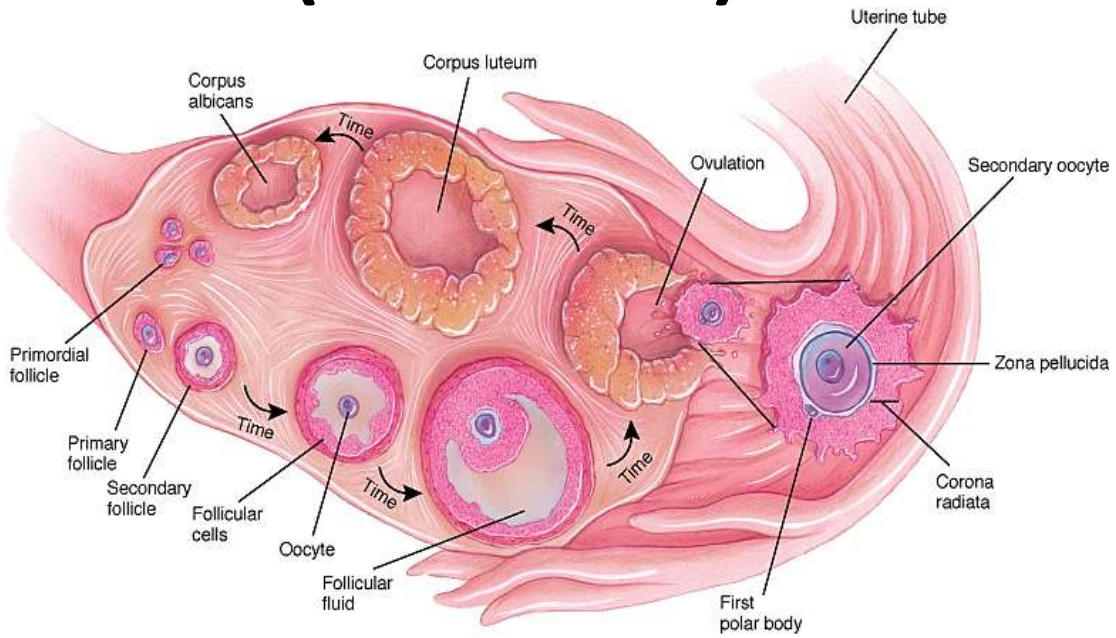

بسم الله الرحمن الرحيم

Foundation Module

1st Year MBBS(LGIS)

Female Reproductive Cycle (Ovulation)



Presented by:
Prof. Dr. Ayesha Yousaf

Date:16-02-2023
Updated on 25.01.2025

First Ten Minutes

Prof. Umar's Model of Teaching Strategy

Self Directed Learning Assessment Program

Objectives :To cultivate critical thinking, analytical reasoning, and problem-solving competencies.

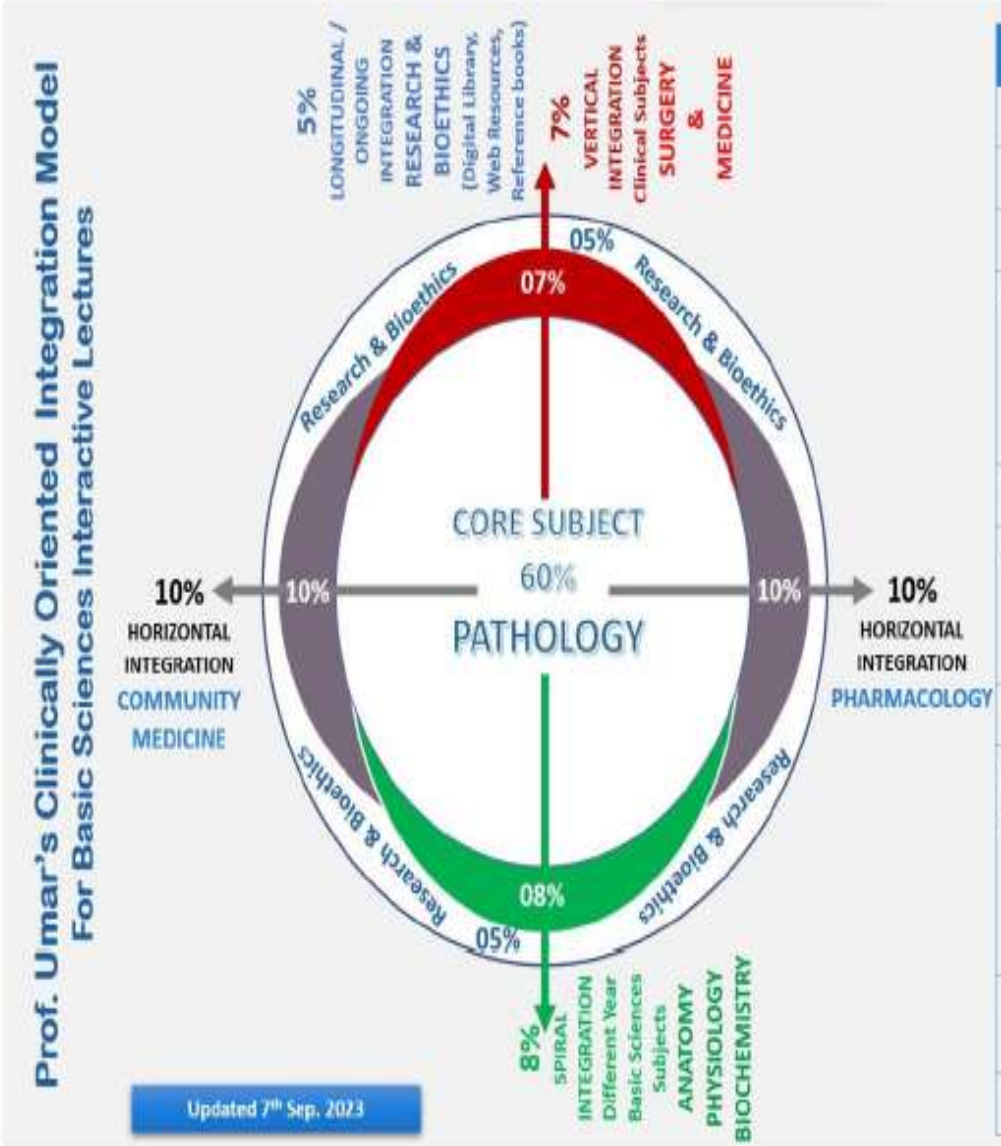
To instill a culture of self-directed learning, fostering lifelong learning habits and autonomy.

How to Assess?

