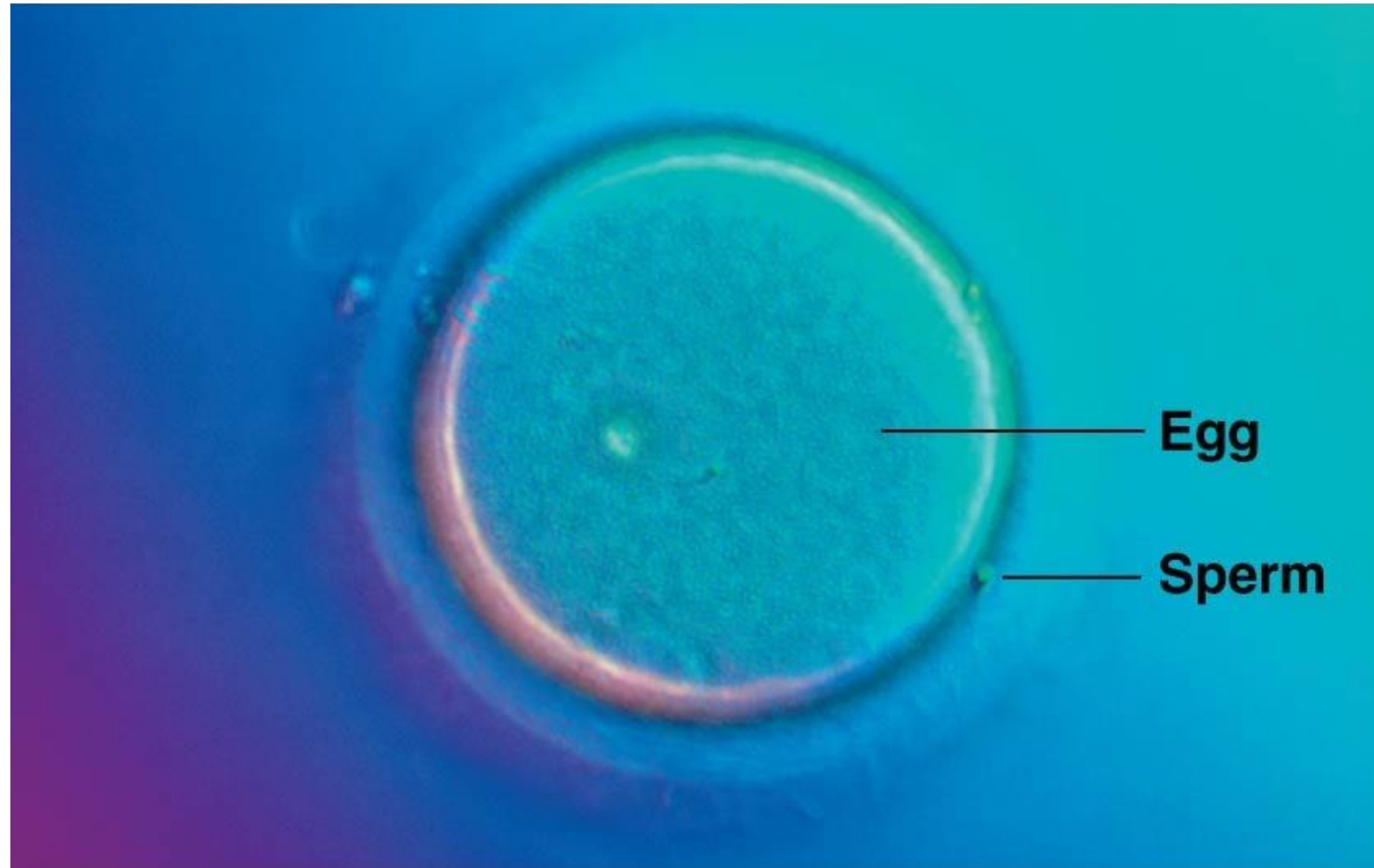


Eggs are BIG and EXPENSIVE
Sperm are SMALL and CHEAP



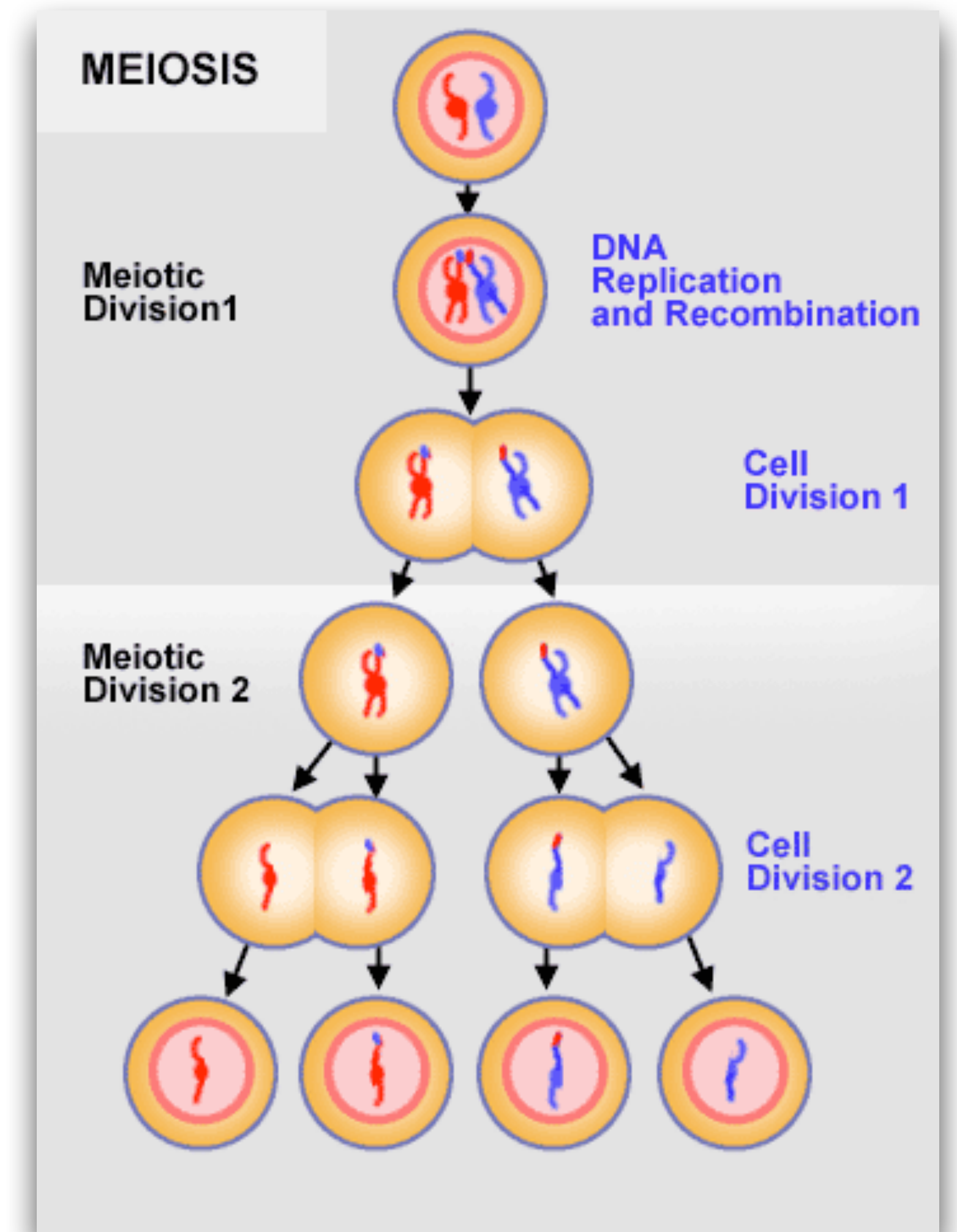
Why Have Sex?

- Lots of animals clone themselves... 100% of their genes are passed on!
- Sex requires sharing, it's expensive (time, mate selection, special parts, pre-nuptial gifts...)
- So why do it?



Meiosis

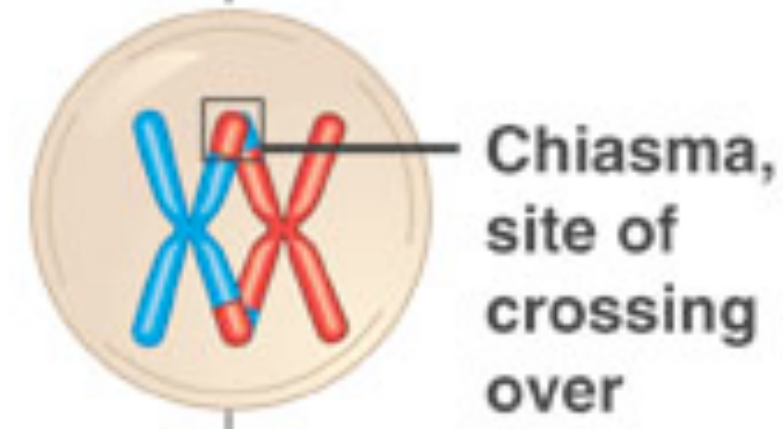
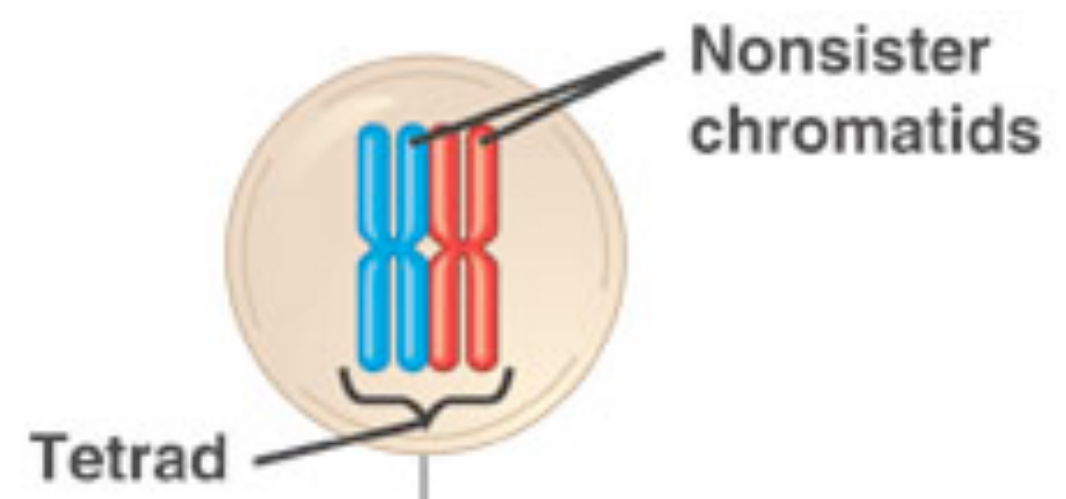
- Can it occur in haploid or diploid cells?
- How many cell divisions are involved?
- What are the results?



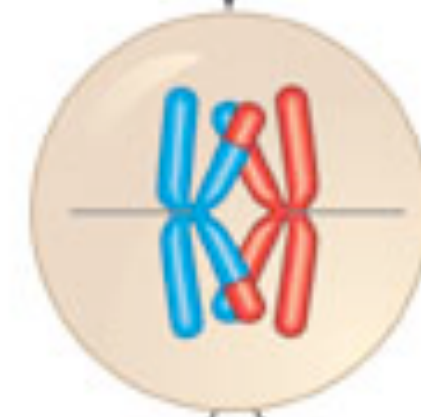
Meiosis

- Creates genetic variety:
 - Independent orientation of chromosome pairs (how many combinations?)
 - How many combinations of gametes between 2 people?
 - Is there something else?

Prophase I
of meiosis



Metaphase I



Metaphase II



Daughter
cells



Recombinant
chromosomes

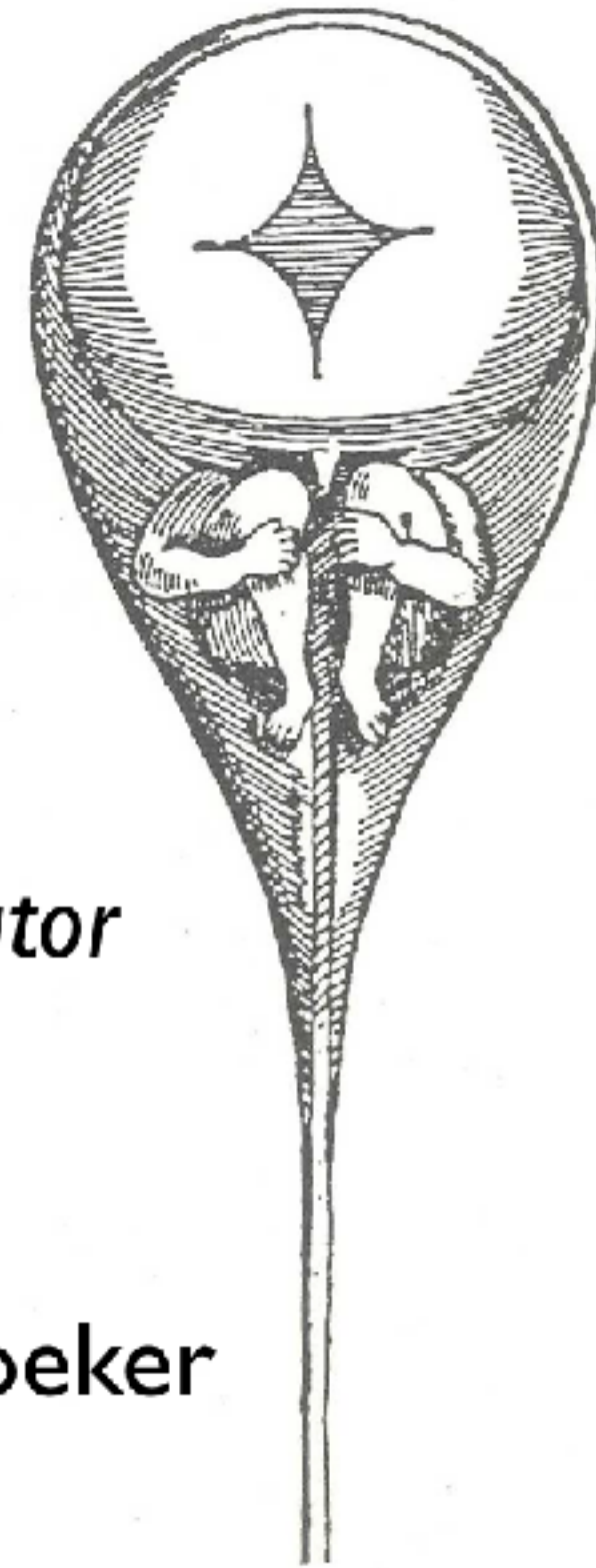
Special Parts: Gender

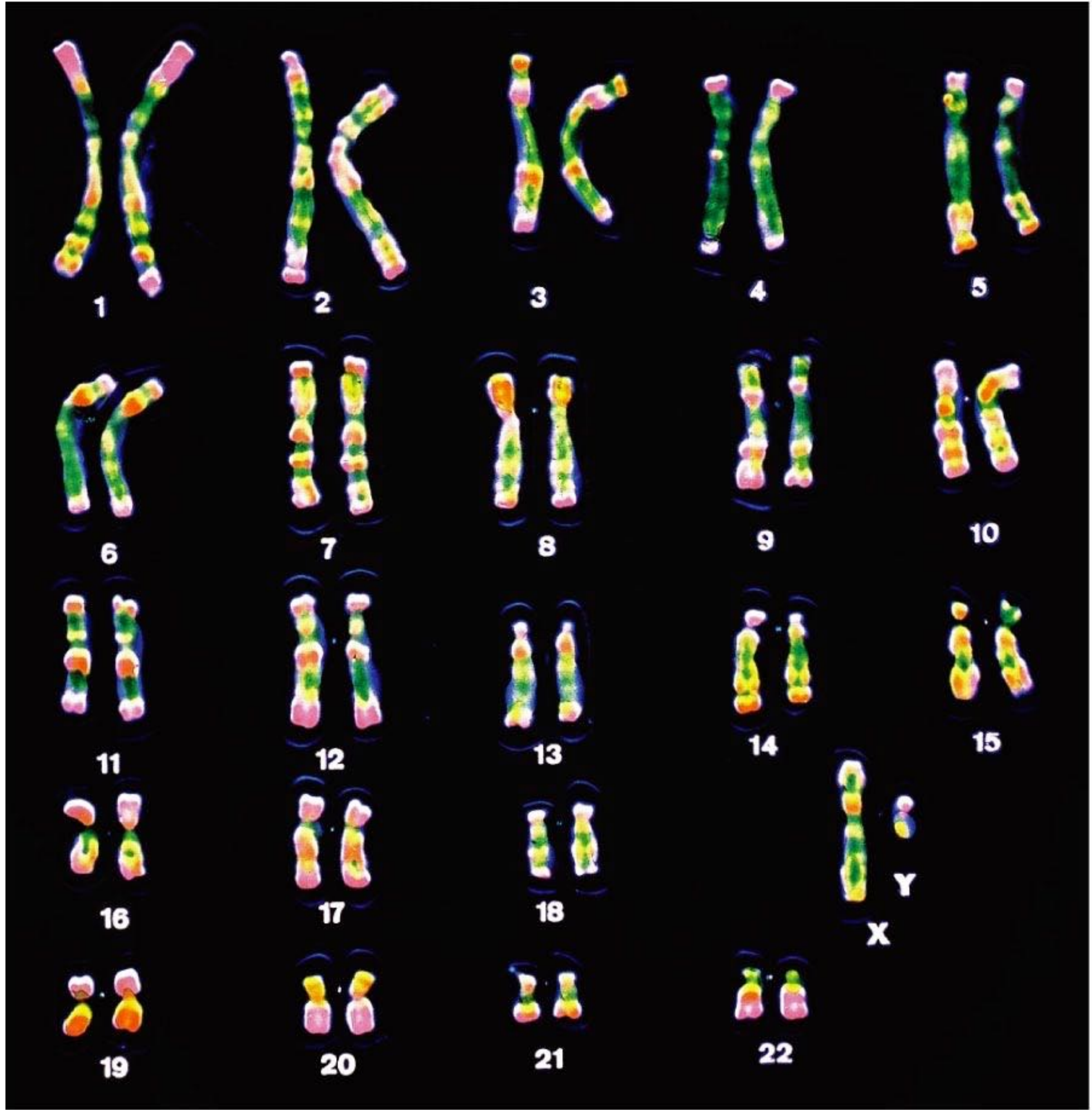
- Sexual reproduction requires **GENDERS**
- What determines gender?
- What is the role of each gender in reproduction?
- These questions were debated for a **LONG** time...

What is LIFE?

*Man the seed,
woman the incubator*

Homunculus
by Nicolaus Hartsoecker
(1694)

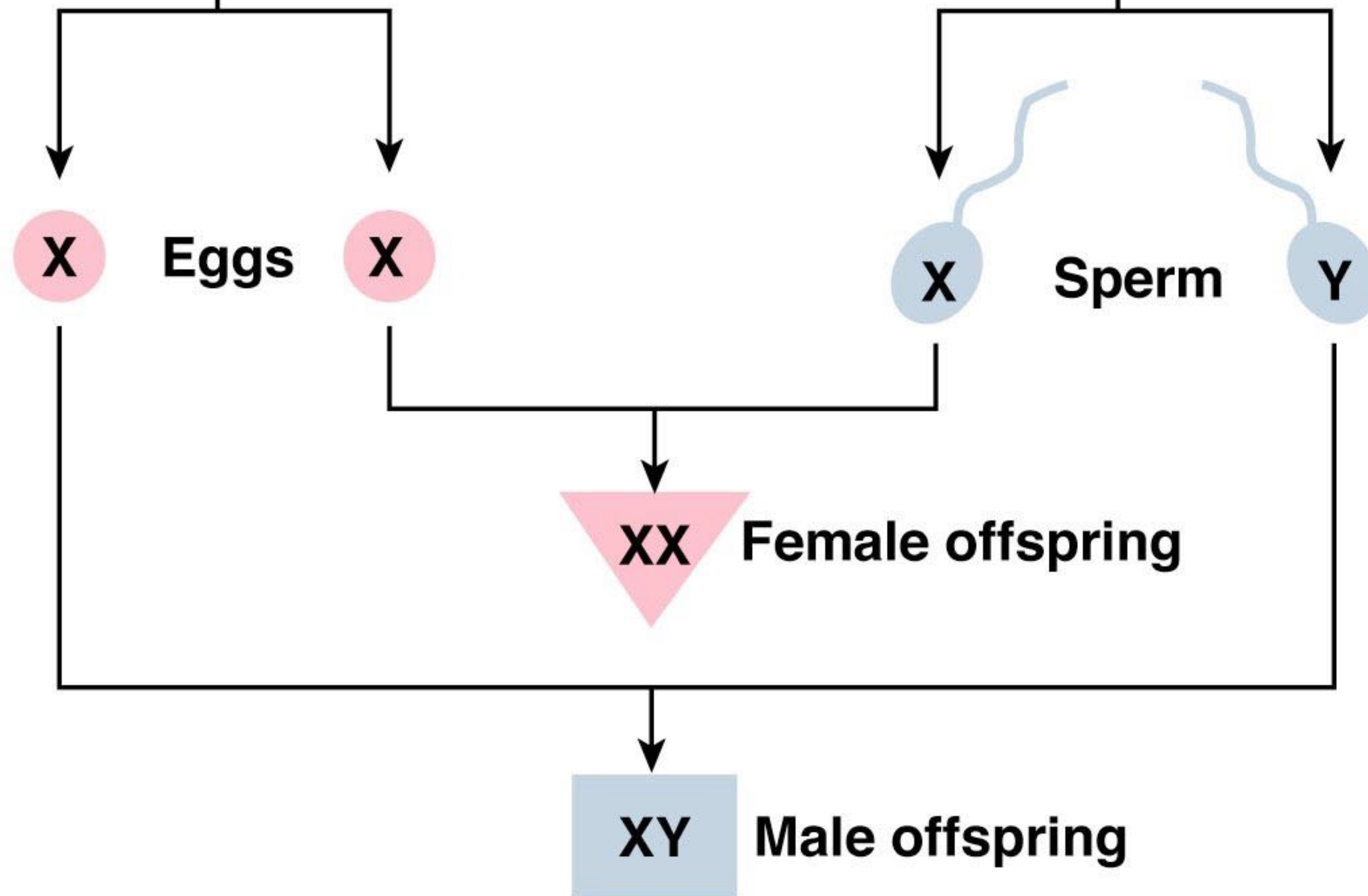
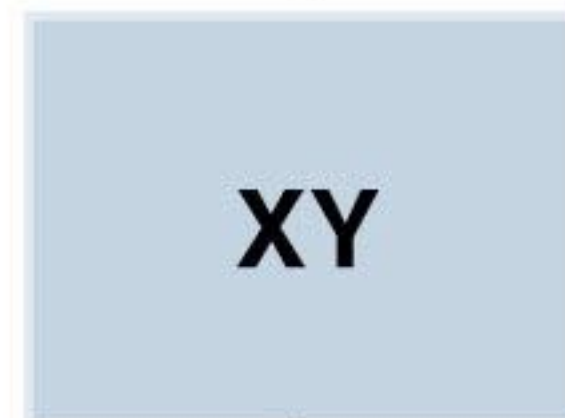




Female parent



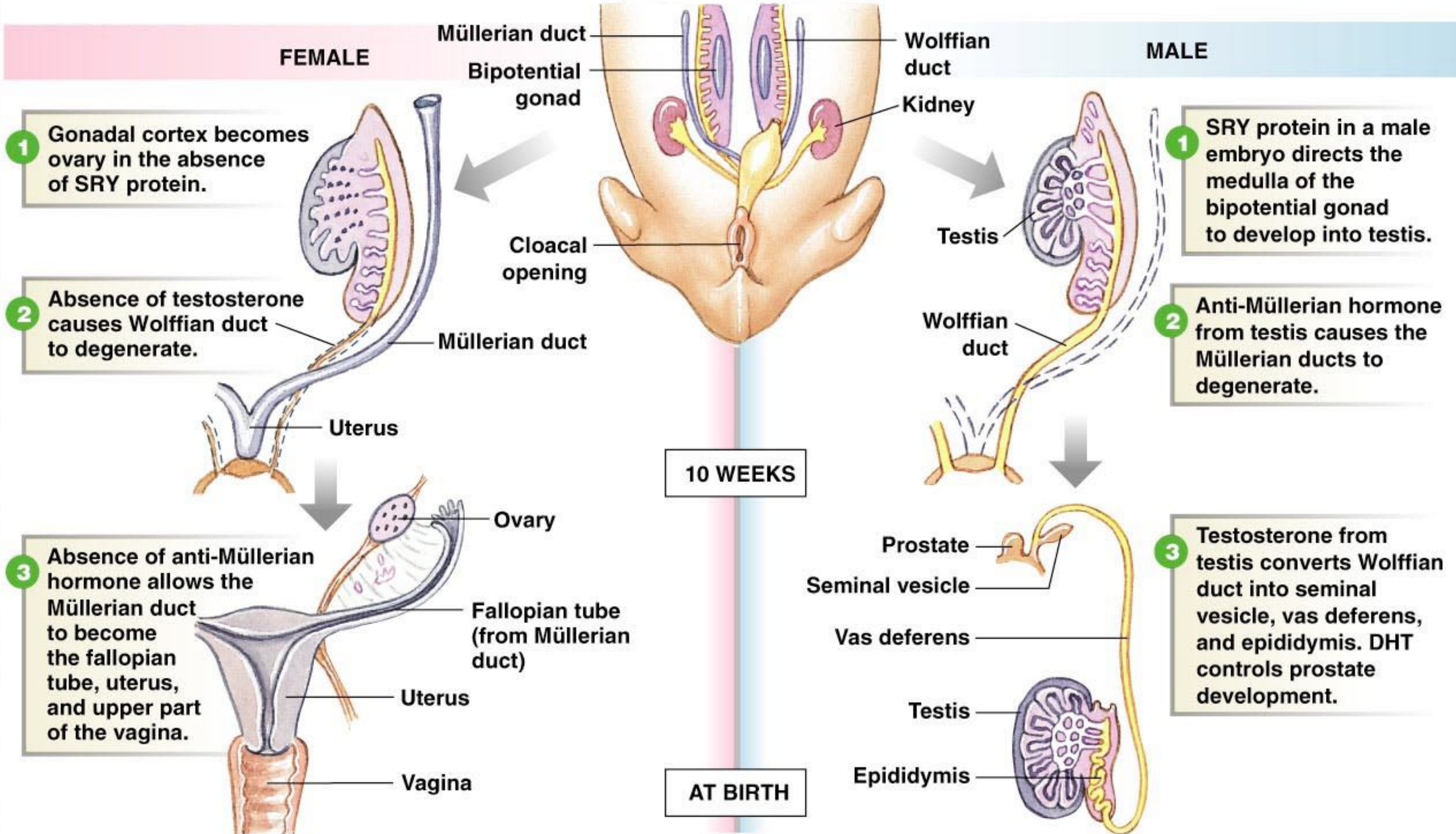
Male parent



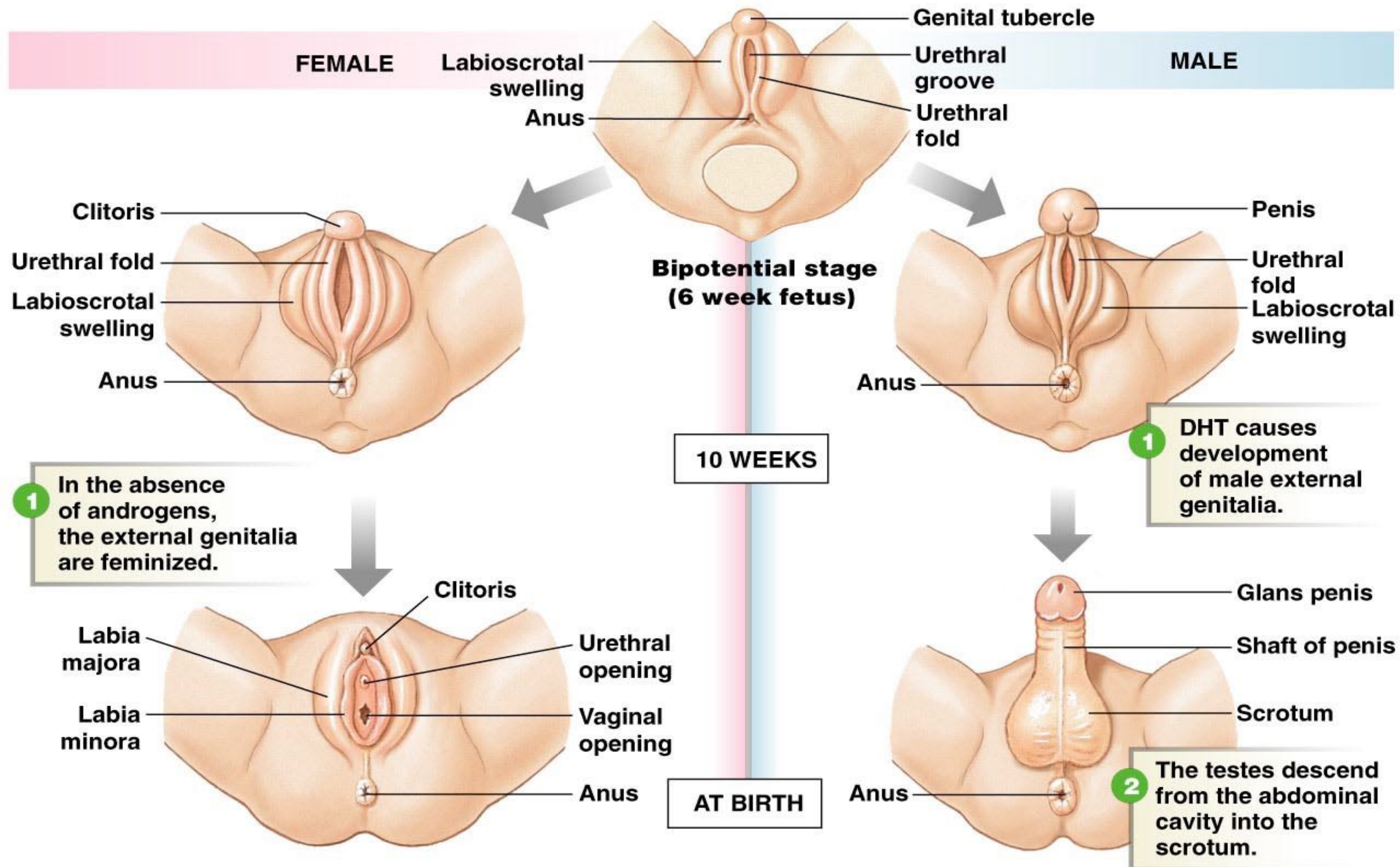
(a) Development of internal organs

Bipotential stage: 6 weeks of fetal development

The internal reproductive organs have the potential to develop into male or female structures.



