Adaptive or acquired immunity

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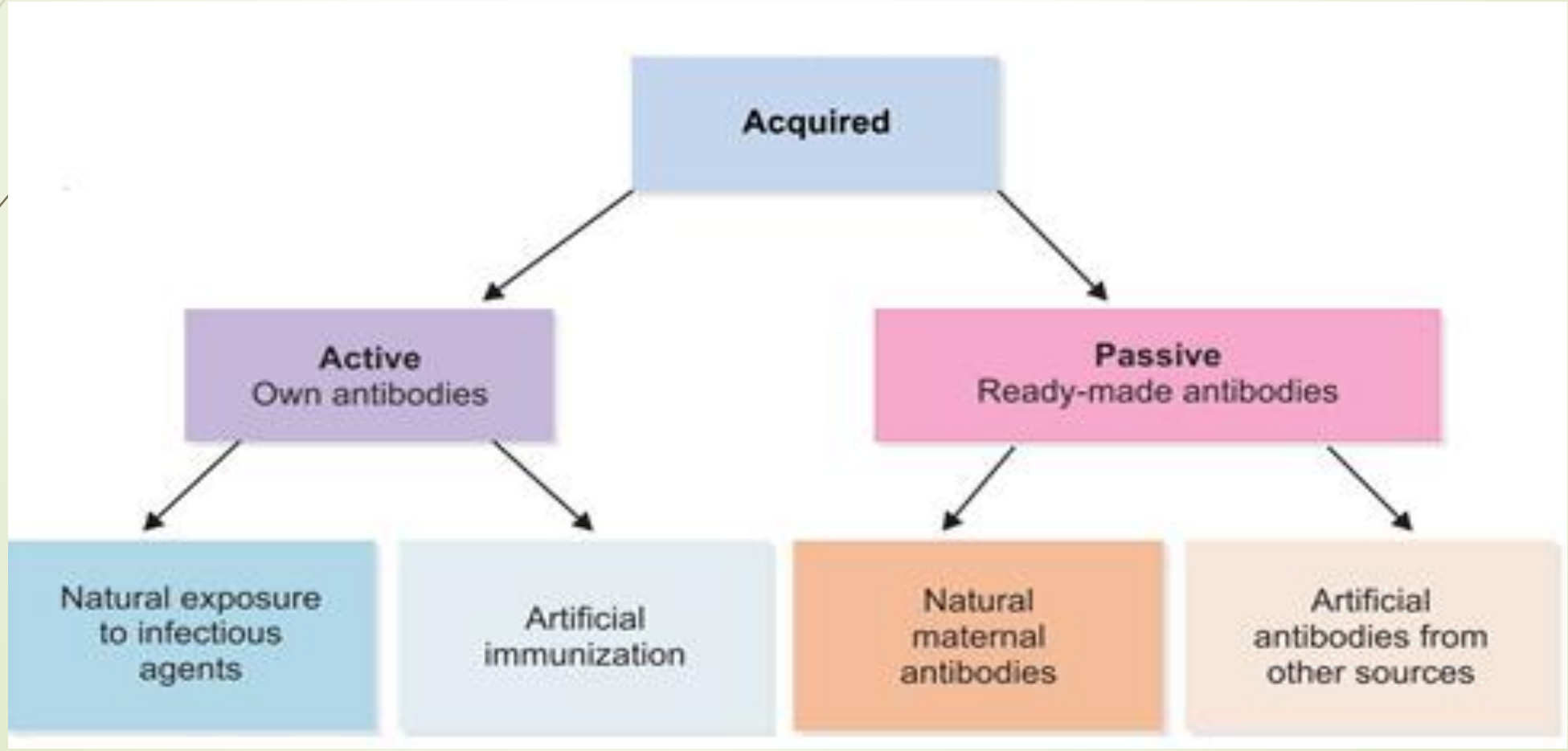
Acquired Immunity

Is The resistance of individual acquires during life, also known as **specific immunity**. It is include the following:



Features of Adaptive (acquired) immunity

- 1. **Antigenic specificity** → permits it to distinguish minor difference among antigens, The antibodies can distinguish between two protein molecules that differ in only a single amino acid
- 2. **Diversity** → its recognition molecules, permitting to recognize vast arrays of unique structures on foreign antigens.
- 3. **Immunological memory** → it exhibits immunological memory to recognize the same antigen
- 4. **Self/non-self-recognition** → responds to foreign antigens, indicating that it is capable of distinguishing self from non-self