- Ten randomly selected students will be evaluated within the **first 10 minutes of the lecture** through 10 multiple-choice questions (MCQs) based on the PowerPoint presentation shared on Students Official WhatsApp group, one day before the teaching session.
- The number of MCQs from the components of the lecture will follow the guidelines outlined in the **Prof. Umar model of Integrated Lecture.**

Component of LGIS	Core Knowledge	Horizontal Integration	Vertical Integration	Spiral Integration
No of MCQs	6-7	1-2	1	1

Professor Umar Model of Integrated Lecture



Model 3rd Year Pathology LGIS (≈30 slides)	
Core Subject – 60% (≈ 18-20 slides)	
Pathology (≈ 18-20 slides)	
Horizontal Integration – 20% (≈ 5-6 slides)	
Same Year Subjects	• Pharmacology (10%) (≈ 2-3 slides) • Community Medicine (10%) (≈ 2-3 slides)
Vertical Integration – 07% (≈ 2-3 slides)	
Clinical Subjects	• Medicine (3-5%) (≈ 1-2 slides) • Surgery (3-5%) (≈ 1-2 slides)
Spiral Integration – 08% (≈ 2-3 slides)	
Different Year Basic Sciences Subjects	• Anatomy (1-3%) (≈ 1-2 slides) • Physiology (1-3%) (≈ 1-2 slides) • Biochemistry (1-3%) (≈ 1-2 slides)
Longitudinal / Ongoing Integration – 05% (≈ 1-2 slides)	
Research & Bioethics (≈ 1-2 slides)	

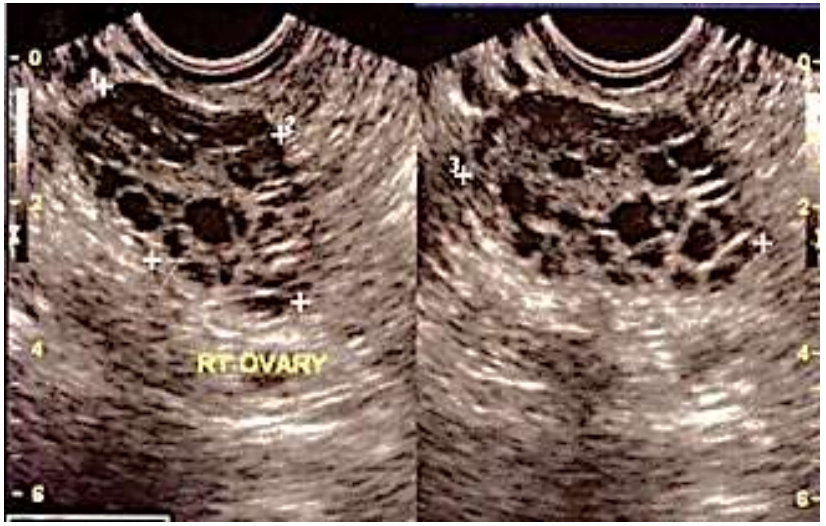
Learning Objectives

At the end of the lecture, students will be able to

- Define ovarian and uterine cycle
- Co-relate ovarian and uterine cycles
- Describe different phases of cycles
- Enumerate female sex hormones
- Discuss functional significance of female reproductive hormones in reproductive cycles
- Discuss related congenital abnormalities

Interactive Session

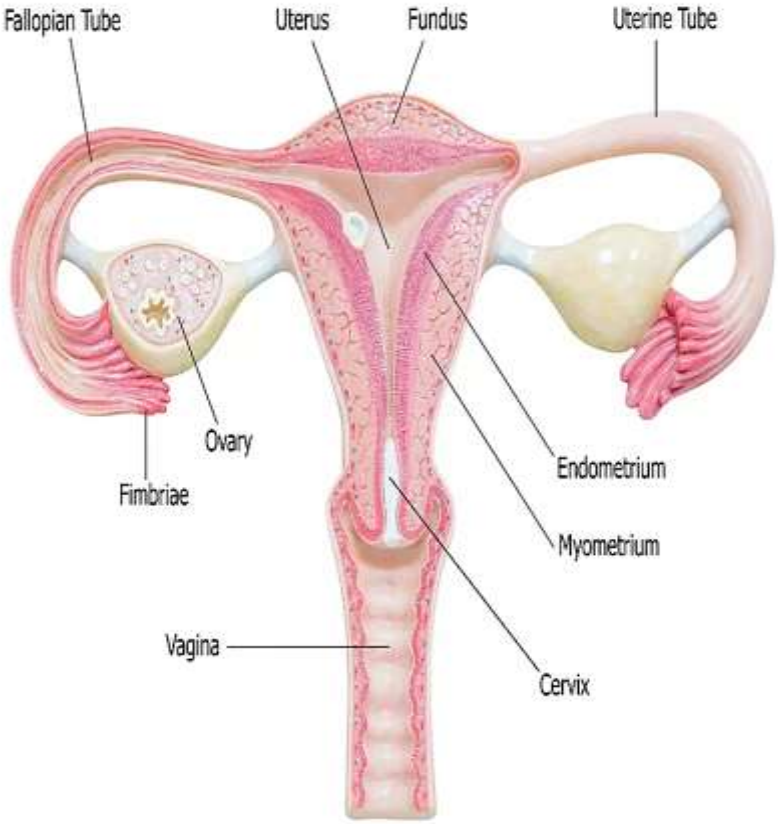
- An 18-year-old female presents to her GP with complaints of weight gain and resistant acne for the last three years. History reveals an irregular menstrual cycle with missed periods **(Anovulation).** Examination reveals male-pattern baldness and excess body hair.



Interactive Session

- **PCOS (polycystic ovarian syndrome) is a common condition that causes 70% of anovulation cases**.
- PCOS causes your body to make too many androgens, which cause the follicles in your ovaries to remain small instead of maturing and growing as they should to prepare for ovulation.

Female reproductive system



- Manufacture eggs
- Equipped to receive sperm from the male
- Provide an environment conducive to **fertilization** and **implantation**
- Nourish the developing baby

Core Knowledge

Uterine tubes

- 4 inches or 10 cm long
- Extend laterally from the uterus
- Have **four** parts each:

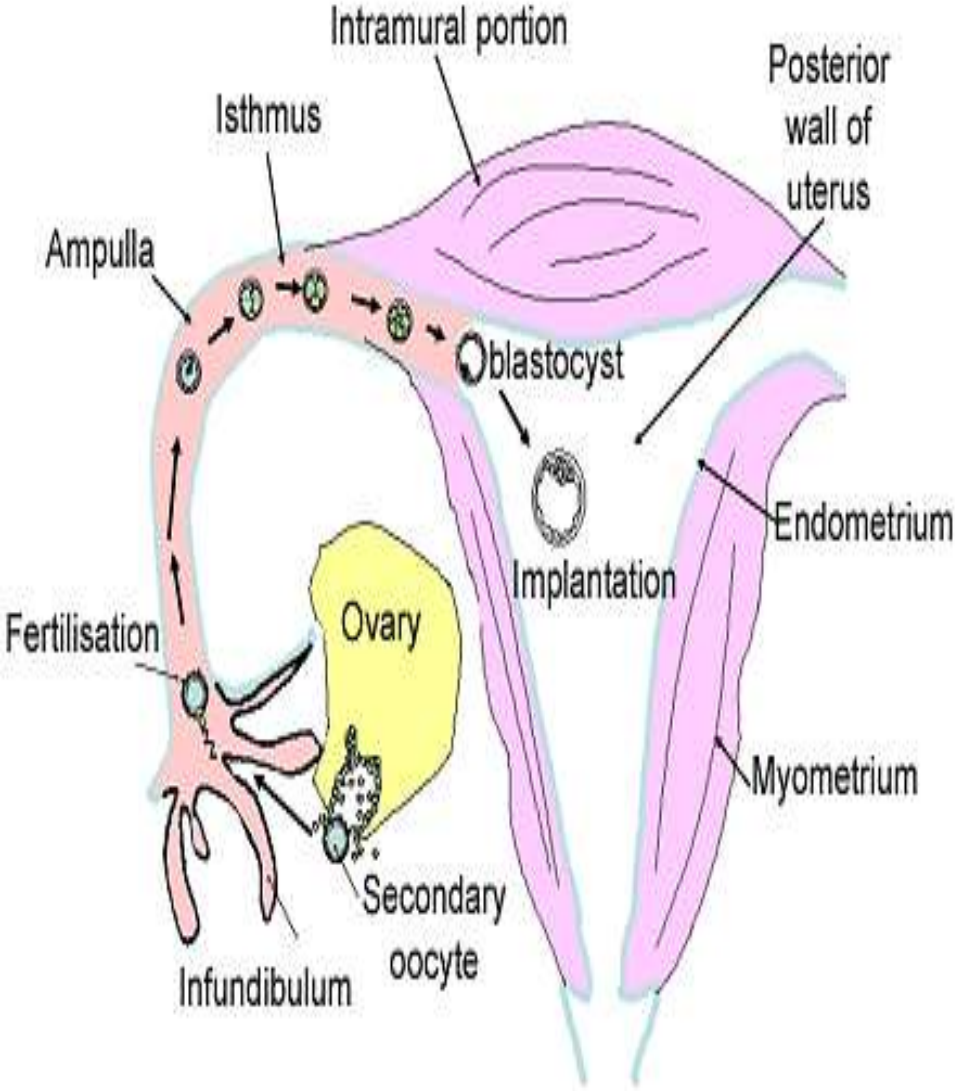
1: Infundibulum

2: Isthmus

3: Uterine part

4: Ampulla

- Carry oocytes from ovaries and sperm entering from the uterus to reach the fertilization (ampulla)
- Ectopic pregnancy
- Tubal ligation



Core Knowledge

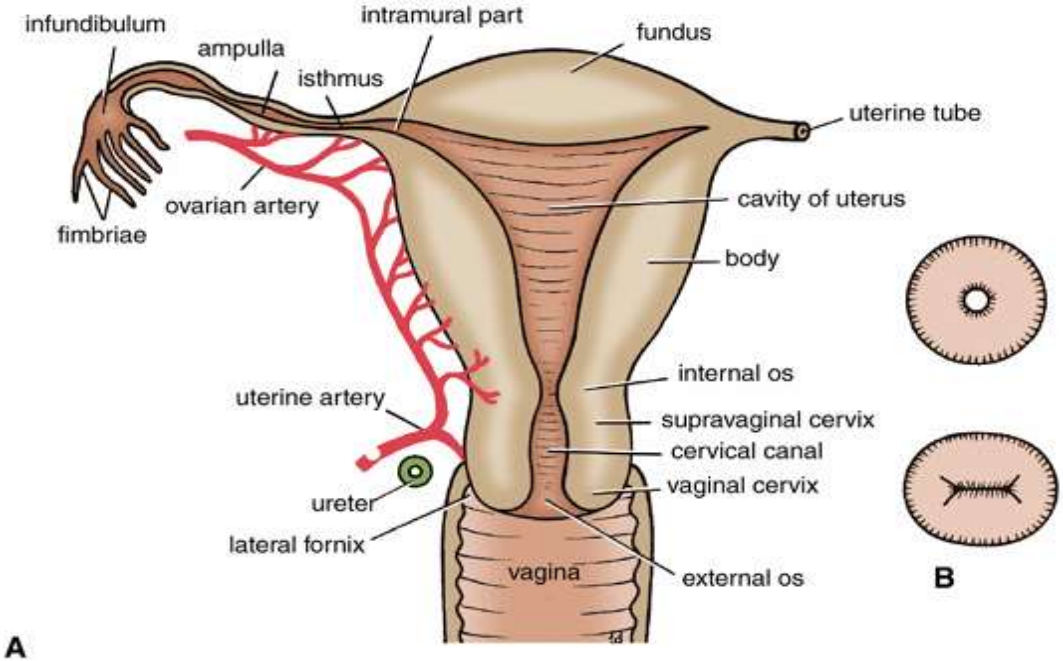
Uterus

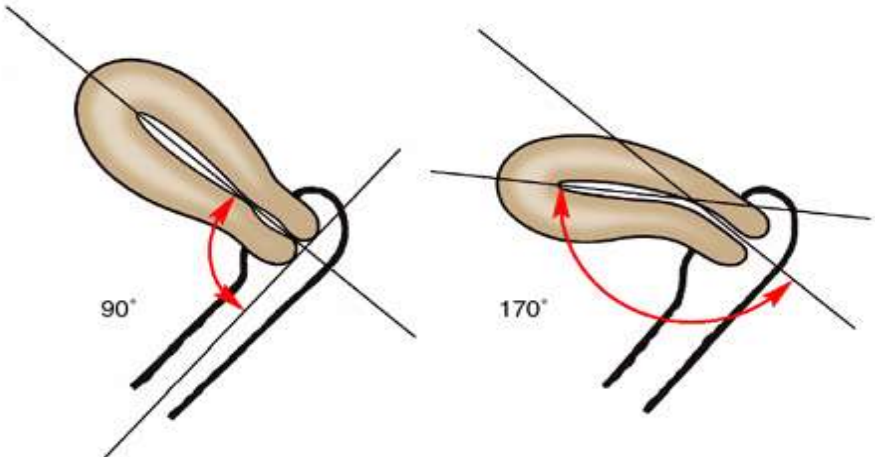
- Hollow, pear shape muscular organ
- 8x6x3cm
- Has three main parts:

1: fundus

2: body

3: cervix





Core Knowledge

Female reproductive Cycles

Are cyclic changes in the female reproductive system at the **onset of the puberty** that involve activities of hypothalamus, pituitary, ovaries and uterus

Occur simultaneously as:-

Ovarian cycle
Uterine cycle

The **ovarian cycle** describes changes that occur in the **follicle of the ovary**, whereas the **uterine cycle** describes changes in the **endometrial lining of the uterus**.

