MENSTRUAL CYCLE

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MENSTRUAL CYCLE

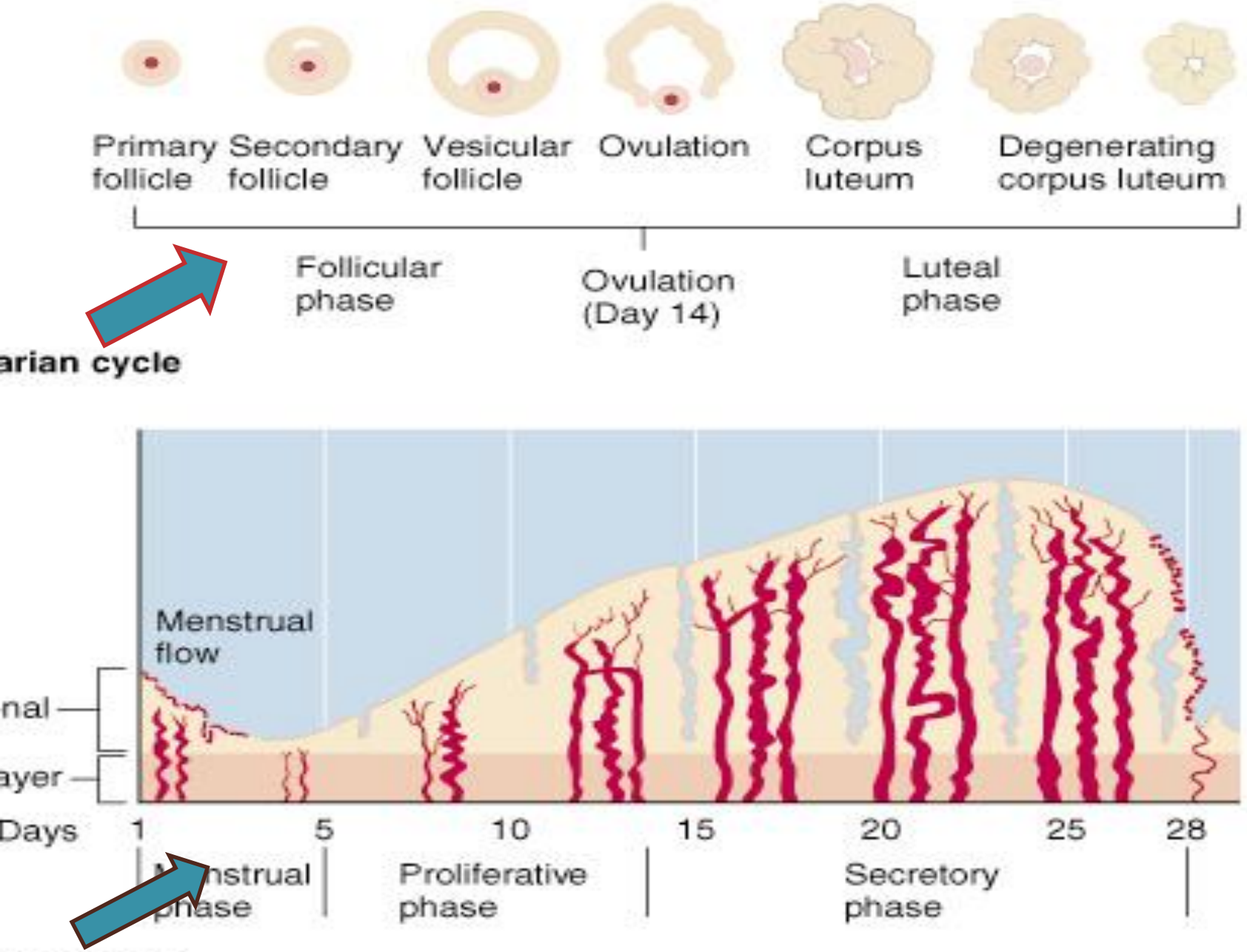
- The Menstrual Cycle describes the cyclic changes in woman's body going through Menstruation , Follicular Phase, Ovulation, Luteal Phase and back to menstruation to begin the cycle.
- Every reproductive organ undergoes cyclic changes during each menstrual cycle.

