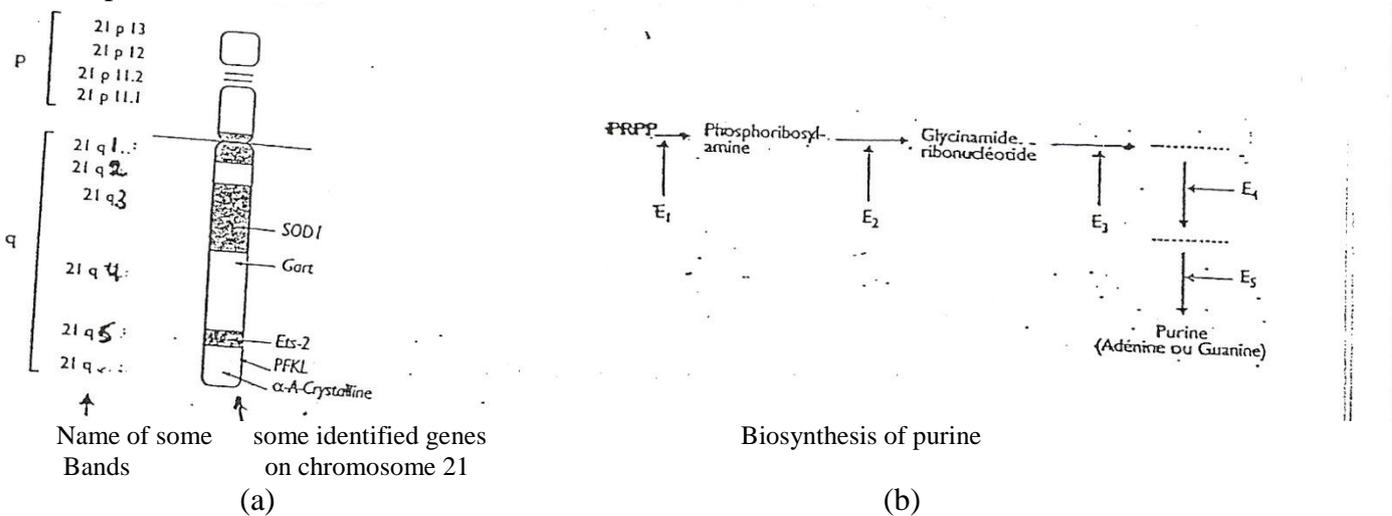


**Exercise I: Heredity and abnormalities**

**(4.5pts)**

Fouad, the son of Samer and Maya, is affected by a mental retardation. His mother is pregnant and she's worried about her new born to be affected by a mental retardation like his brother. Many tests are done to detect the origine of the disease responsible for the mental retardation of Nabil.

A- The following document presents the card of the chromosome 21 and the Biosynthesis of purine.



**Document 1**

The analysis is done on different individuals having different number of 21q<sup>4</sup>. The results are shown in the following table:

Number of 21q <sup>4</sup>	Activity of the enzyme 2	Level of purine in the blood (mmol/L)	Mental retardation
2	100AU	79	Normal
3	150AU	118.5	abnormal

1 – Analyze the obtained results.

B- Many experiments are done on different cells placed on different culture media to study the relation between the concentration of purine and the degeneration of neurons, the experiments and their results are shown below:

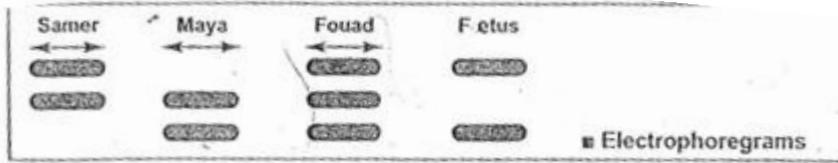
**Experiment 1** : The neurons degenerate when they are placed in a medium rich in purine.

**Experiment 2** : The cells of a mouse known as CHO have lost their ability to produce purine ( the gene that codes for the enzyme 2 in human is inactive). These cells degenerate after place them in a medium without purine.