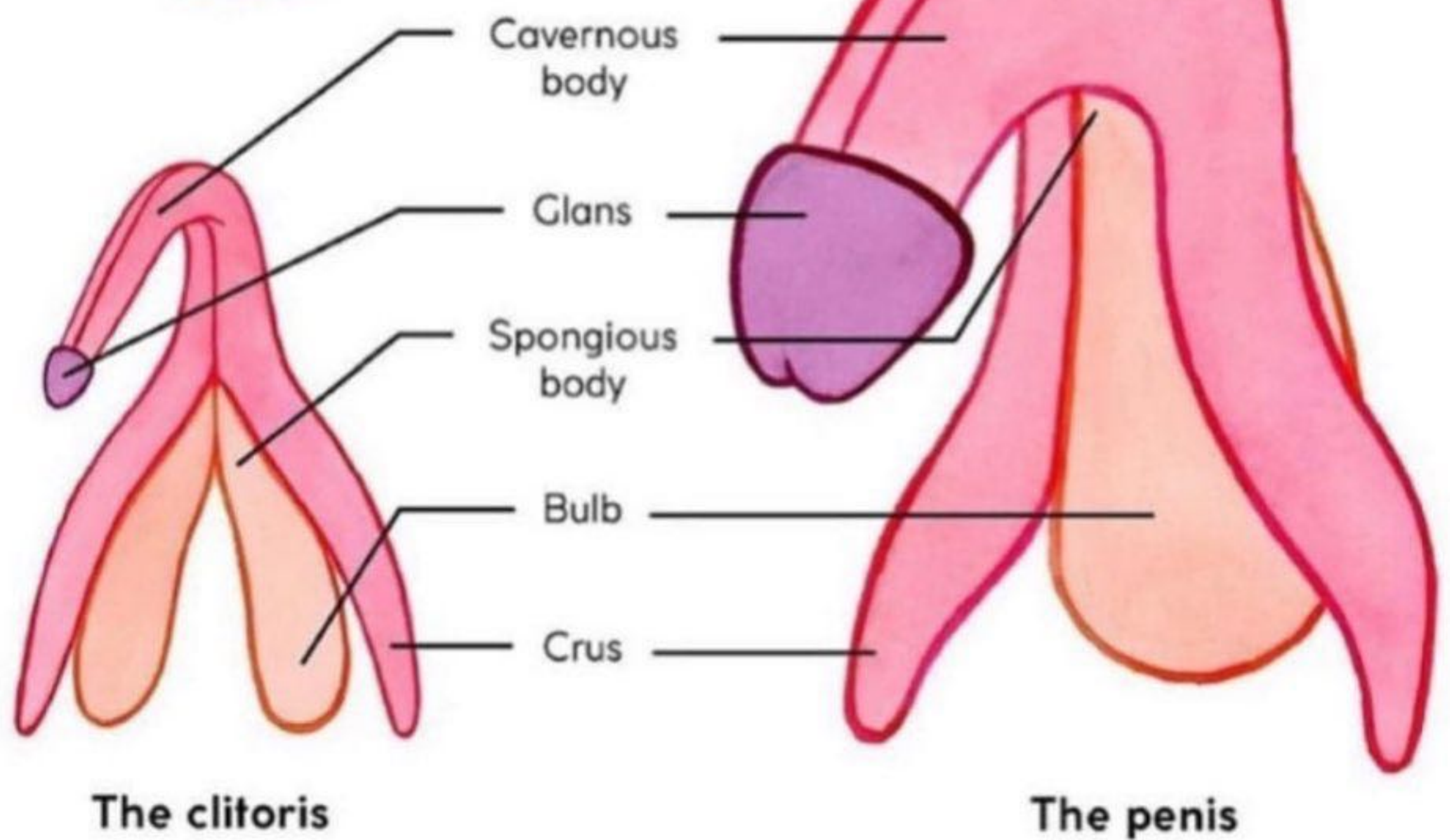
(b) Development of external genitalia

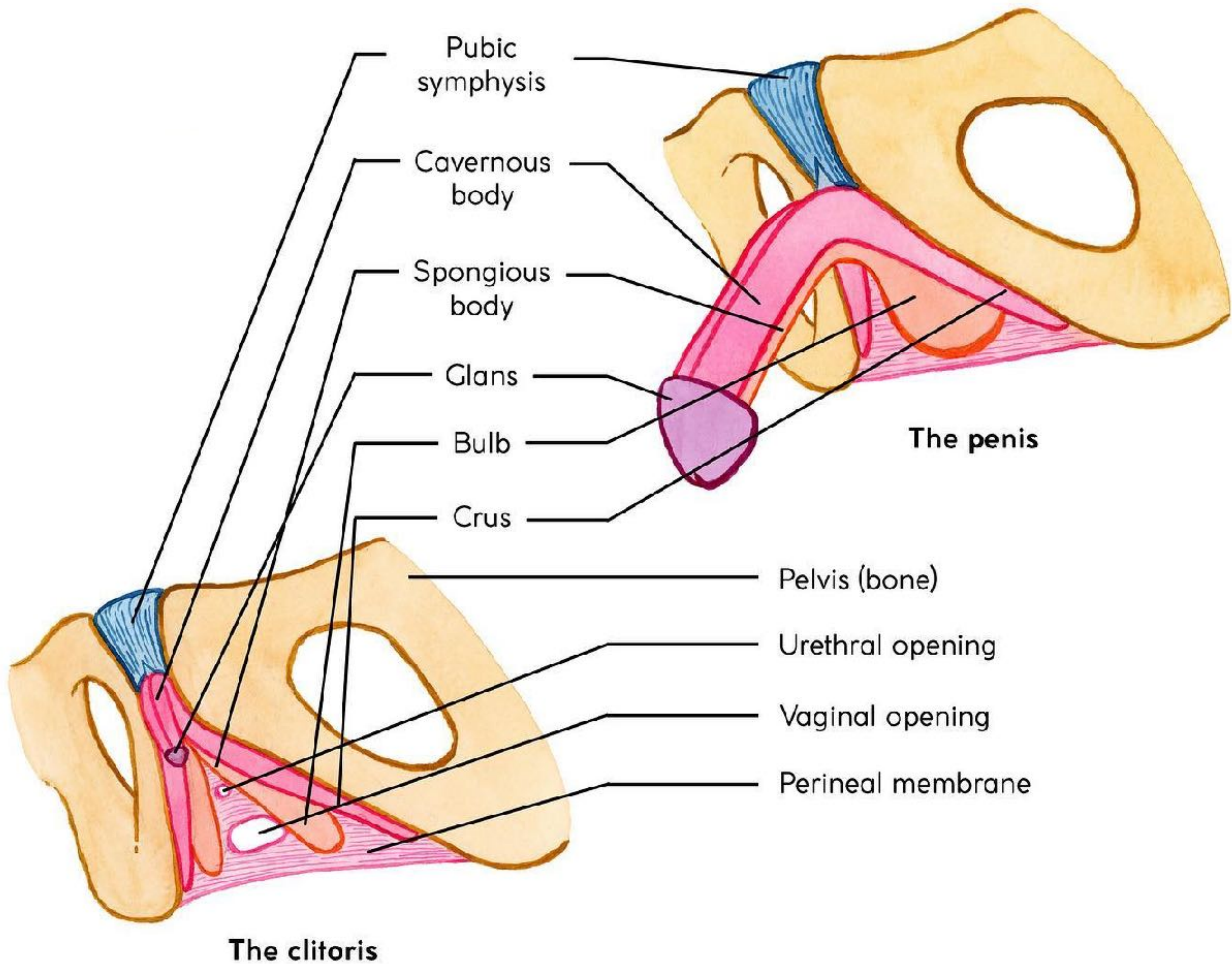


We're all made of the same parts, organized in different ways!

MALE	BIPOTENTIAL STRUCTURE	FEMALE
Glans penis	← Genital tubercle →	Clitoris
Shaft of penis	← Urethral folds and groove →	Labia minora, opening of vagina and urethra
Shaft of penis and scrotum	← Labioscrotal swellings →	Labia majora
Regresses	← Gonad (cortex) →	Forms ovary
Forms testis	← Gonad (medulla) →	Regresses
Becomes epididymis, vas deferens, and seminal vesicle (testosterone present)	← Wolffian duct →	Regresses (testosterone absent)
Regresses (anti-Müllerian hormone present)	← Müllerian duct →	Becomes Fallopian tube, uterus, cervix, and upper 1/3 of vagina (anti-Müllerian hormone absent)

Anatomy of clitoris and penis





Gender Identity and Expression

- **Sex:** anatomical classification assigned at birth: male, female, intersex
- **Gender binary:** a social system whereby people are thought to have either one of two genders: male or female. In the gender binary system, there is no room for interpretations, for living between genders, or for crossing the binary. The gender binary system is rigid and restrictive for many people who feel that their natal sex does not match their gender or that their gender is fluid and not fixed

Gender Identity and Expression

- **Gender Identity:** is each person's internal and individual experience of gender. It is a person's sense of being a woman, a man, both, neither, or anywhere along the gender spectrum. A person's gender identity may be the same as or different from their birth-assigned sex

Gender Identity and Expression

- **Gender Expression:** is how a person publicly expresses or presents their gender. This can include behavior and outward appearance such as dress, hair, make-up, body language and voice. A person's chosen name and pronoun are also common ways of expressing gender. Others perceive a person's gender through these attributes.

Continuum

SEX

Male

Intersex

Female

GENDER IDENTITY

Man/Boy

Transgender/Genderqueer
Two-spirited/etc.

Woman/girl

GENDER EXPRESSION

Masculine

Androgynous

Feminine

SEXUAL ORIENTATION

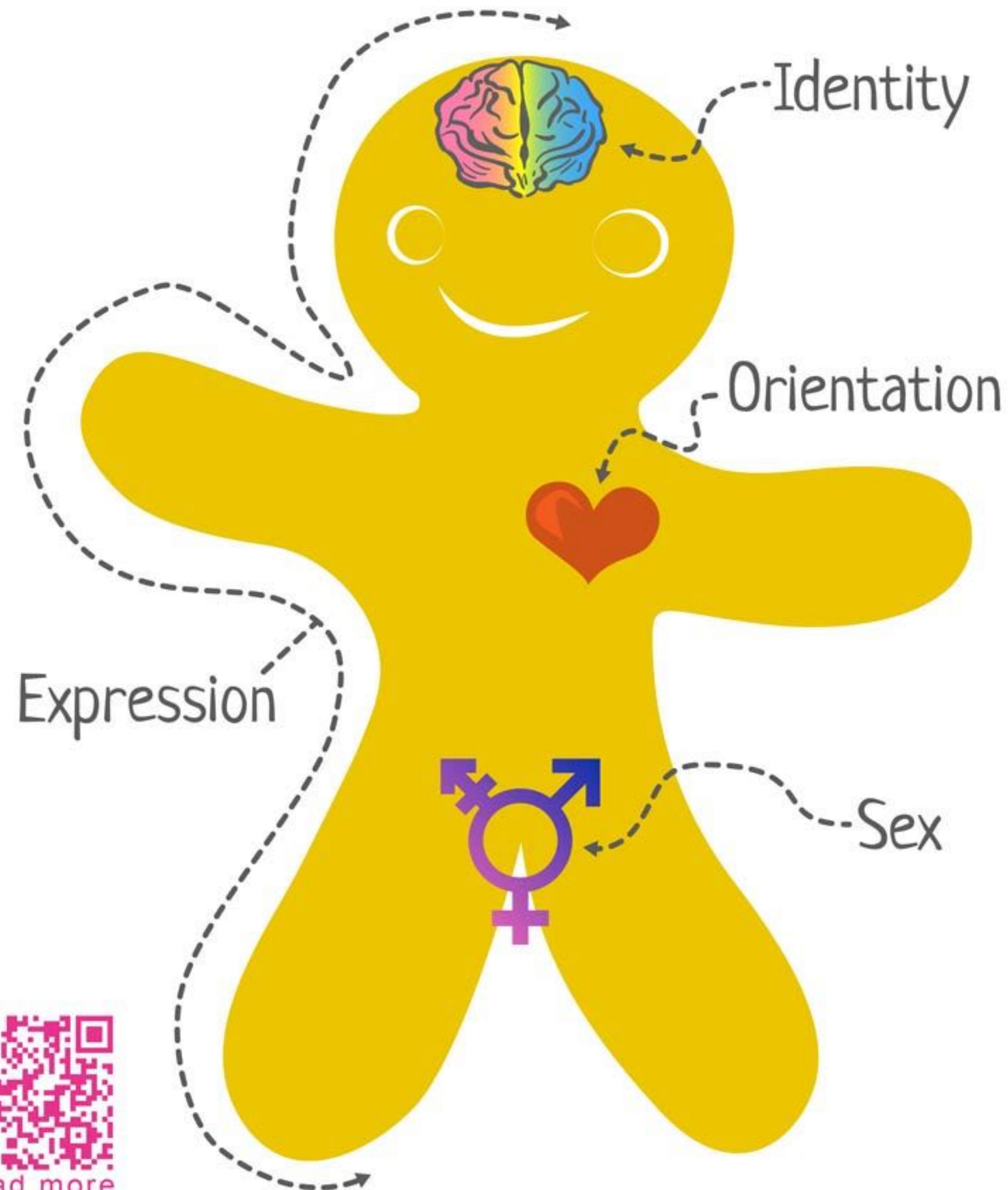
Attracted to women

Attracted to all/both/none

Attracted to men

The Genderbread Person

by www.ItsPronouncedMetrosexual.com



Gender identity is how you, in your head, think about yourself. It's the chemistry that composes you (e.g., hormonal levels) and how you interpret what that means.



Gender expression is how you demonstrate your gender (based on traditional gender roles) through the ways you act, dress, behave, and interact.

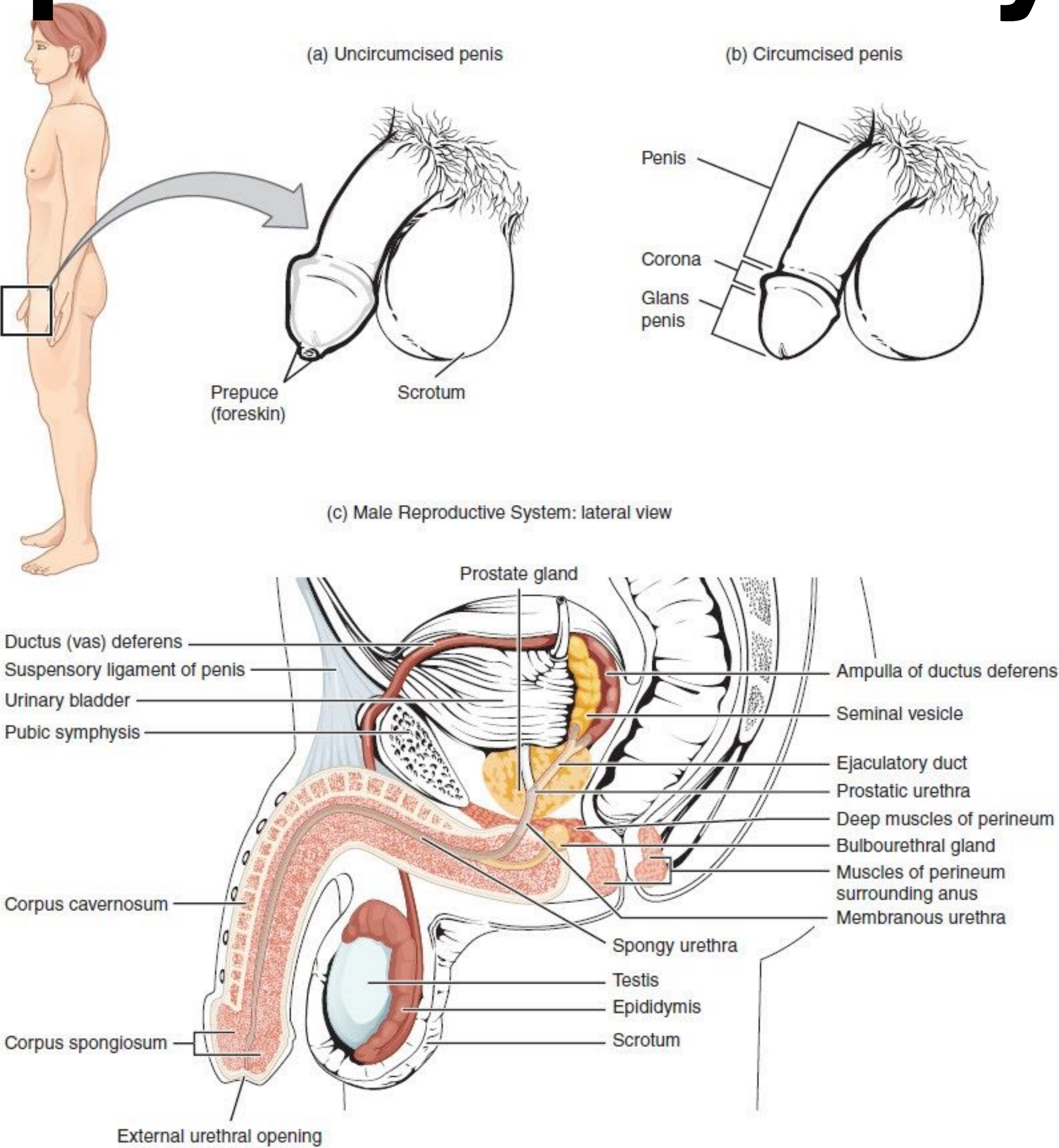


Biological sex refers to the objectively measurable organs, hormones, and chromosomes. Female = vagina, ovaries, XX chromosomes; male = penis, testes, XY chromosomes; intersex = a combination of the two.



Sexual orientation is who you are physically, spiritually, and emotionally attracted to, based on their sex/gender in relation to your own.

Male Reproductive Physiology



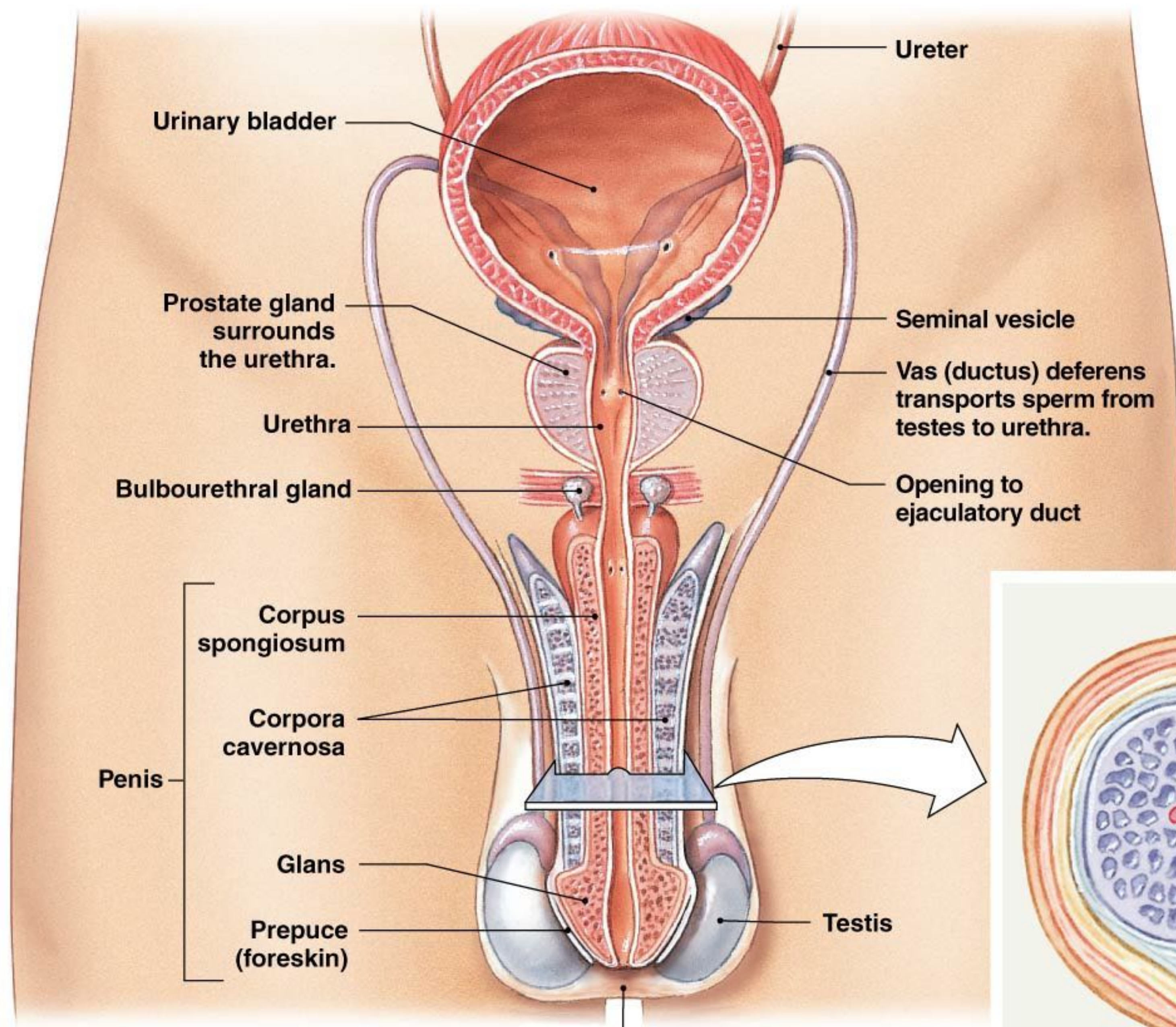
External Genitalia

1. Scrotum

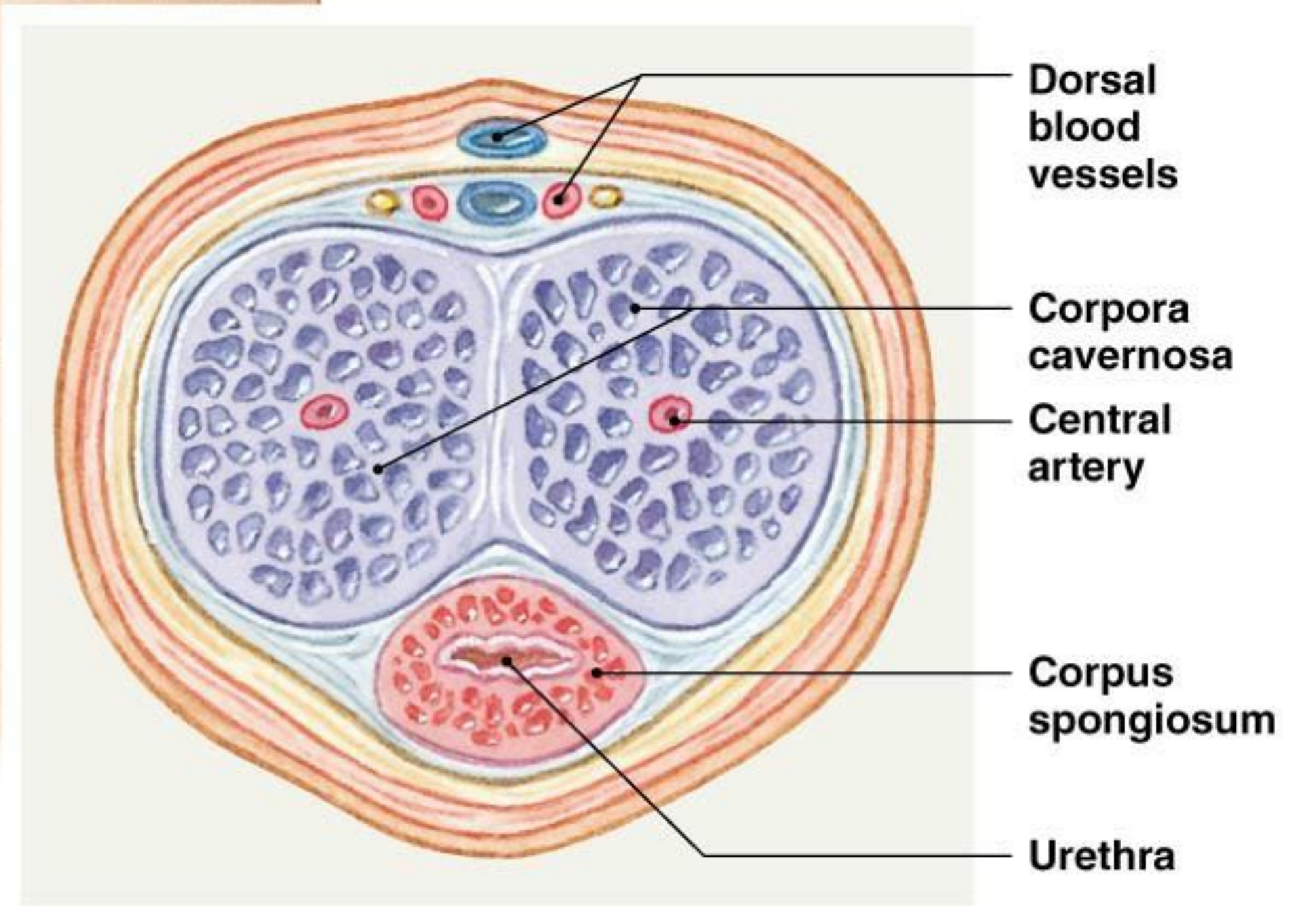
- Where? And WHY?