- Begins at Puberty & Ends with Menopause
- Mean Duration of MC: Mean 28 days (Only 15%)

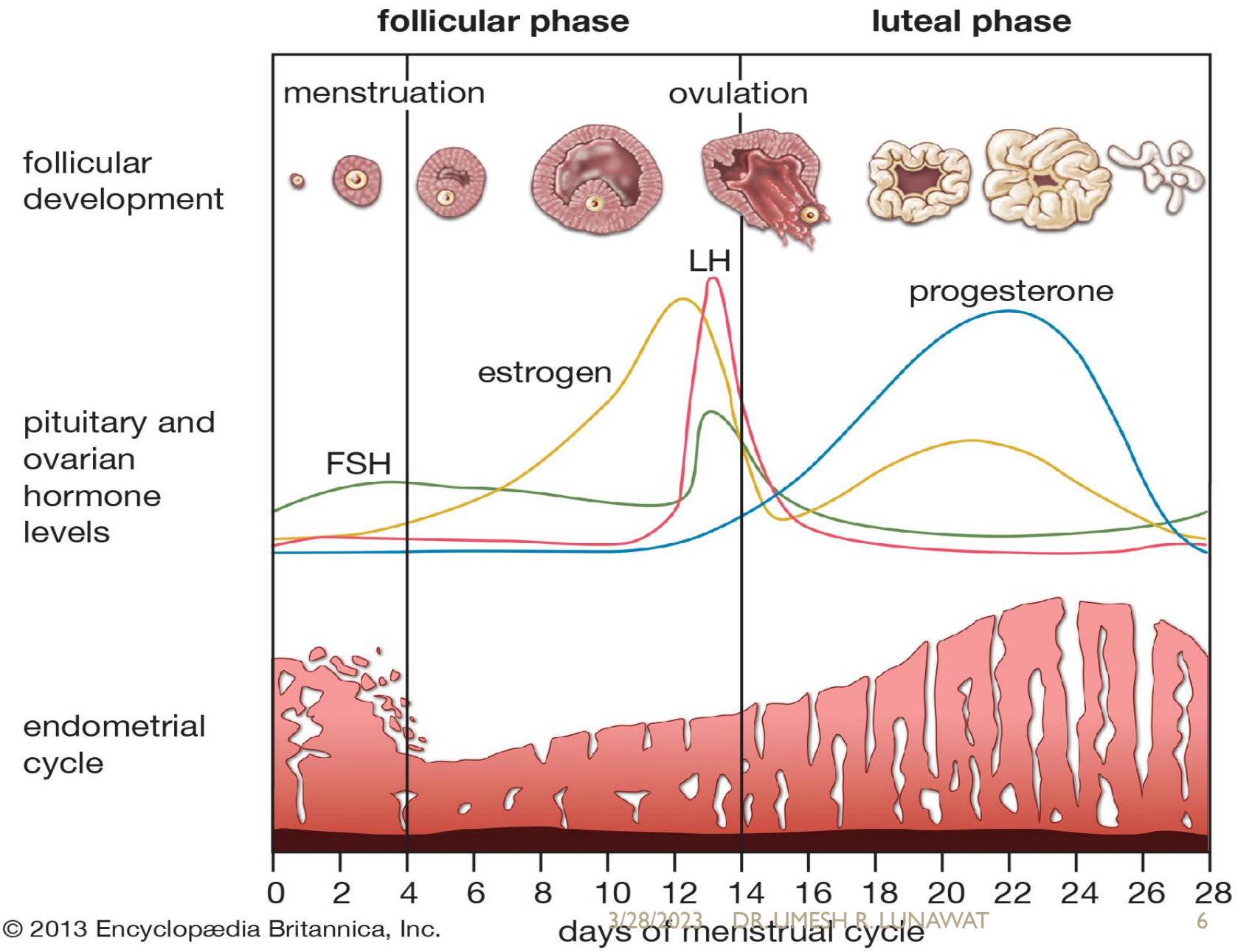
  Range 21 – 35 days
- Average Duration of menses: 3 – 8 days
- Normal estimated blood loss: Approximately 30 ml

