Immunology

I- Role and components of the immune system:

- HLA, graft.
- Blood groups
- The non-self.
- Cells of the immune system.
- Lymphoid organs, lymphocytes maturation.
- Antigen recognition by BL, antibodies, specificity, affinity, cross reaction.
- Antigen recognition by TL, double recognition.

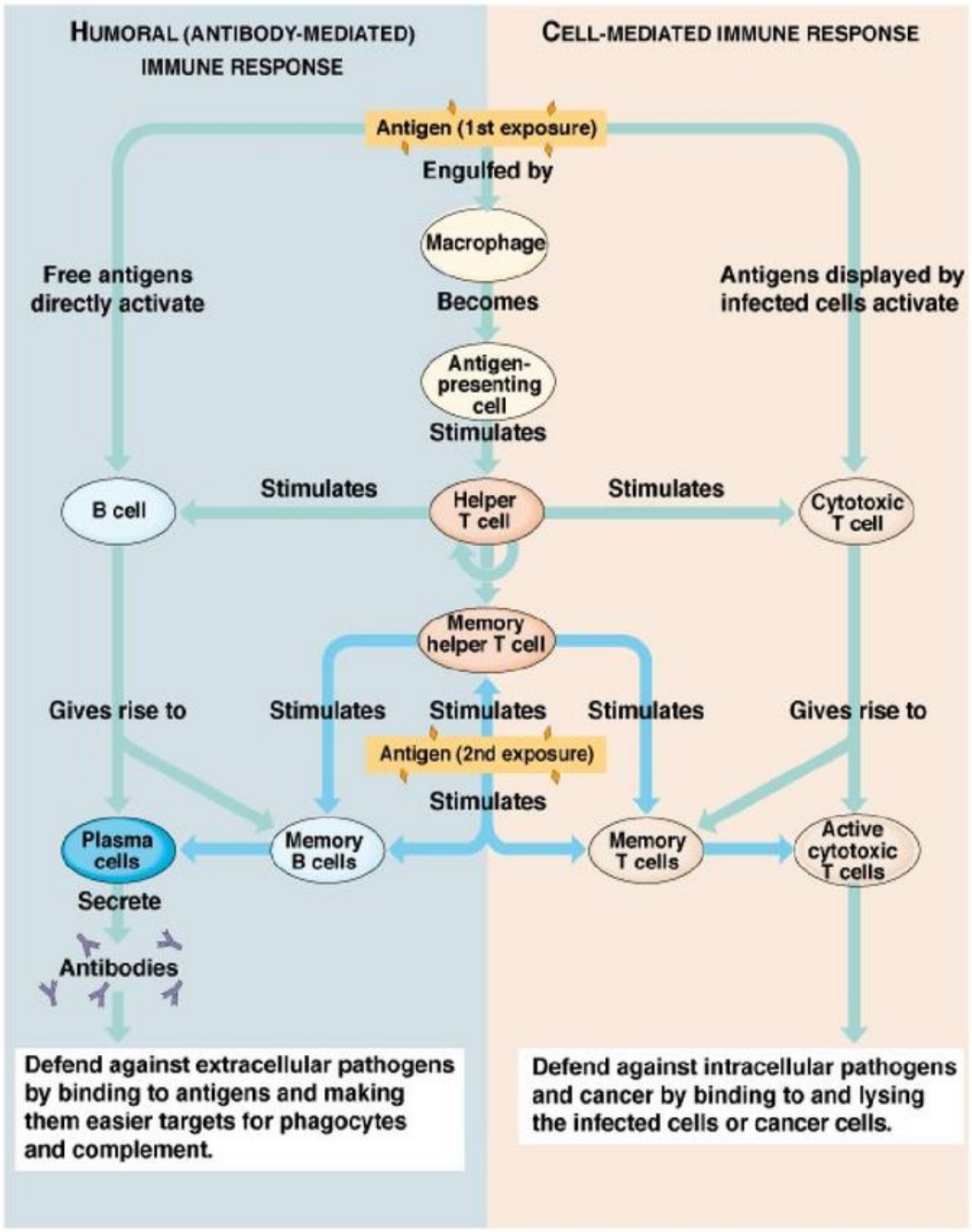
II- The immune response:

- Non-specific immune response (barriers, inflammation, phagocytosis).
- Specific immune response: types (humoral, cell mediated), immunity transfer, (solid matrix).
- Induction of the specific I.R: role of macrophages, fate of activated TH…
- Role of TH in the S.I.R: fate of activated BL and Tc.
- Specific humoral I.R: neutralization, opsonization, complement cascade.
- Specific cell mediated I.R: elimination of infected cells (Describe the mechanism 2002 I), cancer and immunity.
- Immunological memory: characteristics of primary and secondary responses, vaccination.
- Diagnostic applications of antibody properties, agglutination, immunodiffusion in gel, ELISA, immunofluorescence.

