

EMBRYOLOGY

LECTURE

#1

GAMETOGENESIS





TABLE OF CONTENTS

The objectives	2
Ovarian cycle	3
Uterine cycle	5
Helping Timeline	7
Cell division	8
Gametogenesis	9
Spermatogenesis	10
oogenesis	11
Multiple choices questions	12
Additional flashcards	13

OBJECTIVES

By the end of the lecture, you should be able to:

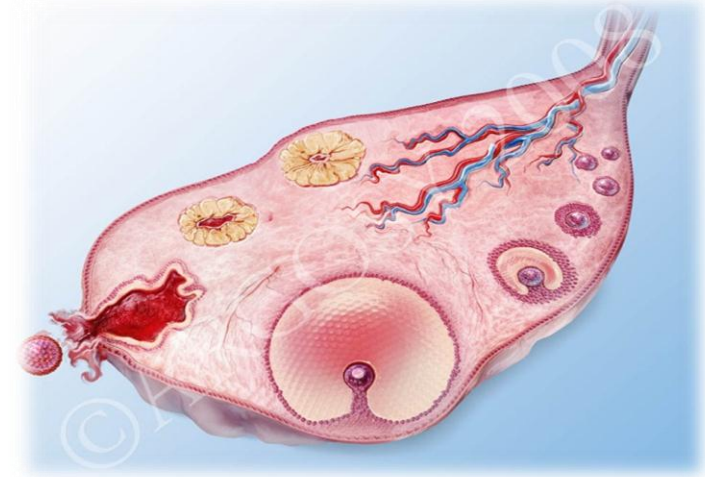
- ❖ Describe the female cycles (**Ovarian&Uterine**).
- ❖ Define **gametogenesis**.
- ❖ Differentiate the types of **gametogenesis**.
- ❖ Describe the process of **spermatogenesis**.
- ❖ Describe the process of **oogenesis**.



OVARIAN CYCLE

❖ Starts at puberty Until menopause.

It's different from one female to another



GnRh =
Gonadotrophin Releasing Hormone
Synthesized by
 neurosecretory cells in the Hypothalamus

Carried to the Pituitary gland (**anterior lobe**)

❖ It stimulates the pituitary gland to release *Two Hormones that act on Ovaries*

FSH

LH

Follicle-Stimulating Hormone

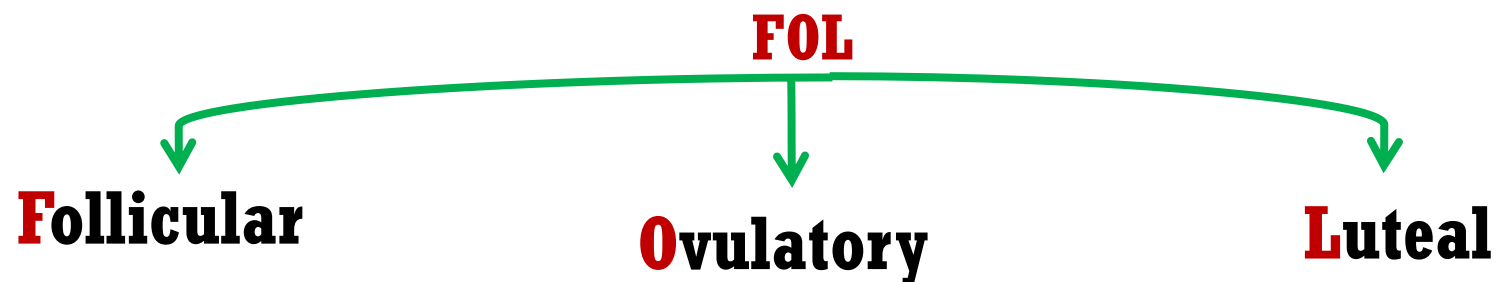
- It stimulates the ovarian follicles to develop and mature.
- Production of Estrogen by the follicular cells.

Luteinizing Hormone

- It serves as the trigger for ovulation.
- Stimulates the follicular cells and stimulate corpus luteum to produce Progesterone.