  Range – 20 to 80 ml
- Menstrual Discharge Consists: Dark altered blood, mucus, vaginal epithelial cells, Fragments of endometrium, PGs, Enzymes, Bacteria
- Phases of Cycle maintained by: HPO axis

	OVARIAN CYCLE	ENDOMETRIAL CYCLE
FIRST 14 DAYS	FOLLICULAR PHASE	MENSTRUAL + PROLIFERATIVE PHASE
14^{TH} DAY	OVULATION	
14^{th} TO 28^{th} DAY	LUTEAL PHASE	SECRETORY PHASE



The menstrual cycle



OVARIAN CYCLE

It includes :-

FOLLICULAR PHASE

a. Recruitment of group of follicles

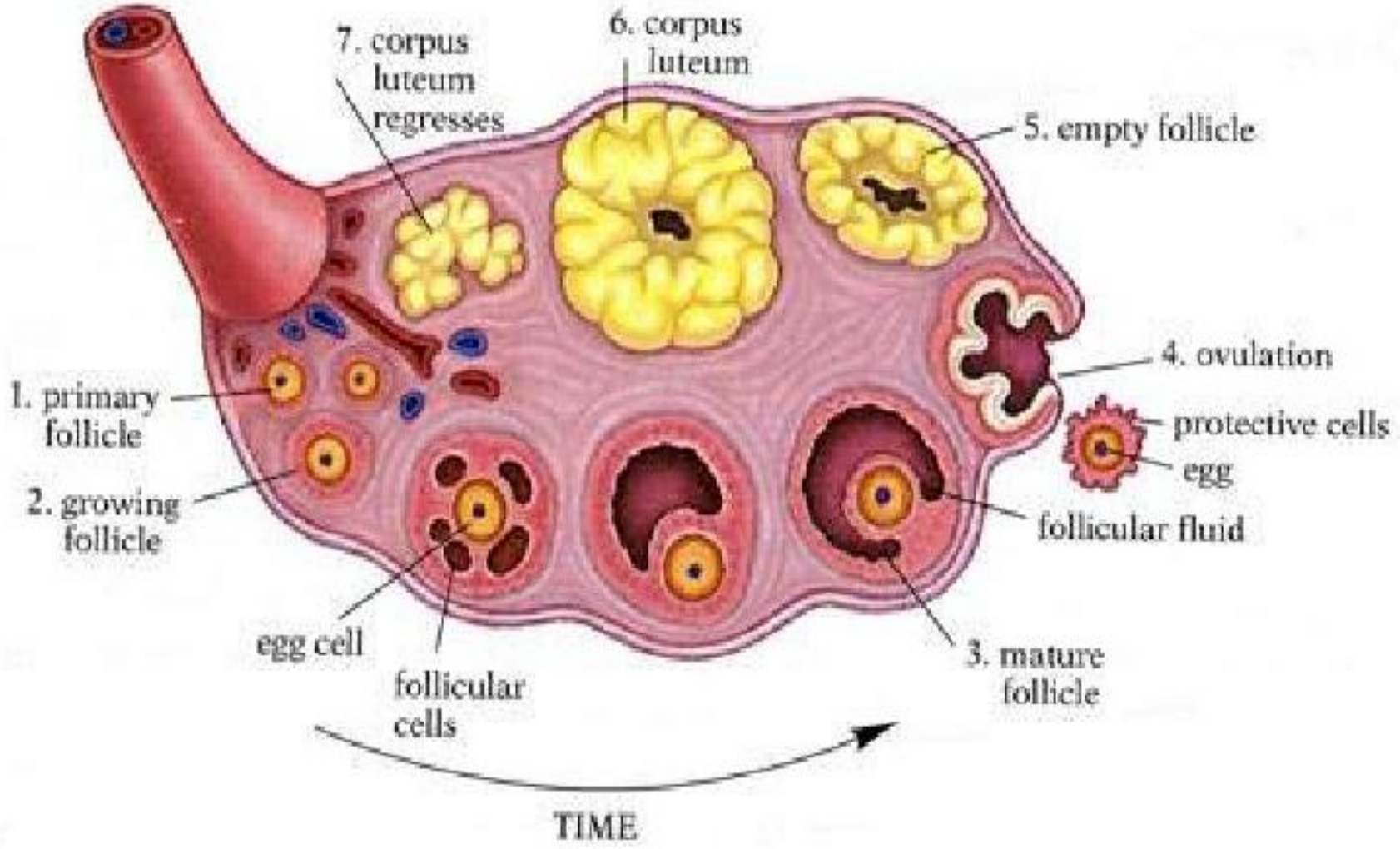
b. Selection of Dominant Follicle and its Maturation