III- Disorders of the immune system:

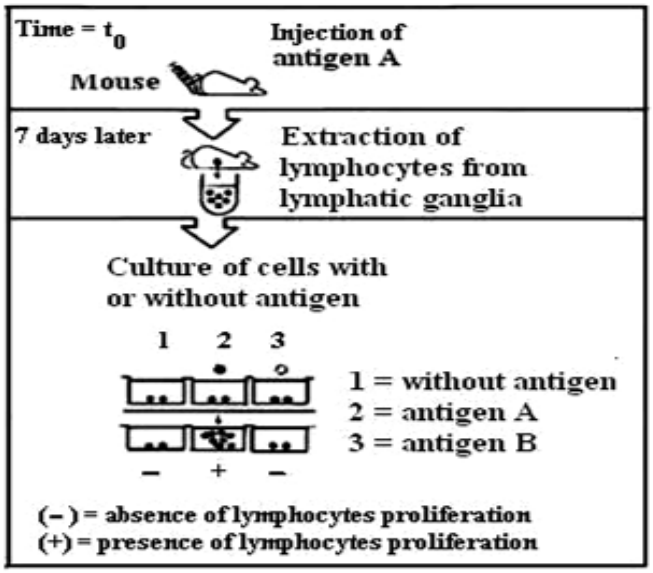
- Immunodeficiencies: AIDS (HIV), CD4.
- Autoimmune diseases: IDDM, Myasthenia.

Overview of Human Immune System Function



Possible questions:

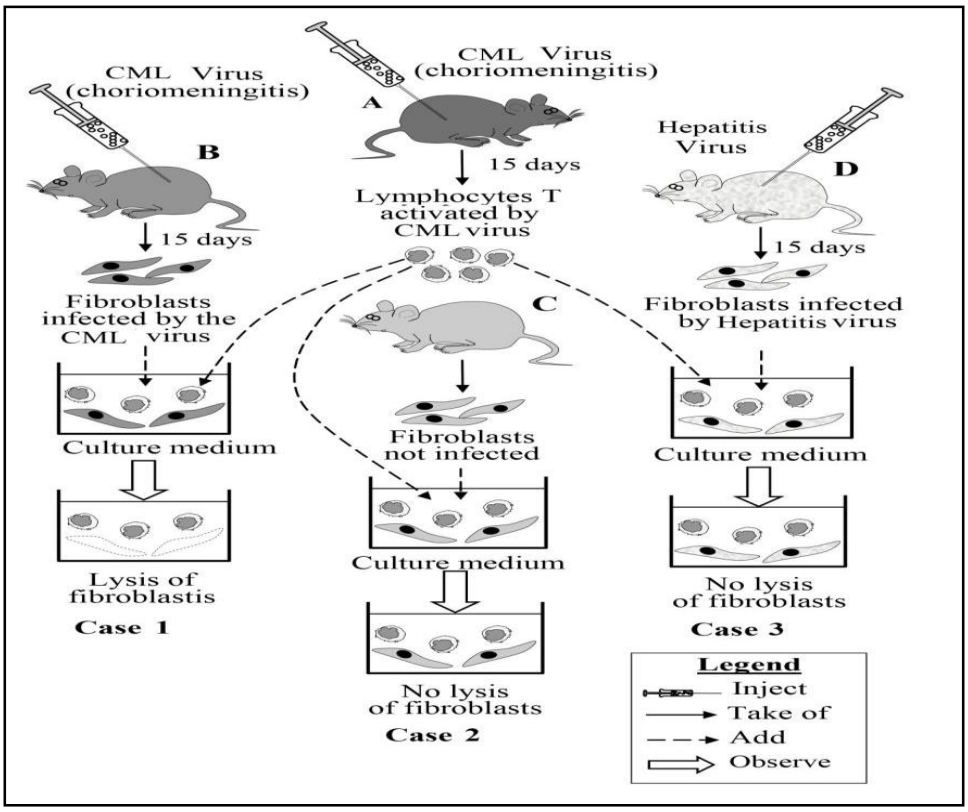
1. **Describe**: 2001 II, 2002 I (hemolysis), 2004 I, 2004 II, 2005 I, 2005 II, 2006 I, 2008 I, 2010 I, 2010 II, 2013 I.
   Example 1: 2008 I: Write a short text describing the experiment carried out as well as the results obtained.