Active Immunity

- Is capable of recognizing and selectively eliminating specific foreign microorganisms and molecules, i.e. tumor antigens, transplanted antigens, etc.
- This involves either producing antibody or creating immune-competent cells for cell-mediated immunity (CMI).
- Active immunity in primary immune response sets in only **after a latent period**, which the immunological machinery needs for its functioning.
- Active immunity in secondary immune response When the individual infected with same antigen, **there is no latent or lag phase.**
- Active immunity is **long lasting.**
- In contrast to the innate immune response, which recognize the common molecular patterns such as PAMPs in potential invaders,
- The adaptive immune system resorts to a highly different approach with a very large repertoire of specific antigen receptors that can recognize virtually, any component of the foreign invader.

Naturally acquired active immunity

- Active immunity develops as a result of **natural contact** with a microbe or its product
- This contact may be with clinical disease without clinical disease.
- the patient, in most cases, will be immune to further infection by the same pathogen for a period, which is different in different diseases.
- The immunity to reinfection lasts as long as the original infection persists.
- In influenza, common cold, gonorrhoea, the immunity lasts for →**short duration**.
- In diphtheria, small pox, measles, yellow fever, the immunity lasts for → **long duration**, and may persist for life
- In general, the immunity following viral infections lasts longer than immunity following bacterial infections
- In syphilis, malaria and few other diseases, a special type of immunity is observed known as **infection immunity (premunition)**, immunity to reinfection persists as long as the original infection remains active.

Artificially acquired active immunity

- This type of immunity results from **vaccination or immunization**.
- Vaccinations may be inactivated OR detoxified bacterial toxins **(toxoids),** killed microorganisms, live but attenuated microorganisms or parts of microorganisms such as capsules.
- These substances can no longer cause disease, but can stimulate immune response.
- **1. Bacterial vaccines**:
- **Live and attenuated** → Bacille Calmette-Guérin **(BCG)** for tuberculosis
- **Killed** → Typhoid-paratyphoid A and B vaccine **(TAB)** for enteric fever
- **2. Viral vaccines**
- **Live and attenuated** → Smallpox, Oral polio (Sabin) Influenza Measles, mumps, rubella (MMR)
- **Killed (inactivated)** → Injectable Polio (Salk), Yellow fever, Influenza, Rabies.