OVULATION

LUTEAL PHASE

a. Formation of Corpus Luteum

b. Degeneration of Corpus Luteum


7. corpus luteum regresses
6. corpus luteum
5. empty follicle
4. ovulation
protective cells
egg
follicular fluid
1. primary follicle
2. growing follicle
egg cell
follicular cells
3. mature follicle
TIME

What hormones level?

- **Follicular Phase**

Estrogen . Inhibin, Progesteron – Low levels

FSH, LH start to Increase under influence of GnRH

FSH – Development of follicle, Increases receptors for FSH (on granulosa cells) & LH (on theca cells)

Develping Follicle start to secrete Estogen

Rise in Estrogen – Negative feedback to Pitutiary --- fall in FSH ---- Atresia of other follicles

LH – Stimulates Theca cells to secrete Androstenedion which converts to estrogen by Granulosa cells

In midcycle – estrogen gives positive feedback to Pitutiary to secrete more FSH, LH --- Ovulation

Luteal Phase –

Corpus luteum secretes – Progesterone (higher conc)

- Estrogen (Low Conc.)

FSH, LH decreses due to negative feedback of E & P

Menstural Phase-

No conception – Degeneration of CL – Sudden Fall in P & E

- **Primary Oocytes: (Egg cells)**

  Oocytes arrested in Diplotene stage (Prophase) of First Meiotic division

  At puberty 4 lakh Primary oocytes present in ovary

- **Primordial Follicles**

  Primary oocytes surrounded by single layer epithelial flat cells granulosa cells (follicular cells)

  Each month 15- 20 primordial follicles start to develop in primary follicles (Recruitment of follicles)

- **Primary follicles:**

  Flat granulosa cells convert to Cuboidal granulosa cells

  FSH acts on Primary follicles to develop in Secondary follicles

- **Pre-Antral follicle (Secondary Follicle)**

  Zona Pellucida develops in between granulosa cells and primary oocyte

  Oocyte surrounded by Zona Pellucida, several layers of Granulosa cells & Theca cells (derived from stromal cells of ovary)

- **Antral Follicle/ Graffian follcile**

  Granulosa cells secrete lot of fluid in small spaces. Small spaces fuses to form one single space call Antrum of follicle

  Oocyte completes its first meiotic division to form secondary oocyte and first polar body

  Well grown GF creats pressure on wall of ovary to form projection on surface, As a result of pressure it forms avascular area called as Stigma. Dilated blood vessels results in more secretion fluid inside follice results in increase in Intrafollicular pressure

  Due to this pressure the Secondary oocyte released

Ovulation:

- Release of Secondary oocyte from graffian follicle
- Occurs approximately 32-36 hrs after onset of LH surge.
- Combined LH/FSH midcycle surge is responsible for – final stage of maturation of follicle, completion of first meiotic division of oocyte with extrusion of first polar boyd and expulsion of oocyte (ovulation)

