



# Reproductive System

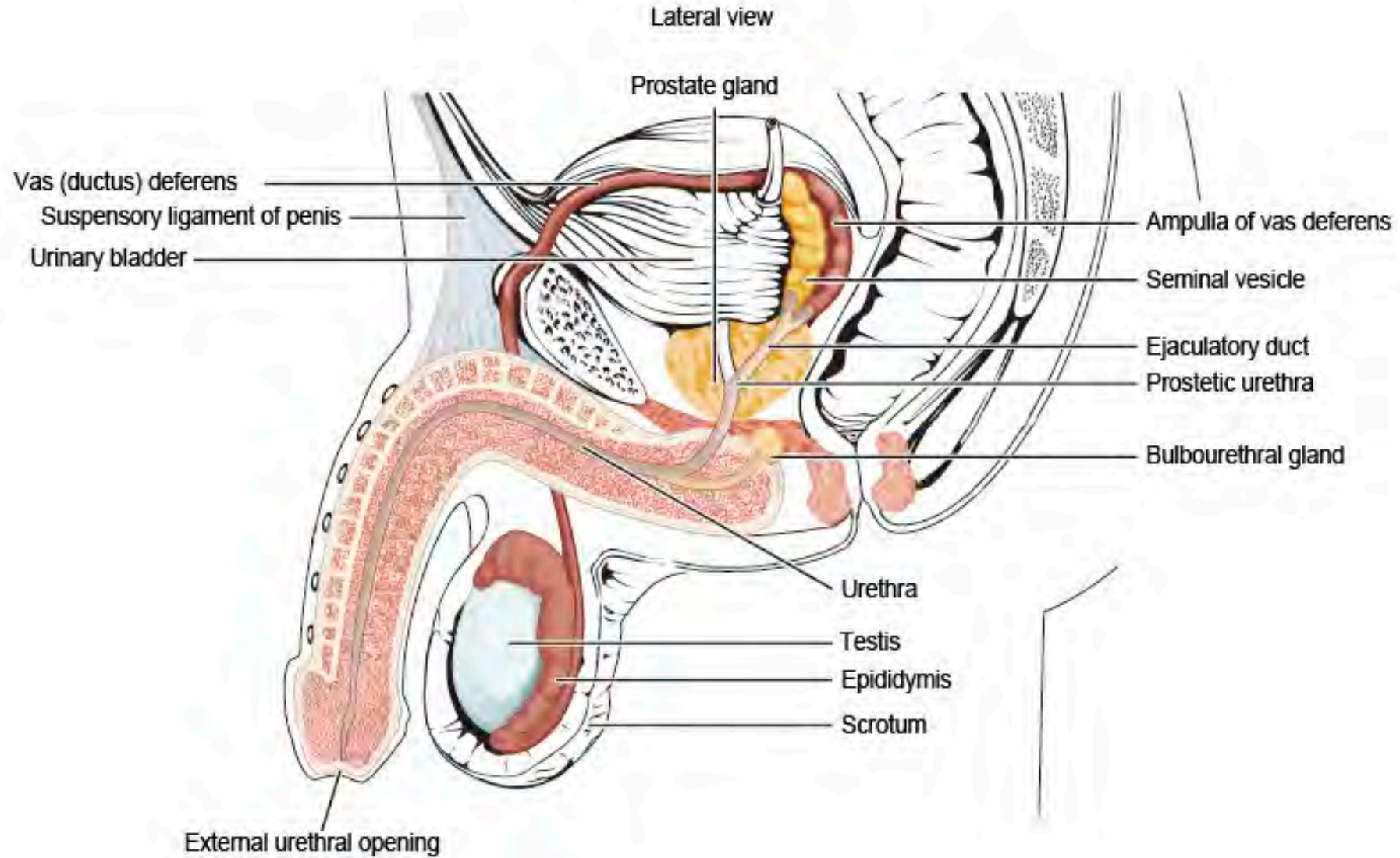
MS. MARTEL

## 9.1 – MALE REPRODUCTIVE SYSTEM

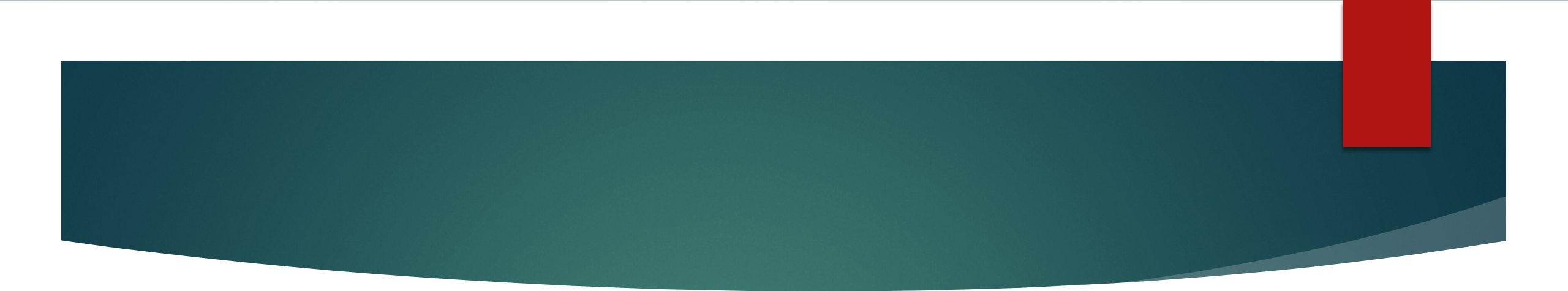
- ▶ Organisms that carry out sexual reproduction **must produce gametes.**
  - ▶ The reproductive system is **different in males and females.**