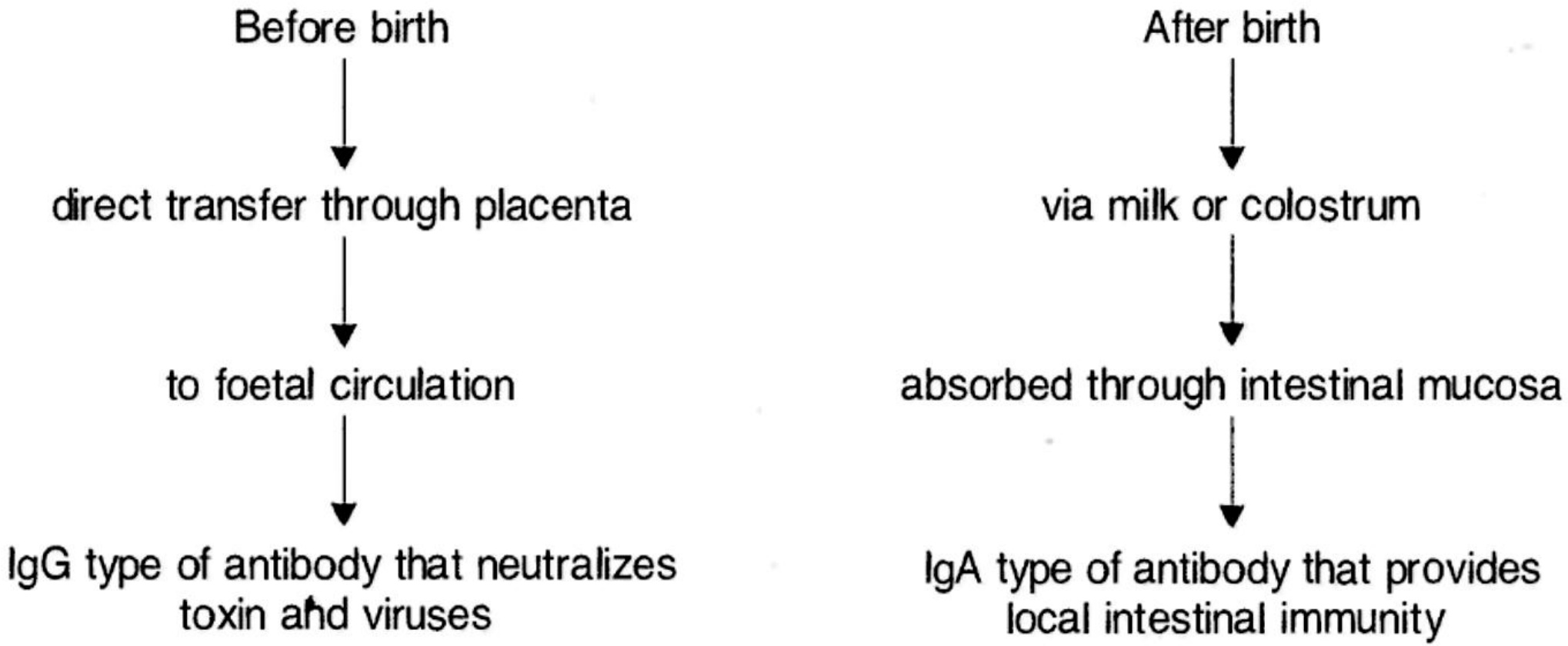
Passive Immunity

- Passive immunity is resistance acquired by transfer of **readymade antibodies** or **defensive cells** are introduced into the body.
- This form of protection is passive, because the individuals own immune system does not make antibodies or defensive cells against the disease producing agents or toxins.
- the immune system does not take any active part in the development of immunity.
- It is rapidly established and immediate protection is offered, which is necessary in certain clinical situations like diphtheria, tetanus, snake bite, etc.
- Passive immunity is of two types:
- **1 . Naturally acquired passive immunity**
- **2. Artificially acquired passive immunity**

Naturally acquired passive immunity

- This type of immunity involves natural transfer of antibodies **from mother to her infant** and also from **mother to fetus**.
- Certain antibodies (IgA) are passed from the mother to her nursing infants in breast milk, especially in the first secretion called **colostrum**.
- The immunity in infants last as long as baby feeds on breast milk.
- During pregnancy, some of the maternal antibodies are also transferred through placenta to the fetus.
- If the mother is immune to diphtheria, rubella or polio, the newborn will be temporarily immune to these diseases as well.

Naturally acquired passive immunity



Pathway of transfer of antibodies from mother to fetus.

