Biology Grade 8

Chapter 1: The Immune Response

Activity 5: Characteristics of Specific Immune Response

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Activity 5: characteristics of specific immune response

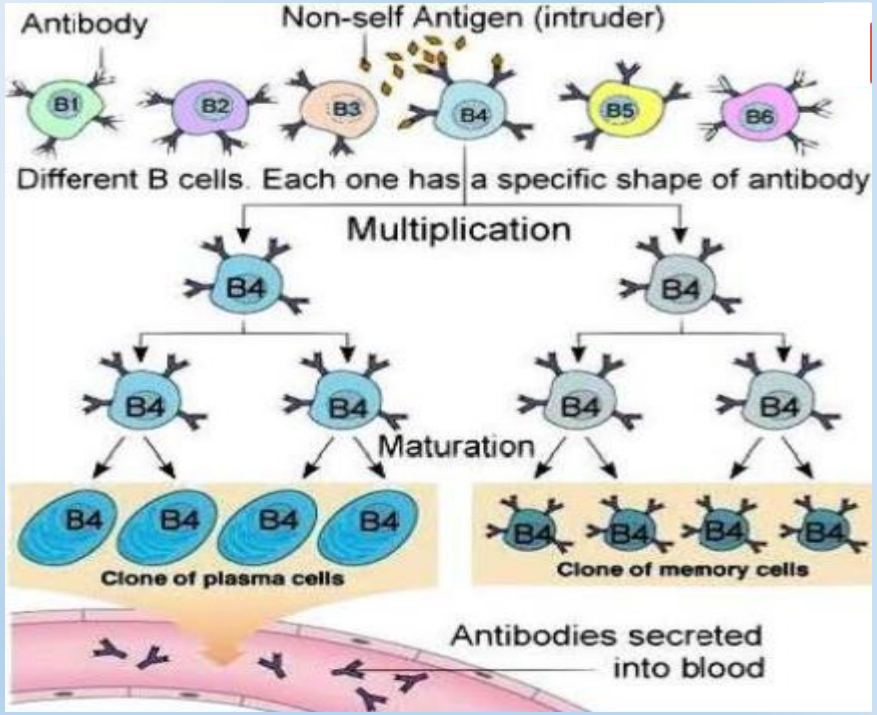
❖ Immunological specificity of B and T lymphocyte

- Every B cell produces **one** antibody type able to **bind specifically** to one single antigen.
- Since the body contains tens of millions of B cells producing as many types of different antibodies, it is able to face all various antigens.
- T lymphocytes have specific membrane receptors with diversity comparable to that of the antibodies.

❖ Steps of amplification of B cells:

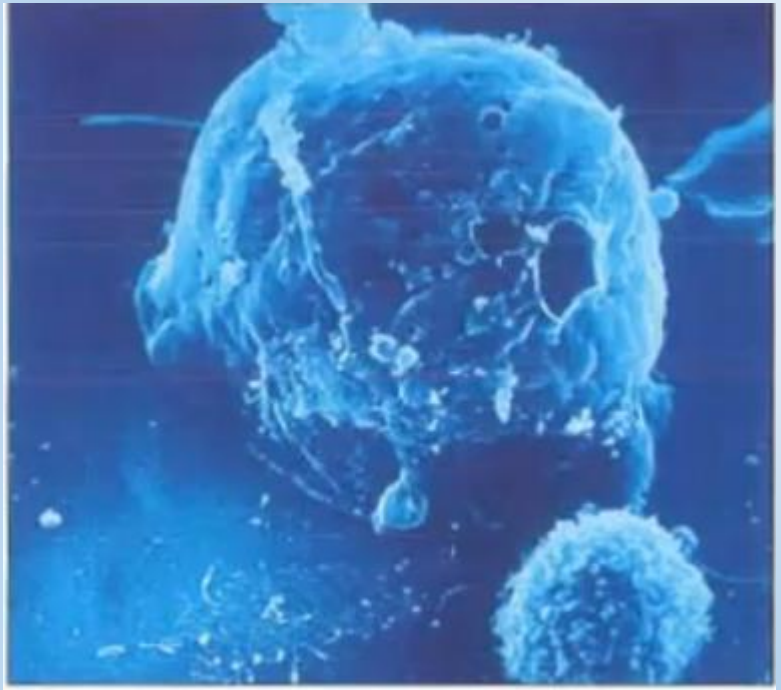
when a specific B cell recognizes the antigen through its surface antibodies:

1. **Natural selection:** B cell which is **specific** to the antigen is **selected**.
2. **Multiplication:** selected B lymphocytes **multiply** and give rise to a clone.
3. **Differentiation:** some B- lymphocytes **differentiate** into **plasma cells (antibodies secreting cells)** that secret circulating antibodies while **others become memory cells**.

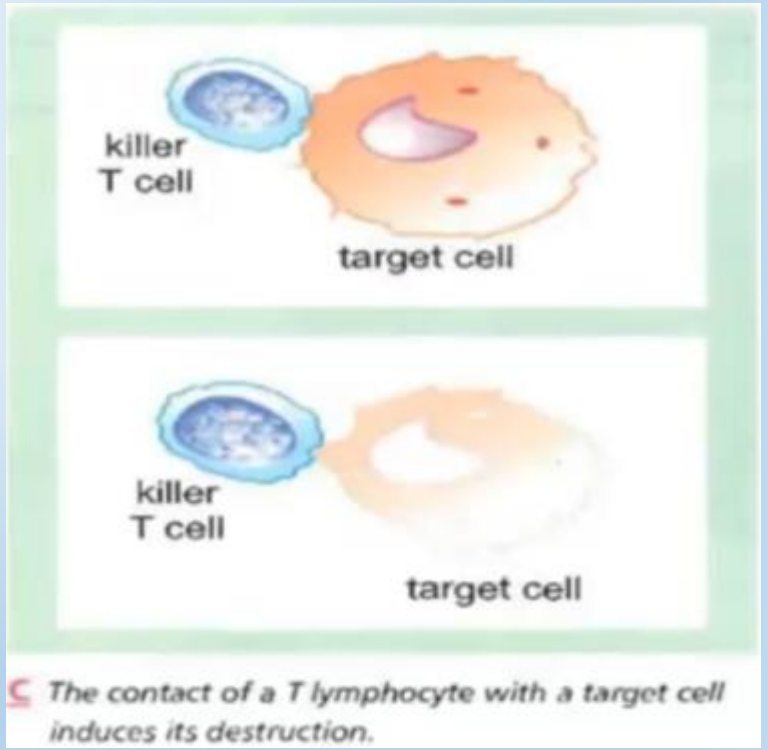


❖ Steps of amplification of T lymphocyte:

1. **Natural selection:** T lymphocyte that has receptor **specific** to the antigen is **selected.**
2. **Multiplication:** selected T lymphocyte **multiplies.**
3. **Differentiation:** T- lymphocytes differentiate into **Killer cells** and **memory cells.**



b A T cell gives a "killer kiss" to a giant target cell*.