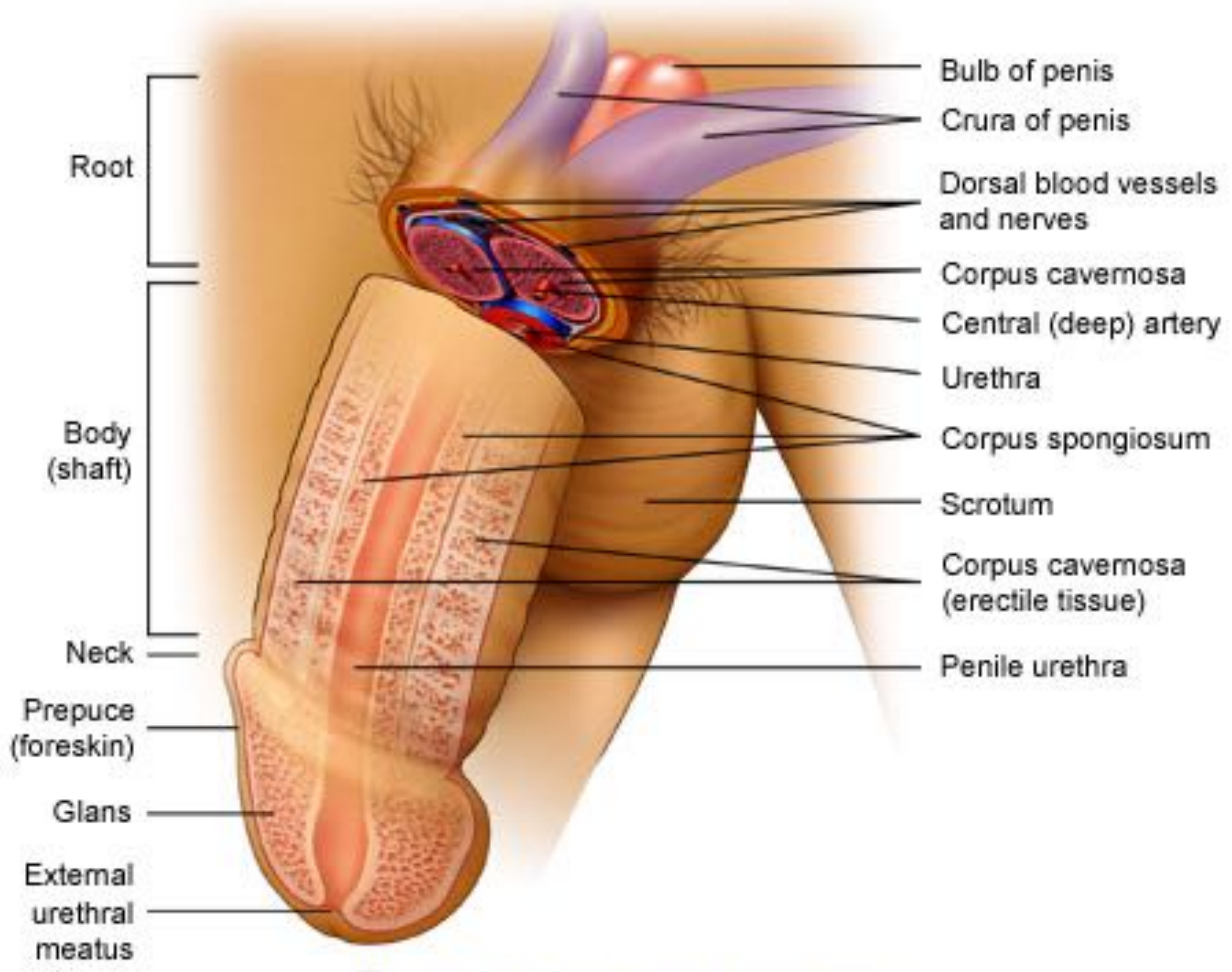
2. Penis

- Erection reflex
- Why doesn't the urethra become constricted during erections?



The scrotum holds the testes outside the abdominal cavity to keep them below body core temperature.





Root

Body (shaft)

Neck

Prepuce (foreskin)

Glans

External urethral meatus

Bulb of penis

Crura of penis

Dorsal blood vessels and nerves

Corpus cavernosa

Central (deep) artery

Urethra

Corpus spongiosum

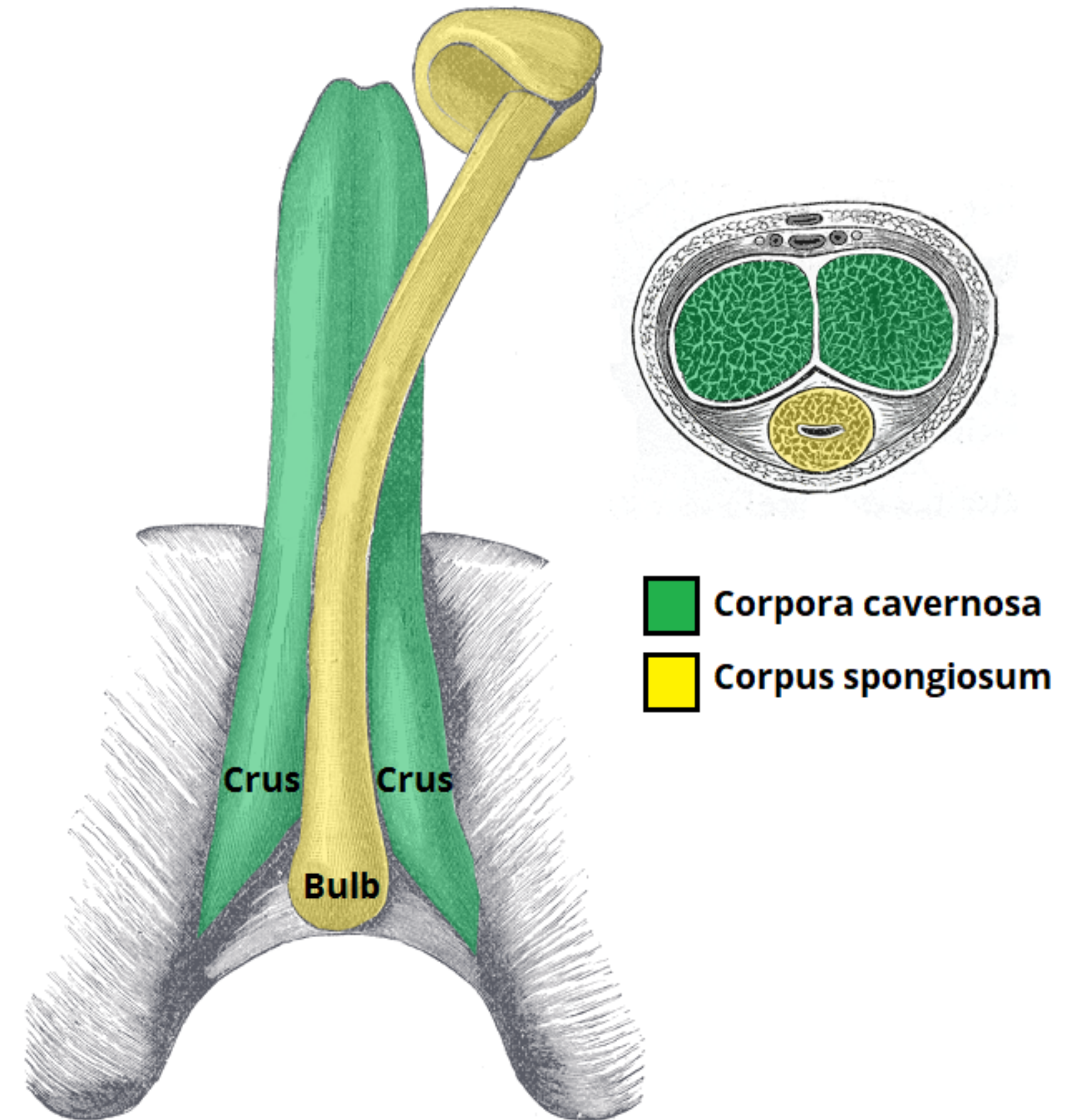
Scrotum

Corpus cavernosa (erectile tissue)

Penile urethra

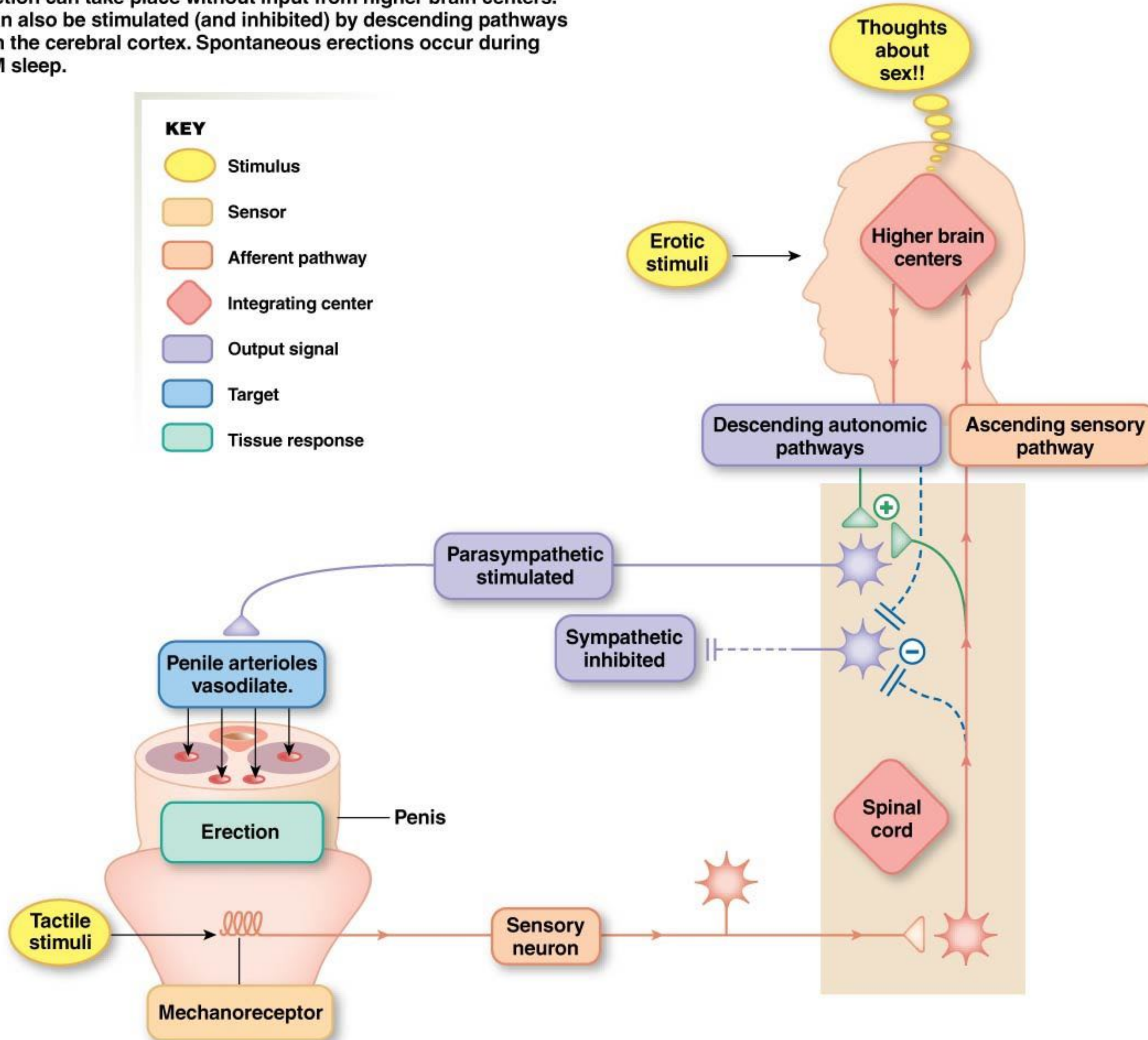
Straight or Curved?

- Straight is normal! Curved is normal! If your genitals aren't causing you problems or pain, they are **NORMAL** (and you don't need surgery!)
- If all 3 compartments aren't exactly the same length, the penis will bend toward the shorter side

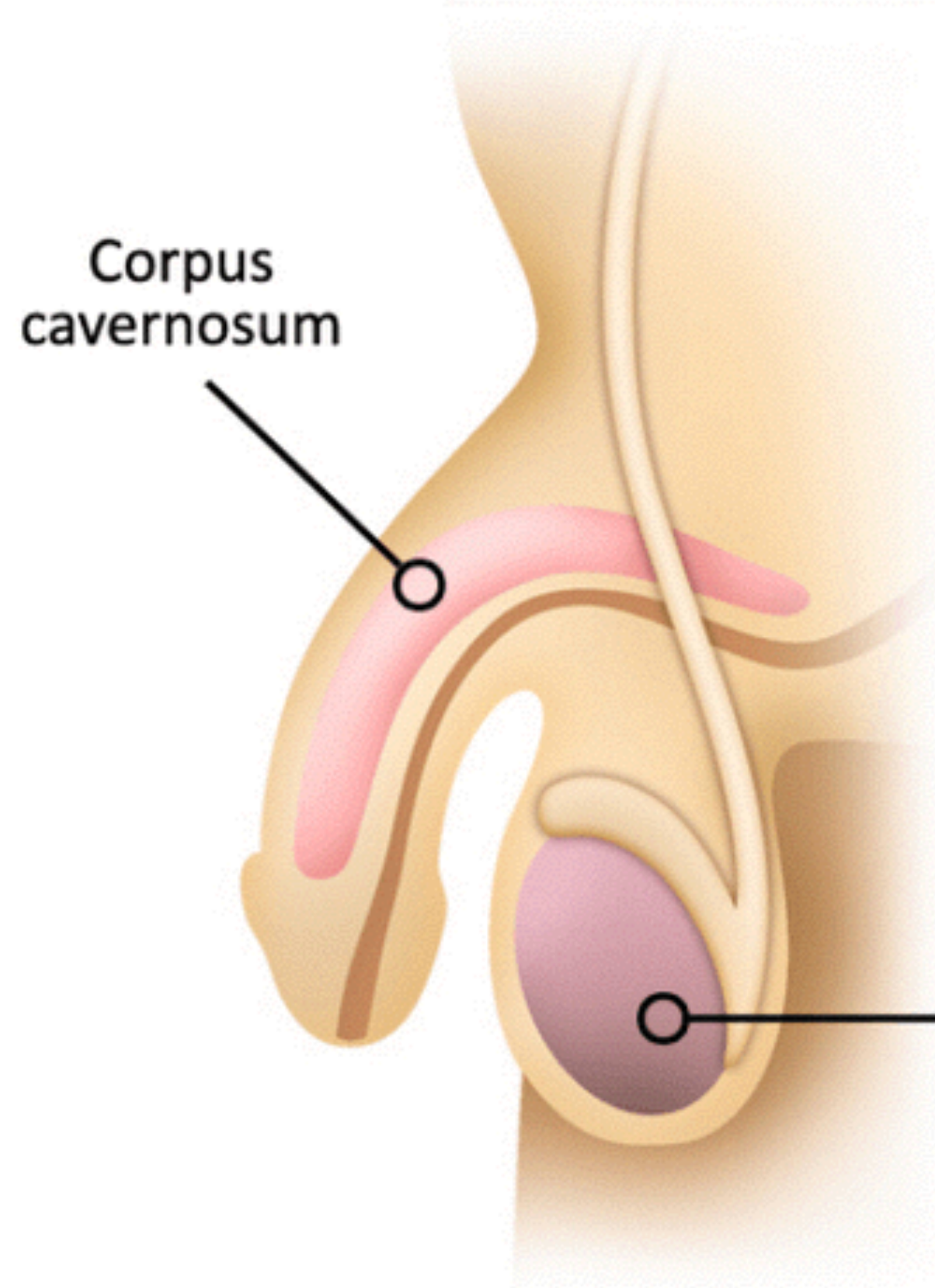


THE ERECTION REFLEX

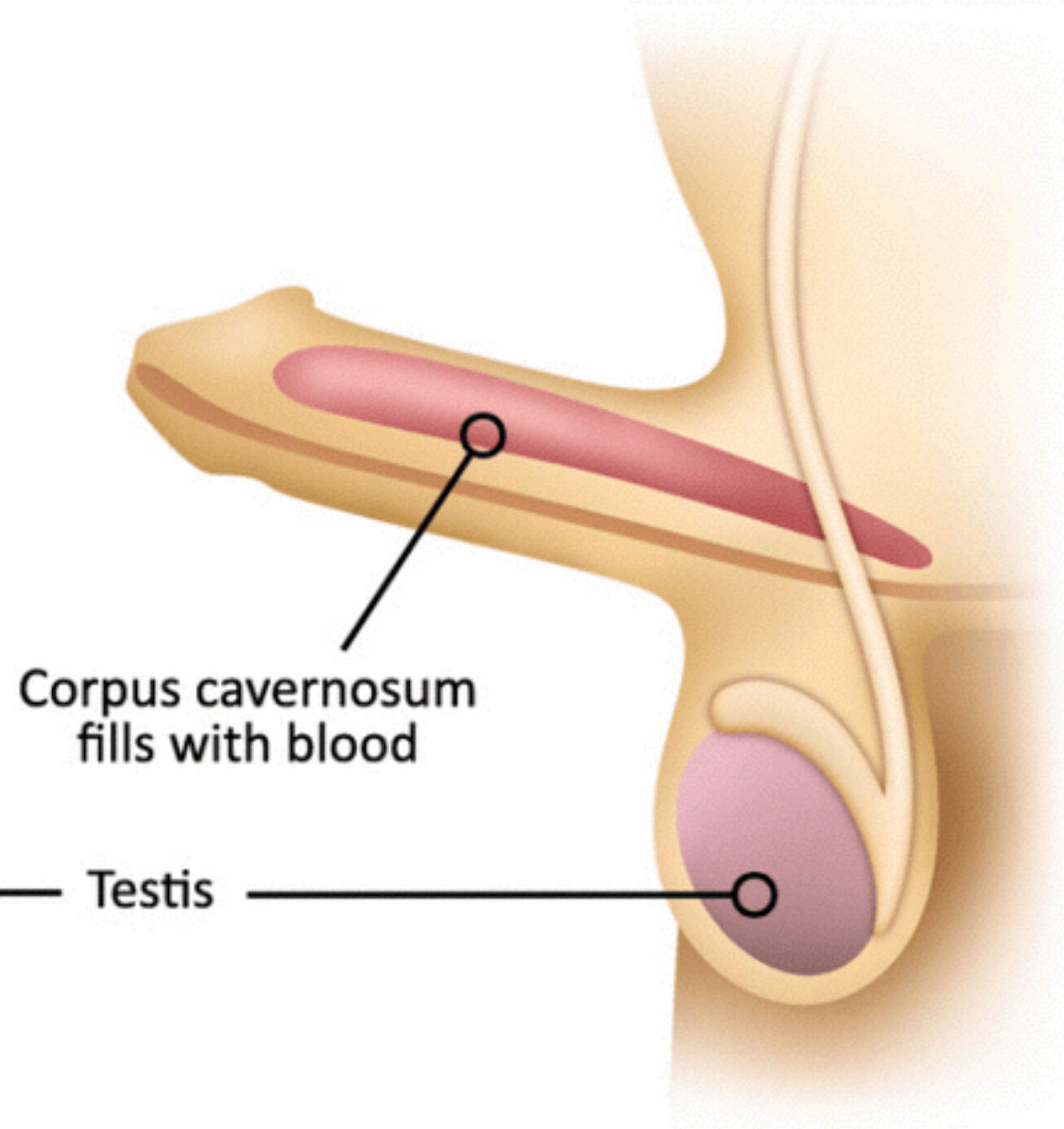
Erection can take place without input from higher brain centers. It can also be stimulated (and inhibited) by descending pathways from the cerebral cortex. Spontaneous erections occur during REM sleep.



FLACCID PENIS



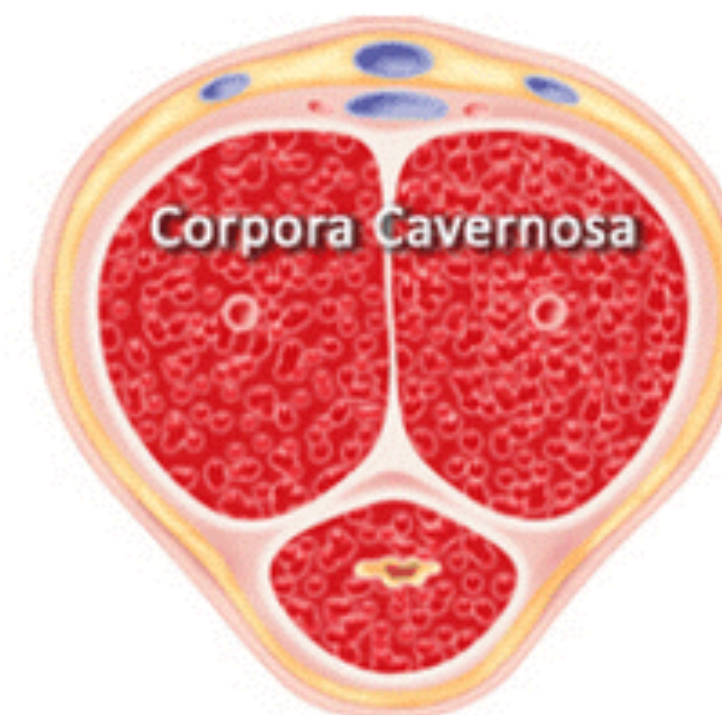
ERECT PENIS



FLACCID



ERECT

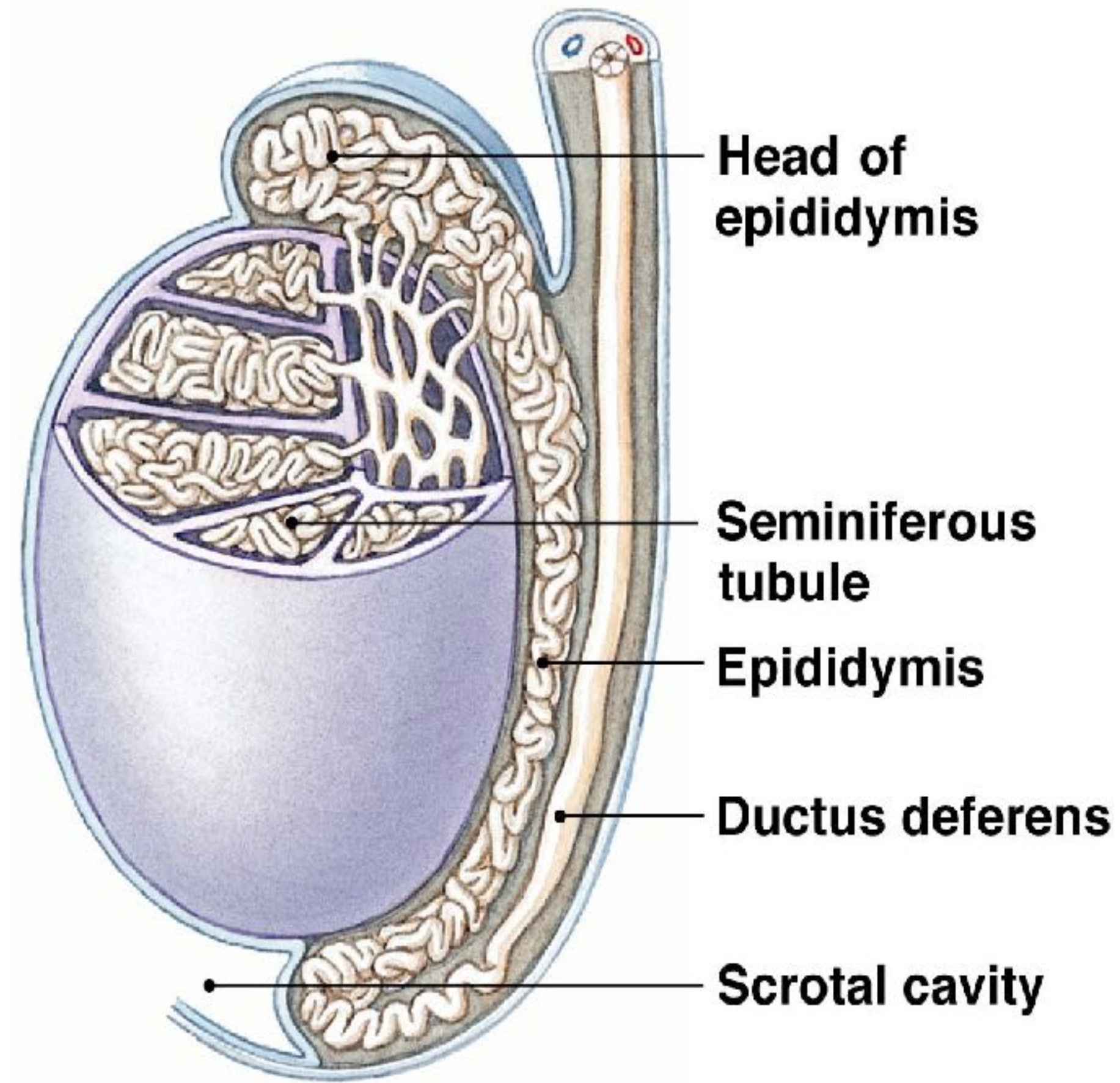


The Big Question...

