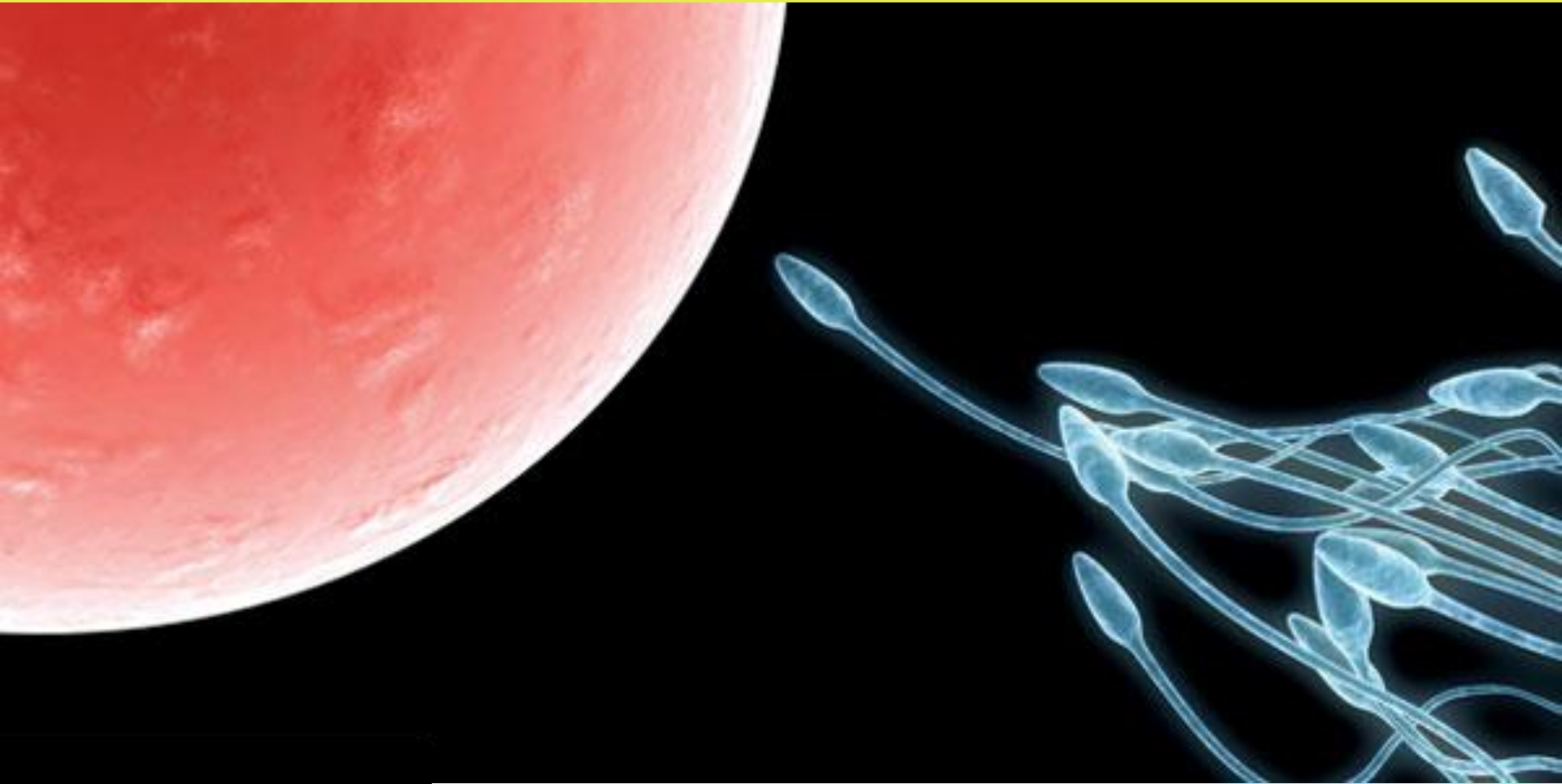


Click on “Slide Show”

Click “From Beginning” or “From Current Slide”

Human Reproduction

Anatomy & Function

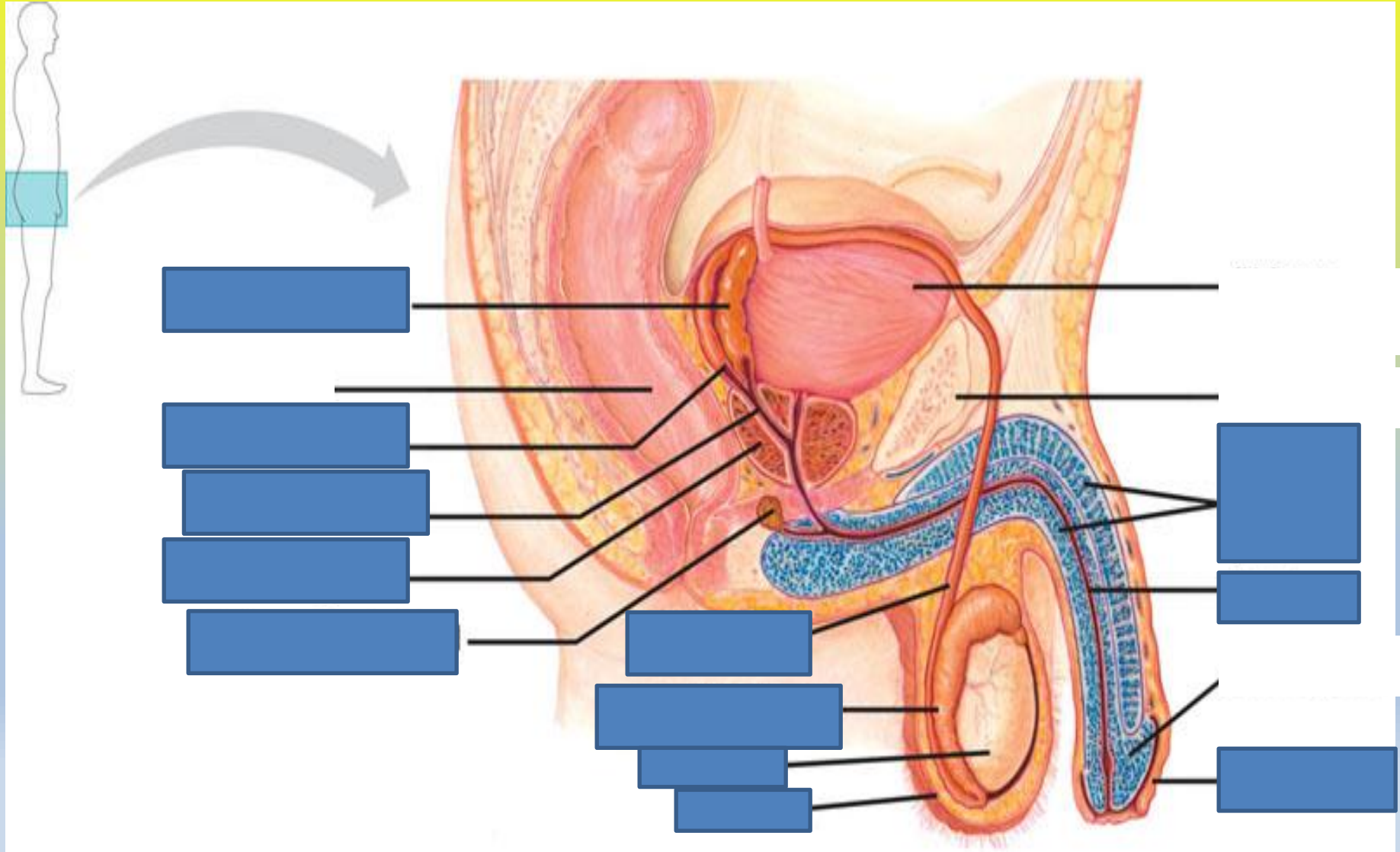


Review of Terms

- **Sexual reproduction**
 - Requires 2 parents (meiosis).
- **Asexual reproduction**
 - 1 parent (mitosis)
- **Internal Fertilization**
 - Union of egg and sperm inside female's body.
 - E.g. chickens, humans
- **External Fertilization**
 - Union of egg and sperm outside the female's body.
 - E.g. Fish, amphibians

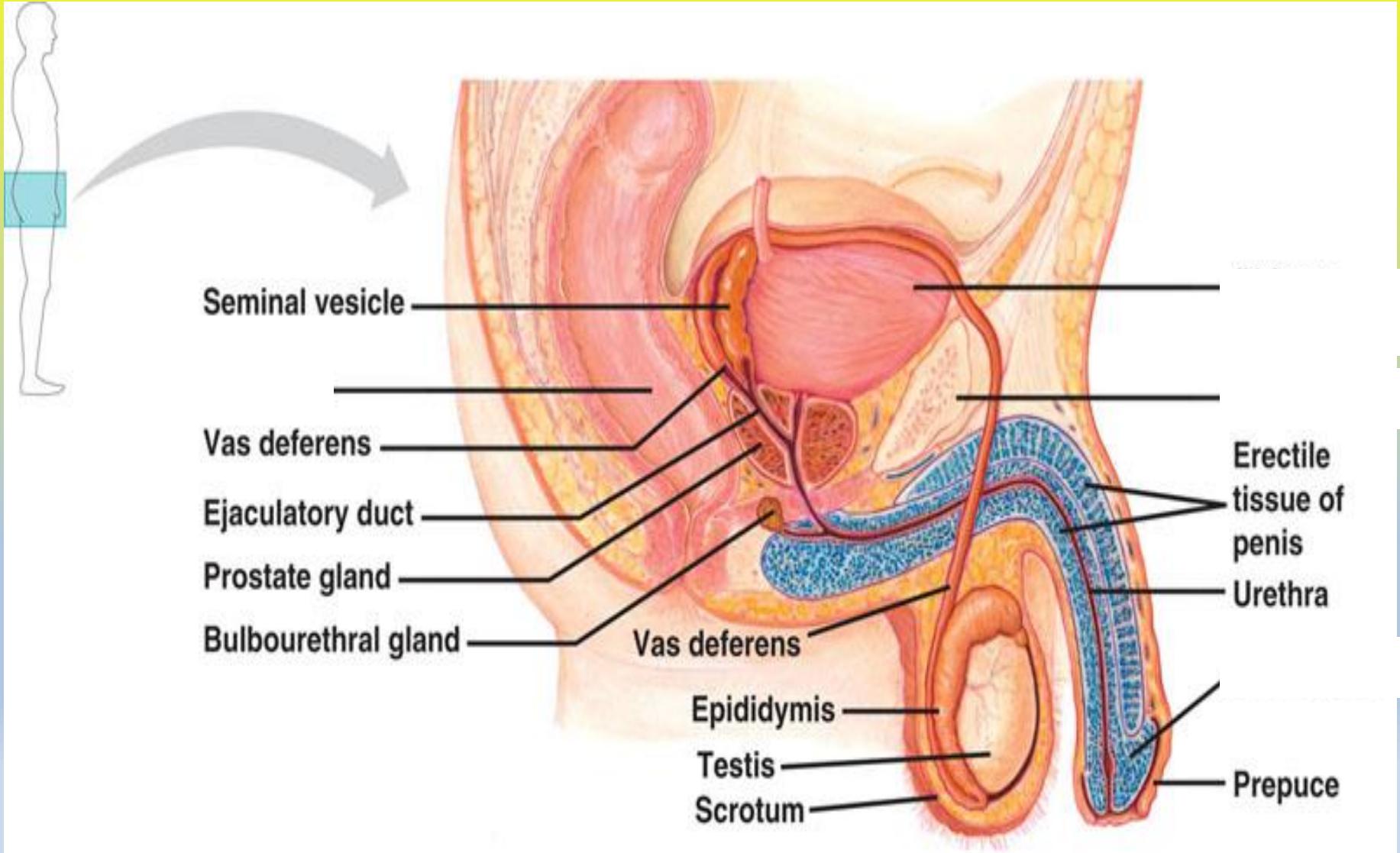
- **Gametes**
 - Specialized sex cells
 - sperm and eggs (haploid cells)
- **Gonads**
 - Organs that produce the gametes.
 - ovaries and testes
- **Zygote**
 - Fertilized egg (diploid)
- **Primary Sex Characteristics**
 - Development of testes and ovaries.
- **Secondary Sex Characteristics**
 - Noticeable characteristics that distinguish the 2 sexes (e.g., breasts, wide hips vs. muscular, facial hair).

Male anatomy: Sagittal View

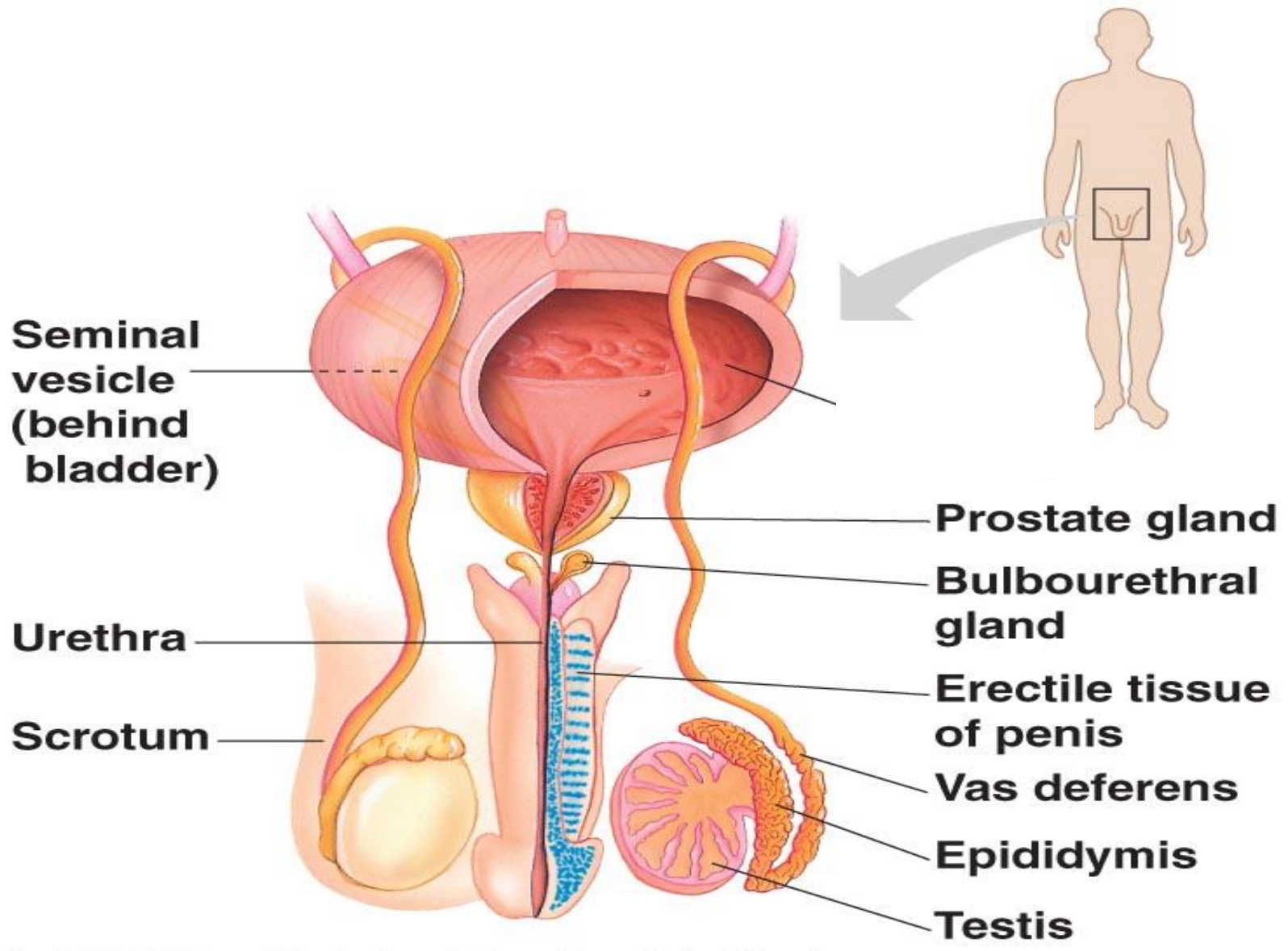




Male anatomy: Sagittal View



Male Anatomy: Frontal View



A. Testis

Male gonad

1. Seminiferous tubules

Site of meiosis and sperm *production*.

2. Interstitial cells

Produce testosterone.

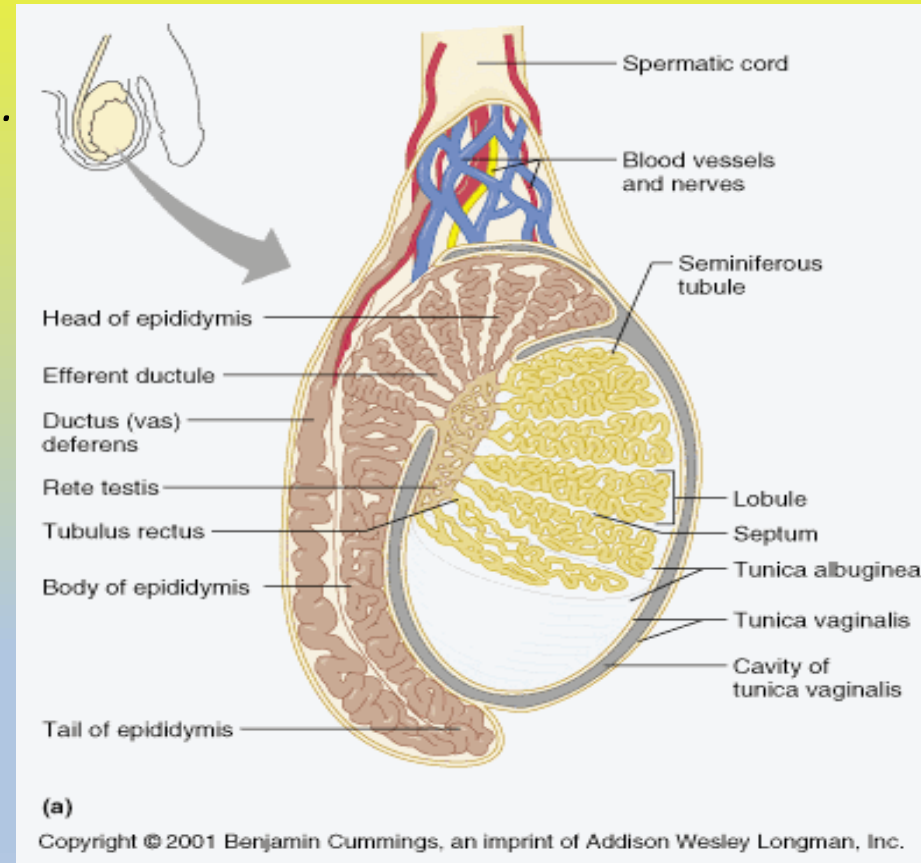
B. Scrotum

External sac that holds testes.

C. Epididymis

- Long tube leading from testes to vas deferens.
- Site of sperm *maturation*.

Male Anatomy



D. Vas Deferens

Tube leading to urethra.

E. Ejaculatory Duct

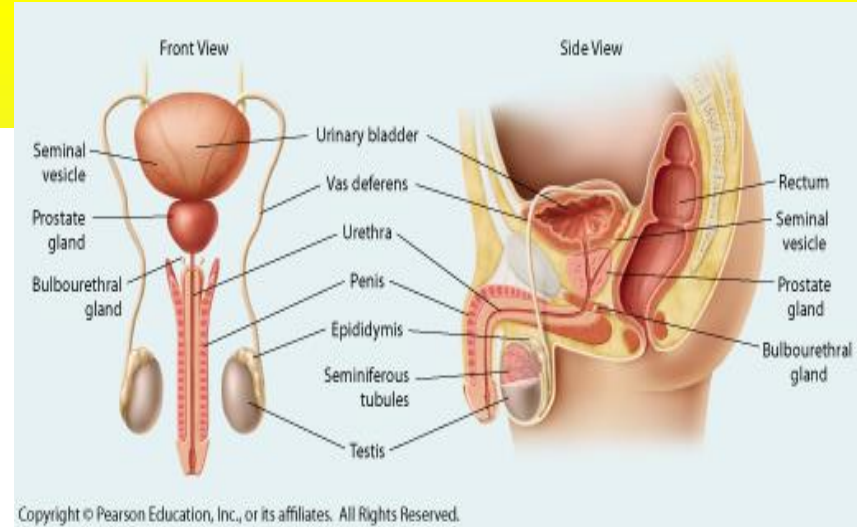
Storage of sperm before ejaculation
between vas deferens & seminal vesicles.

F. Urethra

Tube leading from body, common to both urine and semen.