Artificially acquired passive immunity

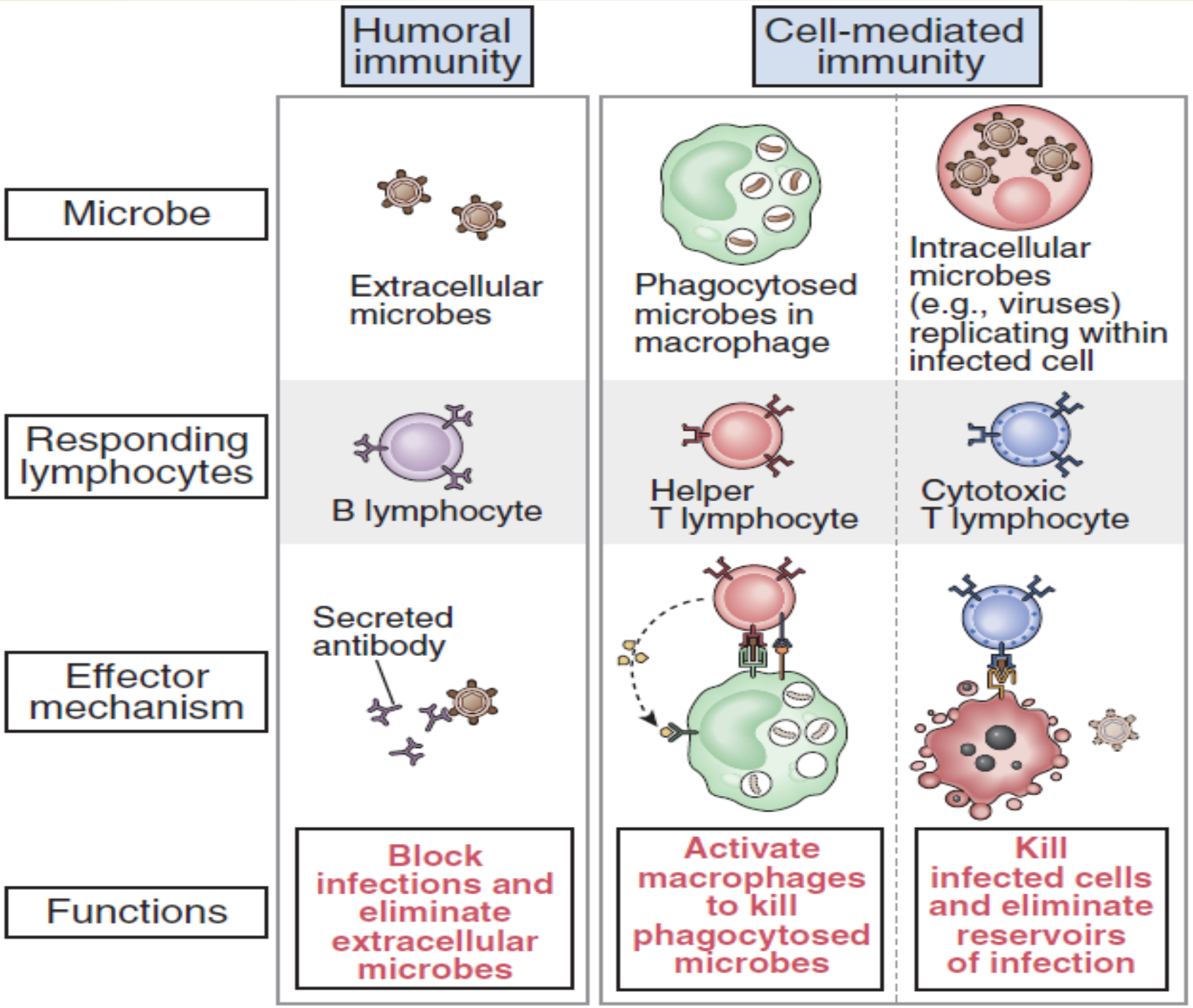
- This type of immunity involves the introduction of antibodies into the body.
- These antibodies come from animal or person, who is already immune to the disease.
- They are:
- **1**. Hyperimmune sera of animal or human origin. Common examples are antitetanus serum **(ATS)**, antidiphtheria serum **(ADS)**, anti-gas-gangrene serum **(AGS)**, antisnake venom, etc.
- **2.** Convalescent sera from patients very recently recovered from measles, rubella, etc.
- **3.** Pooled gamma globulin serum against common infectious diseases.
- **4.** Human gamma globulin is also used in the treatment of immunodeficiency diseases.