- **Formation of Corpus Luteum**

  Collapsed graffian follicle with irregular walls

  CL cells swells up and accumulate lot of fat globules(cholesterol)- Yellow color

  CL – Temporary endocrine gland in female

  CL start to secrete Progesterone and continues up to 10 -12 days

  Progesterone Endometrium becomes warm and red carpet like structure

- **Corpus Albicans:**

  - Degenerated Corpus luteum

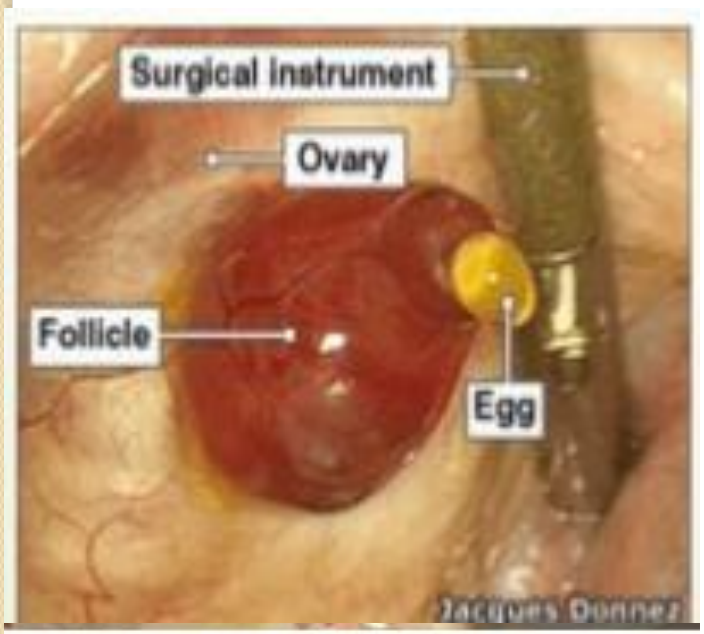
  - Secretory cells of CL phagocytosed by macrophages & replaced by fibrous material

  - Fall in Progesterone, Estrogen, inhibin level

OVULATION

WHAT IS OVULATION ?

Ovulation is when mature egg is released from the ovary, pushed down the fallopian tube, and is available to be fertilized



Time Of Ovulation –

-Varies according to length of cycle

- Generally occurs 36-48 hours after LH Surge (Which occurs 11-13 days of cycle)

- around 14 days before your expected date of period

- Close to day 14 Of Cycle

Causes of ovulation

- LH surge – secondary to sustained peak level of estrogens in late follicular phase. This will cause completion of reduction divison in oocyte & lutenisation of granulosa cells, synthesis progesterone & prostaglandins.

  LH – collagenase action – digestion of collagen fibers around follicle

- FHS rise- leads to plasminogen it hepls in lysis of follicle
- Stretching Factor – Passive stretching
- PG – Increase muscular contraction

Signs Of Ovulation

A) Changes in Cervical Mucus

a) Clear, Thin, Slippary, Stretchy, - Estrogen

b) To allow sperm to pass through cervix

c) blood stained mucus discharge

B) Rise in body temperature

c) Abdominal discomfort: (Mittelschmerz Syn) / Ovulation Pain

Some woman – cramps in lower abdomen

Test for ovulation

- USG – Collapsed follicle , Free Fluid in POD
- Home kits – Tests for LH surge – Ovulation 24 hours later
- BBT – Rise in temp – 0.3 -0.5 F after ovulation. Temp have to take at same time each morning
- Progesterone blood level (on day 21-23 of cycle) – Most reliable

Importance / Significance

- Contraception
- Time of Conception
- Plan some procedures in ART (Artificial Reproduction technique) like

  - I.U.I. (Intra Uterine Insemination)
  - Egg collection

Revise about Endometrium

- Inner lining of Uterus

Superfical Layer	Basal Layer
Stratum Functionalis (2/3rd layer	1/3 rd of layer which lies in contact with myometrium (About 1 mm)
	Stromal cells compactly placed
Influenced by Hormones , so shows cyclic changes	Uninfluenced by hormones, So nocyclic changes occurs
Sheds during menses	Helps to regenerate superfical layer
Spiral Arterioles	Straight arterioles