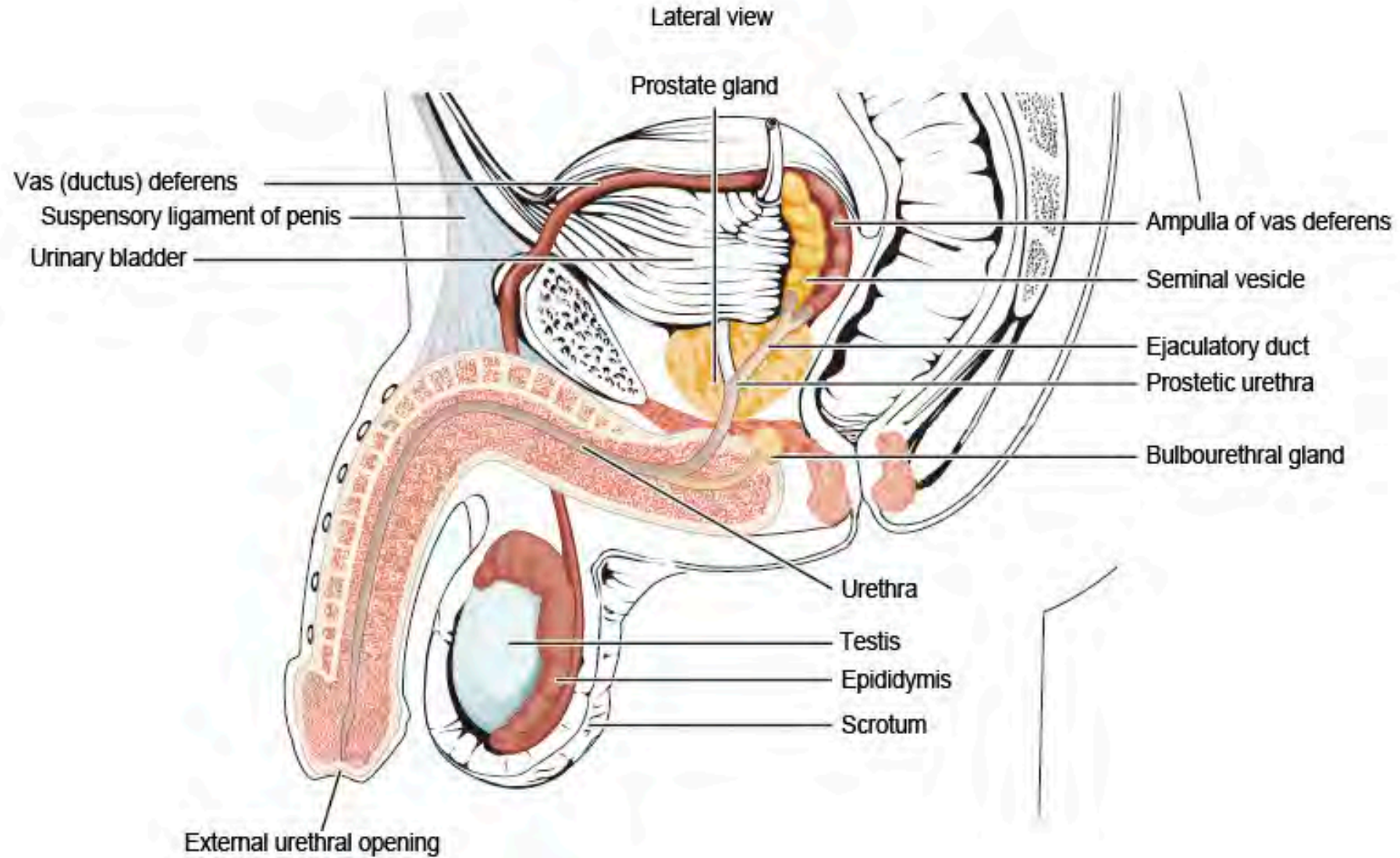
# Genital Tract

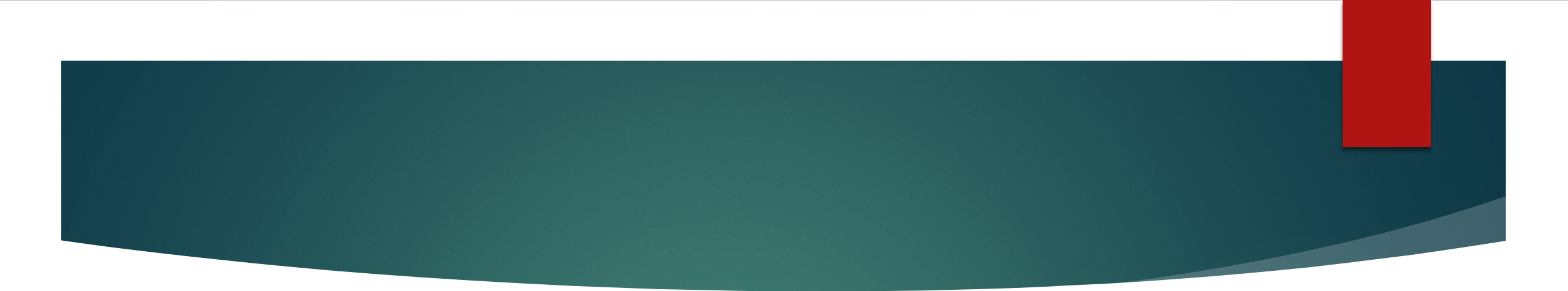
- ▶ Sperm produced in the testes mature within the epididymides, which are **ducts lying outside the testes**.
  - ▶ Maturation seems to be required in order for **sperm to swim to the egg**.
  - ▶ When sperm leave the epididymis, they enter a **vas deferens**.
  - ▶ Each vas deferens passes into the abdominal cavity, where it curves around the urinary bladder and **empties into an ejaculatory duct**.
  - ▶ The ejaculatory ducts connect to the **urethra**.