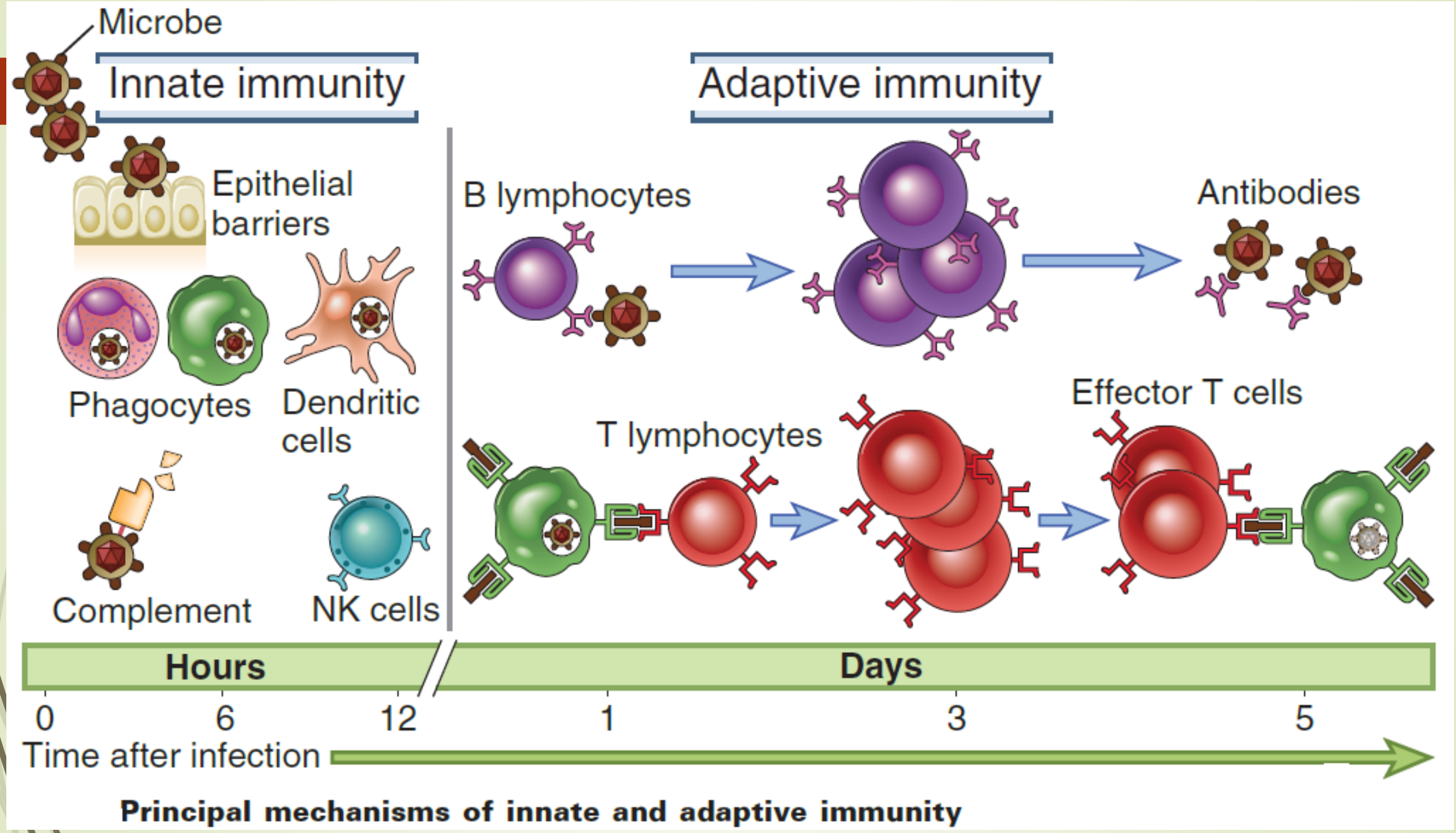
Comparison of active and passive immunity

	Active	Passive
Mechanism	Produced actively by the host immune system	Obtained passively, no participation
Induction	Induced by infection (clinical and subclinical) Induced by immunogens, vaccines	Conferred by ready-made antibody
Durability	Protection is durable and effective	Protection is transient and less effective
Lag phase	Present	No lag phase
Immunological memory	Present, subsequent challenge is more effective	No immunological memory, hence no secondary response
Negative phase	May occur	No negative phase
Application to immune deficient subjects	Not applicable	Effective in immune deficient hosts

Mechanism of adaptive immunity

- Adaptive immune responses develop later and are mediated by lymphocytes and their products.
- Antibodies block infections and eliminate microbes, and T lymphocytes eradicate intracellular microbes.
- **Humoral immunity**– also called **antibody-mediated immunity**– based on **antibody** activity which produced from activated B-cell **(plasma cell)**
- **Cellular immunity**– also called **cell-mediated immunity**– based on action of specific kinds of **T-lymphocytes and B-lymphocytes**


Humoral immunity
Cell-mediated immunity
Microbe
Extracellular microbes
Phagocytosed microbes in macrophage
Intracellular microbes (e.g., viruses) replicating within infected cell
Responding lymphocytes
B lymphocyte
Helper T lymphocyte
Cytotoxic T lymphocyte
Effector mechanism
Secreted antibody
Functions
Block infections and eliminate extracellular microbes
Activate macrophages to kill phagocytosed microbes
Kill infected cells and eliminate reservoirs of infection



Principal mechanisms of innate and adaptive immunity

Questions

- Q 1\ what is the features of adaptive immunity
- Q 2\ compare between innate and adaptive immunity by cells, immune mediators, specificity, memory, response
- Q 3\ compare between active and passive acquired immunity
- Q 4\ numerate the types of acquired immunity and mention one example for each one