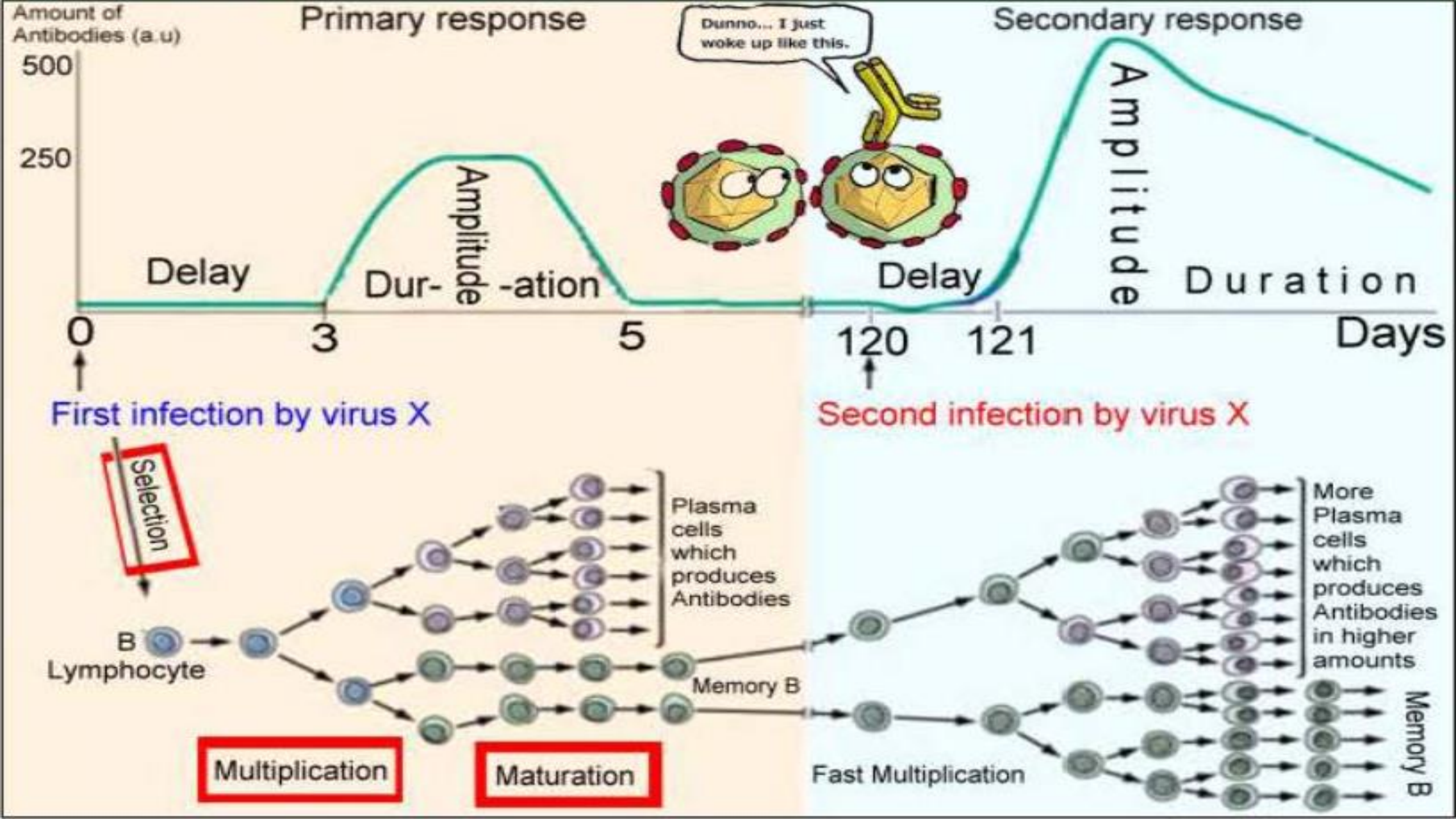
c The contact of a T lymphocyte with a target cell induces its destruction.

❖ Immunological memory

- **Immunological memory is the ability of the immune system to remember a specific antigen after it enters the body.**
- It is characterized by the formation of **memory cells.**

- Immunological memory develops in two stages:

1. **Primary response:** first response of the immune system against an antigen.
2. **Secondary response:** the immune system's faster and stronger response to a **subsequent infection** by the same antigen.


Amount of Antibodies (a.u)
500
250
Primary response
Dunno... I just woke up like this.
Secondary response
Amplitude
Delay
Dur-
Amplitude
-ation
Delay
Amplitude
Duration
0
3
5
120
121
Days
First infection by virus X
Second infection by virus X
Selection
B Lymphocyte
Plasma cells which produces Antibodies
Memory B
Multiplication
Maturation
More Plasma cells which produces Antibodies in higher amounts
Fast Multiplication
Memory B

1. Precise the faster response.

Second response, since antibodies were produced after 1 day, which is less than that of the first response (3 days).

2. Identify the amplified response.

The amount of antibodies in the second response is 500 a.u greater than of the primary, which is 250 a.u.
Therefore, the secondary response is amplified one.