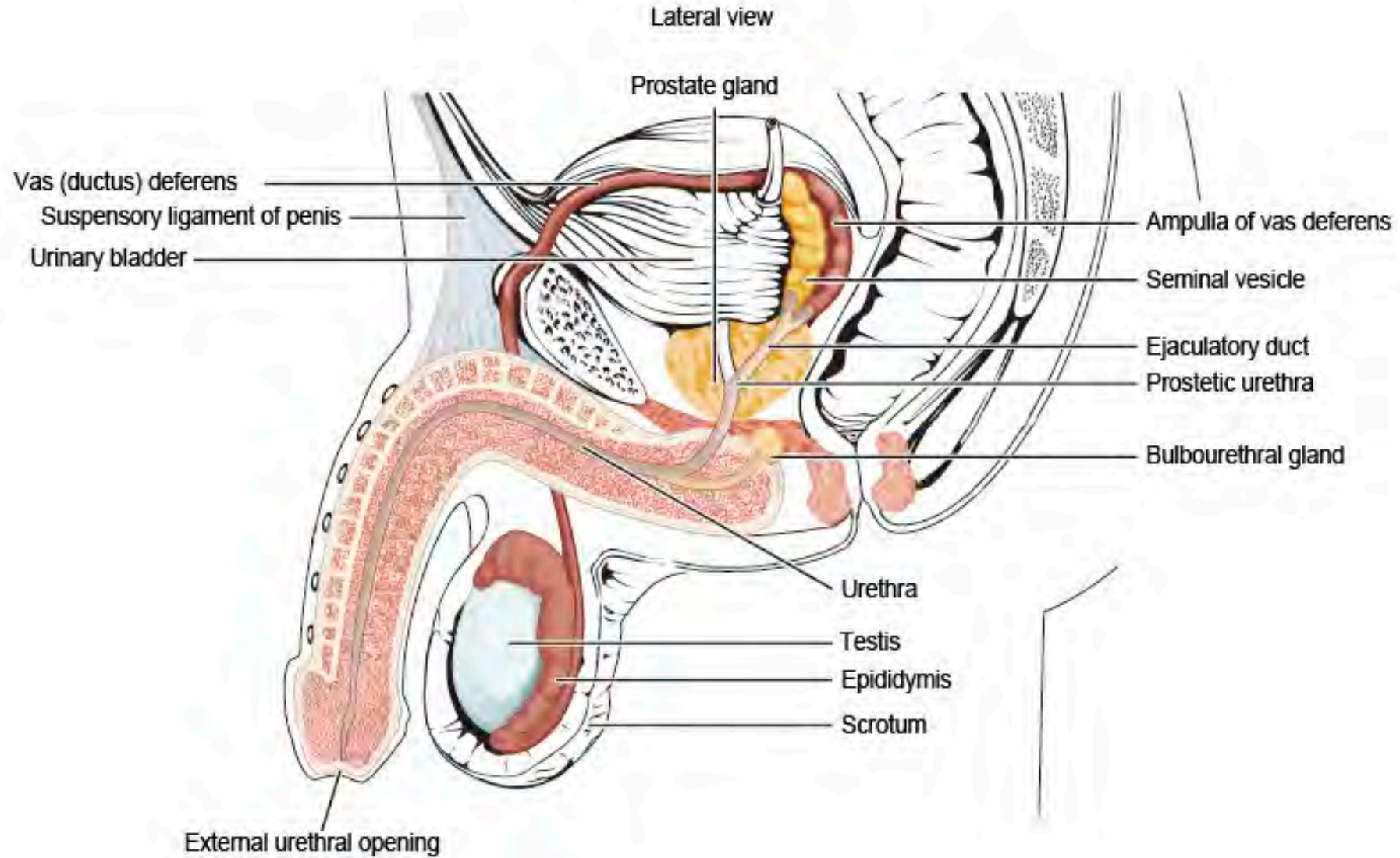




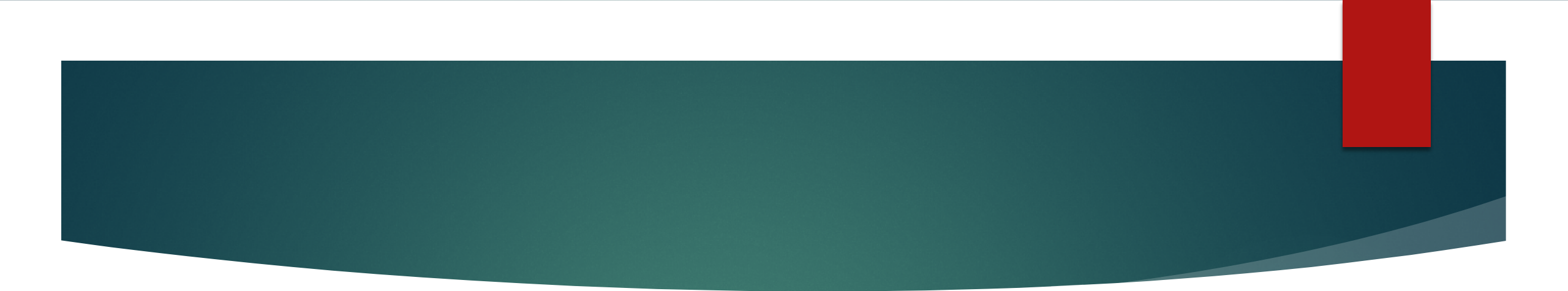
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- ▶ During ejaculation, sperm leave the penis in **seminal fluid**.
  - ▶ The combination of **sperm and seminal fluid** is **semen**.
  - ▶ The paired seminal vesicles lie at the base of the bladder, each has a **duct that joins with the vas deferens**.

