REPRODUCTION & GENETICS

→ Sexual Reproduction is charecterized by: Diversity and polymorphism.
Causes of diversity: meiosis; random fertilization and mutation; random separation and segragation of homologous chromosome while crossing over during prophase I.

→ Female Reproductive System:
1- Ovaries: They are the female gonades.
function: • They produce OOcyte by a process called OOgenesis.
* They secrete estrogen and progesterone

Estrogen and Progesterone: Female sexual hormone that are responsible for the appearance and growth of the female sexual charecteristics.

Primary charecterishics: general organs: testicles & ovaries

Secondary sexual charecterishics: Charecterishics that appear at the age of puberty.

Notes:
- Atrophied; non-functional and small in size.
- The spermatogenesis in male is continous.
- At birth, female has definite nº of OO-cyte & at the age of buberty it resumes to give a definit nº of OO-cyte.
- Abortion: ça l'a!

2- Oviducts or Fallopian tubes:
Function: * It is the site of Fertilization
* It conducts the ova and later on the embryo (in case of fertilization) from ovaries toward the uterus.

. implantation nesting of embryo (when the embryo nests in the endometrium)

In Female: Each month one ovary only is active In some cases, 2 ovaries are active & in this case non-identicle twins are produced.

Menopause: Total depletion of OO-cyte (Arrest and stopage of menstruation).

Bleeding, menstruation & abortion are due to the decrease in the amount of progesterone.

3- Uterus or Womb:
Function: It is the house of the embryo.
It has 3 layers:
1- Endometrium: supplies the implented embryo with the needed nutritive substances during pregnancy. (It is richly vascolarized).

2- Myometrium: muscular layer.
3- Serous layer: Outer layer.

Note: . The OOcyte remains alive for 24 hr while the sperm survives on the Fallopian tube blw 48&72
. The sperm in the male body is inactive It becomes active when it enters the genital organs of the female.

. The sperm is mobile while the oocyte is immobile.

. If there is no fertilization the oocyte degenerates by atresia.

Atresia: Degeneration of oocyte while menstruation (الحيض مع تنزف و تموت)

4- Cervix: It's the neck of the uterus.
Function: It possesses cervical gland that release mucus all the month.

During ovulation: The mucus is thin, smoothy and liquid to facilitate the penetration of sper

Before & After ovulation: (Pre & Post ovulatory phases) The mucus is thick, viscus to prevent the penetration of sperm.

The follicle releases the oocyte during ovulation.

Oxitocyne: A hormone that shimulate the contraction of myometrium.

Diploid: All body cells except gametes. (ch. no. = 2n).
Haploid: Gamete cells (chromosomal no. = n).

Definition & Objective of karyotype:

Definition: karyotype is the process of counting and arranging of chromosomes depending of certain criteria

Objectives:

1- To determine the sex of an organism / fetus.
2- To determine the characteristic no. of chr. of species.
3- " " if the organism or fetus is normal or abnormal (chromosomal neumerical abnormalities)
4- To classify as deploid or haploid.

Chromosomal formulas:

1- Normal male: 46, XY
2- Normal female: 46, XX
3- Missing X chromosome: Turner Syndrom: 45, XO
4- Extra X chromosome: Klinefilter Syndrom: 47, XXY
5- Trisomy 21: 47, XY, +21 / 47, XX, +21
6- Monosomy 13: 45, XY, -13 / 45, XX, -13.
7- Translocation b/w 1 & 18: 46, XX, t(1;18)
8- OOcyte: 23, X Sperm: 23, Y or 23, X.

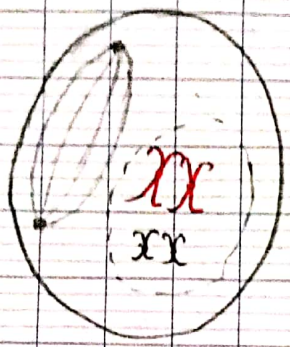
Note: During translocation the chromosomal genetic information is conserved. (abnormal karyotype but normal phynotype).

Sterile: when the abnormality is at the level of sex chromosomes.

Fertile: when the abnormality is at the level of abosomes (chr. 1 → 22)

Mitosis : Division / Multiplication of all body cells.

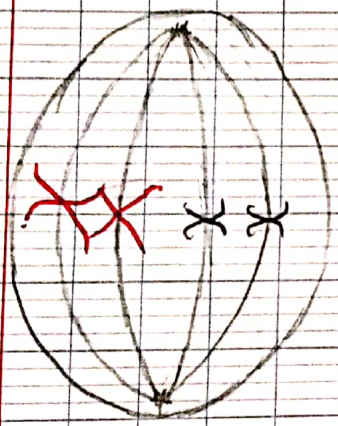
Prophase :



- formation of asters joined by spindel fibers
- formation of 2 chromosomes with 2 chromatids each.

