

CLINICAL OBSTETRICS

NOTES

FOURTH EDITION

**PRE-SUMMARIZED
READY-TO-STUDY
HIGH-YIELD NOTES**

**FOR THE TIME-POOR
MEDICAL, PRE-MED,
USMLE OR PA STUDENT**



123 PAGES



A Message From Our Team

Studying medicine or any health-related degree can be stressful; believe us, we know from experience! The human body is an incredibly complex organism, and finding a way to streamline your learning is crucial to succeeding in your exams and future profession. Our goal from the outset has been to create the greatest educational resource for the next generation of medical students, and to make them as affordable as possible.

In this fourth edition of our notes we have made a number of text corrections, formatting updates, and figure updates which we feel will enhance your study experience. We have also endeavoured to use only open-source images and/or provide attribution where possible.

If you are new to us, here are a few things to help get the most out of your notes:

- 1. Once saved, the notes are yours for life!** However, we strongly advise that you download and save the files immediately upon purchasing for permanent offline access.
- 2. Sharing notes is prohibited.** All files are share-protected and our system will automatically revoke access to and lock files if it detects a customer attempting to share or distribute our notes.
- 3. Your license permits you to do the following:**
 - a. You may download/save/view files on up to 2 simultaneous devices.
 - b. You may save the files to an external hard drive for backup purposes only.
 - c. You may print your notes to hard copy on any home printer/photocopier.
- 4. Once saved, you do not need to download the notes again.** You can simply transfer your file/s to your second personal device (eg: your iPad/tablet) without the need to re-download your files. If you wish to retire an old device, simply transfer your files to your new device, then delete the files from your old device.

Table Of Contents:

What's included: Ready-to-study anatomy, physiology and pathology notes of the relevant clinical obstetrics topics presented in succinct, intuitive and richly illustrated downloadable PDF documents. Once downloaded, you may choose to either print and bind them, or make annotations digitally on your iPad or tablet PC.

Clickable Hyperlinks Below:

- **OBSTETRIC DEFINITIONS**
- **EMBRYONIC SEXUAL DEVELOPMENT**
- **REVIEW OF BASIC FEMALE REPRODUCTIVE ANATOMY**
- **PREGNANCY**
- **MATERNAL PHYSIOLOGIC ADAPTATIONS TO PREGNANCY**
- **EMERGENCY CONTRACEPTION & ABORTION**
- **RHESUS DISEASE**
- **ANTEPARTUM CARE**
 - **NAUSEA & VOMITING IN PREGNANCY**
 - **PRENATAL SCREENING TESTS**
 - **ANTENATAL FOETAL SURVEILLANCE**
- **OBSTETRICAL HAEMORRHAGE**
 - **PLACENTA PREVIA**
 - **PLACENTAL ABRUPTION**
 - **VASA PREVIA**
- **OBSTETRIC COMPLICATIONS**
 - **CHORIOCARCINOMA (MALIGNANT)**
 - **ECTOPIC PREGNANCY**
 - **HYDATIDIFORM MOLES – (PARTIAL & COMPLETE)**
 - **PRETERM LABOUR**
 - **PREMATURE RUPTURE OF MEMBRANES (PROM)**
 - **POST-TERM PREGNANCY**
 - **INTRAUTERINE FOETAL DEATH**
 - **INTRAUTERINE GROWTH RESTRICTION**
 - **MACROSOMIA**
 - **POLYHYDRAMNIOS**
 - **OLIGOHYDRAMNIOS**
- **MALPRESENTATION**
- **HYPERTENSION IN PREGNANCY**
- **NORMAL LABOUR AND DELIVERY**
- **INDUCTION OF LABOUR (IOL)**
- **NEONATAL ADAPTATIONS TO EXTRAUTERINE LIFE**
 - **INFANT RESPIRATORY DISTRESS**
 - **NEONATAL JAUNDICE & KERNICTERUS**
- **COMPLICATIONS OF LABOUR AND DELIVERY**
 - **SHOULDER DYSTOCIA**
 - **UMBILICAL CORD PROLAPSE**
 - **UTERINE RUPTURE**
 - **CHORIOAMNIONITIS**
- **OPERATIVE OBSTETRICS**
- **PUERPERAL COMPLICATIONS**
 - **POST PARTUM HAEMORRHAGE (PPH)**
- **RETAINED PLACENTA**
- **POSTPARTUM CARE**
- **POSTNATAL MENSTRUATION & CONTRACEPTION**
- **THE 3 POSTNATAL MOOD DISORDERS**

OBSTETRIC DEFINITIONS

OBSTETRIC DEFINITIONS

Births, Miscarriages & Abortions

Abortion	Termination of pregnancy (Spontaneous/Intentional) @ <20wks gestation OR <500g
Birth	Complete expulsion of the foetus >20wks OR >500g (Irrespective of placenta)
Miscarriages	Missed Miscarriage: Asymptomatic Intrauterine Foetal Death (IUFD) Threatened Miscarriage: Uterine bleeding +/- Contractions (Note: WITHOUT Labour) Inevitable Miscarriage: Uterine bleeding + Contractions + Dilation (Ie: WITH labour) Incomplete Miscarriage: An ACTIVE miscarriage with retained products Complete Miscarriage: An INACTIVE miscarriage with complete expulsion
Neonatal Death	Early Neonatal Death: Death of baby within 1wk of birth Late Neonatal Death: Death of baby within 4wks of birth
Still Birth	A "Birth" (Ie: >20wks &/or >500g) of a baby showing no signs of life. (As opposed to Live Birth – Has spontaneous breathing/heartbeat/movement)
TOP – Termination of Pregnancy	Medical TOP – Stat Dose Mifepristone/RU486 → 48hrs later – Vaginal Misoprostol Surgical TOP – Dilation & Curettage / Manual evacuation of foetus.
Viability	Gestation of >24wks Or birthweight of >500g

Timing:

Trimesters	T1: 0-12wks T2: 12-28wks T3: 28-40wks
Pre-Term	Pre-Term: <37wks
Term	Term: 37-42wks
Post-Term	Post Term: >42wks
Perinatal Period	Time within 28days of a "Birth". (Ie: Does NOT include Abortions)

Counting Babies:

Gravidity	Number of pregnancies (including current pregnancy) (Nulligravida – Never been pregnant) (Primigravida – First pregnancy)
Parity	Number of births @ >20wks gestation (Including Stillborns) (Nullipara – Never carried a pregnancy to >20wks) (Primipara – 1 previous "birth") (Multipara - >1 previous "births") (Grand-Multipara - >5 previous "births") (Great-Grand-Multipara - >10 previous "births")
Twins – Chorionicity & Amnionicity	Chorionicity = # of Placentas (Monochorionic = Single; Dichorionic = Double; etc) Amnionicity = # of Amnionic Sacs (Monoamnionic = Single; Diamnionic = Double)

Antenatal Screening Anomalies:

AFI – Amniotic Fluid Index	Sum of the amniotic fluid depth (cm) of the largest vertical pockets in each of the 4 uterine quadrants. (N=8-24cm) (<8= Oligohydramnios = Not Enough Amniotic Fluid) (>24= Polyhydramnios = Too Much Amniotic Fluid)
GBS	Group B Streptococcus
GDM	Gestational Diabetes Mellitus

Growth Anomalies:

CPD – Cephalo-Pelvic Disproportion	Foetal head is too big for the maternal pelvis
IUGR – Intrauterine Growth Restriction	Failure to reach genetic growth potential. (Including A plateau/decline in growth velocity) Note: Not necessarily “small for gestational age” (SGA)
LBW – Low Birth Weight	LBW: Low Birth Weight <2500g VLBW: Very low birth weight <1500g ELBW: Extremely low birth weight <1000g
SGA/SFD	Small for Gestational Age/Small for Dates = Foetus <10 th percentile for Gestational Age. (Note: NOT necessarily IUGR)

Bleeding:

APH – Antepartum Haemorrhage	PV bleeding after 24wks gestation (Including During Labour).
PPH: Post-Partum Haemorrhage	Primary PPH: PV Bleeding >500mL WITHIN 24hrs of Delivery Secondary PPH: PV Bleeding WITHIN 6wks of Delivery
Placenta Praevia	A persistent low-lying placenta after 24wks gestation. (<24wks, it is a “Low-lying placenta”)

Lie, Presentation, Attitude & Position:

Foetal Lie	Longitudinal or Transverse (Occasionally Oblique, but will → either Long/Trans during labour)
Foetal Presentation	The presenting part of the foetal body @ the birth canal. <ul style="list-style-type: none">- Cephalic or Breech (If Longitudinal Lie)- Shoulder (If Transverse Lie)
Foetal Attitude/Posture	Relation of the Foetal parts to each other
Foetal Position	Right or Left side of Uterus
Breech Presentation	<ol style="list-style-type: none">1. Frank Breech – Bum first, legs extended (“Pike”)2. Complete Breech – Bum first, legs flexed (“Tuck”)3. Footling Breech – Foot first (one or two) – (le: At least one hip extended)

Membrane Rupture:

ARM	Artificial rupture of membranes (using Amniohook)
PROM/PPROM	PROM: Premature Rupture of Membranes = ROM @>37wks, >24hrs <i>prior</i> to Onset of Labour PPROM: Preterm Premature Rupture of Membranes = PROM @ <37wks without onset of labour.
SROM	Spontaneous Rupture of Membranes (with or without labour) (Note: Can be a PROM or PPROM)

Labour/Delivery:

Engagement	Descent of the presenting part of the foetus into the mother's pelvis. Eg: If Cephalic, the head may be 4/5ths above the brim.
Labour	Regular Painful Contractions + Cervical Dilatation/Effacement + Descent of the Foetus <ul style="list-style-type: none">- Stage 1: Onset of labour → Fully Dilated Cervix- Stage 2: Fully Dilated Cervix → Birth of Foetus- Stage 3: Birth → Delivery of Placenta & Membranes
Pre-Term Term Post-Term	Pre-Term: <37wks Term: 37-42wks Post Term: >42wks
LUCS	Lower-Uterine Caesarean Section (Lower horizontal incision) (Cf. Classical Caesarean – Midline Incision)
SVD/SVB	Spontaneous Vaginal Delivery/Birth
Trial of Scar/VBAC (Vaginal Birth After Caesar)	Trial of Scar = Attempt at vaginal delivery after Caesarean Section VBAC = <i>Successful</i> Vaginal Delivery after CS

Perinatal:

IRDS – Infant Respiratory Distress Syndrome	(AKA: “Hyaline Membrane Disease”) Signs of increased respiratory effort in a baby due to insufficient surfactant &/or structural immaturity of the lungs.
Perinatal Period	Time within 28days of a “Birth”. (Ie: Does NOT include Abortions)

EMBRYONIC SEXUAL DEVELOPMENT

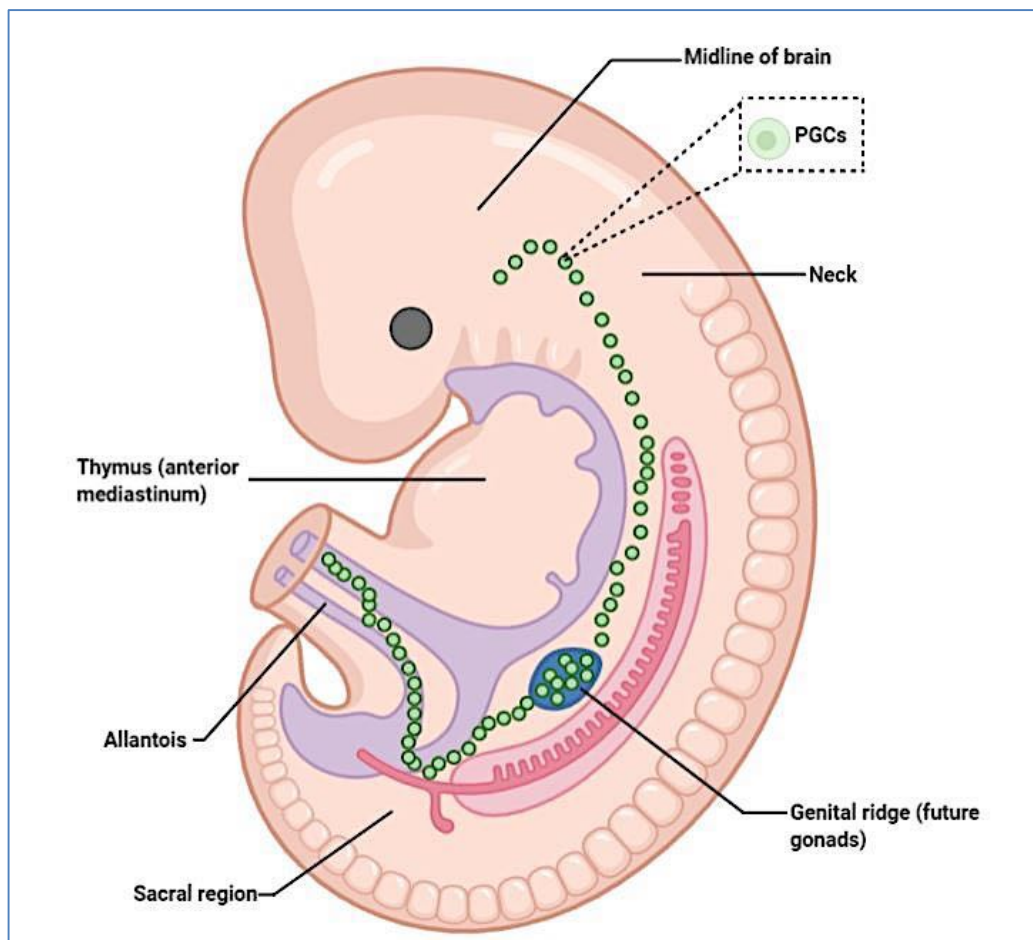
EMBRYONIC SEXUAL DEVELOPMENT

Gametogenesis:

- The formation of gametes (spermatogenesis / oogenesis)
- Largely regulated by hormonal/endocrine system
- A process of **meiosis**
- **Male:** Mitotic division of Spermatogonia and entry to meiosis is continuous from onset at puberty until death
- **Female:** Meiotic division is discontinuous – begins in embryo, lies dormant once born & is completed upon fertilisation by a sperm
 - Events are cyclic between puberty and menopause – **menstrual cycle**
- Gametes are *haploid* cells ($\frac{1}{2}$ Chromosome number – 23 –)
 - 22 pairs of somatic chromosomes
 - 1 pair of sex chromosomes (X, Y)
 - Sperm contains X & Y
 - Egg only contains X & X
 - **Combinations:**
 - XY = produces a male
 - XX = produces a female
 - **Y is the sex determining chromosome**

Embryo Sexual Differentiation:

- During Wk 5 of embryonic growth gonadal tissue develops into a **gonadal ridge**
 - Primordial germ cells migrate into gonadal ridge which then develop into ovaries or testes depending on DNA
 - Mesonephric (Wolffian) ducts = future male ducts
 - Paramesonephric (Mullerian) ducts = future female ducts
 - Both empty into a common chamber = the **cloaca**
 - At this stage the embryo is said to be sexually indifferent as the gonadal ridge can develop either way

