FEMALE REPRODUCTIVE SYSTEM — Anatomy & Physiology

Gametes – sex cells
Gonads – organs

(*) EXTERNAL GENITALIA – "VULVA"
✓ can be directly INSPECTED (except glands)

▽ ↑ age = ↓ estrogen = atrophy of vulvar organs ▽

(1.) MONS PUBIS — "Mons Veneris"
- covers front of symphysis pubis; covered c/ pubic hair
- protects the pelvis esp. during coitus

(2) LABIA MAJORA
- longitudinal, raised folds of pigmented skin
- covered by hair follicles & sebaceous glands

(*) Dartos muscle sheet – responsible for the wrinkled appearance of labia majora
- c/ q pregnancy, the labia majora becomes < prominent
- (+) extensive (lymphatic supply) & (venous network)
  - lymphatic supply → facilitates spread of cancer
  - venous network → varicosities may occur during pregnancy & obstetric/sexual trauma may cause hematomas

(*) L1 – S3 → nerves that supply the labia majora
↳ certain regional blocks will affect them & cause numbness

(3.) LABIA MINORA
- soft folds of skin c/in the L. majora that converge near the anus → "FOURCHETTE"
- rich in sebaceous glands (lubricates & provides bactericidal secretions)
  - sebaceous cysts are common
- ↑ tactile nerve endings (vulvovaginitis in this area: very irritating)
- ↑ size @ puberty
- ↓ size p/ menopause

— changes in estrogen levels

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(3.) CLITORIS – b/w labia minora
- erectile tissue
- partly covered by PREPUCE / CLITORAL HOOD
- ↑ blood vessels & nerve supplies
- PRIMARY EROGENOUS ORGAN OF WOMEN
- secretes SMEGMA ← has a unique odor & may be sexually stimulating to men

(4) URETHRAL MEATUS (Ø true part of female repro. system)
- 1-2.5 cm beneath clitoris in the midline of vestibule
- puckered, slitlike opening

(5.) PARAURETHRAL GLANDS – "Skene's Glands"
- opens into the posterior wall of the urethra close to its opening
- lubricates the vaginal opening to facilitate sexual intercourse

(6) VAGINAL VESTIBULE
- contains the vaginal opening – "INTROITUS" → border b/w external & internal genitalia

(*) HYMEN
- thin, elastic collar / semicollar of tissue surrounding the vaginal opening
- AVASCULAR
- ↑ free nerve endings : receptors to pain

(*) VULVOVAGINAL GLANDS – "Bartholin's Glands"
- secretes a clear, thick, alkaline mucus that enhances the viability & motility of sperm deposited in the vaginal vestibule
- can harbor Neisseria gonorrhea ← (+) pus formation & abscess

PERINEAL NERVE – innervates the vestibular area
↳ fr. sacral plexus

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⑦ PERINEAL BODY (❌ true part of female repro system)
- wedge-shaped mass of fibromuscular tissue
- b/w lower part of vagina & anus

① External sphincter ani
② Levator ani (superficial & deep transverse perineal)
③ Bulbocavernosus

} muscles that meet @ the perineal body

- @ last part of labor — perineal body thins out
- often the site of episiotomy / lacerations during childbirth

⑧ INTERNAL GENITALIA

① VAGINA — muscular & membranous tube that connects the external genitalia & the uterus
- extends fr vulva to uterus
- "BIRTH CANAL" ← forms the lower part of the pelvis through which the fetus must pass during birth

Vaginal vault - upper part of vagina & very thin walls

Vaginal Fornix - recess/hollow around the cervix

Rugae - covers the walls of vagina that allows vaginal tissues to stretch enough for the fetus to pass through during childbirth

* ACIDIC vaginal environment } moist d/t secretion of vaginal epith.
- maintained by symbiosis b/w lactic acid producing bacilli (Doderlein bacillus/lactobacillus) & vaginal epith. cells
  - contains glycogen
    - amount is regulated by ovarian hormones
    - broken down by bacilli into lactic acid!
- normal ONLY during the mature repro. yrs & 1st days of life
- pH 7-5 (neutral)
  - normal fr infancy → puberty & ❌ menopause