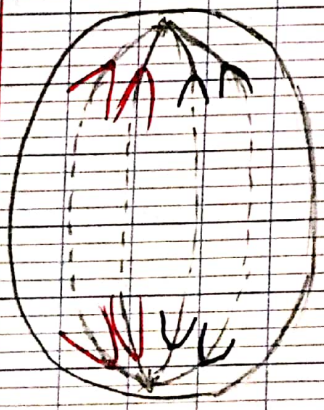
2n chr, 2C corresponds to quantity of DNA : 2Q

Metaphase :



- The chromosomes occupy the middle of the cell to form the equatorial plate. 2n chr, 2C corresponds to quantity of DNA : 2Q

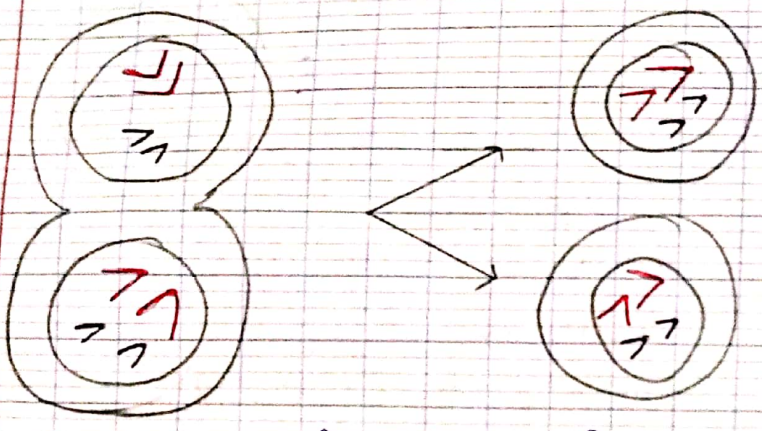
Anaphase :



- Separation of sister chromatids to the opp. poles of the cell

2n chr, 1C / pole corresponds to quantity of DNA Q / pole.

Telophase :