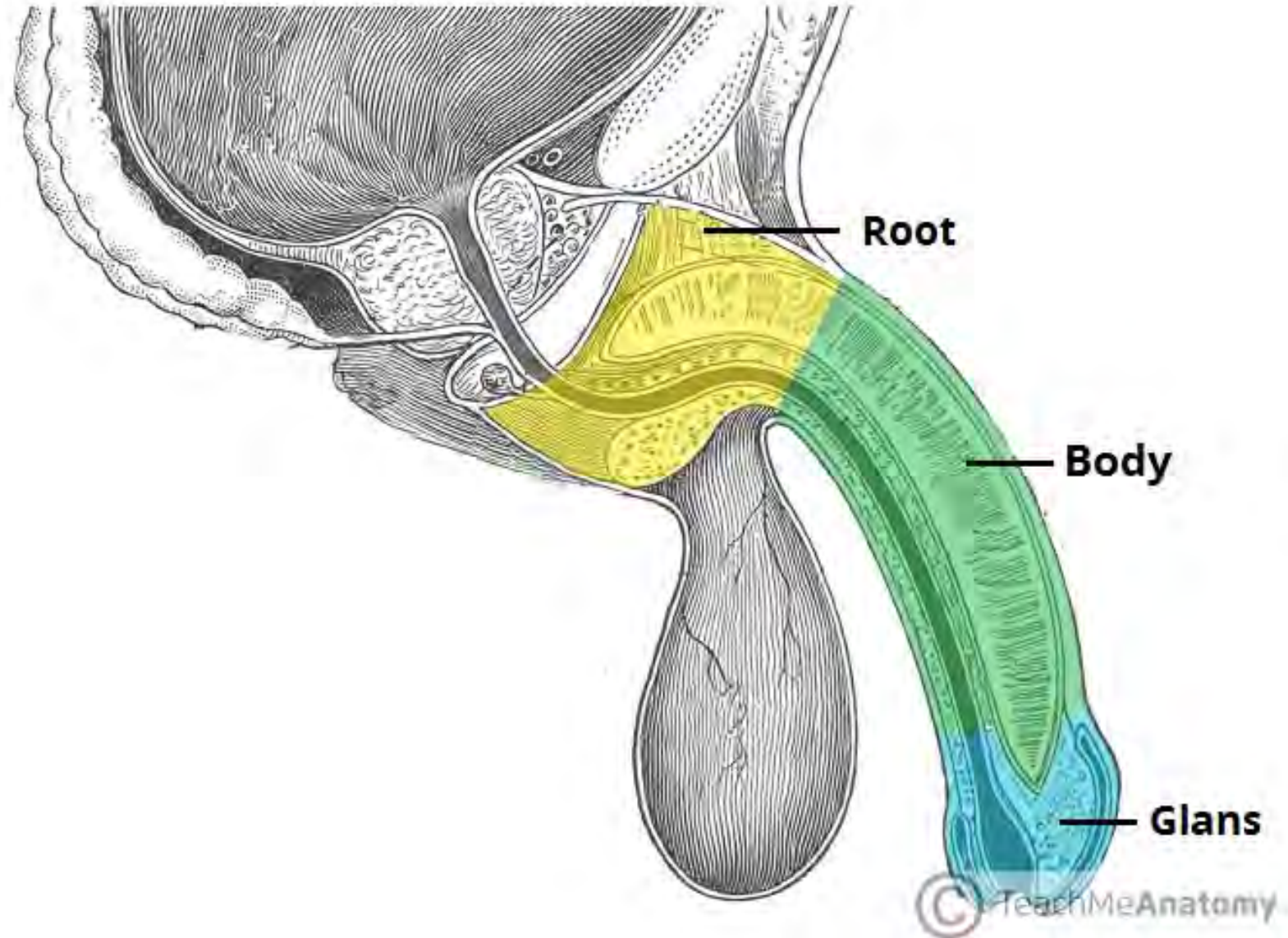


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- ▶ The prostate gland is a single, donut-shaped gland that surrounds the upper portion of the **urethra just below the urinary bladder.**
  - ▶ Semen also contains prostaglandins that cause the **uterus to contract.**
    - ▶ Scientists believe this may help propel the **sperm toward the egg.**



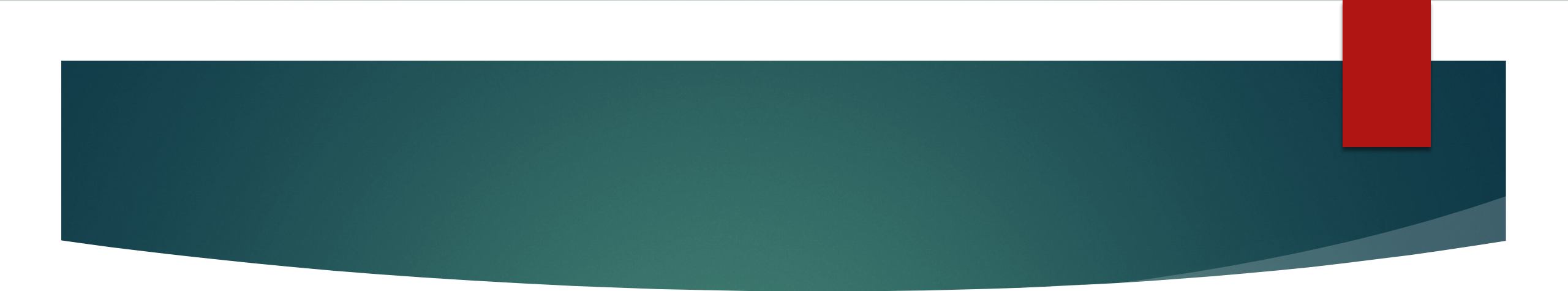


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- ▶ The penis is the male organ of **sexual intercourse**.
    - ▶ The penis has a shaft and enlarged tip called the **glans penis**.
    - ▶ At birth the glans penis is covered by **foreskin**.
    - ▶ Circumcision, the surgical removal of the foreskin is sometimes performed for **cultural reasons or perceived health benefits**.

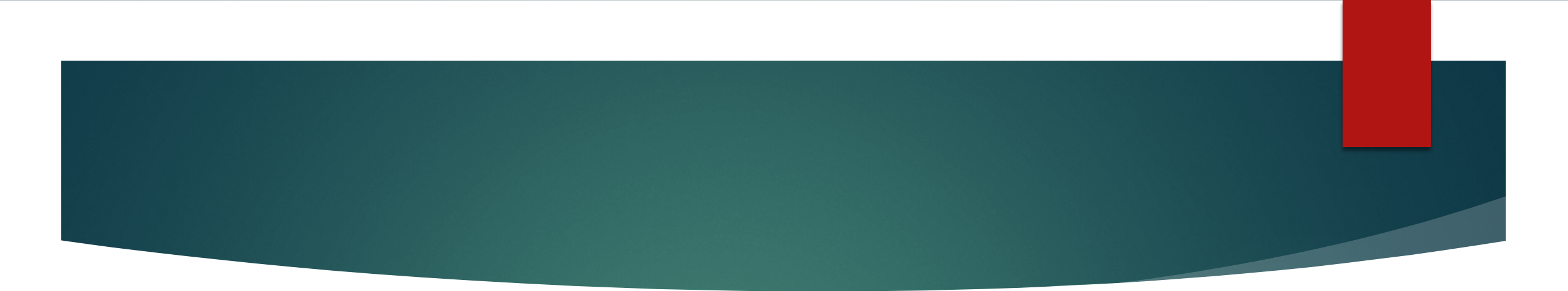


# Erection & Orgasm in Males

- ▶ Spongy erectile tissue containing distensible blood spaces **extends through the shaft of the penis.**
  - ▶ When a man is sexually excited, the arteries in the penis **relax and widen.**
  - ▶ Increased blood flow causes the penis to **enlarge and become erect.**