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(*) Vaginal lymphatics → drain into external & internal iliac nodes, hypogastric nodes & inguinal glands

(*) Posterior wall → drains into nodes lying in the rectovaginal septum

Pudendal nerve → supplies lower 3rd of the vagina
↓
so the sensation during sexual excitement & coitus is reduced + vaginal pain during 2nd stage of labor

FXNS OF VAGINA:
→ passage for sperm & fetus during birth
→ passage for menstrual products & uterine endometrium to outside of the body
→ protect against trauma & sexual intercourse & infxn & pathogens

(2) UTERUS – "womb"
- shaped as an upside-down pear @ center of pelvic cavity b/w base of bladder & rectum and above the vagina
- its body can more freely forward/backward so its position may vary
  ↓
  Depending on:
  ✓ Posture & musculature
  ✓ # of children born
  ✓ bladder & rectal fullness
  ✓ Respi. patterns

(*) cervix: anchored laterally
→ bends forward – sharp angle c vagina
"ANTEVERTED"

✓ Cardinal lig.
✓ Pubocervical lig.] Upper support
✓ Uterosacral lig.
✓ Pelvic muscular floor – Lower support

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→ site for lower segment cesarean births
→ becomes the lower uterine segment in pregnancy

Isthmus - slight constriction in the uterus

→ CORPUS - "uterine body"; upper 2/3; composed of MYOMETRIUM (smooth muscle layer)

→ CERVIX/NECK - lower 3rd

→ FUNDUS - rounded uppermost portion of corpus that extends above the points of attachment of fallopian tubes

→ CORNUA - elongated portion of uterus where fallopian tubes enter

ANS → entirely innervates the uterus

$T_{11} - T_{12}$ nerve roots - carries the pain of uterine contractions to CNS

Ilioinguinal & pudendal nerves - where pain fr cervix & upper vagina passes through

$T_7 - T_8$ - where motor fibers to the uterus arise from

(F) Epidural anes. can be used during labor & birth bc sensory & motor levels are separate

"NIDATION" - implantation of embryo (uterine lining is cyclically prepared by steroid hormones)

(F) Body never returns to its prepregnant size

(F) External OS changes fr circular opening to TRANSVERSE SLIT c IRREGULAR EDGES

(2) CORPUS

3 LAYERS
- Perimetrium - outermost; SEROSAL LAYER; composed of peritoneum
- Myometrium - middle; MUSCULAR UTERINE LAYER
- Endometrium - innermost; MUCOSAL LAYER

Myometrium
- 4
- → continues c muscle layers of fallopian tube & vagina → unified reacxn c → ovulation, → orgasm, → sperm deposition in vagina
- ↳ extend into the ovarian, round & cardinal ligaments
  - ↳ pelvic "aches & pains"

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(*) RADIAL ARTERIES → branch off fr Arcuate arteries @ Right angles

3 LAYERS OF UTERINE SMOOTH MUSCLES

→ OUTER LAYER: over the fundus; longitudinal muscles that cause cervical effacement & expel fetus during birth

→ THICK MIDDLE LAYER: interlacing muscle fibers in figure-8 patterns and surround large blood vessels; contraction produces a hemostatic action

→ INNER MUSCLE LAYER: circular fibers that form sphincters @ fallopian tube attachment sites @ internal os

(*) Internal os sphincter – inhibits expulsion of uterine contents during pregnancy but stretches in labor as cervical dilatation occurs

(*) Sphincter @ fallopian tube – prevent menstrual blood fr flowing backward into the f.t. fr uterus

(*) Uterine contractions = dilatation of cervix

Endometrium → consists of columnar epith, glands & stroma

↳ undergoes monthly degeneration & renewal in the absence of pregnancy

its glands produce a thin, watery, alkaline secretion which keeps the uterine cavity moist (Endometrial mill) → helps sperm travel to the fallopian tube & nourishes developing embryo a it implants in the endometrium