3. Determine the longer protection response.

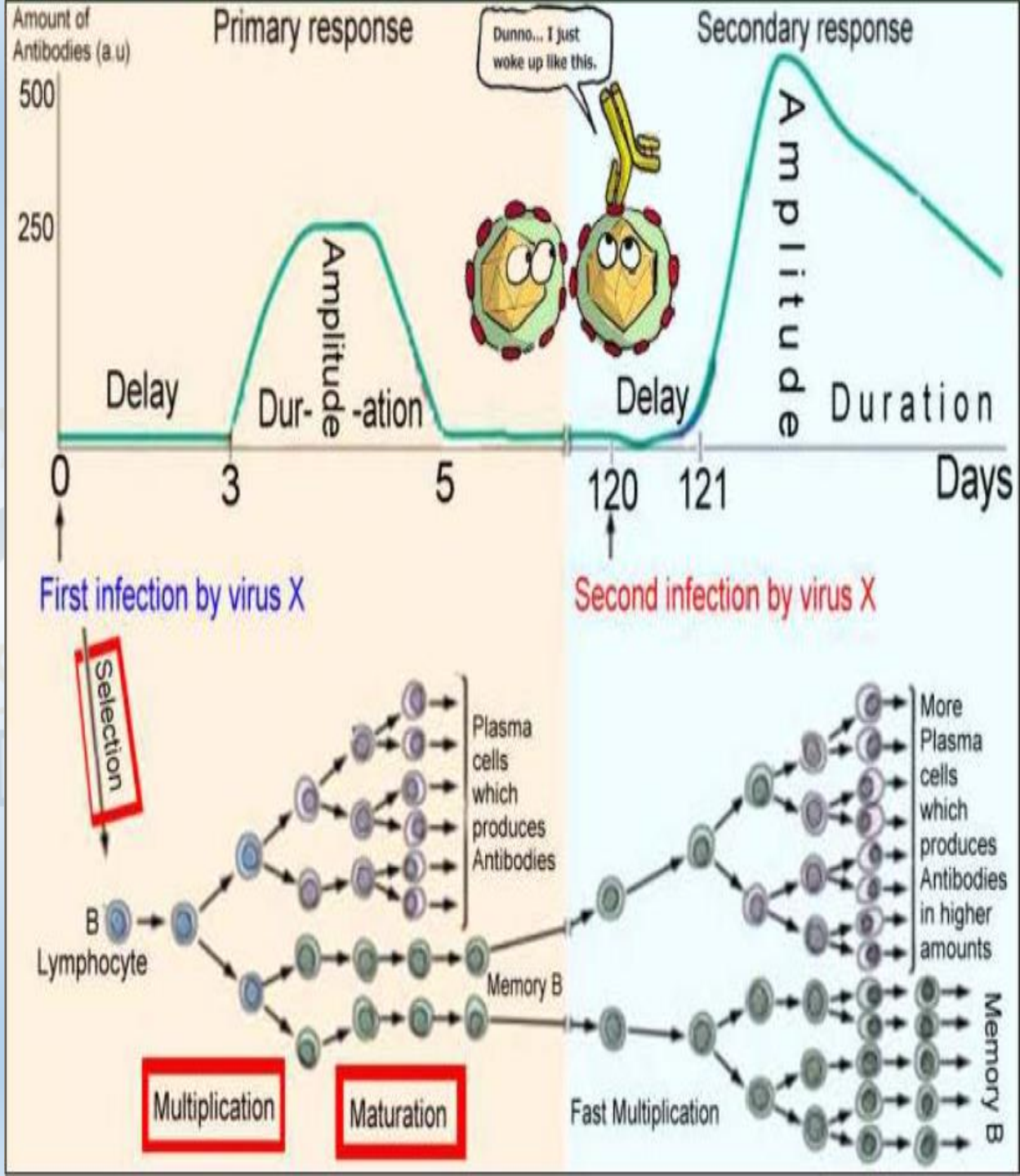
Since the duration of the first response is 2 days less than that of the second response (many years).
So, the second response has longer protection duration.

4. The secondary response is more efficient than the primary one. Explain the reason behind that.

The secondary response is more efficient because it is faster, amplified and protect for longer duration due to the presence of memory cells.

5. Pick out the steps of amplification.

Selection- Multiplication – Maturation.