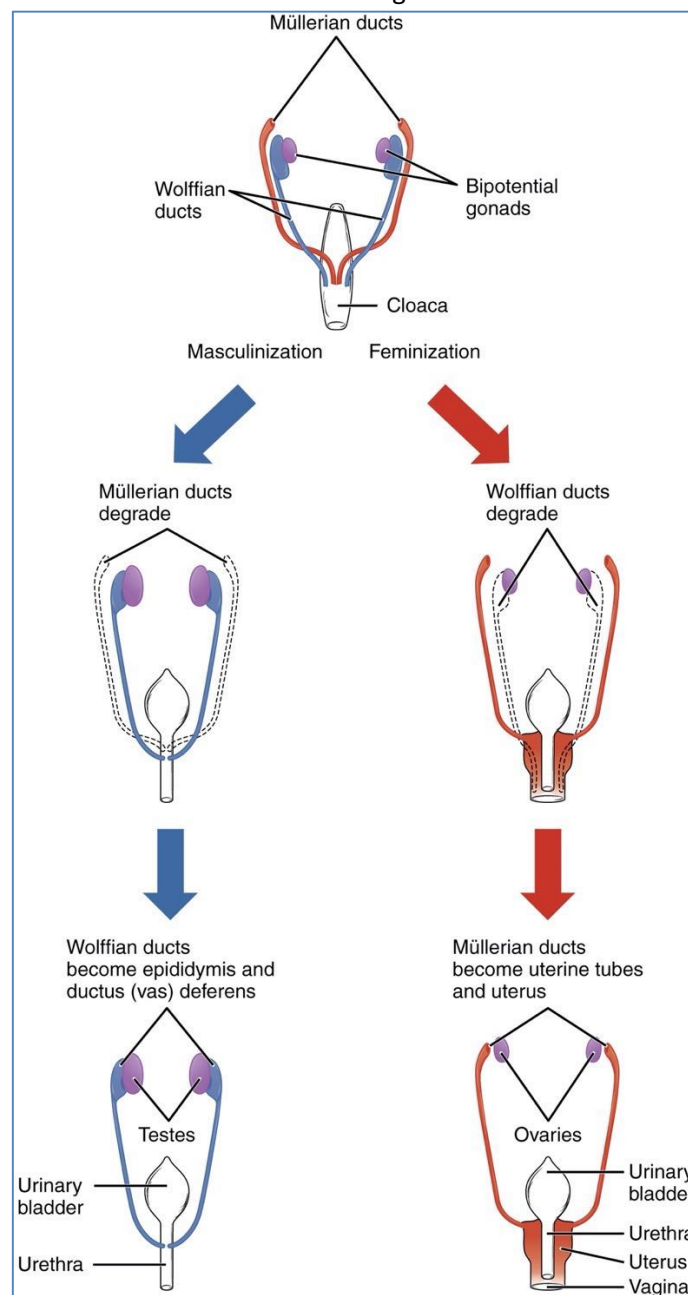


- **Male:**

- Y = The **sex determining** chromosome - causes the gonadal ridge to develop into testes (Ie: Females are the default sex)
- Testes then produce testosterone
 - Testosterone causes the Mesonephric (Wolffian) duct to develop into the male tract
- Also produces AMH (anti-mullerian hormone)/MIH (mullerian inhibiting hormone) which causes the Paramesonephric (Mullerian) duct to degenerate
- External genitalia:
 - Penis develops from the genital tubercle
 - Scrotum develops from the labiascrotal swellings

- **Female:**

- By default, if there is no 'Y' chromosome → no testes, the female tract will develop
 - The gonadal ridge develops into immature ovaries
 - Without testosterone, the Mesonephric (Wolffian) ducts will degenerate
 - The cortical (outer) part of the immature ovaries forms follicles
 - Without AMH/MIH, the paramesonephric ducts differentiate into structures of the female duct system
- External genitalia:
 - glans clitoris develops from the genital tubercle
 - Labia minora forms from the urethral groove

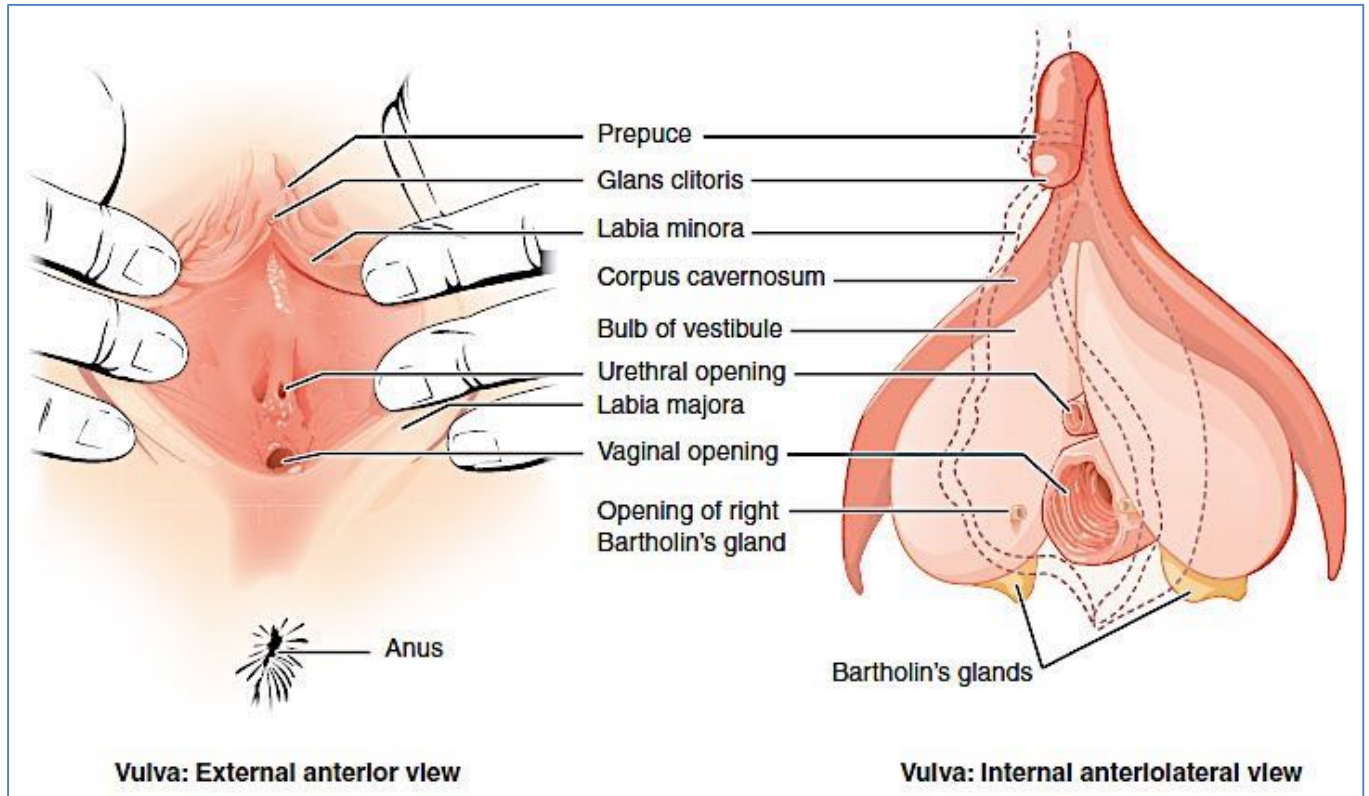


REVIEW OF BASIC FEMALE REPRODUCTIVE ANATOMY

REVIEW OF BASIC FEMALE REPRODUCTIVE ANATOMY

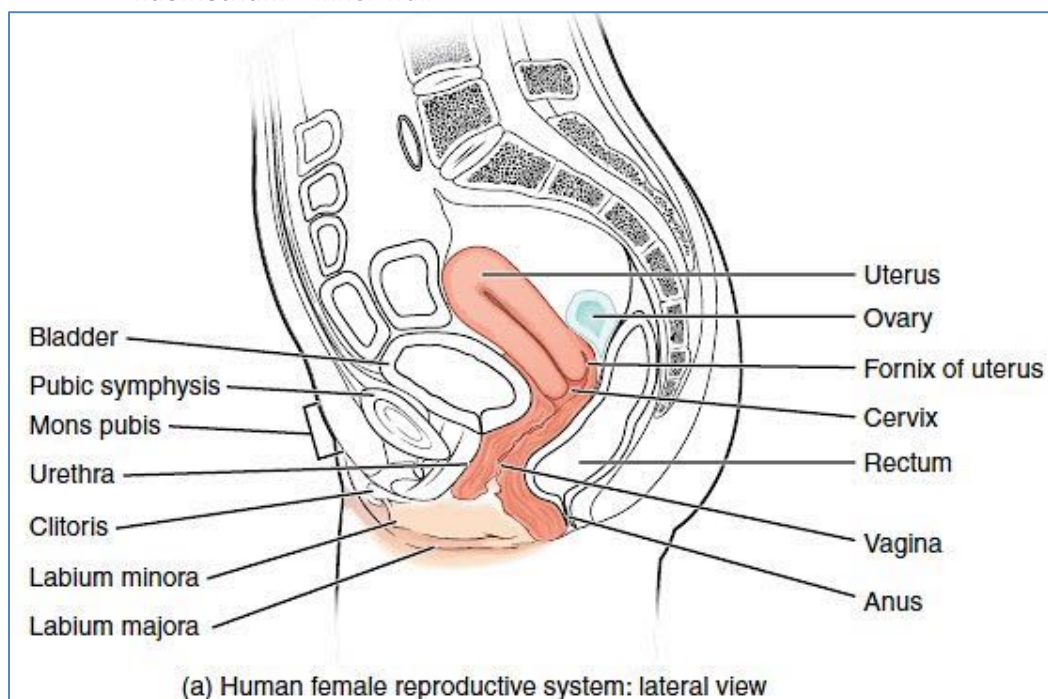
Review of Female Reproductive Structures:

- **Anatomy:**
 - **Vagina/Vulva:**
 - Labia Majora & Minora
 - Clitoris & prepuce of clitoris
 - Urethral orifice

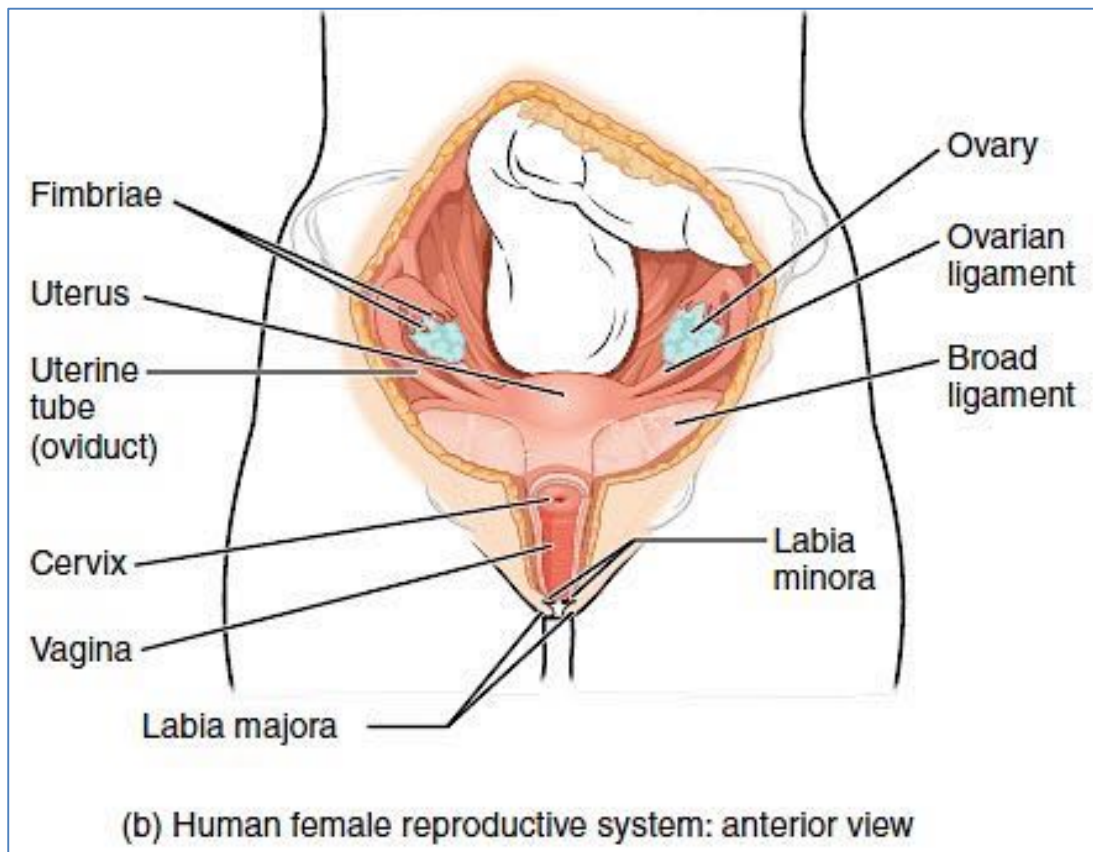


OpenStax, CC BY 4.0 <<https://creativecommons.org/licenses/by/4.0>>, via Wikimedia Commons

- **Uterus** - Fundus (top / head), Body, Cervix (external os, canal, internal os), Lumen (internal cavity)
 - **Perimetrium** – Outer wall
 - **Myometrium** – Middle of wall
 - **Endometrium** – Inner wall

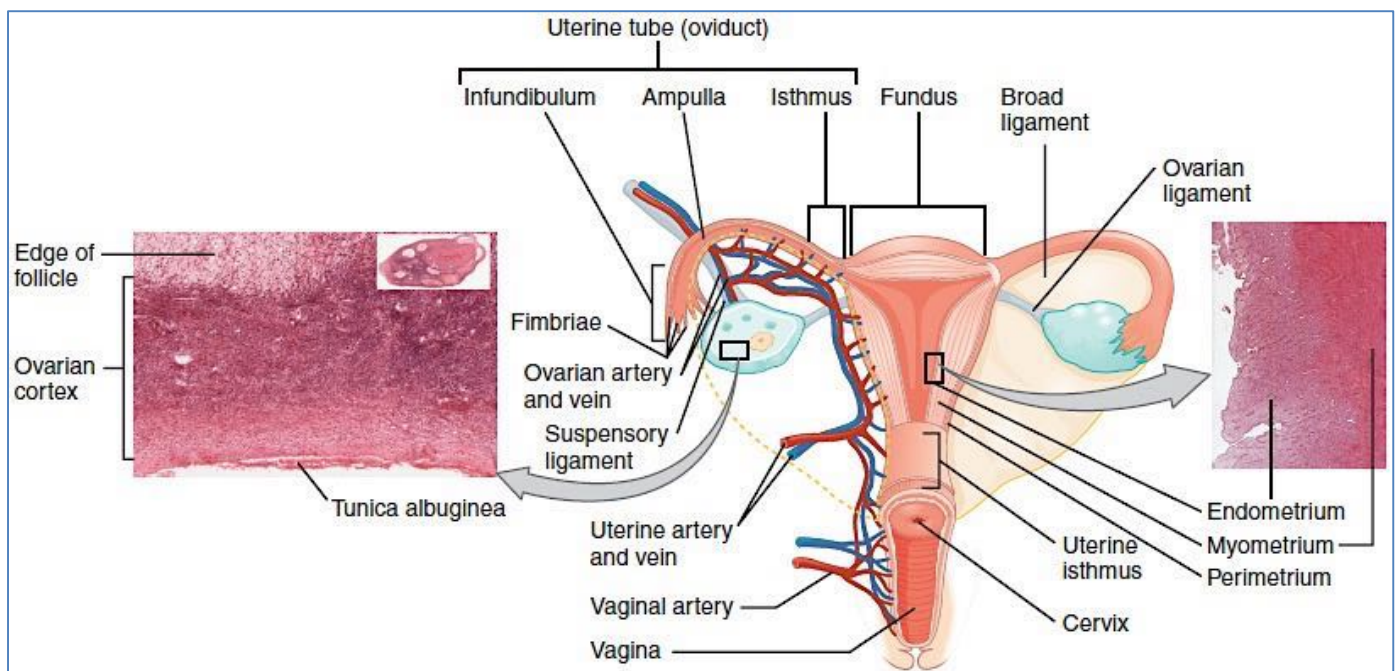


OpenStax, CC BY 4.0 <<https://creativecommons.org/licenses/by/4.0>>, via Wikimedia Commons



OpenStax, CC BY 4.0 <<https://creativecommons.org/licenses/by/4.0>>, via Wikimedia Commons

- **Uterine (fallopian) Tubes**
 - Common site of fertilisation
 - Infundibulum – projections = fimbriae (closest to ovary) → Receives oocyte
- **Ovaries (gonads)**
 - Produce female gametes (oocytes)
 - Secrete female sex hormones – (Oestrogen & Progesterone)
 - Held in place by ligaments & muscles

