against bacterial cells, viruses, and toxins.

b. IgA is in exocrine gland secretions (breast milk, saliva, tears) and defends against bacteria and viruses.

c. IgM is found in plasma and activates complement and reacts with blood cells during transfusions.

d. IgD is found on the surface of most B lymphocytes and functions in B cell activation.

e. IgE is found in exocrine gland secretions and promotes allergic reactions.

E. Types of Acquired Immunity

1. Naturally acquired active immunity occurs after exposure to the antigen itself.
2. Artificially acquired active immunity occurs through the use of vaccines, without the person becoming ill from the disease.
3. Artificially acquired passive immunity involves the injection of gamma globulin containing antibodies and is short-lived.
4. Naturally acquired passive immunity occurs as antibodies are passed from mother to fetus and is short-lived.

Immunization and Vaccination

Immunization

- **Administration of a vaccine or toxoid to protect susceptible individuals from infectious diseases**
- **Process whereby a person is made immune or resistant to an infectio disease, typically by the administra of a vaccine (WHO, 2015)**
- **Reduces risk of infection spread**
- **Decreases the susceptibility of the**

Immunization: WHO Key Facts

- **Immunization prevents illness, disability and death from vaccine-preventable diseases including cervical cancer, diphtheria, hepatitis B, measles, mumps, pertussis, pneumonia, polio, rotavirus diarrhoea, rubella and tetanus.**
- **Immunization currently averts an estimated 2 to 3 million deaths every year.**
- **But an estimated 21.8 million infants worldwide are still missing out on basic vaccines.**

MOH-KSA Immunizations Recommendations:

جدول التطعيمات الوطني

الزيارة Visit	التطعيم Vaccine	
عند الولادة At Birth	BCG	درن
	Hepatitis B	التهاب كبدي (ب)
عمر شهرين 2 months	IPV	شلل أطفال معطل
	DTaP	الثلاثي البكتيري
	Hepatitis B	الالتهاب الكبدي (ب)
	Hib	المستدمية النزلية
	Pneumococcal Conjugate (PCV)*	البكتيريا العقدية الرئوية*
	Rota**	فيروس الروتا**
عمر ٤ شهور 4 months	IPV	شلل أطفال معطل
	DTaP	الثلاثي البكتيري
	Hepatitis B	الالتهاب الكبدي (ب)
	Hib	المستدمية النزلية
	Pneumococcal Conjugate (PCV)*	البكتيريا العقدية الرئوية*
	Rota**	فيروس الروتا**
عمر ٦ شهور 6 months	OPV	شلل الأطفال الفموي
	IPV	شلل أطفال معطل
	DTaP	الثلاثي البكتيري
	Hepatitis B	الالتهاب الكبدي (ب)
	Hib	المستدمية النزلية
	Pneumococcal Conjugate (PCV)*	البكتيريا العقدية الرئوية*
عمر ٩ أشهر 9 months	Measles	الحصبة المفرد
	Meningococcal Conjugate quadrivalent (MCV4)	الحمى الشوكية الرباعي المقترن
عمر ١٢ شهر 12 months	OPV	شلل الأطفال الفموي
	MMR	الثلاثي الفيروسي
	Pneumococcal Conjugate (PCV)*	البكتيريا العقدية الرئوية*
	Meningococcal Conjugate quadrivalent (MCV4)	الحمى الشوكية الرباعي المقترن
عمر ١٨ شهر 18 months	OPV	شلل الأطفال الفموي
	DTaP	الثلاثي البكتيري
	Hib	المستدمية النزلية
	MMR	الثلاثي الفيروسي
	Varicella	الجديري المائي
	Hepatitis A	الالتهاب الكبدي (أ)
عمر ٢٤ شهر 24 months	Hepatitis A	الالتهاب الكبدي (أ)
عند دخول الصف الأول الإبتدائي First class primary school age	OPV	شلل الأطفال الفموي
	DTaP (Td)***	الثلاثي البكتيري (الثنائي البكتيري)***
	MMR	الثلاثي الفيروسي
	Varicella	الجديري المائي

* لقاح البكتيريا العقدية الرئوية (PCV١٣).
** لقاح الروتا الأحادي.
*** يعطى الثنائي البكتيري إبتداء من ٧ سنوات.

al Conjugate (PCV13).
Rota vaccine.
rom 7 years of age.

Exercise

Apply Your Knowledge

What is an immunization?

ANSWER:

An immunization is the administration of a vaccine or toxoid to protect susceptible individuals from infectious diseases.

Vaccination(WHO, 2016)

- **A biological preparation that improves immunity to a particular disease.**
- **typically contains an agent that resembles a disease-causing microorganism, and is often made from weakened or killed forms of the microbe, its toxins or one of its surface proteins.**
- **The agent stimulates the body's immune system to recognize the agent as foreign, destroy it, and "remember" it, so that the immune system can more easily recognize and destroy any of these microorganisms that it later encounters.**

ASSESSING RISK POTENTIAL

- Any exposure to a communicable disease carries a certain amount of risk. For blood borne pathogens, an exposure occurs whenever there is contact with blood or other body fluids through open wounds, mucous membranes, or parenteral (by injection) routes.
- The degree of risk depends on the degree of exposure**. Five factors** are critical in assessing potential risk in any exposure situation:

1- Communicability

Identification of the causative agent is critical.

Some disease-producing organisms are more readily communicable than others; some are capable of causing more serious effects.

2- Dosage of the Disease-Producing Organism

- Dosage refers to the number of viable (live) organisms received during an exposure.
- Each illness requires that a certain number of infectious agents be present in order to cause disease.
- For example, one Hepatitis B virus in 1 milliliter of blood may be all that is needed to spread the infection, while 100,000 HIV viral particles may be needed.

3- Virulence of the Disease-Producing Organism

- Virulence is the disease-evoking power of the organism, in other words, the strength or ability of the organism to infect or overcome bodily defenses.

4- Hardiness of the Organism

- Hardiness is the organism's ability to survive in the environment.
- This varies from one situation to another.
- In most cases, the organism must be one that survives outside the body.
- For example, the hepatitis B virus has been shown to live on a surface for days to weeks and still be infectious.

5- Host Resistance

- Host resistance is the ability of the host to fight infection.
- Infection occurs as a result of an interruption in the body's normal defense mechanisms, which allows the organism to enter the body.
- Typically, the healthier you are, the less likely you are to become ill.