**Expérience 3** : The hybridoma is obtained by the fusion of the human cells with the cells of mouse CHO. This hybridoma is cultured in a medium without purine. Spontaneously with time, most of the cells lost their human chromosomes and degenerate. Only the chromosomes that keep the chromosome 21 can survive in this medium.

2- Interpret these experiments.

C- An analysis of DNA is carried out according to Southern Blot technique.  
The obtained result is shown in document3 :



Document 3

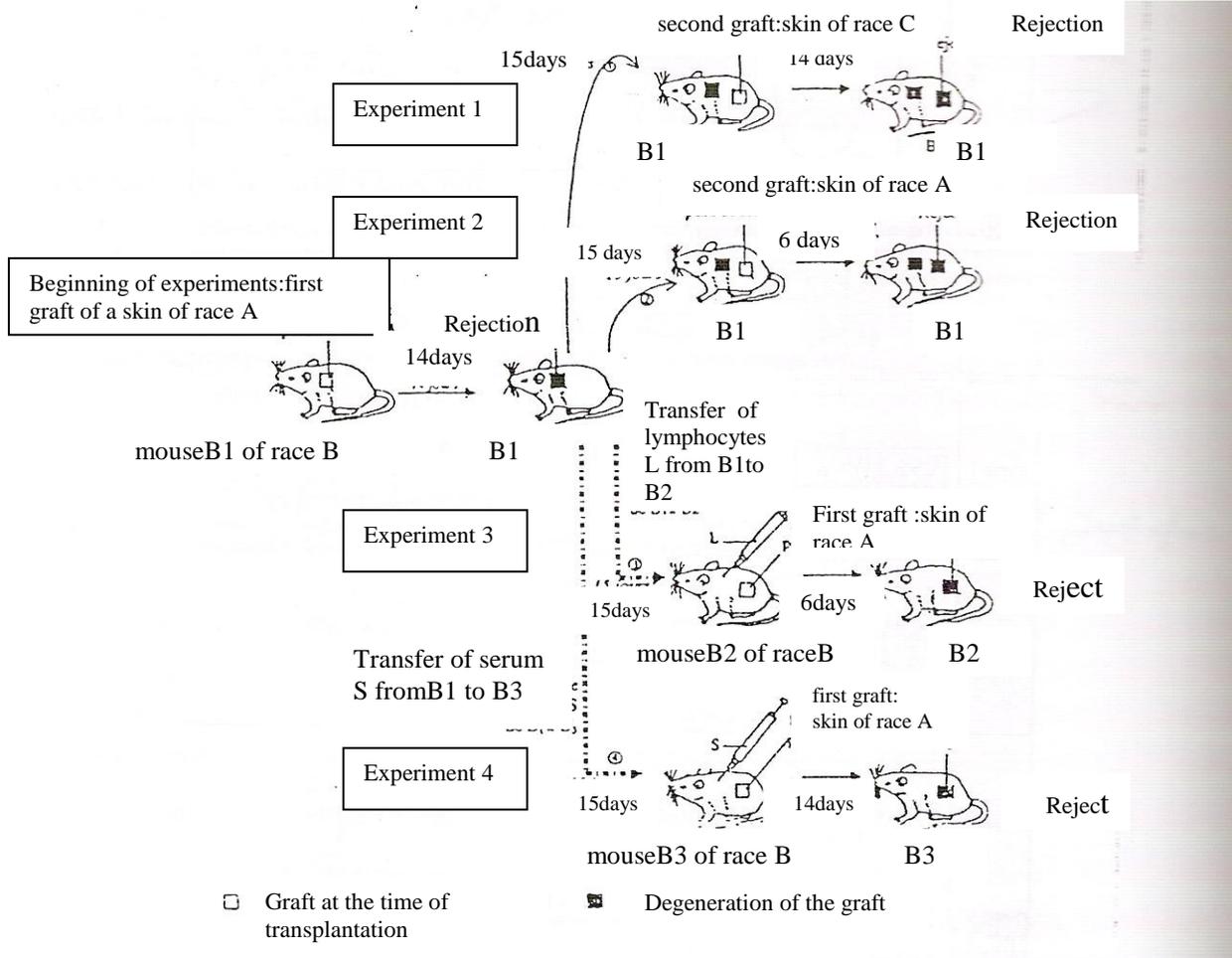
- 3- By referring to this result, formulate a hypothesis that explains the disease of Fouad.
- 4- Propose an experiment that allows verifying this hypothesis.
- 5- Find the relation between the biochemical origin and the genetic origin of the mental retardation.
- 6- Will the fetus be affected? Justify the answer.