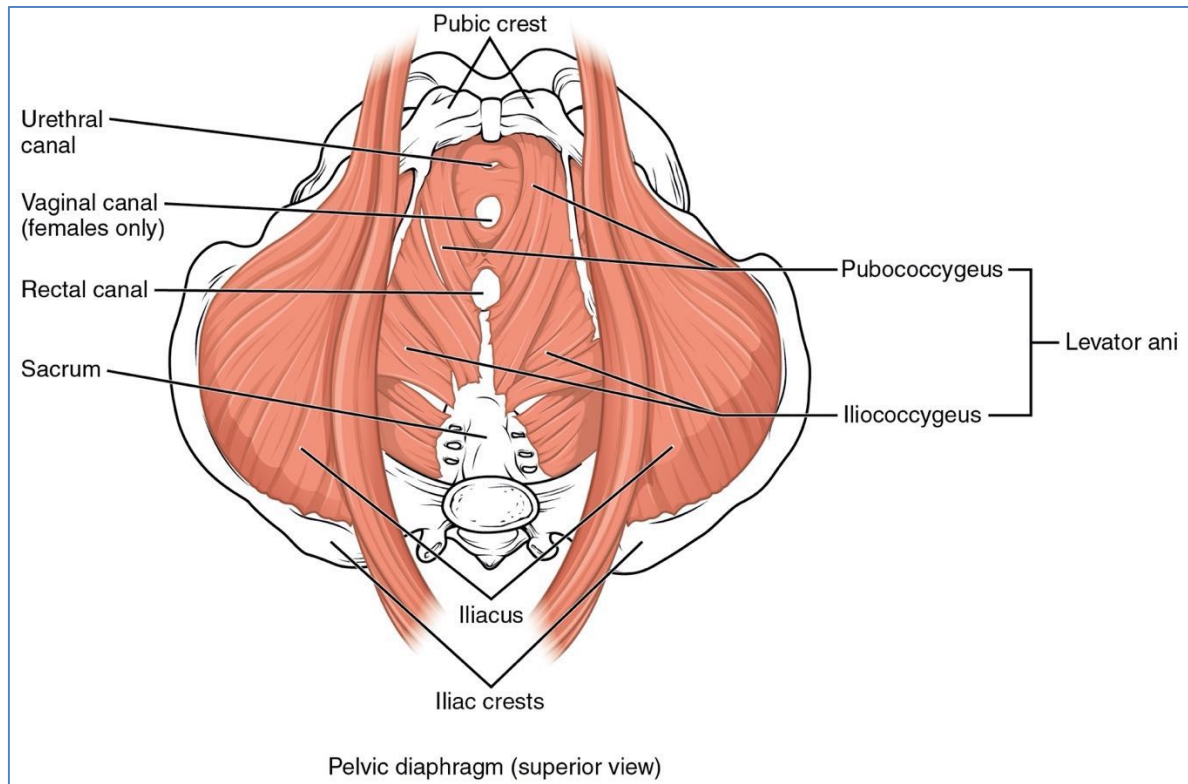


OpenStax, CC BY 4.0 <<https://creativecommons.org/licenses/by/4.0>>, via Wikimedia Commons

- **Blood Supply:**
 - **Internal iliac artery:**
 - Branches from common iliac artery
 - Uterine Artery
 - Vaginal Artery
 - To external genitalia
 - **Ovarian Artery:**
 - To ovaries, uterine tubes and uterus

- **Pelvic Diaphragm:**

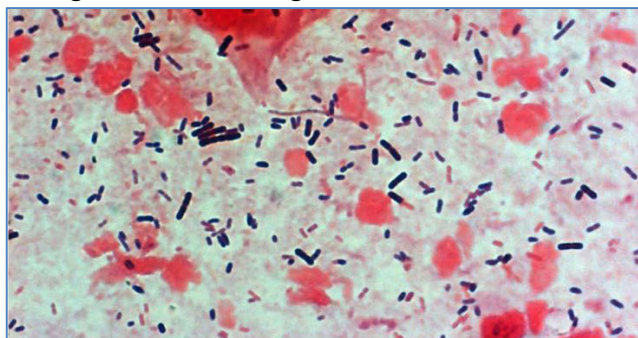
- **Levator Ani (anterior half)**
 - Iliococcygeus
 - Pubococcygeus
- **(posterior) Coccygeus** (ischiococcygeus)
- **(posterior) Piriformis**



OpenStax, CC BY 4.0 <<https://creativecommons.org/licenses/by/4.0>>, via Wikimedia Commons

Normal Flora of the Genital Tract

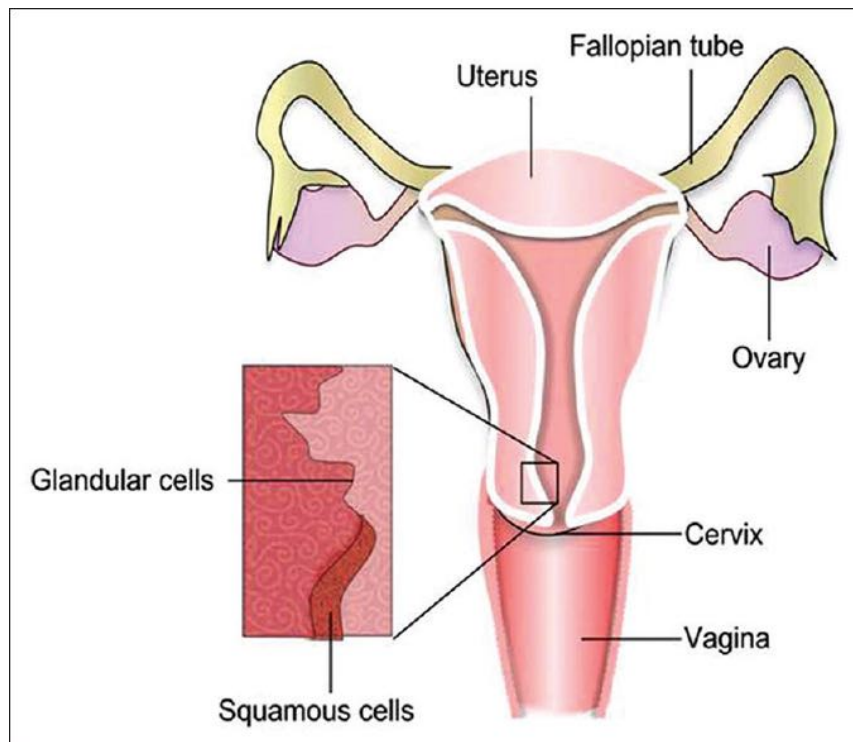
- **Male:**
 - **Urethra** – Few Organisms - (*Staph epidermidis*, *Streptococci*, *Ureaplasma urealyticum*)
- **Female:**
 - **Vagina** – High Numbers of Bacteria – (*Lactobacillus* - Blue Gram Positive Rods, + Some Anaerobes)
 - → Produce lactic acid
 - → Protects against Bacterial Vaginosis & Yeast Infections



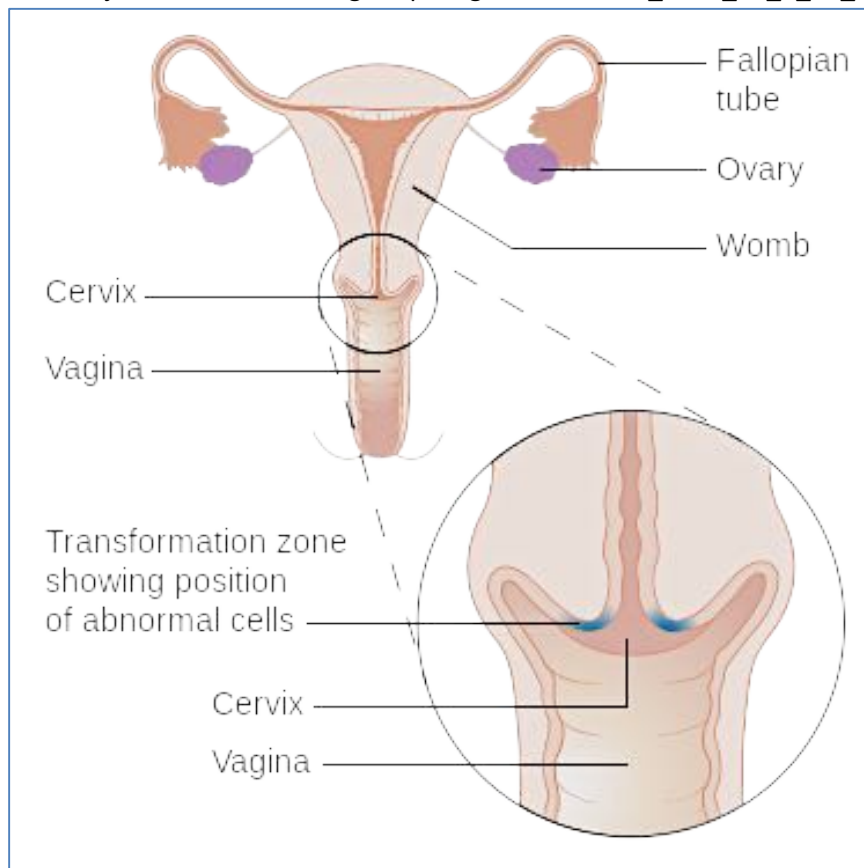
https://embryology.med.unsw.edu.au/embryology/index.php?title=File:Bacteria_-_gram-stained_vaginal_smear_05.jpg

Background Information on the Cervix:

- **Note: The Transformation Zone – Commonest location of Cervical Cancer**
 - TZ = The location of Transition from Squamous to Columnar Epithelium
 - **Note:** During puberty, Columnar Epithelium Migrates out of the os → Exposed to Vaginal Acidity → Metaplasia to Squamous Epithelium
 - This is the area Predisposed to Cancer

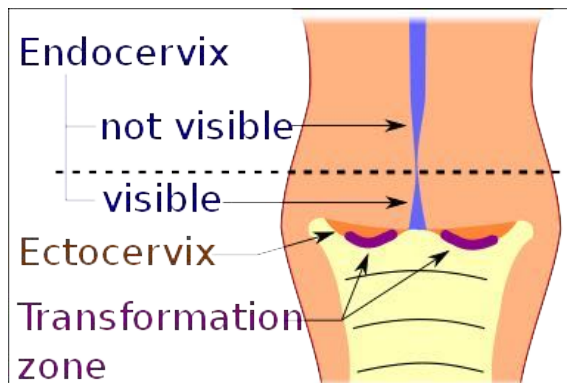


https://www.cancerjournal.net/viewimage.asp?img=JCanResTher_2015_11_1_10_154065_f2.jpg

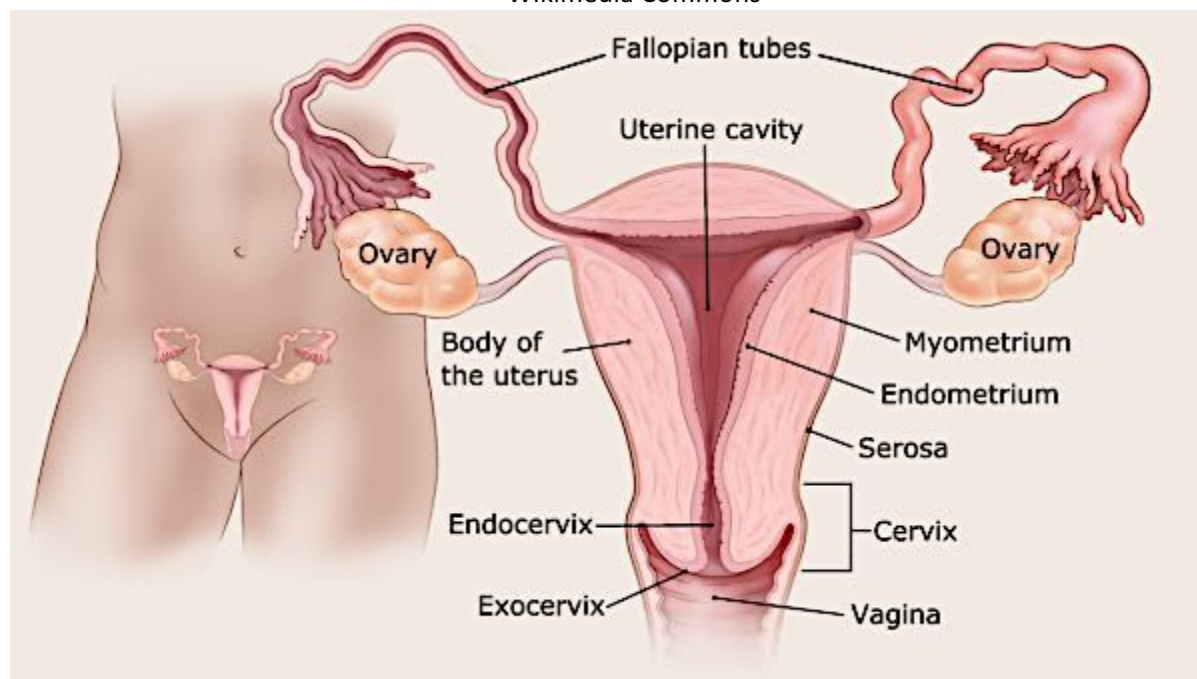


Cancer Research UK, CC BY-SA 4.0 <<https://creativecommons.org/licenses/by-sa/4.0>>, via Wikimedia Commons

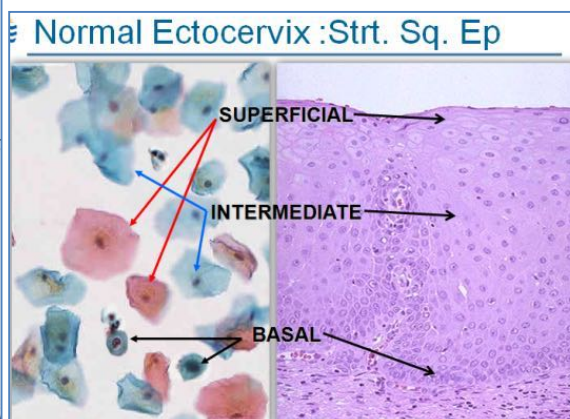
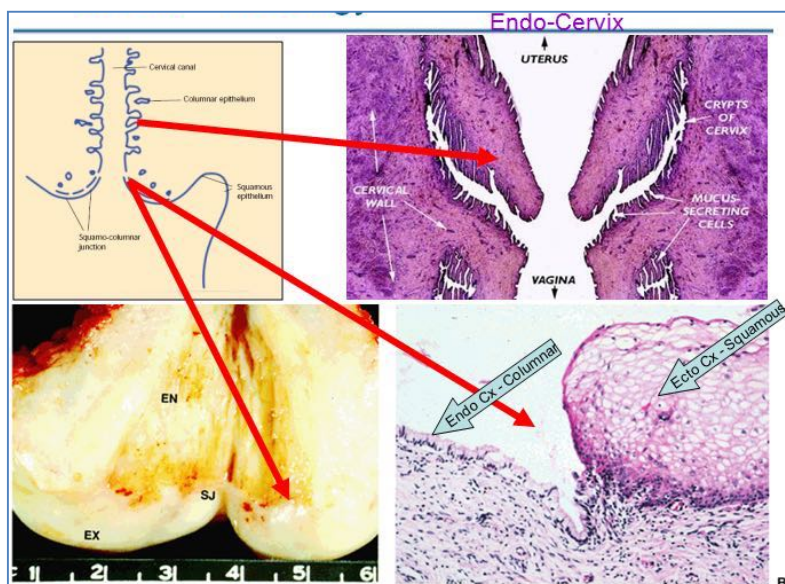
- **Note: The Normal Cervix – Anatomy & Histology:**
 - **Endocervix** = Simple Columnar Epithelium
 - **Ectocervix** = Stratified Squamous Epithelium