*final stages of maturation
 primary follicle continue to increase in size until ovulation

*early development of the ovarian follicle
 primordial follicle -> primary follicle



Follicle-Stimulating Hormone do its functions which are :

stimulates the ovarian follicles to develop and mature.

Production of *Estrogen* by the follicular cells.

Note :

-The ovarian cortex contains hundreds of thousands of **primary follicles** (400,000 to 500,000).

-Each consists of one **primary oocyte** encircled by single layer of flat follicular cells.

-The simple flat follicular cells become cuboidal then forming many layers columnar then around the oocyte.

The follicle becomes enlarged until it gets maturity.

It produces swelling on the surface of the ovary.

Early development of ovarian follicle is induced by *FSH*.

Final stages of maturation require *LH*.

***LH* causes ovulation (rupture of the mature follicle).**

Note :

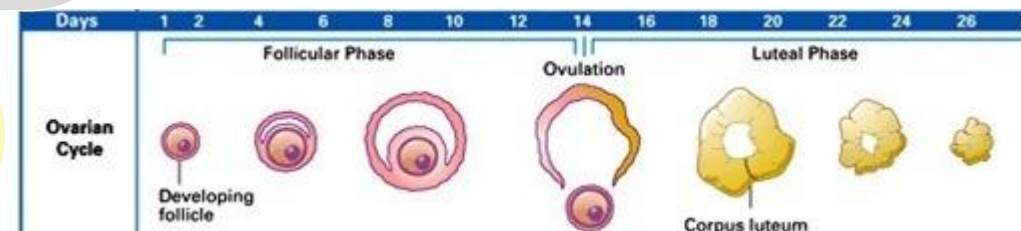
Growing follicles produce estrogen which regulates the development and functions of the reproductive organs.

The remaining of the ruptured follicle is now called corpus luteum It secretes *Progesterone* and small amount of *Estrogen* .

These 2 hormones stimulate endometrial glands to secrete and prepare endometrium for implantation of fertilized Ovum (Blastocyst).

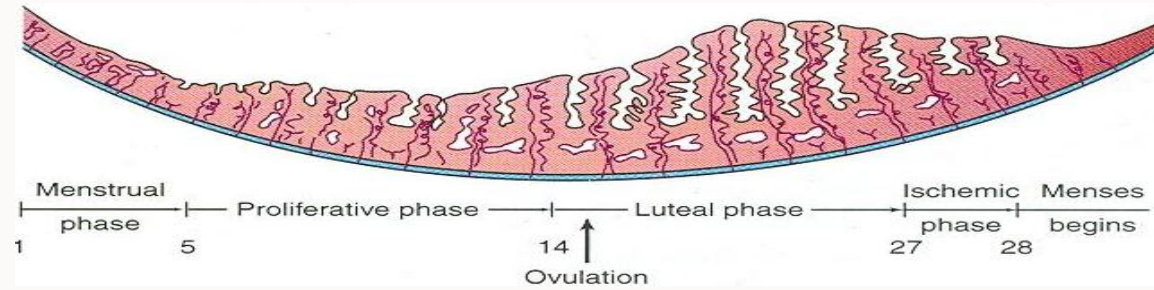
If the oocyte is fertilized the Corpus Luteum enlarges and remains till the 4th month of pregnancy.

If the oocyte is not fertilized the corpus luteum involutes and degenerates in 10-12 days



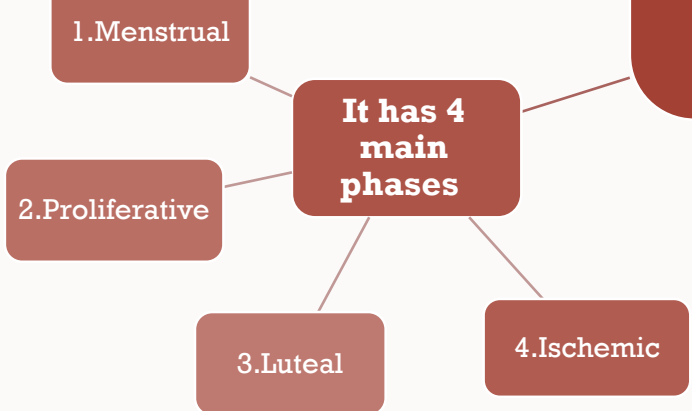


UTERINE CYCLE



UTERINE OR MENSTRUAL CYCLE

Day One : the day when menstrual blood flow begins



Average menstrual cycle is 28 days.

