This is a Class 1 exam

Lebanon Evangelical School for Boys and Girls

Lighting the fires that burn for eternity

Louezeh - Baabda

Lebanon Evangelical School

for Boys and Girls — Loueizeh - Baabda

Stage Exam 02

19DEC2022

Do NOT write in this box. Your MARK will be placed here.

Subject :	Biology
Class :	12E
Teacher :	Christine Khalil
Duration :	1 hour

Write your answers on a separate sheet of paper.

Your name :		*Time taken to complete exam*
Your Class :		
Exam Room :		
How many sheets, including cover sheet :		

- Do not open this paper until the teacher in charge instructs you to do so.
- The most important thing to remember in taking an exam is NEVER PANIC.
- If you are caught cheating in this exam, you will be awarded zero for ALL exams that are taken on this day.

Exercise 1 (10 points)

Roles of Macrophage

The monocytes circulate in the blood and can migrate to the tissues where they become macrophages.

1. Indicate the origin of monocytes. (0.5)

In order to study the mode of action of macrophages and their cooperation with certain cells of the immune system, the following experiments are performed.

Experiment 1:

Cells are extracted from the ganglia of a guinea pig which is immunized against antigen X. T4 lymphocytes and macrophages are isolated and placed in different culture media. The experimental conditions and the results are shown in document 1.

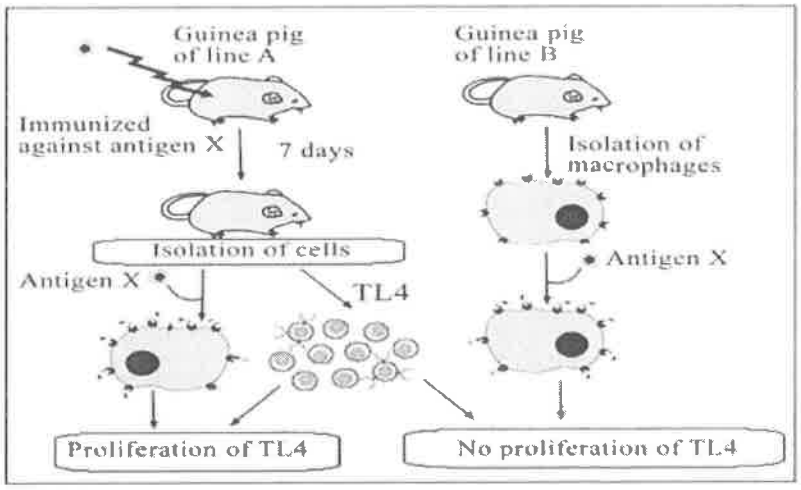
Culture medium	Conditions of the culture	Results
1	T4 lymphocytes and antigen X	No proliferation of T4 lymphocytes
2	T4 lymphocytes and macrophages	No proliferation of T4 lymphocytes
3	T4 lymphocytes, macrophages and antigen X	Proliferation of T4 lymphocytes
4	T4 lymphocytes	No proliferation of T4 lymphocytes

Document 1

2. Determine the conditions indispensable for the proliferation of T4 lymphocytes. (2)

Experiment 2:

An experiment is performed on two different strains of guinea pigs, A and B. The experimental conditions as well as the results are shown in document 2.



Document 2

3. Indicate the condition indispensable for the proliferation of T4 lymphocytes shown in this experiment. Justify the answer. (2)

Experiment 3:

Macrophages are incubated with the same antigen X labeled with radioactive ^{131}Iodine isotope. At phase I, radioactivity is detected inside the macrophage, and in phase II a rapid degradation of antigen X is noticed. After some time, 80% of radioactivity is detected in the culture medium in the form of ^{131}Iodine isotope linked to peptides, while the remaining 20% are found attached to the cell surface.

4. Draw out the role of macrophages shown at phase I of the experiment. (1)
5. Explain the results obtained at phase II of the experiment. (1)
6. Explain the mode of action of the macrophages that permits the proliferation of T4 lymphocytes. (1.5)
7. Specify the consequence of the absence of the macrophages on the specific immune responses. (2)

Exercise 2 (4 points)

A series of experiments were conducted to identify the type of specific immune response initiated against a virus V.

Experiment A: A lot of mice is subjected to the ablation of the thymus and the injection of virus V (lot A). This lot shows an important multiplication of virus V.

Experiment B: A lot of mice is immunized against virus V (lot B). Two weeks later, we extract the serum of mice of lot B and inject this serum to lot A. Virus V shows a slowed multiplication in lot A but does not disappear and is not destroyed. (The mice of lots A and B are of the same strain).

Experiment C: Lot A is subjected to the removal of lymphocytes B and grafting of the thymus. Two weeks later, we notice the disappearance of virus V from this lot.

Experiment D: We remove Tc lymphocytes from lot A of experiment C. We inject these lymphocytes as well as virus V to lot mice D that previously underwent a bone marrow irradiation. We observe an important multiplication of virus V in lot D. (mice of lot A and those of lot D are of different strains).

1. Justify the following statement: "The specific immune response at the origin of the elimination of virus V is mainly cell-mediated". (2)
2. Explain the results of experiment D. (2)

Answer Key for SE02 12E

Exercise 1 (10 points)

1. Bone marrow. (0.5)
2. Proliferation of T4 lymphocytes takes place only in culture of medium 3 in the presence of T4, macrophages and antigen X. Hence the proliferation of T4 lymphocytes necessitate the association or cooperation between T4 and macrophages in the presence of antigen X. (2)
3. The macrophages and the T4 cells must descend from the same strain. Since there is no proliferation of T4 lymphocytes when T4 cells of strain A are incubated with macrophages from another strain B. However, proliferation takes place when T4 cells and macrophages previously in contact with an antigen X that descend from the same strain A. (2)
4. Phagocytosis. (1)
5. At phase II of the experiment, 20% of radioactivity is detected on the surface of the cell, because a part (80%) of the degraded radioactive protein is eliminated out of the cell; The remaining 20% is degraded into peptides that are associated with MHC II on the surface of macrophages. (1)
6. The macrophages that are transformed into APC present the non-self-peptide associated with MHC II on its surface. So TCR of T4 lymphocytes bind to this complex and the T4 becomes activated. (1.5)
7. The induction of specific immune response ceases because the activation of T4 lymphocytes necessitate its binding to APC. So, in the absence of activated T4 lymphocytes, no more secretion of interleukin 2 takes place which is responsible for launching the specific cell mediated immune response. Moreover, no interleukin 4 secretion takes place which is responsible for launching of the specific humoral immune response. (2)

Exercise 2 (4 points)

1. An important multiplication of virus V is observed after the ablation of the thymus while this virus disappears in lot A after removing B lymphocytes and grafting of the thymus. This shows that the presence of the thymus inhibits the multiplication of the virus. Since

the thymus is responsible for the maturation of T lymphocytes alone therefore T lymphocytes were able to eliminate the virus and thus the specific immune response is mainly cell-mediated. (2)

2. Virus V multiplies after injecting it in lot D in the presence of T8 lymphocytes from mouse A. T8 lymphocytes of mouse A recognize the complex self-MHC I- viral peptide of mouse A presented by the infected cells (double recognition). And since MHC I of mouse D are different of those of mouse A, then the complex MHC-viral peptides will not be recognized by the T8 lymphocytes of mouse A and will not be destroyed by cytotoxicity which leads to the multiplication of the virus. (2)