Mikael Häggström, M.D. - Author info - Reusing images- Conflicts of interest: None Mikael Häggström, CC0, via Wikimedia Commons

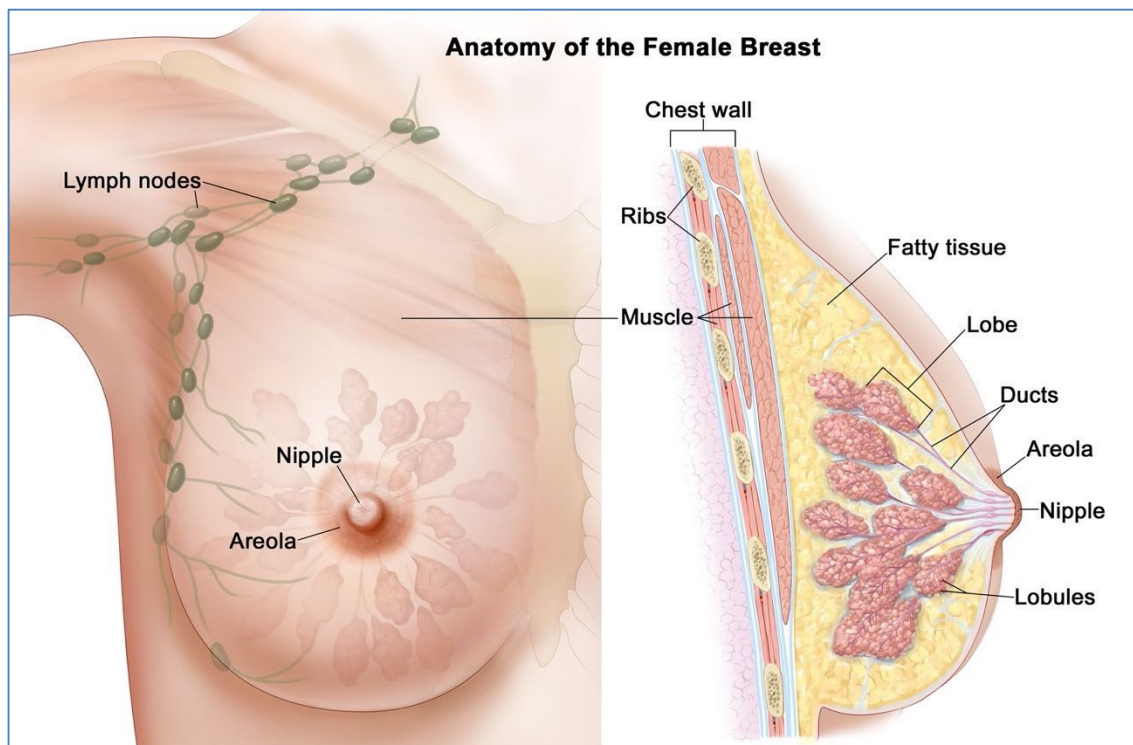


<https://unclineberger.org/cecs/for-researchers/>

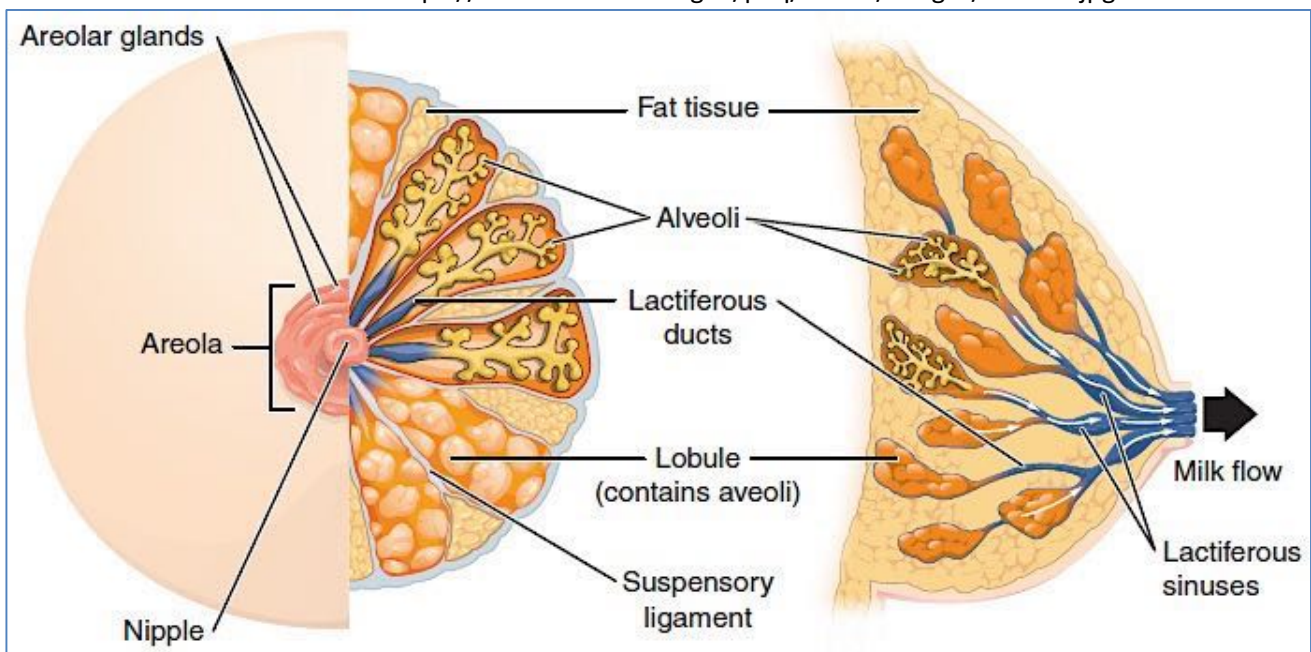


Overview of The Breast:

- **Mammary glands:**
 - o Exist in both sexes – only functional in females
 - o Contained within the breast – within the hypodermis (superficial fascia), anterior to pectoral muscles of the thorax
- **Areola** – ring of pigmented skin surrounding nipple – contains large sebaceous glands (stop chapping)
- **Nipple** – protrudes from centre of areola
- Attached to Pec-Major by Suspensory Ligaments
- **Glandular Breast Tissue:**
 - o Approx 20 lobes/lobules → Converge to Lactiferous Ducts → Lactiferous Sinuses → Nipple
 - o Padded and separated from each other by connective tissue (suspensory ligaments) and fat
 - o Within the lobes are smaller lobules – containing glandular alveoli – produce milk during lactation
 - o Compound alveolar glands pass milk into the lactiferous ducts → accumulates in a lactiferous sinus
- **Lymphatic Drainage:**
 - o Supraclavicular, Infraclavicular, Parasternal, Pectoral, Axillary, Central, Subscapular



Public Domain: <https://nci-media.cancer.gov/pdq/media/images/415520.jpg>



OpenStax, CC BY 4.0 <<https://creativecommons.org/licenses/by/4.0/>>, via Wikimedia Commons

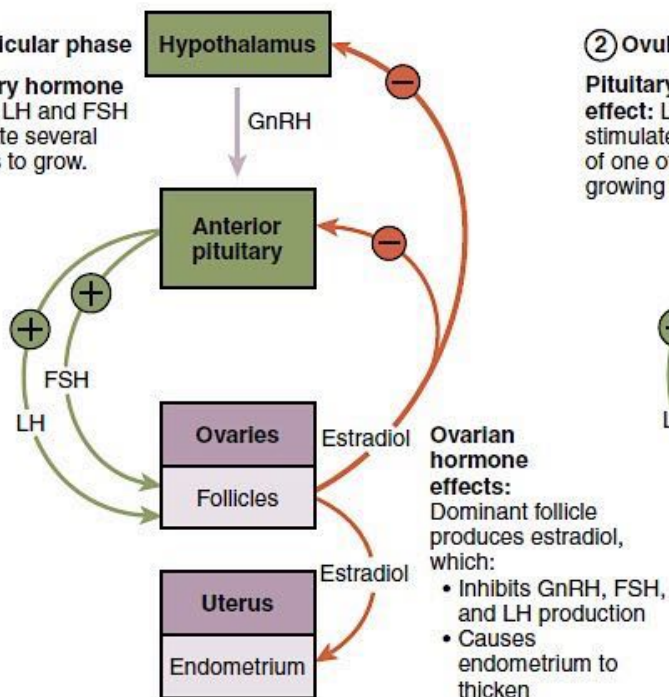
Review of Female Reproductive Physiology:

- **Puberty:**
 - A gradual series of events that transform a child into a sexually mature adult
 - **Female:** Marked by first menstrual period (average age 13)
 - **(Male:** Marked by physical development of Male Sex Characteristics)
- **Initiation:**
 - Activation of **Hypothalamo-Pituitary-Gonadal Axis** → establishes regulation of gonadal function
 - **At puberty** → ↓ Sensitivity of the hypothalamus to Inhibitory Steroid Hormones → ↑ GnRH → ↑ FSH & LH → ↑ Gonadal Testosterone/Oestrogen/Progesterone → Sexual Maturation
- **The Female Reproductive Cycle:**
 - The monthly series of events associated with the maturation of an egg
 - Typically 28 days long
 - **Days 1-5: *Menstruation*:**
 - **Shedding of the Endometrium**
 - Low levels of all hormones (FSH, LH, Oestrogen & Progesterone)
 - **Days 5-14: The Follicular/Proliferative Phase:**
 - **Follicular Recruitment & Growth**
 - **+ Endometrial Proliferation**
 - Rising levels of Oestrogen as Follicle/s get larger
 - **Day 14 (Mid-Cycle): *Ovulation*:**
 - Surge of FSH & LH → Ovulation into peritoneal cavity → Oocyte enters Fallopian Tubes
 - **FERTILE**
 - **Days 14-28: The Luteal Phase:**
 - **Transformation of Follicle → Corpus Luteum**
 - Corpus Luteum Secretes Mainly Progesterone (& Some Oestrogen)
 - Degenerates (Unless pregnancy occurs → Corpus Luteum persists until the placenta can take over)
 - **FERTILE**
 - **Day 28: End of Cycle:**
 - **Corpus Luteum Degenerates** → No Oestrogen/Progesterone to sustain Thick Endometrium → Endometrial Arteries become Spastic & Tortuous → Menstruation

(Diagram over the page)

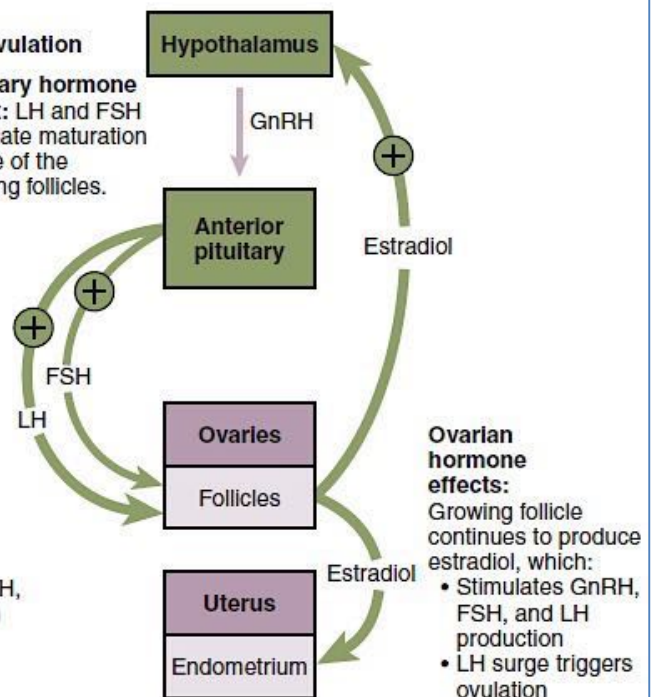
① Follicular phase

Pituitary hormone effect: LH and FSH stimulate several follicles to grow.



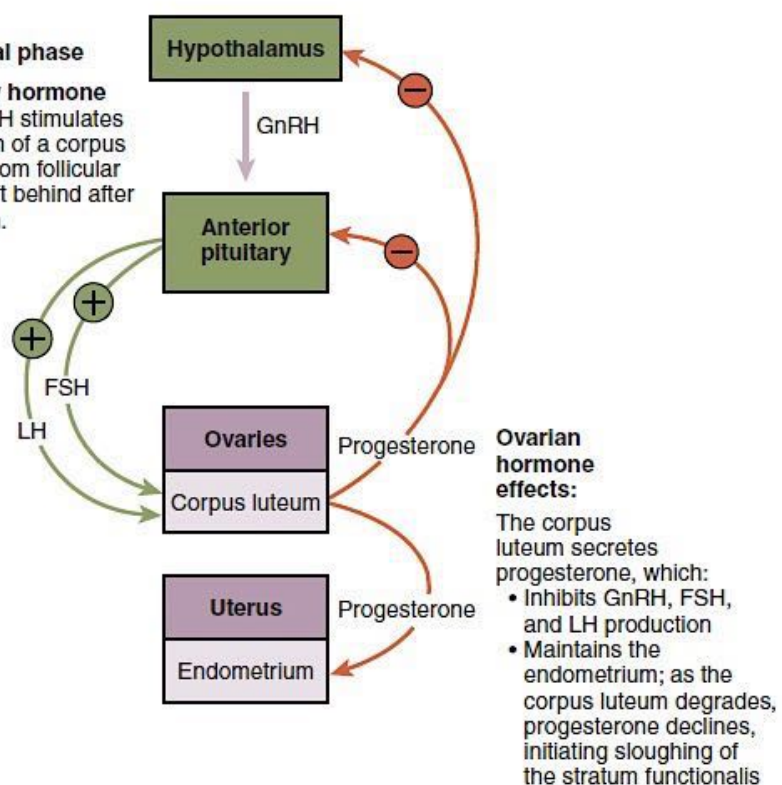
② Ovulation

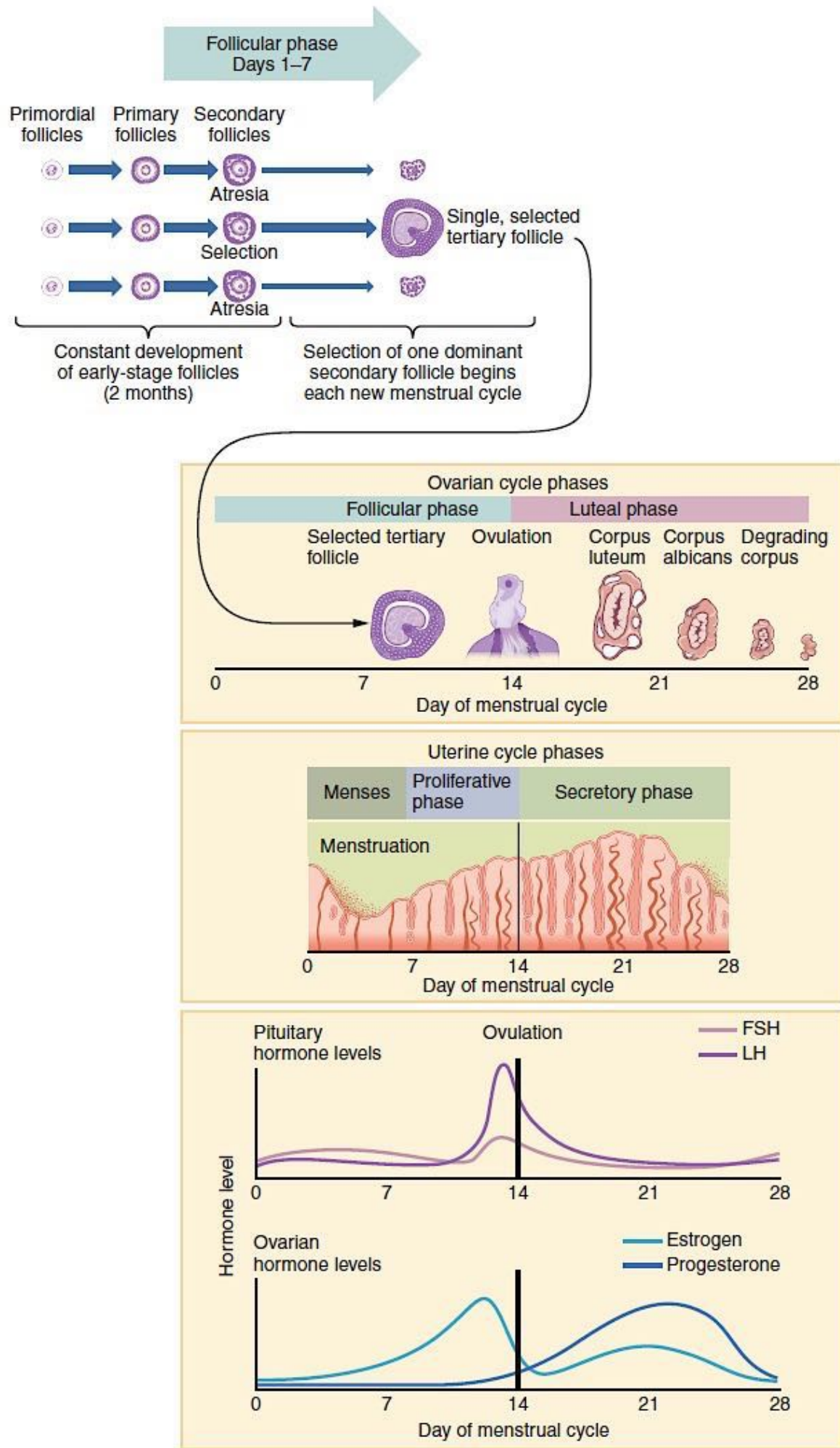
Pituitary hormone effect: LH and FSH stimulate maturation of one of the growing follicles.