Endometrial cycle

- Changes in endometrium during menstrual cycle
- Influenced by the cyclical production of steroid hormones(estrogen, Progesterone)
- Without Estrogen & Progesterone– Endometrium breaks down – menstruation occurs

- **Menstrual Phase (Menstruation)**

- External hallmark of menstrual cycle
- Periodic desquamation of endometrim
- Fall in estrogen , Progesterone
- Just before menstruation endometrium is infiltrated with leucocytes and prostaglandins
- PG ⟶ Constriction of spiral arterioles ⟶ Ischemia and desquamation

  Followed by arteriole relaxation , bleeding and tissue breakdown

  Blood along with superficial functional layer sheds into uterine cavity ⟶ coagulates ⟶ soon liquifies by plasmin

- Mechanism behind flow stop:

  - Prolonged vasoconstriction

  - myometrial constriction

  - local aggregation of platelets

  - deposition of fibrin around vessels

  - Resumption of estrogen results in repair of blood vessels and endometrium

Just to revise….

- Duration – 3 to 8 days
- Quantity – 20 to 80 ml (Avg.=30ml)
- Flow pattern – Crescendo-Decrescendo

  (amount increases gradually to reach maximaum, then decreases gradually)
- Quality- bright red color / brown

  No foul odour

  small lots in flow normal feature
- Associated symptoms – mild lower abd pain, cramping, irritability, diarrhoea, constipation, vomiting, breast fullness/tenderness etc

Regeneration stage

- Regeneration of degraded endometrium and its components
- Regeneration starts even before menstruation stops
- Completes 2-3 days after end of menstruation

  Cubical surface epithelium – from gland lumina & stromal cells

  New blood vessels – from stumps of old vessles

  Glands & stromal cells – from remnants in basal zone

  THICKNESS = AVG. 2 mm

Proliferation Stage

- **Duration** – from 5th day till ovulation (14th day)
- **Endomentrim under influence of** - Estrogen
- **What happens?** - mitotic activity in glands & stroma

  - increases endometrial thickness from 2 to 8 mm

Endometrial glands – tubular and lie perpendicular to surface

Epithelium – Columnar with nuclei at base

Epithelium of one gland continuous with other

Stromal cells – Spindle shaped, compact

Spiral vessels – extends to below epithelium to form loose capillary network **Subepithelial congestion**

Secretory Stage

- **Duration** – after ovulation till few days before menses (14 days)
- **Endometrium under influence of** – Progesteron & Estrogen
- Progesteron can only act on endometrium previously primed by oestrogen
- **What happens?** – mitotic activity get restricted

  Before 21st day of menses

  Epithelium – More columnar, ciliated at places

  Glands – increase in size, Corkscrew shaped

  - Subnuclear vacuolation due to glycogen production

  - Saw toothed glandular epithelium

  Stromal cells – Edema, Enlargement
- Blood vessels – Spiralling of vessels

- After 22nd – 23rd day

  - Disappearance of subnuclear vacuolation as nucleus pushed towards basement membrane