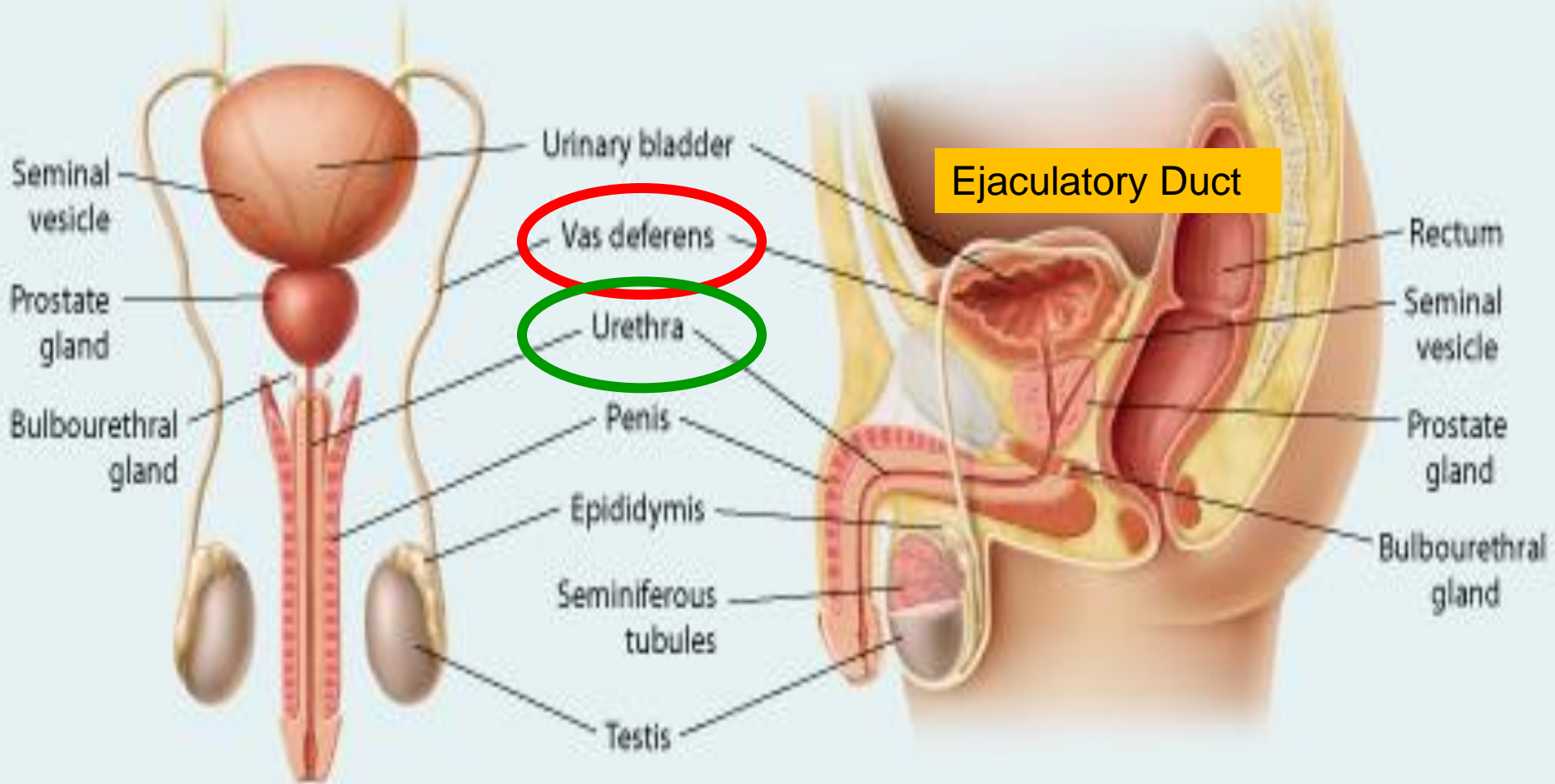
G. Penis

Contains erectile tissue that fills with blood.



Front View

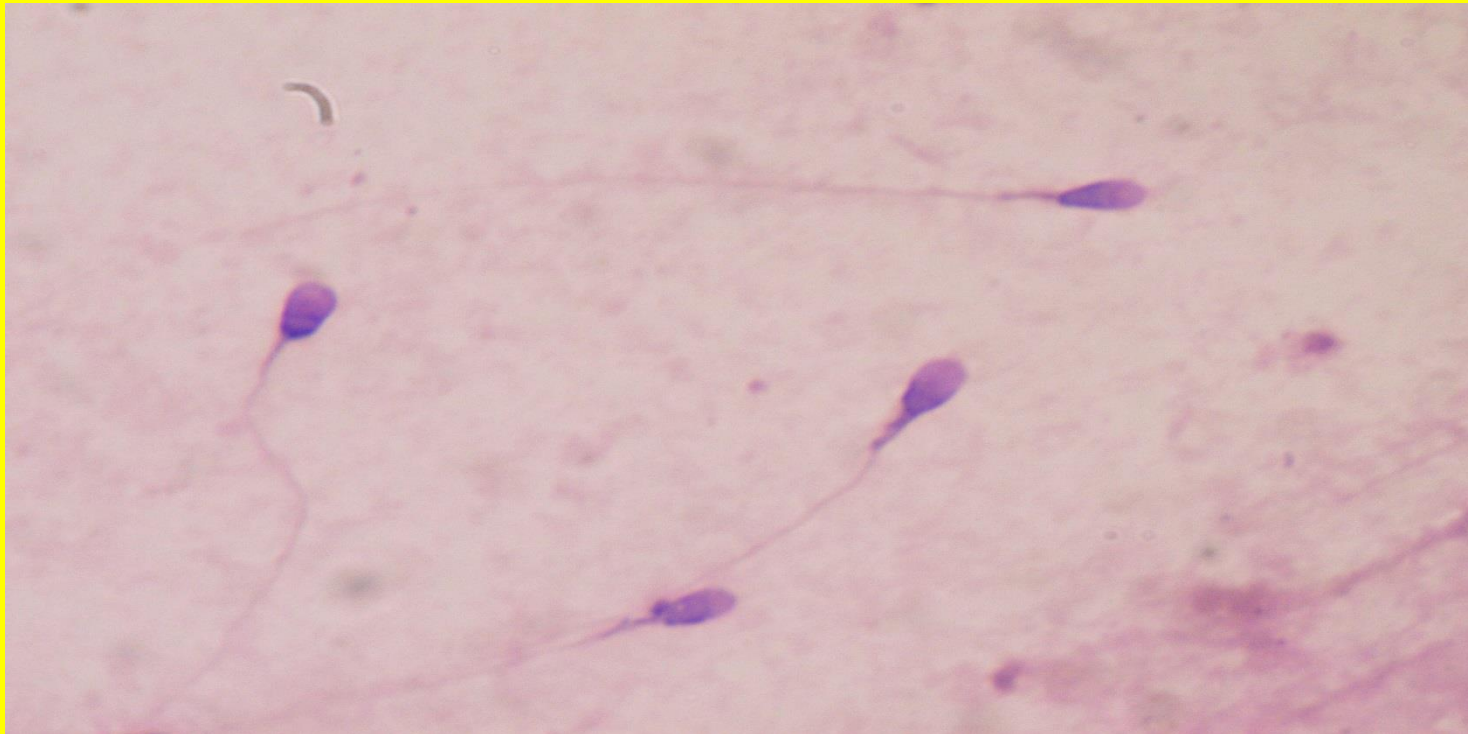
Side View



H. Semen

Alkaline (basic) pH

Fructose



I. Three Accessory Glands

1. Two Seminal Vesicles

Produce majority of semen
(50-60%).

2. Prostate Gland

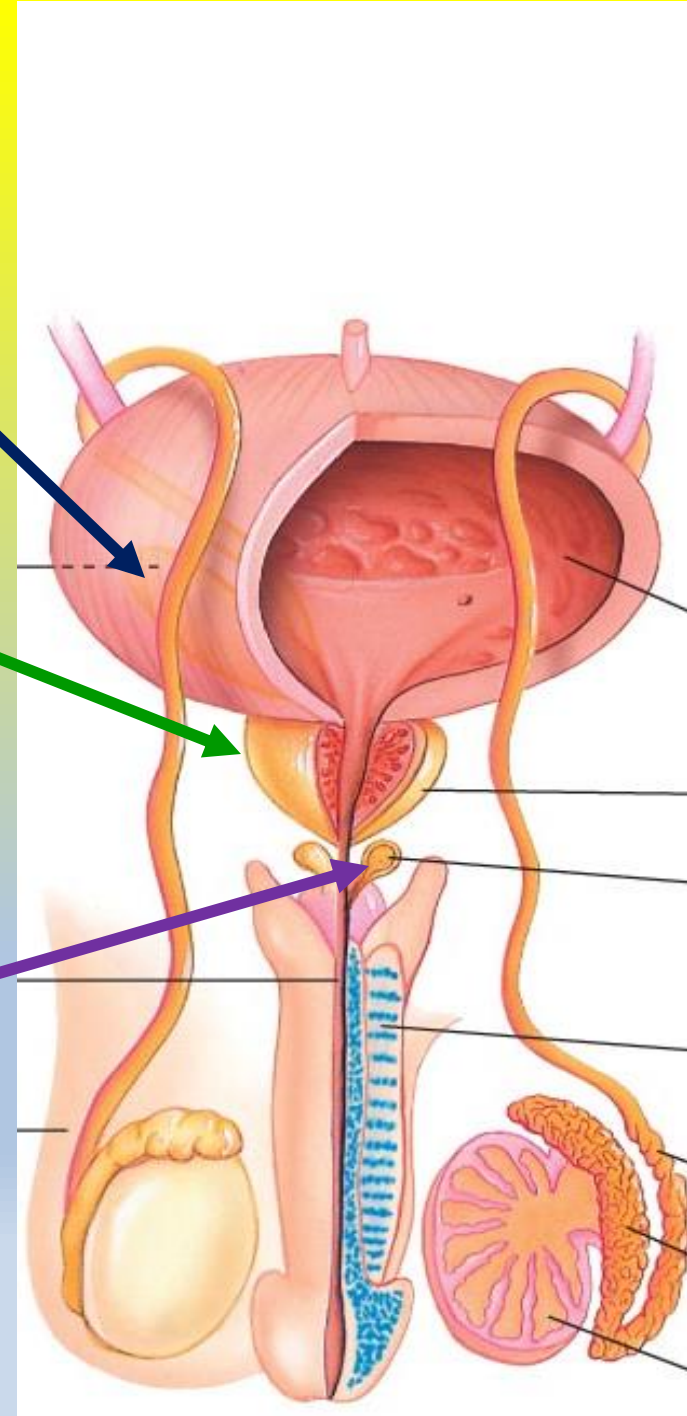
-Large gland surrounding urethra; produces basic solution found in semen.

-Common site of cancer in older men.

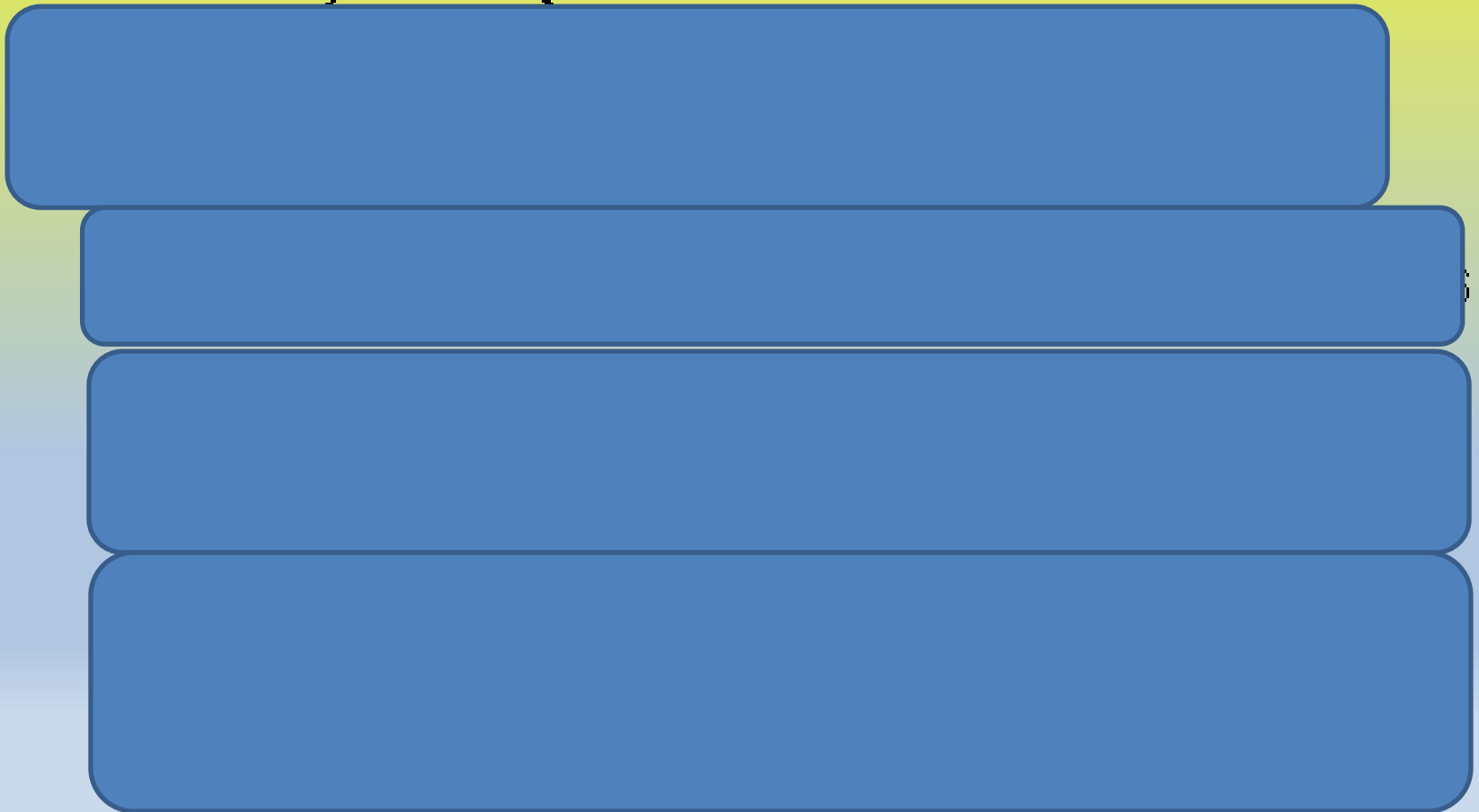
3. Two Bulbourethral glands

-Secrete pre-ejaculatory fluid.

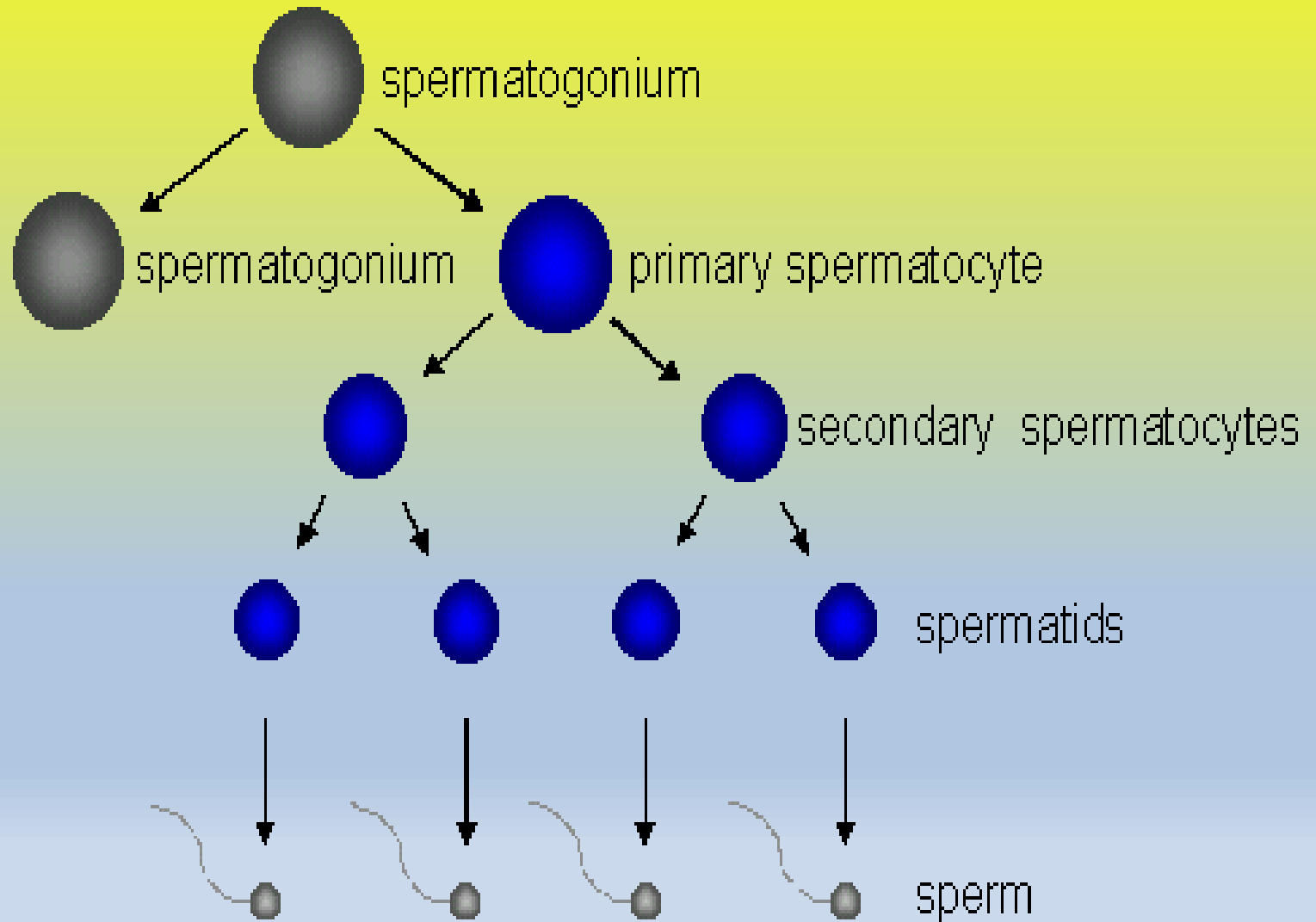
-Prepare urethra for passage of semen.