③ Luteal phase

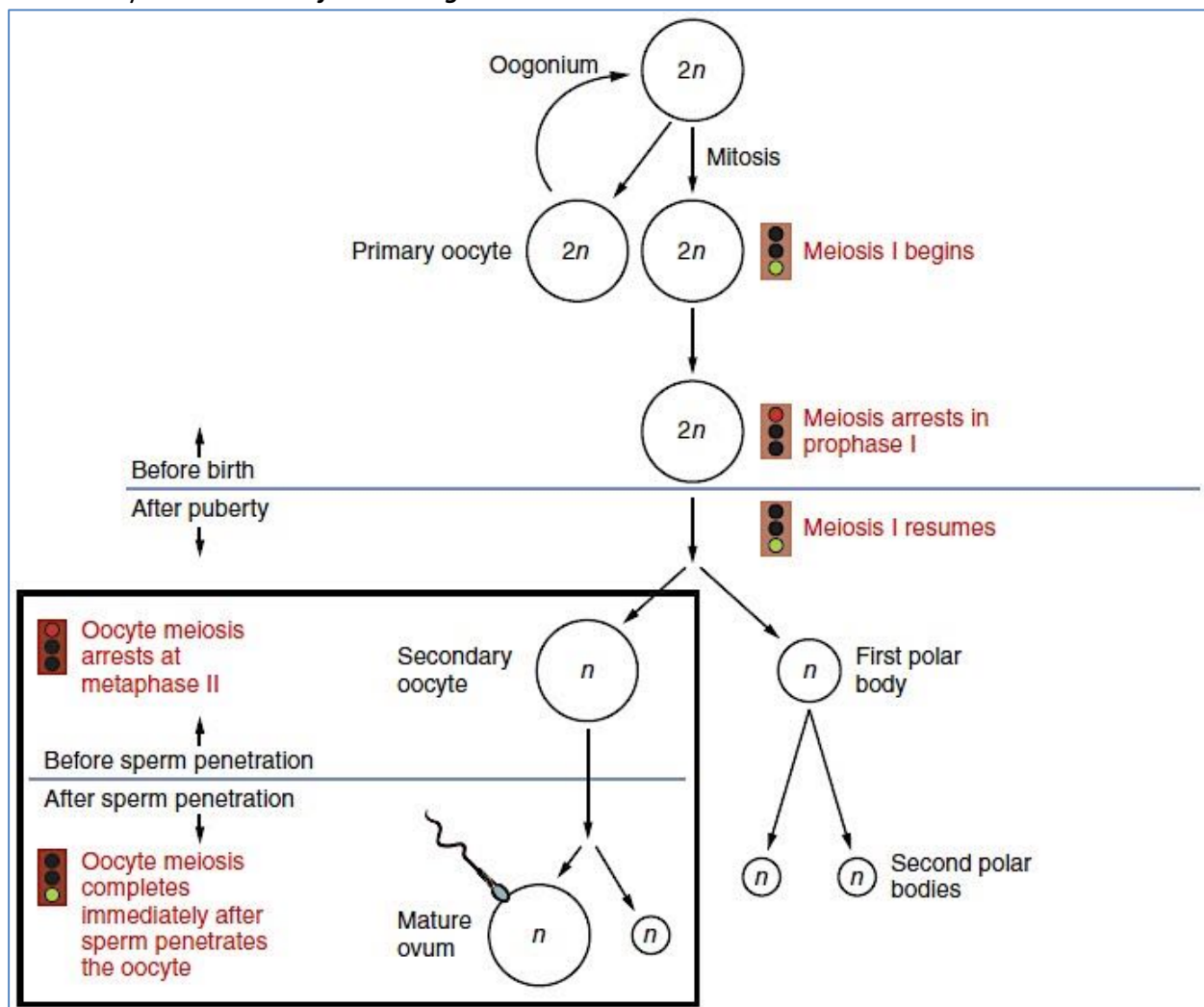
Pituitary hormone effect: LH stimulates formation of a corpus luteum from follicular tissue left behind after ovulation.



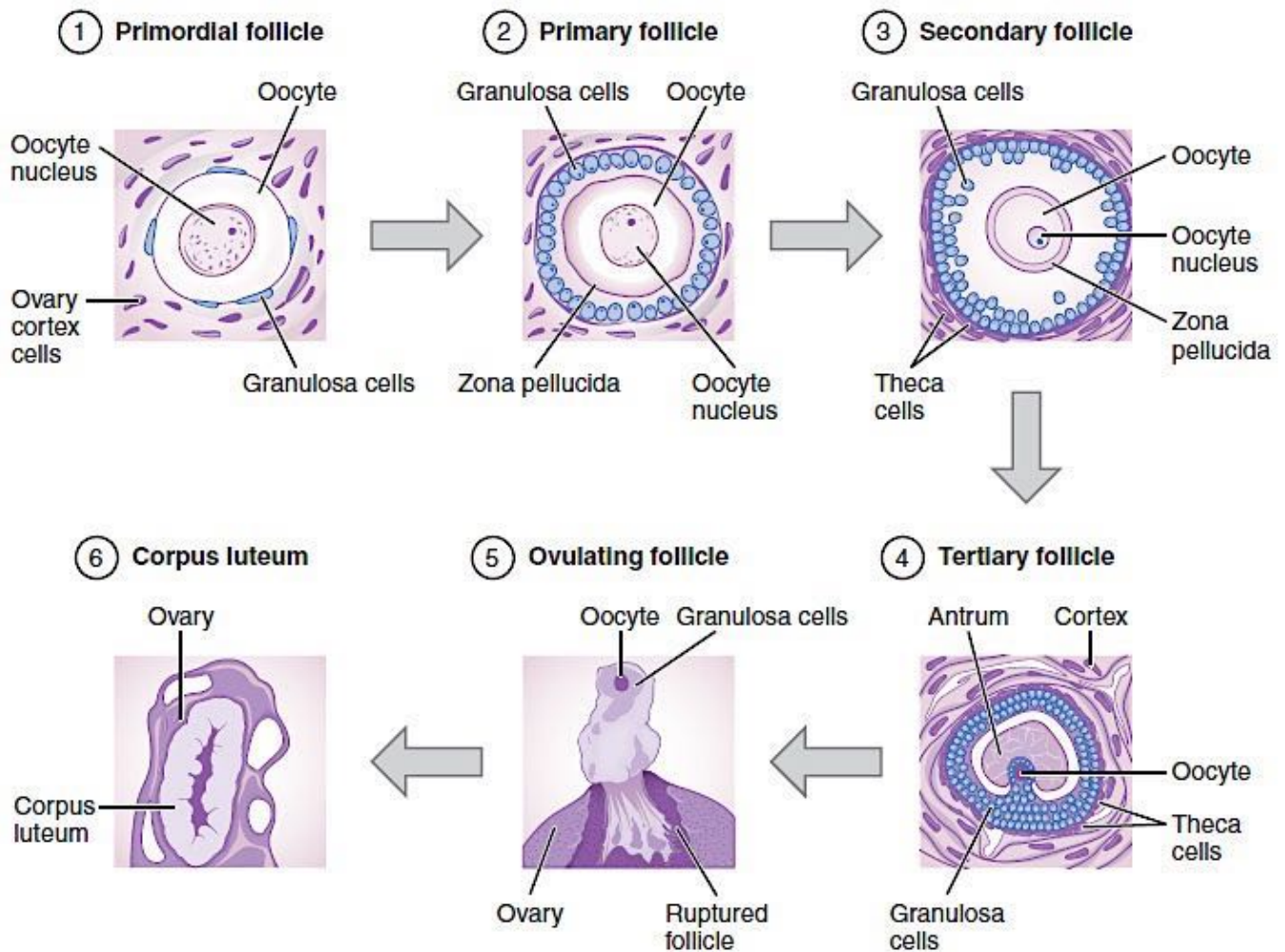


Meiosis (Female) – Oogenesis:

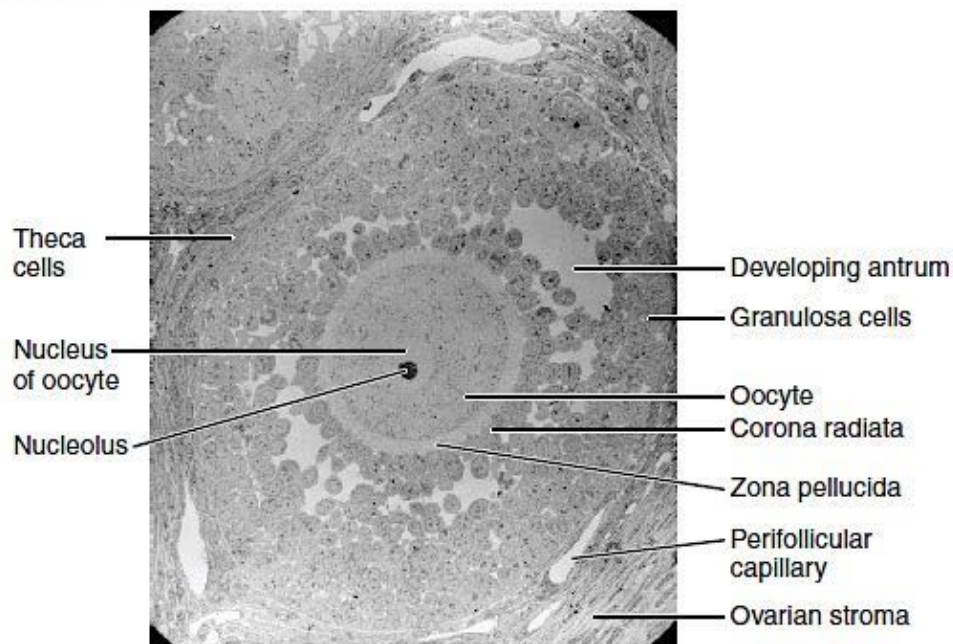
- It is thought that in general, the total number of eggs in a female is predetermined at birth
 - **Female gamete production = Oogenesis**
 - o Done through **meiosis**
 - Specialized cell division
 - Usually produces 4 haploid cells
- 1) **Foetal period** - the, **Oogonia** (diploid ovarian stem cells) multiply rapidly by mitosis, then enter a growth phase and lay in nutrient reserves as **Primary Oocytes**
 - 2) These **Primary Oocytes** then become **surrounded by** a single layer of **Follicle Cells** forming a **Primordial Follicle**
 - 3) **Primary Oocytes** (of the primordial follicles) then begin the **first meiotic division**. However, they are **arrested in prophase I**
 - 4) Female is born with approximately 2million primary oocytes. By puberty, 250000 primary oocytes are left.
 - 5) **Puberty—Menopause**: Each month, a small number of **primary oocytes** are recruited in response to the LH surge midway through the menstrual cycle. (Luteinising Hormone) As these **primary oocytes** prepare to divide, a spindle forms on its edge, creating a small “nipple” where half of the chromosomes will be cast during division
 - 6) Only **one of the primary oocytes** is selected to **continue meiosis I**. Produces **2 haploid cells** (23 chromosomes each) **dissimilar in size**. The smaller cell is the “**first polar body**” (little->no cytoplasm) and the larger cell is the **secondary oocyte**. → The **secondary oocyte** is then arrested in **metaphase II** and **OVULATED**. (unequal Cytoplasmic divisions ensure that a fertilised egg has ample nutrients for its week-journey to the uterus.)
 - 7) The **ovulated secondary oocyte MUST be penetrated by a SPERM** for it to complete **MEIOSIS II**, yielding one large **OVUM** and a “**Second polar body**”
- *Note:** - The potential products of oogenesis are 3 small polar bodies and one large ovum. (3 polar bodies aren't always formed – first polar body often perishes before meiosis II)
-Only the **OVUM** is a **functional gamete**



(a) Stages of Folliculogenesis



(b) A Secondary Follicle



PREGNANCY

PREGNANCY

Aetiology:

- Unprotected Intercourse
- IVF (In Vitro Fertilisation)
- AI (Artificial insemination)

Clinical Features:

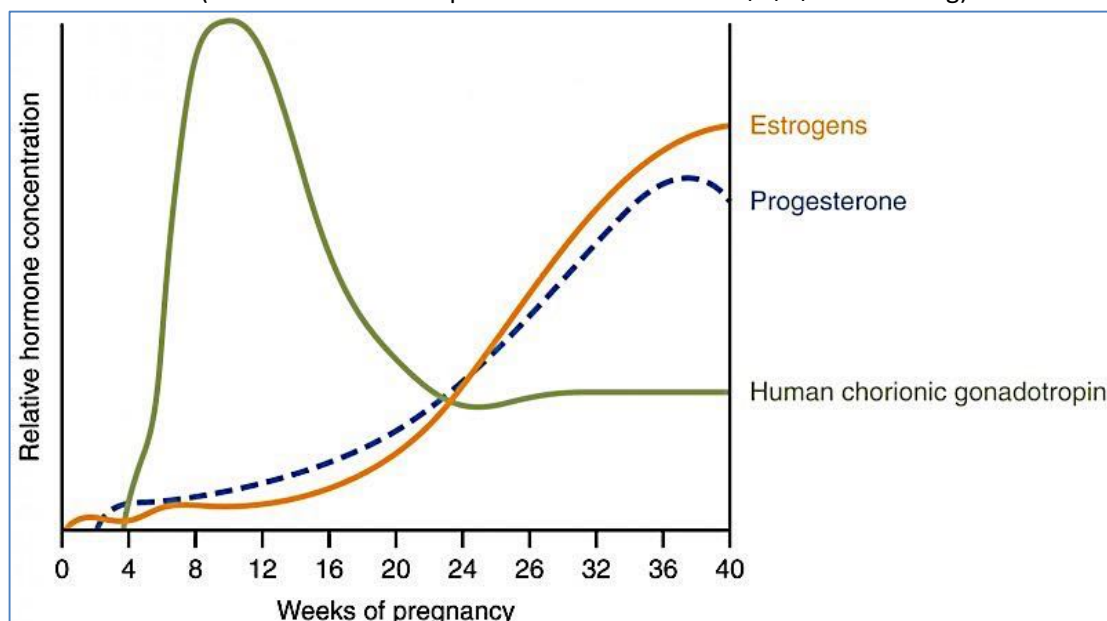
- **Symptoms:**
 - o Amenorrhoea
 - o Nausea/Vomiting
 - o Heartburn/Reflux
 - o Breast Tenderness
 - o Urinary Frequency
 - o Constipation
 - o Fatigue
- **Signs:**
 - o Softening of the cervix (4-6wks)
 - o "Chadwick's Sign" - Bluish Hue of Vagina (Engorgement of pelvic vasculature)
 - o Uterine Enlargement
 - o Breast Enlargement & Areolar Darkening