Both cycles consist of three phases each:

The **Ovarian cycle**

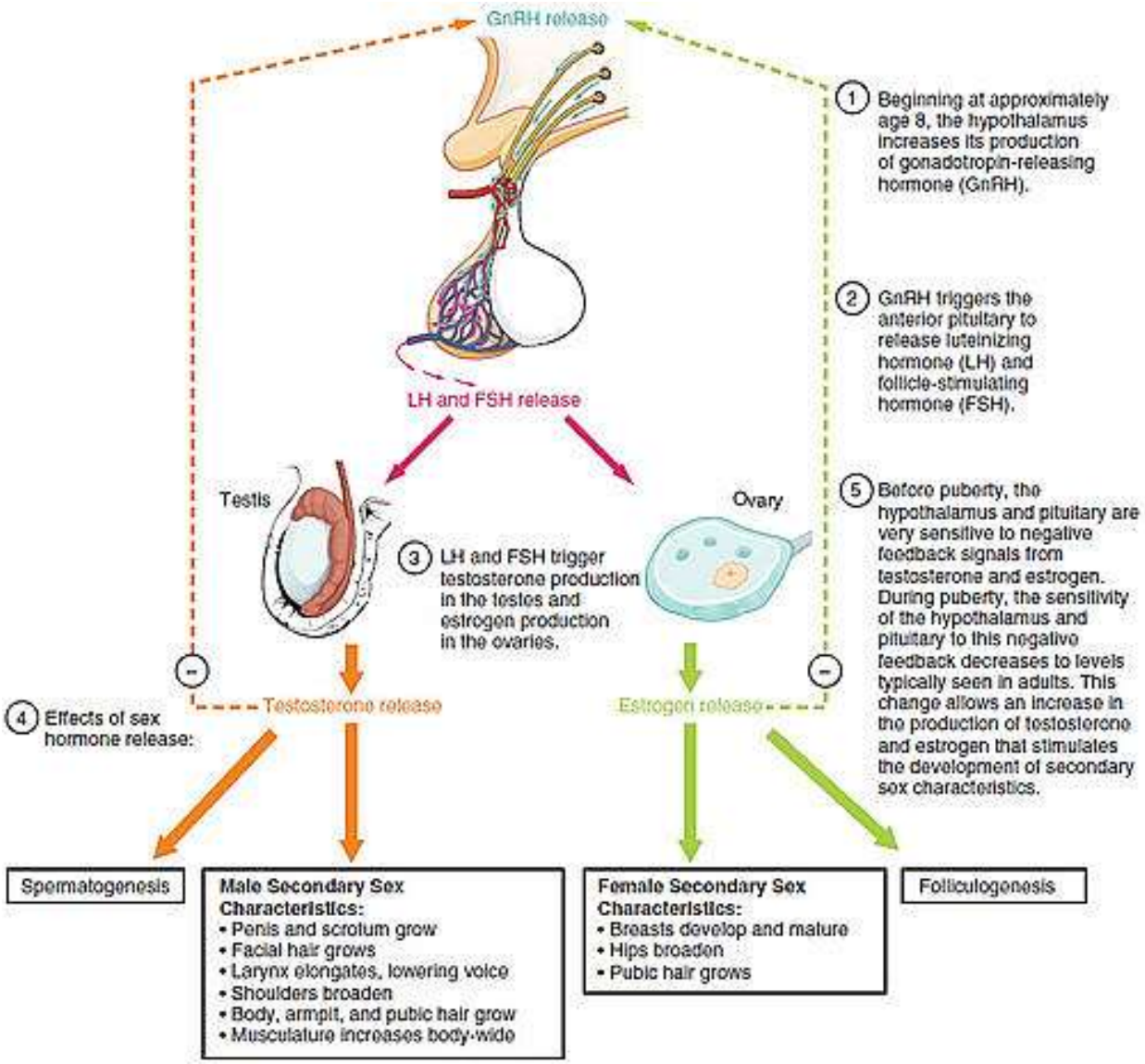
- Consists of:
- Follicular phase
- Ovulation
- Luteal phase

The **Uterine cycle**

- Consists of:
- Menstrual phase
- Proliferative phase
- Secretory phase

Horizontal Integration

Role of Hormones



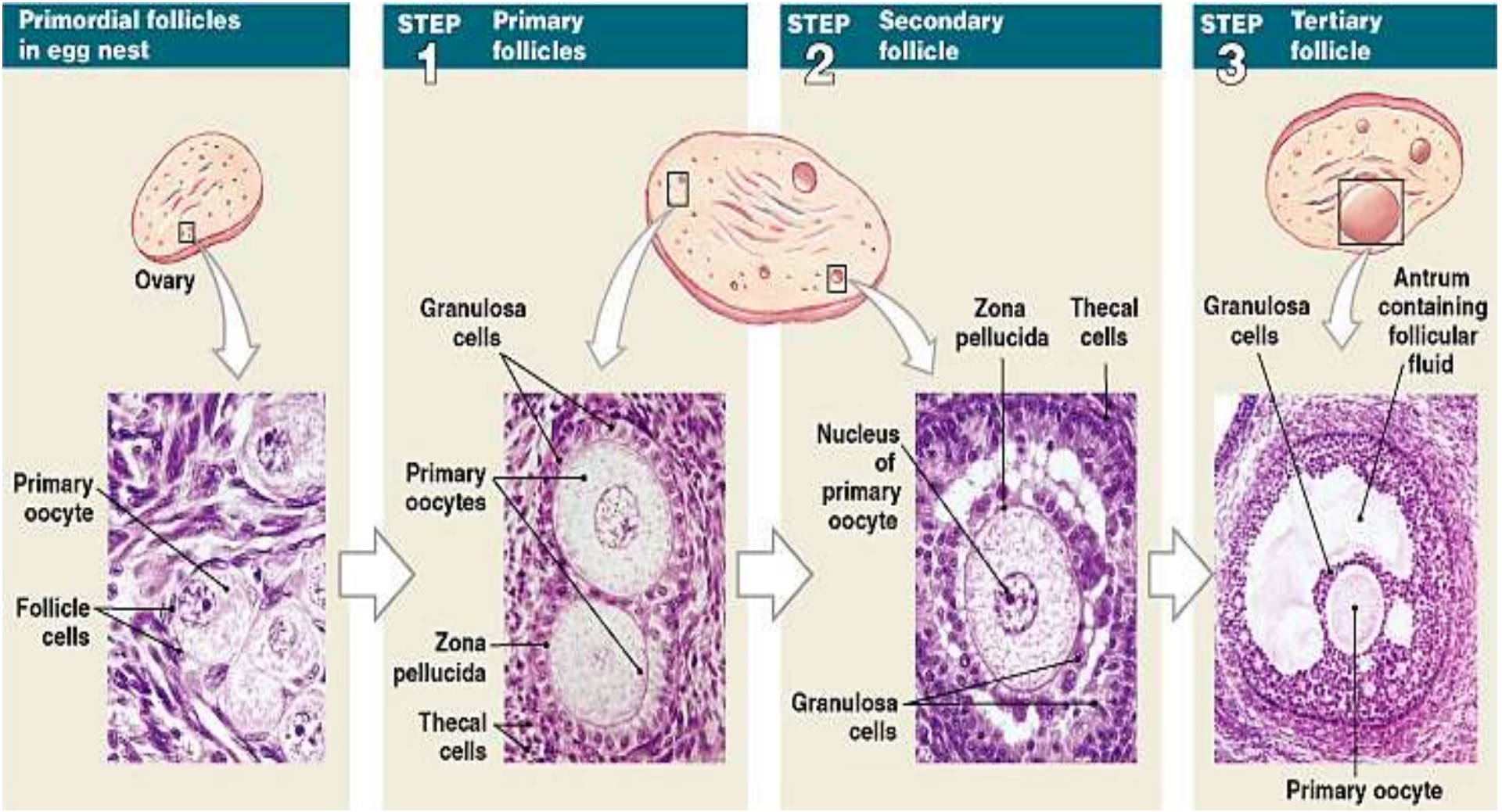
Ovarian Cycle

- **FSH AND LH produce cyclical changes in ovaries**
- **<u>Follicular Phase</u>:**