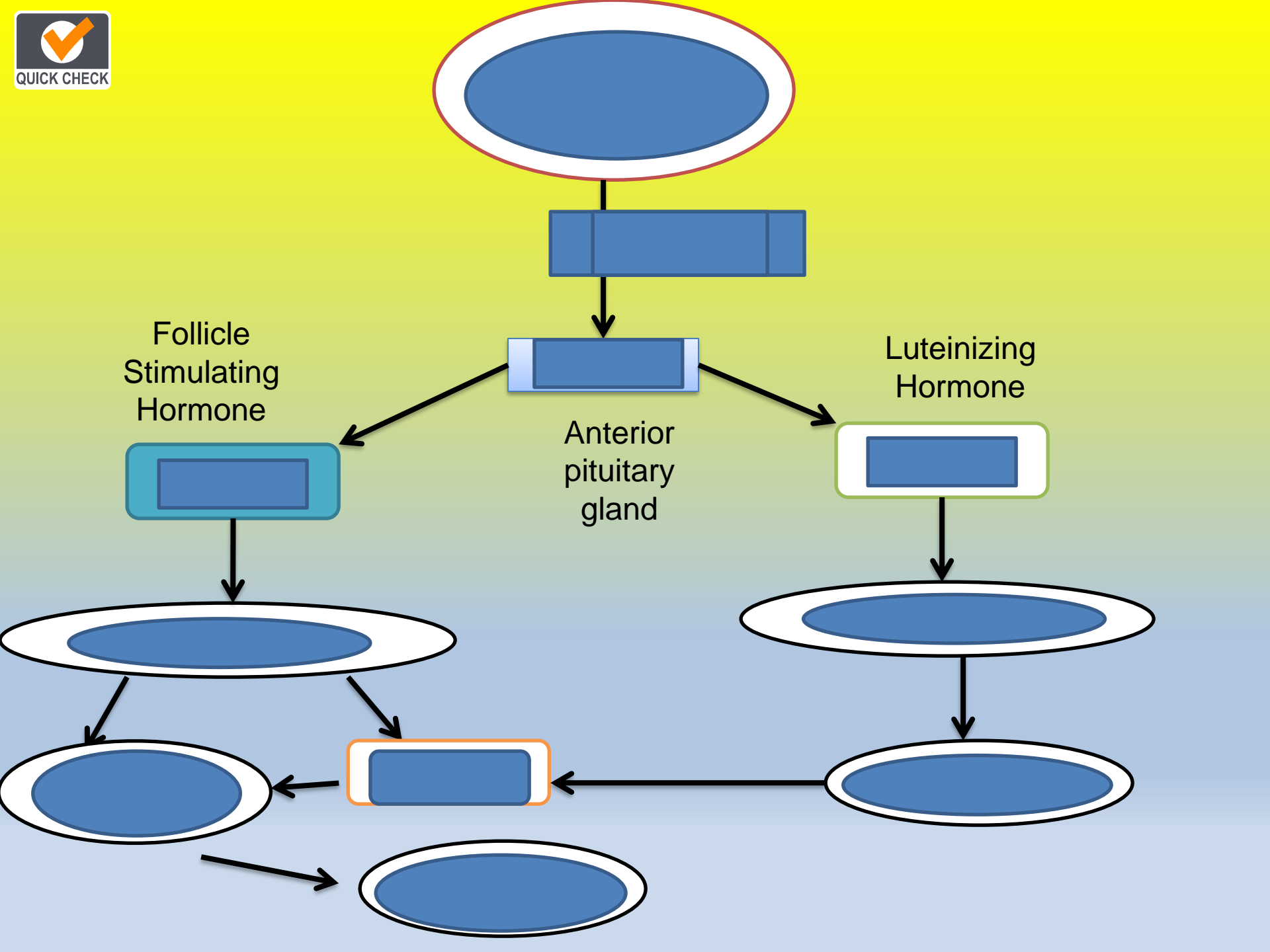


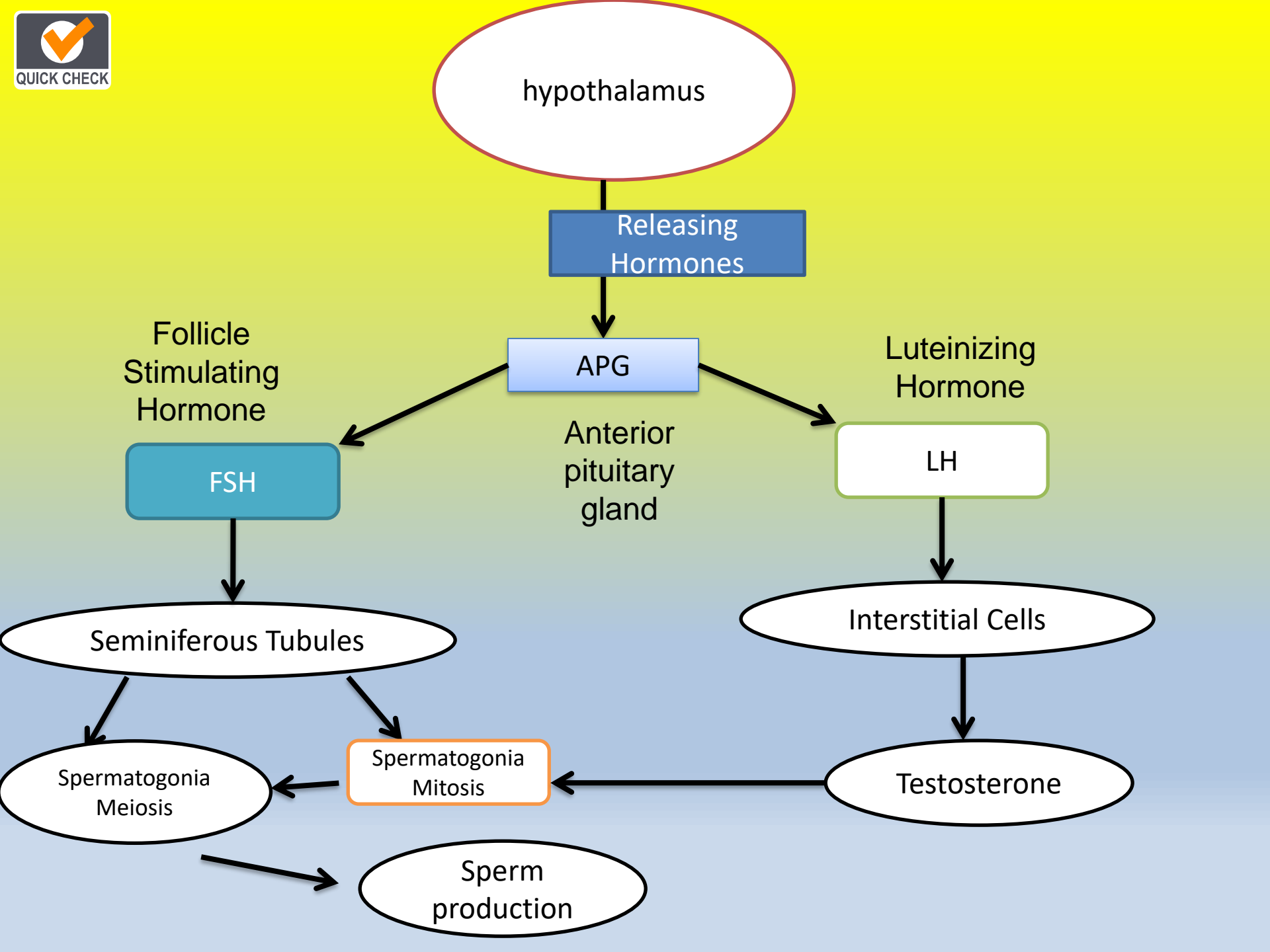
Review of Spermatogenesis



Review of Spermatogenesis



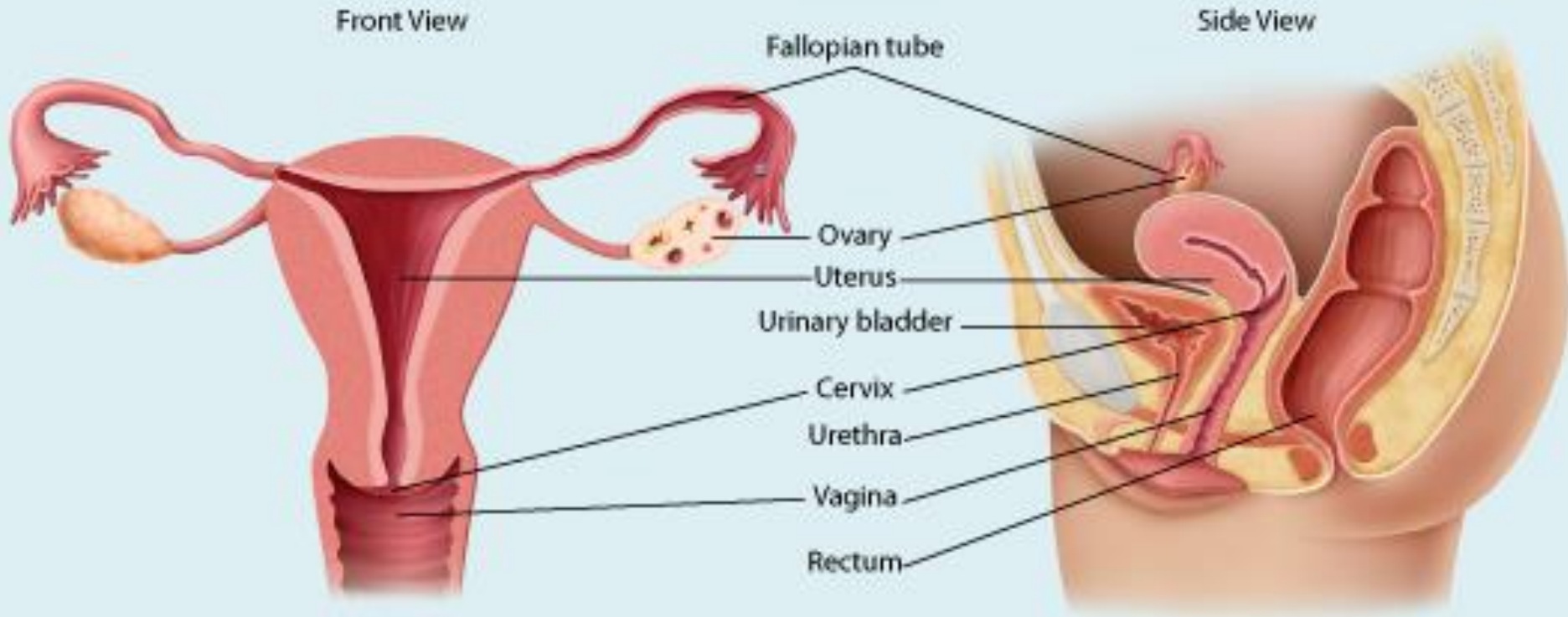




General Information about Sperm Production

- 1. Where are SPERM PRODUCED?**
 - Seminiferous Tubules
- 2. Where do SPERM MATURE?**
 - Epididymis
- 3. When do males begin sperm production?**
 - Puberty
- 4. How many sperm per year do humans produce?**
 - About 30 BILLION (1000/SEC)
- 5. How many sperm are present in a single ejaculation event?**
 - 200-300 MILLION
- 6. Why are the testes located outside the body?**
 - Temperature Regulation

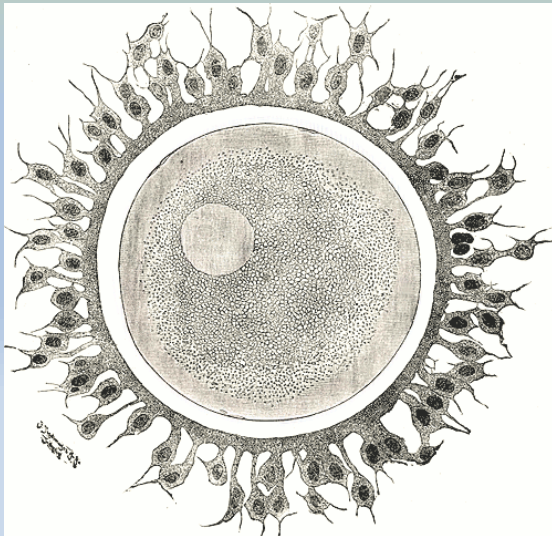
Female Reproductive Anatomy



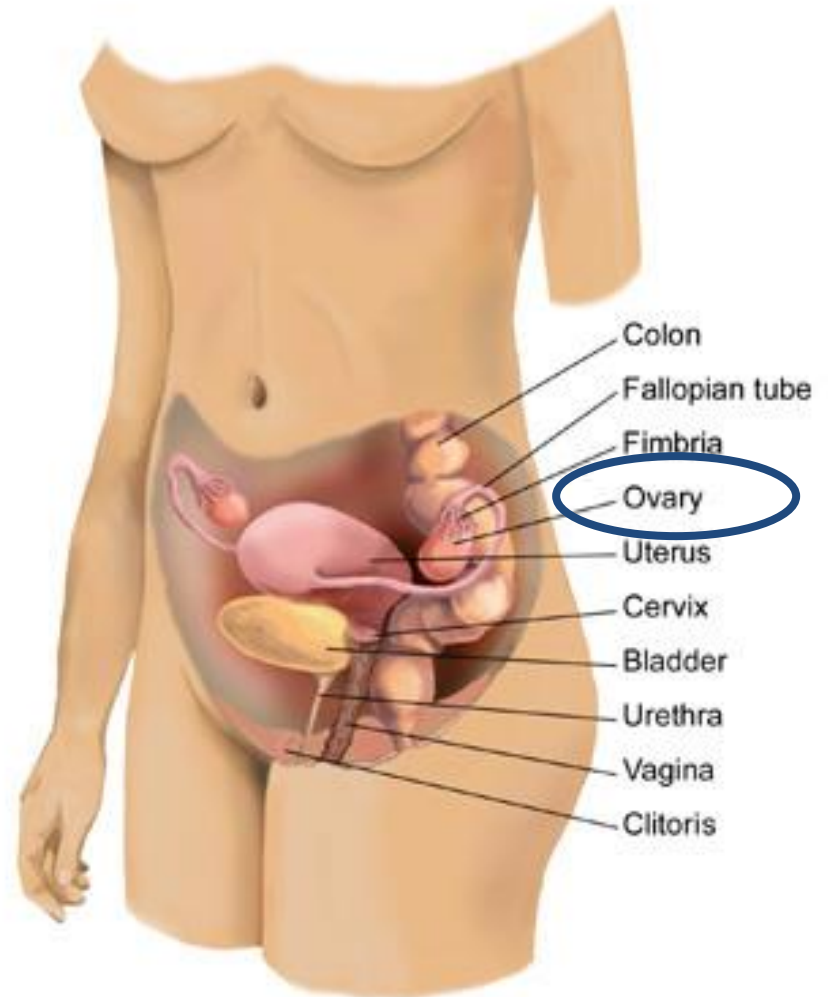
Female Reproductive Anatomy

A. Ovary

- Female gonad
- site of egg production



The Female Reproductive System



Female Reproductive Anatomy

Ovum

(plural: ova)

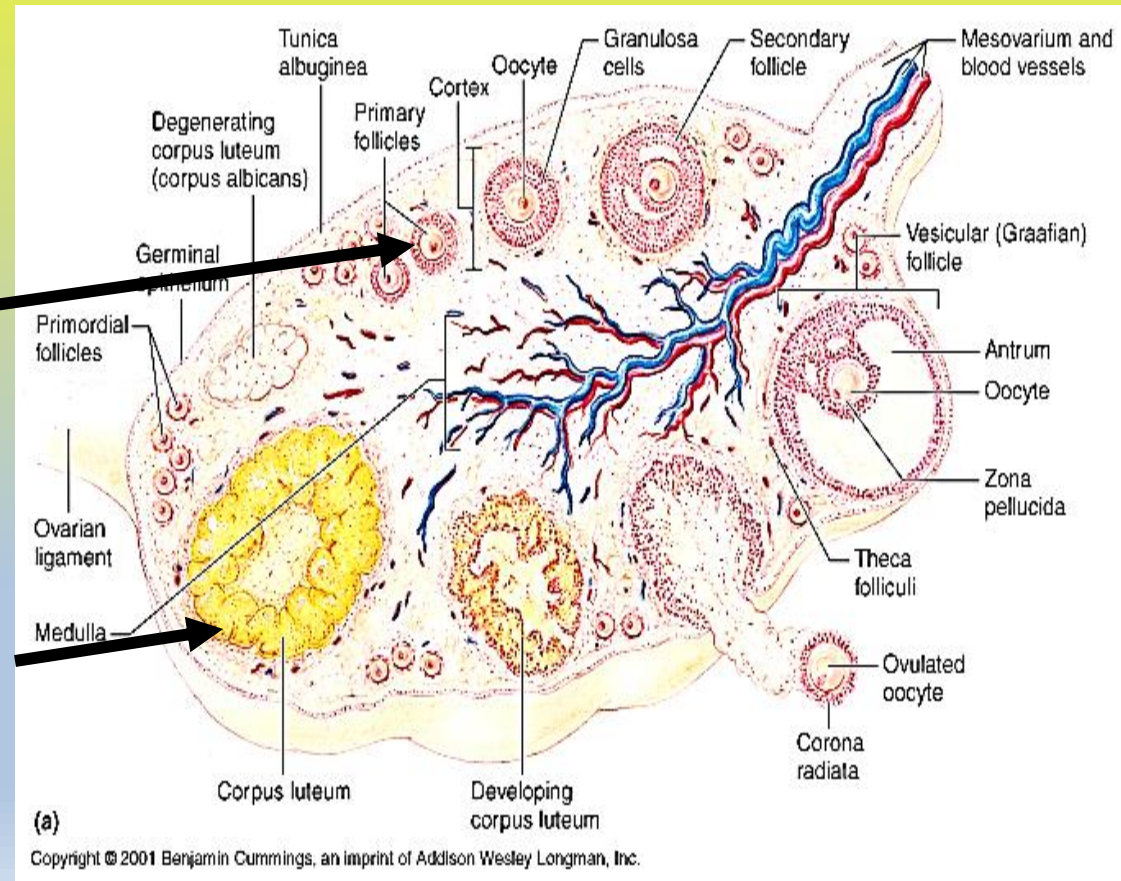
- Egg

Follicle

- Site in ovary that contains egg
- Produces estrogen

Corpus Luteum

- After release of egg, follicle becomes a Corpus Luteum
- Produces progesterone



B. Oviducts (Fallopian Tubes)

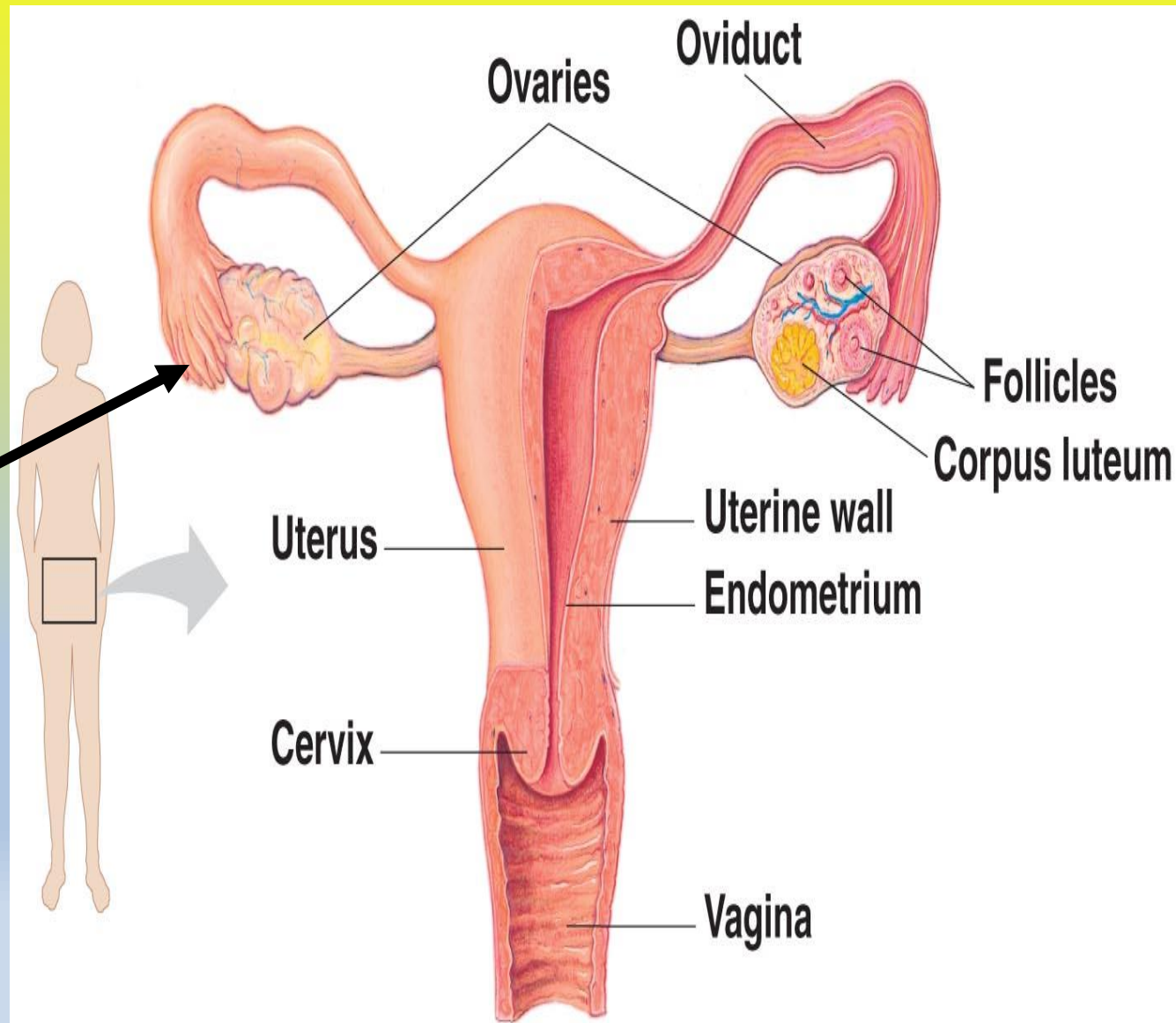
- Tubes leading from outside of ovary to the uterus.

- Site of fertilization.

Fimbriae

- Fingerlike projections on each oviduct.

- catches the ovum.



C. Uterus

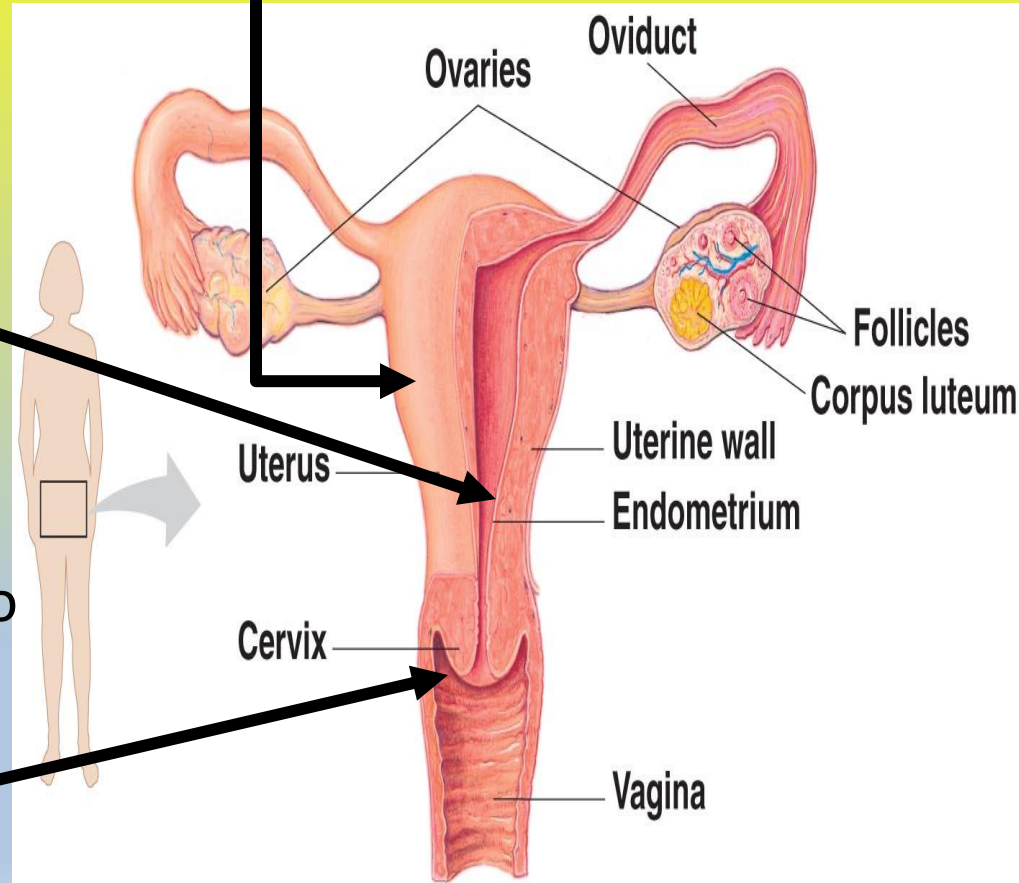
- Thick smooth muscle layer
- Baby develops here!