Diagnosis of Pregnancy

- **B-HCG:**
 - o +ve in *Serum* @ 9days post-conception
 - o +ve in *Urine* @ 28days post-conception
- **Transvaginal USS:**
 - o 5 wks: Gestational Sac Visible
 - o 6 wks: Foetal Pole Visible
 - o 7-8wks: Foetal Heartbeat Detectable
- **Trans-Abdominal USS:**
 - o >6 wks: Pregnancy Detectable

Physiological Amenorrhoea:

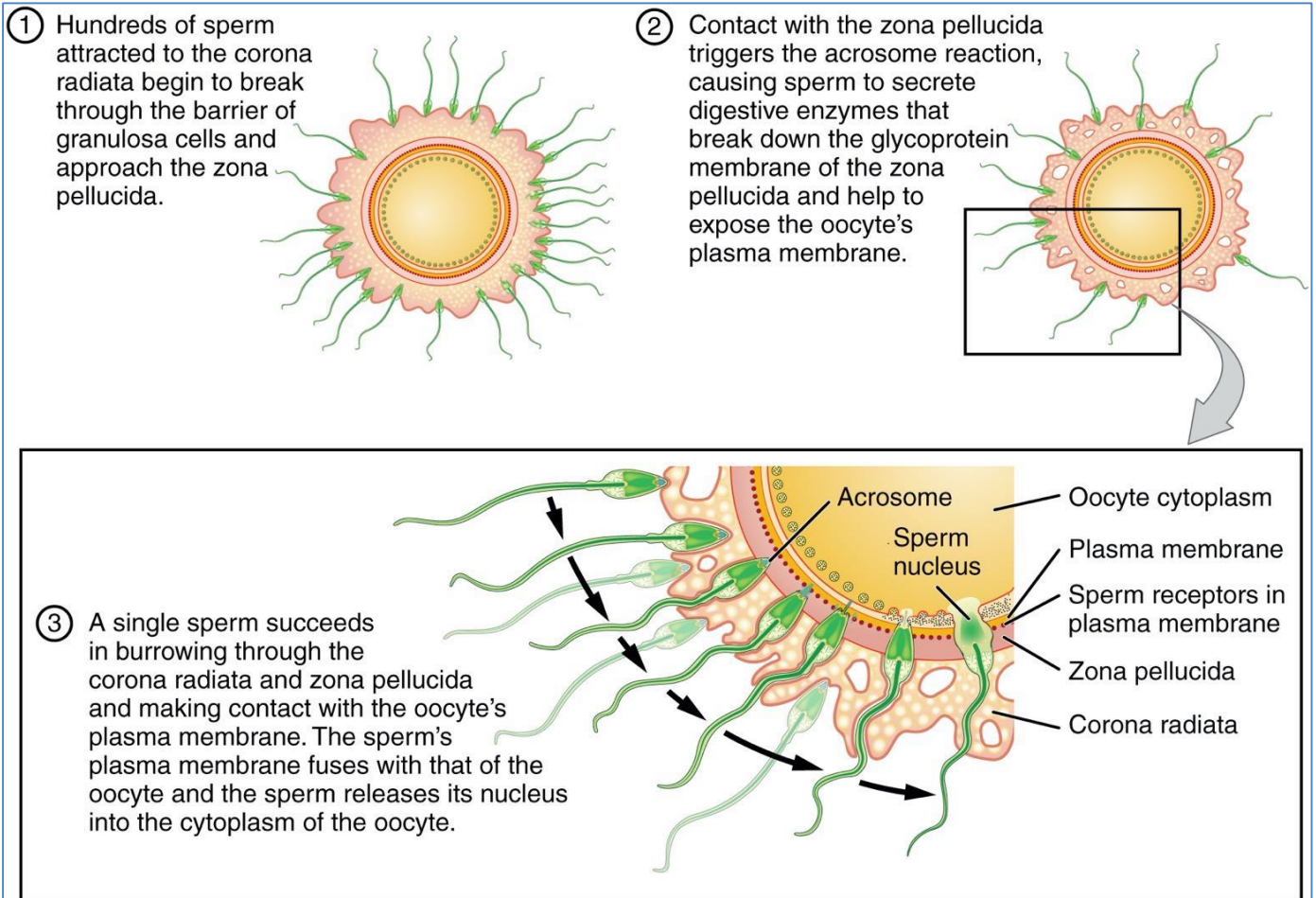
- Trophoblasts secrete B-HCG (Human Chorionic Gonadotropin) → Promotes Corpus Luteum to continue secreting Oestrogen & Progesterone (Ie: Prevent Menstruation)
- Trophoblasts → "Chorion" (continues secreting B-HCG)
 - o **(Note: B-HCG *Below* expected for dates could = Ectopic/Abortion/Wrong Dates)**
- Chorion → Placenta (Takes over from Corpus Luteum → Secretes ↑↑↑ Oest & Prog)



FERTILISATION & IMPLANTATION

From Egg (Oocyte) → Zygote:

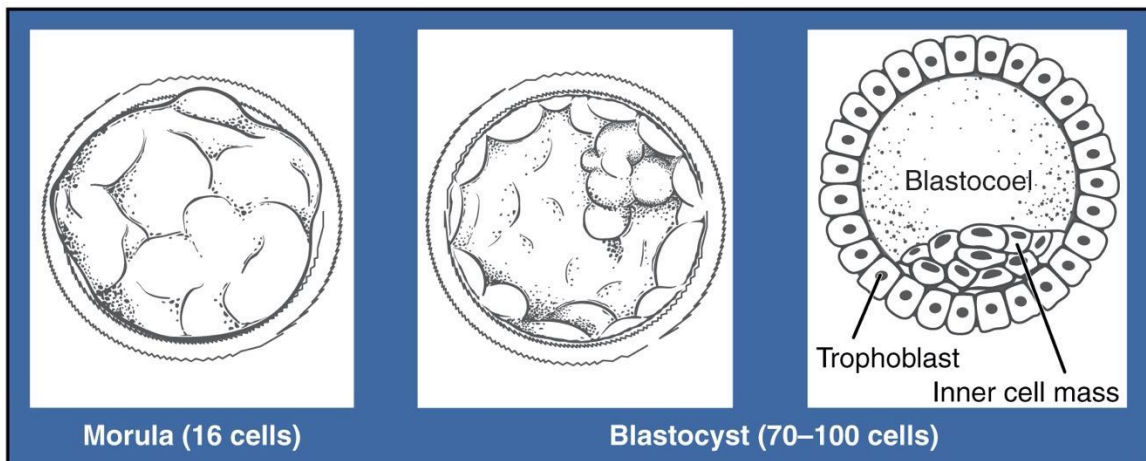
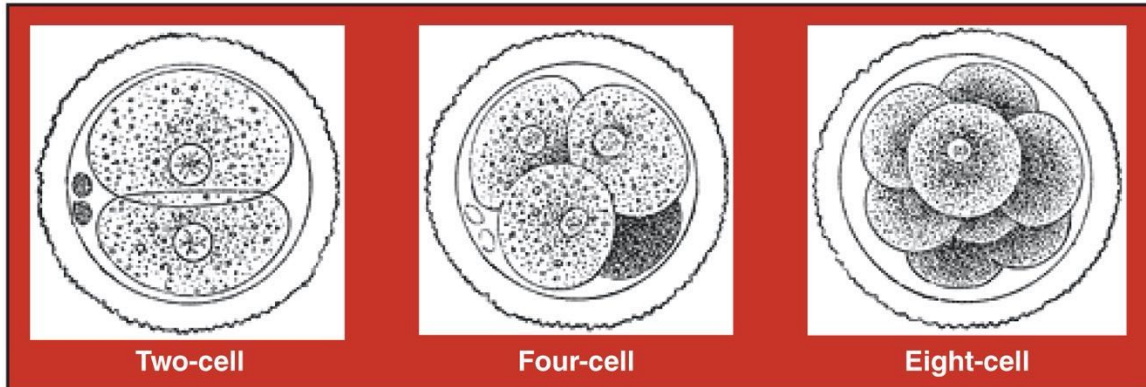
- **Viability:**
 - Oocyte is viable up to 24 hrs after ovulation
 - Sperm are viable inside female for up to 2 days
 - 3 day viable window = Sex between 2 days before ovulation and 1 day after
- **Fertilisation:**
 - Only a few thousand sperm reach the uterine tubes (site of fertilisation)
 - Sperm must be capacitated (increased mobility + fragile acrosomal membranes) before they can penetrate the oocyte (caused by secretions of female tract)
 - Oocyte is encapsulated in a "corona radiata" and the deeper "zona pellucida", which both need to be breached before the oocyte itself can be penetrated by a sperm
- **Steps:**
 1. Sperm penetrates the corona radiata, assisted by hyaluronidase, and corona radiata cells fall away from the oocyte
 2. Sperm head binds to zona pellucida, which triggers the release of acrosomal enzymes → digest holes through the zona pellucida (hundreds of sperm are needed to expose the oocyte membrane)
 3. Single sperm fuses with oocyte membrane, its nucleus is pulled into the oocyte cytoplasm
 4. Ca^{2+} is released by oocyte ER, causing cortical reaction → cortical granules in oocyte membrane release enzymes (zonal inhibiting proteins) that destroy remaining sperm receptors + detach all sperm still bound
 5. Secondary oocyte completes meiosis II, forming ovum pronucleus + 2nd polar body
 6. The lucky sperm loses its tail + midpiece, & its nucleus swells to 5x → forms male pronucleus
 7. These 2 pronuclei fuse and form the zygote (moment of fertilisation)
 8. Mitosis of conceptus begins



From Zygote → Blastocyst Implantation:

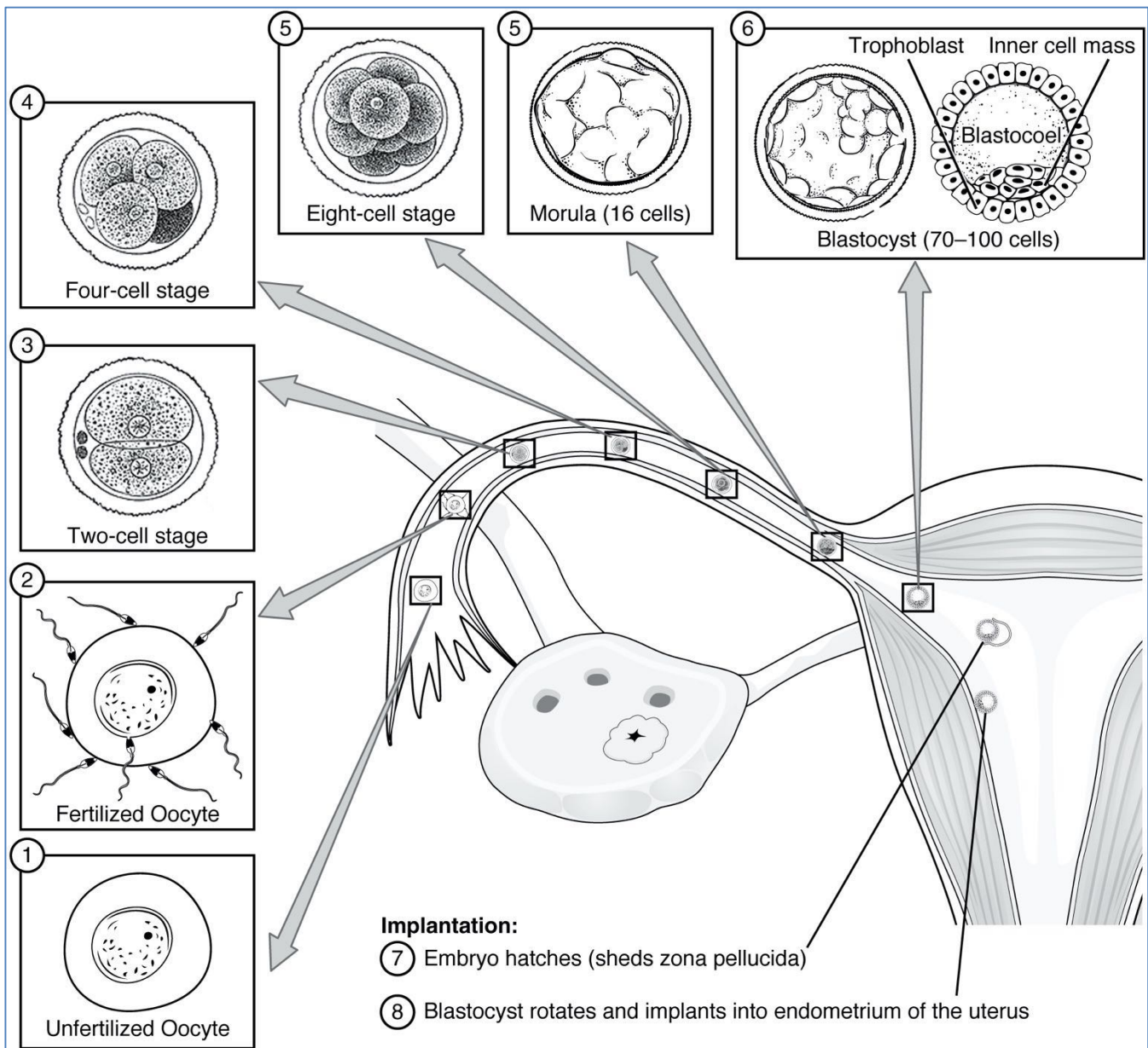
- Cleavage & Blastocyst Formation:

- Rapid series of mitotic divisions without intervening growth → produces many smaller cells collectively called the **morula**
- Cells of the morula compact (forming the inner cell mass), the zygote accumulates fluid and trophoblast cells develop around the inside of the zona pellucida (Early blastocyst)
- Zona pellucida starts to break down and the blastocyst “hatches” from it