To cut or not to cut

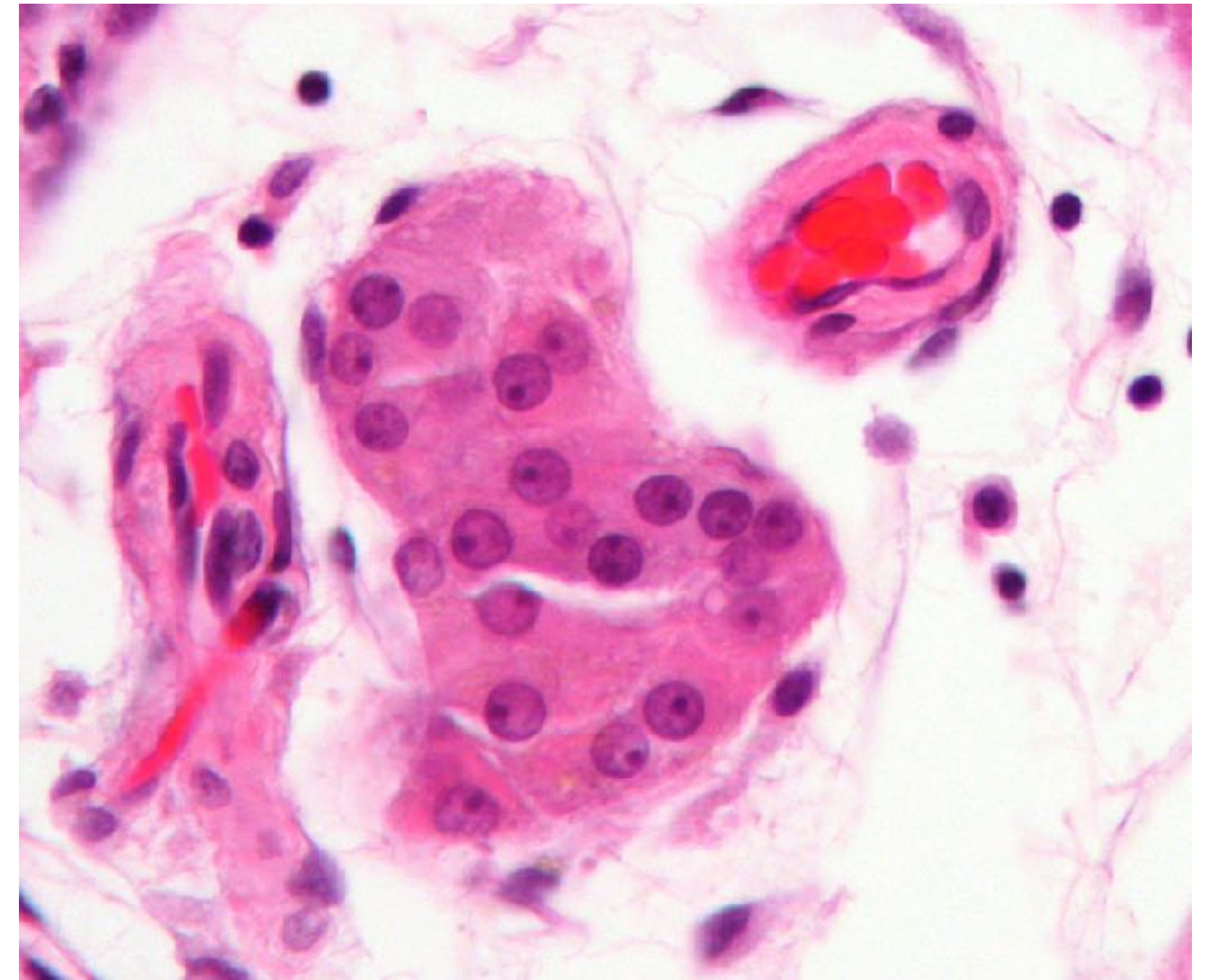
The Testes and Spermatogenesis

- Testes Functions:
 - Produce sperm
- Secretions:
 - Exocrine
 - Endocrine



The Testes and Spermatogenesis

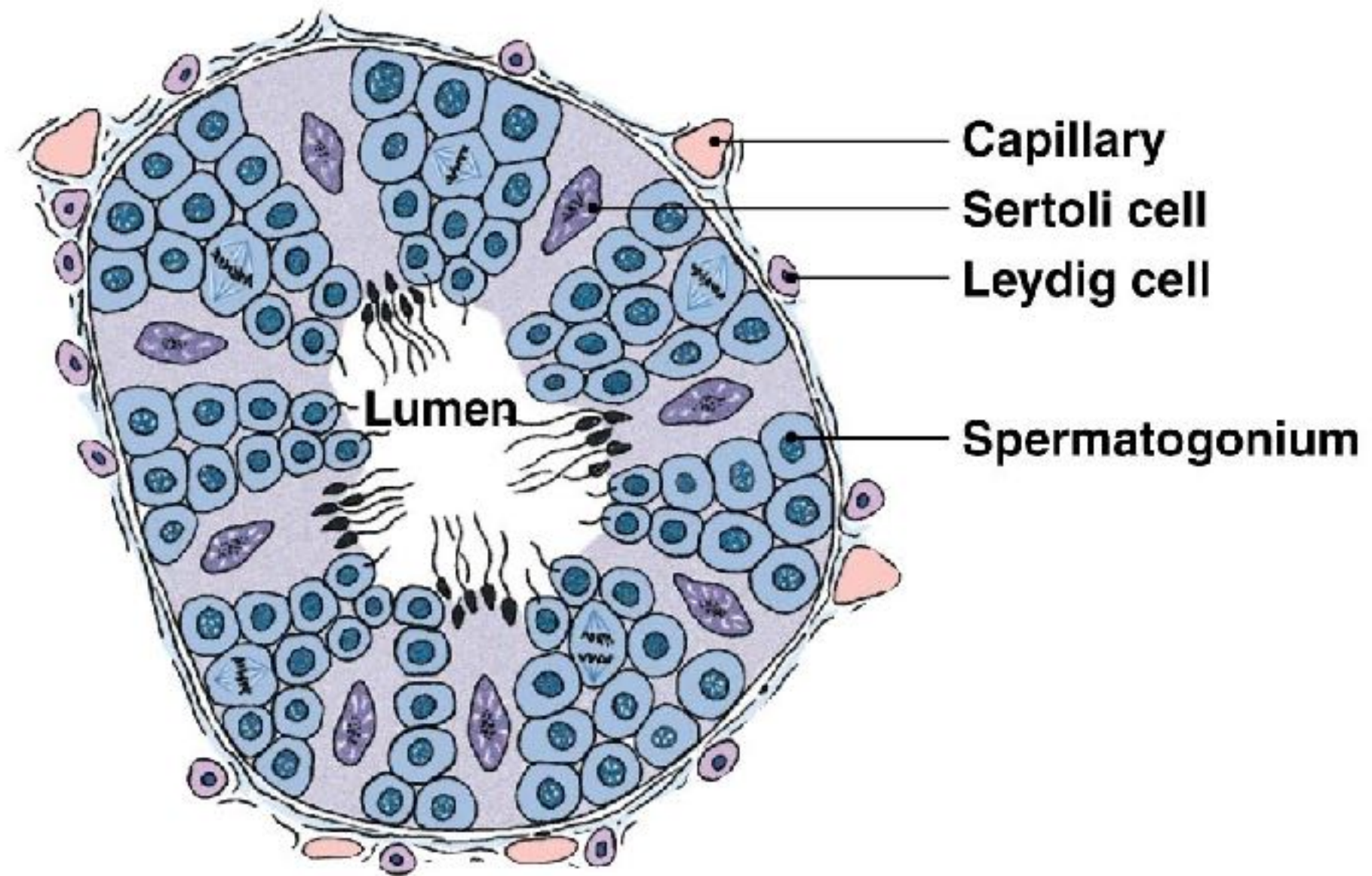
- Leydig (or interstitial) cells produce testosterone:
 - Determines 'maleness'
 - Helps gonads form
 - Brings about secondary sex characteristics



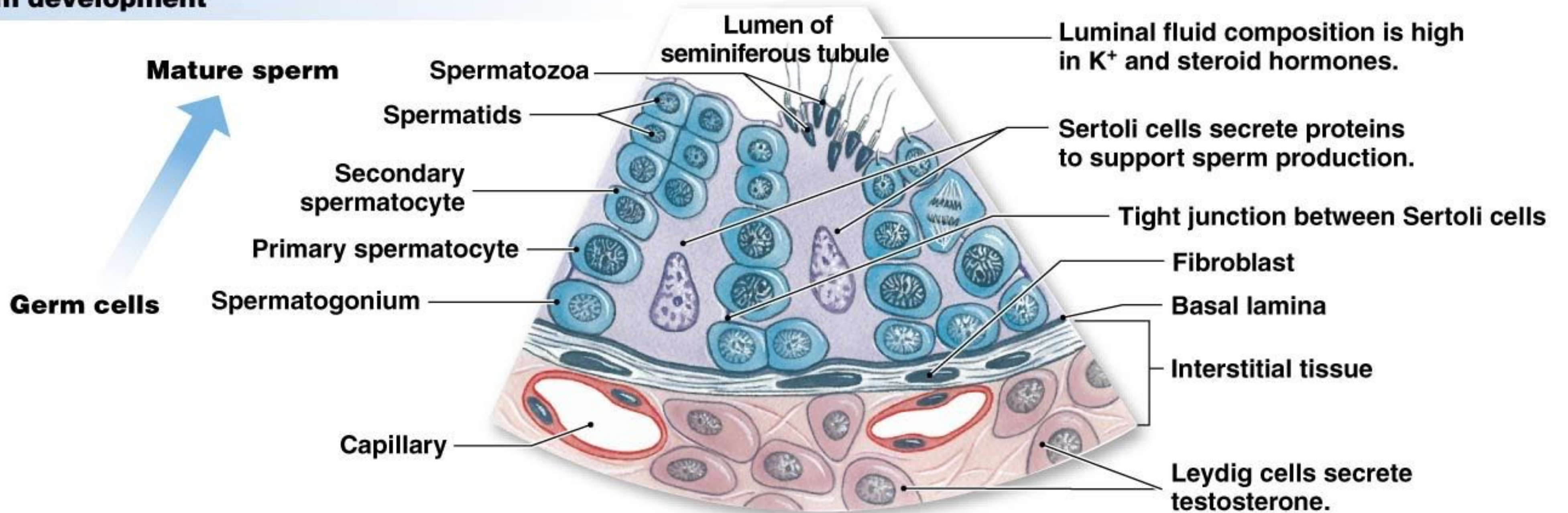
Spermatogenesis

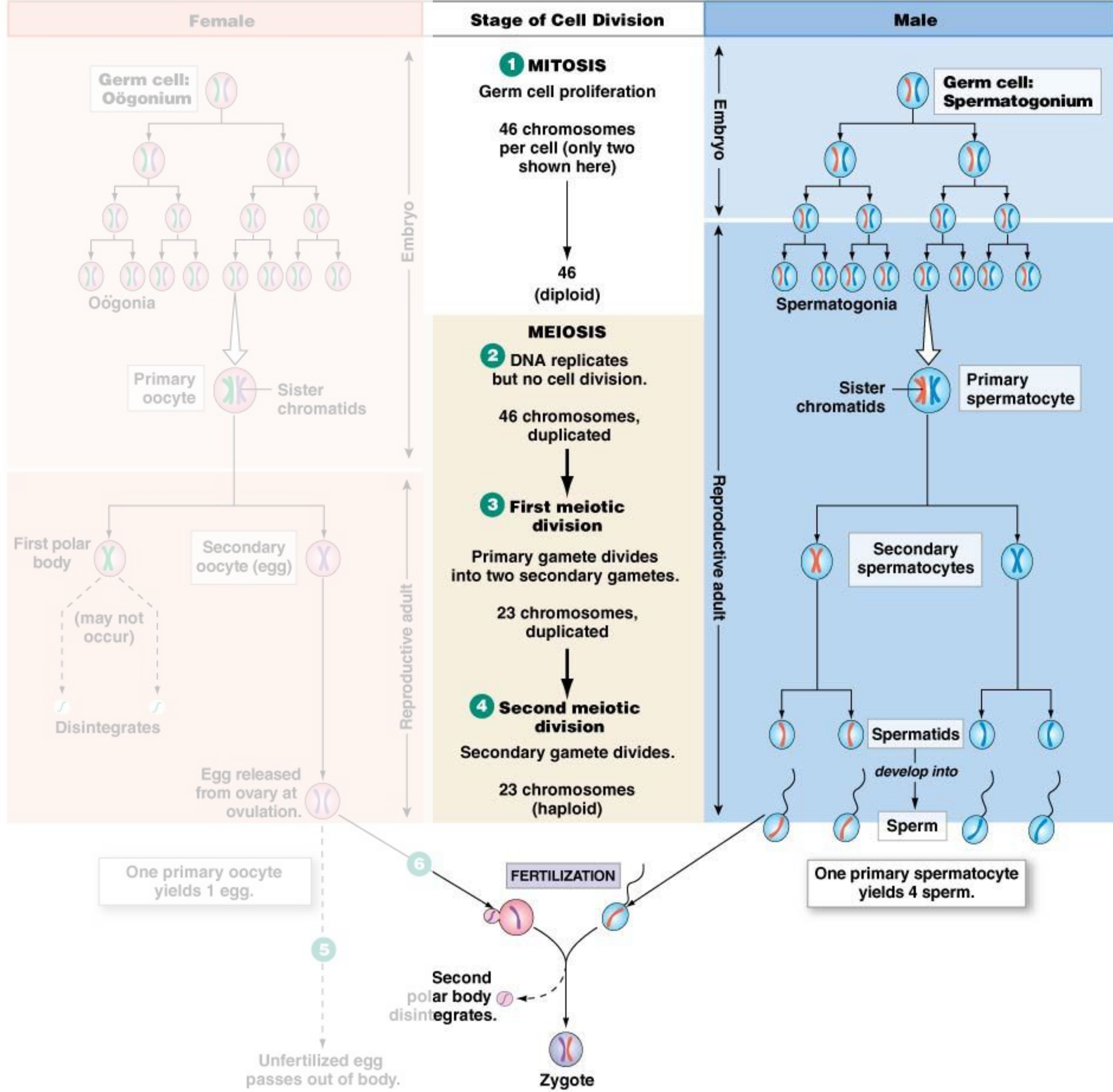
- Seminiferous tubules = sperm factories
- Spermatogonium = diploid stem cell
- Will all spermatogonia become sperm?
- FSH (??)

(d) Cross section of a seminiferous tubule



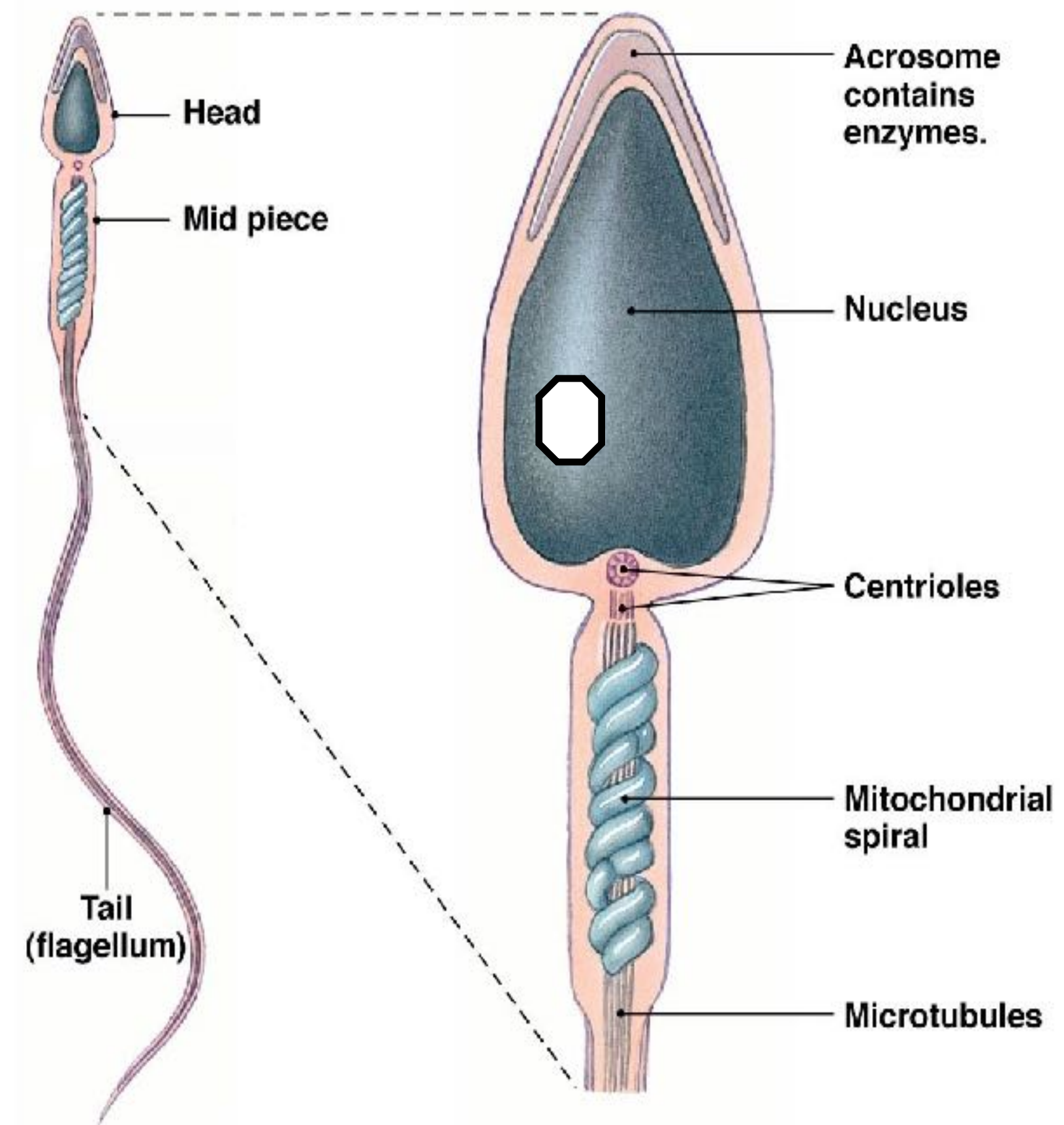
(e) Sperm development





Sperm

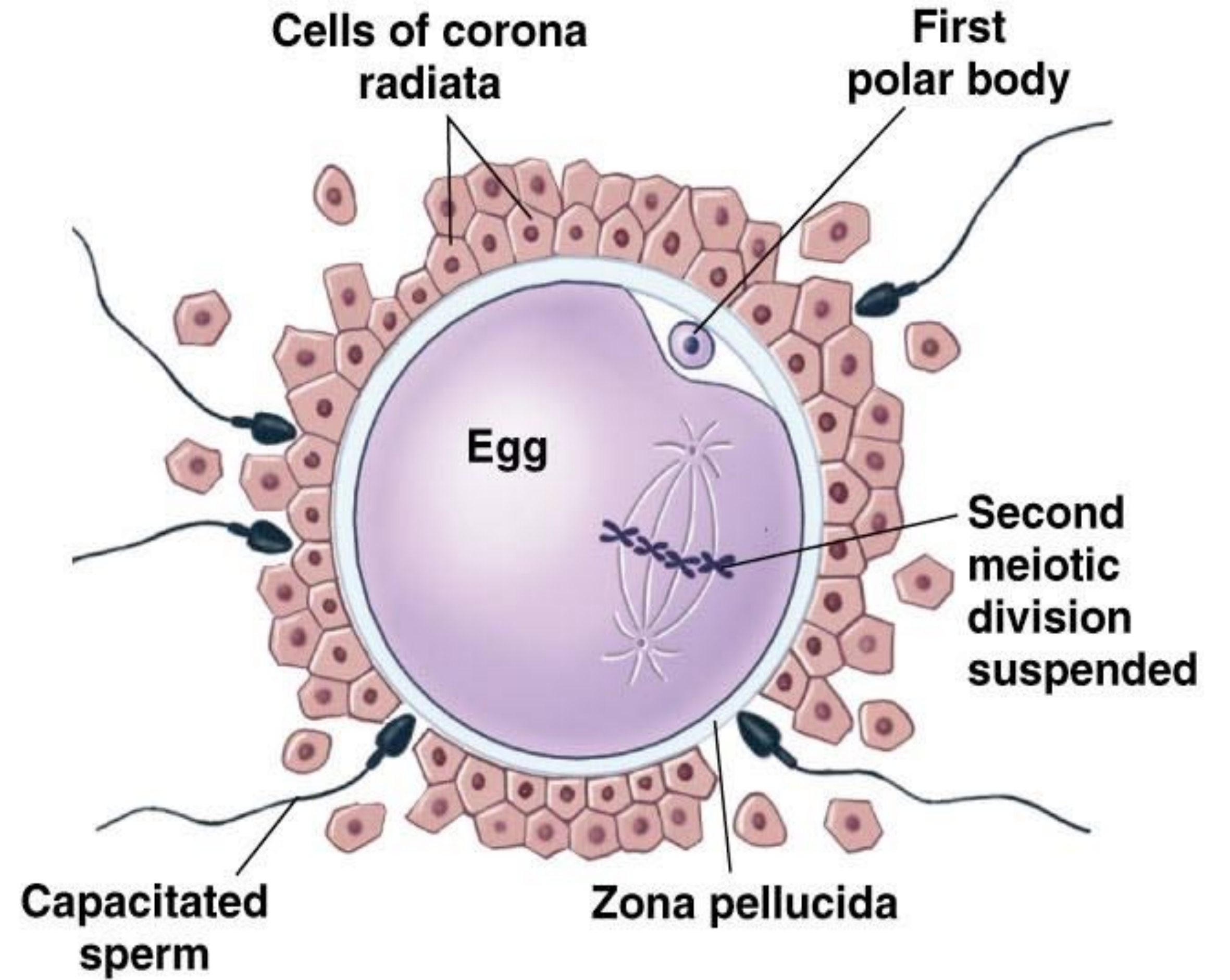
- Mature sperm:
 - head (w/ acrosome)
 - midpiece
 - tail



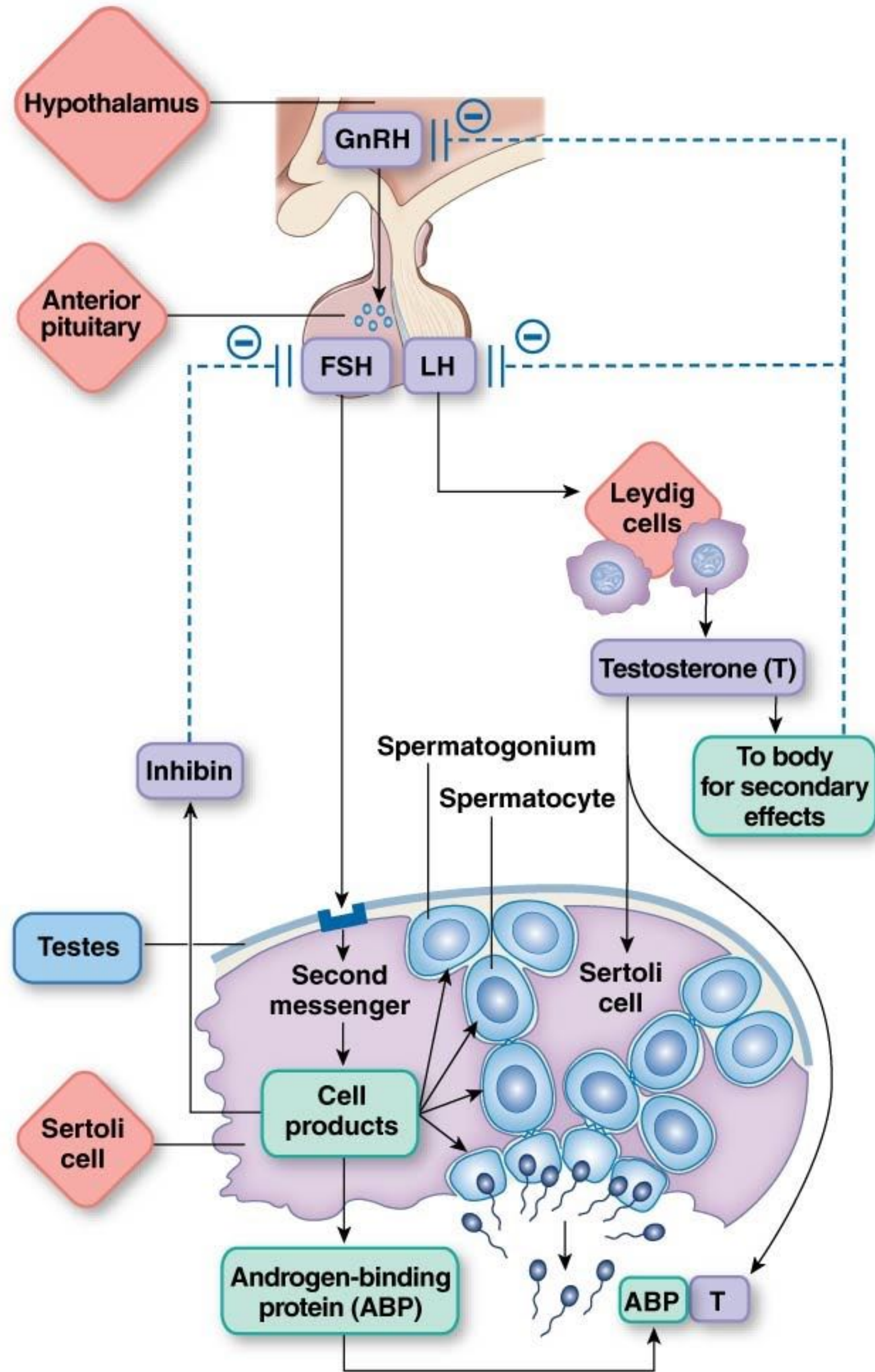
(a)



(b) Capacitated sperm release enzymes from their acrosomes in order to penetrate the cells and zona pellucida surrounding the egg.



HORMONAL CONTROL OF SPERMATOGENESIS

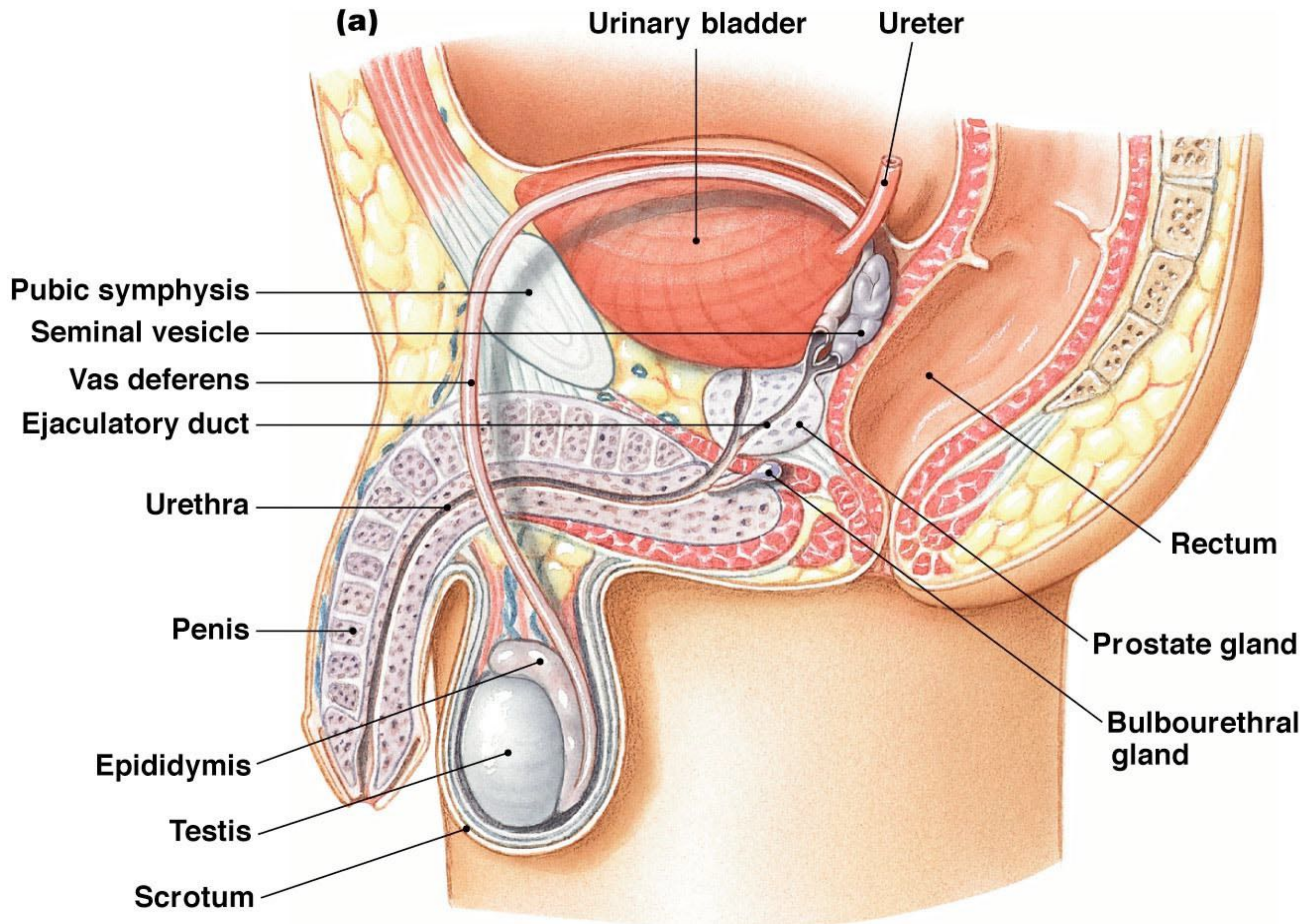


Male Duct System

- Epididymis
 - Comma-shaped highly coiled tube
 - Serves as a temporary storage site for immature sperm
 - Epididymal walls contract to push sperm out
- Vas deferens
 - From epididymis to pelvic cavity; empties sperm into the ejaculatory duct
 - Enclosed in the spermatic cord
 - Propels sperm from storage sites to the ejaculatory duct via peristalsis

Male Duct System

- Ejaculatory duct
 - Sperm are moved into the urethra via peristalsis during ejaculation
- Urethra
 - During ejaculation, the bladder sphincter constricts, keeping urine out of the urethra and sperm out of the bladder.