Note that it varies by several days in normal women . Also it sometimes varies in the same women .

It is cyclic changes in the endometrium of the uterus caused by 2 hormones : Progesterone , estrogen

Range between 23 and 35 days in 90% of women

Phase	Menstrual Phase	Proliferative Phase	Luteal Phase	Ischemic Phase
Duration	4-5 DAYS	9 DAYS	13 DAYS	One Day



Aim: It is the phase for repairing and proliferation .

It coincides with growth of ovarium follicle , so it is controlled by *estragine* which is secreted by the *follicular cells*.

Changes in the phase:

- 1- thickness of the endometrium is increased into 2-3 folds .
- 2- The glands increase in number and length the spiral arteries elongate

Menstrual Phase

Luteal Phase

Degeneration of corpus luteum leads to **decrease** the levels of **estrogen & progesterone**.

Loss of interstitial fluid.

Marked shrinking of endometrium.

Spiral arteries become constricted.

Venous stasis & Ischemic necrosis.

Rupture of damaged vessel wall.

Blood seeps into the surrounding connective tissues.

Loss of 20-80 ml of blood

Entire compact layer and most of the spongy layer of endometrium is discarded.

Starts with the first day of menstrual cycle .

What happens in this phase?

- 1- Function layer of the endometrium sloughed Off and Discarded with the menstrual flow .
- 2- Blood discharge from vagina is combined with small pieces of endometrial tissues .

Proliferative Phase

-This phase coincides with the formation and function of the corpus luteum

Changes in this phase:

- 1- Glandular epithelium secrete *glycogen rich material* .
- 2- Endometrium thickness under the influence of *Estrogen* and *Progesterone* .
- 3- Spiral arteries grow into the superficial layer .
- 4- Arteries become increasingly coiled.
- 5- Layer venous network develops
- 6- Direct arterio – venous anastomoses are the prominent features .