■ Occurs in uterine tube ■ Occurs in uterus

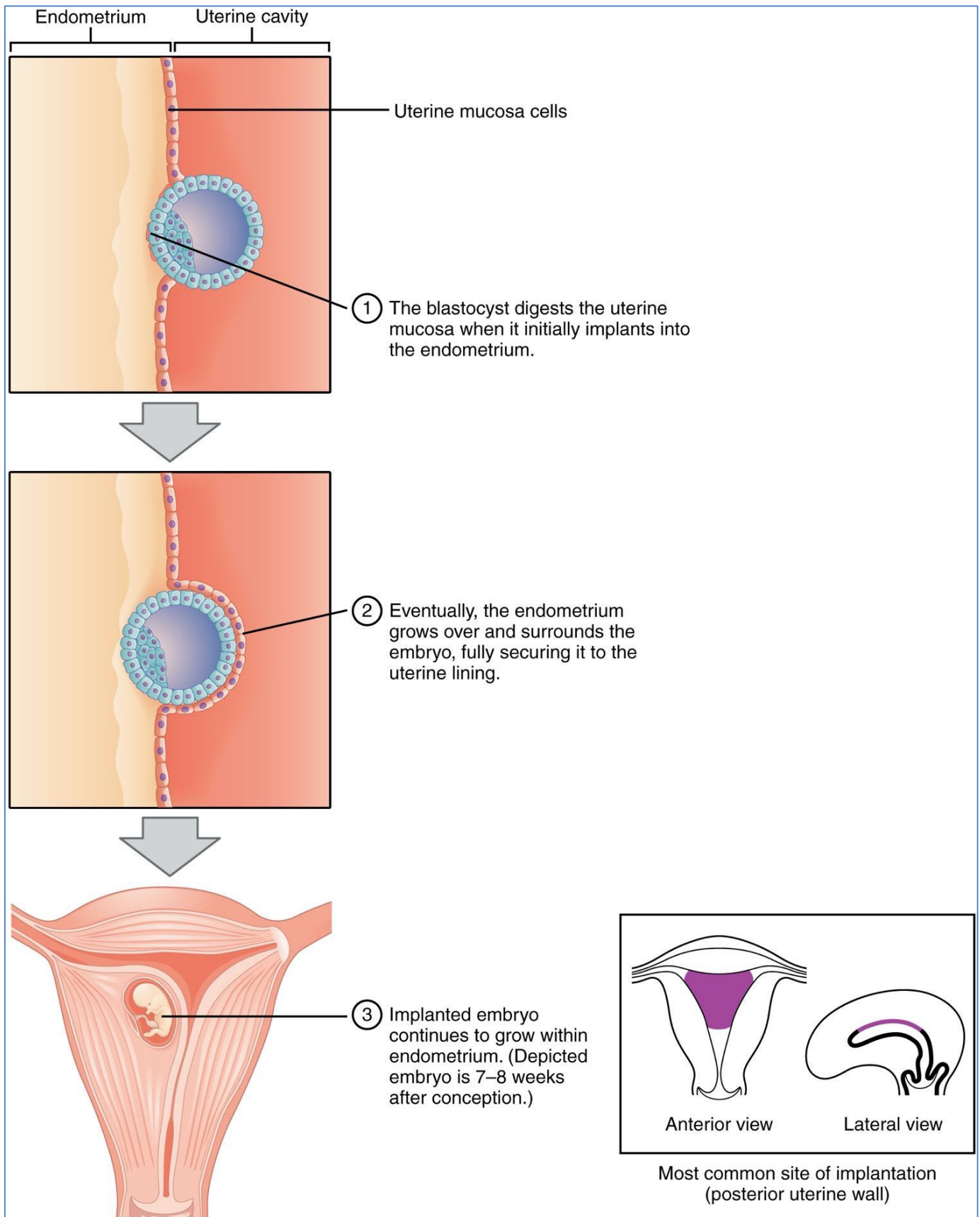
OpenStax, CC BY 4.0 <<https://creativecommons.org/licenses/by/4.0>>, via Wikimedia Commons



OpenStax, CC BY 4.0 <<https://creativecommons.org/licenses/by/4.0>>, via Wikimedia Commons

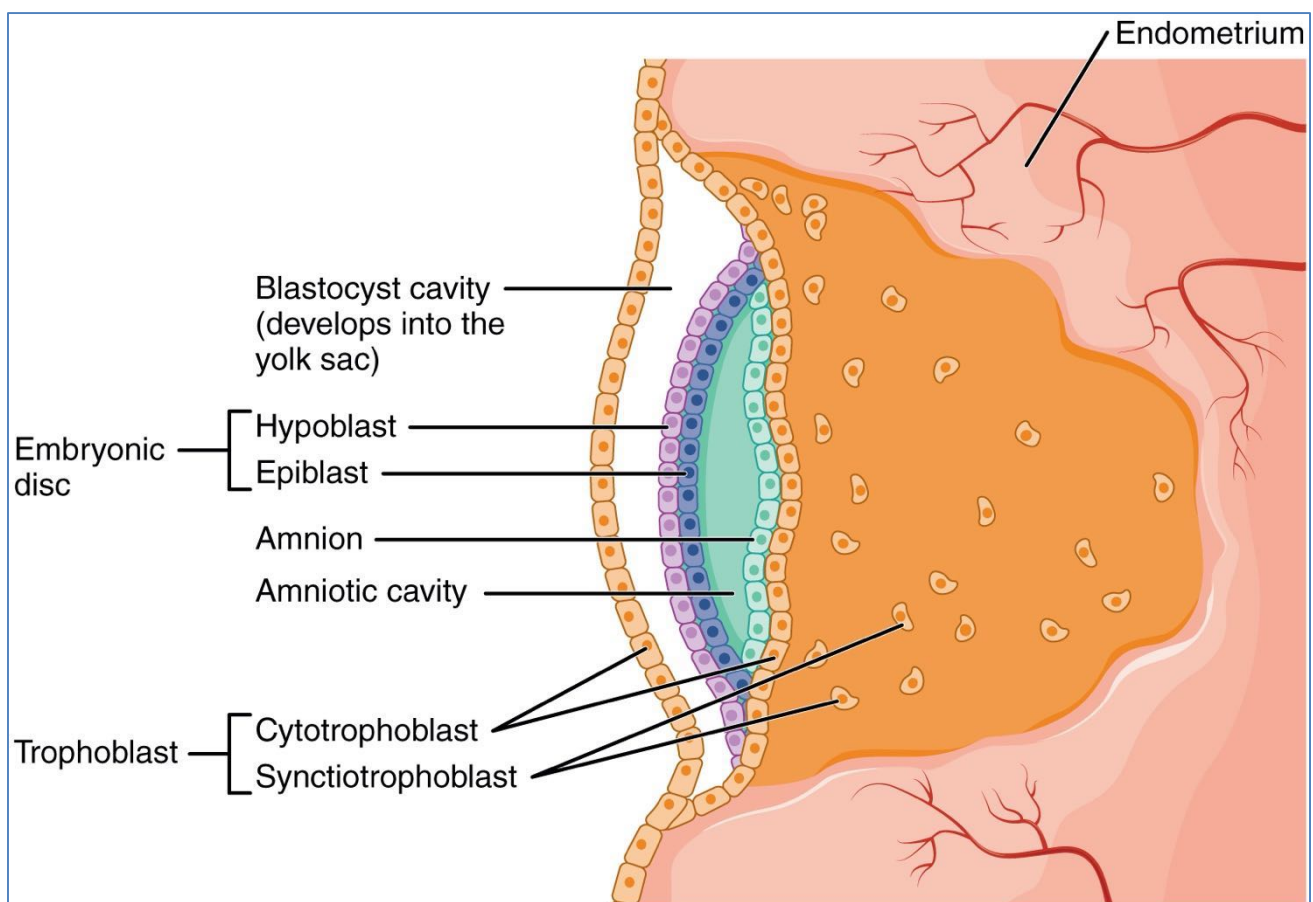
- **Implantation (6-7 days after ovulation)**

- Endometrium must be receptive (at the height of the secretory stage) (caused by surging estrogens and progesterone)
- Trophoblast cells bind to the extracellular matrix of endometrial cells on the inner uterine wall (implantation may be attempted several times where the blastocyst detaches from the immature Endometrium and floats south to try again)
- Endometrium thickens, blood vessels become more permeable/leaky and inflammatory cells invade the area
- Trophoblast cells proliferate, forming 2 distinct layers: **cytotrophoblast** (adjacent to inner cell mass) and the **syncytiotrophoblast** (multinucleated mass – invades the Endometrium by digesting uterine cells)
- At this stage implanted embryo obtains nutrition by digesting endometrial cells
- Blastocyst burrows through the Endometrium and is surrounded by a pool of blood (**lacuna**)
Blastocyst is covered over and sealed off from uterine cavity by endometrial cells
- Successful implantation takes 5 days (12 days after ovulation – usually time of menstruation)
- To stop menses, trophoblast cells secrete hCG (Human Chorionic Gonadotropin) which promotes Corpus Luteum to continue secreting oestrogen and progesterone
 - Trophoblast cells differentiate into the **chorion** which continues secreting hCG
- Chorion later forms the **placenta**, which takes over from corpus luteum & produces shit loads of progesterone and oestrogen

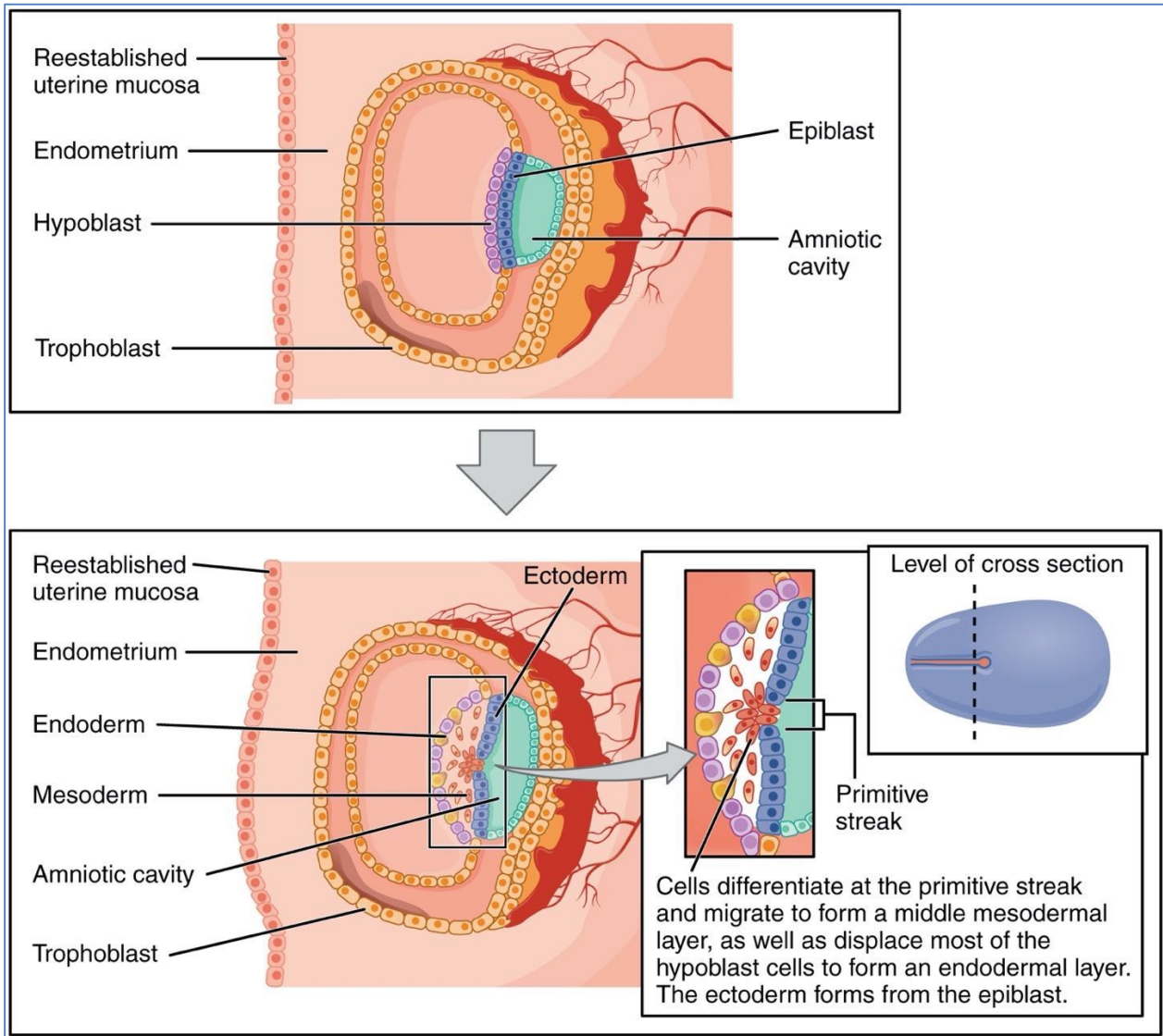


- **Placentation:**

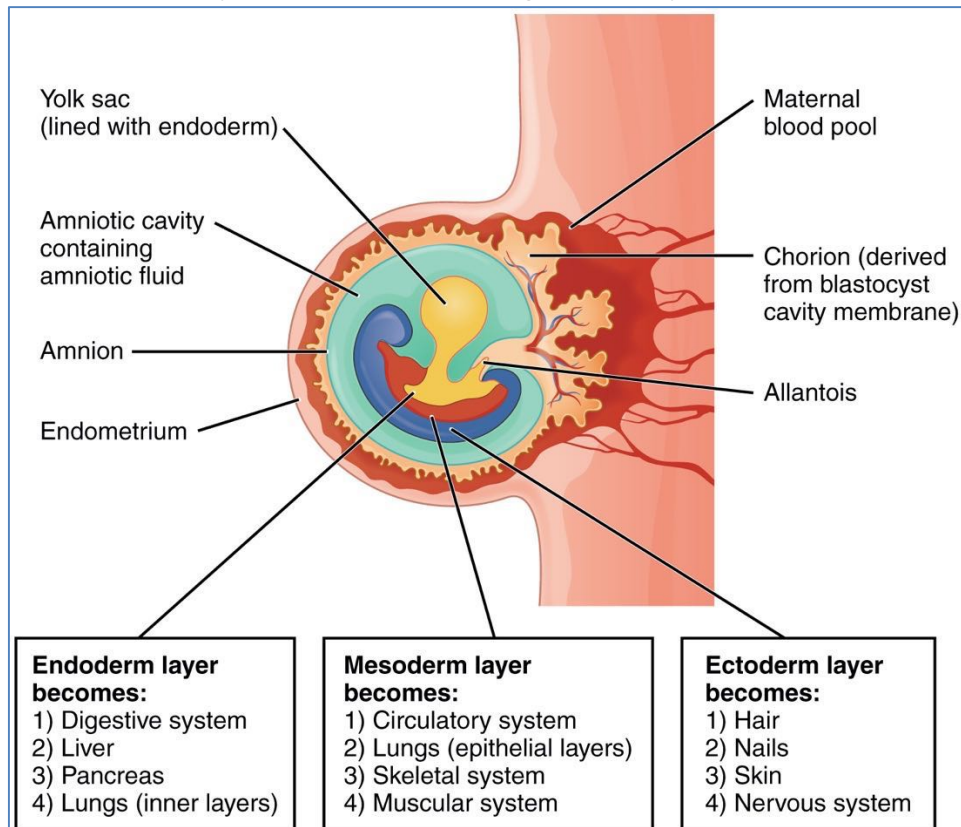
- Cells from original inner cell mass give rise to a layer of **extraembryonic mesoderm** which lines the inner surface of the cytotrophoblast. Together the **cytotrophoblast** and **extraembryonic mesoderm** form the **Chorion**
- **Germ layers form:** inner cell mass facing blastocyst cavity form a flat disc with 2 layers:
 - **1: Ectoderm:**
 - Forms nervous system and skin during gastrulation
 - – and the amnion formed from the ectoderm (later fills with fluid → amniotic sac)
 - **(Mesoderm:** formed later during gastrulation – forms heart, blood vessels, connective Tissue & everything else)
 - **2: Endoderm:**
 - Forms the mucosa (epithelial lining) of the GI tract, respiratory tract, and urogenital tract
 - - and the yolk sack formed from the endoderm (later forms part of the gut/digestive tube and produces the earliest blood cells & blood vessels)
 - – and the allantois – structural base of the umbilical chord
- **By 8 weeks all organ systems are formed**



OpenStax, CC BY 4.0 <<https://creativecommons.org/licenses/by/4.0>>, via Wikimedia Commons