Blood supply: BASAL ARTERIES → Zona Basalis → site of new endometrial tissue generation

↓ coiled arteries - sensitive to

Zona Functionalis

ϕ sensitive to cyclic hormonal control

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* Response of Coiled Arteries: alternate relaxation & constriction during the ischemic / terminal phase of menstrual cycle

* (+) Pregnancy (endometrium is ∅ shed) → RETICULAR STROMAL CELLS that surround the endometrial glands become the DECIDUAL CELLS of PREGNANCY

↑ vascular = rich blood supply to endometrial surface

(4) CERVIX → narrow neck of the uterus

* Supravaginal cervix — surrounded by the attachments that give the uterus its main support
  - ✓ Uterosacral ligaments
  - ✓ Mackenrodt's ligaments (transverse lig. of cervix)
  - ✓ Pubocervical ligaments

* Vaginal cervix — pink and ends @ external os
* Cervix canal — rosy red and lined c̄ columnar ciliated epith.
  - ↳ most cervical CA begins @ this squamocolumnar junction

"ELASTICITY" — main characteristic of the cervix d/t ↑ fibrous & collagenous content of supportive tissues & vast number of folds in the cervical lining

CERVICAL MUCUS FXNS:
- ✓ Lubricate vaginal canal
- ✓ Bacteriostatic agent
- ✓ Alkaline environment to shelter deposited sperm fr the acidic vagina

@ OVULATION, cervical mucus is CLEARER, THINNER, MORE PROFUSE & MORE ALKALINE

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UTERINE LIGAMENTS — support & stabilize various repro. organs

→ BROAD LIGAMENT - keeps the uterus centrally placed and provides stability in the pelvic cavity.
- covers the uterus anteriorly & posteriorly and extend outward & uterus to enfold the f.t.
- round & ovarian lig. @ upper border of this lig.
- cardinal lig. @ lower border of this lig.
- in b/w are c.t; invol. muscle, blood & lymph vessels & nerves

→ ROUND LIGAMENTS - helps the broad lig. keep the uterus in place
- arise fr the sides of uterus near the f.t. insertions
- made up of longitudinal muscle and enlarges during pregnancy
- during labor: it steadies the uterus, pulling downward & forward so presenting part of fetus is moved into the cervix

→ OVARIAN LIGAMENTS - anchor the lower pole of ovary to the cornua of the uterus
- contractile ability helps the fimbria of f.t. to "catch" the ovum as it is released q month

→ CARDINAL LIGAMENTS - chief uterine supports and suspend the uterus. fr the side walls of the true pelvis
"Mackenrodt's / Transverse Cervical Ligaments"
- prevents uterine prolapse & support upper vagina

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→ INFUNDIBULOPELVIC LIGAMENT – suspends & supports the ovaries containing the ovarian vessels & nerves

→ UTEROSACRAL LIGAMENTS – supports the uterus & cervix @ the level of ischial spines
– contains sensory nerve fibers that contribute to dysmenorrhea

(5.) FALLOPIAN TUBES – "oviducts / uterine tubes"

→ ISTHMUS – straight & narrow c a thick muscular wall and an opening (2-3 mm) in dm
– site of TUBAL LIGATION

→ AMPULLA – outer 3rd of F.t.
– site of FERTILIZATION of the secondary oocyte by a spermatozoon
– ends @ fimbria

→ FIMBRIA – funnel-shaped enlargement c many projections
@ Fimbria ovarica – longest; attached to the ovary to increase the chances of intercepting the ovum as it is released

4 LAYERS OF F.T.

→ PERITONEAL (SEROUS) LAYER – covers the tubes

→ SUBSEROUS (ADVENTITIAL) LAYER – contains blood & nerve supply

→ MUSCULAR LAYER – responsible for peristaltic movement of tube

→ MUCOSAL LAYER – composed of ciliated & nonciliated cells
↓
More abundant @ Fimbria