  - glycogen reach fluid reach to uterine cavity to nourish fertilized ovum

  - Endometrial growth ceases 5-6 days prior to menses in infertile cycle

  - Regressive changes pronounced 24-48 hrs prior to menstruation

  - Subepithelial capillaries & spiral vessels engorged

  - Intense spasm in arterioles at basal parts results in anoxaemia

  - Stromal cells – Infiltration of leucocytes & monocytes

Cervical cycle

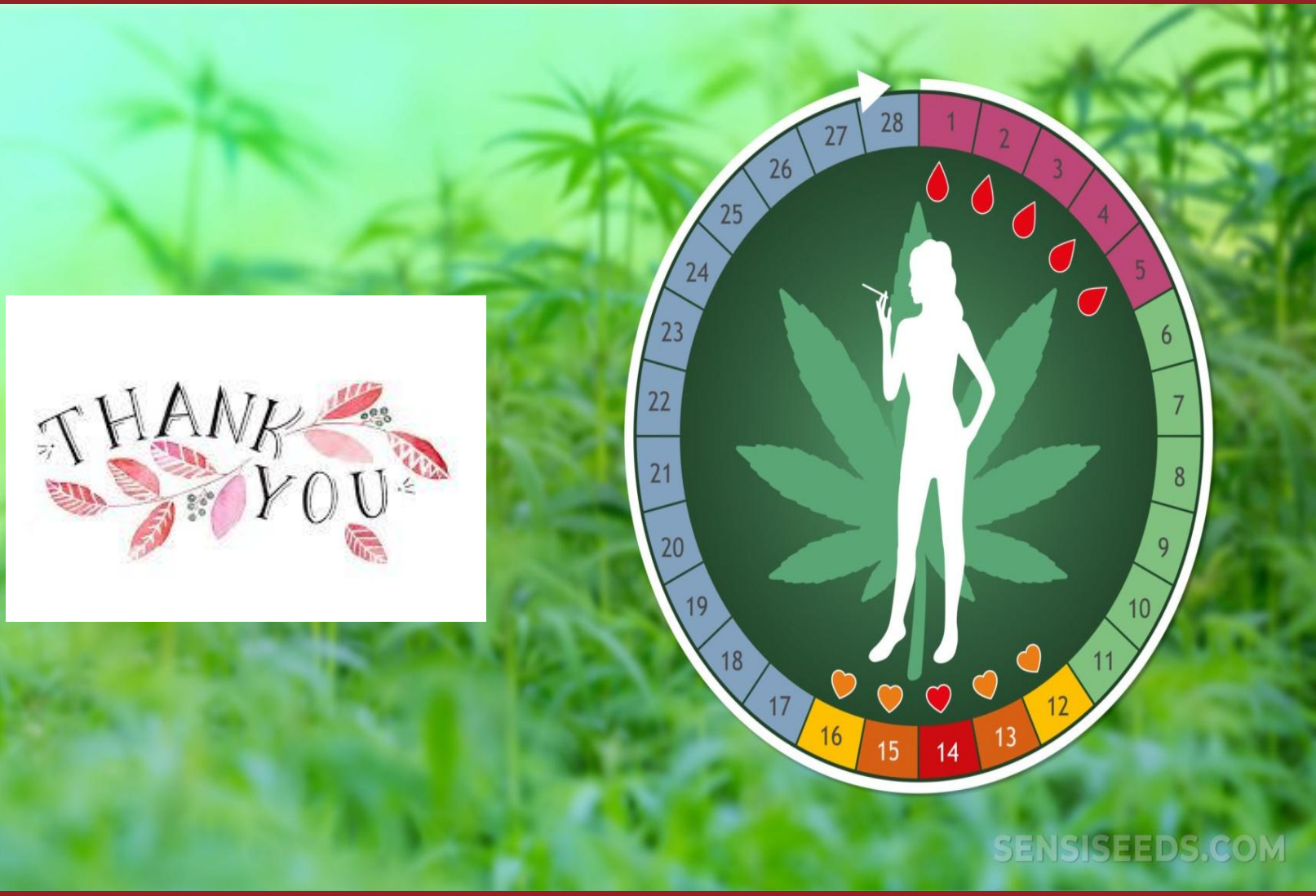
- Changes in Cx during phases of M.C.

FOLLICULAR PHASE	LUTEAL PHASE
ESTROGEN EFFECT	PROGESTERONE EFFECT
Int Os – Funnel Shaped	Tightly closed
Mucus- Thin, watery	Thick , Viscid
Stretchability – increased to beyond 10 cm	Lost
Fern tree patter present	Lost
Glycoprotein network – Parallel, thus facilitating sperm penetration	Interlacing bridges, preventing sperm penetration
Glandular epithelium – Taller	Glands- More branched

Vaginal cycle

- Changes in vaginal cytology & Secretion

Follicular Phase	Luteal Phase
Cytology – preponderance of superficial large cornified cells with pyknotic nuclei	Prepondarance of intermediate cells with folded edges (Navicular cells)
Background of smear – Clear	Dirty due to presence of leucoctyes and bacilli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