The development of one primary follicle to form a mature follicle. {Estrogen}

Core Knowledge

Follicular phase



Core Knowledge

Ovulation

In the **days** prior to ovulation, under the influence of **FSH and LH:**

vesicular follicle grow rapidly to the diameter or 25 mm,
meiosis I is completed, secondary oocyte is formed
meiosis II is initiated but oocyte is arrested in **metaphase 3 hours before the ovulation**

Stigma appears on the surface of ovary

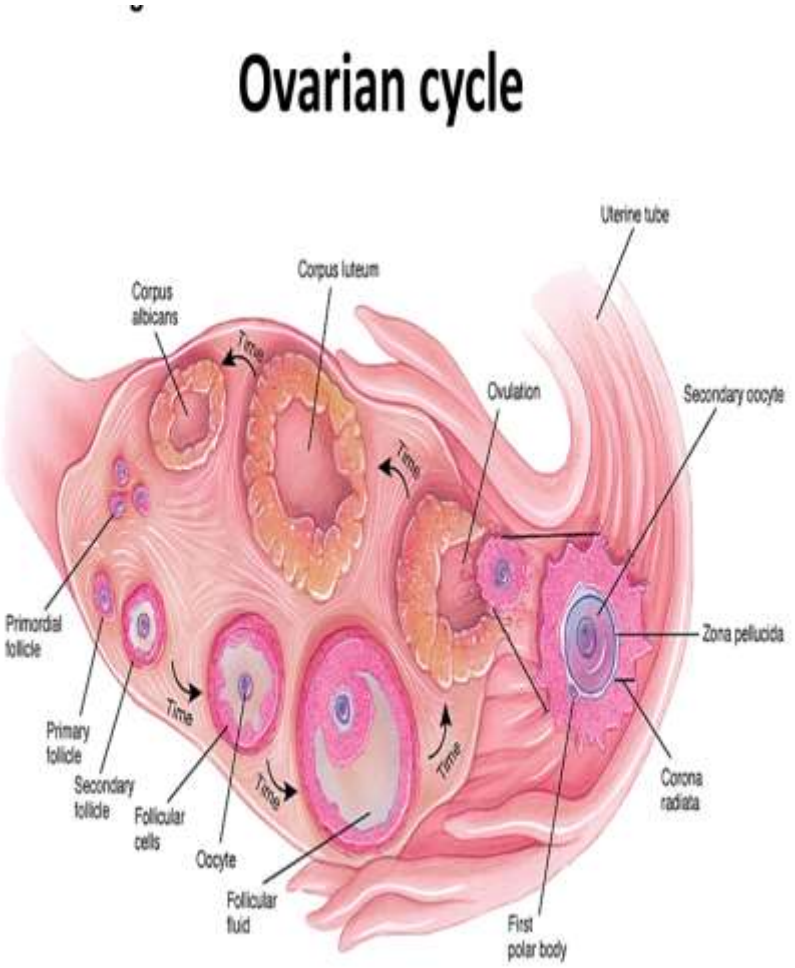
Ovulation is triggered by **LH surge** an follows LH peak by 12-24 hrs.

LH surge elicited by high estrogen level in blood causing stigma to balloon out-vesicle –**rupture-expelling secondary oocyte** with fluid

Core Knowledge

Ovulation

- Rupture of the mature follicle to release the ovum.
- **Increases collagenase activity** so collagen surrounding the follicle is digested.
- **Prostaglandin** levels also increases in response to LH and cause local muscular contraction in the ovarian wall.
- Expelled oocyte is surrounded by zona and one or more layers of follicular cells arranged radially **Corona radiata**



Corpus luteum

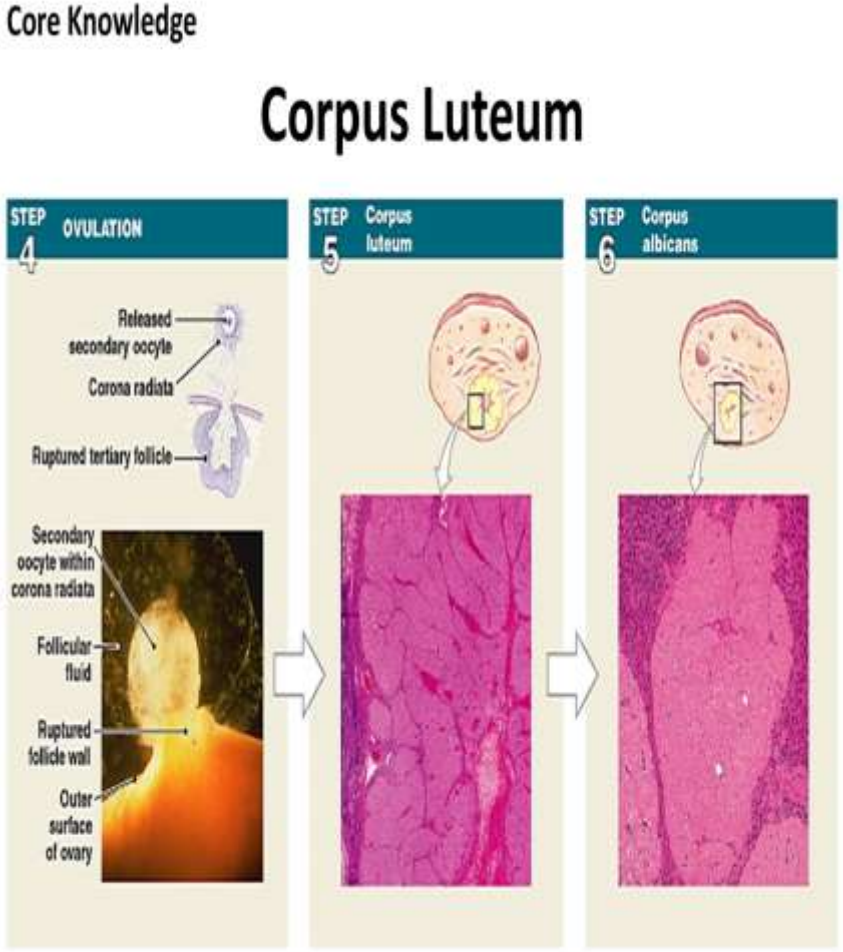
- After ovulation granulosa cells in the wall of ruptured follicle , together with cells of theca interna are vascularized by the surrounding structures
- Under the influence of **LH** these cells develop a yellowish pigment and changed into **lutein cells** which secrete **estrogen and progesterone,** and this progesterone causes uterine mucosa to enter **progestational or secretory phase**

Corpus luteum of pregnancy

- If oocyte is fertilized-corpus luteum enlarges to form **Corpus luteum of pregnancy**.
- Hormones production increases
- Degeneration is prevented by HCG-secreted by synctiotrophoblast
- Remains functionally active through first 20 weeks of pregnancy then placenta takes over