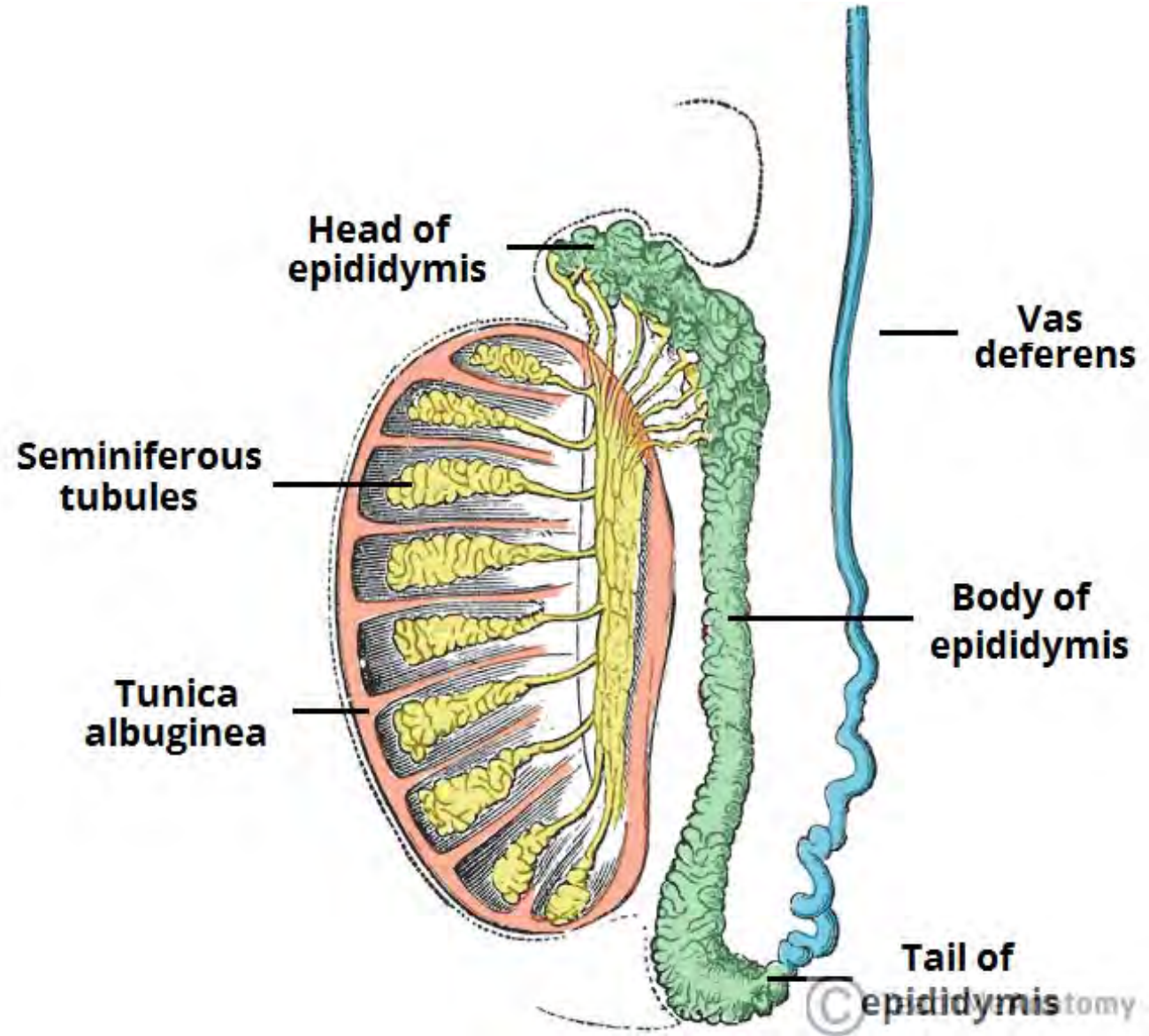
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- ▶ When sexual stimulation intensifies, sperm enter the **urethra from the vas deferens**.
  - ▶ During ejaculation, a sphincter normally closes off the urinary bladder so that **no urine enters the urethra**.
  - ▶ The contractions that expel semen from the penis are **part of the male orgasm**.



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- ▶ Following ejaculation, the penis returns to its **normal flaccid state**.
  - ▶ After ejaculation males typically experience a refractory period, during which time, **stimulation does not bring about an erection**.
  - ▶ There may be in excess of 400 million sperm in approximately **2-6mL of semen**.

# Male Gonads, the Testes

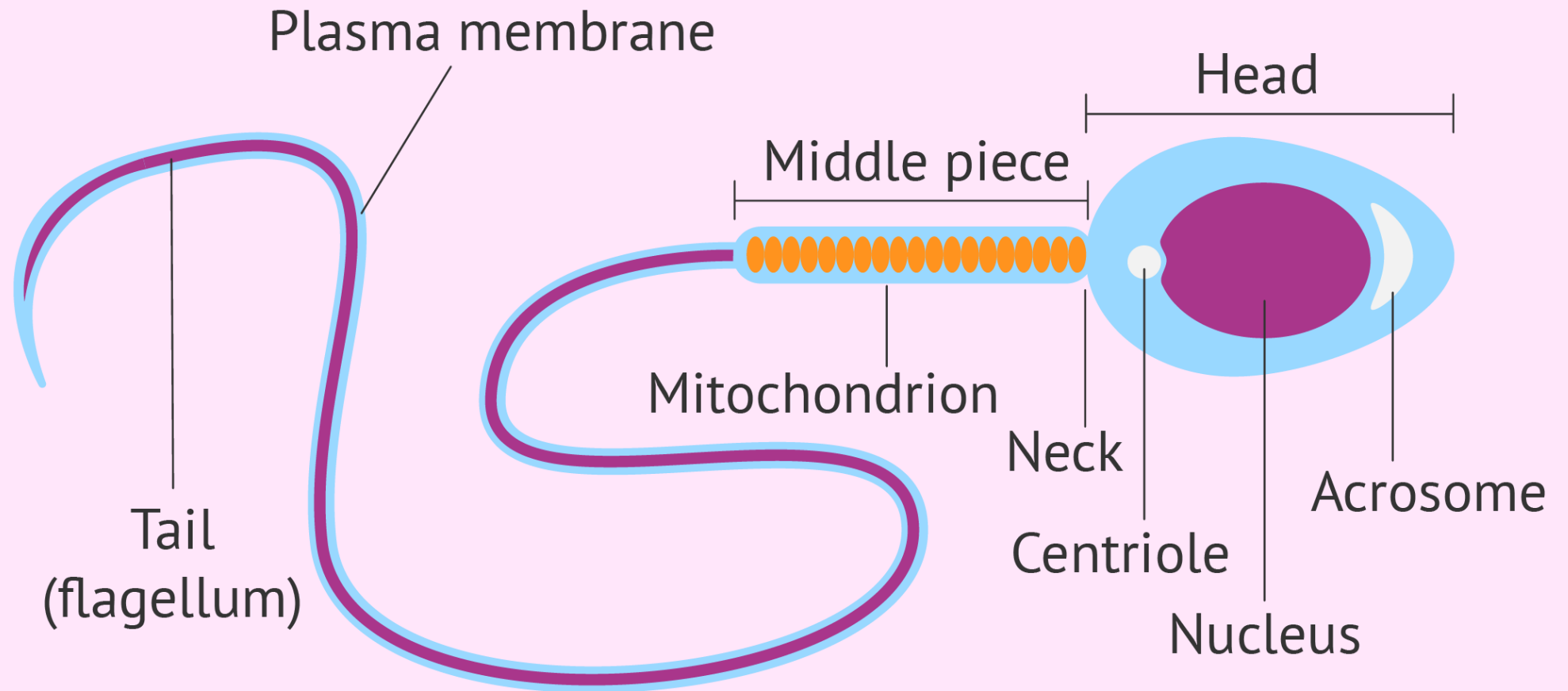
- ▶ The testes, which produce sperm as well as the male sex hormones, lie outside the abdominal cavity, **within the saclike scrotum.**
- ▶ The testes descend outside the abdomen because the internal temperature of the body is **too high to produce viable sperm.**



# *Seminiferous Tubules*

- ▶ Testis are composed of compartments called lobules, each of which contains **1-3 seminiferous tubules**.
  - ▶ Spermatogenesis is the production of **sperm**.
  - ▶ Sertoli cells support nourish, and regulate the **spermatogenic cells**.
  - ▶ Mature sperm have a **head, a middle piece, and a tail**.
  - ▶ Mitochondria in the middle piece is where ATP is produced so the tail(flagellum) **can propel sperm forward**.
  - ▶ The head contains a nucleus covered by a cap called the acrosome, which stores **enzymes needed to penetrate the egg**.