Answer: Antigen A is injected into a mouse. 7 days later, cells of the lymphatic ganglia are extracted and put in 3 culture mediums: without antigens in medium (1), with antigen A in medium (2), and with antigen B in medium (3). We observe the absence of lymphocytes proliferation in the 1st and 3rd culture mediums and the proliferation of lymphocytes occurs in the second medium.

Example 2: 2013 I: Describe the experiments schematized in document 1.

Answer: Mouse A is injected with CML virus (choriomeningitis). 15 days later T lymphocytes activated by CML of this mouse are taking of and added to three culture media.
Mouse B is injected with CML virus (choriomeningitis). 15 days later, the fibroblasts infected by CML of this mouse are taken of and are added with the activated T lymphocytes of mouse A to a culture medium. Lysis of these fibroblasts is observed.
Non infected fibroblasts of mouse C are taken of and added with the activated T lymphocytes of mouse A to a culture medium. No lysis of these fibroblasts is observed.
Mouse D is injected with hepatitis virus. 15 days later, the fibroblasts infected by hepatitis virus of this mouse are added with activated T lymphocytes of mouse A to a culture medium. No lysis of these fibroblasts is observed.



Document 1

2. **Interpret:** 2004 I, 2004 II, 2006 I, 2008 I,2010 I, 2010 II, 2013 I, 2016 I, 2017 I.
   Example 1: 2013 I: Interpret the results of the experiments of document 1.

   Answer: There is lysis of the fibroblasts of mouse B that are infected by the CML virus in the medium containing T lymphocytes activated by the same virus, while there's no lysis of non-infected fibroblasts of the mouse C neither of the fibroblasts of the mouse D that are infected by another virus (hepatitis virus) which are placed in a culture medium containing the same T lymphocytes. This shows that activated T lymphocytes destroy only the cells that are infected by the same virus that led to their activation OR activated T lymphocytes destroy only the cells that are infected and that they are specific to the CML antigen.
   Example 2: 2008 I: Interpret the obtained results.

Answer: A high proliferation of lymphocytes extracted from the mouse immunized antigen A was observed when they are put in culture with this antigen. On the contrary, no proliferation was observed when they are alone or in contact with antigen B. This implies that the proliferation of the lymphocytes, selected after the first contact with antigen A, cannot occur unless the lymphocytes are put again in contact with the same antigen.

3. **Characteristics of serotherapy/ vaccination/ Immunological memory:** 2008 I, 2015 I, 2016 I.
   Example 1: 2015 I: **Distinguish** serotherapy from vaccination concerning: the nature of the injected substance, the latency period, and the duration of the protection established against Ebola.

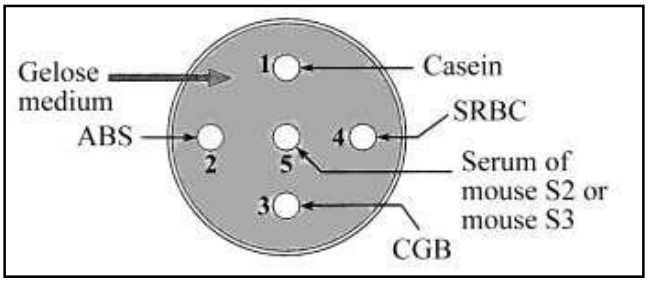
Answer: In serotherapy, the injected substances are the specific antibodies while in vaccination; the injected substances are viral or antigenic proteins.
In serotherapy, the latency time is null while in vaccination, the latency time is 2 weeks.

In serotherapy, the duration of protection time is short while in vaccination, the Protection is more durable.

Example 2: 2016 I: Explain the importance of vaccination.
Answer: Vaccine ensures the first contact with this antigen and triggers immunological memory. Consequently, the body, after a second contact, develops a secondary response which is more amplified, more rapid and more durable against this antigen.