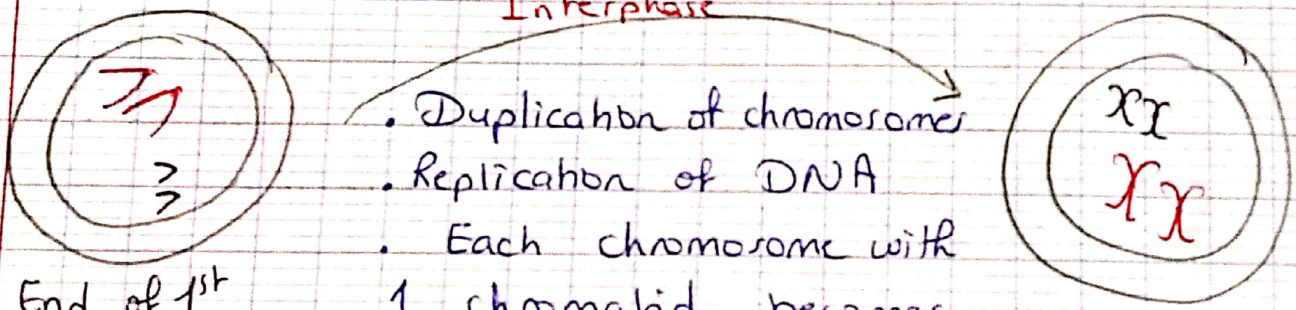


2n chr, 1C corresponds to quantity of DNA: 2

- Construction of cytoplasm.
- Cytokinesis

- Formation of 2 daughter cells

Cell Cycle : Interphase + Mitosis



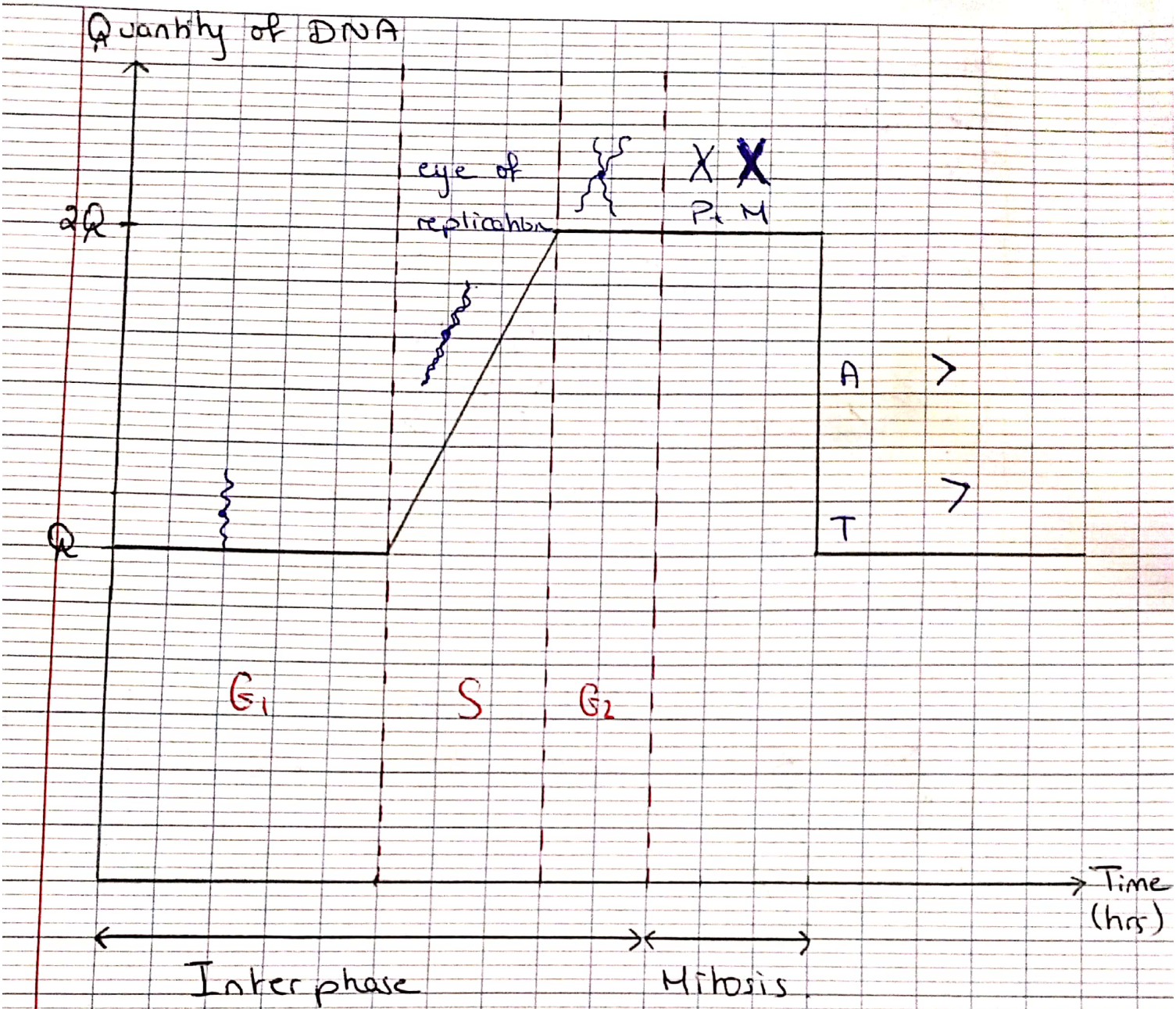
End of 1st mitosis

- Duplication of chromosomes
- Replication of DNA
- Each chromosome with 1 chromatid becomes a chromosome with 2 chromatids.

End of interphase begining of new mitosis

→ These 2 cells are genetically identicle.

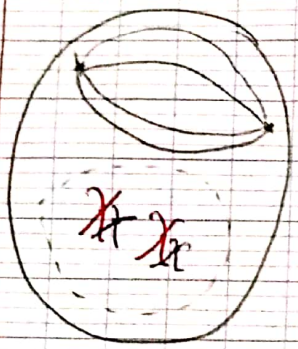
Interphase : The reason for which ~~to~~ the 2 sister chromatids are genetically IDENTICAL.


Quantity of DNA
2Q
Q
eye of replication
X X
P + M
A
T
G1
S
G2
Time (hrs)
Interphase
Mitosis

Meiosis : Formation of Gametes (Sperm & Oocyte)

Reductional Division:

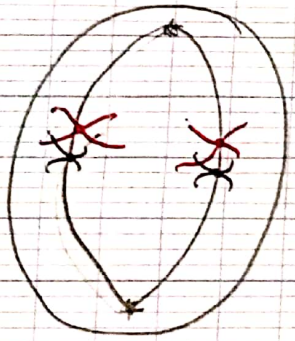
Prophase I:



- Chiasma or Chiasmata
- Crossing Over
- Exchange of Genetic material
- Formation of tetrads.