❖ Comparative table between primary and secondary responses:

Response	Primary	Secondary
Latency	Long	Short
Amount of secreted antibodies	Low	High
Duration of response	Short	Long

Latency: it is the time needed for the immune response to start.

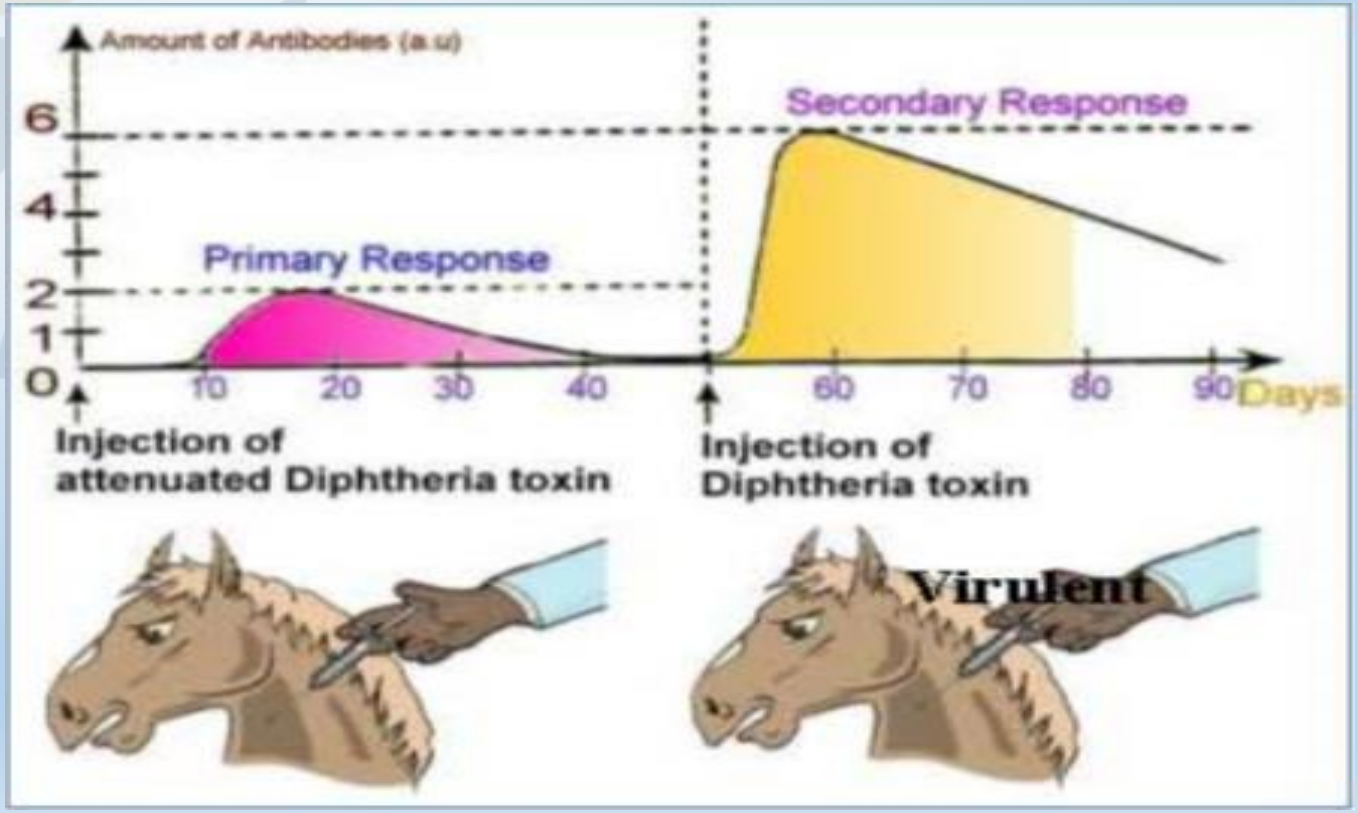
So the secondary immune response is faster, more efficient and longer lasting than the primary response.