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(#) Nonciliated cells – secrete a protein-rich, serous fluid that nourishes the ovum toward the uterus

(#) Ciliary action – assist the tube's muscular layer peristalsis

▽ WELL-FUNCTIONING TUBAL TRANSPORT SYSTEM ▽

↳ Active fimbriae close to the ovary
↳ Peristalsis of tube created by the muscular layer
↳ Ciliated currents beating toward the uterus
↳ Proximal contraction & distal relaxation of the tube d/t diff. types of prostaglandins

(#) F.T. have an unusual ability to recover fr an inflammatory process d/t rich blood & lymphatic supply

FALLOPIAN TUBE FXNS:

✓ Provide transport for the ovum fr ovary to uterus (3 - 4 days)
✓ Site of fertilization
✓ Warm, moist, nourishing env. for ovum/zygote (fertilized egg)

(6) OVARIES – below the pelvic brim

↳ of girls: SMALLER!
↳ p puberty: LARGER!

DULL-WHITE, SMOOTH-SURFACED → PITTED GRAY ORGAN
↳ d/t scarring fr ovulation

(#) NO PERITONEAL COVERING!
↳ assists mature ovum to erupt but also allows easier spread of malignant cells & CA of ovaries

(#) GERMINAL EPITH – cuboidal epith. cells (single layer) that covers the ovaries

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3 LAYERS OF OVARIES:

→ TUNICA ALBUGINEA - dense & dull white; protective layer

→ CORTEX - main fxnal part because it contains OVA, GRAAFIAN FOLLICLES, CORPORA LUTEA & DEGENERATED CORPORA LUTEA (CORPORA ALBICANTIA)

→ MEDULLA - completely surrounded by the cortex & contains the nerves and blood + lymph. vessels

(*) Ovaries are PRIMARY SOURCES OF 2 HORMONES:

(1.) ESTROGENS - characteristics of FEMALENESS
↳ breast alveolar lobule growth
↳ duct development

→ ovaries secrete large amts of estrogen

→ Adrenal cortex (Extraglandular sites) produces minute amounts of estrogen in nonpregnant women

(2) PROGESTERONE - hormone of pregnancy bc its effect on uterus allows pregnancy to be maintained

→ PLACENTA: primary source of progesterone @ pregnancy
- inhibits acxn of prolactin in α-lactalbumin synthesis → prevents lactation @ pregnancy

(*) 45-55 y/o: woman's ovaries secrete ↓ estrogen
↳ ↓ ovulatory activity = MENOPAUSE

(7.) BREAST - Mammary glands
↳ accessory of repro system (specialized seb. glands)

(*) Cooper's ligaments - fibrous tissues suspending the breast
- extends fr deep fascia in the chest outward to just under the skin covering the breast

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(F) (L) breast is LARGER than the (R) breast

Nipple - protrusion @ center → d/t smooth muscle
- composed of erectile tissue that becomes ↑ rigid and prominent during the menstrual cycle, sexual excitement, pregnancy & lactation

Areola - heavily pigmented structure surrounding the nipples

Tubercles of Montgomery - small papillae that roughens both nipples & areola
- secretes fatty substance to lubricate & protect the breast during breastfeeding

(F) Glandular Tissue - arranged in a series of 15-24 lobes separated by fibrous & adipose tissue

Lactiferous Ducts - open on the surface of the nipple

BREAST FXNS:
✓ Provide nourishment & protective maternal Ab to infants through the lactation process
✓ Source of pleasurable sexual sensation

BONY PELVIS

FXNS: ✓ support & protect the pelvic contents
✓ Form the relatively fixed axis of birth passage

- resembles a bowl / basin; lined ☐ fibrocartilage & held together by ligaments

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COMPOSITION OF PELVIS:

① Innominate Bones - "Hip bones" ← ilium, ischium, pubis → fuse to form ACETABULUM