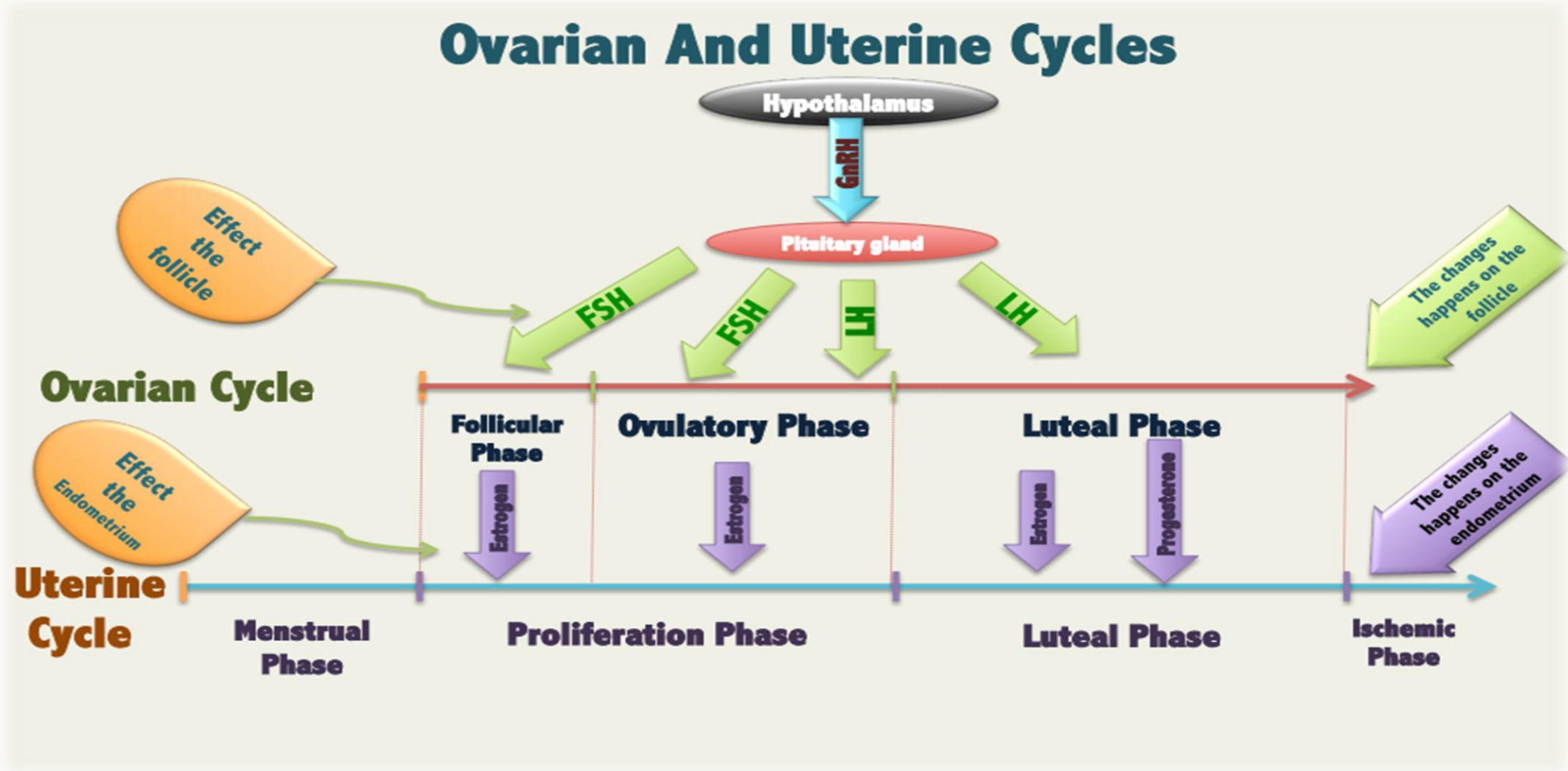
Ischemic Phase

YouTube For Further explanation

<http://www.youtube.com/watch?v=WGJsrGmWeKE>

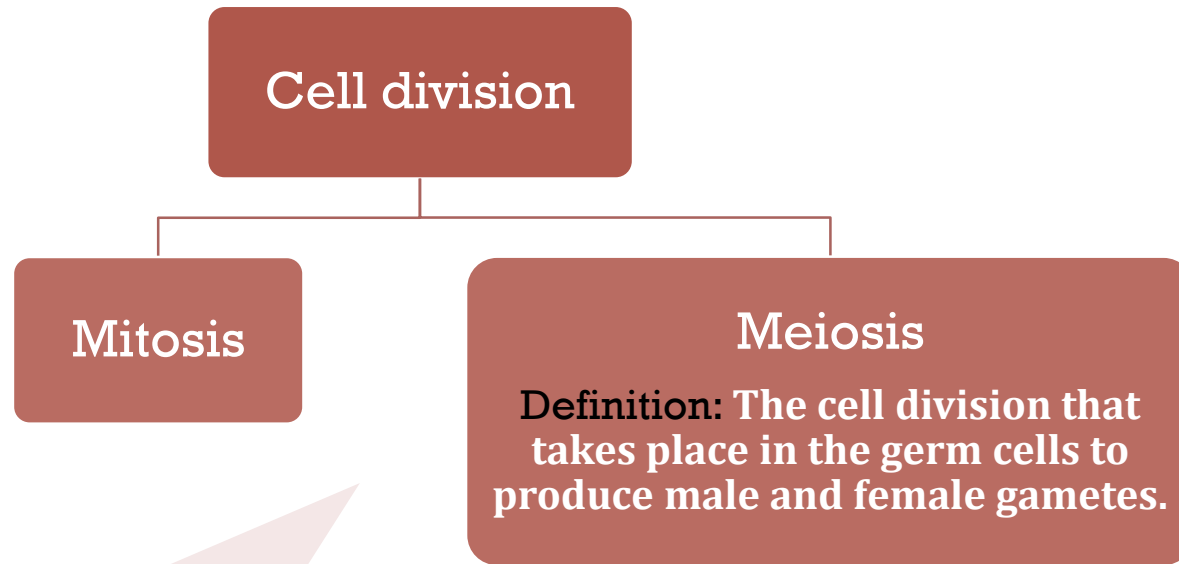
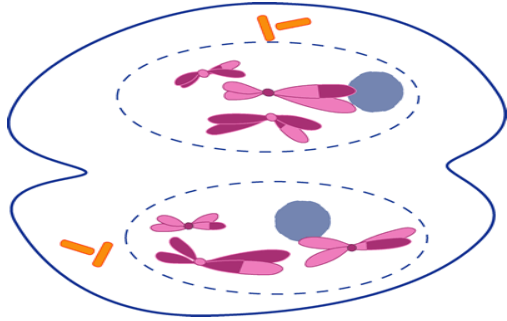