Male Accessories

- Seminal Vesicles
 - Located at base of bladder and produce 60% of seminal volume.
 - Secretion is full of fructose, vitamin C, prostaglandins, zinc (??) and other substances which nourish and activate the sperm
 - Sperm and seminal fluid enter the urethra together during ejaculation.

Male Accessories

- Prostate Gland
 - Located just anterior to the rectum
 - Prostatic secretions help to activate sperm.
- Bulbourethral Glands
 - Produce a thick, clear mucus which clears the urethra of traces of acidic urine and provides lubrication for intercourse.

(f) Semen is composed of sperm and secretions from the accessory glands.

COMPONENT	FUNCTION	SOURCE
Sperm	Gametes	Seminiferous tubules
Mucus	Lubricant	Bulbourethral glands
Water	Provides liquid medium	All accessory glands
Buffers	Neutralize acidic environment of vagina	Prostate, bulbourethral glands
Nutrients Fructose Citric acid Vitamin C Carnitine	Nourish sperm	Seminal vesicles Prostate Seminal vesicles Epididymis
Enzymes	Clot semen in vagina, then liquefy the clot	Seminal vesicles and prostate
Zinc	Unknown, possible association with fertility	Unknown
Prostaglandins	Smooth muscle contraction; may aid sperm transport	Seminal vesicles

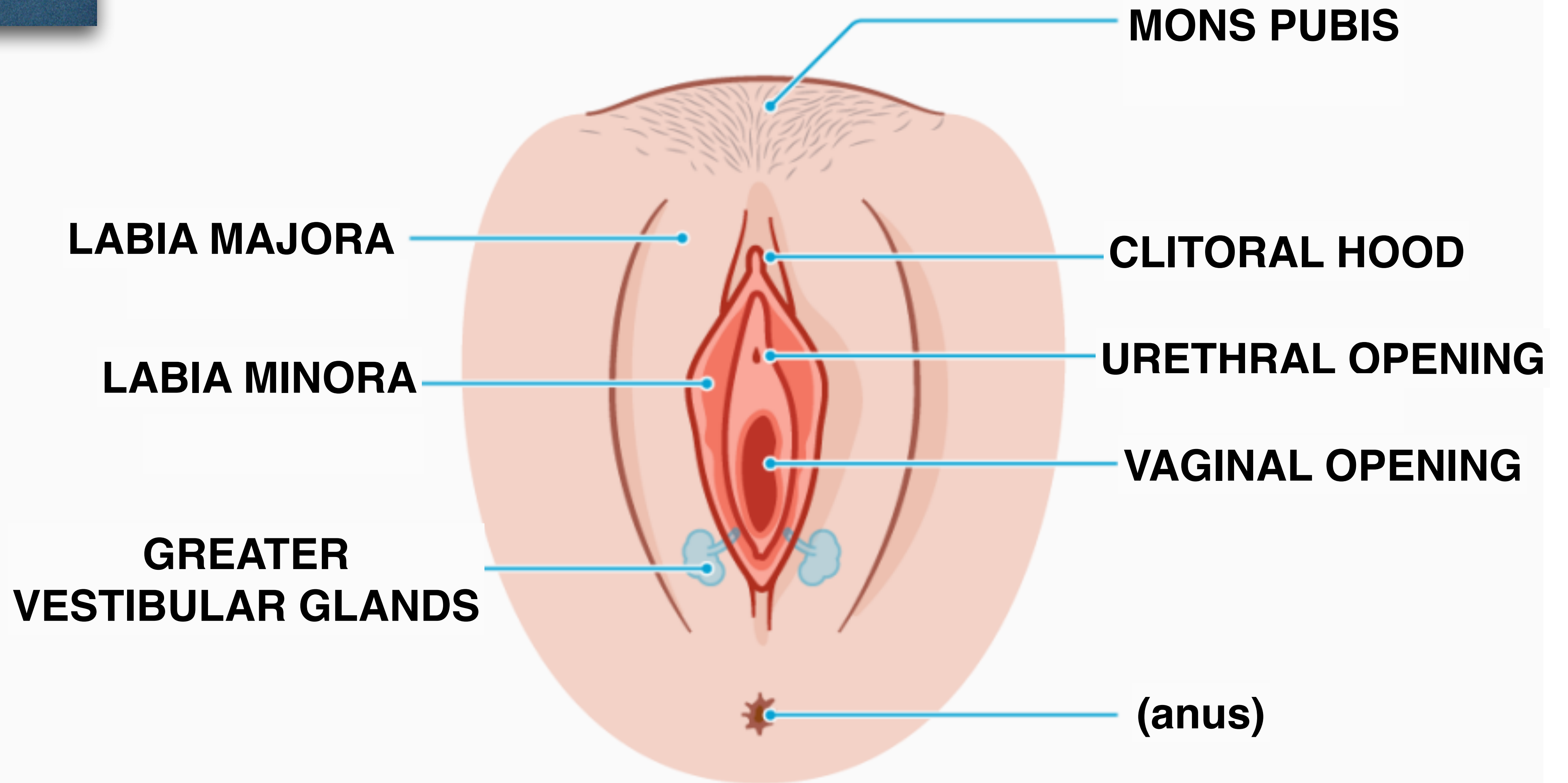
Female Reproductive System



Female Reproductive System

- Functions of the Female System:
 - Development and release of one ovum each month
 - Provide a place for fertilization and implantation of a fertilized egg
 - Support a fetus for 9 months
 - Feed the infant after birth

External Genitalia (Vulva)



External Genitalia (Vulva)

- Mons pubis
 - Overlying the pubic symphysis for protection
- Labia
 - Majora and minora enclose the vaginal opening
 - RARELY symmetrical



External Genitalia (Vulva)

- Labia
 - ALL shapes and sizes are normal!
 - If your genitals aren't causing you problems or pain, they are **NORMAL** (and you don't need surgery!)
 - Labiaplasty was the 15th most popular plastic surgery for American women in 2019.



External Genitalia

- Greater Vestibular Glands (Bartholin Glands)
 - Secretions serve as lubricants for vaginal opening
- Clitoris
 - Concentration of sensory neurons
 - Becomes engorged with blood during sexual arousal
 - Focus for FGM procedures

FGM

- WHO defines FGM as:
 - “Procedures involving partial or total removal of the external female genitalia or other injury to the female genital organs whether for cultural, religious or other non-therapeutic reasons.”
- FGM is often called “*female circumcision*” implying that it is similar to male circumcision. However, the degree of cutting is far more extensive, often impairing a woman’s sexual, reproductive, renal and bowel functions.

FGM

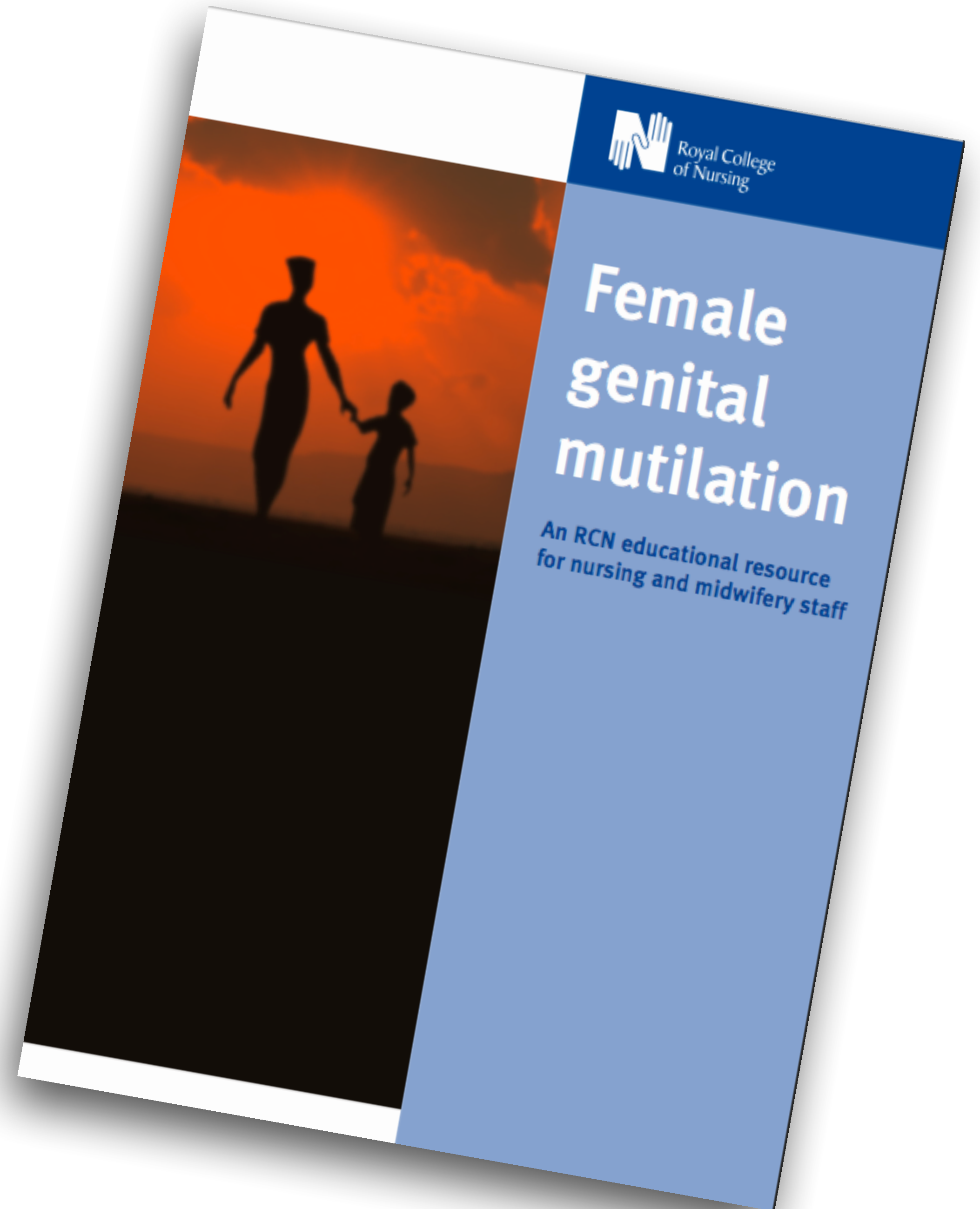
- Three million girls and women are subjected to female genital mutilation worldwide each year. (8000 girls per day)
- Female genital mutilation (FGM) is a harmful practice that is recognized worldwide as a human rights violation. The practice of FGM violates:
 - Right to physical and mental integrity
 - Right to highest attainable standard of health

FGM

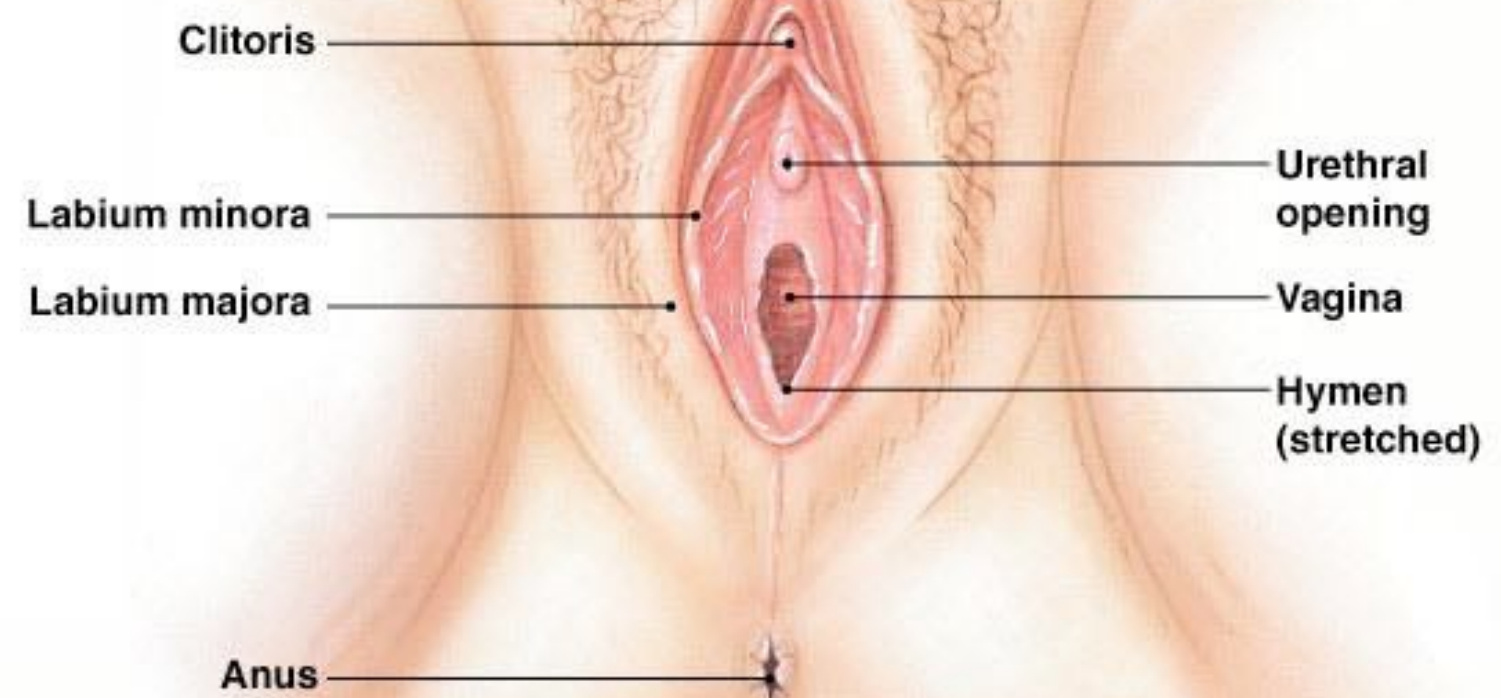
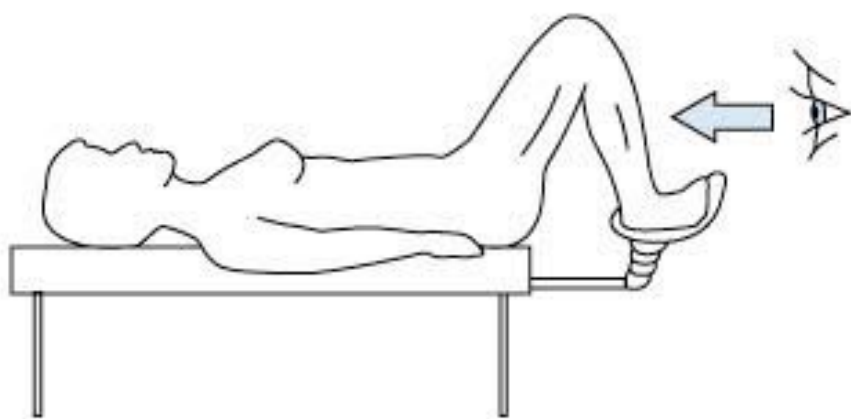
- Right to be free from all forms of discrimination against women (including violence against women)
- Right to freedom from torture or cruel, inhuman or degrading treatment
- Rights of the child, and
- Right to life

Excellent FGM Resource

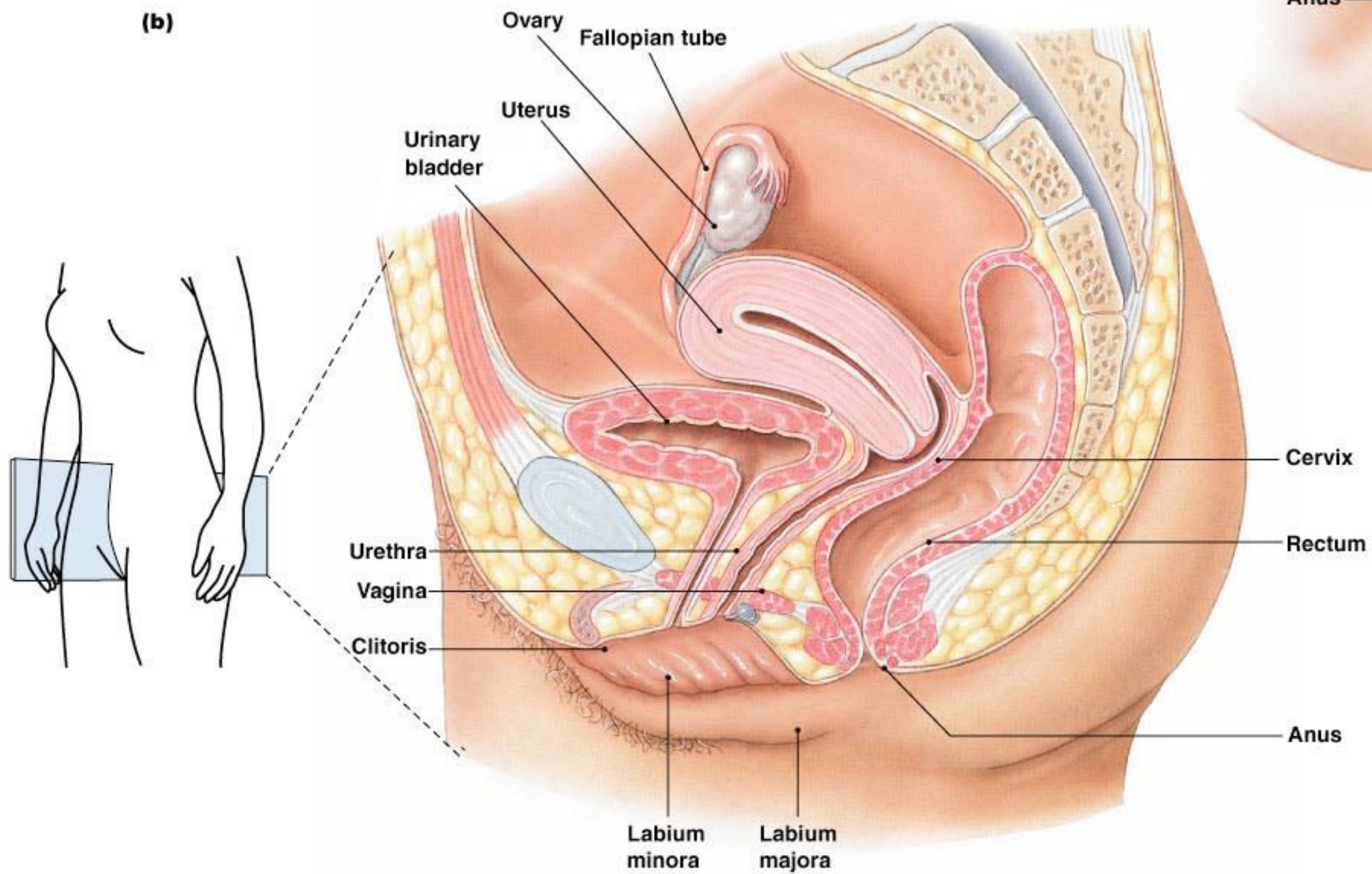
WHO on FGM



(a)



(b)

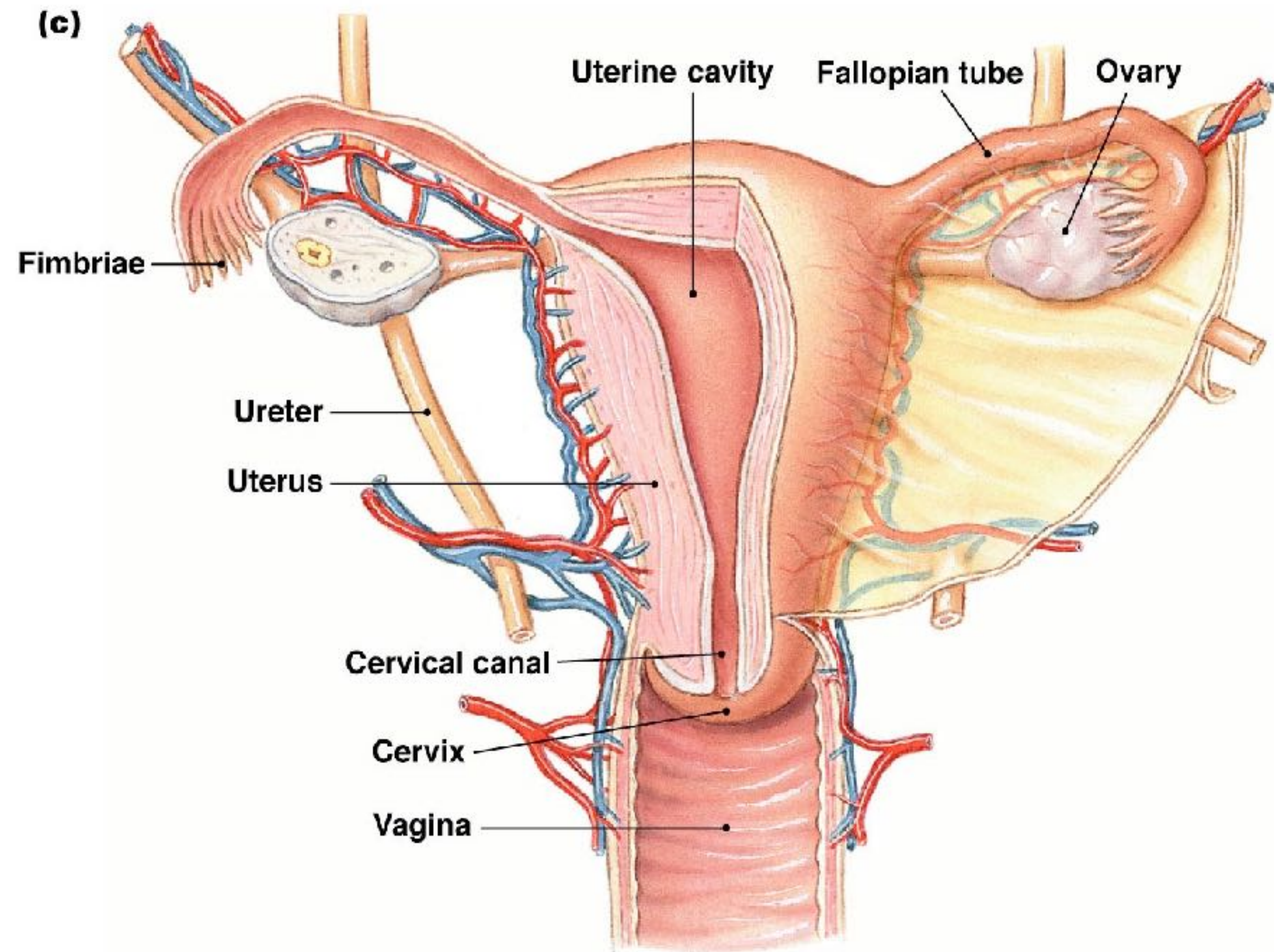


Ovaries, Ovulation, Oogenesis

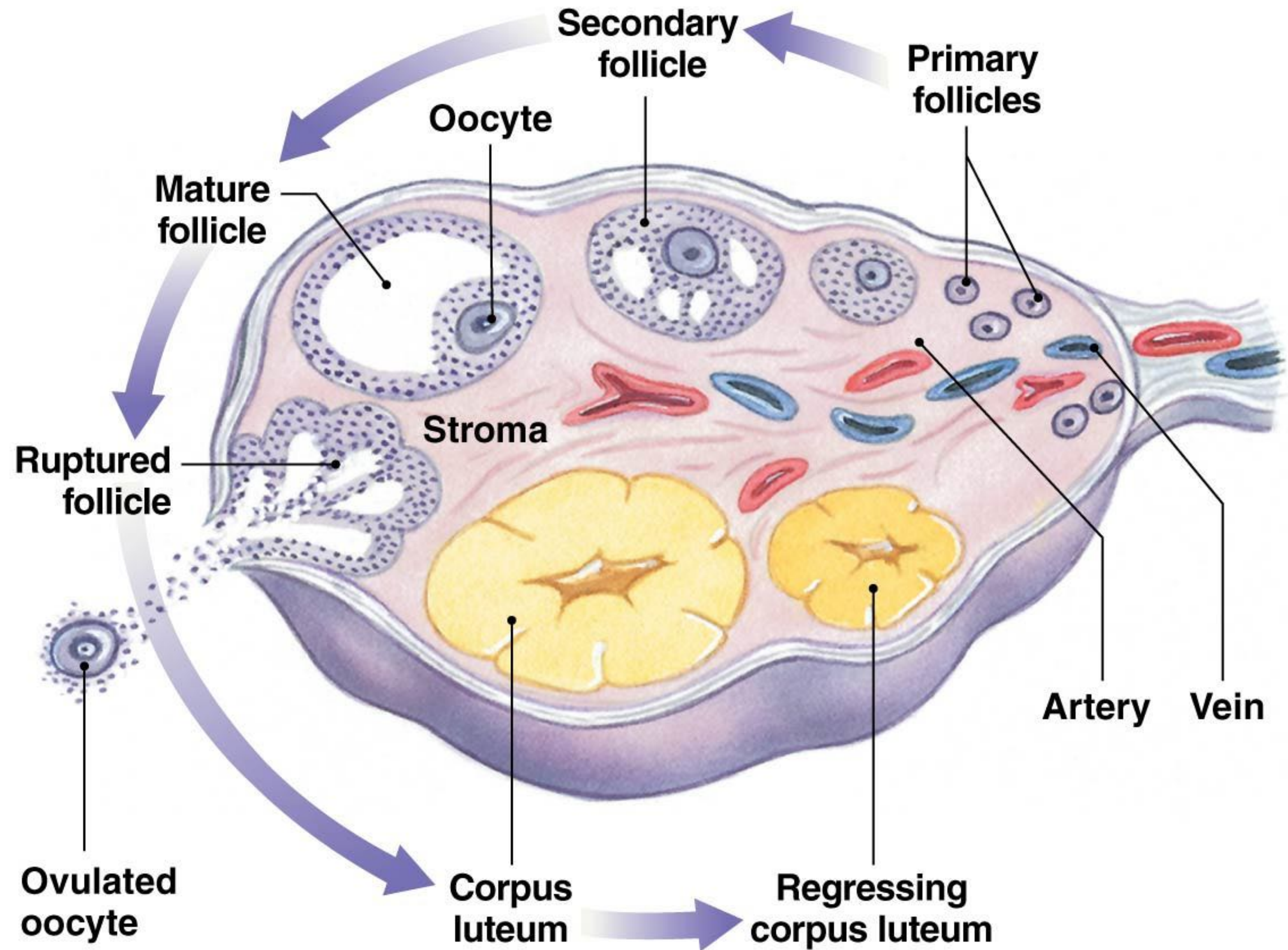
- Human females are silent ovulators... that's rare!

Ovaries, Ovulation, Oogenesis

- Exocrine
- Endocrine



(e) Cross section of an ovary, showing all different stages of follicular development.

