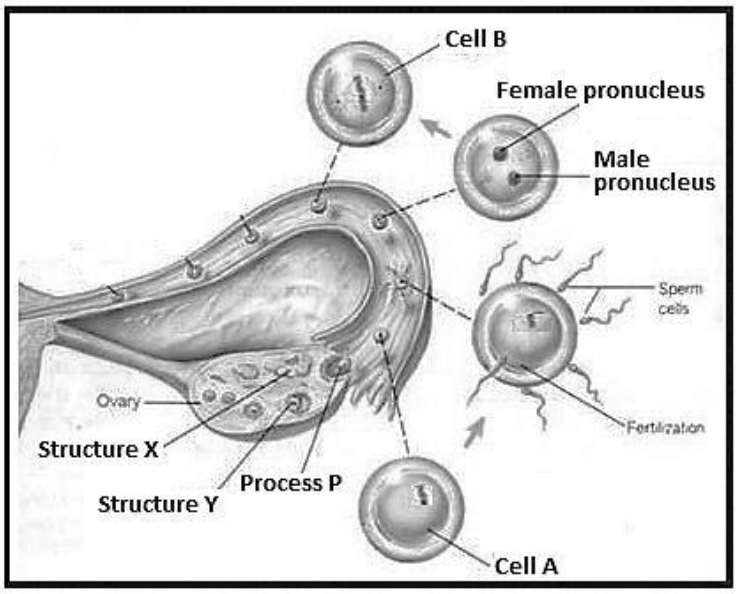
Zahia Kaddoura Official School	First Monthly Exam	2023-2024
Garde 12-LS		90 min

Exercise 1: (7.5 points) **Oogenesis and Fertilization**

The figure of document 1 shows the steps of the evolution of the female gamete in the Fallopian tube in the presence of sperm cells.

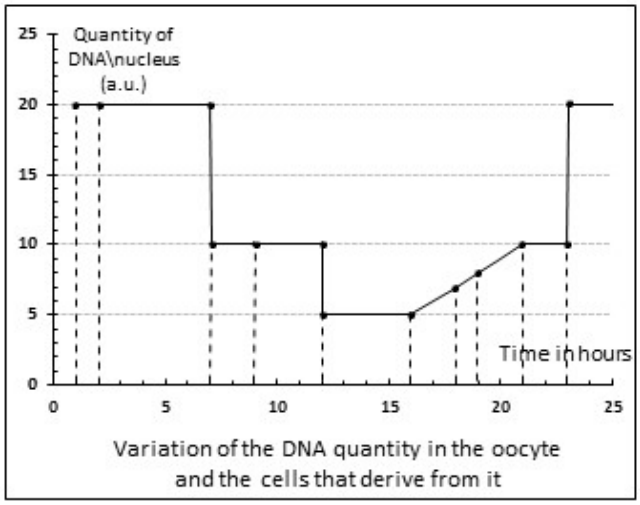
1- Name the structures X and Y, the cells A and B, and the process P of the document 1.
2- Justify why the cell of the oogenesis in the structure Y does not have a polar body.
3- Precise the number of polar bodies around the cell A and the cell B.



Document 1

The graph of the document 2 shows the variation of the DNA quantity in the oocyte starting from the ovary and during its passage through the Fallopian tube.

4- Translate this graph into a table.
5- Relate each of the two cells A and B of document 1 to the corresponding quantity of DNA of the graph. Justify your answer.
6- Explain the variation of the DNA quantity during the interval of time 16 – 21 hours and at 23 hours.

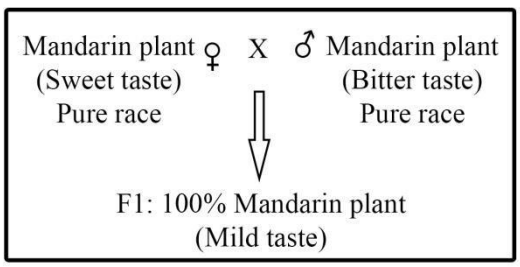


Document 2

Exercise 2: (5 points)

Transmission of a Hereditary Trait in Mandarin Plants

To determine the type of inheritance of the gene responsible for the taste of mandarin fruits, a cross is performed between two varieties of mandarin plants that differ by one trait only. The cross and its results are represented in document 1.