HELPING TIMELINE





CELL DIVISION



The differences between mitosis and meiosis

<u>Mitosis</u>	<u>Meiosis</u>
End with diploid number of chromosomes.	End with haploid number of chromosomes.
Somatic cells	Germ cells

Meiosis 1

#At the beginning (prophase 1) germ cells replicate their DNA so that each of the 46 chromosomes is duplicated into sister chromatid.

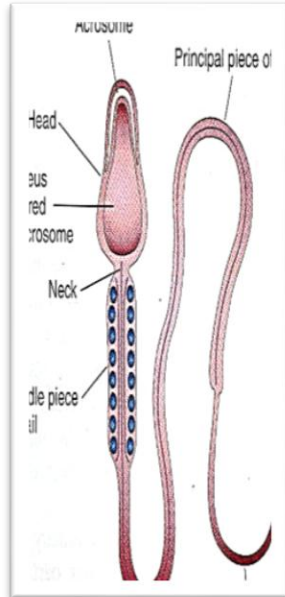
#By the end of meiosis 1 division each Secondary spermatocyte or oocyte has haploid (half) number of chromosomes of the primary spermatocyte or oocyte.

Meiosis 2

In both Meiosis 1 & Meiosis 2 the Diploid number of chromosomes (46) is reduced to haploid number (23).

GAMETOGENESIS

***Definition:** It is the production of mature male and female gametes (sperm and ova) (Gamete formation)



Spermatogenesis

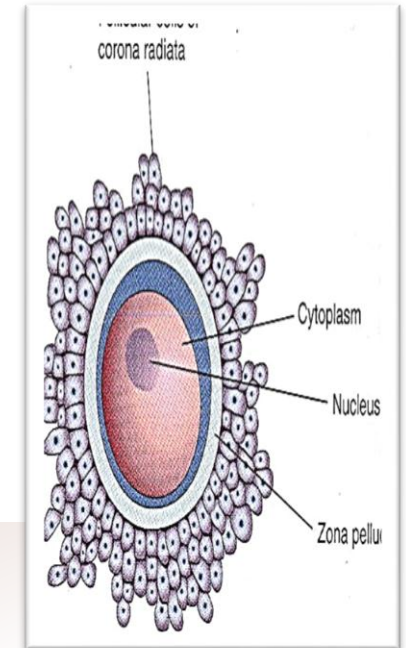
Definition: series of changes by which the spermatogonia are transformed into mature sperms.

Note :

Mature sperm contain little cytoplasm comparing to mature oocyte.

Oogenesis

Definition: sequences of events by which the oogonia are transformed into mature oocytes.