1. Endometrium

- Nutrient rich, vascular lining of uterus.
- Builds up to prepare for baby and sloughs off if no baby is present.

2. Cervix

Neck of uterus



D. Vagina - Birth canal

E. Vestibule of Vagina

1. Labia majora

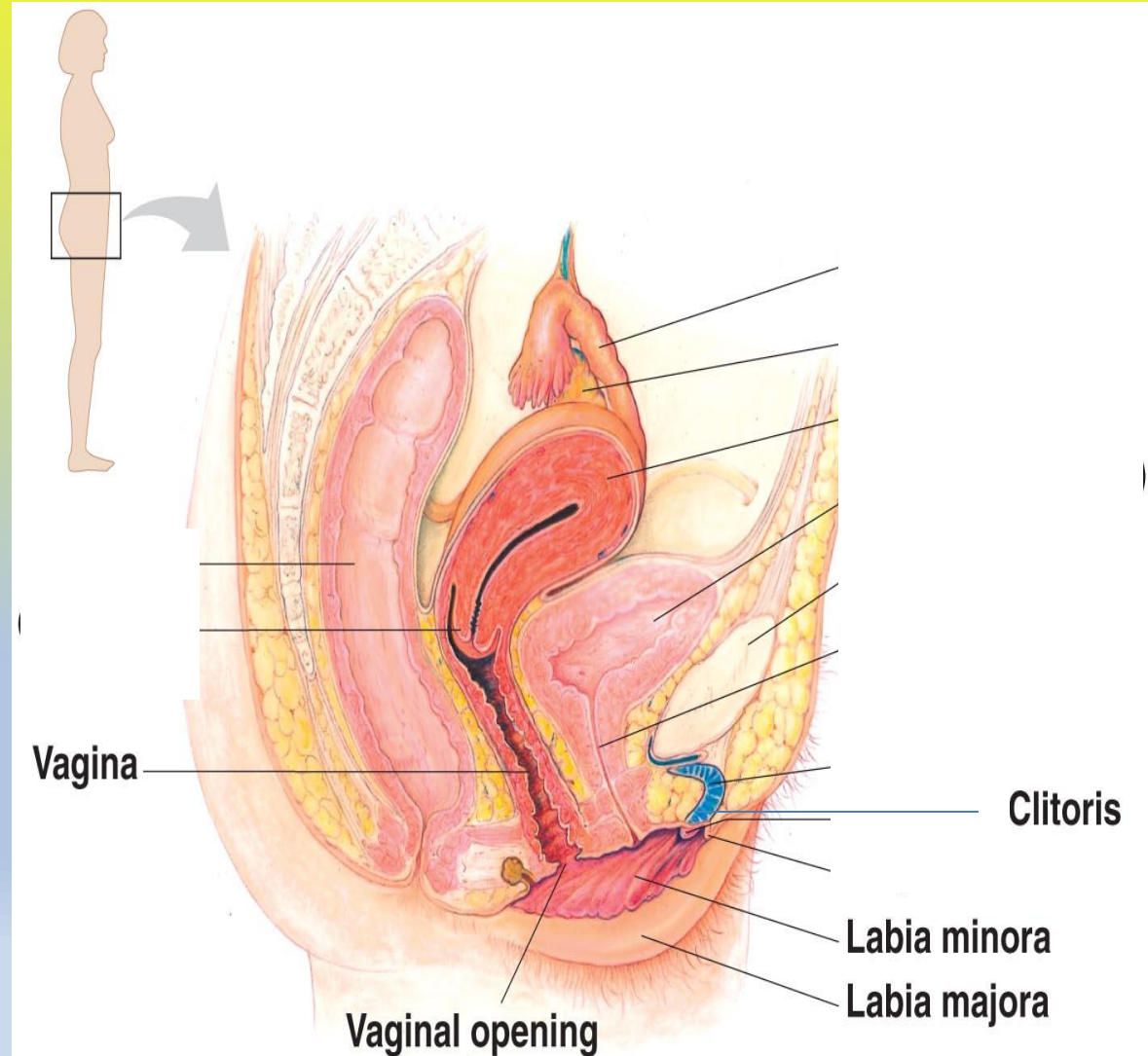
- Thick protective folds of skin

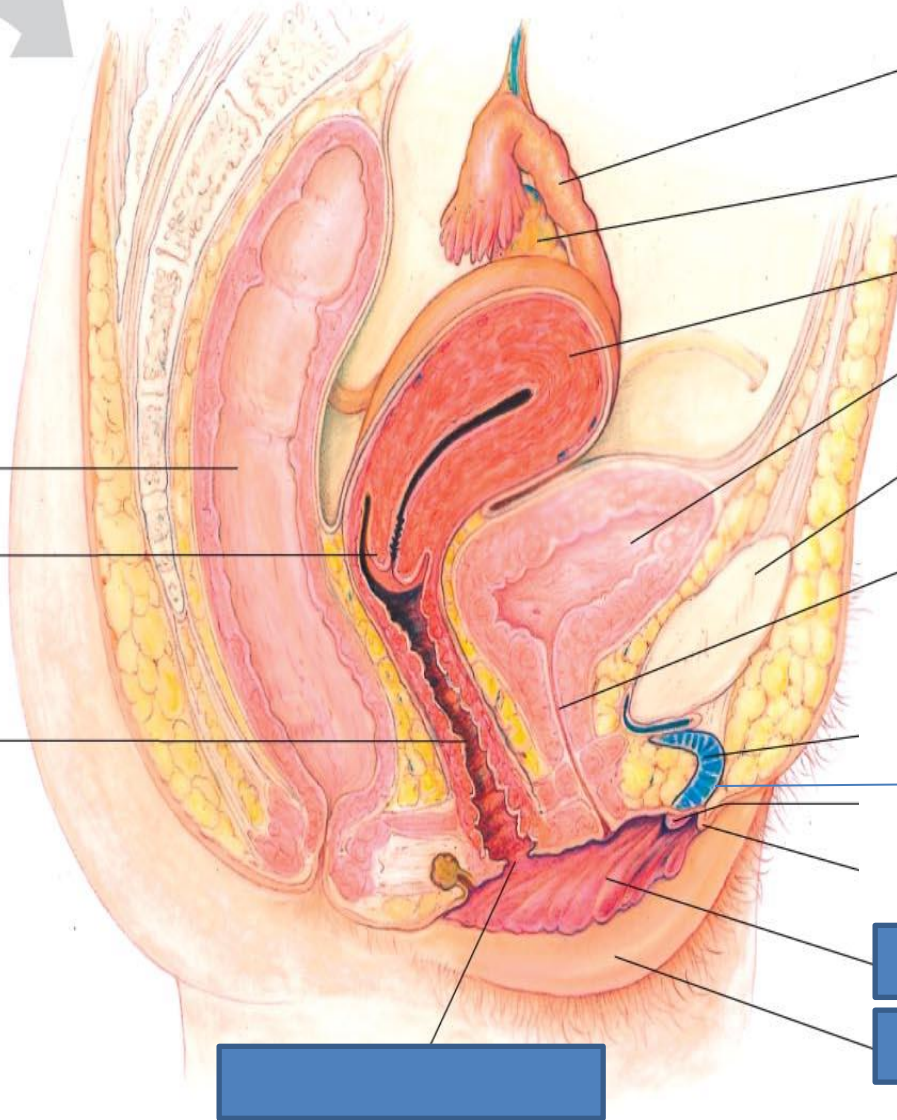
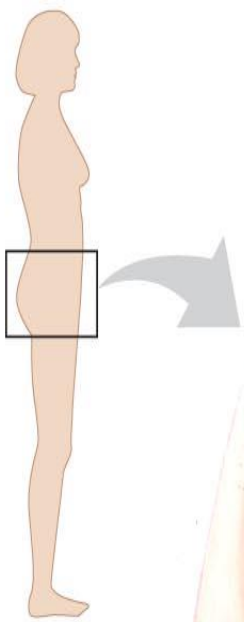
2. Labia minora

- Thin protective folds of skin

3. Clitoris

- Erectile tissue





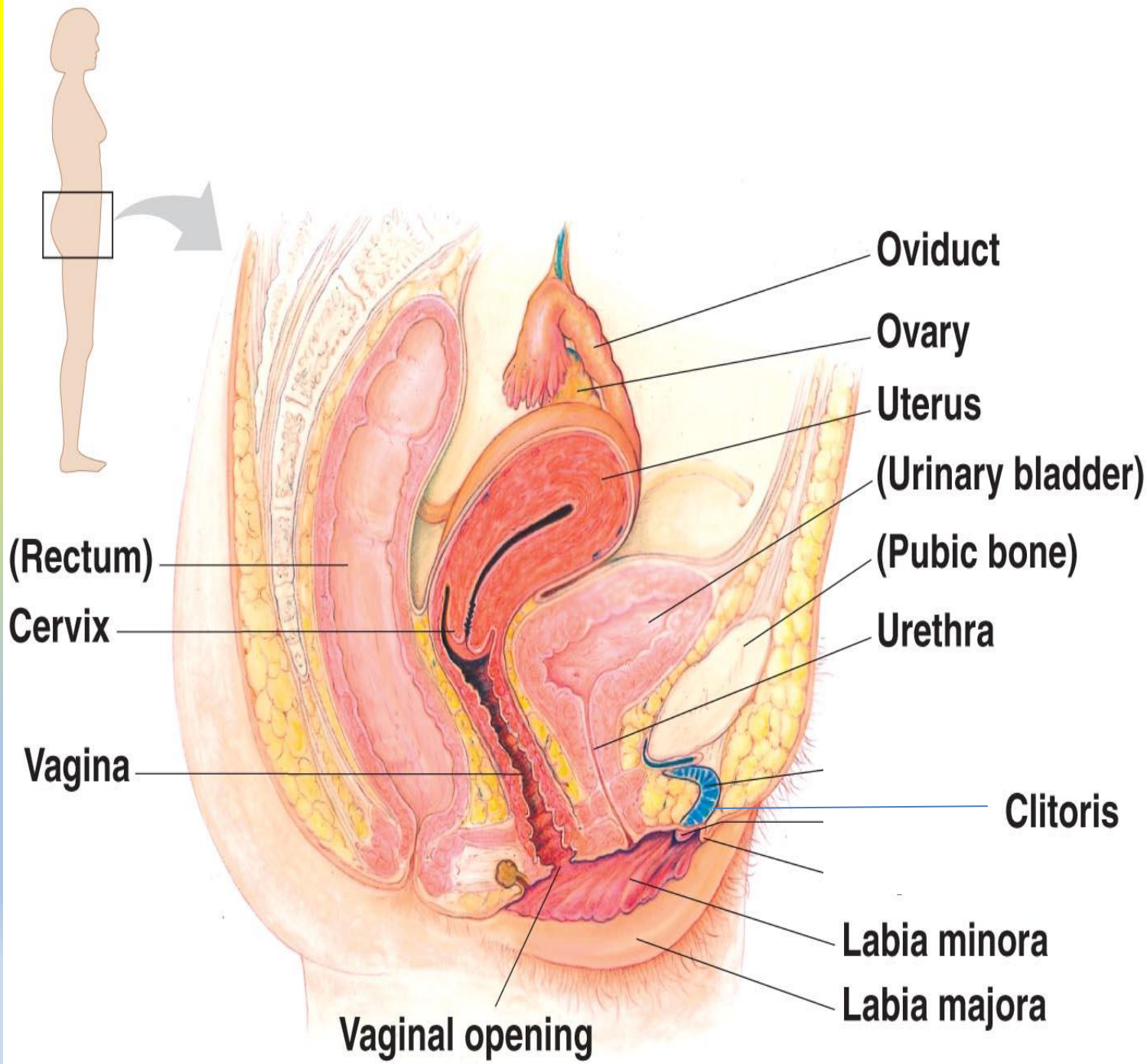
(Rectum)

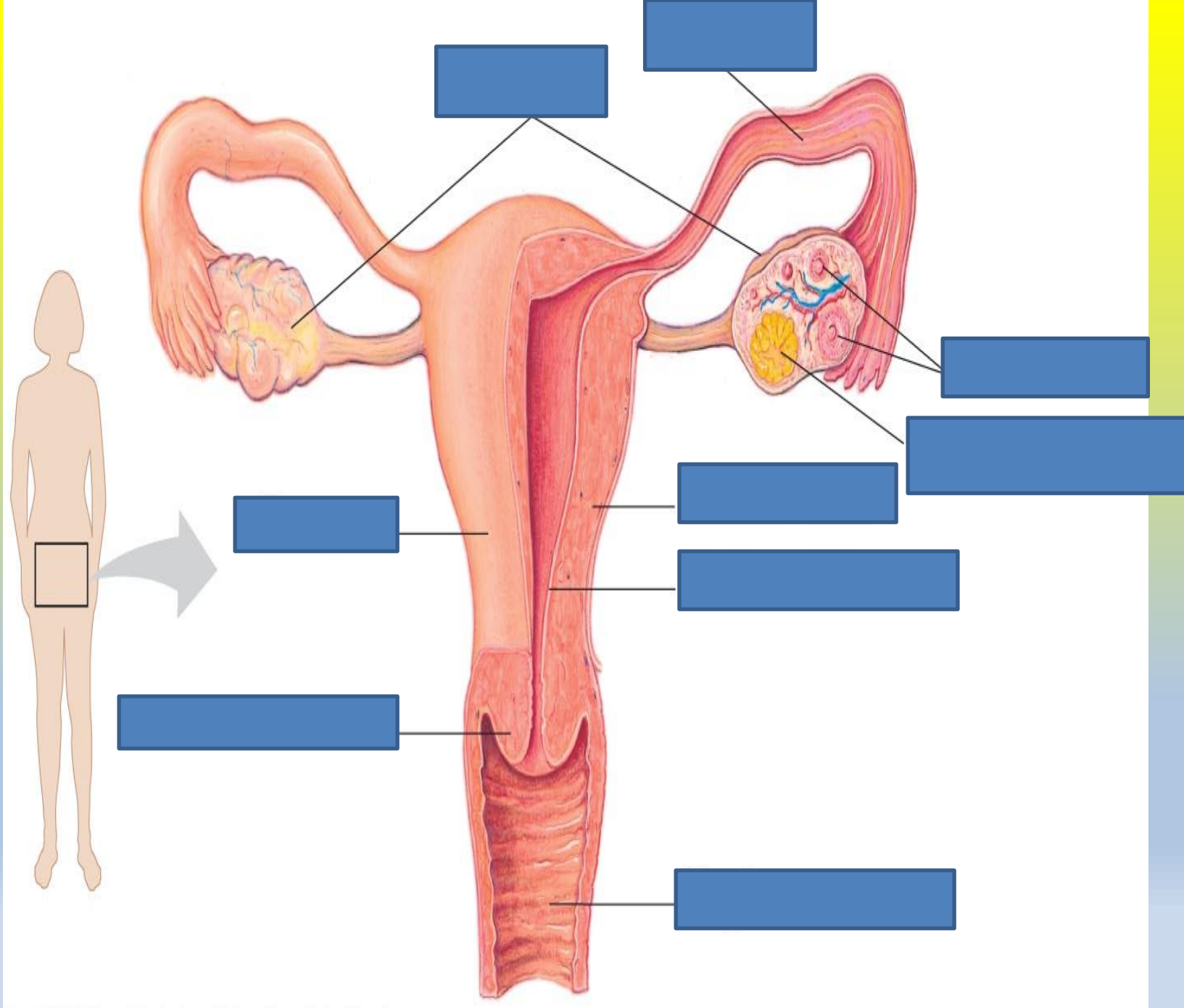
(Urinary bladder)

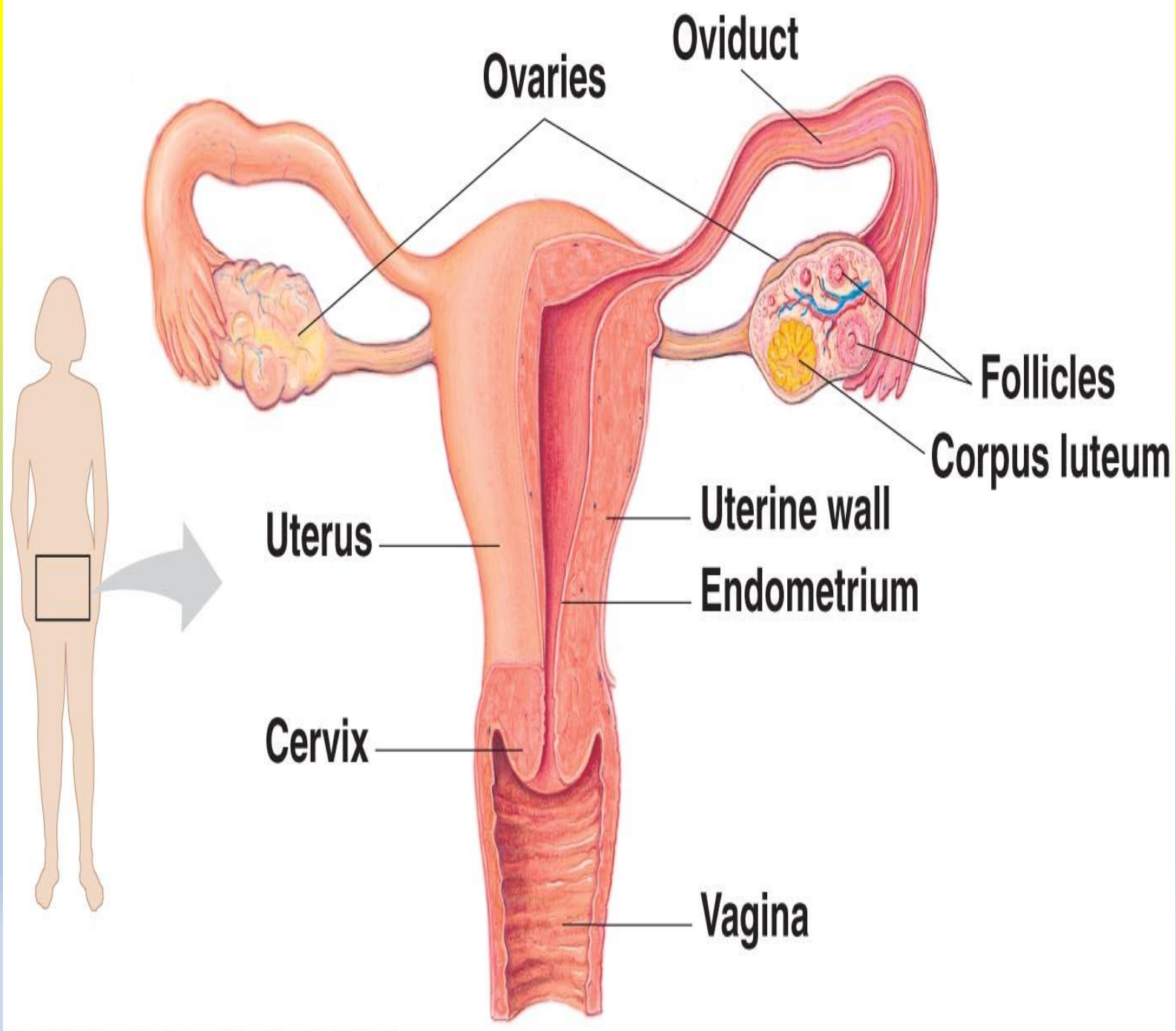
(Pubic bone)