* ILIUM - broad, upper prominence of the hip
  - ↳ ILIAC CREST - margin of ilium
  - ↳ ILIAC FOSSA - concave anterior portion
  - ↳ ILEOPECTINEAL LINE / LINEA TERMINALIS - line or ridge which separates the ilium & ischium & forms part of the pelvic brim or inlet

* ISCHIUM - strongest bone; under ilium, below acetabulum
  - ↳ ISCHIAL TUBEROSITY - ends in a marked protuberance where the weight of a seated body rests
  - ↳ ISCHIAL SPINES - foremost projections nearest the groin & site of attachment for ligaments & muscles
    - reference points during labor to evaluate descent of fetal head into the birth canal
    - → Ant. Superior Iliac Spine - ant. terminal point of iliac crest
    - → Ant. Inferior Iliac Spine - ant. lower point of iliac crest
    - → Post. Superior Iliac Spine - post terminal point of iliac crest

* PUBIS - forms the slightly bowed front portion of innominate bone
  - meets @ SYMPHYSIS PUBIS (formed by heavy fibrocartilage)
  - ↳ PUBIC ARCH - triangular space below this junction where the fetal head passes during birth

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(2) Sacrum - wedge-shaped bone formed by the fusion of 5 vertebrae

↳ SACRAL PROMONTORY - @ anterior upper portion of sacrum - projection that serves as obstetric guide in determining pelvic measurements

(3) COCCYX - small triangular bone last on the vertebral column - articulates c sacrum @ SACROCOCCYGEAL JOINT - usually moves BACKWARD during labor = ↑ room for fetus

PELVIC JOINTS:

→ (R) & (L) SACROILIAC JOINTS - points of union b/w sacrum & ilium

→ SACROCOCCYGEAL JOINT - b/w sacrum & coccyx

→ SYMPHYSIS PUBIS - junction of 2 pubic bones united by a pad of cartilage

PELVIC LIGAMENTS:

→ SACROILIAC LIGAMENTS - strongest in the whole body & connects sacrum to the iliac bones on each side

→ SACROTUBEROUS LIGAMENTS - b/w sacrum & ischial tuberosities

→ SACROSPINOUS LIGAMENTS - b/w sacrum & ischial spines

→ INTERPUBIC LIGAMENTS - strengthens the symphysis pubis

→ SACROCOCCYGEAL LIGAMENTS - b/w S5 & coccyx

PELVIC FLOOR - overcomes the force of gravity exerted on the pelvic organs

- supports the irregularly shaped pelvic outlet

For stability & support for surrounding structures

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PELVIC DIAPHRAGM - formed by the deep fascia, levator ani & coccygeal muscles

PELVIC CAVITY - above the pelvic diaphragm

PERINEUM - below & behind the pelvic diaphragm

(*) Levator ani - makes up the major portions of the pelvic diaphragm & consists of 4 muscles:

- ✓ ILEO COCCYGEUS - thin muscular sheet underlying the sacrospinous ligament & helps levator ani to support the pelvic organs
- ✓ PUBOCOCCYGEUS
- ✓ PUBORECTALIS - raises anus
- ✓ PUBOVAGINALIS - supports vagina

PELVIC DIVISION

→ FALSE PELVIS - portion above the pelvic brim / linea terminalis
- support the weight of the enlarged pregnant uterus & direct the presenting fetal part into the true pelvis

→ TRUE PELVIS - portion below the linea terminalis
- represents the bony limits of birth canal
- its SIZE & SHAPE must be ADEQUATE for normal fetal passage during labor & @ birth

PARTS:

→ PELVIC INLET - upper border of true pelvis (rounded)
- size & shape are determined by assessing 3 A.P. diameters

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* Diagonal Conjugate - extends fr subpubic angle to the middle of sacral promontory
  - can be measured manually during the pelvic examination
  ↳ 12.5 cm