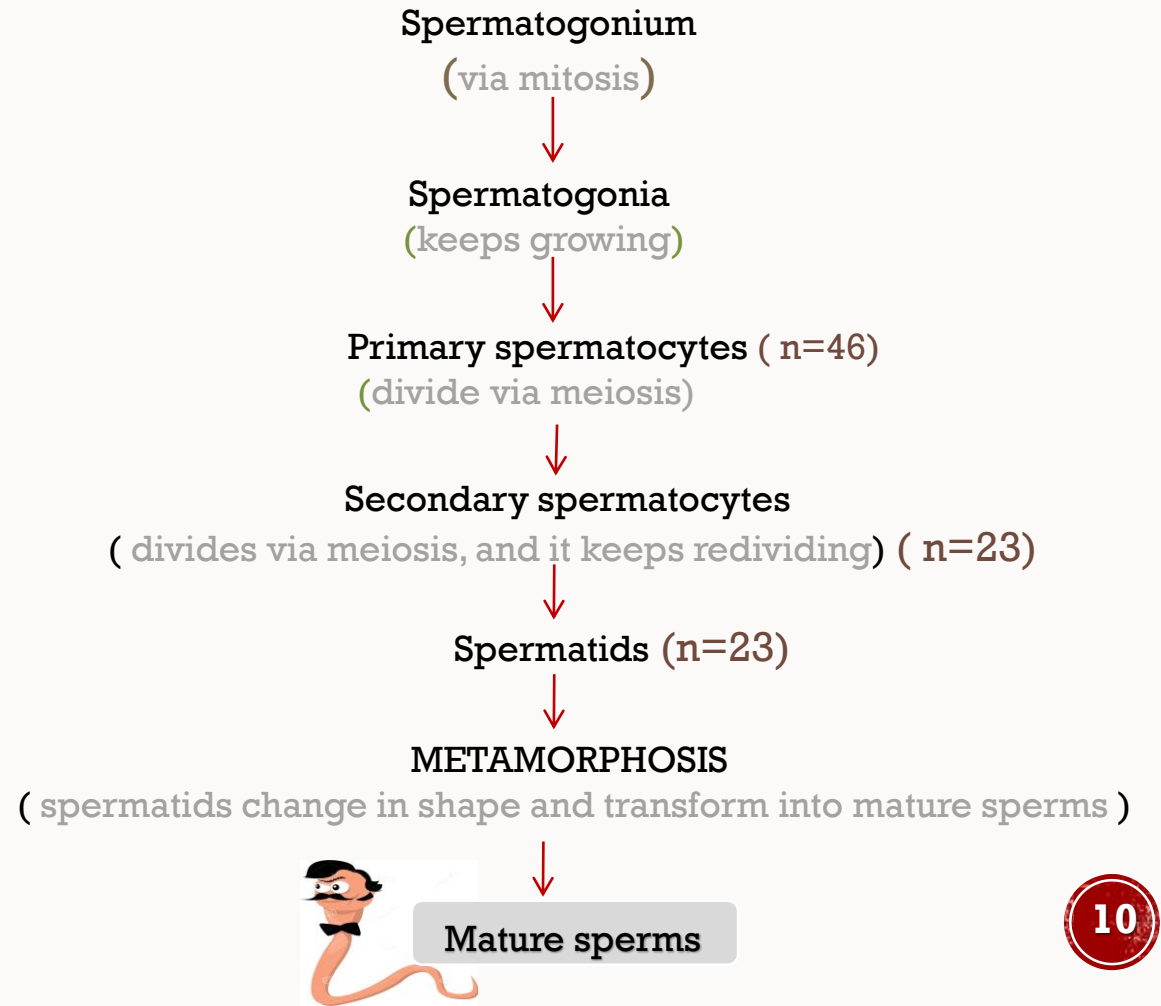
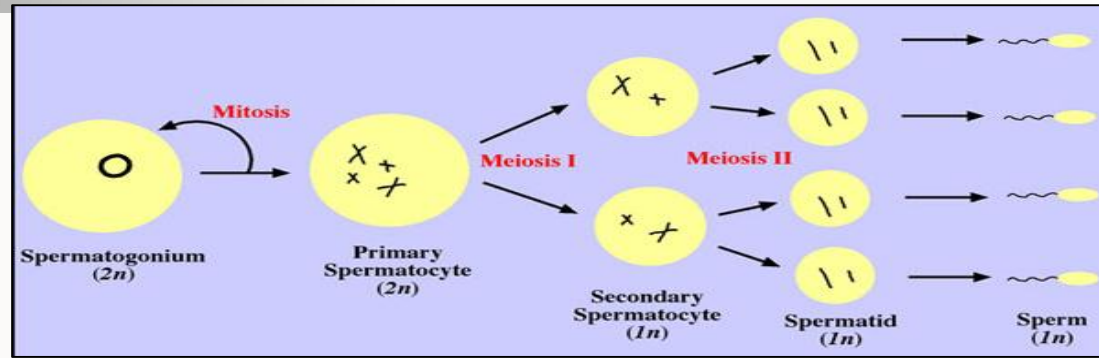