2n chr, 2C 2Q.

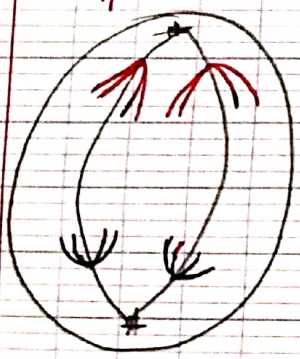
Metaphase I



- Tetrads form the equatorial plate

2n chr, 2C 2Q

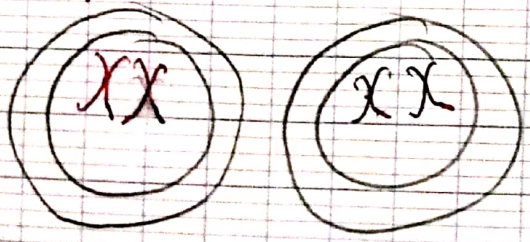
Anaphase I



- The homologous chromosomes

n chr, 2C 1 Pole

Telophase I



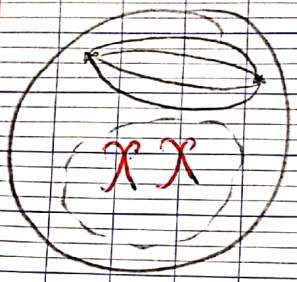
- formation of 2 daughter cells

The number of chromosomes is reduced to half

n chr, 2C Q

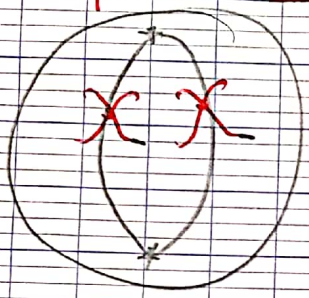
Equatorial Division

Prophase II



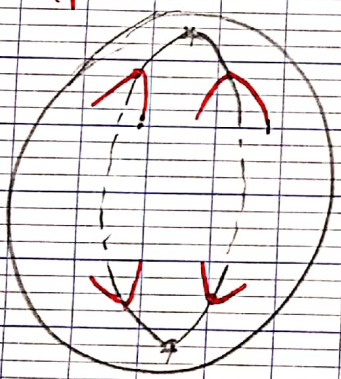
n chr, 2C ④

Metaphase II



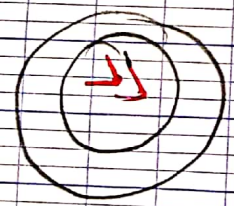
n chr, 2C ④

Anaphase II

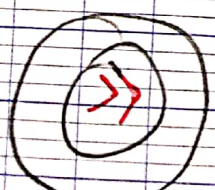


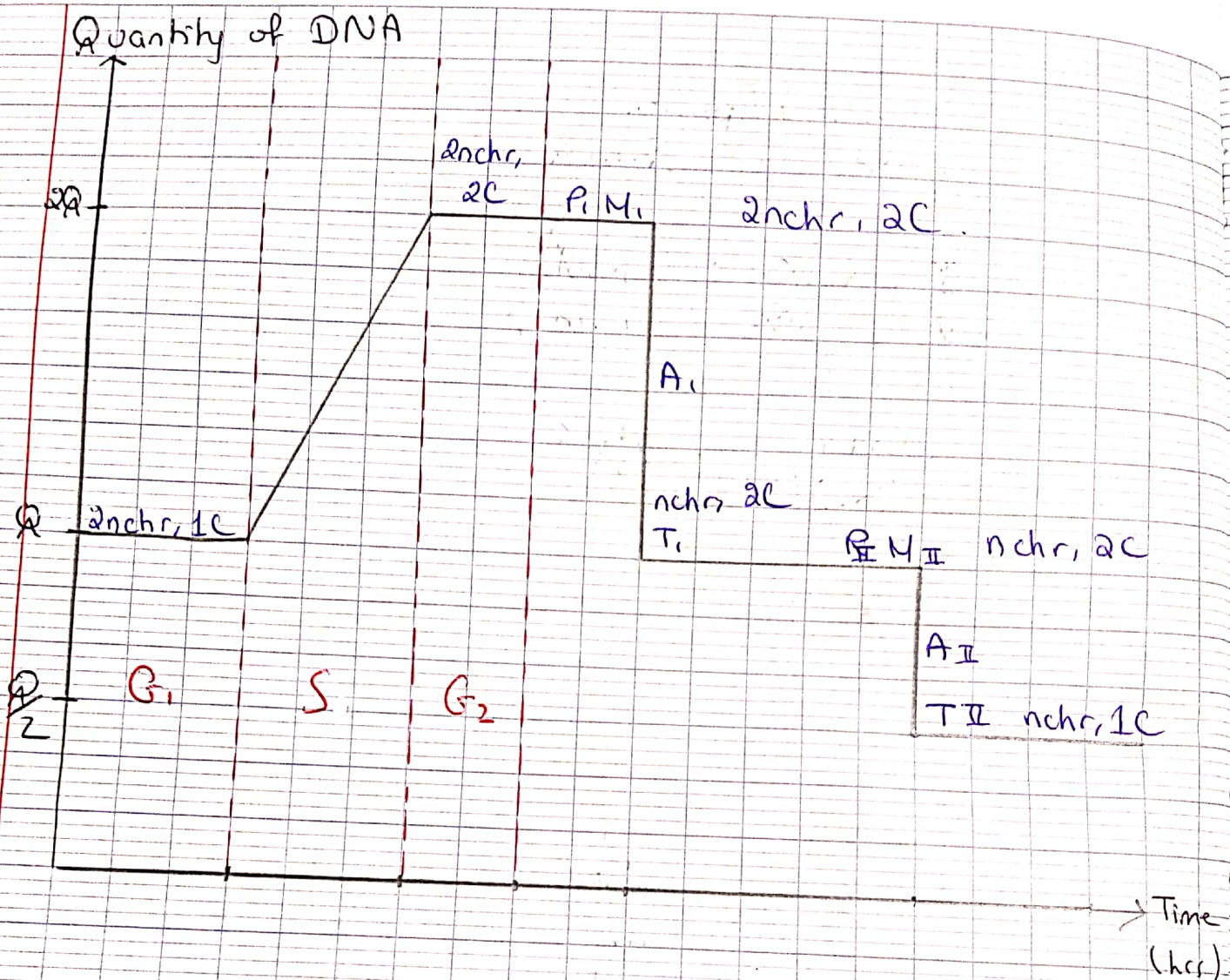
n chr, 1C / pole ④/2

Telophase II

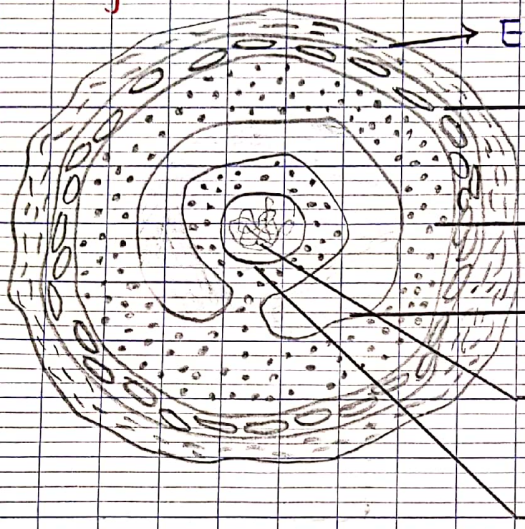


n chr, 1C ④/2




Quantity of DNA
2n chr, 2C
P, M,
2n chr, 2C
A,
n chr 2C
T,
P II M II
n chr, 2C
A II
T II n chr, 1C
2n chr, 1C
G,
S
G2
Time (hrs)

OOgenesis :



Follicles:

Primordial → Primary → Secondary → Terbiary
(cavitary) → Graafian follicle.

Primordial :

Primary :

Secondary :

Terbiary

Graafian : Har a very imporkant role in ovulation.

Note : During embryonic life we obtain only OOcyte I blocked at prophase I

Folliculogenesis and OOgenesis start during embryonic life.
But during embryonic life we obtain only primordial follicles.

At birth the female has inside the ovaries primordial follicles enclosing (inside it) oocyte I blocked at prophase I.

Ovulation: Is the release of oocyte II blocked at met II in the pavlion of the oviduct.

. The blocked oocyte I retaines its meiosis before 12 hrs from ovulation to become oocyte II blocked at metaphase II waiting for fertilization in the fallopian tube.

. The raptured graafian follicle becomes yellow body.

. If there is no fertilization, the yellow body degenerates within 7 to 8 days and becomes a white body (degenerate by atresia).

. If fertilization took place, the yellow body persists to 3 to 4 monthes to secrete progesterone nessecary for the maintanance of pregnancy, then it degenerates because the placenta becomes able to secrete its own progesterone.

Note: The hormone HCG (pregnancy hormone) maintance the persistance of yellow body.