**Exercise II: Immunology. Experiments of skin grafting.**

(6pts)

A- We consider the experiments of skin grafting between mice of different races; these experiments are presented in the document 1.

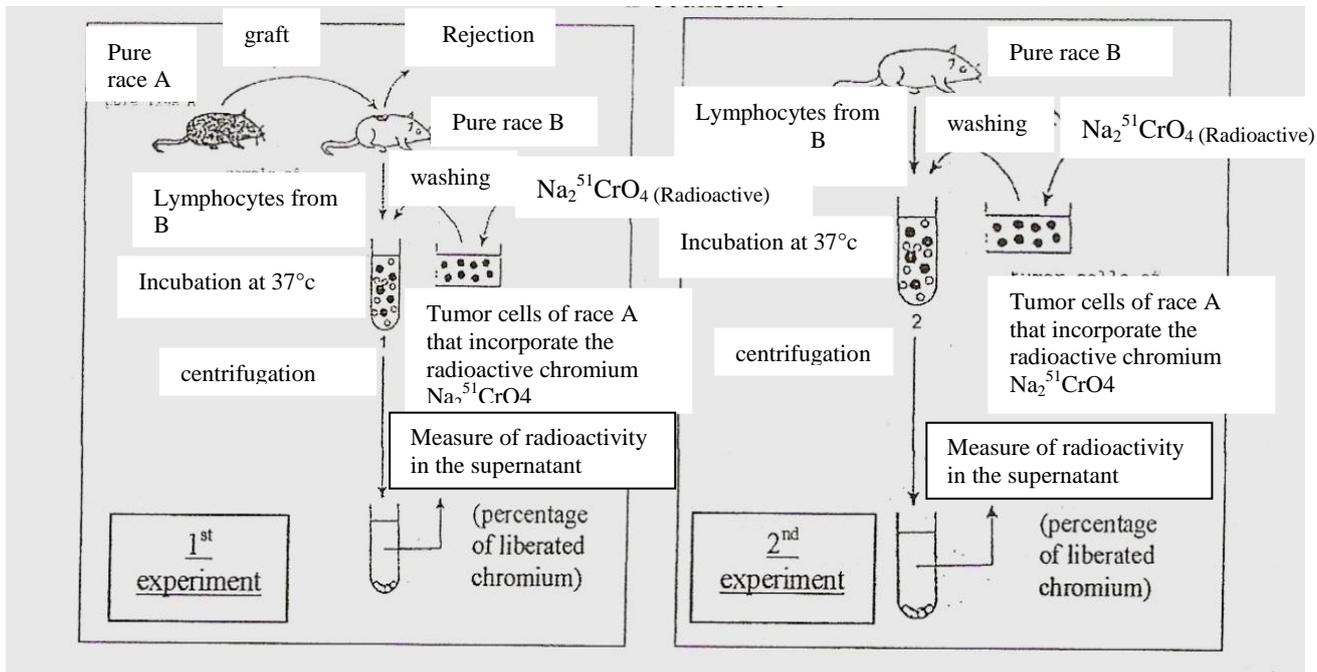
Document1:graft experiments



- 1- Describe the different experiments of document 1 with their results.
- 2- Analyze the first and second experiments and deduce a property of the immune response.
- 3- Interpret the 3rd and 4th experiments and precise the nature of the immune response that took place.