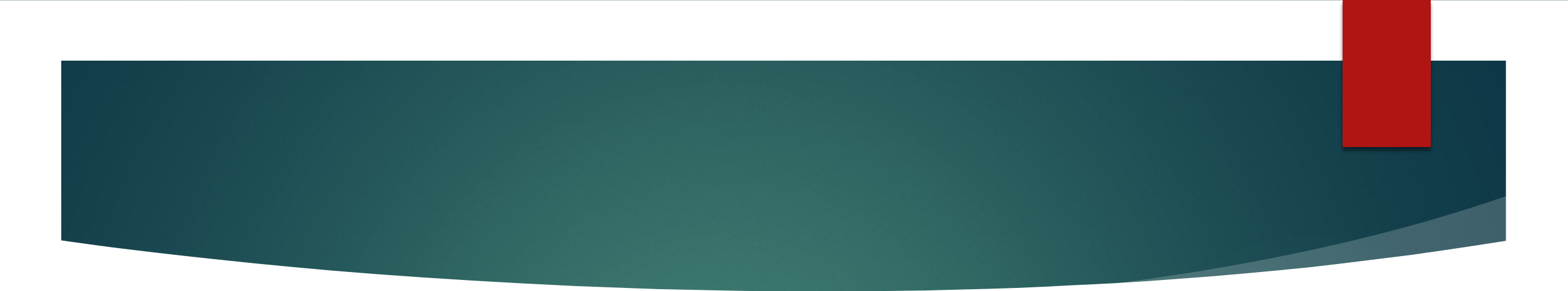


# *Interstitial Cells*

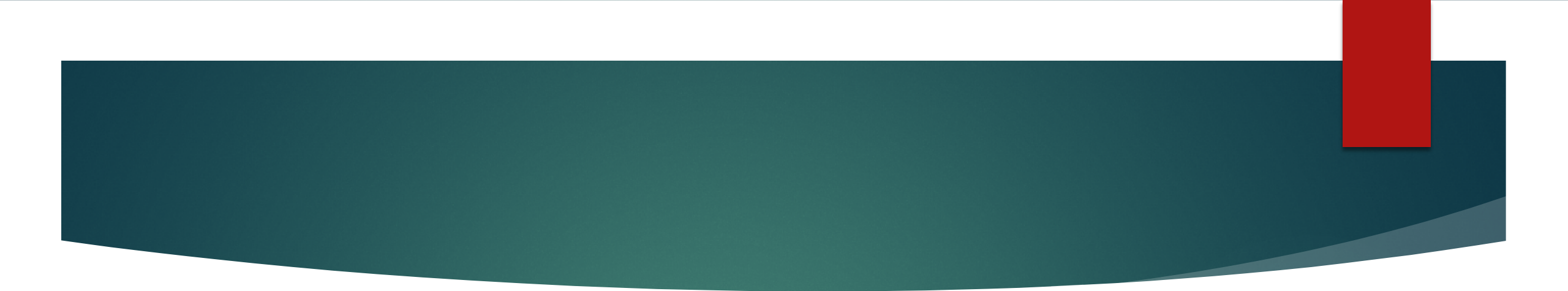
- ▶ The male sex hormones are secreted by cells that lie **between the seminiferous tubules**.
- ▶ **They are called the interstitial cells**, testosterone is one of the hormones secreted here.

# Hormone Regulation in Males

- ▶ The hypothalamus controls the **glandular secretions of the pituitary gland.**
  - ▶ The pituitary is broken into the **anterior and posterior pituitary.**
- ▶ The hypothalamus has the ultimate control of the testes function because it secretes **gonadotropin-releasing hormone (GnRH).**
  - ▶ This signals the anterior pituitary to secrete **gonadotropic hormones.**

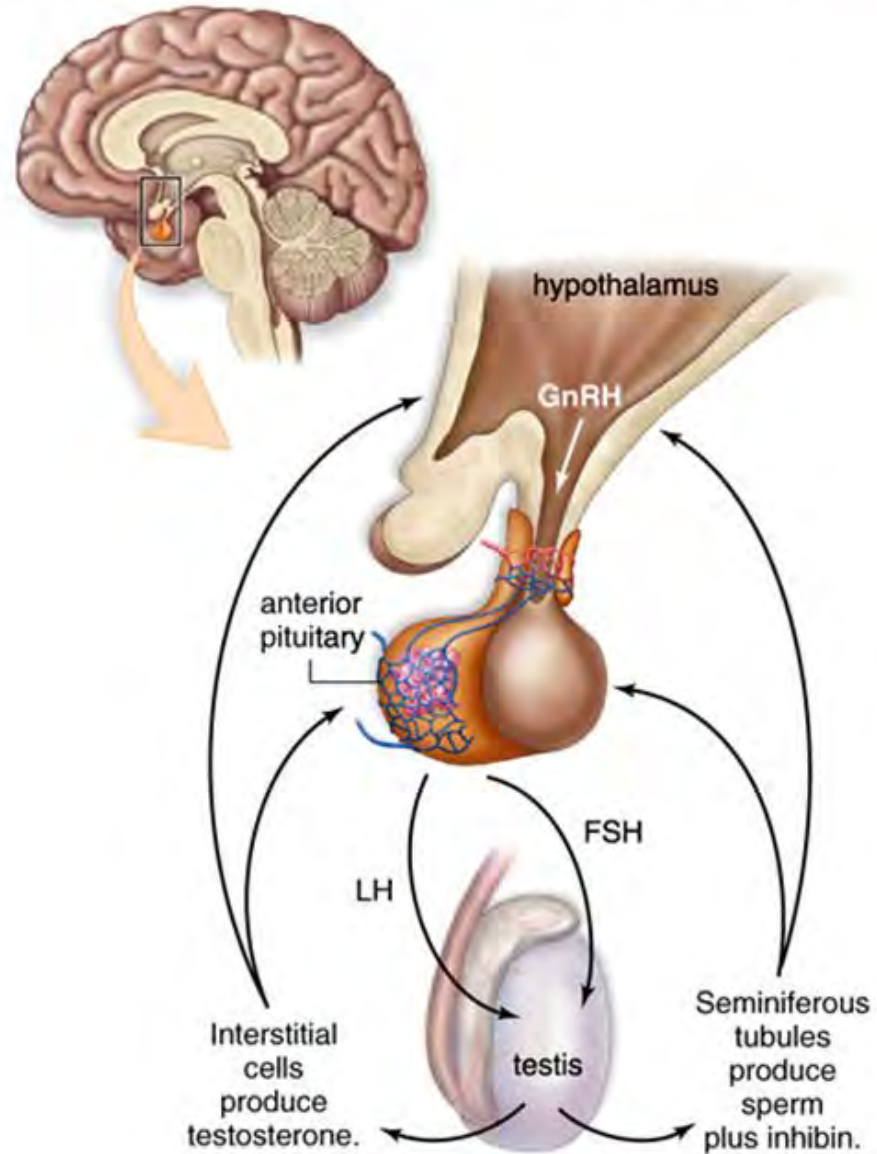
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- ▶ There are 2 gonadotropic hormones:
    - ▶ **Follicle-stimulating hormone (FSH)**
    - ▶ **Luteinizing hormone (LH)**
  - ▶ In males (FSH) promotes **sperm production**.
    - ▶ Once enough sperm are produced, the hormone **inhibin** inhibits further FSH release.