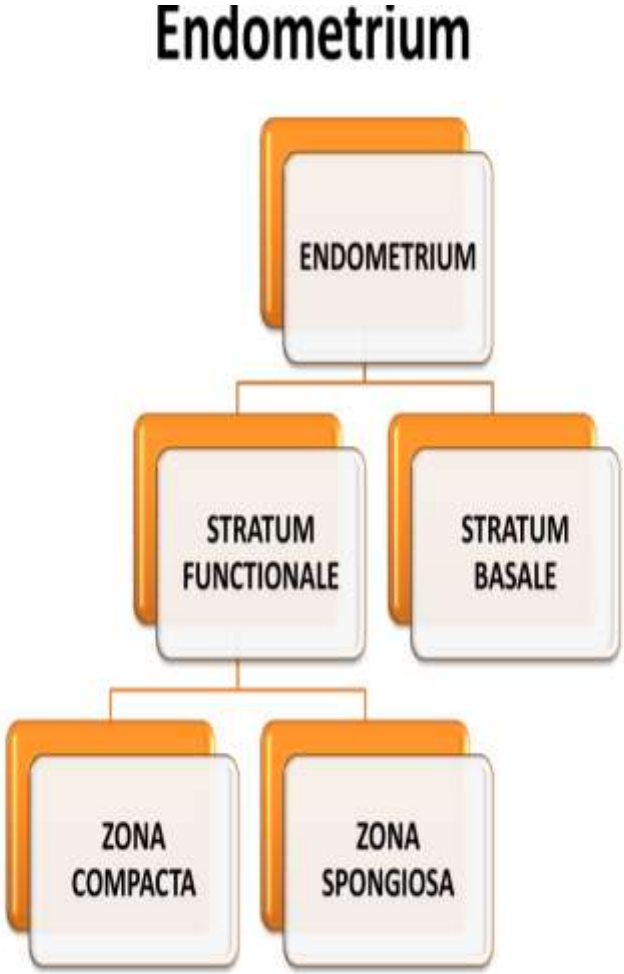
Corpus Albicans (CA)

- If fertilization does not occur , the corpus luteum reaches maximum development **9 days after ovulation–Corpus luteum of menstruation.**
- Subsequently CL shrinks because of degeneration of lutein cells (luteolysis) and form a mass of fibrotic scar tissue - **corpus albicans.**



Menstrual cycle

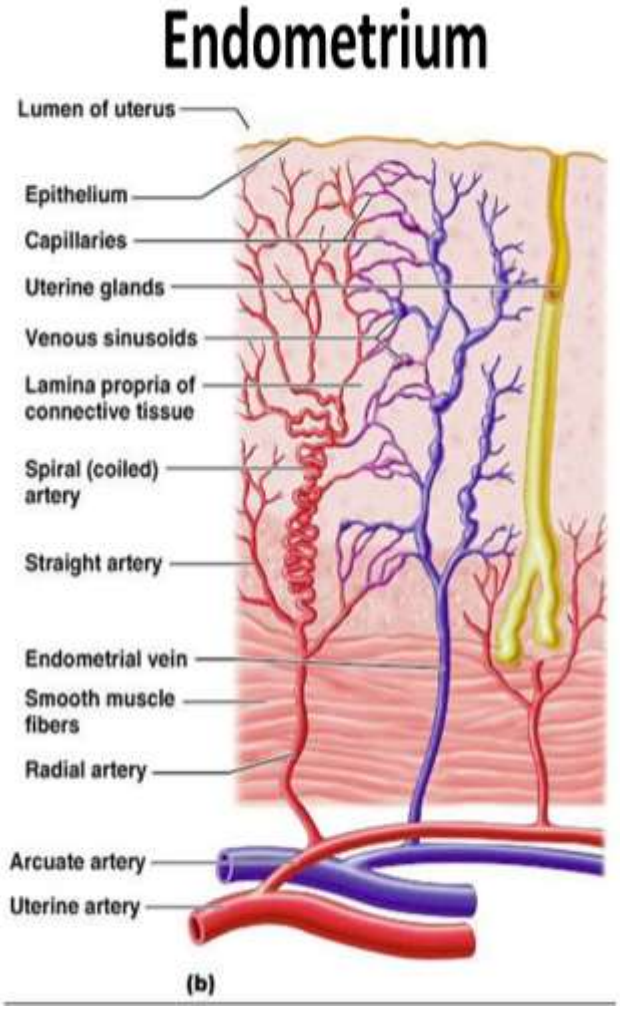
- Is the time during which oocyte mature is ovulated and enters the uterine tube
- Hormones produced by ovarian follicles and corpus luteum estrogen and progesterone produce cyclical changes in endometrium
- These monthly changes in internal layer of uterus constitute **Endometrial cycle or Menstrual cycle**



Core Knowledge

Menstrual cycle

- The first period usually begins **between 12 and 15 years** of age, which is known as **menarche**.
- Typical length of time between the first day of one period and the first day of the next is 21 to 45 days in young women and **21 to 35 days** in adults (**an average of 28 days**).
- Menstruation stops occurring after **menopause** which usually occurs between **45 and 55** years of age.
- Bleeding usually lasts around **2 to 7** days.



Core Knowledge

Endometrium

Two layers (zones)

- Functionalis

  Thick, superficial (surface epith.,lam. prop,., & gland)

  Rich capillary network(coiled arteries)