* Obstetric Conjugate - extends fr the middle of the sacral promontory to an area approx. 1 cm BELOW the crest
  - shortest A.P. diameter through which the head must pass descending to the pelvic inlet
  - estimated INDIRECTLY by subtracting 1.5-2 cm fr diagonal conjugate
  - determines if fetus can move down into the birth canal for engagement to occur
  ↳ 10.5-11 cm

* True (Anatomic) Conjugate / conjugate Vera - extends fr the middle of sacral promontory to middle of pubic crest (superior surface of the symphysis)
  ↳ 11 cm

* Transverse Diameter - helps determine the shape of inlet
  - largest diameter of the inlet & is measured by using the linea terminalis as point of reference
  ↳ 13.5 cm

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④ Oblique Diameters - measured from sacroiliac joint to the ileopectineal eminence of the ① & ② side of pelvis

↳ 12.5 CM (both sides)

→ PELVIC CAVITY (CANAL) - curved canal ∴ longer posterior than anterior wall
- change in lumbar curve: ↑ tilt of the pelvis & influence the progress of labor

→ PELVIC OUTLET - lower border of true pelvis
- size can be determined by ax the transverse diameter (BI-ISCHIAL or INTERTUBEROUS DIAMETER)
- contains the PUBIC ARCH as to where the fetus must pass under @ birth

⑧ OUTLET DYSTOCIA - condition wherein the pubic arch NARROWS and the baby's head is pushed backwards towards the coccyx, making extension of the head difficult
- may require use of forceps @ c/s birth

TYPES OF PELVIS (Caldwell-Moloy Classification)

① GYNECOID PELVIS - most common female pelvis (50%)
- inlet is rounded
- AP diameter is a little shorter than transverse diameter

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- posterior segment is broad, deep, roomy
- anterior segment is well rounded

② ANDROID PELVIS — normal male pelvis
↳ 20% in females — inlet is heart shaped
↓ — AP & transverse diameters are adequate for birth
MATERNAL IMPLICATIONS:
- descent into pelvis is slow
- fetal head engages in transverse or occipital posterior diameter in ASYNCLITISM (Oblique presentation) c extreme molding
- arrest of labor is frequent → requires difficult forceps manipulation (rotation & extraction)
- post. sagittal diameter: too short
- ant. sagittal diameter: long
- posterior segment: shallow (d/t indentation of sacral promontory) ↳ ↓ capacity
- anterior segment: narrow
- forepelvis: sharply angled

③ ANTHROPOID PELVIS — inlet is oval c long AP diameter & adequate but short transverse diameter
↳ 25% in females
- anterior & posterior segments: DEEP
- Post. sagittal diameter: extremely long
- ant. sagittal diameter: extremely long

④ PLATYPELLOID PELVIS — flat female pelvis
↳ 5% in females
- inlet: transverse oval c short AP & extremely short transverse diameter
- Post. sagittal & ant. sagittal diameter: short
- Ant. & Post segments: Shallow

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FEMALE REPRODUCTIVE CYCLE

↳ ovarian cycle – ovulation
↳ Uterine cycle – menstruation

⊛ p̄ menarche: female undergoes ovulation & menstruation (if s̄ pregnancy) = 30-40 yrs
↳ NEUROHORMONAL CONTROL

⊛ OVARIES: sensitive to FSH & LH

⊛ UTERUS: sensitive to Estrogen & Progesterone

ESTROGEN → Estrone
→ β-estradiol (major estrogen)
→ Estriol

- assoc. c̄ characteristics contributing to "femaleness"
- secondary sex characteristics: breast dev't, widening of hips & fat deposition @ buttocks & mons pubis
- maturation of ovarian follicles & cause the endometrial mucosa to proliferate p̄ menstruation
- ↑ amount during the PROLIFERATIVE (Follicular / Estrogenic) PHASE of menstrual cycle
- cause the uterus to ↑ in size & wt (d/t ↑ glycogen, amino acids, electrolytes & water)
- ↑ myometrial contractility both in uterus & fallopian tubes
- uterine sensitivity to oxytocin is INCREASED
- ↓ FSH production ; ↑ LH production
- ↑ CHON-bound iodine in pregnant women & those who use O.C. pills
- ↑ libido (↓ excitability of hypothalamus)