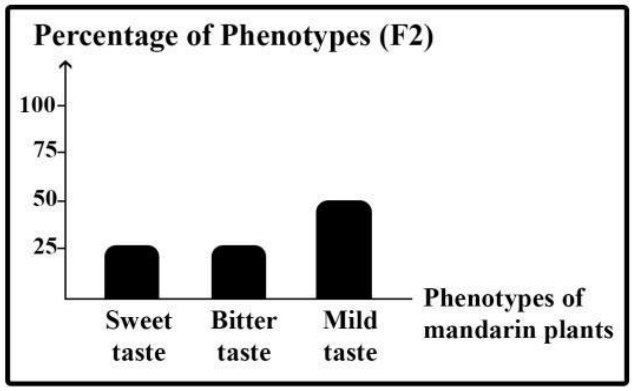
Document 1

1. Specify the type of inheritance studied in mandarin plants.

2. Designate by symbols the corresponding alleles.

3. Write, by referring to document 1, the genotypes of each of the two parents and their descendants.

The descendants of F_1 generation are self-crossed (F_1 x F_1). The phenotypic results of the descendants of this cross (F_2) are represented in document 2.



Document 2

4. Make the necessary factorial analysis to verify the phenotypic results represented in document 2.

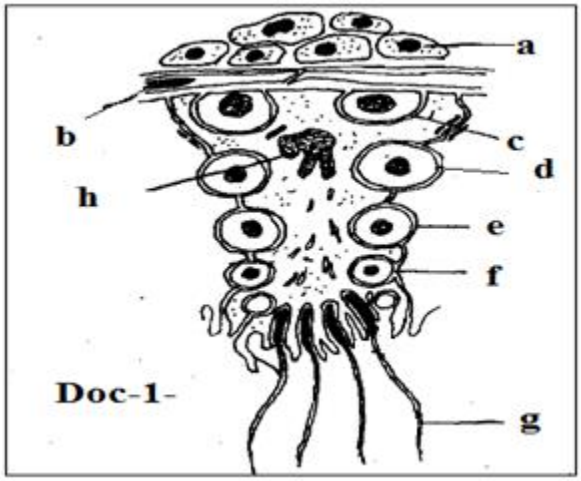
5. Verify if it is necessary to perform a test cross to determine the real genotypes of the descendants of the 2nd generation (F_2).

Exercise 3(5.5pts)

Spermatogenesis and male hormone

In the frame work of studying the spermatogenesis, we realize the following cross section of the seminiferous tubules of a cock. The adjacent Document 1 shows the different stages of this process.

1- Label document 1 from (a to h)
2- Indicate the role of both cells (a and h).
3- Compare the number of chromosomes and chromatids in both cells (d and g).



To understand the influence of testosterone on the functioning of the male reproductive tract of mammals, several experiments were done.

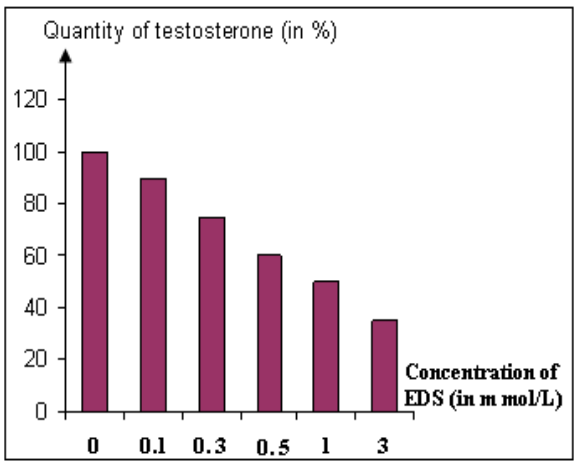
1st experiment:

We culture a set of leydig cells in a medium with or without LH, the results show that there is presence of testosterone only in the medium containing LH.

2nd experiment:

Leydig cells are cultured in the presence of increasing concentration of EDS substance (Ethane, demethane, sulfonade) and the amount of testosterone produced was measured and shown in document 2 as a percentage relative to normal.

4- Formulate a hypothesis showing the mode of action of EDS.
5- Interpret both experiments.



After injecting of EDS in rats followed by injection of testosterone in variable doses or only injecting only EDS, different measurements and observations on the testis are performed including their mass, diameter and the aspect of cells. The results are shown in document 3.

Document 3 shows the results of EDS and testosterone injection on the testis.

Treatment	Diameter of the seminiferous tubules in micrometer	Types of cells found in the seminiferous tubules
Control rat	325	Spermatogonium+ spermatocyte 1+ spermatocyte 2+ spermatid + sperm cell
EDS injection	180	Spermatogonium+ spermatocyte 1
EDS + 1mg of testosterone injection	260	Spermatogonium+ spermatocyte 1+ spermatocyte 2+ spermatid
EDS + 25mgs of testosterone injection	315	Spermatogonium+ spermatocyte 1+ spermatocyte 2+ spermatid + sperm cell

Document 3

6- Deduce the role of testosterone.
7- Based on all what preceded, explain the role of EDS.