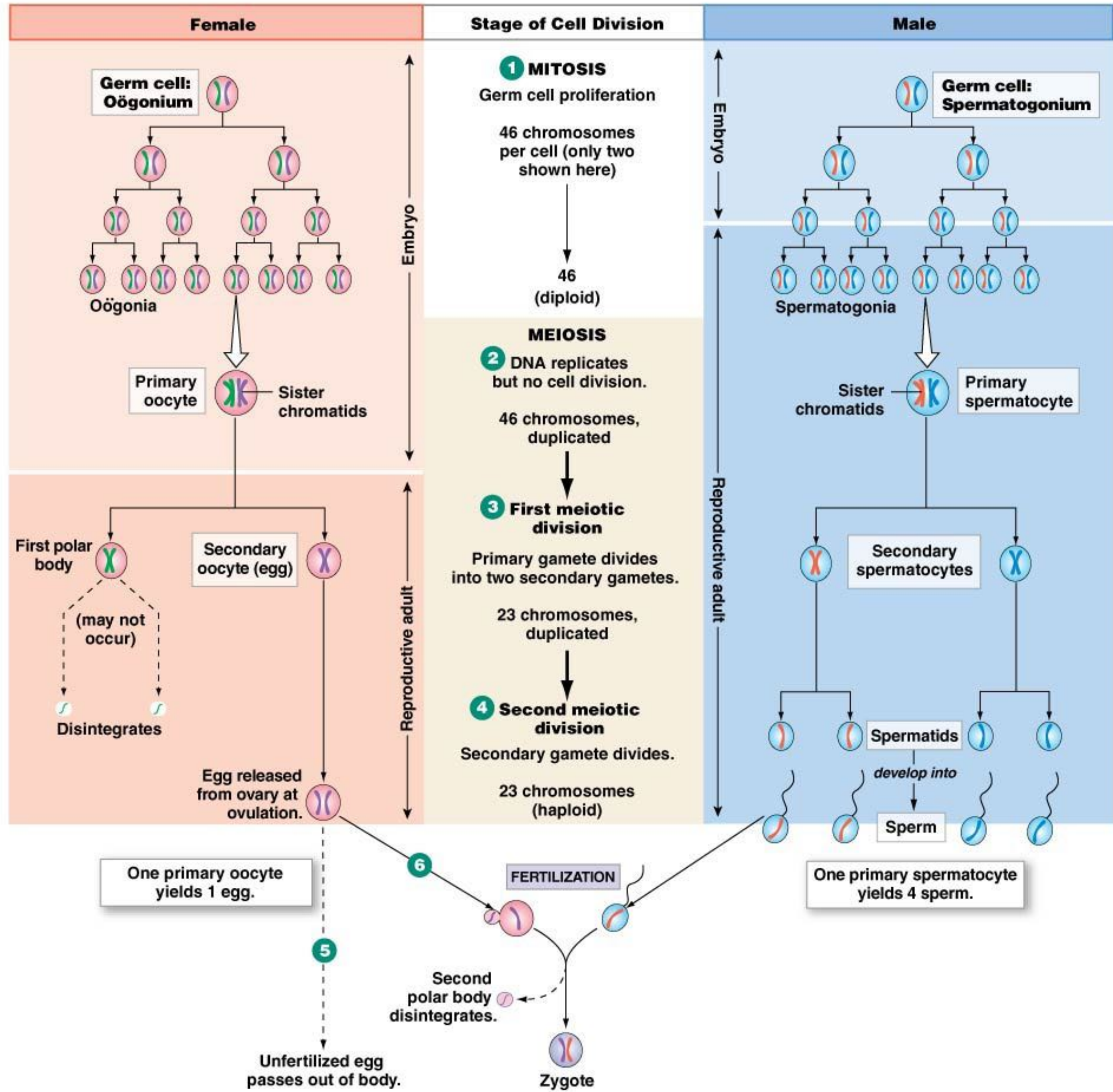


Oogenesis

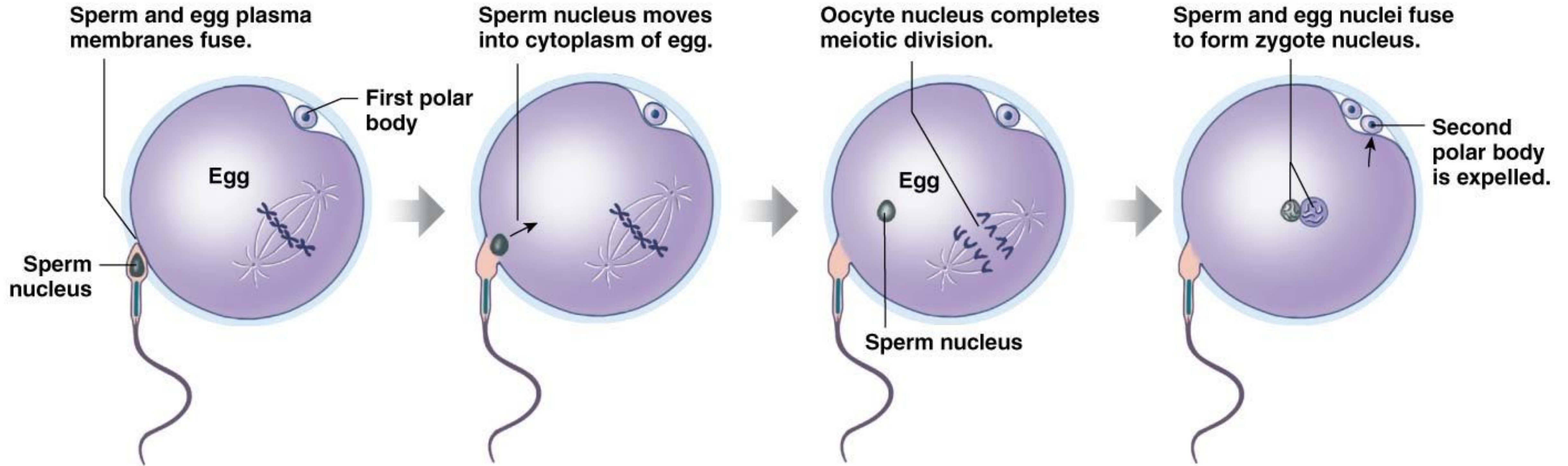
- FSH stimulates follicle development.
- Primary oocyte begins to go through meiosis I. The products are:
 - one polar body
 - secondary oocyte

Oogenesis

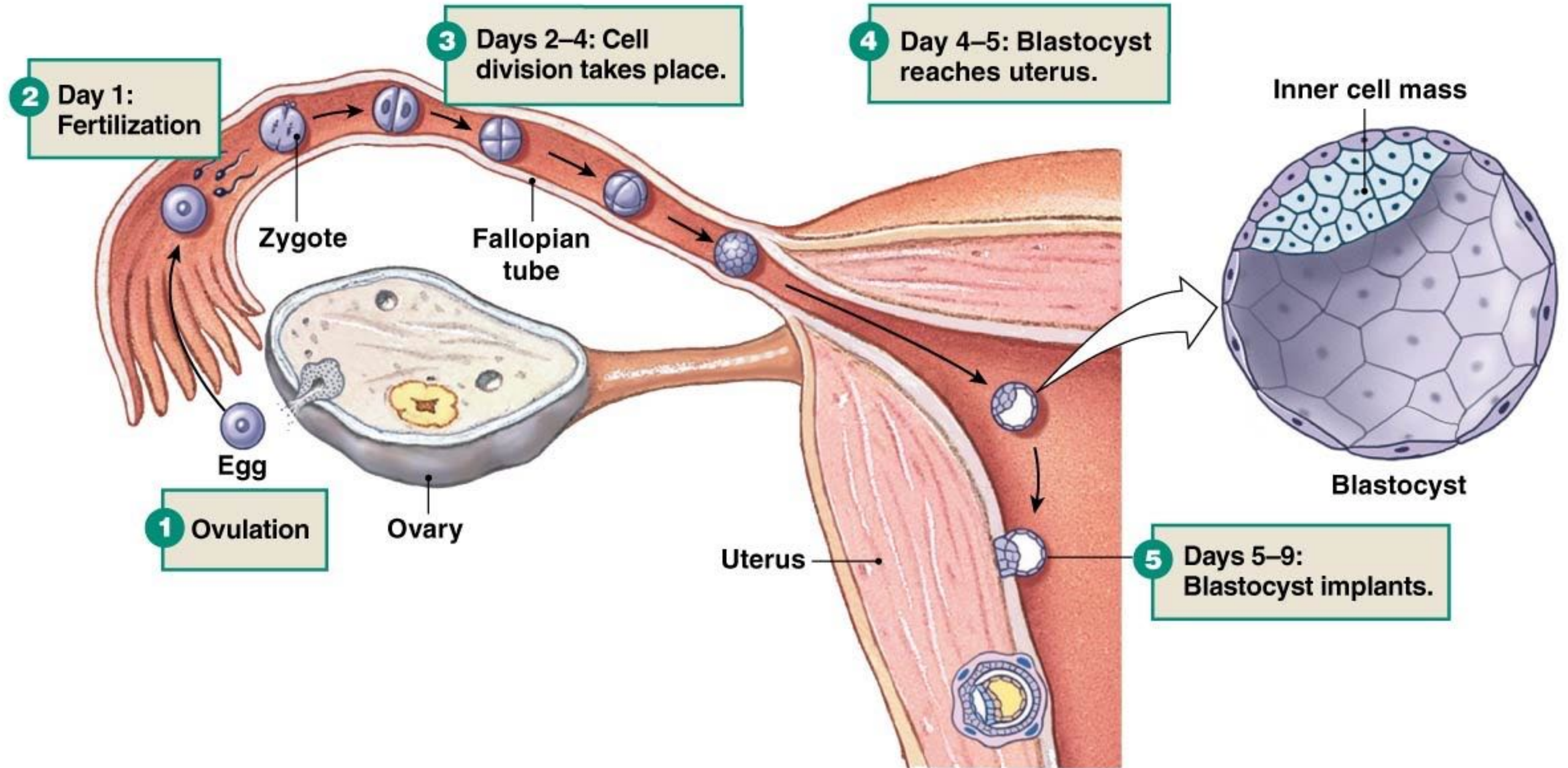
- Dominant follicle breaks free from the ovarian wall in the process of ovulation.
- Only if the secondary oocyte is fertilized by a sperm cell will it undergo the second meiotic division



(c) The first sperm to fuse with the egg fertilizes it.



(d) Timing of ovulation, fertilization, and implantation

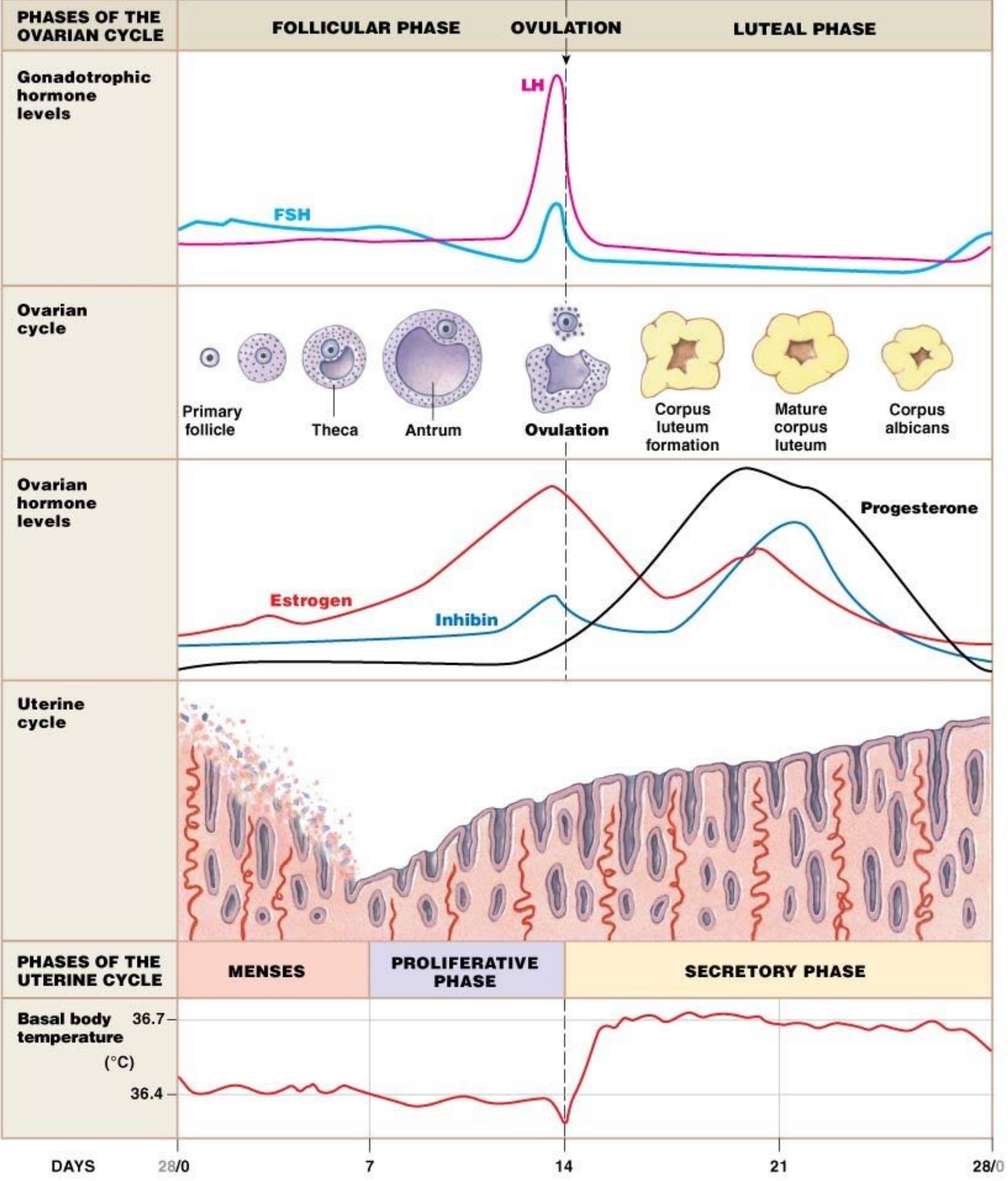


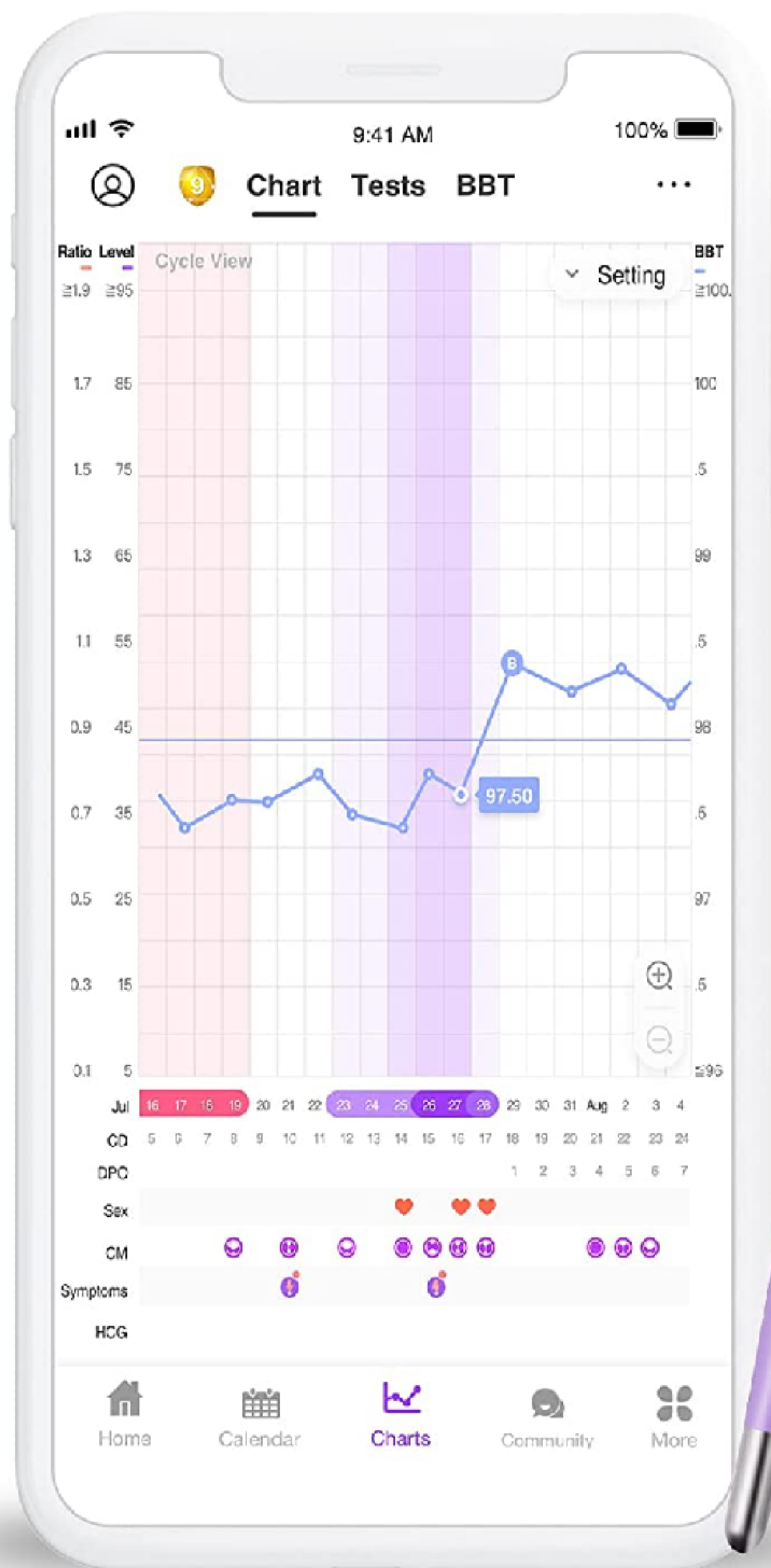
Menstrual Cycle

- Days 1 - 5: Menses
 - Thick endometrial lining is sloughed off and it leaves the body via the vagina.
- Day 6 - 13: Proliferative Stage
 - Repair and regrowth of the endometrium. Glands are re-formed, blood supply increases.

Menstrual Cycle

- Day 14: Ovulation
 - Egg is released due to a surge of LH
- Day 15 - 28: Secretory Stage
 - Endometrium to increase in vascularization and gland production.
 - Lack of ovarian hormones in the blood causes endometrial cells to die





Here's what you need

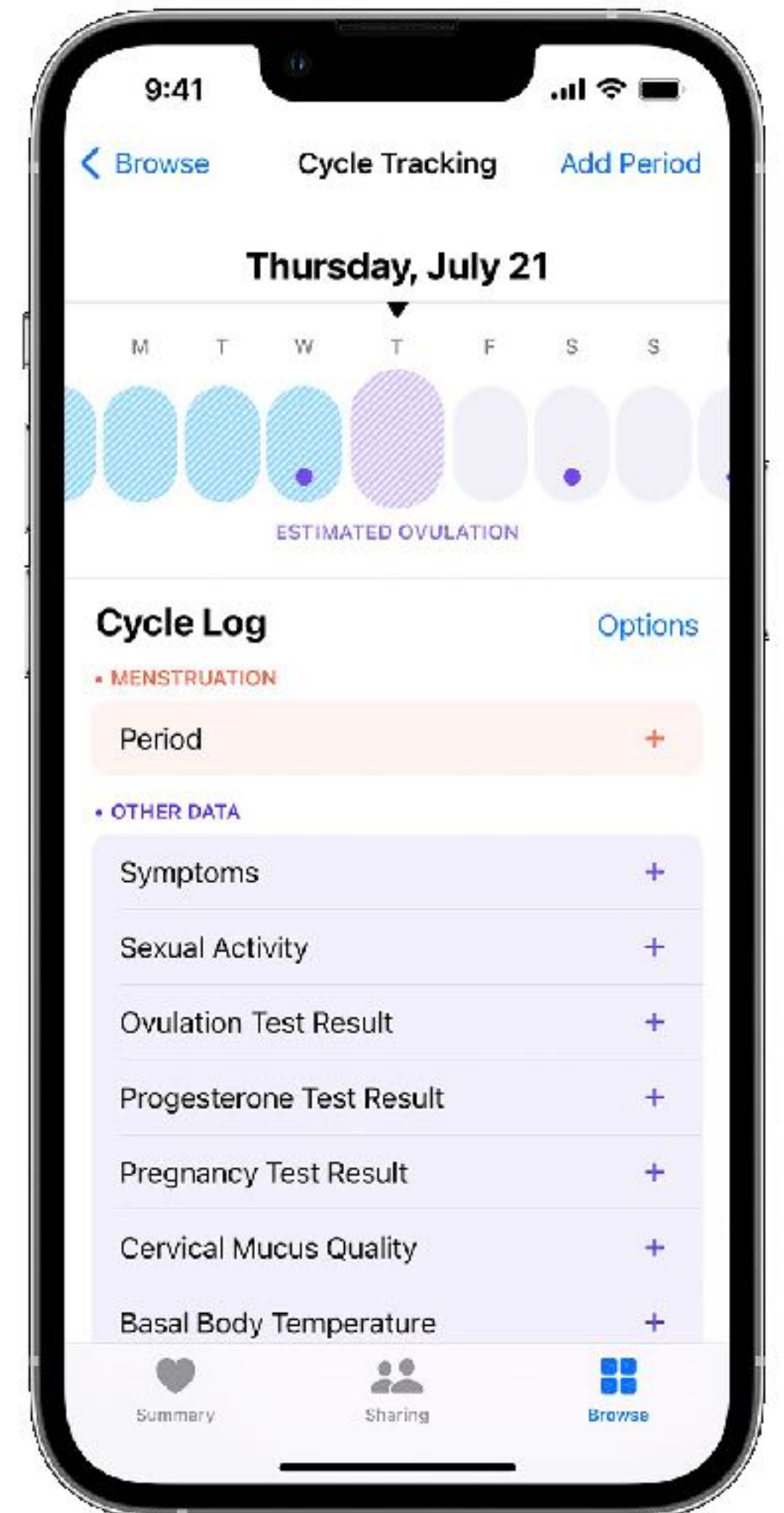
- An Apple Watch Series 8 or Apple Watch Ultra.
- [Cycle Tracking](#) must be set up with fertility predictions enabled and no ongoing cycle factors logged.
- [Sleep must be set up](#) with Track Sleep with Apple Watch and Sleep Focus enabled.
- Sleep Focus must be enabled for at least 4 hours a night for 5 nights to get accurate [wrist temperature data](#).

View your ovulation estimates

When an estimate of when you likely ovulated is available, you'll receive a notification on your Apple Watch or iPhone. In the Health app on iPhone or Cycle Tracking app on Apple Watch, your ovulation estimate appears as a light purple oval in your fertile window.

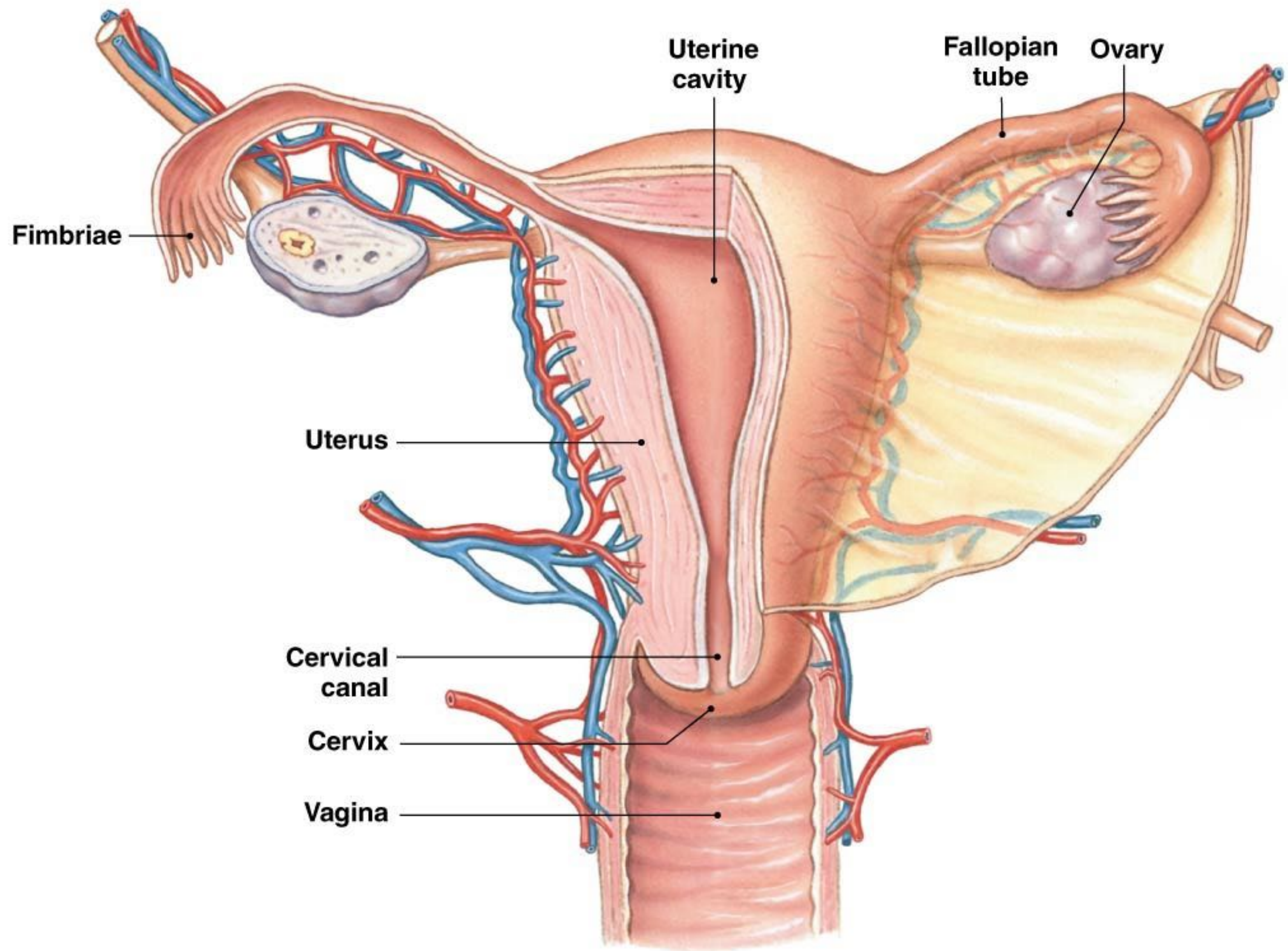
How retrospective ovulation estimates work