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PROGESTERONE — "HORMONE OF PREGNANCY"

- secreted by CORPUS LUTEUM
- ↑ amount in SECRETORY (Luteal or Progestational) PHASE of MENSTRUAL CYCLE
- ↓ uterine motility & contractility caused by estrogens to prepare uterus for implantation ∴ ovum is fertilized
- ↑ supply of glycogen, arterial blood, secretory glands, amino acids & water in the endometrium
- allows pregnancy to be maintained
- vaginal epith. proliferates
- cervix secretes THICK, VISCOUS mucus
- ↑ size & complexity of breast glandular tissue
- prepares the breast for lactation
- responsible for ↑ body temp (0.3-0.6°C) which accompanies ovulation & persists throughout the secretory phase of menstrual cycle

PROSTAGLANDINS (PGs) → PGE (Grp E), PGF (Grp F)

- oxygenated FAs by cells of endometrium
- ↑ amount during follicular maturation
- dependent on gonadotropins & critical to follicular rupture
- found in & around the follicle @ time of ovulation

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④ PGE - potent VASODILATOR
- relaxes smooth muscles

④ PGF - potent VASOCONSTRICTOR
- ↑ contractility of muscles & arteries

→ $PGF_{2\alpha}$ - believed to be the cause of extrusion of the ovum which results in FOLLICULAR SWELLING & ↑ contractility of smooth muscle in the THECA EXTERNA LAYER of the mature follicle

NEUROHUMORAL BASIS OF THE FEMALE REPRODUCTIVE CYCLE

HYPOTHALAMUS - secretes GnRH ← FSHRH, LHRH

goes to the

ANTERIOR PITUITARY GLAND (Adenohypophysis)

FSH ← ANTERIOR PITUITARY GLAND → LH

FSH
- maturation of ovarian follicle
(↑ estrogen)

LH
- "luteinizing" of theca & granulosa cells of the ruptured follicle
④ progesterone secretion continues
④ ↓ estrogen production

④ OVULATION - takes place p̄ the very rapid growth of the follicle, as the sustained ↑ estrogen diminished & progesterone secretion begins

④ CORPUS LUTEUM - when the ruptured follicle undergoes rapid change, complete luteinization is accomplished

④ Lutein cells = secrete ↑ progesterone c̄ smaller amts of estradiol
- secretes sig. amounts of Inhibin A

④ Day 7 or 8 p̄ ovulation = corpus luteum begins to INVOLUTE, losing its secretory fxns

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OVARIAN CYCLE

→ Follicular Phase (Days 1-14)

→ Luteal Phase (Days 15-28 → in a 28-day cycle)
└ fixed length

* @ Follicular Phase: immature follicle matures (d/t FSH)
  ↳ oocyte grows within
* 14th day - mature graafian follicle usually appears on this day under dual control of FSH & LH
  (from primordial follicle)
  → produces ↑ estrogen

Mature Graafian Follicle → the cells surrounding the fluid-filled antral cavity are GRANULOSA CELLS

* CUMULUS OOPHORUS - mass of granulosa cells surrounding the oocyte & follicular fluid
* ZONA PELLUCIDA - thick elastic capsule that develops around the oocyte in a FULLY mature graafian follicle
* POLAR BODY - a small cell formed when the mature oocyte completes its 1st meiotic division
* SECONDARY OOCYTE - larger cell that matures into ovum

* Ovum: Fertile for only 12-24 hrs
  ↳ reaches the uterus 72-96 hrs p its release from the ovary

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(*) @ Luteal Phase - begins when the ovum leaves its follicle

↳ d/t (LH), corpus luteum develops fr ruptured follicle ↓ becomes yellowish & spherical and ↑ in vascularity