Notes:

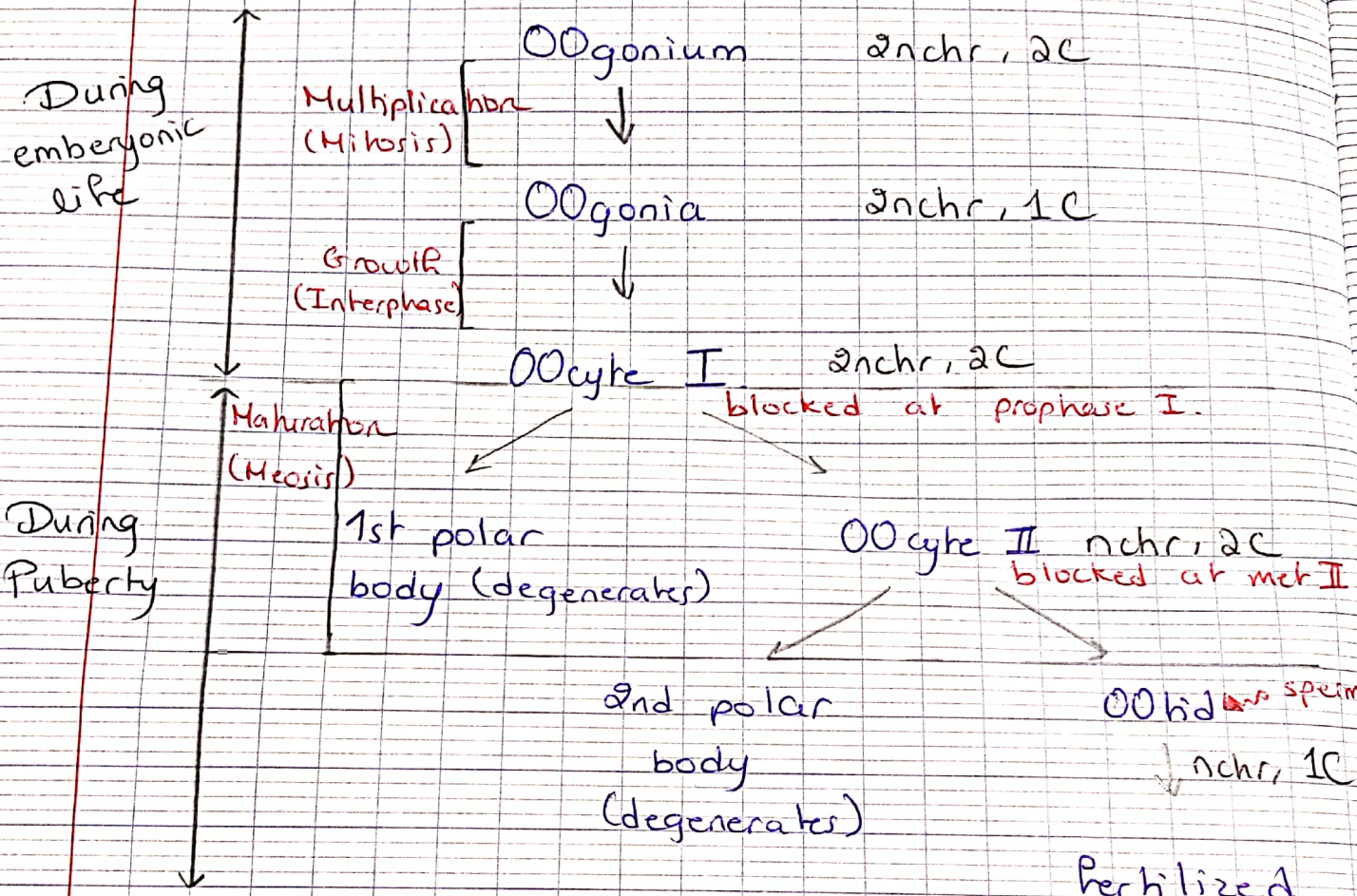
- In female every month before puberty 500 primordial follicles inter in achvity but only one completes to become a graafian follicle ready to release oocyte during ovulation.

- At puberty folliculogenesis and oogenesis resume to give a graafian follicle enclosing an oocyte II blocked at metaphase II.

Fertilization:

Is the process of union or fusion b/w the haploid male gamete (sperm) and female haploid gamete (ovum or oocyte) to restablish or restore the deploity of a new organizim.

OOgenesis Process (Phases)



At the end of OOgenesis only one ovum is obtained.

Note: Karyogramy is the pronucleous of the sperm united with the pronucleous of the oocyte.