Exercise 1:

Diphtheria toxin is a fatal toxin. It kills horses after being infected in a short time. To protect horses from death, horses are injected with **attenuated diphtheria toxin** before being in contact with virulent diphtheria toxin. A horse is subjected to two different injections (at t = 0 days and then at t = 50 days) as shown in the given document. The horse survives after the two injections are done. The variation in the amount of anti-diphtheria antibodies is measured during the experiment. The results are represented in the given graph.

1. Copy and complete the following table.

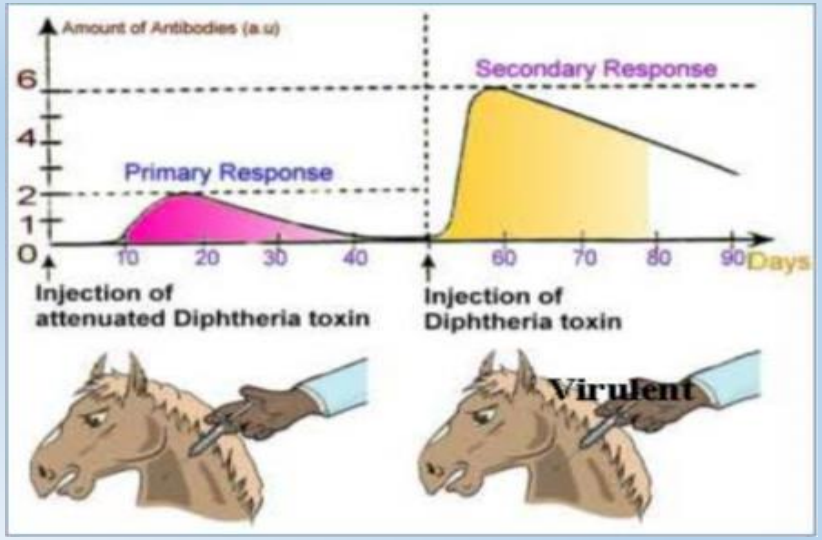
Response	Primary	Secondary
Delay (Days)	10	2
Amplitude (a.u.)	2	6
Duration (Days)	30	Long



2. Indicate the amplified response.

The secondary response.

3.1. Compare the time needed for the primary response to start with the time needed for the secondary response to start.



The delay time of the first response is 10 days greater than that of the second response, which is 2 days.

3.2. Conclude the faster response.

The secondary response.

4. Determine the longer protection response.

Since the duration of the secondary response is **longer than that** of the primary response (30 days).

Than the secondary response has longer protection.

5. Deduce the more efficient immune response.

Since the secondary immune response is faster, more amplified and longer lasting than the primary response.

So the more efficient immune response is the secondary.

6- Are the horses protected against diphtheria toxin using this method? Justify.

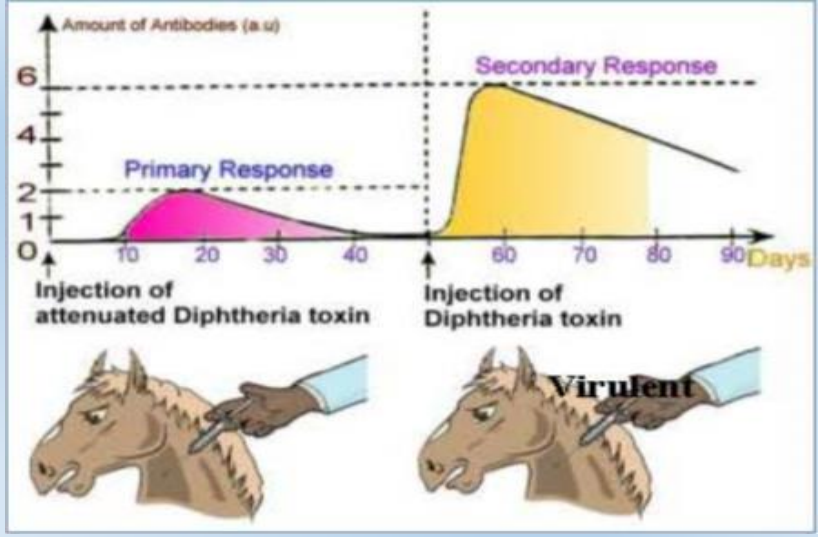
Yes, since the amount of antibodies is high and protect for longer duration and faster time.