SPERMATOGENESIS

Definition	Spermatogonia primitive germ cells are transformed into mature sperms
Aim	Formation of sperms with haploid number or chromosomes (23)
Site	Seminiferous tubules of the testis
Time	From puberty till old age
Duration	About two months

N.B sperms are stored and they become functionally mature in the epididymis



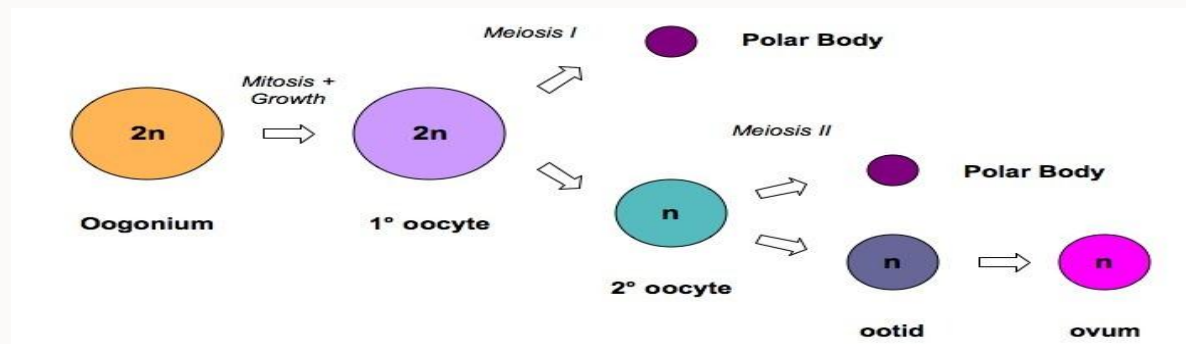
Structure of mature sperms

Nucleus	Golgi apparatus	Mitochondria	Centriole
Condensed and forms most of the head	Forms the acrosome	Forms a spiral sheath	Elongates to form the axial filament



OOGNESIS

Definition	Oogonia primitive germ cells are transformed into mature oocytes
Aim	Formation of secondary oocytes with haploid number of chromosomes
Site	Cortex of the ovary
Time	Starts during fetal life, it's completed after puberty and then continues until menopause
Duration	It occurs monthly except during <u>PREGNANCY</u>



Oogonium divides via mitosis to produce oogonia (46). The oogonia keeps growing

Primary oocyte (46) begins first meiotic division and stops at prophase.

Before ovulation
The first meiotic division is completed.

Secondary oocyte is produced (23)

At ovulation
Second meiotic division begins and stops at metaphase

The second meiotic division is completed

The secondary oocyte divides into mature ovum (23)



MULTIPLE CHOICES QUESTIONS

1. Concerning gametogenesis :

- a. Spermiogenesis is the first stage in spermatogenesis.
- b. The sperm contains diploid number of chromosome.
- c. Primary oocytes can be formed after birth in females.
- d. Spermatogenesis occurs in the seminiferous tubules of testis.**

2. One primary spermatocyte gives rise to:

- a. 2 spermatids.
- b. 2 sperms.
- c. One sperm.
- d. 4 sperms.**

3. In spermiogenesis:

- a. The spermatogonium changes to primary spermatocyte.
- b. The primary spermatocyte changes to secondary spermatocyte.
- c. The secondary spermatocyte changes to spermatid.
- d. The spermatid changes to sperm.**

4. The oogenesis begins:

- a. Prenatally (before birth).**
- b. Immediately after birth.
- c. After puberty.
- d. Just before puberty.

5. Which is true regarding spermiogenesis ?

- a. Transforms spermatids to mature sperms.**
- b. Reduces the diploid number of chromosomes to haploid.
- c. Takes about two months to complete.
- d. Transforms the spermatogonia into mature sperms.

6. Regarding meiosis, all the following are true EXCEPT:

- a. It maintains the diploid number of chromosomes.**
- b. It takes place in germ cells.
- c. It allows crossing over of segments of chromosomes.
- d. It allows shuffling of maternal and paternal chromosomes.