Bareme:

Part of the Q	Answer Key Exercise 1 (8points) Oogenesis and Fertilization	Mark
1	Structure X=Corpus luteum Structure Y=GraffianFollicle Process P= Ovulation Cell A=Oocyte II blocked at metaphase 2 Cell B= Zygote	**1.5**
2	It doesn't continue its first meiotic division.	**1**
3	Cell A one polar body. Cell B two polar bodies.	**1**
4 **5**	Table Since cell A is an oocyte II blocked at metaphase, so it has 23 chromosomes with two chromatids each. Its corresponding quantity of DNA is 10a.u. Since cell B is a zygote, so it has 46 chromosomes with two chromatids each. Its corresponding quantity of DNA is 20 a.u.	**2** **1.5**
6	Between 16 and 21 hours the quantity of DNA increases from 5 a.u to 10 a.u because of fertilization that is the union of male and female pro-nuclei.	**1**

Part of the Q	Answer Key Exercise 2 (5points) Transmission of Hereditary Trait in Mandarin Plants	Mark
1	It is an incomplete dominance (intermediate), because the cross between the two pure race parents, the bitter taste mandarin and the sweet taste mandarin plant, gives rise to intermediary phenotype descendants in F_1 generation, mild taste mandarin plants. These latter receive one allele responsible for sweet taste from the female and one allele responsible for bitter taste from the male; however, neither of the alleles is expressed in F_1 generation. This means that both alleles are incompletely dominant.	**0.25** **0.75**
2	Let "S" be the symbol of the allele coding for the "sweet taste". Let B be the symbol of the allele coding for "bitter taste".	**0.25** **0.25**
3	The genotype of ♀ parent is: SS, the genotype of ♂ parent is: BB The genotype of the descendants of the F_1 generation is: BS	**0.5**

<table>
<tr><td>4</td><td>Factorial analysis: Mandarin plant of "Mild taste" ♀ x ♂ Mandarin plant
"Mild taste"
Genotypes of the parents: ♀ BS x ♂
Gametes of parents: 50% S 50% S
B Table of cross:
<table><tr><td>γ♂ / 50% B 50% S γ♀
50% B</td><td>25 % BB</td><td>25% BS</td></tr><tr><td>50% S</td><td>25% BS</td><td>25% SS</td></tr><tr><td>ones.</td><td></td><td></td></tr></table>B
Phenotypic percentages : 25% [B],25% [S], 50% [BS]
The histogram (document 2) represents 3 different phenotypic percentages:
25% of the mandarin plants having "sweet taste"; 25% of mandarin plants having "bitter taste"; 50% of mandarin plants having mild taste.
Thus, the theoretical results verify the experimental</td><td>2.5</td></tr>
<tr><td>5</td><td>No, it is not necessary to perform the test cross, because the descendants who have the same phenotype as their parents (sweet and bitter taste) are of pure race having the same genotypes as their parents and those of intermediate phenotype (mild taste) are hybrids (heterozygous).</td><td>0.5</td></tr>
</table>

Exercise 3 (6pts)		
nb	Correction	Remark
1-	A= leydig cells b= basal layer cells c= spermatogonium cell d= spermatocyte I E= spermatocyte II f= spermatid g= sperm cell	1.5pts
2-	The role of leydig cell: secretes testosterone hormone The role of the sertoli cells: nursing cells.	1 pt
3-	Spermatocyte I has 46 chromosomes with 2 chromatids each while sperm cell has 23 chromosomes with 1 chromatid each.	0.75pt
4-	Hypothesis: EDS inhibits the secretion of testosterone by leydig cells.	0. 5pt
5-	The leydig cells secrete testosterone in the presence of LH only. This means that leydig cells are the target for LH to secrete testosterone. While the quantity of testosterone in the medium containing cultured leydig cells decreases from 100 to 40 % when the amount of EDS increases from 0 to 3 (m mol/L). This means that EDS inhibits the secretion of testosterone by leydig cells.	0.75pt
6-	Only when there is injection of testosterone in the medium with increasing quantity, the diameter of the seminiferous tubules increases from 180 micrometer (in a medium deprived from testosterone but containing EDS) to 315 micrometer (retaining its value) when there is an important value of testosterone. In addition, the spermatogenesis completes its steps only in the presence of an important value of testosterone. Thus testosterone is an important hormone for an inducing proliferation of seminferous tubules and the drive of spermatogenesis.	0.75pt
7	As we know that leydig cells are stimulated by the peak of LH in blood to secrete testosterone. As it is shown in experiment 2 that EDS inhibits the secretion of testosterone by the leydig cells. And the presence of EDS in the medium containing testosterone doest arrest its action for an inducing proliferation of seminferous tubules and the drive of spermatogenesis (doc 3). This shows that EDS inhibits the action of LH.	0.75pt