Urethra









Female Menstrual Cycle: General Characteristics

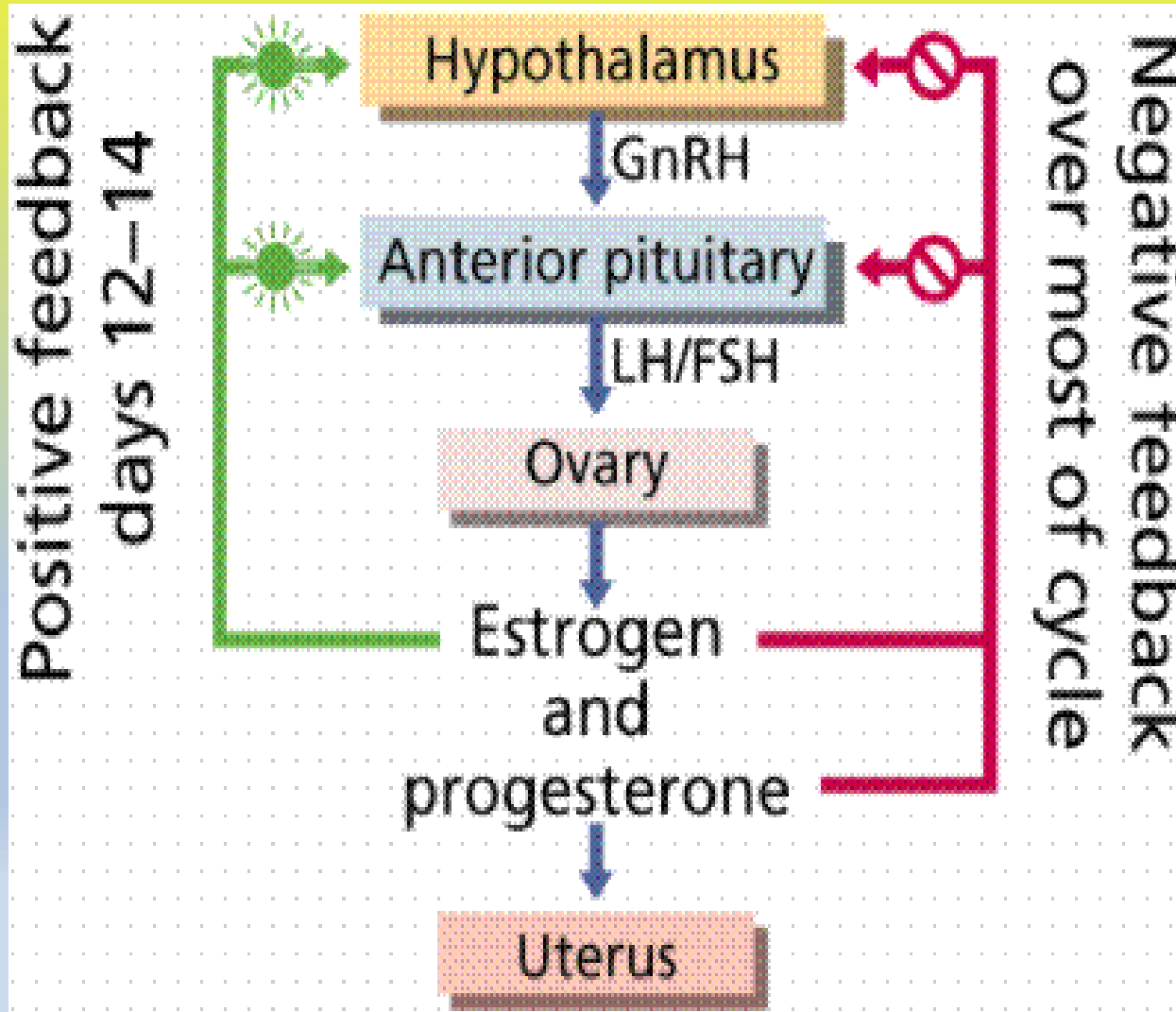
- When do women begin to menstruate?
- Average age is about 11 - 13
- When do women stop menstruating?
- Menopause begins in late 40s / early 50s

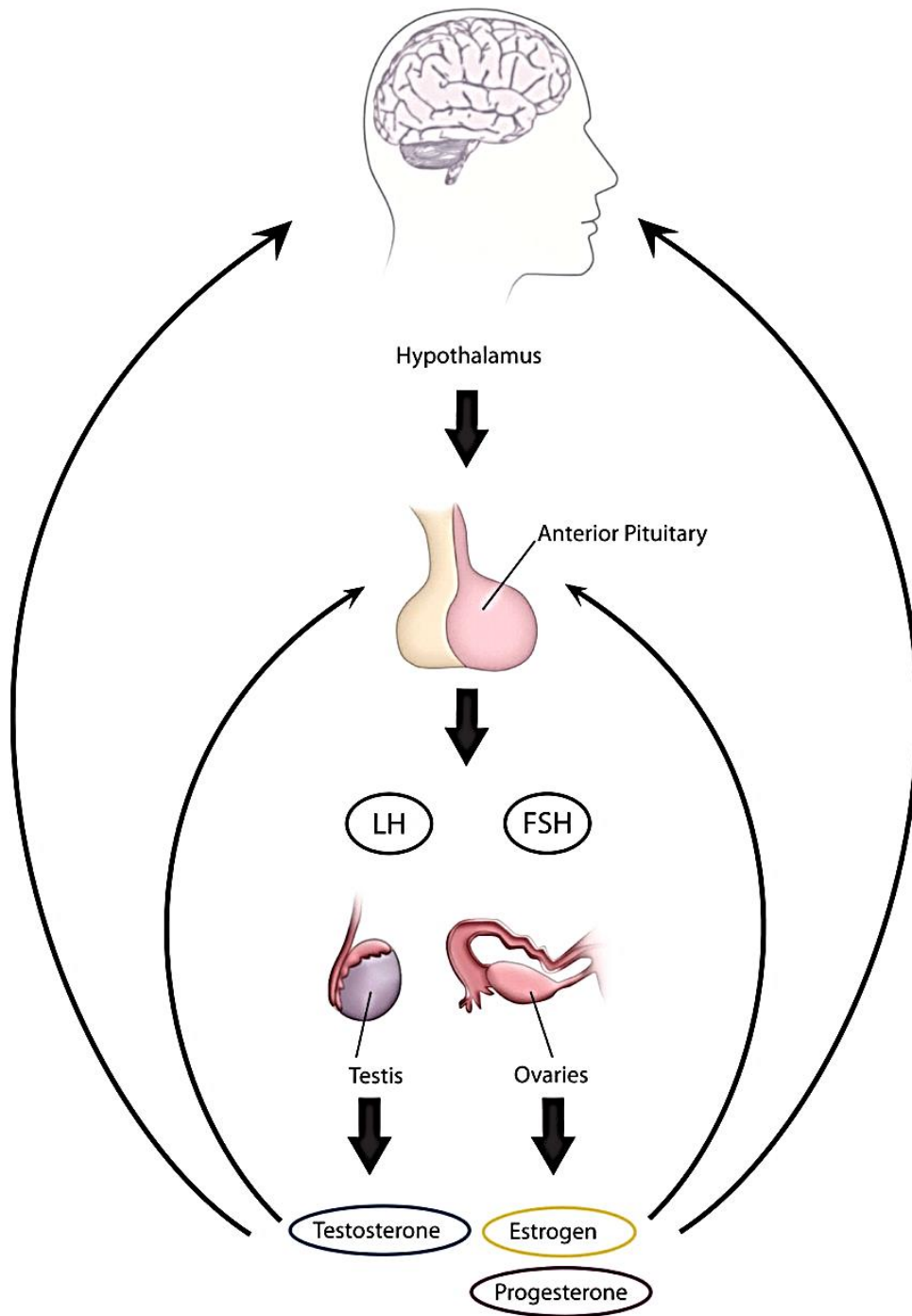
Hormones Involved in Female Menstrual Cycle

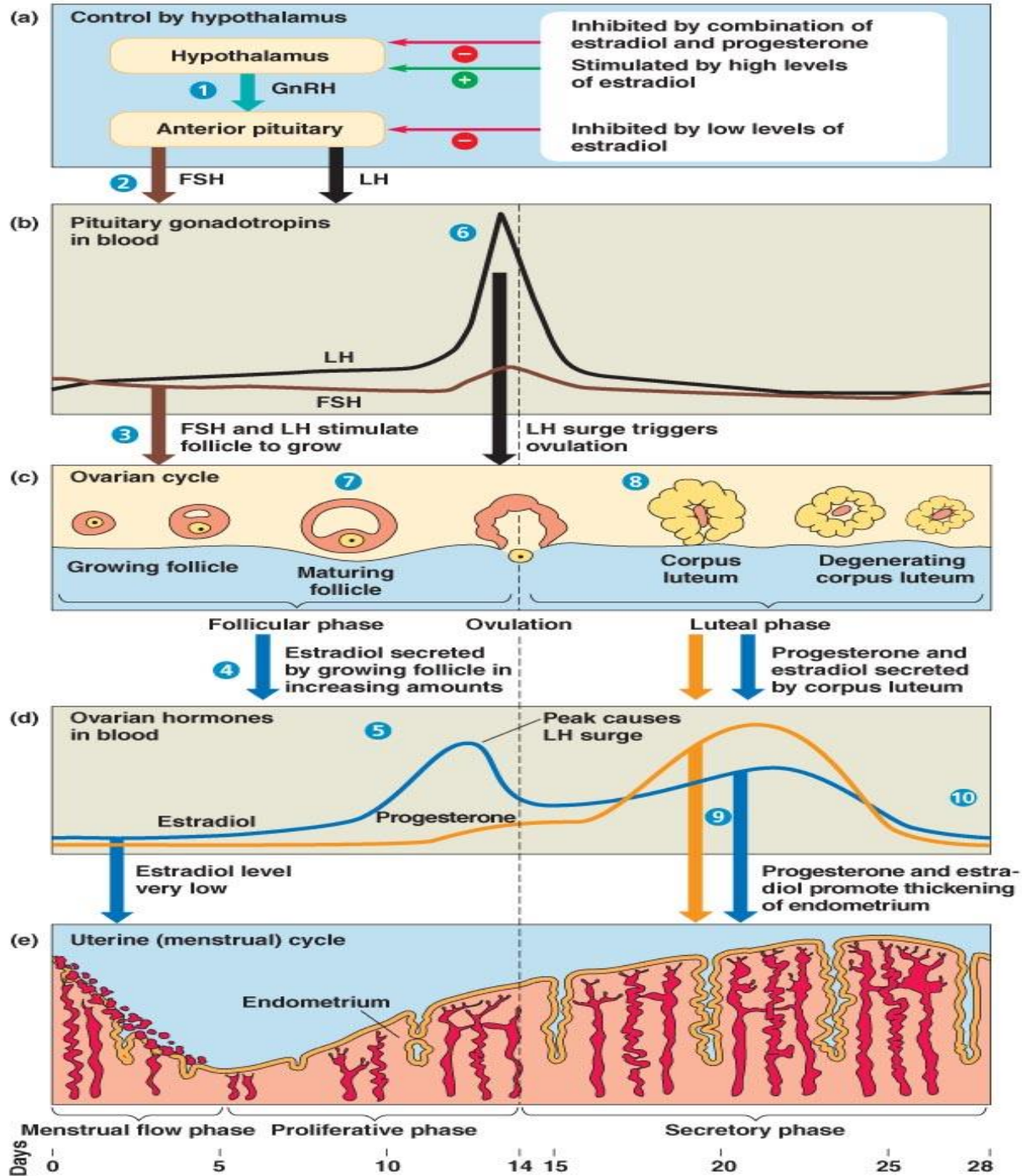
Hormone	Produced in:	Function
1. Follicle Stimulating Hormone FSH	Anterior Pituitary Gland	Follicle development.
2. Luteinizing Hormone LH	APG	Ovulation (release of egg from follicle).
3. Estrogen	Ovary	1. Coordination of uterus with follicle. 2. Thickens Endometrial lining.
4. Progesterone	Ovary	1. Maintains thickness of endometrium. 2. When no baby, lining breaks down and menstrual cycle begins.

What controls and regulates all four hormones?

Hypothalamus (in brain)



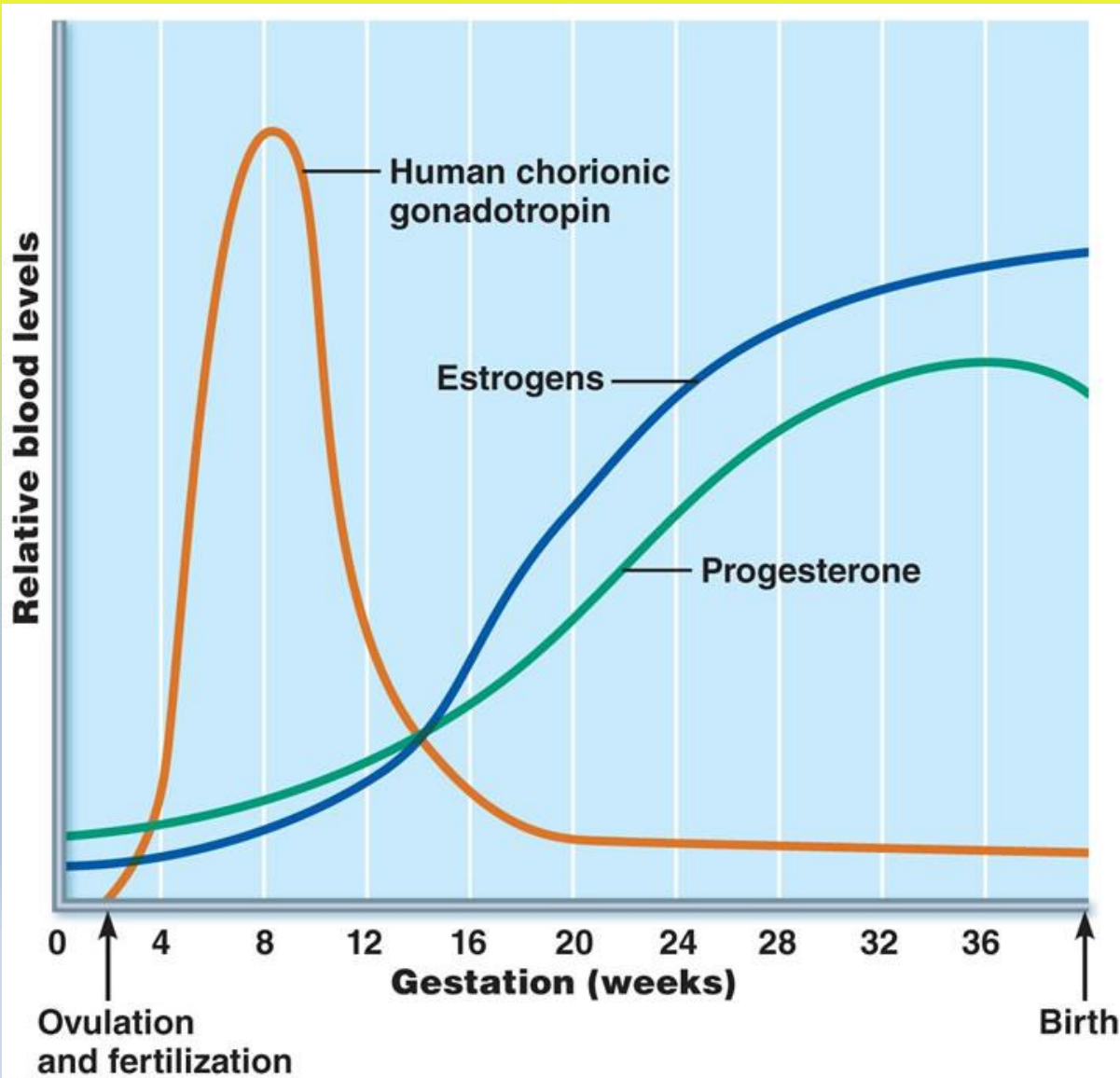




Menstrual Cycle VS Estrus (heat) in Mammals

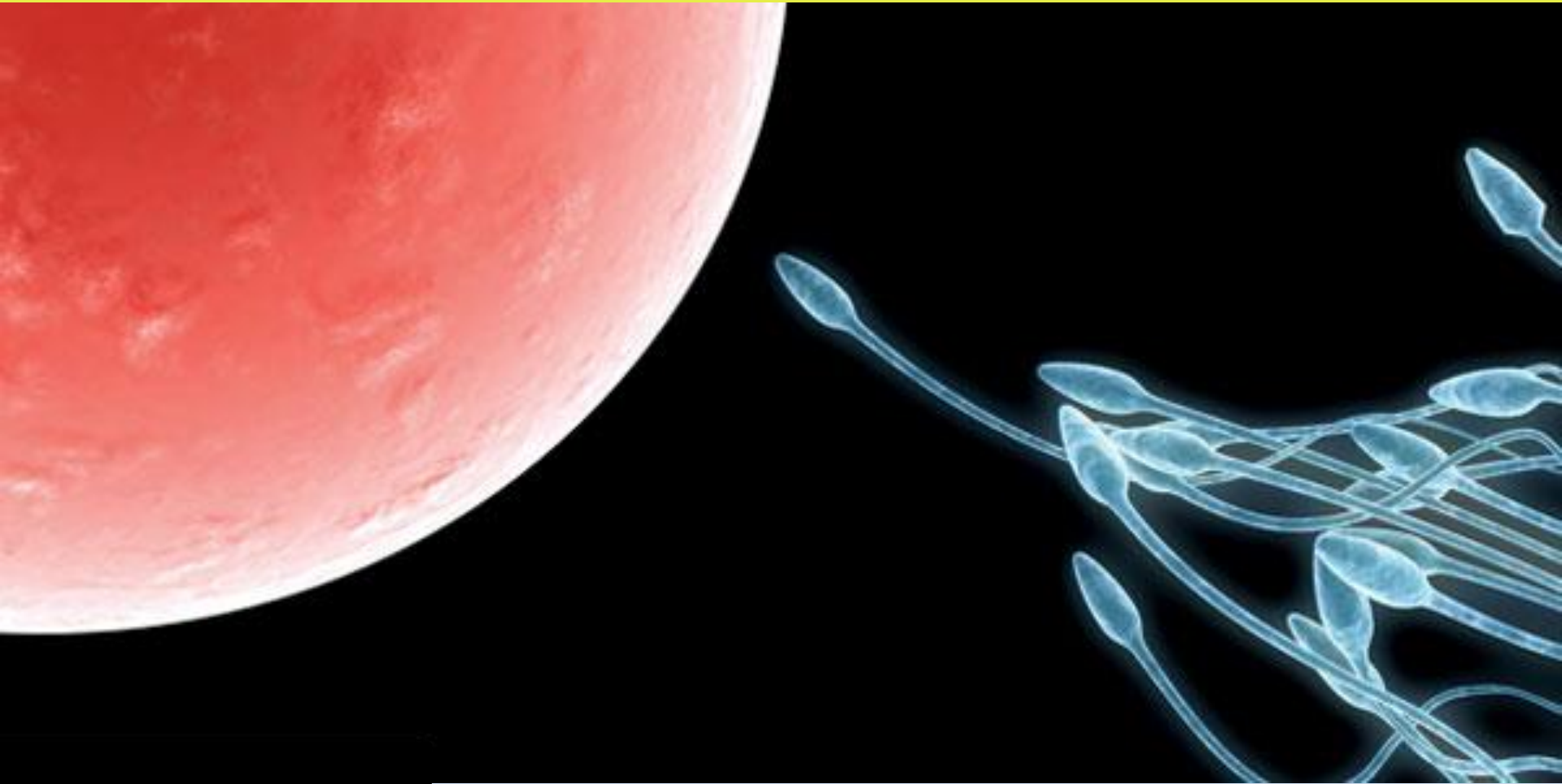
- **Menstrual Cycle (humans)**
 - Duration of ~28 days
 - Receptive to sex throughout cycle
 - If no baby: shedding, fluid and tissue release
- **Estrus Cycle (Heat)
(non-human mammals)**
 - 1, 2, 3 or more times per year depending on species.
 - Only receptive to copulation when in heat.
 - Reabsorption of tissues in some.