B- In the framework of the study of the immune reaction against cancer, the following experiments are realized.

**Document 1: The experiments of cytotoxicity test**



The results of the measure of the radioactivity found in the supernatants (fluid parts) of these experiments are found in document 2.

	Percentage of liberated chromium
Tumor cells A with lymphocytes of B after the graft(1 <sup>st</sup> experiment)	40
Tumor cells A with lymphocytes of B without graft(2 <sup>nd</sup> experiment)	5

**Document 2: Results of cytotoxicity in experiments of document 1.**

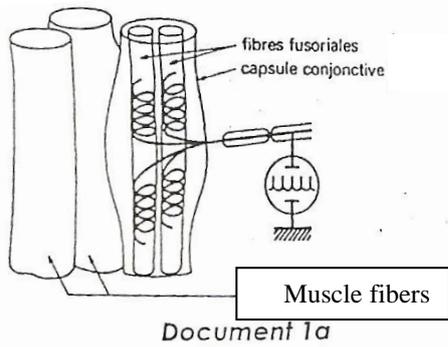
1- Knowing that the lysis of target cells leads to the liberation of radioactive chromium and that the quantity of liberated chromium is proportional to the destroyed cells, **Interpret** the experiments of document 1 and their results in document 2.

2-Name the immune response revealed in the document 2.Justify your answer.

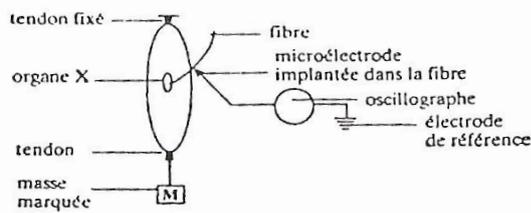
**Exercice III : The myotatic reflex**

**(4.5pts)**

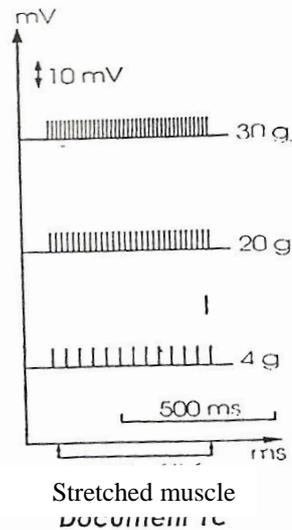
A- The document 1-a represents an organ X found in the muscle. One fiber issued from this organ is submitted to the action of increasing masses (doc.1-b), the registering of the nervous message is shown in the document 1-c.



Document 1a



Document 1b

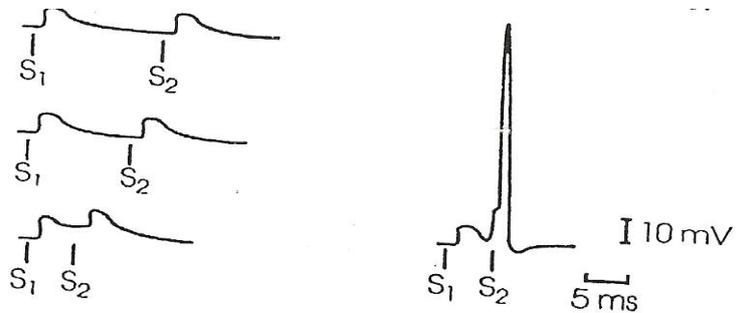


Stretched muscle  
Document 1c

1- Identify the organ X and precise its function.

2- Analyze the results and deduce how is coded the intensity of stimulus in the nerve fiber.