Apple Watch Series 8 or Apple Watch Ultra uses wrist



Female Duct System

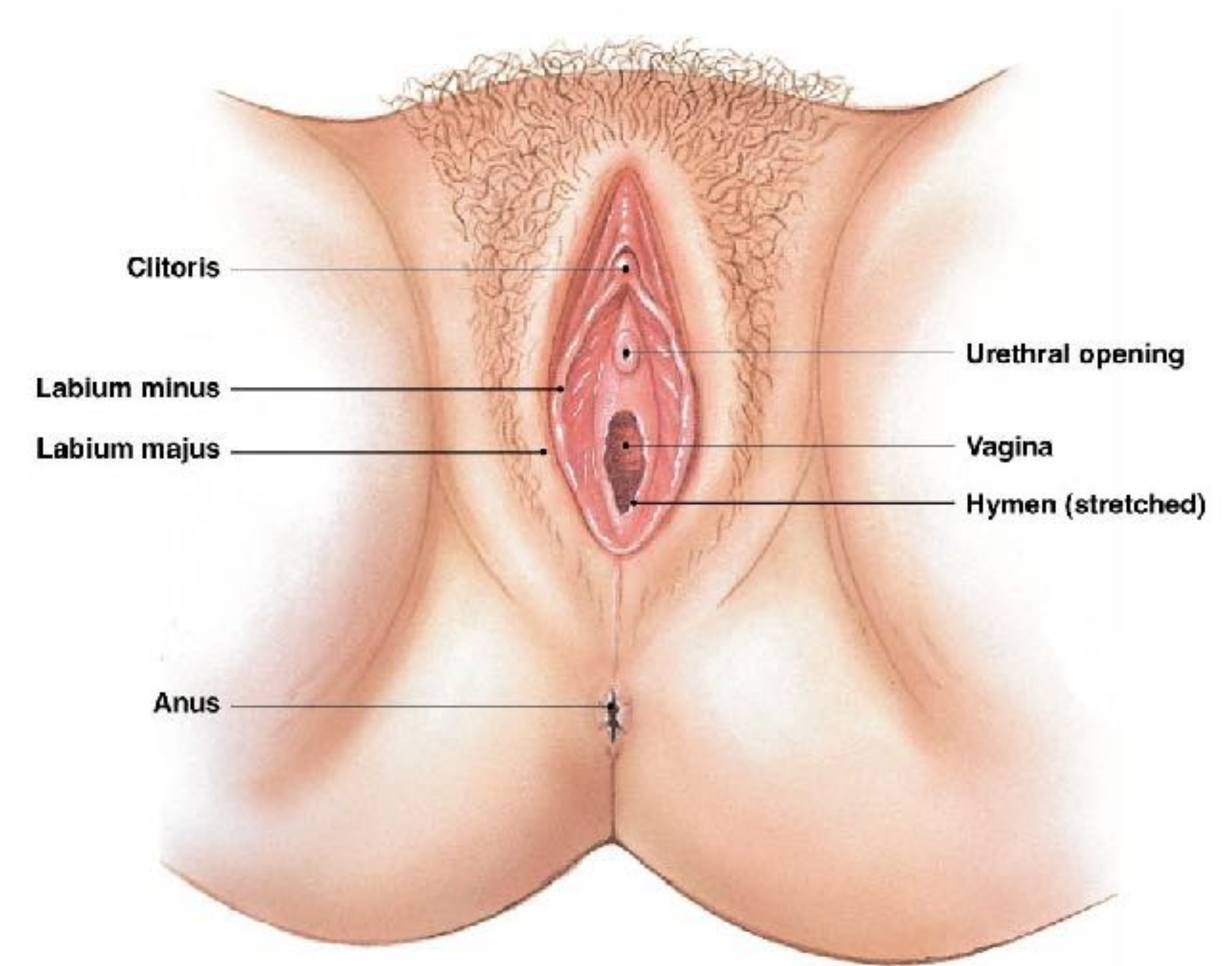
- Uterine (Fallopian) Tubes
 - Provide a place where fertilization can occur
 - Discontinuous w/ the ovaries
 - Fimbriae and cilia are critical
- Uterus
 - Receive, retain and nourish the fertilized egg.
Contraction during labor and menstruation



Female Duct System

Vagina

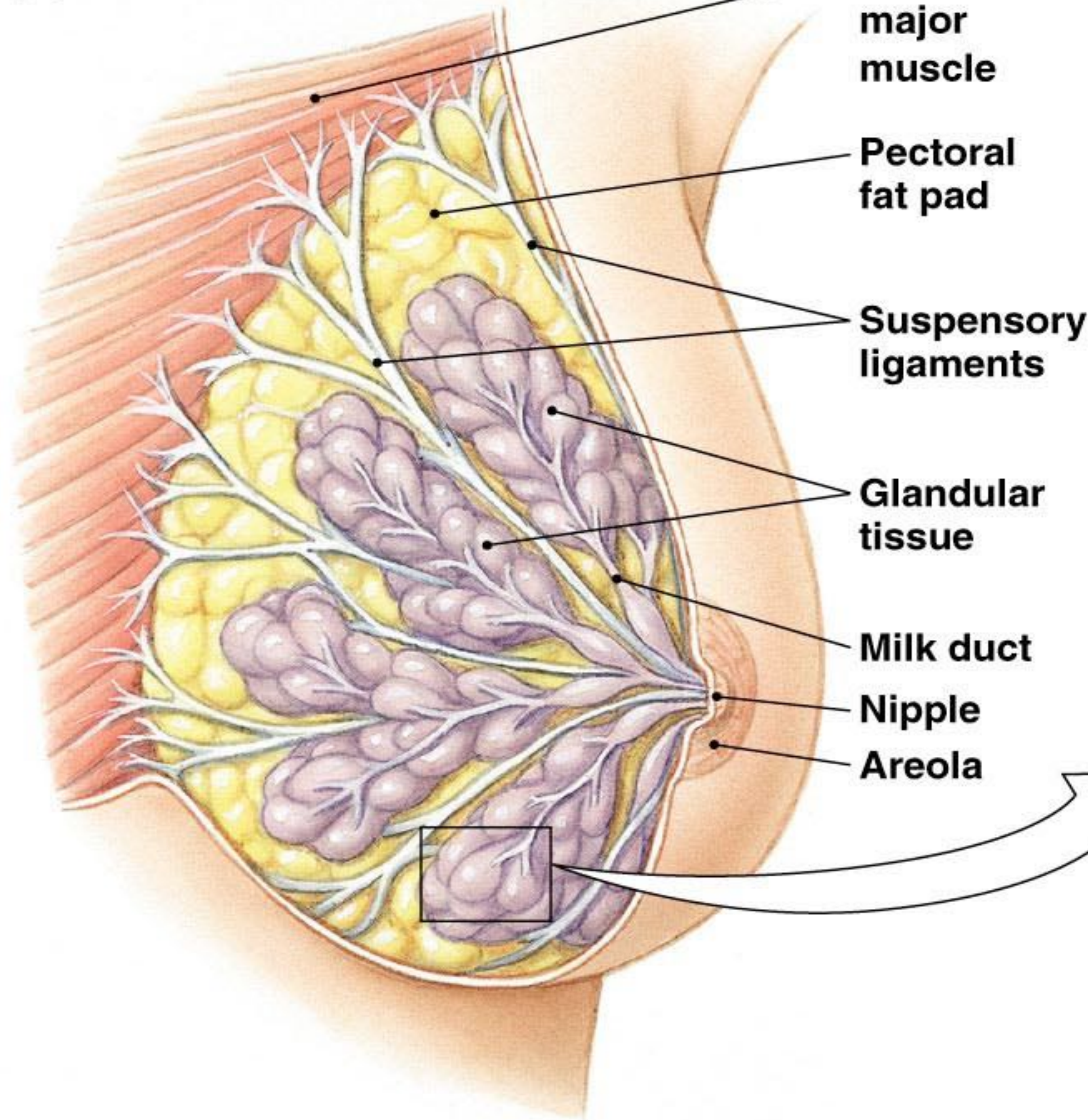
- Receives penis and semen; allows for passage of baby and menstrual flow
- And the most important part...



Female Accessories

- Mammary Glands
 - Nourish the baby with milk.
 - Developmentally, they are modified sweat glands
 - Areola surrounds the central nipple.
 - 15 - 25 lobes, which are further divided into lobules w/ areolar glands (produce milk).
 - Lactiferous ducts

(a)



Pectoralis major muscle

Pectoral fat pad

Suspensory ligaments

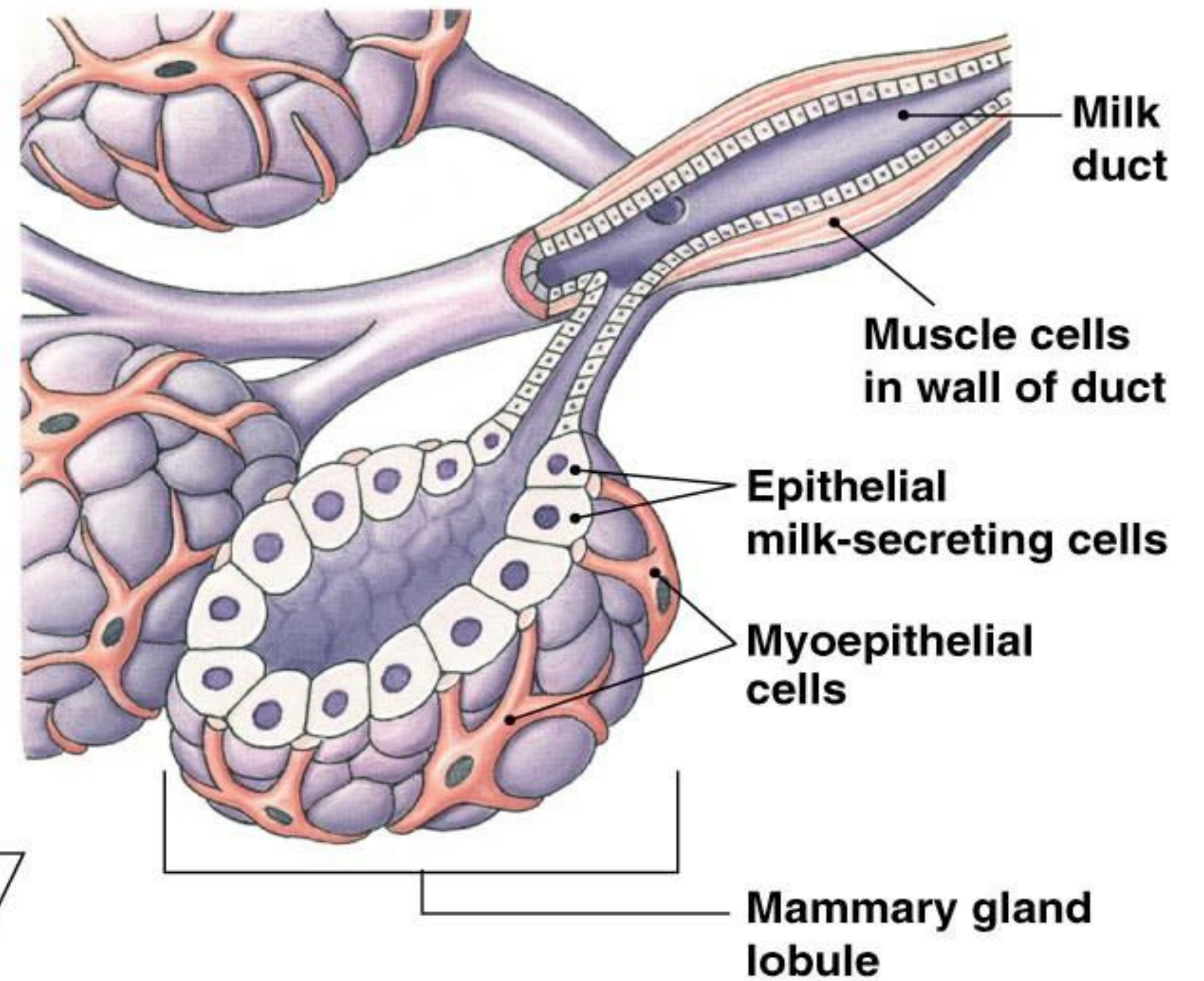
Glandular tissue

Milk duct

Nipple

Areola

(b)



Milk duct

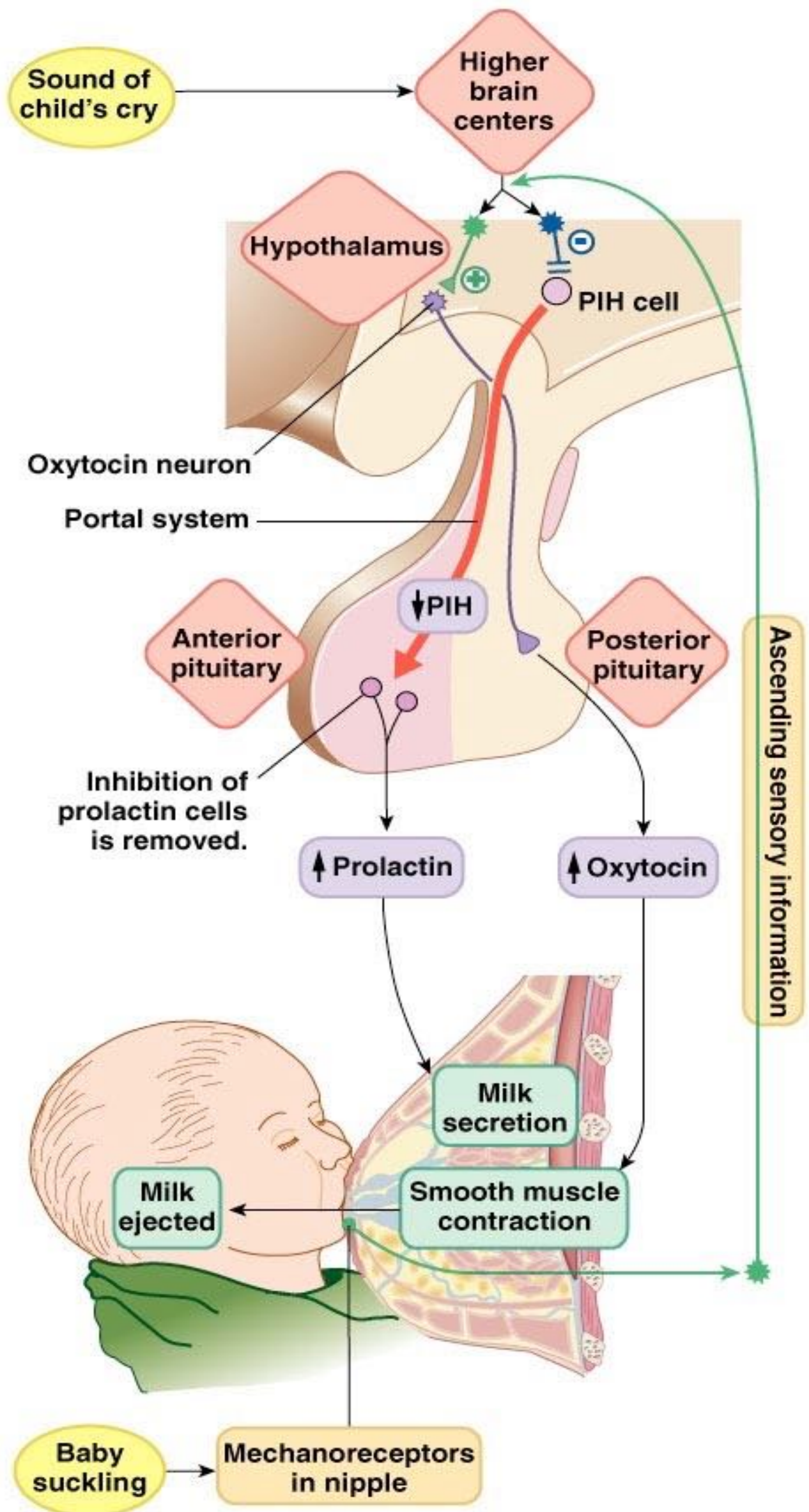
Muscle cells in wall of duct

Epithelial milk-secreting cells

Myoepithelial cells

Mammary gland lobule





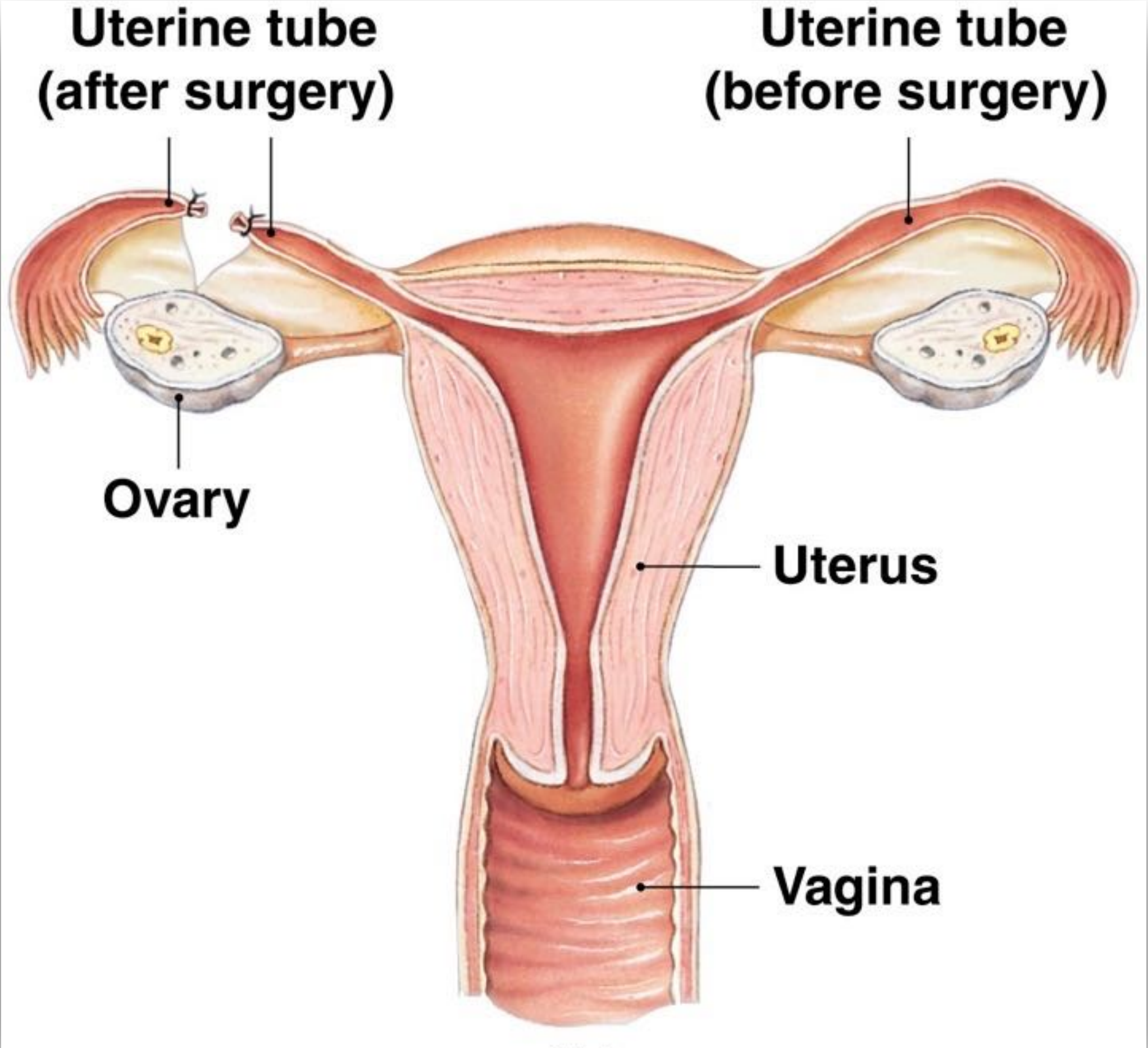
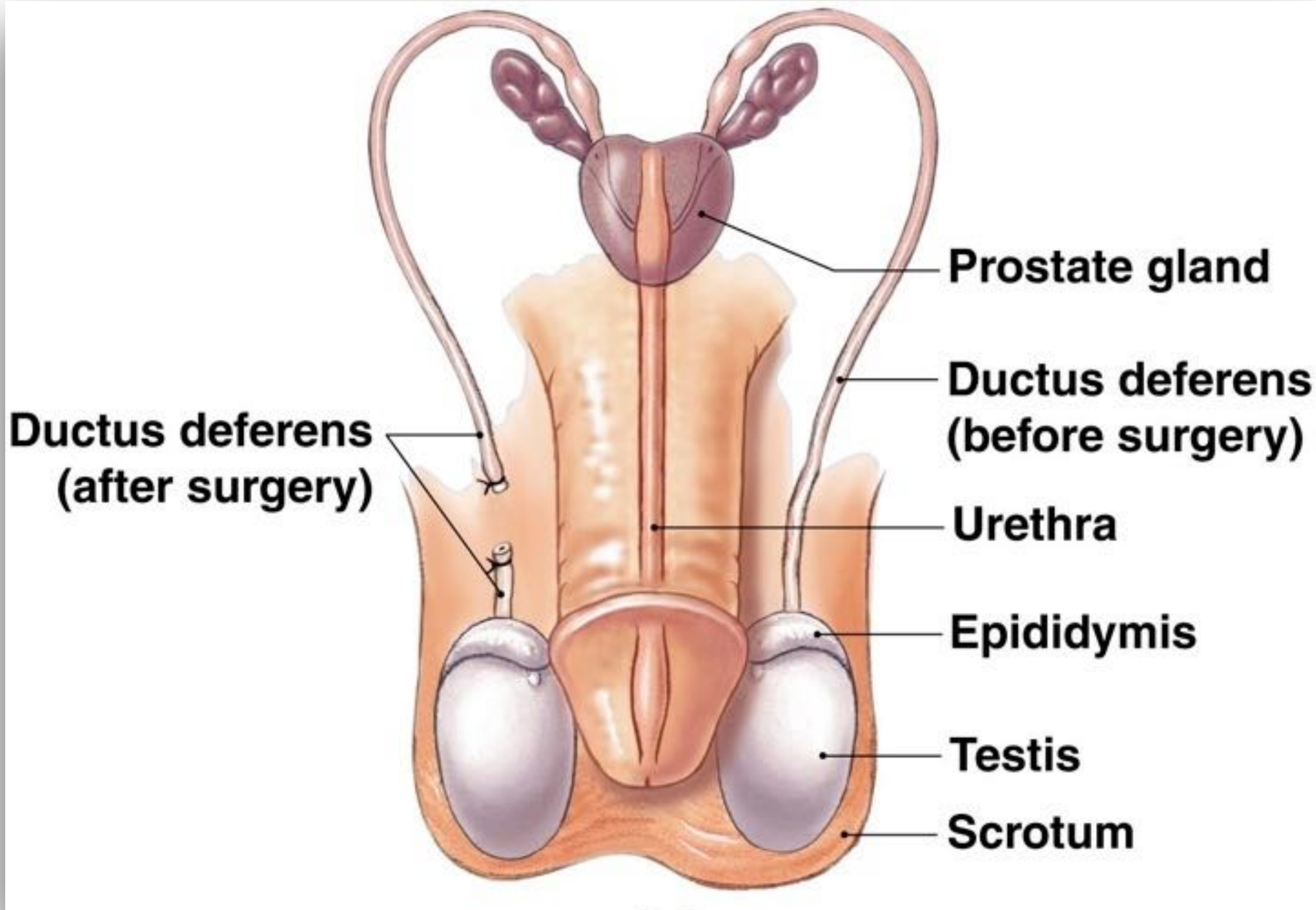
Special Topics



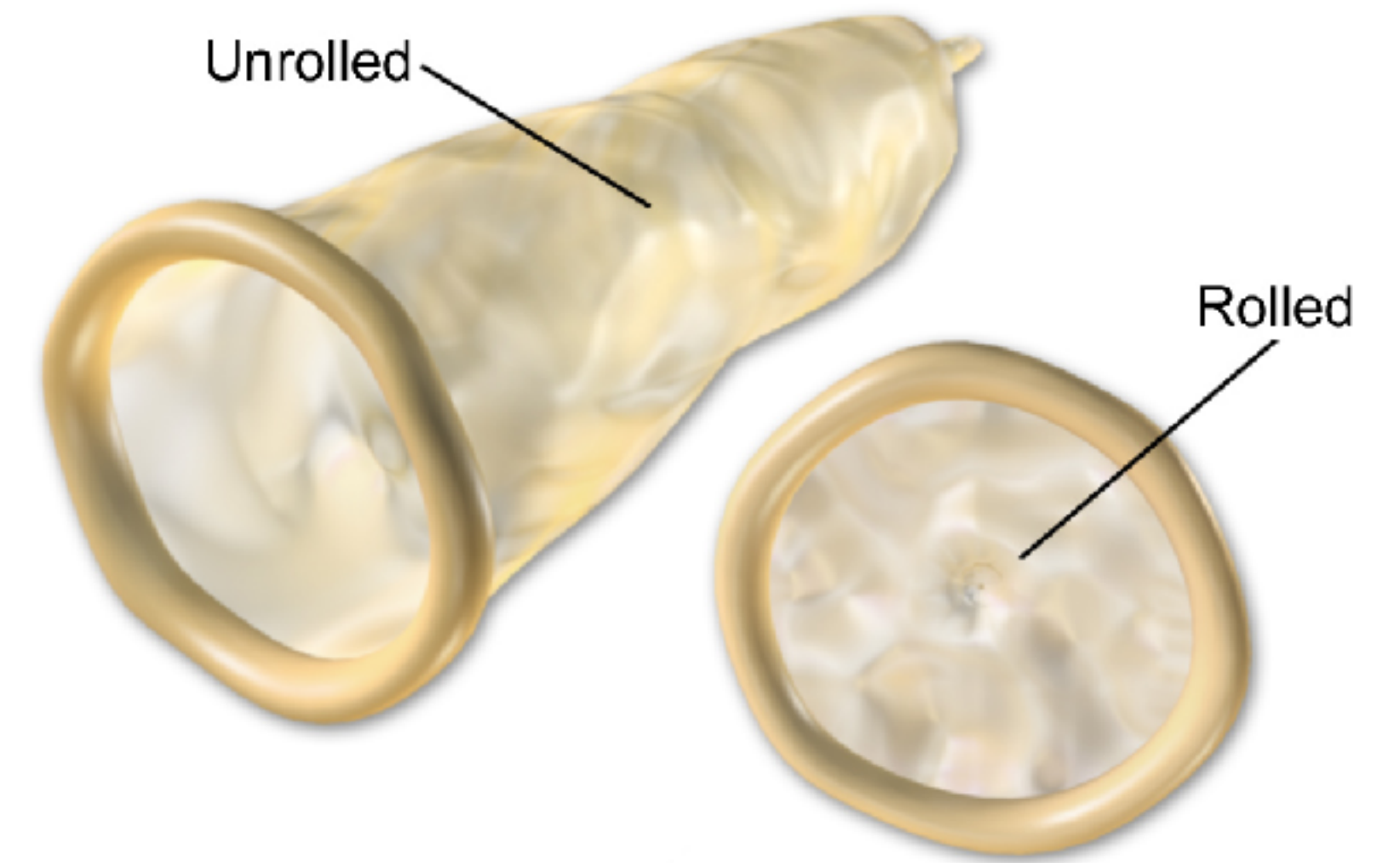
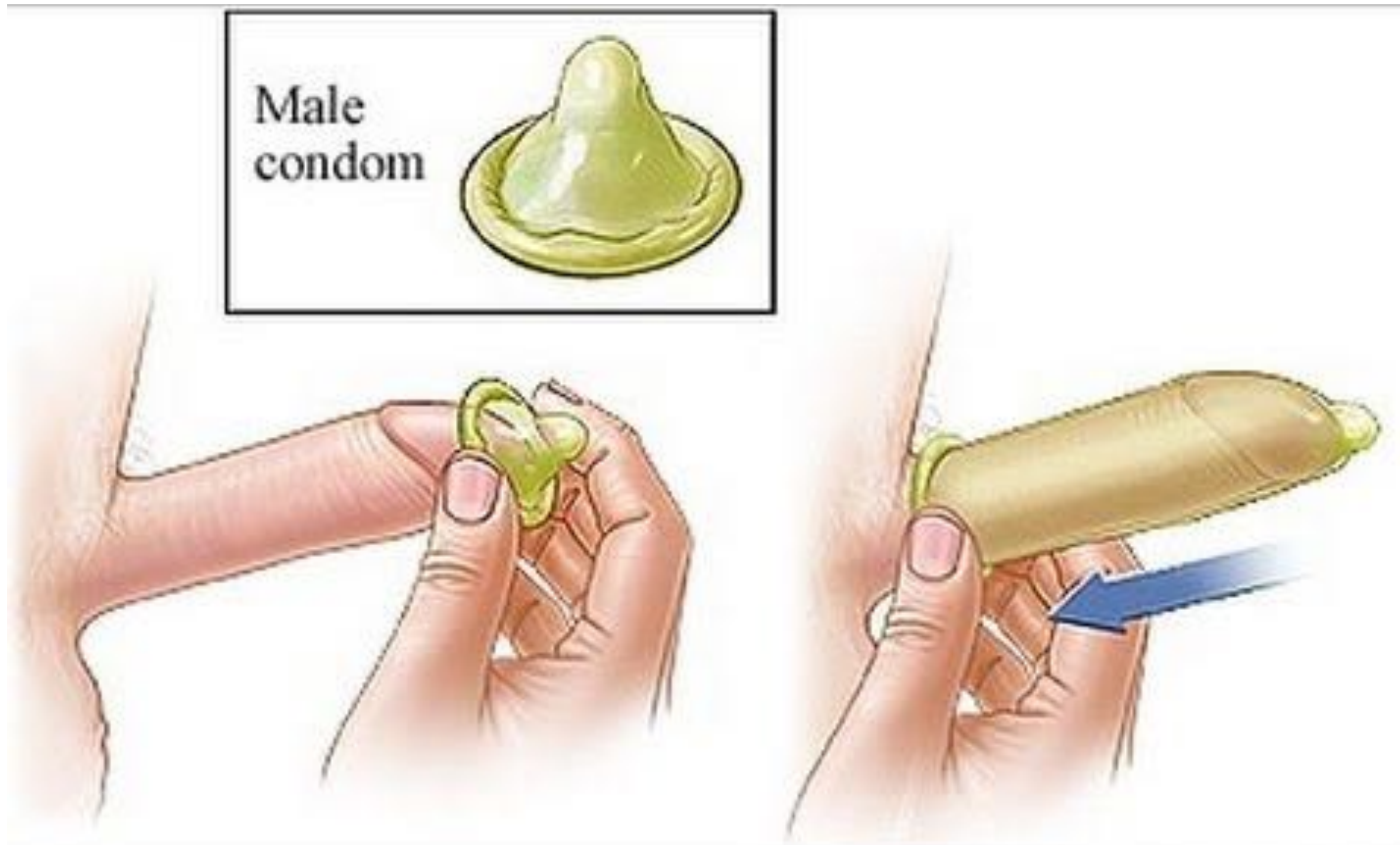
Preventing Pregnancy