Gestational Hormones



Human Reproduction

Fertilization to Birth



Baby Development

Fertilization

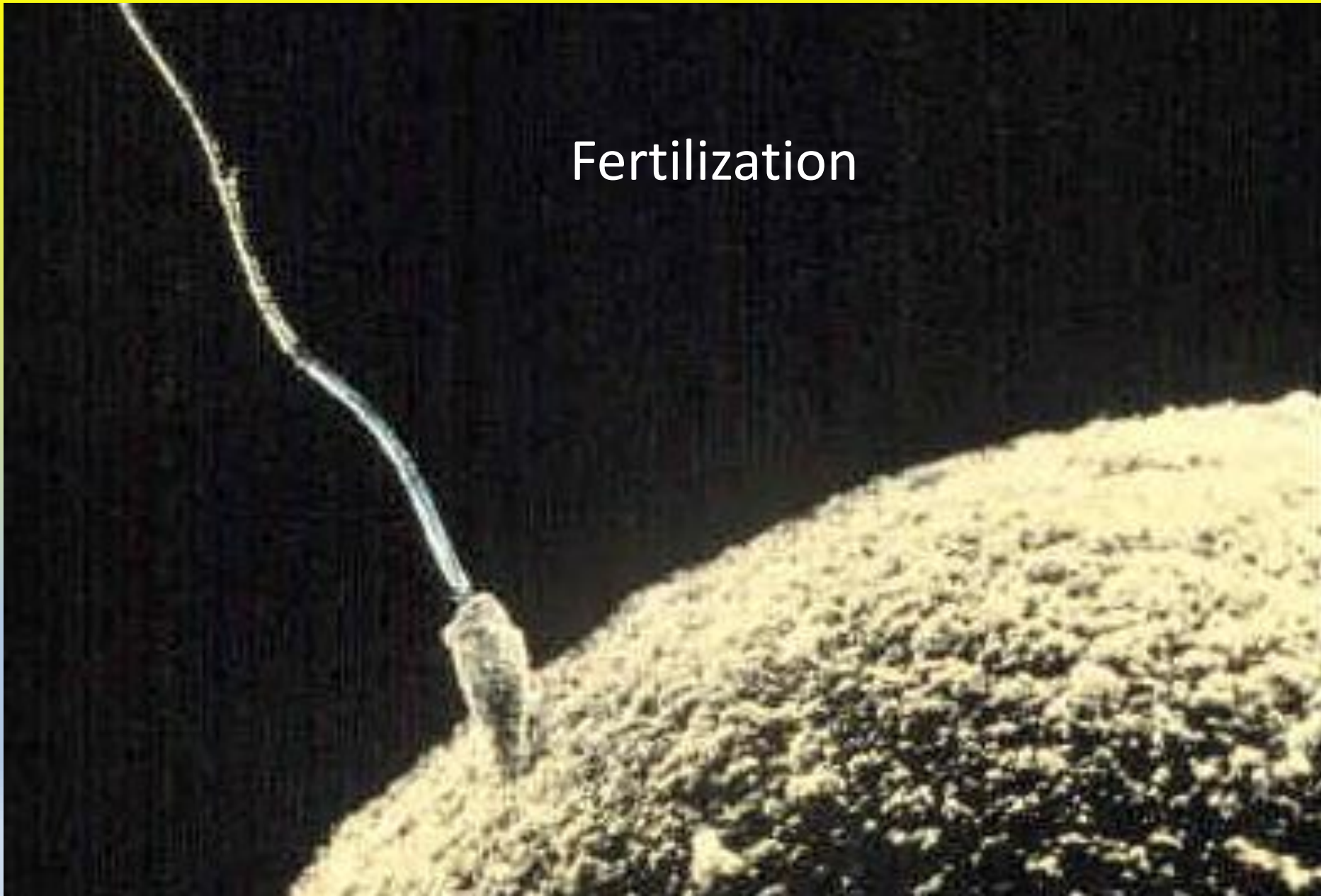
Cleavage

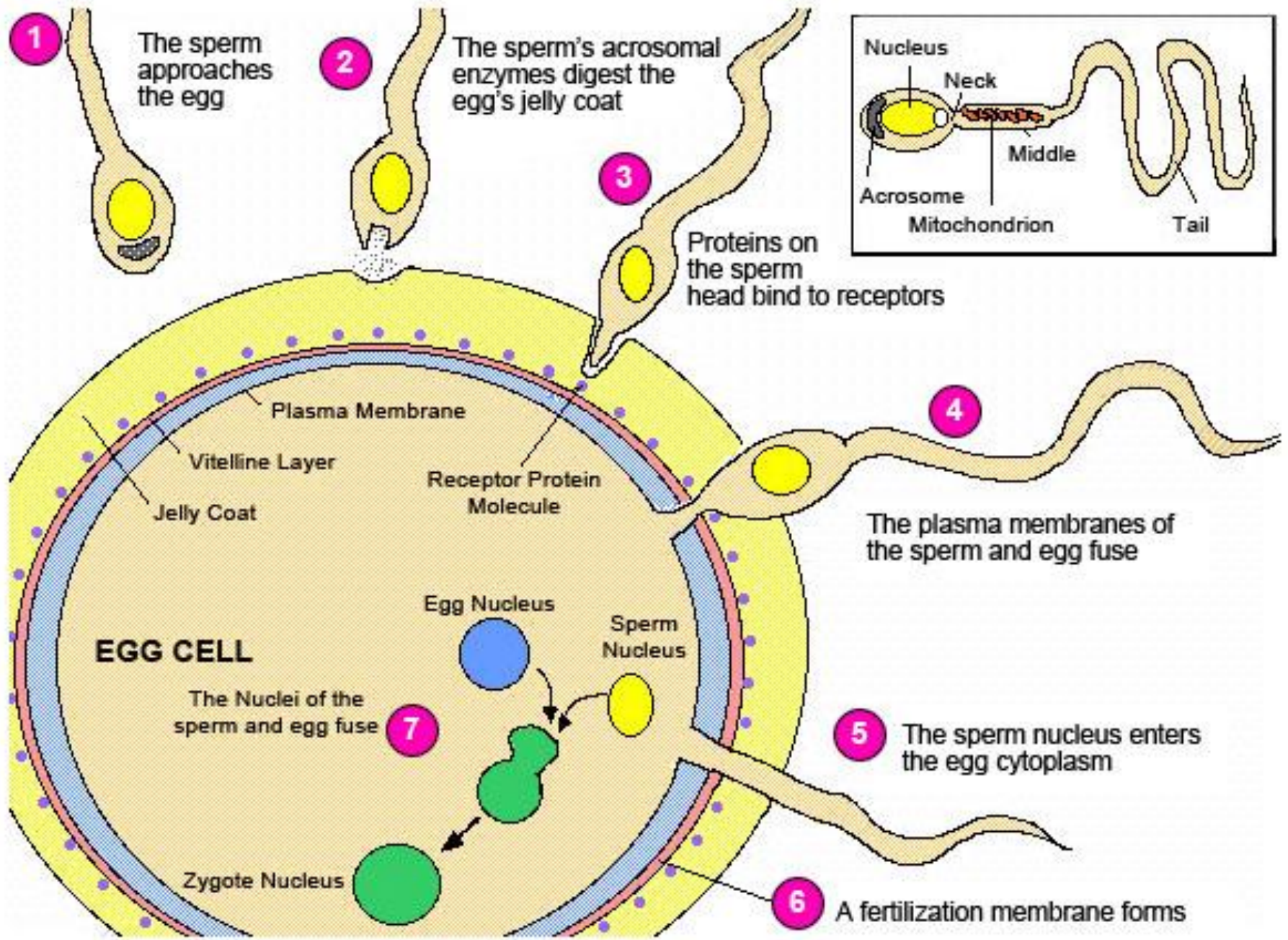
Embryonic Stage

Fetal Stage

Birth

Fertilization





Fertilization

1. Intercourse

2. Fertilization

- Fusion of egg and sperm nuclei.
- Zygote forms.
- Takes place in oviduct.

3. Polyspermy

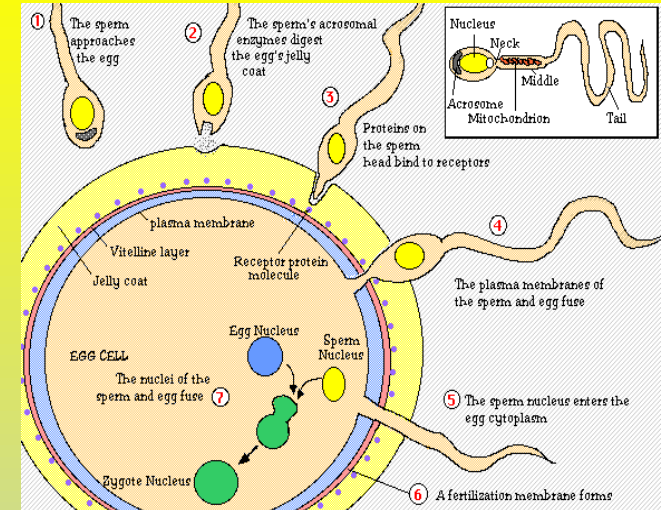
- More than 1 sperm entering the egg.

4. Fast Block to Polyspermy

- Calcium enters and causes electrical zap.
- Sperm are temporarily stunned.

5. Slow Block to Polyspermy

- Creation of Fertilization Membrane.
- Keeps additional sperm out.



Cleavage

Rapid form of cell division, cells get smaller

1. When does it begin?

- a. Zygote Formation
- b. Day 1

2. When does it end ?

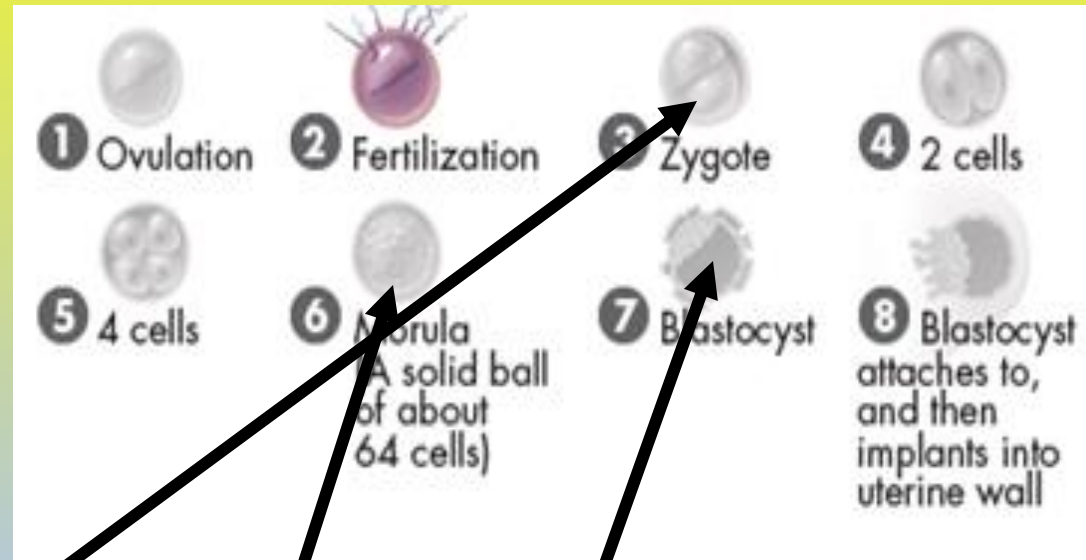
- a. Implantation of blastula (hollow ball of cells)
- b. Day 7

3. Where does it occur?

- a. Oviduct and Uterus

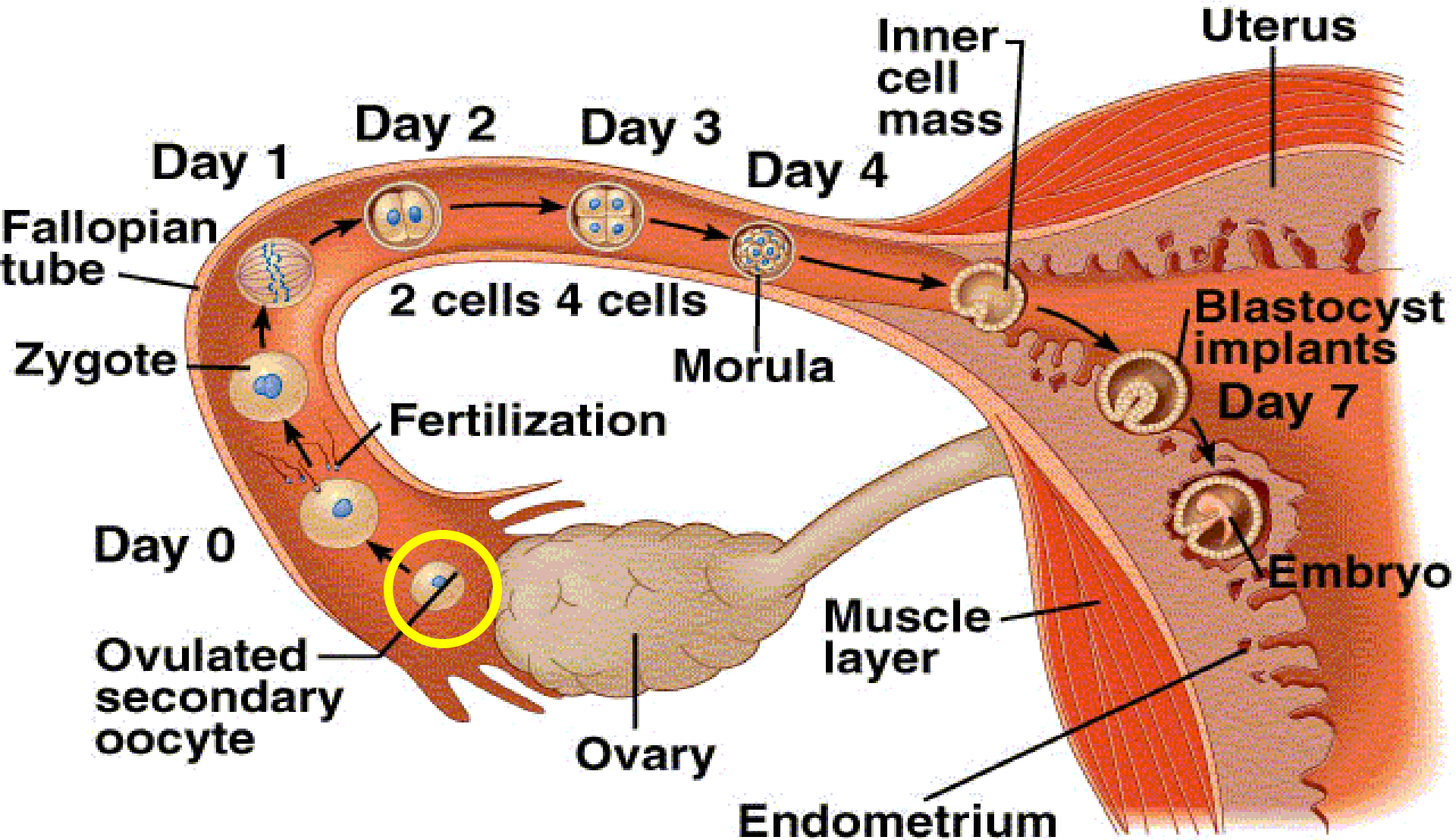
4. Stages involved:

Zygote → 2-cells, 4,8,16 → morula → blastula (aka blastocyst)

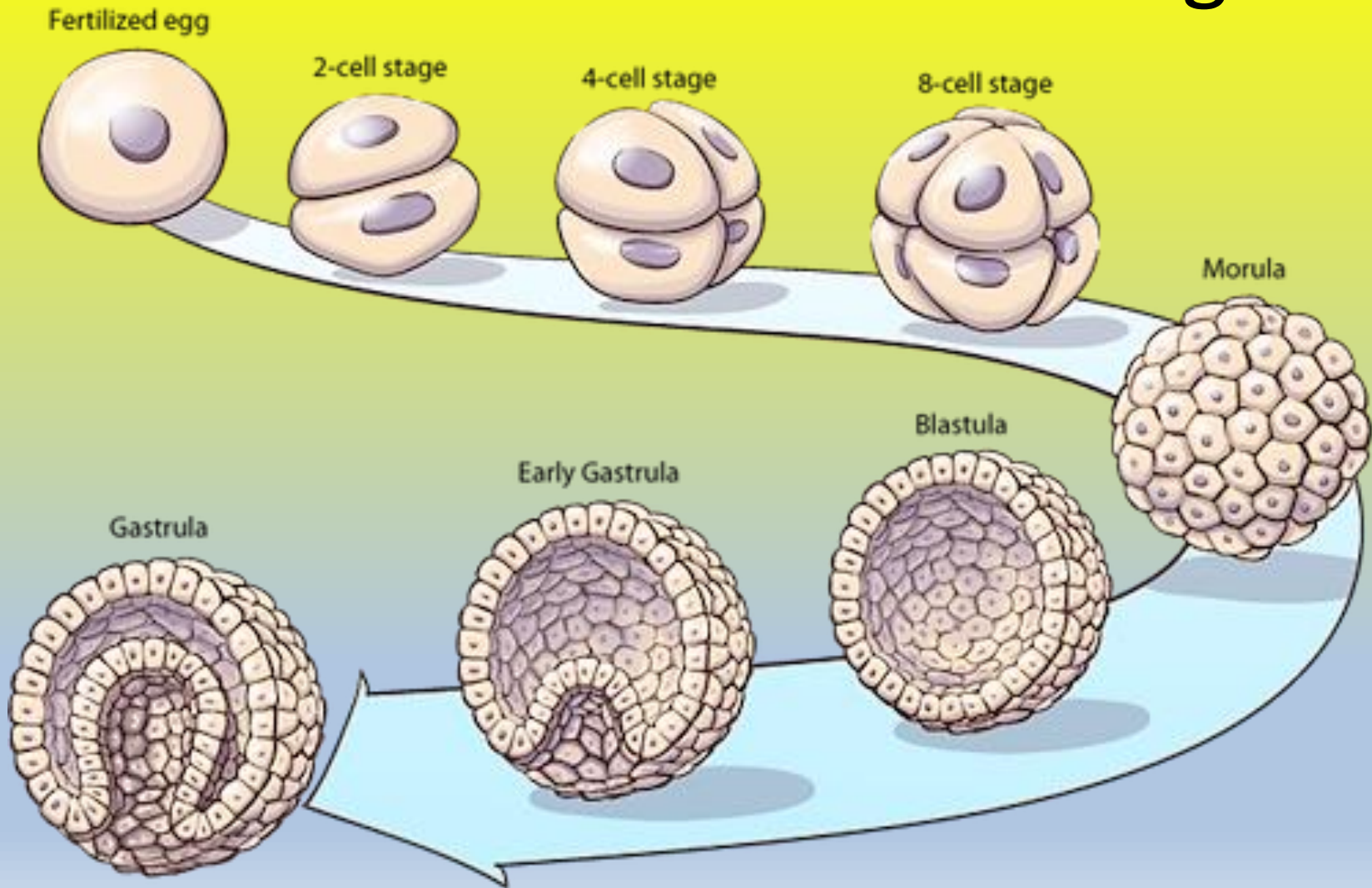


Cleavage

From ovulation to implantation



Cleavage

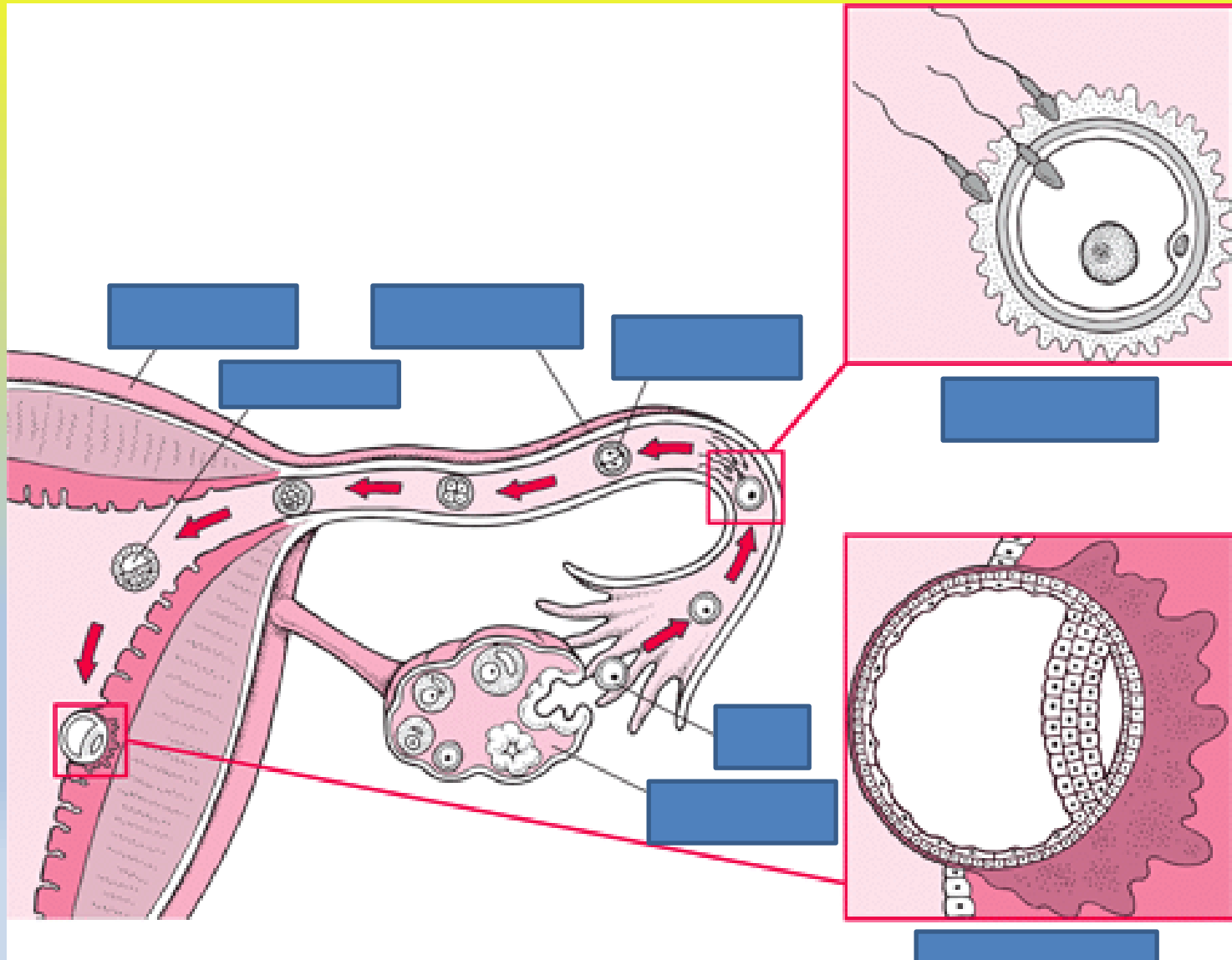


Cell Cleavage

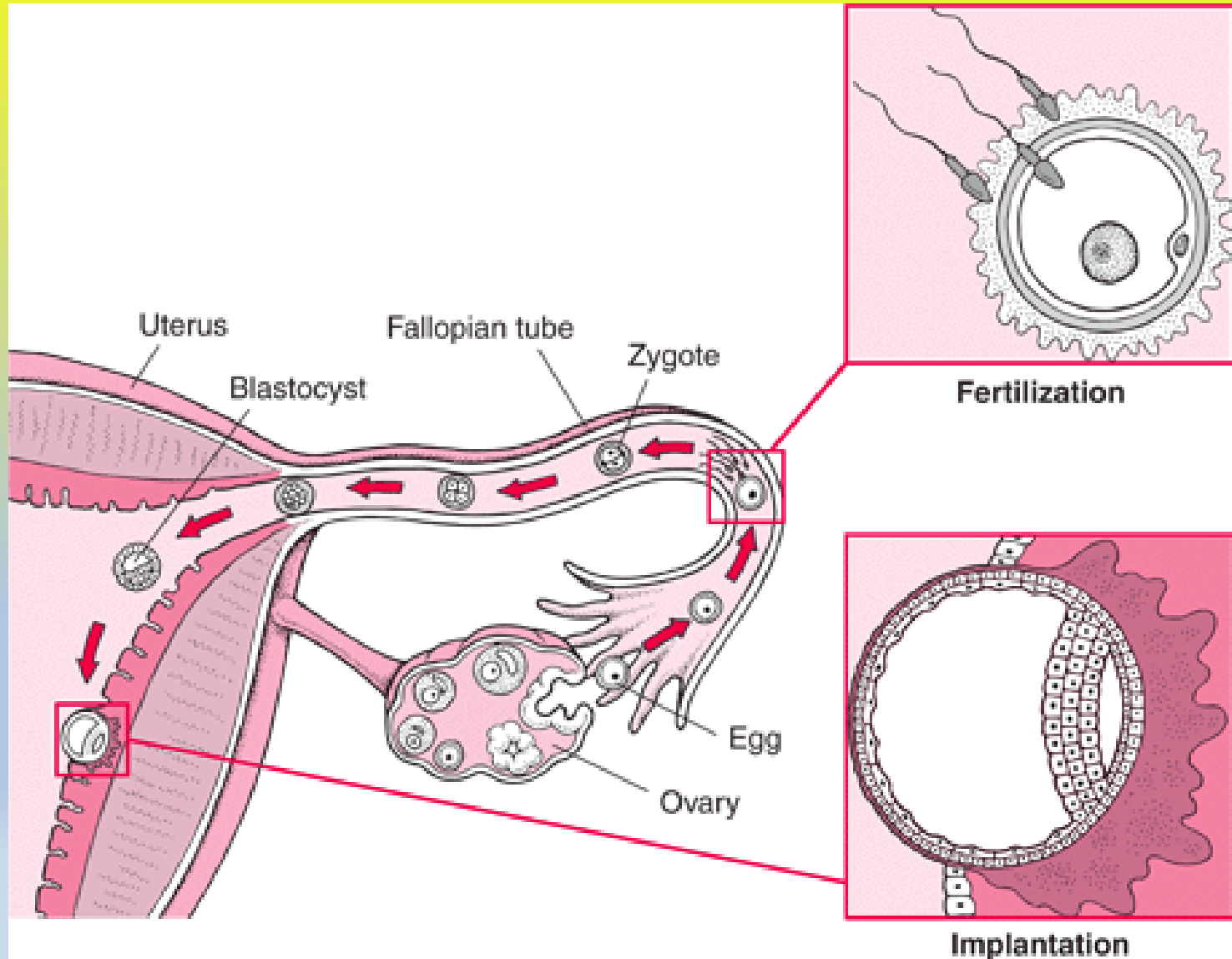
Process by which the number of cells in a developing embryo is multiplied through cell division.