QUIZ LINKS

Gametogenesis & Female Cycles 1

<http://www.onlineexambuilder.com/gametogenesis-female-cycles-1/exam-8287>

Gametogenesis & Female Cycles 2

<http://www.onlineexambuilder.com/gametogenesis-female-cycles-2/exam-8288>



ADDITIONAL FLASHCARDS

Ovarian cycle → Pituitary gland.

Fsh = follicle-stimulating hormone.

(2) main functions.

* Stimulates the ovarian follicle to develop and mature. → Growing follicles

* Production of estrogen by follicular cells. ⇒ function of Estrogen. Regulates the development and functions of the reproductive organs.

Ovulatory

- Growing follicle enlarged until it reaches "maturity"

- Swelling on the surface of the ovary is produced

- Final stages of maturation controlled by LH → required for ovulation, rupture of follicle.
- Early development of ovarian follicle induced by FSH

Luteal

- ruptured follicle is now called corpus luteum.

- Secretes progesterone and small amounts of estrogen.

- These two hormones cause the endometrial gland to prepare and secrete the endometrium for the implantation of the fertilized oocyte (blastocyst)

fertilized
4th month, enlarges.

not fertilized
involved & discarded in 10/12 days

Female reproductive cycle.

Time:- Starts at Puberty - until menopause

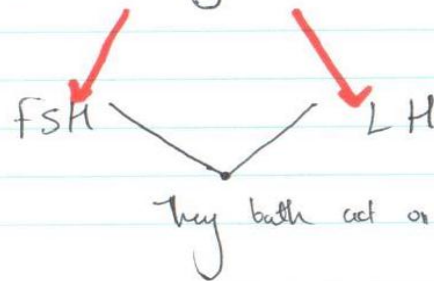
Vital Glands :-

- ① Hypothalamus
- ② Pituitary gland
- ③ ovaries
- ④ uterus
- ⑤ uterine tubes
- ⑥ Vagina
- ⑦ Mammary Glands

Neurosecretory cells → (in the Hypothalamus)

↓ (release)
↓ (GnRH)

GnRH → Pituitary Gland (anterior lobe)



Time:

[21 - 28 - 35]

Shorter / longer
varies from one
person to another.

ADDITIONAL FLASHCARDS

LH:-
Luteinizing hormone.

- * The trigger for ovulation
- * Stimulates the corpus luteum and follicular cells to produce progesterone.

* uterine / menstrual cycle. *

* Cyclic changes in the endometrium of the uterus is caused by

Progesterone

Estrogen

it usually lasts for about 28 days, and it ranges from 23-35 days.
of women → varies even with the same women.

- menstrual blood flow starts from day one.

Phases

- menstrual phase
- Proliferative / follicular phase
- luteal phase
- ischemic phase.

Menstrual

- * Starts from the first day of the menstrual cycle. / 4-5 days.
- * The functional layer of the endometrium is sloughed off and discarded with the menstrual flow.
- * Blood is discharged from the vagina with small pieces of the endometrial tissue combined with it.

Proliferative

- repair and proliferation phase / 4 days.
- coincides with the growth of the ovarian follicle
- so it's controlled by the estrogen secreted by the follicular cells
- Thickness of the endometrium increases to 2-3 folds
- endometrial glands increase in number & length / spiral arteries elongate.

ADDITIONAL FLASHCARDS

Luteal

- * Secretory / Progesterone Phase 1/3 days
- * coincides with the formation, functioning and growth of the corpus luteum
- * Glandular epithelial secrete glycogen rich material
- * thickness of the endometrium increases under the influence of
 - Progesterone
 - Estrogen
- * Spiral arteries go into the superficial layer
- * arteries become coiled / large venous network develops
- * direct arterio-venous anastomoses are the prominent features

Ischemic

- Degeneration of the corpus luteum
↓ causes a decrease in the level of

- Estrogen
- Progesterone.

- loss of interstitial fluid.
- marked shrinking of the endometrium
- spiral arteries become constricted
- venous stasis & arterio-venous anastomoses
- rupture of damaged vessel wall
- blood seeps into surrounding connective tissue.
- 20-20ml of blood
- entire compact layer and most of the spongy layer of the endometrium is discarded.

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