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- ▶ LH in males controls the production of testosterone by **interstitial cells**.
    - ▶ All these hormones are involved in a negative feedback relationship that maintains the **production of sperm and testosterone**.
  - ▶ Testosterone is the main sex hormone in males and is essential for the normal development and **functioning of male sex organs**.

# Hormonal Control of Testes

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## 9.2 – FEMALE REPRODUCTIVE SYSTEM

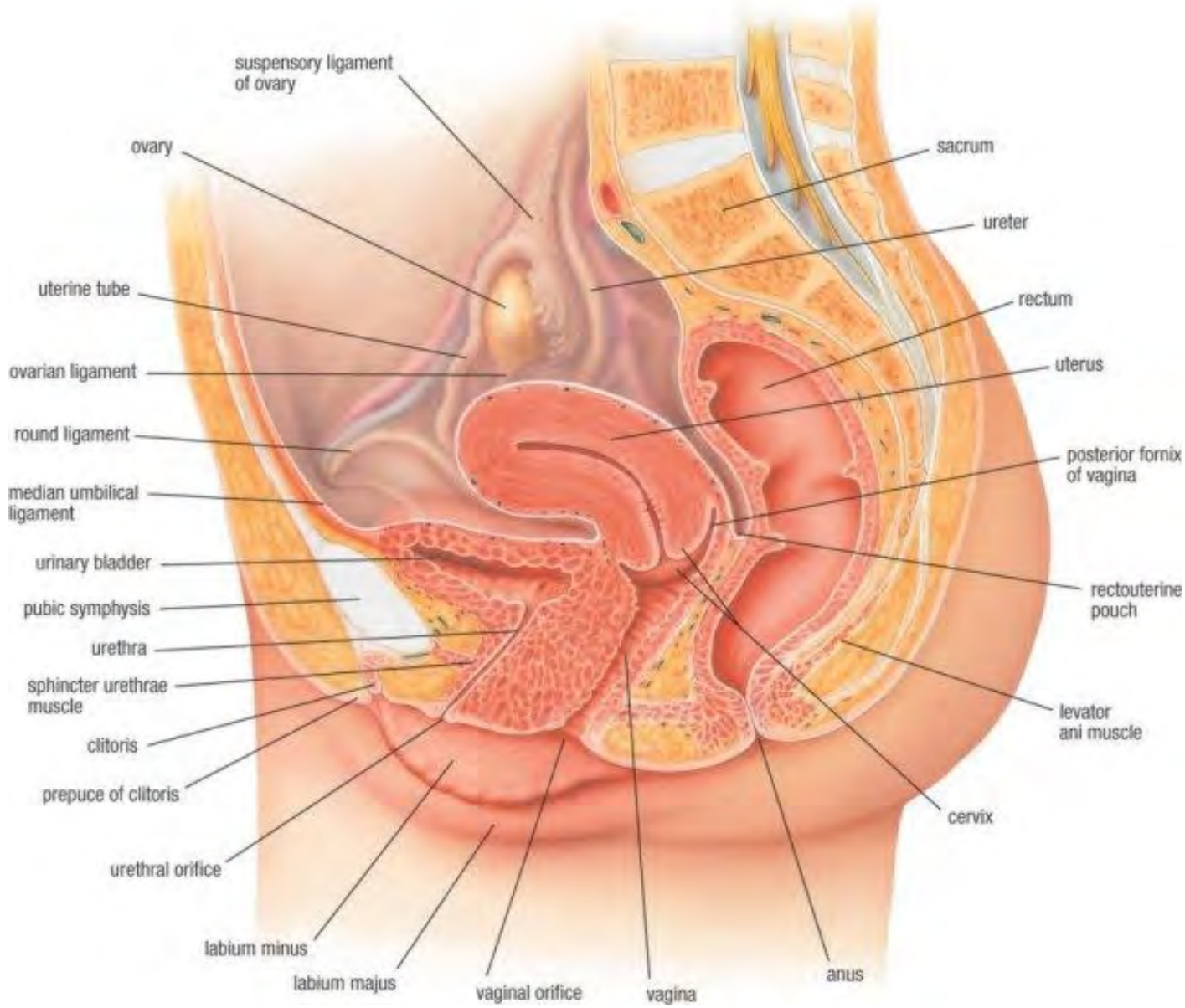
- ▶ The female gonads are paired ovaries that are on each side of the **upper pelvic cavity**.
  - ▶ Oogenesis is the production of an egg, **the female gamete**.
  - ▶ The ovaries usually alternate in producing **one egg per month**.
  - ▶ Ovulation is the process by which an egg bursts from an **ovary and enters an oviduct**.