From Egg to Embryo

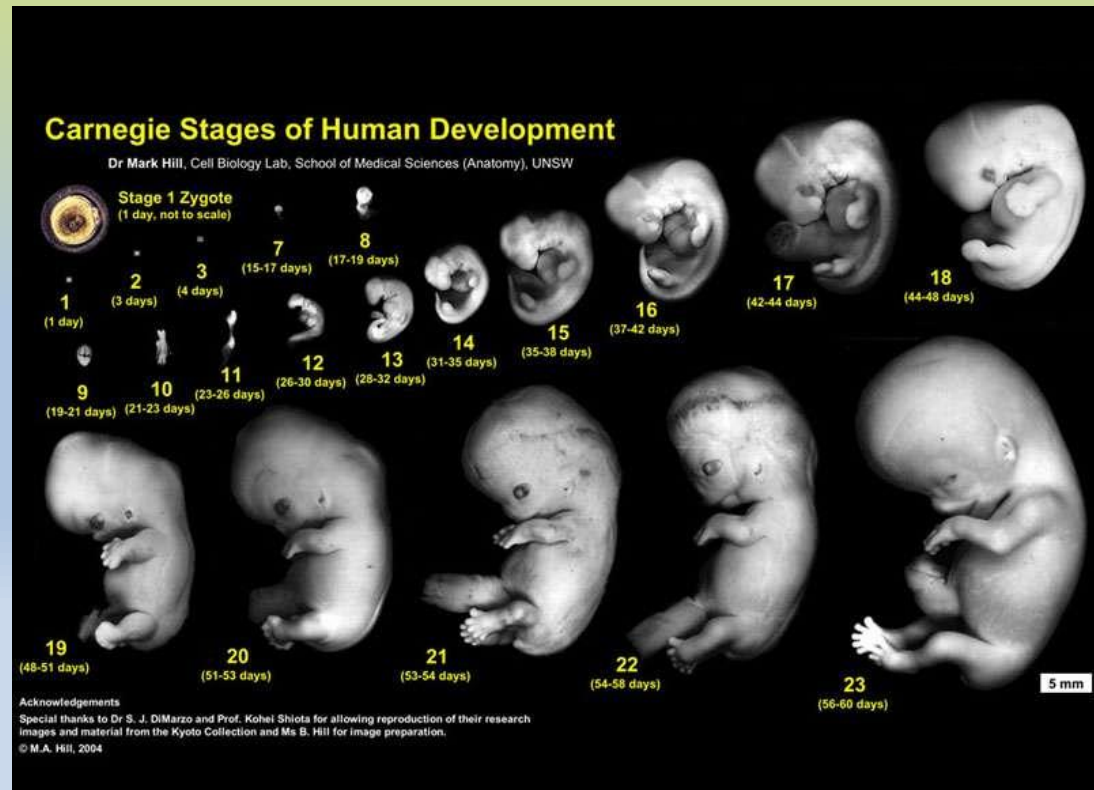


From Egg to Embryo



Embryonic Stage

1. Timeline: Day 8 through end of second month
2. Location: Uterus
3. Purpose: Formation of body organs, symmetry and shape.



Embryonic Stages

Carnegie Stages of Human Development

Dr Mark Hill, Cell Biology Lab, School of Medical Sciences (Anatomy), UNSW



Acknowledgements

Special thanks to Dr S. J. DiMarzo and Prof. Kohel Shiota for allowing reproduction of their research

Steps in Embryonic Stage

Outcome

Gastrulation

Formation of Germ Layers.

Extra Embryonic Membranes

Formation of membranes on the exterior of the embryo- leads to formation of placenta and umbilical cord.

Morphogenesis

Formation of form/shape.

Organogenesis

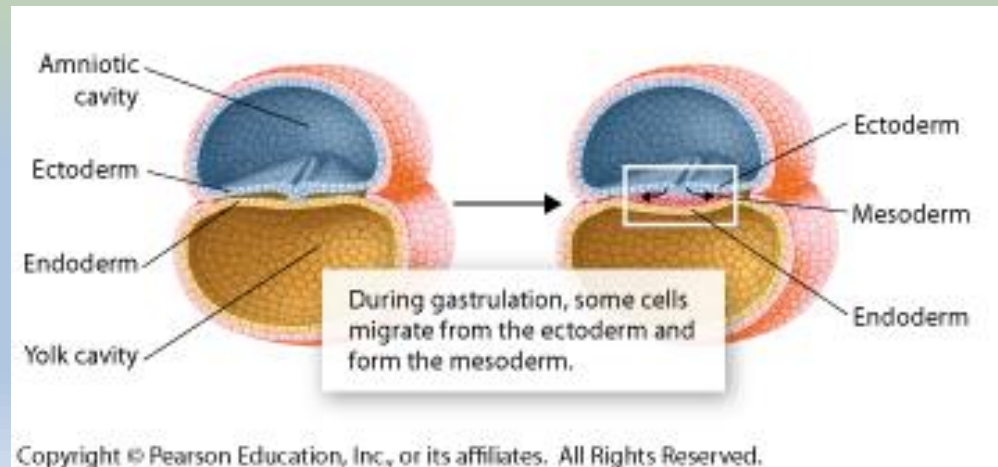
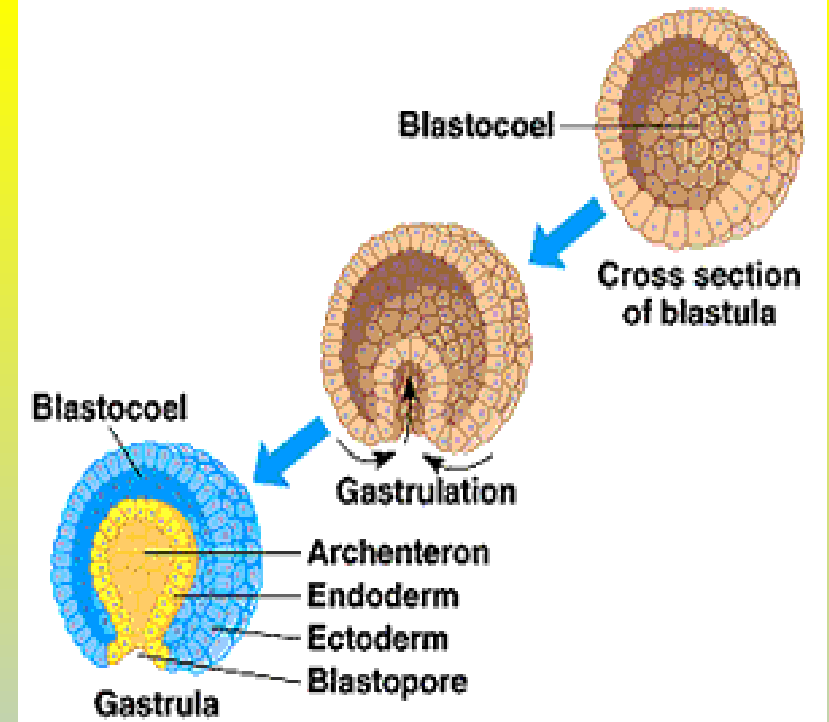
Formation of Organs.

Somite Formation

Vertebrae formation.

Gastrulation

1. Inward folding of Blastula
2. Formation of three Germ Layers
 - i. Ectoderm
 - ii. Mesoderm
 - iii. Endoderm



3. Specialization of Cells

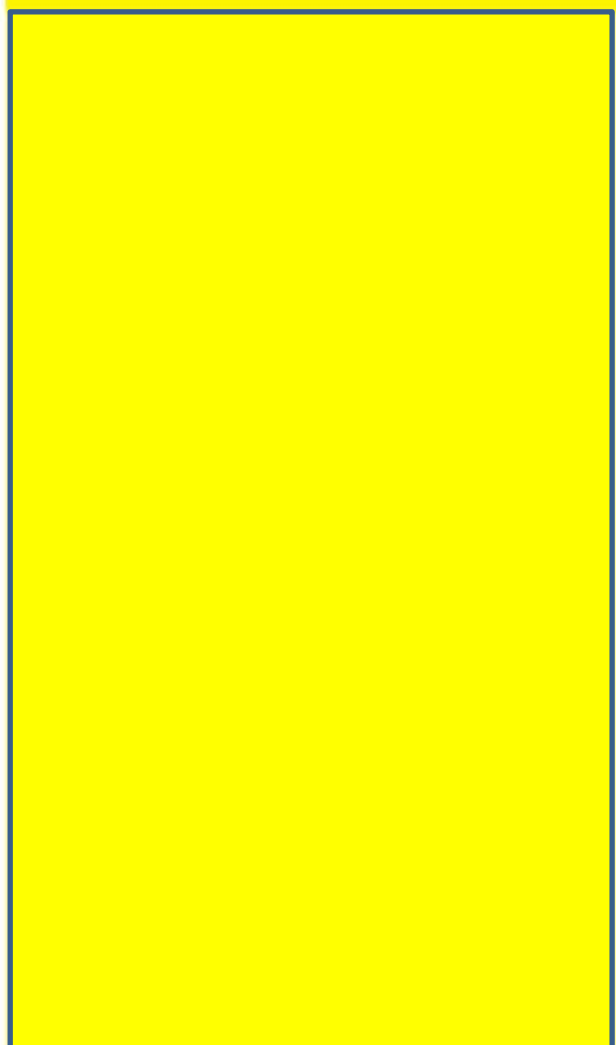


Germ Layer Functions

ECTODERM

MESODERM

ENDODERM





Germ Layer Functions

ECTODERM

- Epidermis of skin and its derivatives (including sweat glands, hair follicles)
- Epithelial lining of mouth and anus
- Cornea and lens of eye
- Nervous system
- Sensory receptors in epidermis
- Adrenal medulla
- Tooth enamel
- Epithelium of pineal and pituitary glands

MESODERM

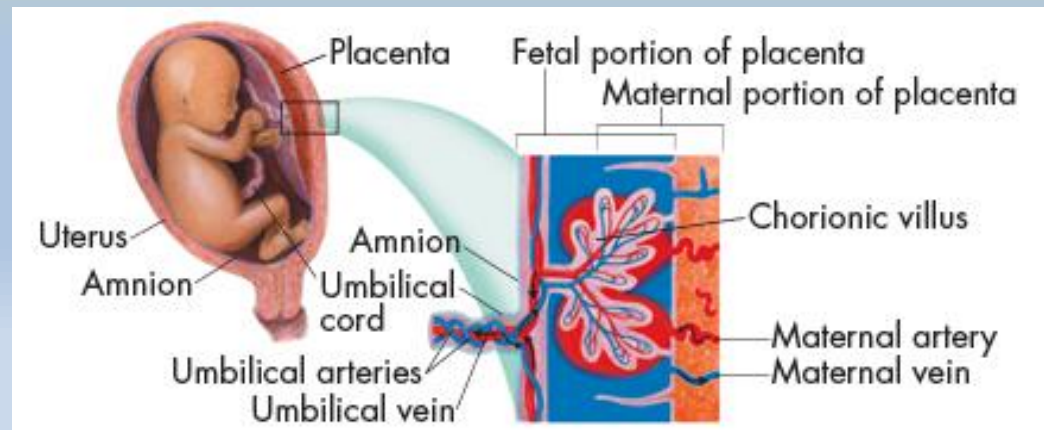
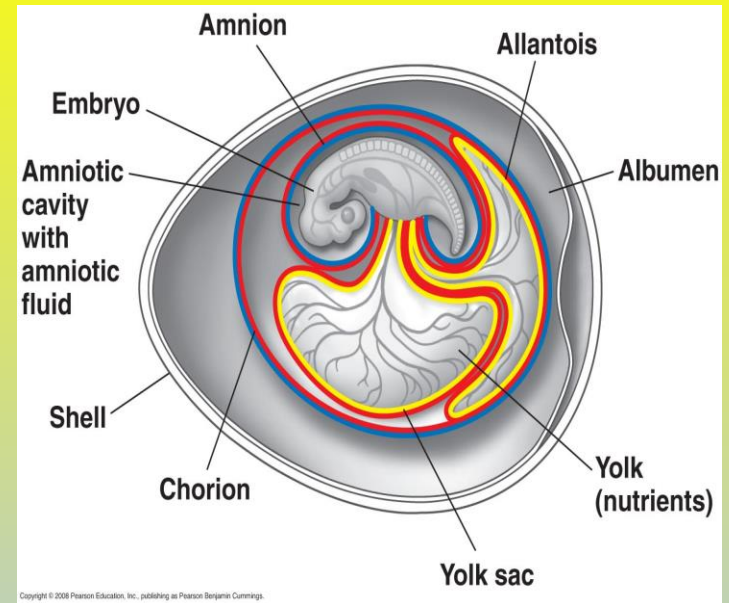
- Notochord
- Skeletal system
- Muscular system
- Muscular layer of stomach and intestine
- Excretory system
- Circulatory and lymphatic systems
- Reproductive system (except germ cells)
- Dermis of skin
- Lining of body cavity
- Adrenal cortex

ENDODERM

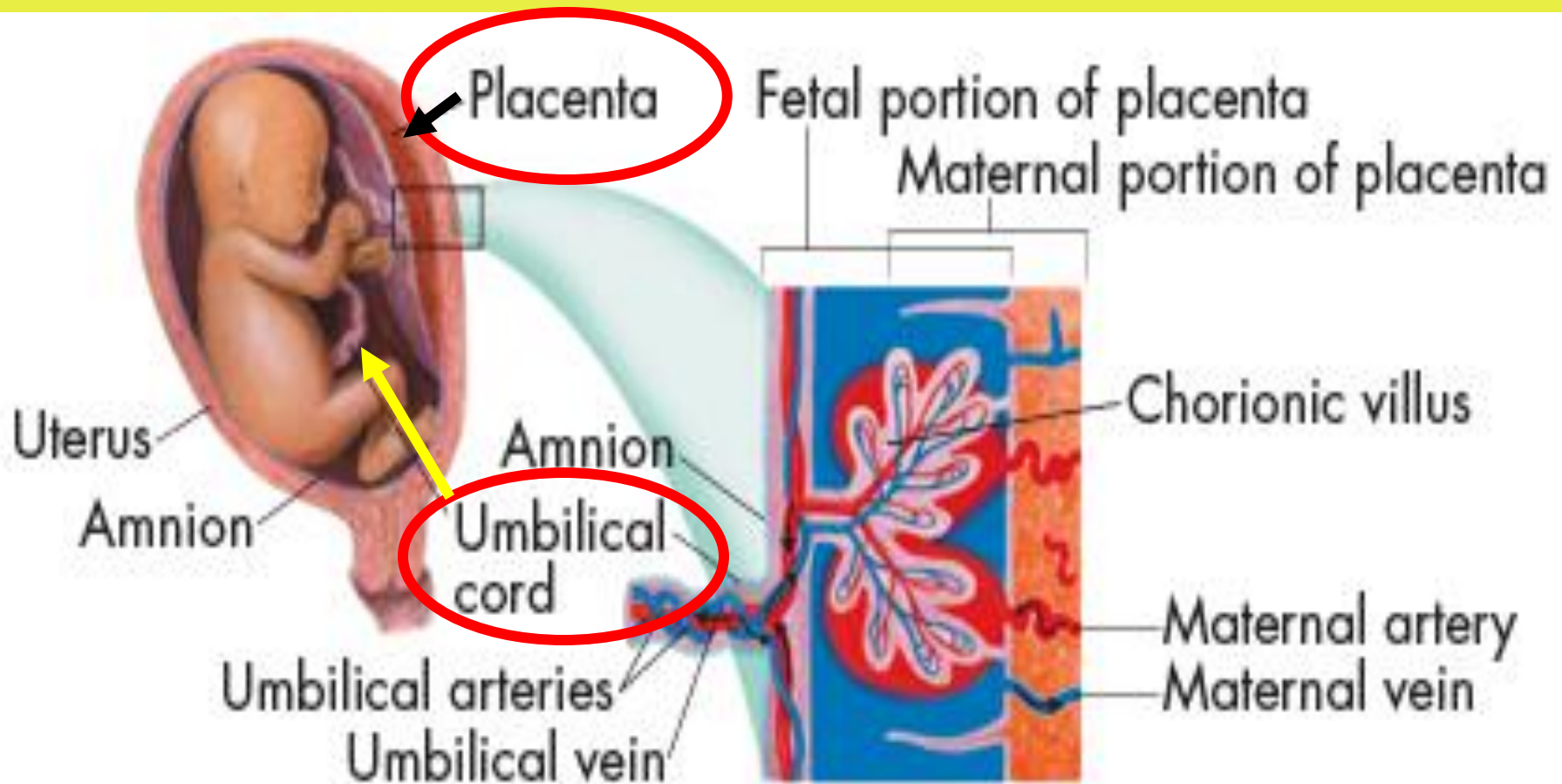
- Epithelial lining of digestive tract
- Epithelial lining of respiratory system
- Lining of urethra, urinary bladder, and reproductive system
- Liver
- Pancreas
- Thymus
- Thyroid and parathyroid glands

Extra Embryonic Membranes

- a. **Formation of membranes on the exterior of the embryo which leads to formation of:**
- b. **Umbilical Cord:** A cord which is filled with blood vessels that connects the embryo/fetus with the placenta of the mother.
- c. **Placenta:** Transports nourishment/ O_2 from the mother and wastes/ CO_2 away from the fetus.