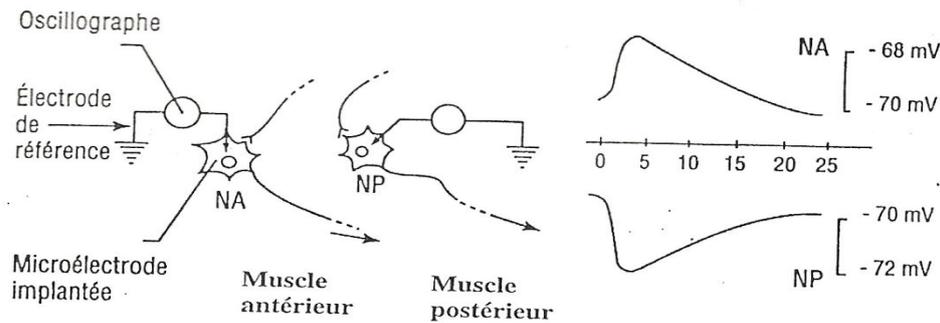
**B-** The following document represents the recordings of the electric activity in a motoneuron of the spinal cord after a double stimulation of the nerve fiber issued from the organ X and arriving to the motoneuron, the two stimulations are of equal intensity, but the interval of time between the two stimulus is different.



Document 2

3- Interpret the experiments and deduce the integrator role of the motoneuron.

**C-** The document 3 represents the recording of the electric activity in two motoneurons NA and NP related respectively to the anterior muscle and to the posterior muscle of the thigh, When we apply an effective electric stimulation on a nerve fiber of the organ X of the anterior muscle of the thigh.



Document 3

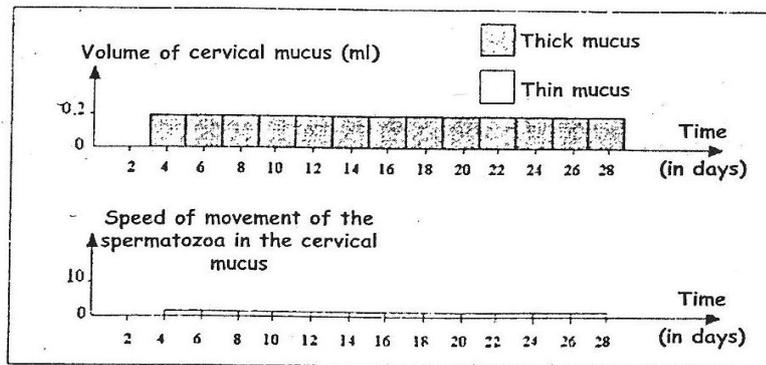
4- After analyzing document 3, indicate the importance of the difference in the function of -3 the two synapses in the reflex of leg extension.

**Exercice IV : Birth Control**

(5pts)

Mrs.Hassoun has 6 children and is not interested in having more. So, she started to follow a special treatment (from July 4 till July 26) that helps her in birth control.

Different tests done to Mrs. Hassoun showed that the volume of her cervical mucus was constant at 0.2 ml in the thick and viscous state: whereas, the velocity of sperm cells in her cervical mucus during the treatment was also constant at 0.1mm/15minutes, as shown in document 1.



Document 1

Different tests done to another woman who is not following any treatment showed the following results in the table of document 2.

State of the cervical mucus	Dense & viscous			dilute			Dense & viscous				
	4	8	10	11	12	14	15	16	16	24	26
Time (days of July)											
Volume of the cervical mucus in ml	0.2	0.4	0.8	0.	0.8	0.8	0.8	0.8	0.4	0.4	0.2
Velocity of the sperms in mm/15minutes	0.1	0.1	0.1	20	40	40	0.1	0.1	0.1	0.1	0.1

Document -2-

1- Draw, on 2 separate graphs, the variations of the state & volume of the cervical mucus( graph 1) as a function of time and the velocity of sperms in the cervical mucus ( graph 2) as a function of

time (during the month of July) in the control woman. Use the same scale to facilitate the comparison.

- 2- Specify on the graph the ovulation period, and describe the hormonal changes that would lead to such an event in a normal woman.
- 3- Compare the 2 curves. What do you deduce?
- 4- Based on documents 1 & 2, pick up how the treatment of Mrs. Hassoun helped her in birth control.
- 5- If in her treatment, Mrs. Hassoun was injected with moderate amounts of estrogen & progesterone all the period of her cycle, she will not be able to make ovulation. Explain how these injections can help in preventing ovulation.

**Good Work**