For reading :

OOgenesis Vs. Folliculogenesis

An ovum, released by a 40 years old woman is itself more than 40 years old. In fact, a large number of OOcyte are formed very early, by the 15th week of emberyonic life.

The ovaries of a five month old emberyo contain more than 6 million OOcytes.

A large number of there degenerate during emberyonic life (follicular atresia).

Each OOcyte is surrounded by few follicular cells to form a primordial follicle.

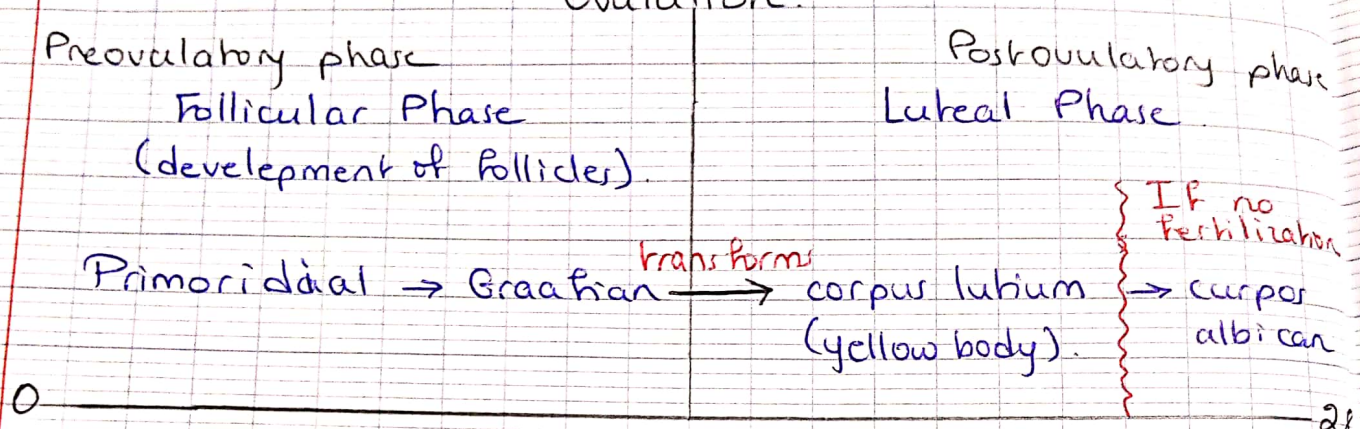
At puberty, each female porcessise in her ovaries around 400 thousands OOcyte & releases by ovulation not more than 400

The total depletion of these oocytes correspond to menopouse.

Regulation of Female Sexual Hormones

Ovarian Cycles

Menstrual Cycle: Ovaries, endometrium, cervix & temperature.



During post ovulatory phase:
Corpus luteum secrete estrogen and progesterone

Ovarian cycle: In the ovary, follicles develop from primordial till graafian at day 14 and to corpus albicans at day 28

- Follicles release estrogen in the first 2 weeks, then the corpus luteum release estrogen & progesterone.

Gonadotropic hormones: LH & FSH stimulates ovaries.

FSH: Follicular stimulating hormone (development of follicle)

GnRH: Gonadotropic releasing hormone.

Endometrial Cycle:
Proliferative phase: Before Ovulation.
Estrogen stimulates:
1_ Development of endometrium (uterine mucosa).
2_ Formation of tuble-like glands
3_ Growth of blood vessels.
4_ Preparation of receptors of progesterone.
Secretory phase: After ovulation.
Progesterone stimulates:
1_ More development of endometrium covered by Uterine lace.
2_ Nutritive Glands produce neutrition.
3_ Blood vessels become spiral.
Its called secretory phase since nutrients are secreted
During endometrial cycle:
After bleeding (menses) endometrium (uterine mucosa) starts developing & supplies O_2 via blood.
All of these are prepared for a possible implantation of a new emby.
If no fertilization, then this endometrium will slough off causing bleeding.

Cervical mucus cycle:
Cervical gland release thick mucus to prevent the entrance of sperm in the days where no ova are available, while it release a thin mucus to facilitate the intrance of sperm in the days of ovulation.

Thermal Cycle:
The temperature of the female fluctuates between 36 & 36.8 °C while after ovulation the temperature increases to 37.2 °C & it remains high till the end of the cycle.