↑ Progesterone
↓ Estrogen

Human Chorionic Gonadotropin (hCG) - needed to maintain the corpus luteum; secreted if the ovum is fertilized & implants in the endometrium

CORPUS ALBICANS - a connective tissue scar that results if fertilization doesn't occur so within about a week p̄ ovulation, the corpus luteum begins to degenerate

↳ ↓ estrogen & progesterone = ↑ LH & FSH (triggers hypothalamus)

MENSTRUAL CYCLE

↳ cyclic uterine bleeding in response to cyclic hormonal changes

- occurs when ovum is not fertilized & begins about 14 days p̄ ovulation in a 28-day cycle

MENSTRUAL DISCHARGE / MENSES / MENSTRUAL FLOW - composed of blood mixed c̄ fluid, cervical & vaginal secretions, bacteria, mucus, leukocytes & other cellular debris

- occurs q 28 days +/- 5-10 days
- Emotional & physical factors can alter the cycle interval

(4) Duration of menses: 1-7 days
(5) Blood loss: 30-50 mL (in average)
(6) Iron loss: 0.5-1 mg daily (in average)

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4 PHASES:

① Menstrual Phase – menstruation occurs
– endometrial areas are shed
– ↓ estrogen
– endometrium = 1-2 mm deep
– cervical mucus: SCANTY, VISCOUS, OPAQUE

② Proliferative Phase – endometrial glands enlarge & becomes twisted & longer d/t ↑ estrogen
– blood vessels: prominent & dilated
– endometrium thickens 6-8 fold
– cervical mucus: THIN, CLEAR, WATERY and MORE ALKALINE (favorable to sperm)

* estrogen PEAKS prior to ovulation
* d ovulation, body temp may drop slightly
* @ ovulation, body temp rises sharply & remains elevated (d/t progesterone)

* Spinnbarkeit – increased elasticity, characteristic of cervical mucus as ovulation nears
* @ OVULATION – mucus will stretch > 5 cm
– cervical mucus pH ↑ fr > 7.0 to 7.5
– (+) FERNING pattern

③ Secretory Phase – allows ovulation
↓ estrogen
↑ progesterone
– endometrium undergoes slight cellular growth (d/t estrogen)
– ↑ tissue glycogen
– ↑ vascularity to nourish for implantation

if implantation occurs → endometrium will continue to develop & thicken (because of progesterone)

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④ Ischemic Phase - if fertilization doesn't occur
- corpus luteum begins to degenerate
- ↓ estrogen & progesterone
- (+) areas of necrosis under epith. lining
- extensive vascular changes
- small blood vessels rupture
- spiral arteries constrict & retract
  → ↓ blood in endometrium = PALE
- escape of blood into stromal cells of uterus
- menstrual flow begins
- ∫ menstruation, BASAL LAYER remains

* Mucus of cervix & uterine body changes each month during the menstrual cycle
* @ 1st half of the cycle = ↓ estrogen = cervical mucus is THICK & SCANTY so sperm survival is poor
* @ ovulation = ↑ estrogen = cervical mucus is THICK & COPIOUS so sperm penetration & survival are excellent
* @ 2nd half of cycle = ↑ progesterone = cervical mucus becomes THICK & sperm survival is POOR

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FERN TEST - d/t ↑estrogen = cervical mucus forms fernlike patterns when placed on glass slides and allowed to dry

↓

"ARBORIZATION OR FERNING"

- caused by crystallization of Sodium chloride on mucus fibers
- cervical mucus can be examined @ midcycle to detect whether ferning / ↑ estrogen surge is present

SPINNBARKEIT TEST - d/t ↑ estrogen = cervical mucus can also be stretched into long strands
- can also be examined @ midpoint of menstrual cycle

- 2 ways to examine this:
  - ✓ stretching a mucus sample b/w thumb & finger
  - ✓ smearing a cervical mucus specimen on a slide & stretching the mucus b/w the slide & cover slip

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