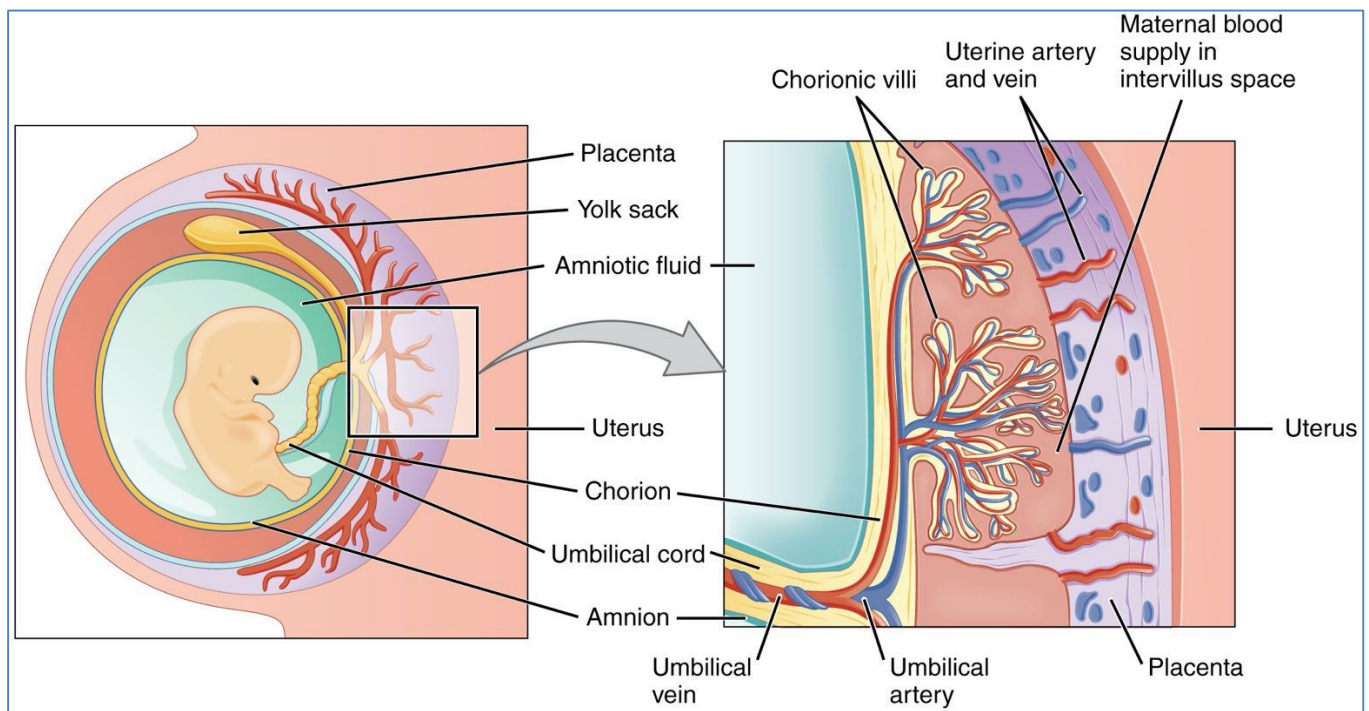


OpenStax, CC BY 4.0 <<https://creativecommons.org/licenses/by/4.0>>, via Wikimedia Commons



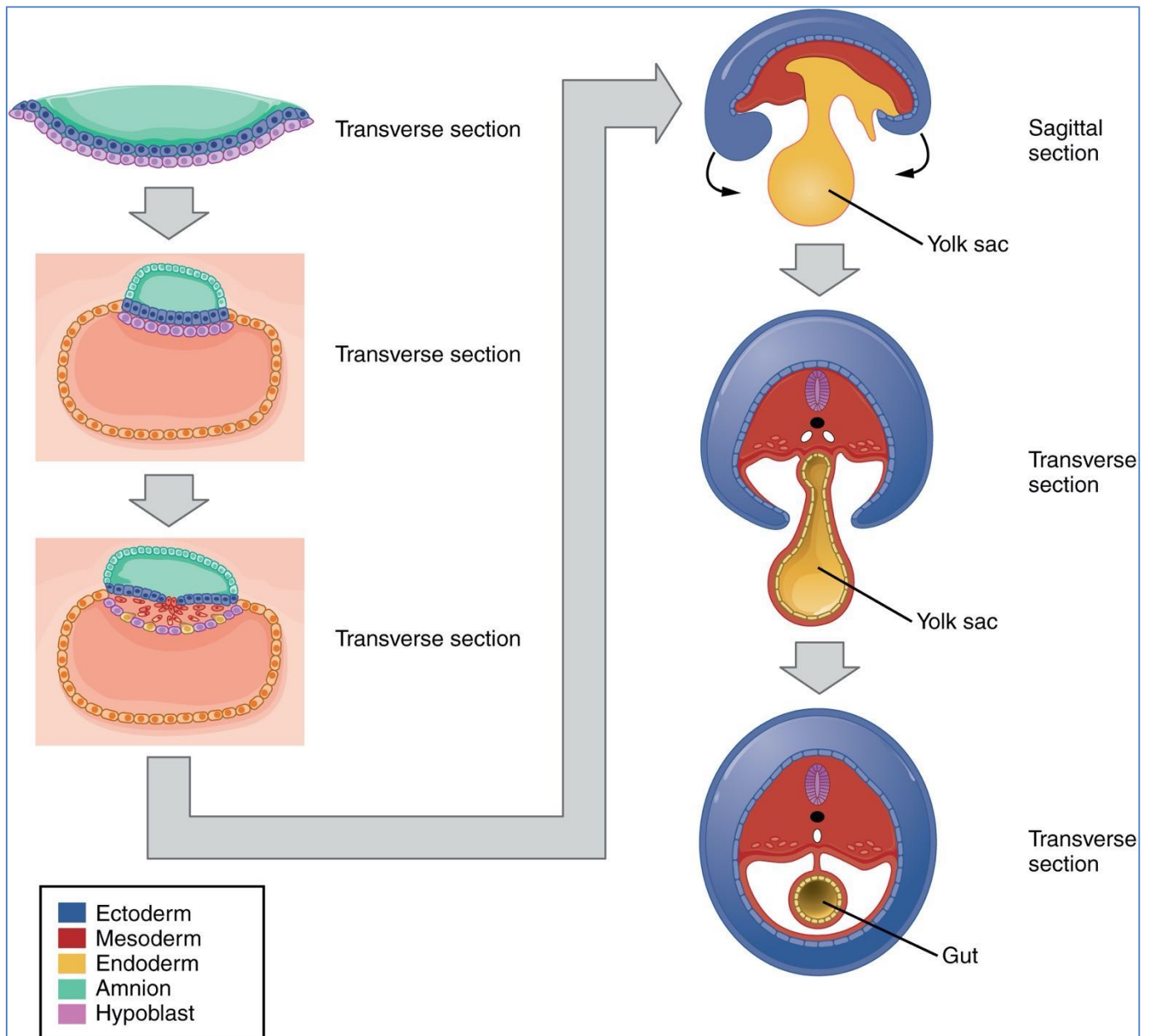
OpenStax, CC BY 4.0 <<https://creativecommons.org/licenses/by/4.0>>, via Wikimedia Commons

- **Chorion** develops fingerlike **chorionic villi** which are in contact with maternal blood and are highly vascularised
- Large blood-filled **lacunae** form in the Endometrium and the villi become totally immersed in blood
- Around the chorionic villi, the Endometrium splits into 2 parts: **the decidua basalis** (basal side/ stratum basalis [side of umbilical cord]) and **the decidua capsularis** (luminal side of embryo)
 - Decidua capsularis expands to accommodate foetus & villi are compressed & degenerate
 - Decidua basalis forms the eventual placenta and villi increase in number and branch even more profusely
 - Placenta functions as a nutritive, respiratory, excretory and endocrine organ
 - Transports glucose, amino acids, fatty acids, O₂, CO₂ and other wastes

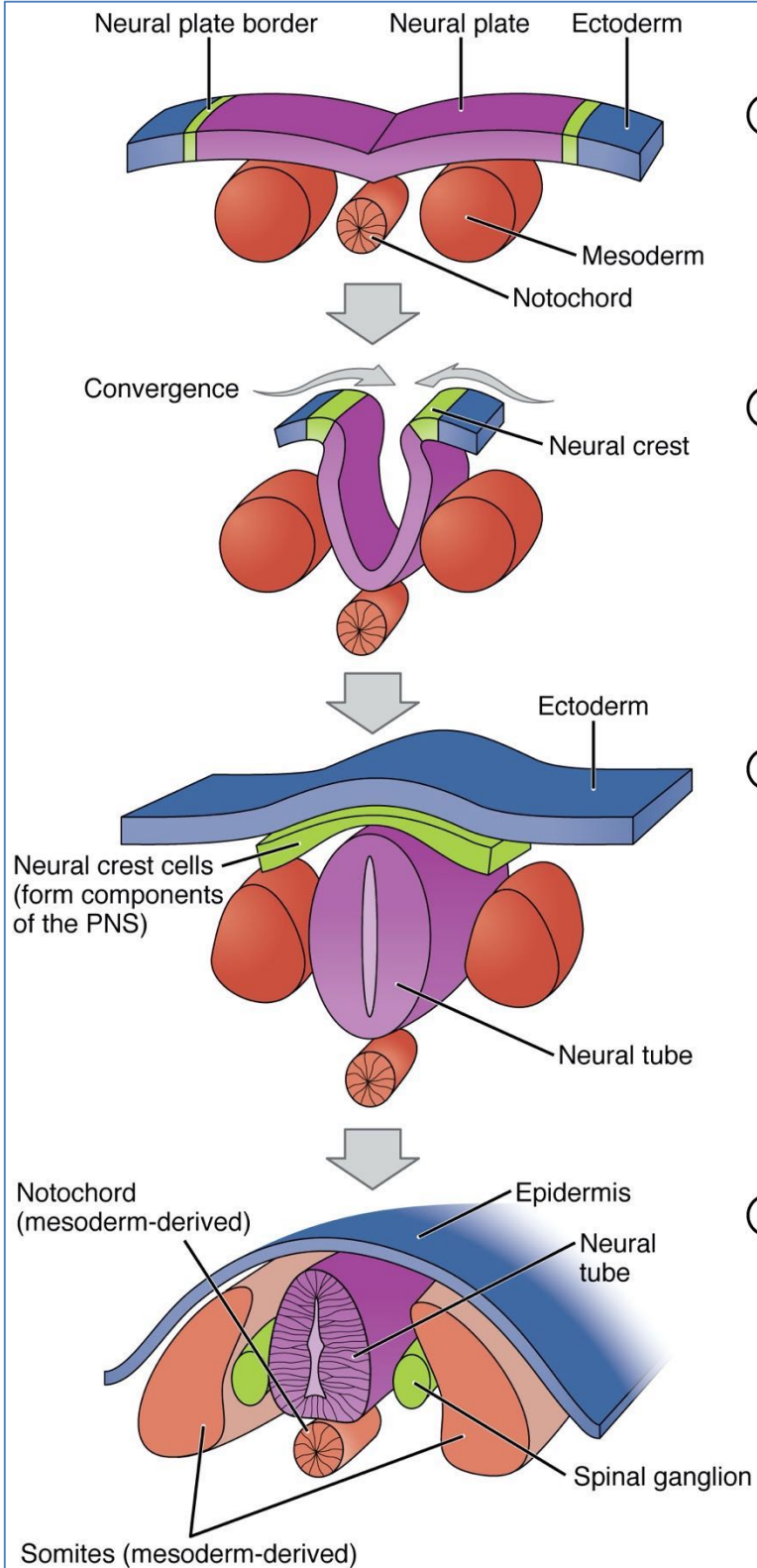


OpenStax, CC BY 4.0 <<https://creativecommons.org/licenses/by/4.0>>, via Wikimedia Commons

Embryonic Development



OpenStax, CC BY 4.0 <<https://creativecommons.org/licenses/by/4.0>>, via Wikimedia Commons

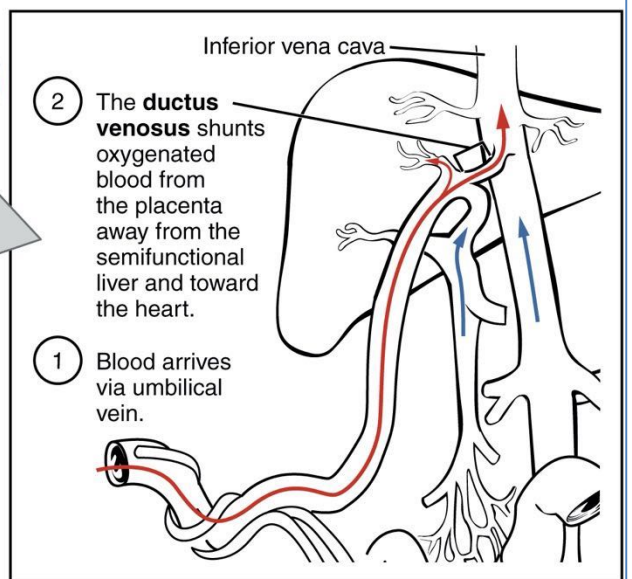
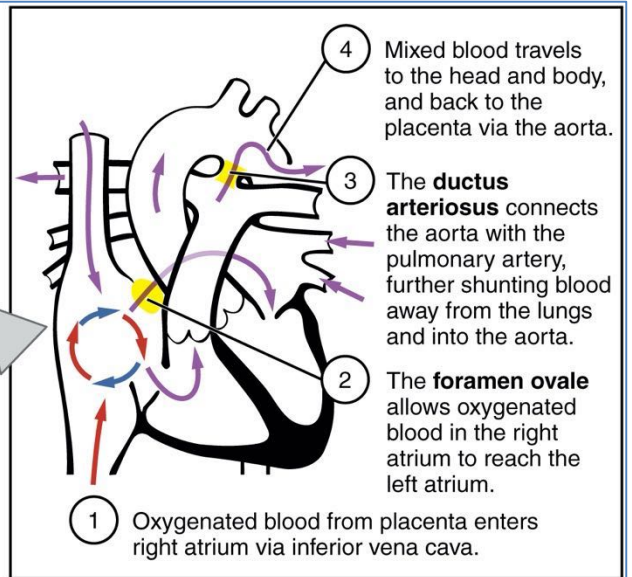
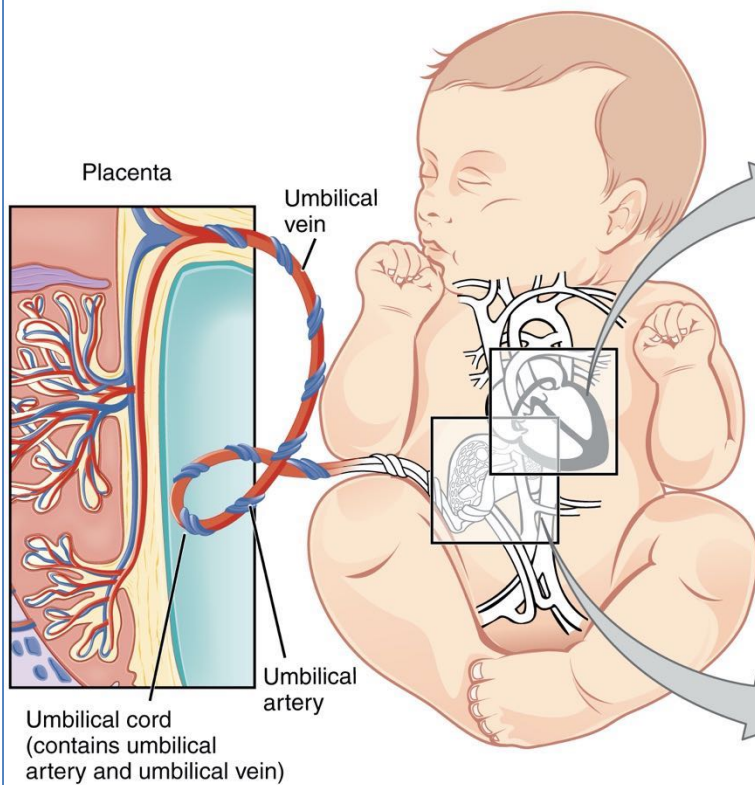


① Neuroectodermal tissues differentiate from the ectoderm and thicken into the neural plate. The neural plate border separates the ectoderm from the neural plate.

② The neural plate bends dorsally, with the two ends eventually joining at the neural plate borders, which are now referred to as the neural crest.

③ The closure of the neural tube disconnects the neural crest from the epidermis. Neural crest cells differentiate to form most of the peripheral nervous system.

④ The notochord degenerates and only persists as the nucleus pulposus of the intervertebral discs. Other mesoderm cells differentiate into the somites, the precursors of the axial skeleton and skeletal muscle.



End of Sample

Thankyou for previewing this **FREE** sample.
For the rest of this subject, or to explore more of our range of
amazing study notes, visit the link below:

>>> <https://mednotesstudent.com/product/all-21-notes-80-off-bundle/> <<<

OR GET 80% OFF THIS SUBJECT IN THE BUNDLE DEAL HERE!

(Offer Ends Soon)

MOST POPULAR