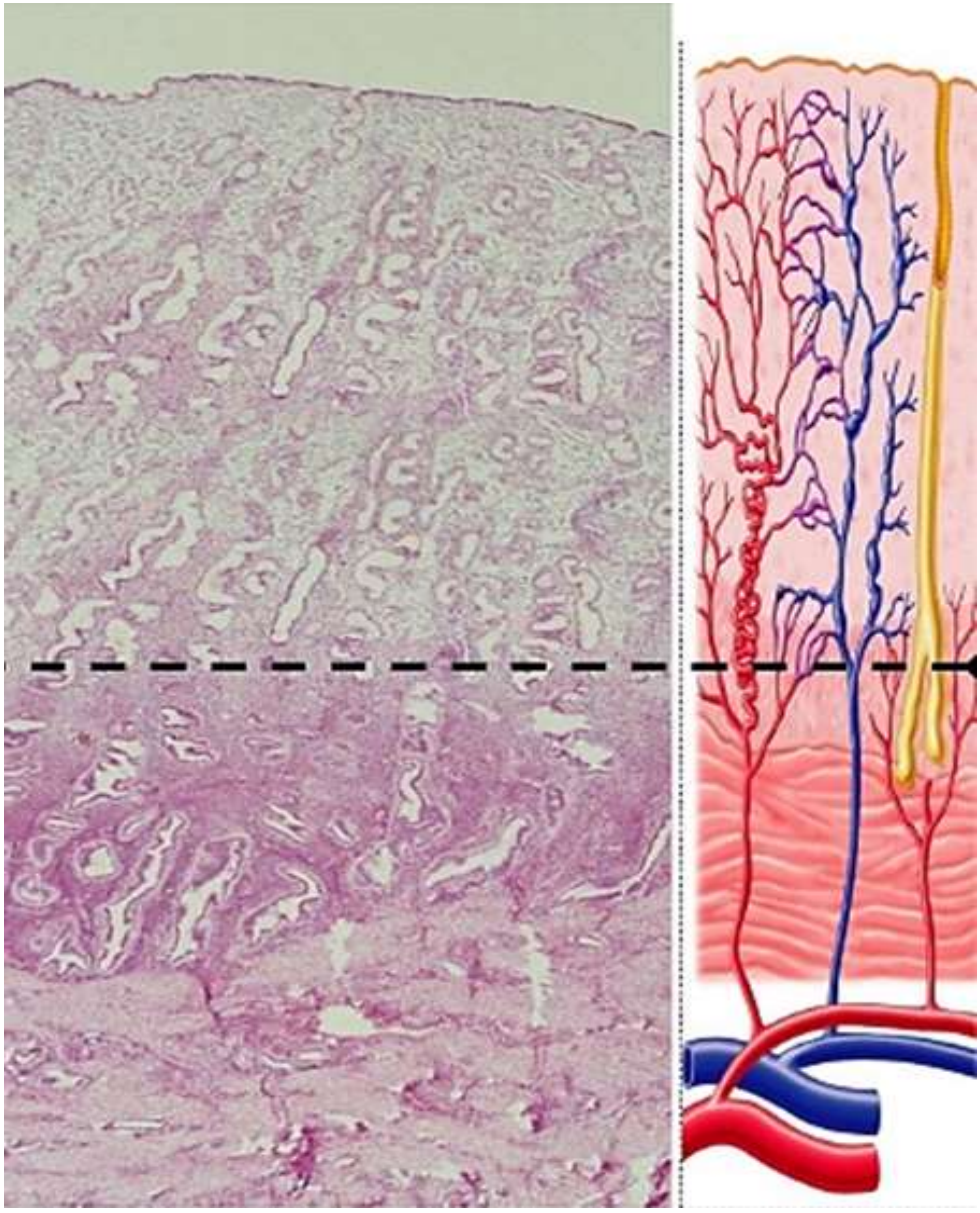
  Sloughed at menstruation

- Basalis

  Deep., narrow (lam. Prop., & gland)

  Straight arteries

  Regenerate functionalis layer each cycle



Uterine cycle

Menstruation:- Breakdown of the uterine endometrium and vaginal bleeding due to low estrogen and progesterone levels.

Proliferative Phase:- Growth of the uterine endometrium under estrogen stimulation.

Secretory Phase:- Stimulation of the uterine glands' secretion by progesterone.

Menstrual phase

- **Functional layer** of uterine wall is sloughed off
- Lasts for **4-5 days**
- Blood discharged is combined with small pieces of endometrial tissue
- Eroded endometrium is thin

Proliferative phase (follicular, estrogenic)

- Spans from **6-14 days** (approx. 9 days)
- Coincides with growth of ovarian follicles
- Controlled by **estrogen** secreted by follicles

2-3 fold increase in the **thickness and water content of endometrium**

Surface epithelium reforms and covers the endometrium

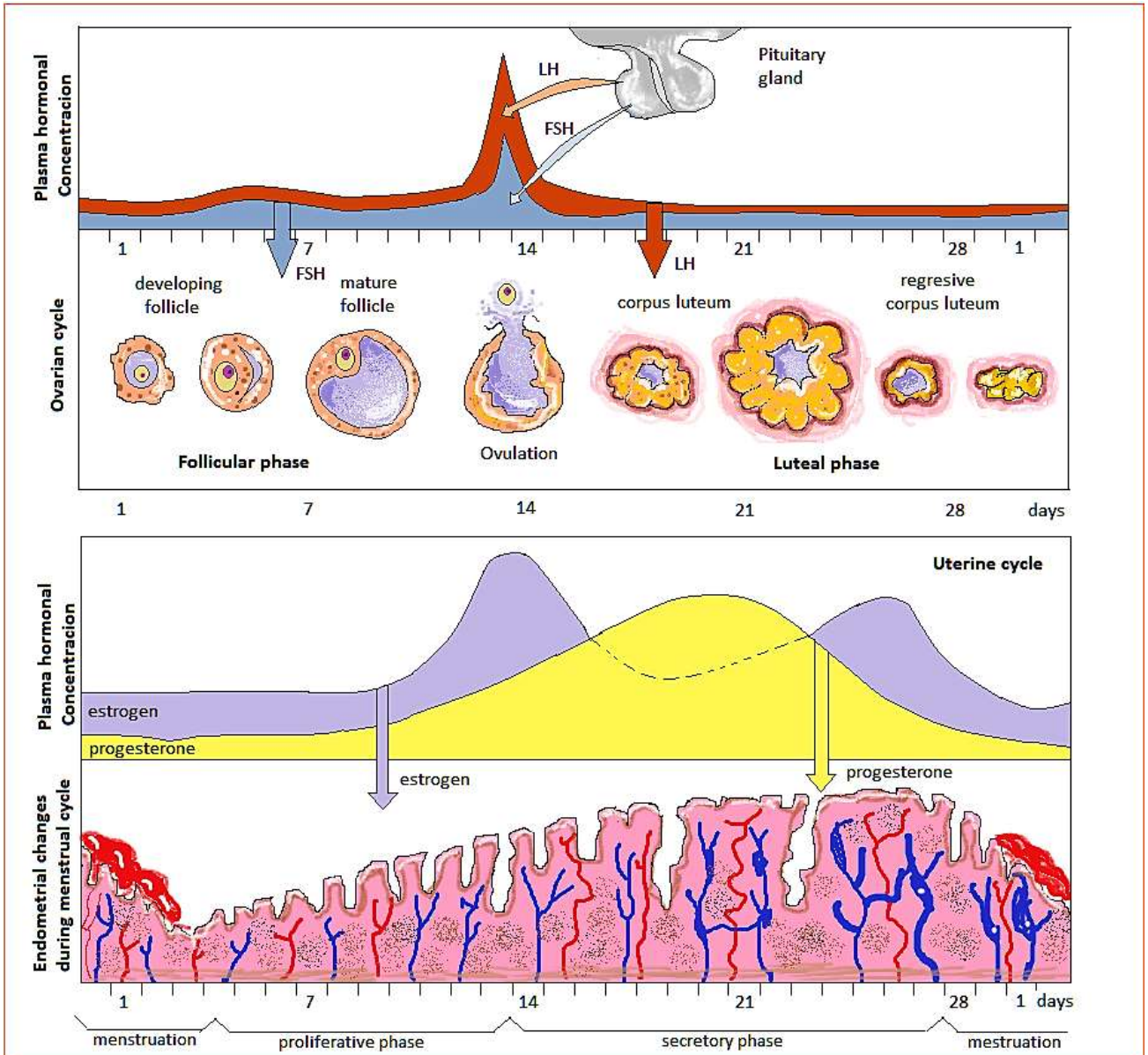
Glands increases in number and length

Spiral arteries elongates

Cervical mucus thins out

Core Knowledge

Uterine Cycle



Luteal phase (Secretory, Progesterone)

From **15-18 day**
Lasts approx. **13 days**

Progesterone produced by corpus luteum stimulates **glandular epithelium** to secrete a **glycogen rich material**