Extra Embryonic Membranes

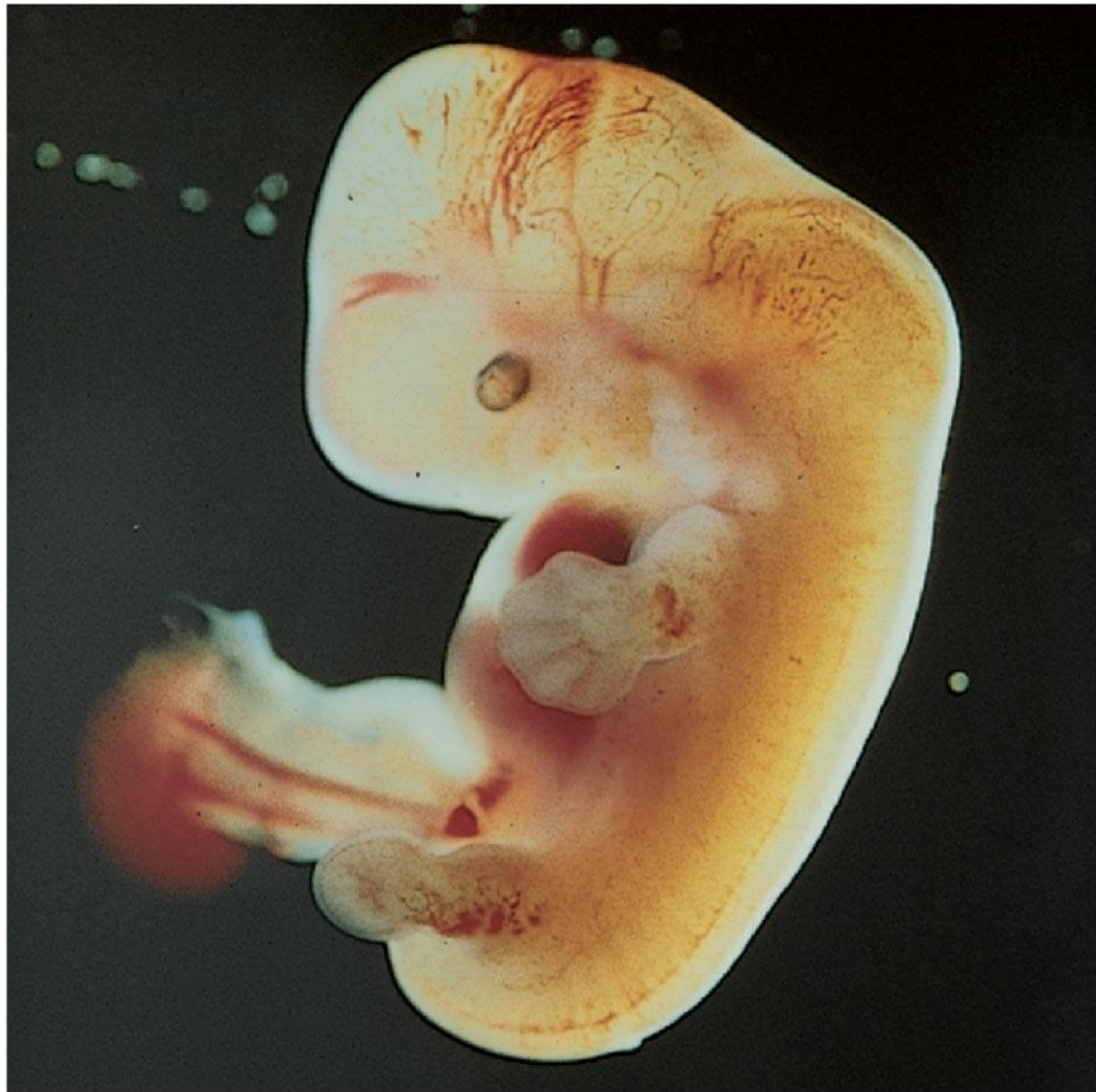


Morphogenesis

- Formation of body shape.

Organogenesis

- Formation of body organs.



(a) 5 weeks

Embryonic Stage Summary

Stage of Development?

Embryonic

When Does it Begin?

Day 8

When Does it End?

2 Month / 8 weeks

Where does it occur?

Uterus

What happens?

Produce Embryo



Embryonic Stage: Summary

Stage of Development	When Does it Begin?	When Does it End?	Where does it occur?	What happens?
?	Day 8	2 Months	?	Produce ?

Steps in Embryonic Stage	Outcome
?	Formation of ? Layers
?	Formation of ?/Shape
?	Formation of ?
Extra Embryonic Membranes	Lead to the formation of ? and ? cord
?	? formation



Embryonic Stage: Summary

Stage of Development	When Does it Begin?	When Does it End?	Where does it occur?	What happens?
Embryonic	Day 8	2 Months	Uterus	Produce Embryo

Steps in Embryonic Stage	Outcome
Gastrulation	Formation of Germ Layers
Morphogenesis	Formation of Form/Shape
Organogenesis	Formation of Organs
Extra Embryonic Membranes	Lead to the formation of placenta and umbilical cord
Somites	Vertebrae formation

Fetal Stage

1. When does it begin and end?

- a. 3rd month—Birth of baby

2. Where does it occur?

- a. Uterus

3. What happens?

- a. GROWTH
- b. Maturation of Organs and Organ Systems



(a) 5 weeks



(b) 14 weeks



(c) 20 weeks

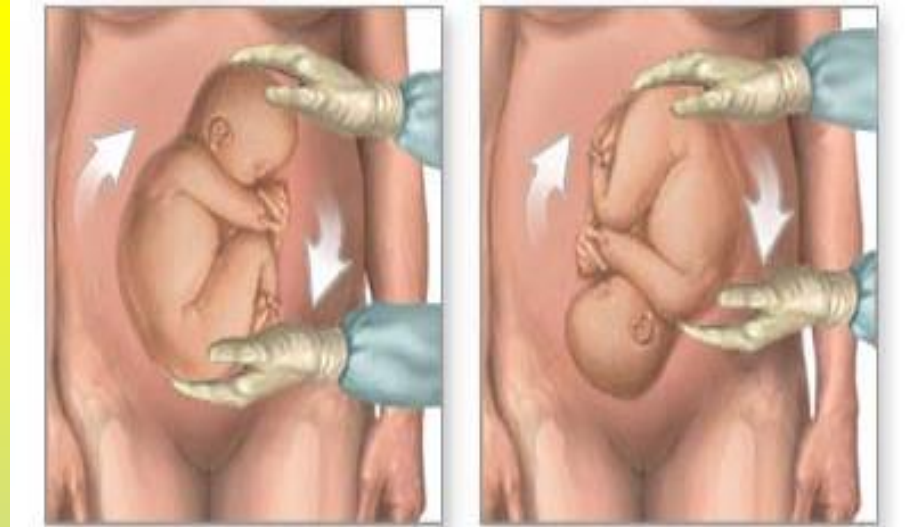
Squibb 20 week ultrasound



Birth

1. When does this occur?

a. About 40th week



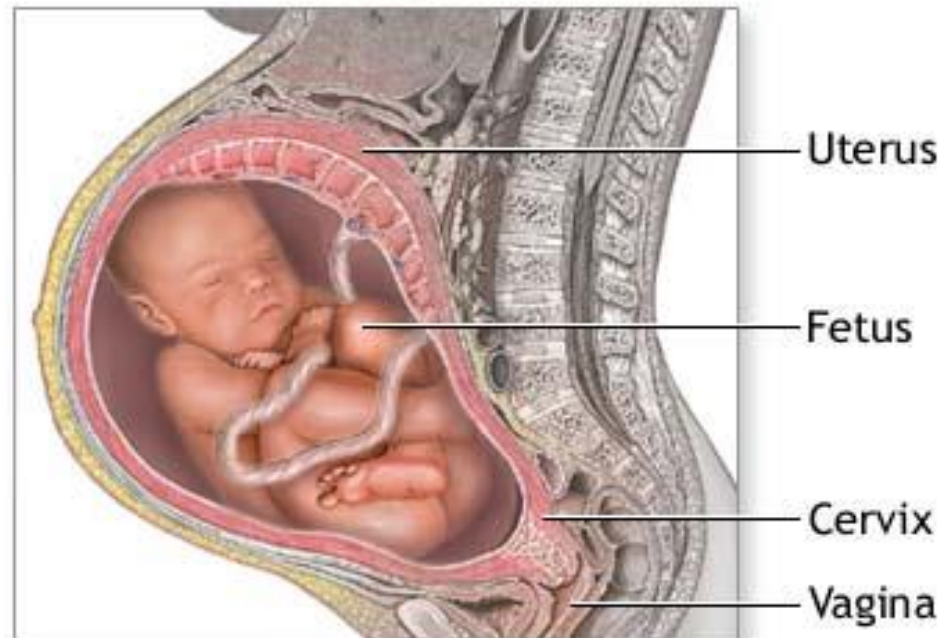
2. Position of baby and breech baby

3. Dilation Stage

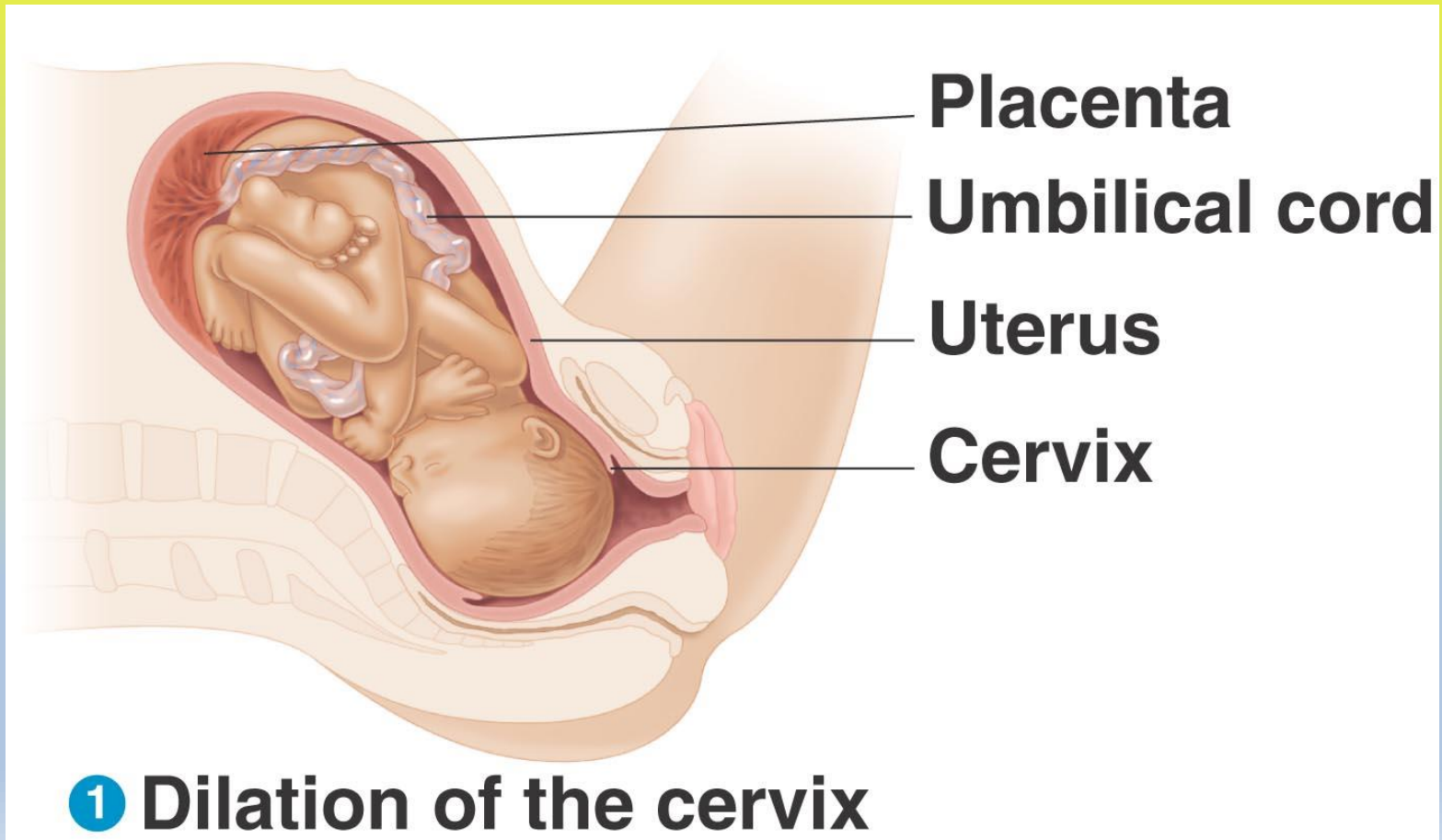
4. Expulsion Stage

5. After-Birth Stage

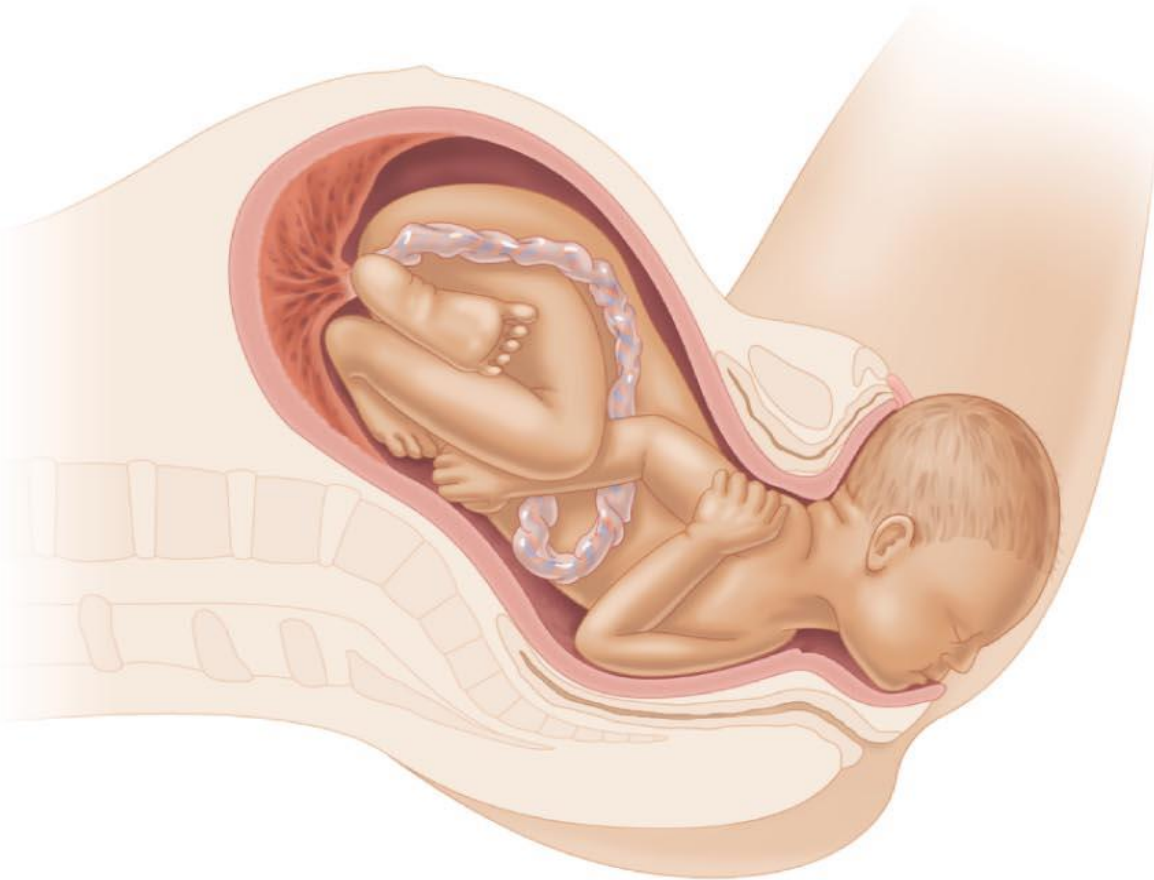
Fetus in breech presentation



Birth: Dilation Stage

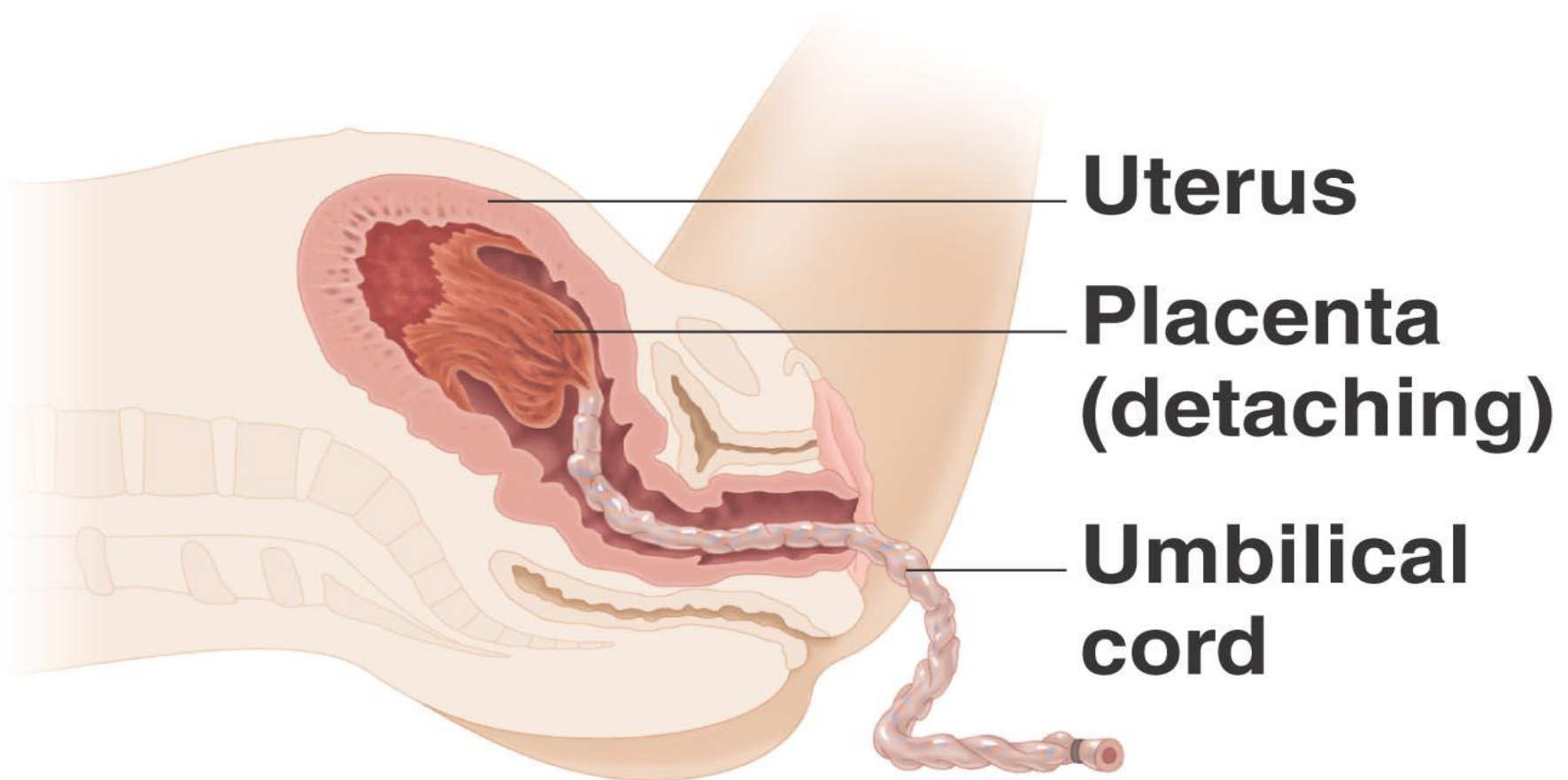


Birth: Expulsion Stage



2 Expulsion: delivery of the infant

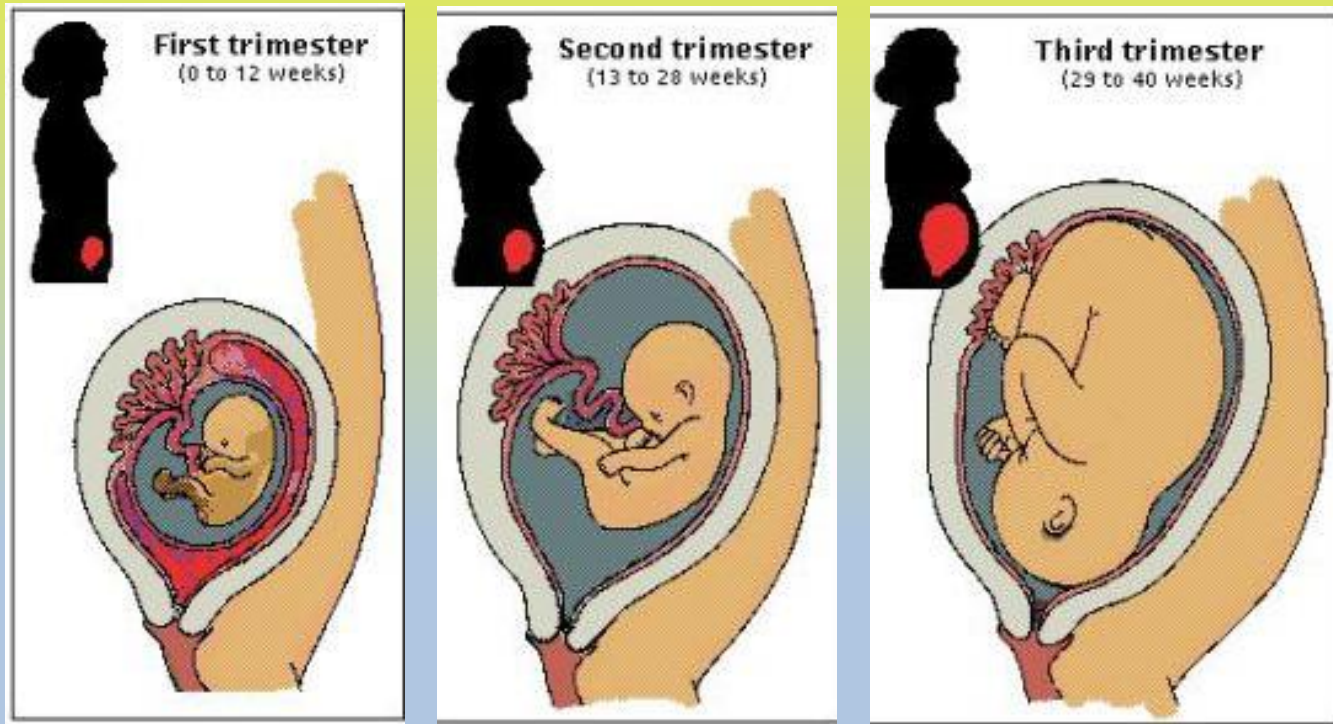
Birth: After-Birth Stage



3 Delivery of the placenta

General Birth Considerations

- What are **Trimesters** and how do they correspond to the stages we've discussed?



- What are Teratogens?
 - Substances that cause birth defects.

General Birth Considerations

- Identical Twins?
 - Zygote splits to form 2 embryos.
- Fraternal Twins?
 - 2 eggs fertilized by 2 sperm.