7. Name the immune therapy method applied to this horse.

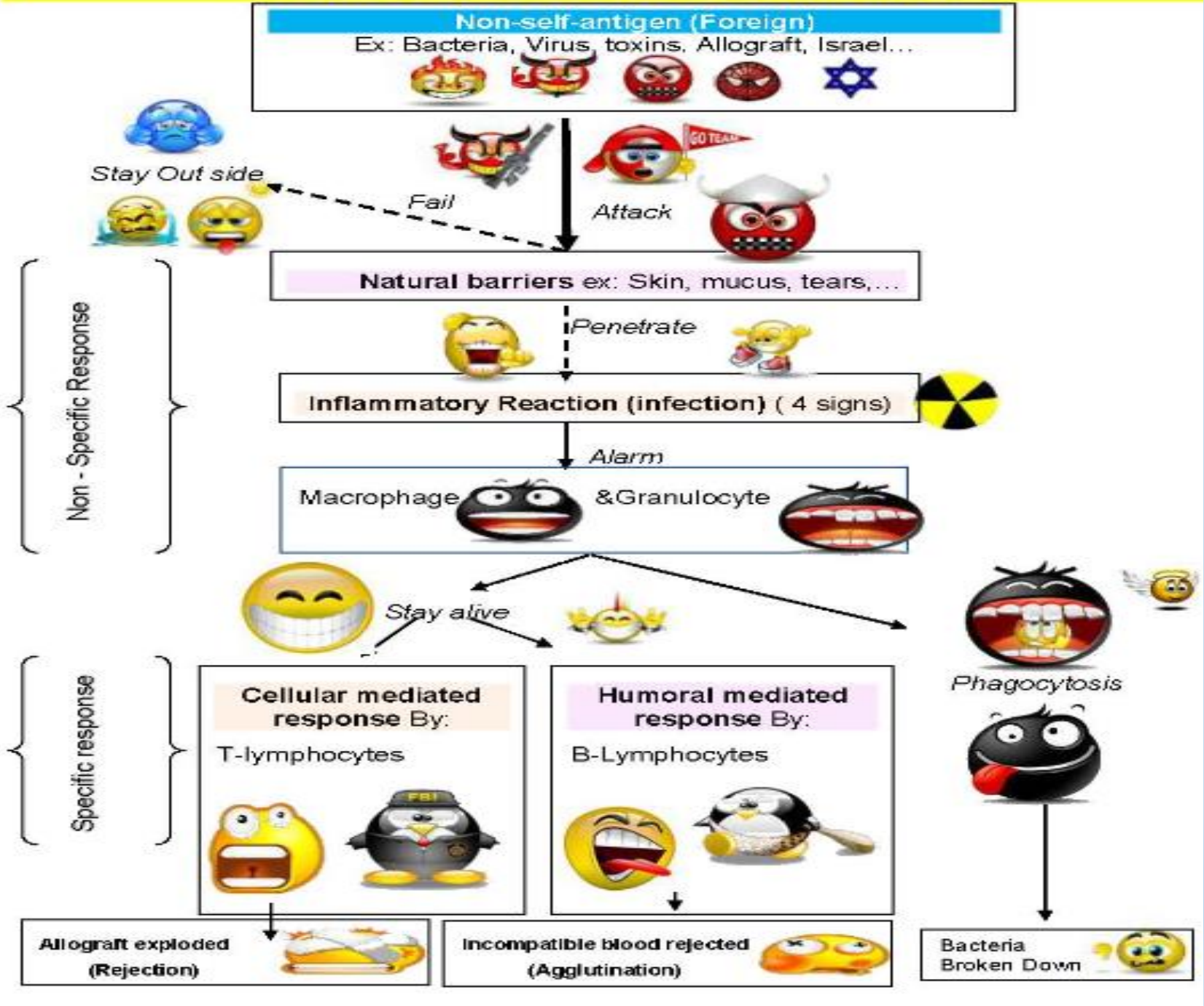
Vaccination

8. Indicate the type of immune response mounted against diphtheria toxin .

Humoral specific immune response.



CHAPTER-1-CONCEPT MAP



Summing Up –For Study