Cyclic Evolution of Ovarian Hormones:

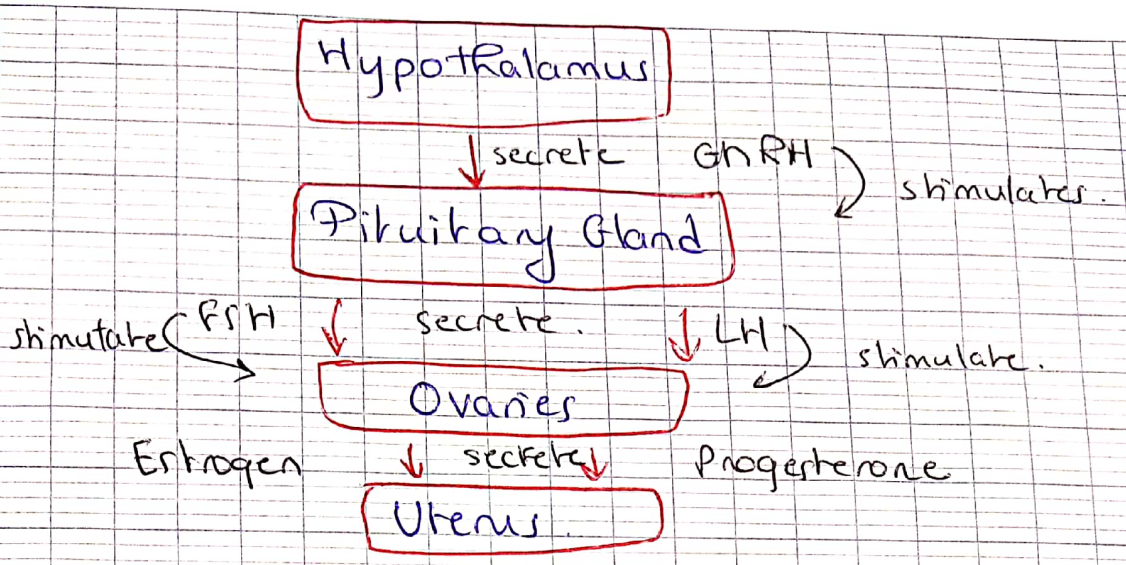
Ovarian hormones: Estrogen & Progesterone.
Ovarichomy: Ablation of ovaries.
Activity 15 page: 490
2- The ovaries are indespensible for the development of endometrium.
3- Ovaries act independently of its location (act via blood).
4- Ovarian extract contains chemicals that shimulates the development of endometrium.
Conclusion:
Ovaries are endocrine glands that secrete chemicals that shimulate the development of endometrium.

During follicular Phase:

Estrogen is secreted by the internal theca of developing follicles & by granulosa.

During Secretory Phase:

Progesterone is secreted by yellow body.



Note: FSH & LH are secreted by the anterior pituitary gland.

Doc: 3 Page: 491

Exp. 2 & This indicates that anterior pituitary is indispensible for the development of ovaries and its cyclic activity.

Exp. 3 & This indicates that anterior pituitary gland acts via blood in the pituitary area.

Important this indicates

Conclusion & Anterior pituitary is an endocrine gland that stimulates the activity of ovaries and uterus.

Hypothalamic Control on Pituitary Secretions:

Exp. 1 & 2 : This indicates that hypothalamic neurons are indispensible for the stimulation of the anterior pituitary to secrete FSH & LH

Exp. 3 : The connection between hypothalamous and anterior pituitary gland is indispensible for the stimulation of anterior pituitary to secrete LH and FSH by the hypothalamous.

Exp. 4 : The hypothalamous stimulates the pituitary gland by GnRH.

Doc e1:
This indicates that the hypothalamous is indispinsible for the secretion of LH

Doc e2:
This indicates that the hypothalamour is indispensible for the secretion of FSH.

Pulsatile manner: Discontinous Injections.

② Doc f:

This indicates that the conhinous injechon of GnRH inhibits the release of LH and FSH while the discontinous injechons of GnRH shimulates the release of LH and FSH

Hypothalamow release the GnRH disconhinowly (in a pulsabile manner) to achivate the pihuitary gland leading to the secrehon of LH and FSH.

The FSH will shimulate the development of follicles which will increase in volume and secrete a large amount of estrogen.

Doc 4 Page: 492

Ovarian feedback control on the hypothalamo-pituitary axis.

Exp 1

The fall in estrogen level leads to a raise in LH and FSH was detected after bilateral ovariectomy. This indicates that the ovaries are indispensible for the secretion of estrogen. Moreover, the presence of estrogen and progesterone inhibits the secretion of FSH & LH

Exp 2:

This indicates that moderate amount of estrogen inhibits the secretion of LH.

This indicates that high amount of estrogen stimulates LH peak.

Conclusion (on the feed back).

Moderate estrogen exerts a negative feedback on LH secretion

High estrogen exerts a positive feedback on LH secretion