Endometrium thickens

Glands become wide, tortuous and saccular

Spiral arteries becomes more coiled as they grow in superficial compact layer

Venous network becomes more complex and LACUNAE

If fertilization <u>does NOT</u> occur:

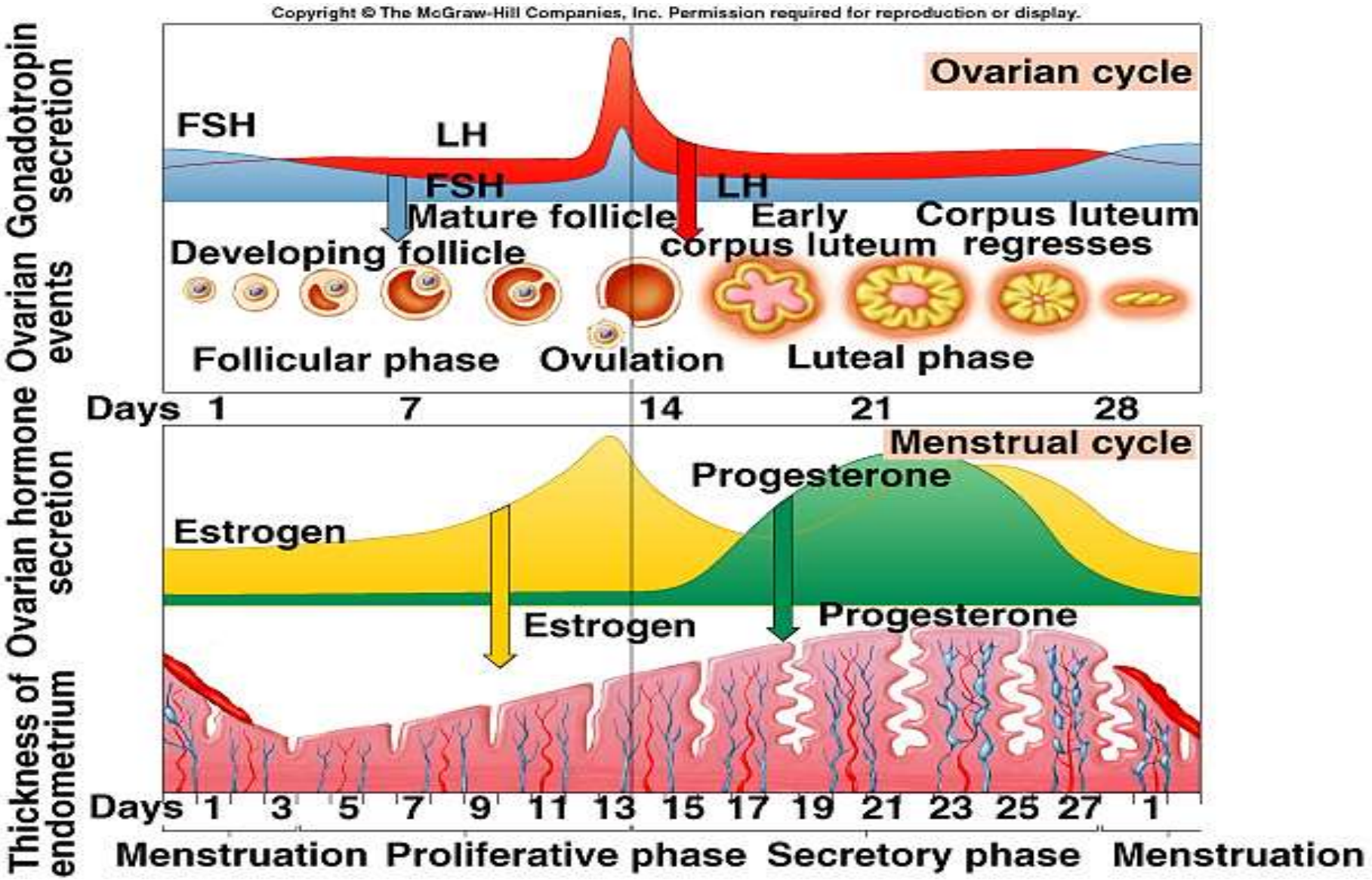
- Corpus luteum degenerates
- Estrogen progesterone level falls
- Secretory endometrium enters **ischemic phase**
- Menstruation occurs

Ischemic phase

- Occurs when oocyte is **NOT fertilized**
- Ischemia occurs as **spiral arteries constrict**
- Constriction results because of decreased secretion of hormones- **progesterone**
- Vascular changes and hormone withdrawal results in **stoppage of glandular secretion, loss of fluid, shrinkage of endometrium**
- Spiral arteries become constricted for longer periods→**VENOUS STASIS→patchy necrosis**
- Rupture of damaged vessel wall follows→blood seeps into surrounding CT
- Pools of blood forms→bleeding in uterine lumen

Core Knowledge

Cycle of Ovulation and Menstruation



Anovulation(KLM pg 22)

- Some women do not ovulate because of inadequate release of gonadotrophins
- Ovulatory agents such as **clomiphene citrate**
- Stimulates release of pituitary gonadotrophins FSH and LH
- Maturation of several ovarian follicles and multiple ovulations
- Multiple pregnancies increases tenfold
- Spontaneous abortion occurs

Causes Of Infertility In Females

- Occluded uterine tubes
- Hostile cervical mucus
- Anovulatory cycles
- Pelvic inflammatory diseases

Let’s Recap

Covid-19 infection and changes in the female menstrual cycle

Chourasia U H, Khormi A H, Jawkhab H A, et al. (December 12, 2022) Determining the Effect of COVID-19 on the Menstrual Cycle Among Women of Reproductive Age Group in the Jazan Region: A Cross-Sectional Study. Cureus 14(12): e32431. doi:10.7759/cureus.3243

- Did the COVID-19 infection and the associated physical impact and psychosocial turmoil affect the menstrual cycles of women? The short answer-YES.

Artificial Intelligence (AI) & PCOS

- Artificial intelligence (AI) and machine learning (ML) can effectively **detect and diagnose** PCOS, which is the most common hormone disorder among women, typically between ages 15 and 45, according to a new study by the National Institutes of Health.
- Accuracy of diagnosis via AI and ML ranges from **80-90%.**

Reference: Barrera FJ, Brown ED, Rojo A, Obeso J, Plata H, Lincango EP, Terry N, Rodríguez-Gutiérrez R, Shekhar S. Application of machine learning and artificial intelligence in the diagnosis and classification of polycystic ovarian syndrome: a systematic review. Frontiers in Endocrinology. 2023 Sep 18;14:1106625.

Take Home Message

- PCOS is the commonest cause of anovulation and a leading cause of infertility with **70% of cases remaining undiagnosed.**

- Weight reduction is an underutilized yet highly effective strategy for combating infertility in patients of PCOS.

Learning Resources

- Langman's Medical Embryology, 14th Edition
- The Developing Human: Clinically Oriented Embryology KLM Embryology
- Textbook of Clinical Embryology (Kevin Coward, Dagan Wells)
- Google Scholar
- Google images


Thank
You!