- Barriers: methods to prevent egg/sperm encounters
- Contraceptives: methods to prevent pregnancy by disrupting ovulation or fertilization (*contra-conception*)
- Contragestives: prevent implantation of an embryo in the uterus (*contra-gestation*)

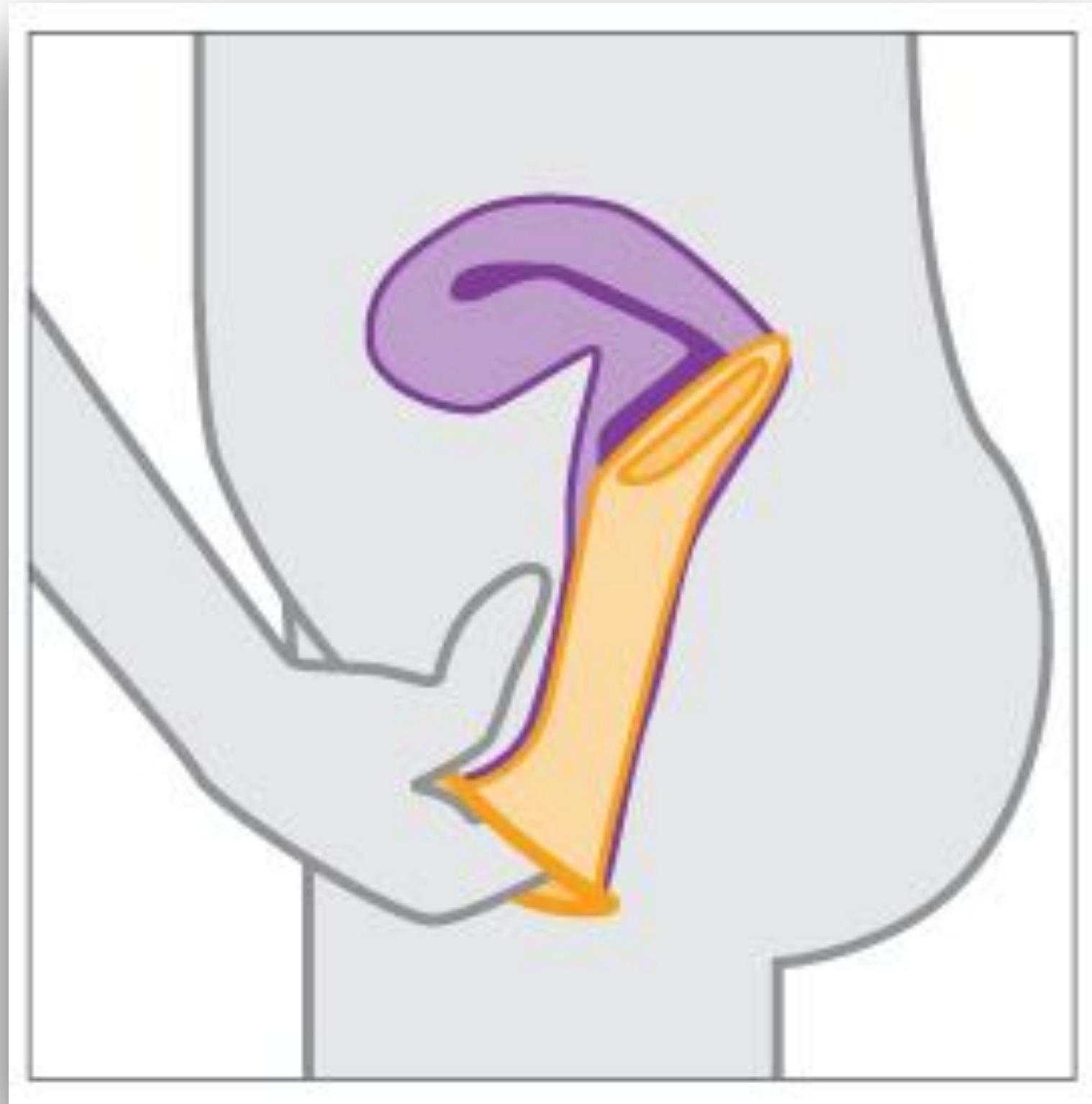
Contraceptive: Surgical Sterilization



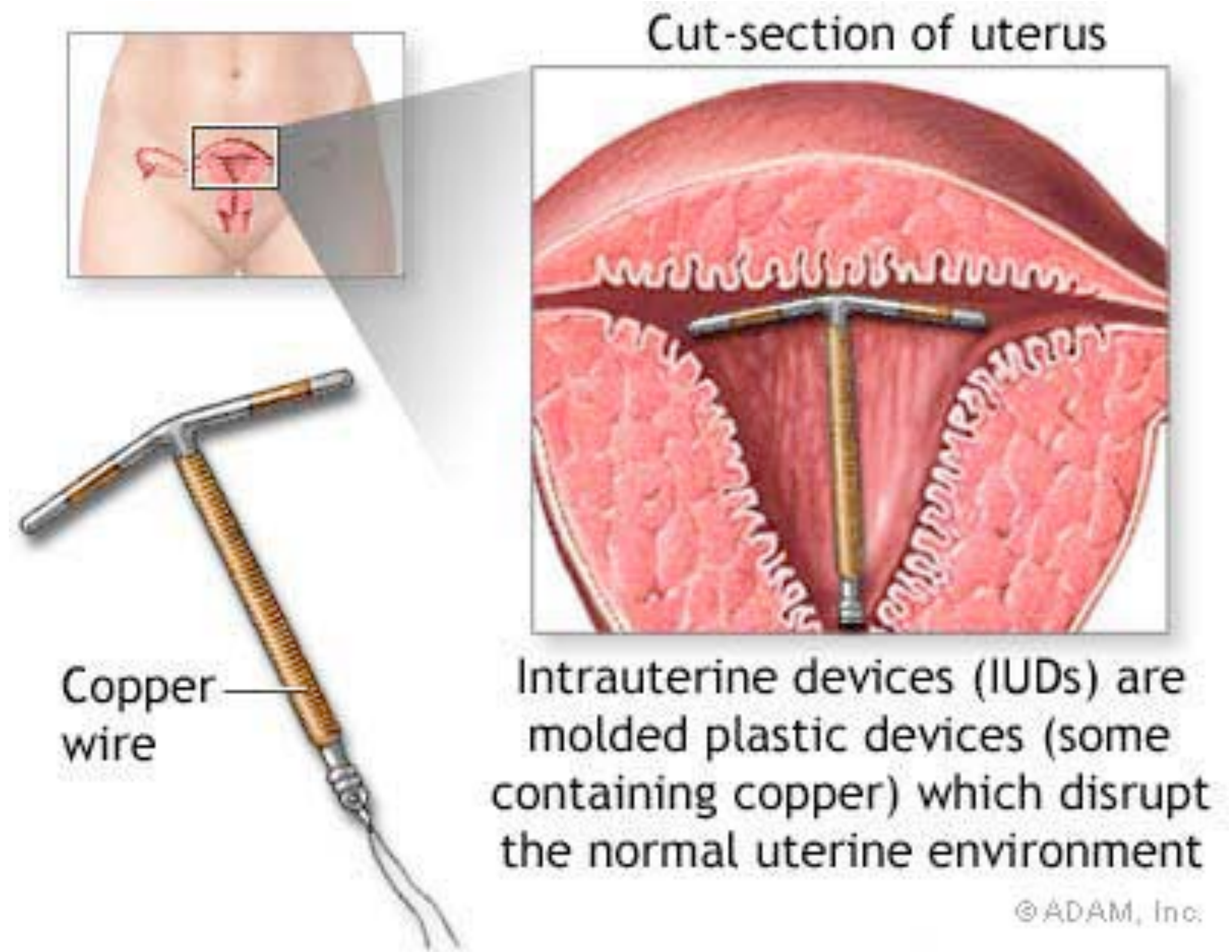
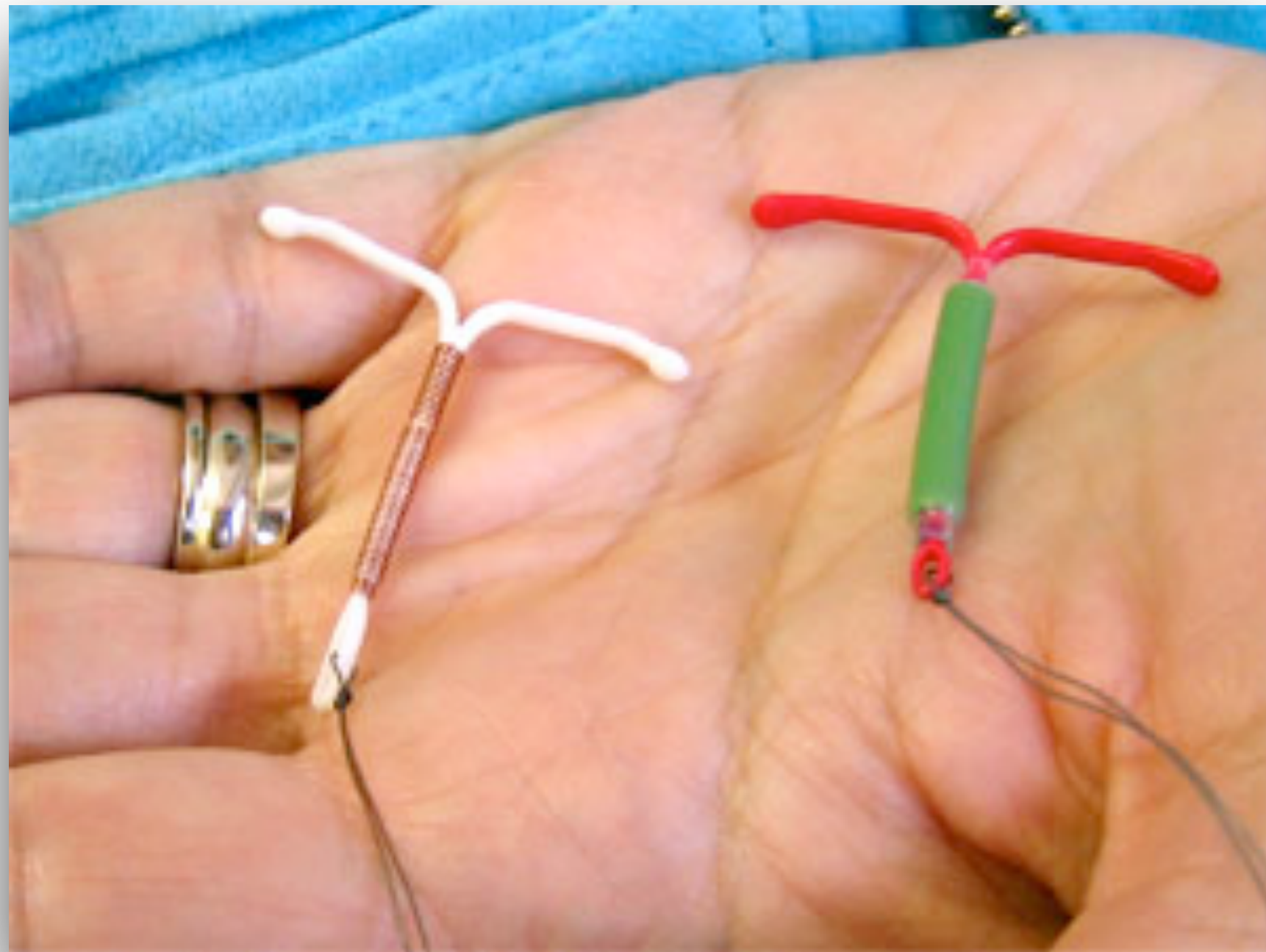
Condoms: Contraceptive



Condoms



IUD: Contraceptive



“The Pill” Contraceptive

- Birth-control pills contain estrogen and progesterone agonists
- Prevent ovulation



Implants and Injections: Contraceptives

- Synthetic progesterone (progestin) prevents implantation
- Nexplanon (Implants)
 - protect against pregnancy for 4 years



Implants and Injections: Contraceptives

- Synthetic progesterone (progestin)
- Depo-Provera Injections

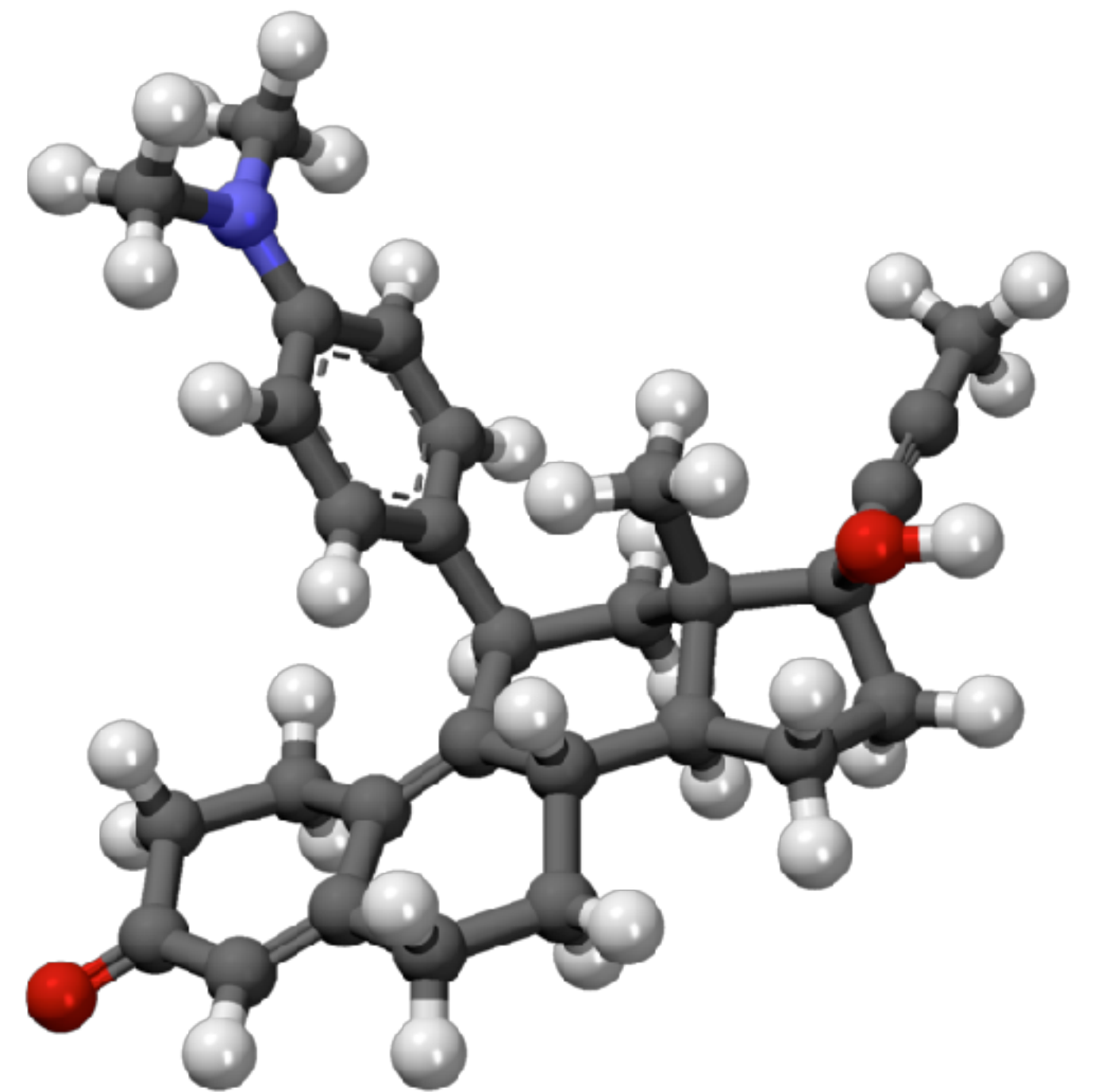


Emergency Contraception (EC): Contraceptive



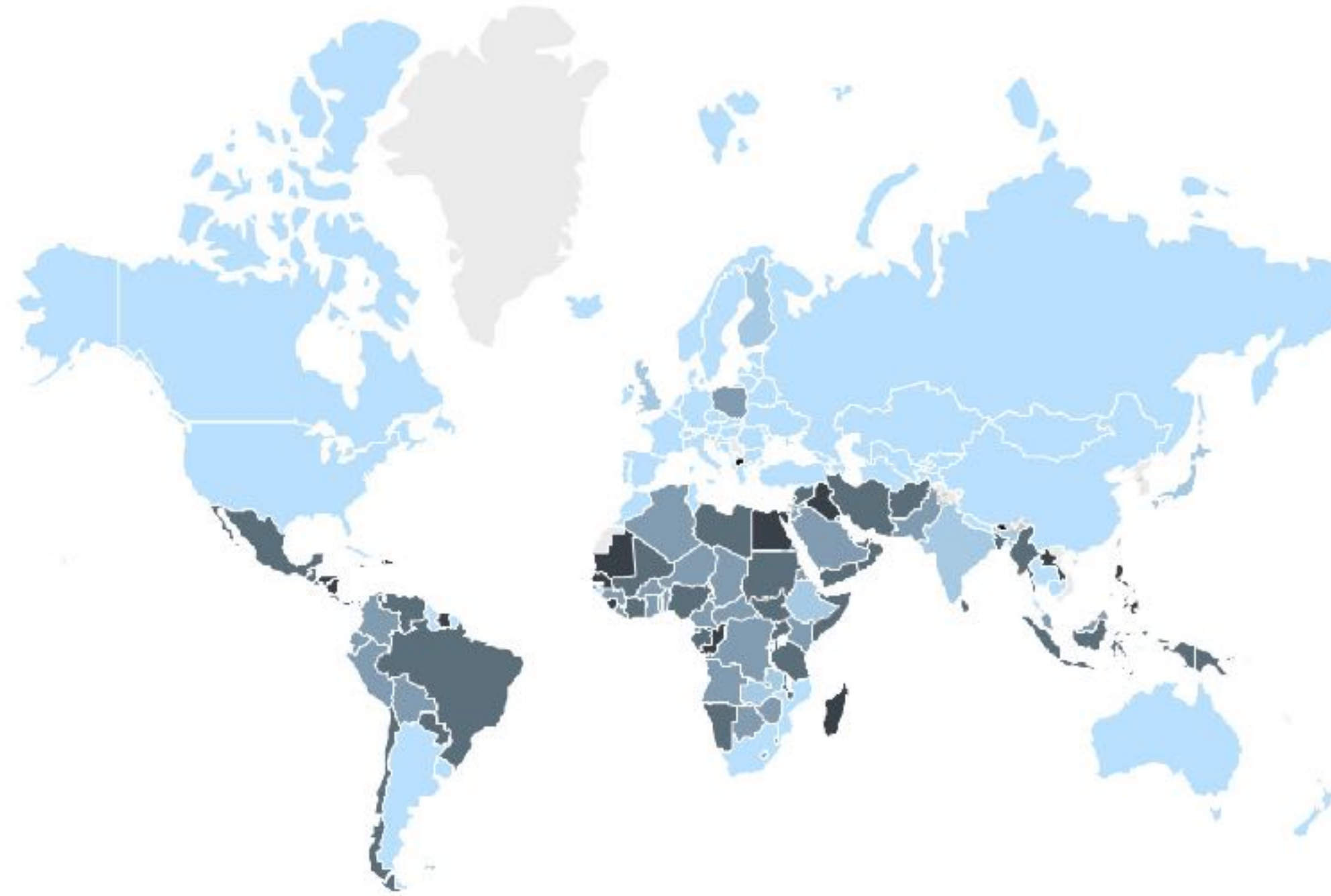
Mifepristone (Mifeprex) (RU-486) Contraceptive

- Competitive progesterone receptor antagonist
- FDA-approved abortifacient to terminate pregnancies of up to 49 days gestation
- 600 mg dose followed by 400 ug dose of misoprostol two days later (induces uterine contractions)



Abortion laws around the world

Categories: ❶ Prohibited ❷ Save the pregnant person's life ❸ Preserve health
❹ Broad social/economic grounds ❺ On request (*gestational limits vary*)



Category 1

Abortion is not permitted under any circumstances, including when the pregnant person's life or health is at risk. 24 countries globally fall within this category.

90 million women (5%) of reproductive age

Category 2

Abortion is permitted when the pregnant person's life is at risk. 42 countries fall within this category.

360 million women (22%) of reproductive age

Category 3

Abortion is permitted on the basis of health or therapeutic grounds.

225 million women (14%) of reproductive age

Category 4

Abortion is permitted under a broad range of circumstances, including a pregnant person's actual or reasonably foreseeable environment and her social or economic circumstances in considering the potential impact of pregnancy and childbearing.

386 million women (23%) of reproductive age

Category 5

Abortion is allowed on request. 72 countries globally fall within this category.

601 million women (36%) of reproductive age

Fertility Control

- Planned Parenthood birth control information and efficacy
- Center for Reproductive Rights

Arousal Non-Concordance

- When your genital response does not align with subjective arousal (wanting or liking)
 - For people with penises: 50% concordance
 - For people with vaginas: 10% concordance
- Erection and vaginal lubrication occur because sensory inputs tell your brain that what you are experiencing is sexually relevant, **not because you necessarily want or like what is happening**

Arousal Non-Concordance

- Vaginal lubrication, erection and orgasm have all been used to prove *implied consent* in courts all over the world
- Unwanted genital responses (to inappropriate or violent stimuli for example) cause tremendous emotional stress (especially for teenagers)

**So your GENITALS don't tell your
partner what you want or like...
YOU do!**

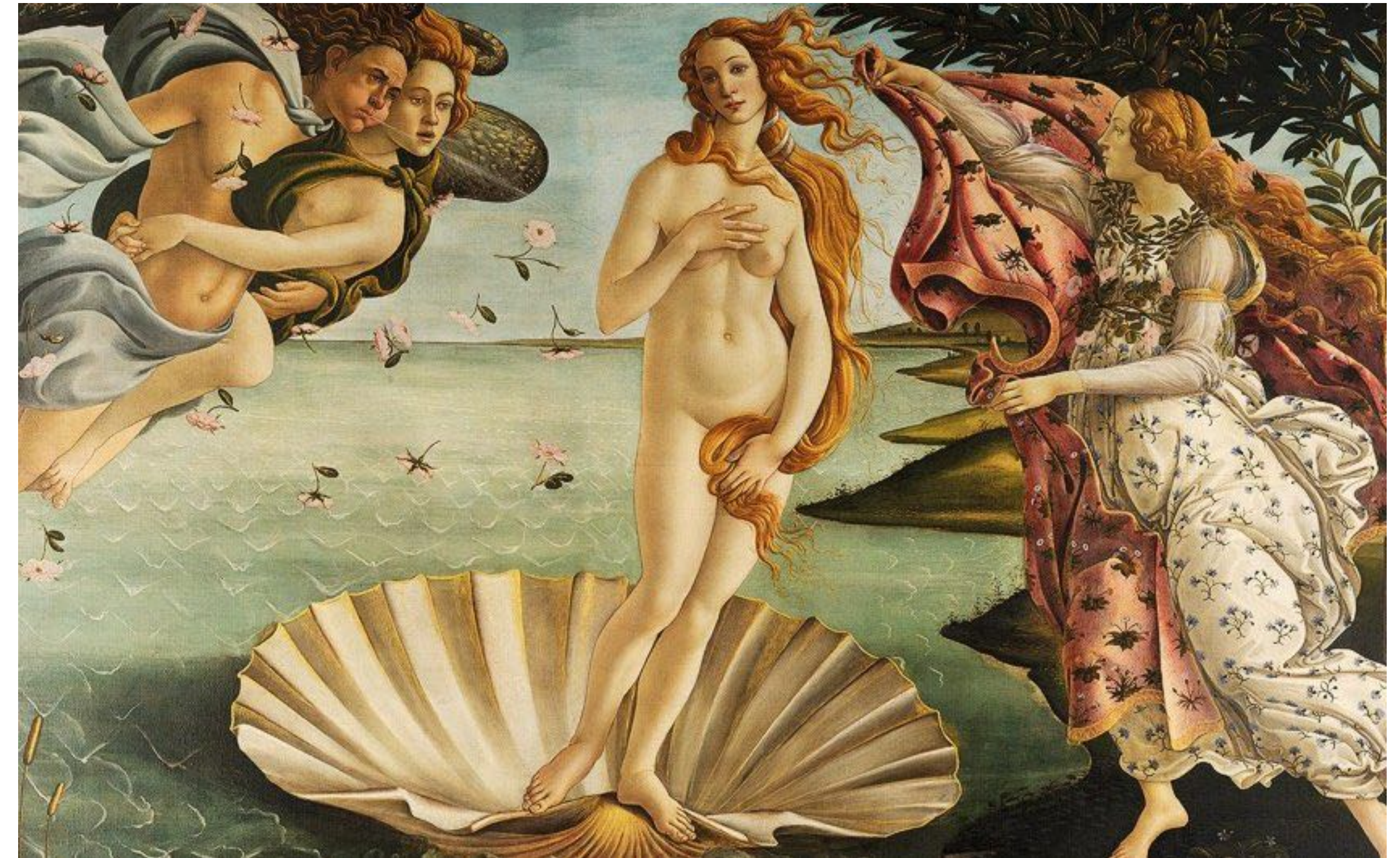
Clinical Conditions

- Prostatic hypertrophy and prostate cancer
- Male infertility
- Female Infertility
- Cervical cancer
- Breast cancer
- Uterine cancer
- Male and female circumcision

Aphrodisiacs

- Chocolate
- Kava kava root
- Yohimbe bark extracts
- Be careful of ephedrine
 - Check labels for:
 - ma huang (Chinese ephedrine)
 - ephedra
 - epitonin
- Good Reproductive Health!

Aphrodite, Greek
Goddess of Love



Alessandro Botticelli
"Birth of Venus" (1485)
Uffizi, Firenze