4. **Characteristics of primary and secondary immune response.**
   Primary: slow, less amplified and not persistent.
   Secondary: more rapid, amplified and more persistent.
5. **Immunodiffusion in gel:** 2003 II, 2010 I.

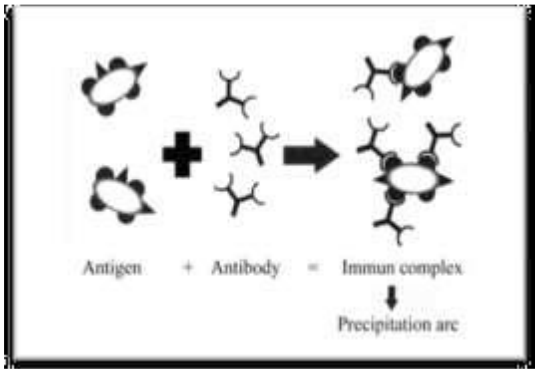
Example:
The following document shows a serological test called immune diffusion in gel where antibodies and antigens are deposited in wells in agar gel medium. We deposit an antigenic substance in each of the wells 1, 2, 3 and 4 and deposit either serum taken from mouse S2 or serum taken from mouse S3 in the central well 5.



Specify where precipitation arc (s) would be formed with each serum after 24 hrs of antigens' deposit.
Answer: With the serum of mouse S2, a precipitation arc is formed between well 2 and well 5; and between well 3 and well 5 **(¼ pt)**, because mouse S2 produced anti -ABS antibodies and anti-CGB antibodies specific to ABS and CGB antigens respectively.
With serum of mouse S3, the precipitation arc is formed between well 3 and well 5 **(¼ pt),** because mouse S3, in the absence of lymphocytes specific to ABS antigen, produces only anti-CGB antibodies which have an antigen binding site specific to CGB antigen.

Schematize the mechanism which leads to the formation of the precipitation arcs.

Answer: mechanism of the formation of the precipitation arc.



6. **Lysis of infected cells/ chromium liberated:** 2003 II, 2006 II, 2007 I, 2010 II, 2013 I

Example 1: 2013 I: Explain the mechanism of cell lysis.

Answer: Tc recognizes the infected body cell and binds by its TCR to the self HLA-I non self peptide complex expressed on the membrane of the infected cell. Then it liberates perforine to form polyperforine channels through the membrane of the infected cell.
After that the TcL releases granzymes that penetrates into the infected cell through the polyperforine channels leading to the degradation of its DNA, thus causing lysis of the infected cell.

Example 2: 2010 II: Explain the mechanism that leads to the destruction of target cells by Tc lymphocytes.

Answer:
The Tc lymphocytes recognize and bind, by its TCR, to target cells expressing the modified self: self MHC carrying a non-self-peptide of the antigen that is at the origin of their activation. They will then release, by exocytosis, perforine molecules forming hollow polyperforine channels through the cell membrane, and then they release granzymes molecules that penetrate the target cell through these channels leading to its DNA degradation and to the target cell destruction.

7. **Cancer:** 2004 II, 2015 II.

8. **AIDS:** 2005 I (ELISA), 2009 I, 2014, 2016 I.
   Example: 2016 I

9. **Skin graft:** 2007 I, 2008 II, Namouthaj CERD.

10. **IDDM:** 2007 II. (important)

11. **Neutralization/ Opsonisation:** 2008 I, 2011 I.

Example 1: 2011 I: Explain how the secreted antibodies contribute to the destruction of the flu virus.

Answer: The specific antibodies neutralize their corresponding antigens of the flu virus by binding to them through their specific antigenic binding sites forming immune complexes. Thus the antibodies become able to bind through their constant part on macrophages that phagocyte the whole immune complexes thus destroying the virus (opsonization).

Example 2: 2008 I: Explain the appearance then the disappearance of the immune complexes following the antigen's injection.

Answer: The appearance of immune complexes is due to the neutralization of the antigen by the antibodies secreted by plasmocytes. The disappearance of these complexes is due to the opsonisation and phagocytosis carried out by macrophages.

2017 I: Hypertrophy of lymph nodes

2017 II: Role of macrophages

2018 I: A Case of Thyroiditis (autoimmune disease)

2018 II: Therapy against an autoimmune disease

2019 I: Immune Responses Against Flu Virus

2019 II: AIDS

2020: Action of Antibodies and the Complement