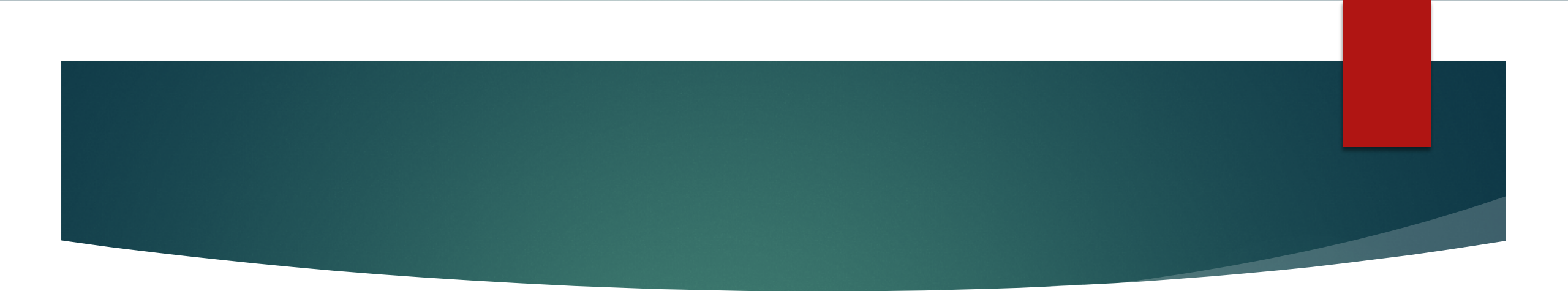
# The Genital Tract

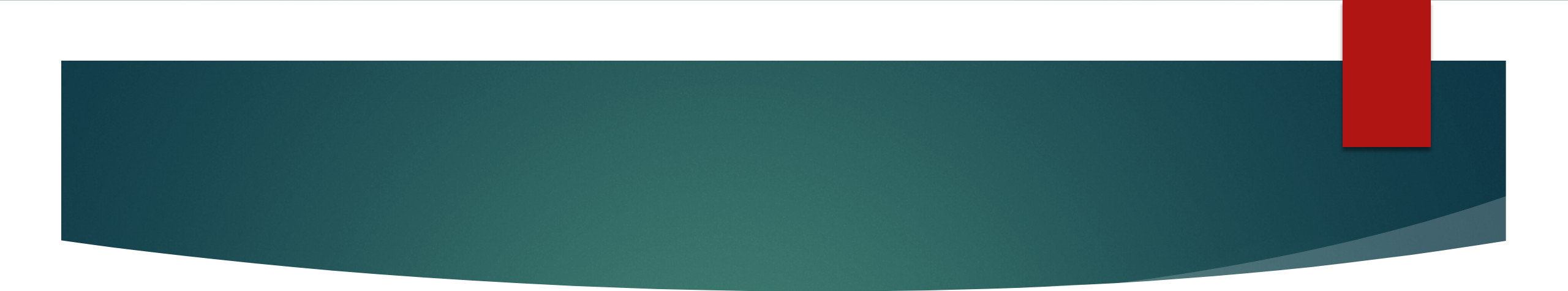
- ▶ Oviducts, or fallopian tubes, extend from the **uterus to the ovaries**.
  - ▶ However they are not attached to the ovaries, instead they have fingerlike projections called fimbriae that **sweep over the ovaries**.
  - ▶ Once the egg is in the oviduct it is propelled slowly by ciliary movement, it only lives approximately **6-24 hours unless fertilization occurs**.



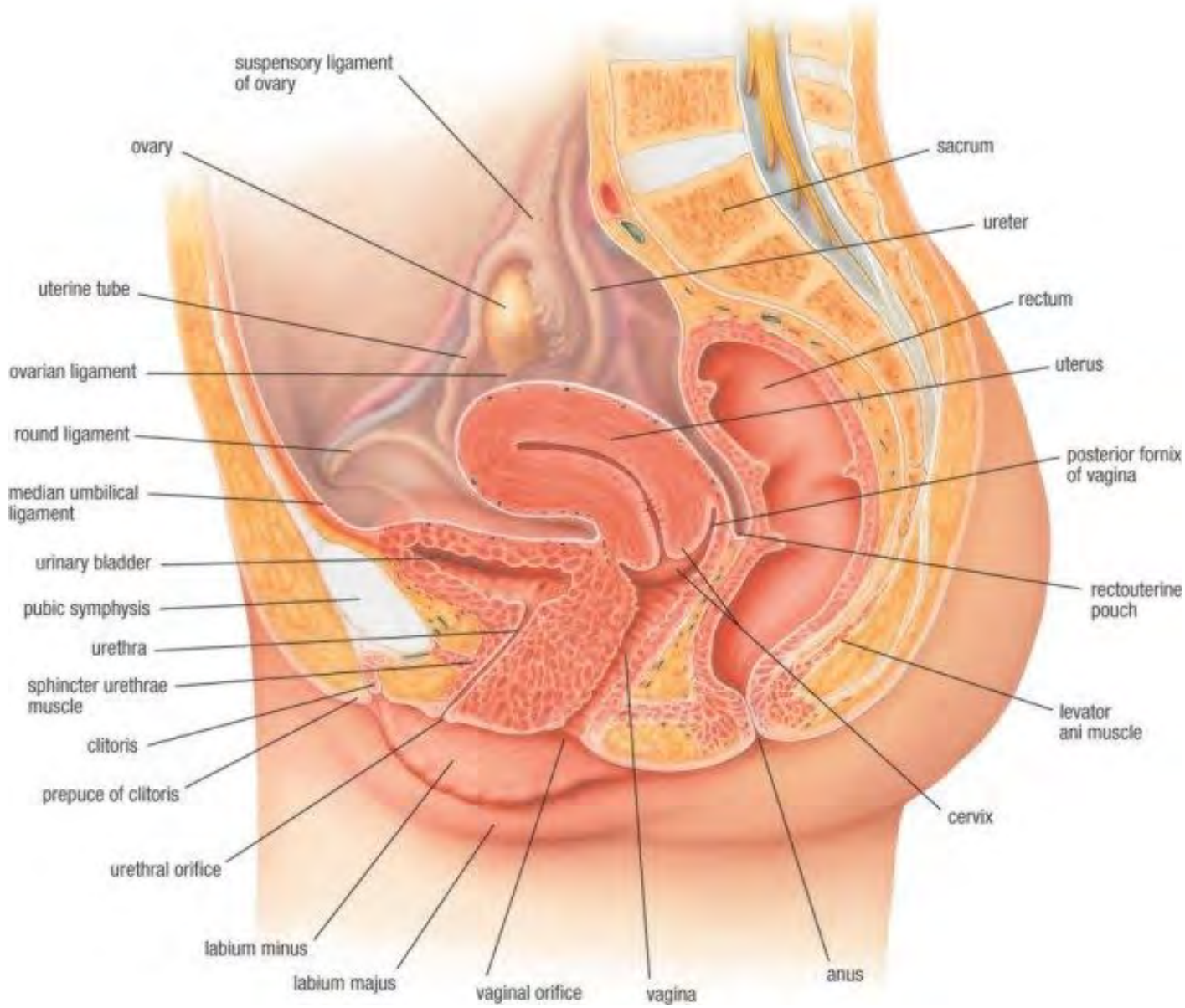
# FEMALE UROGENITAL SYSTEM (MIDSAGITTAL VIEW)



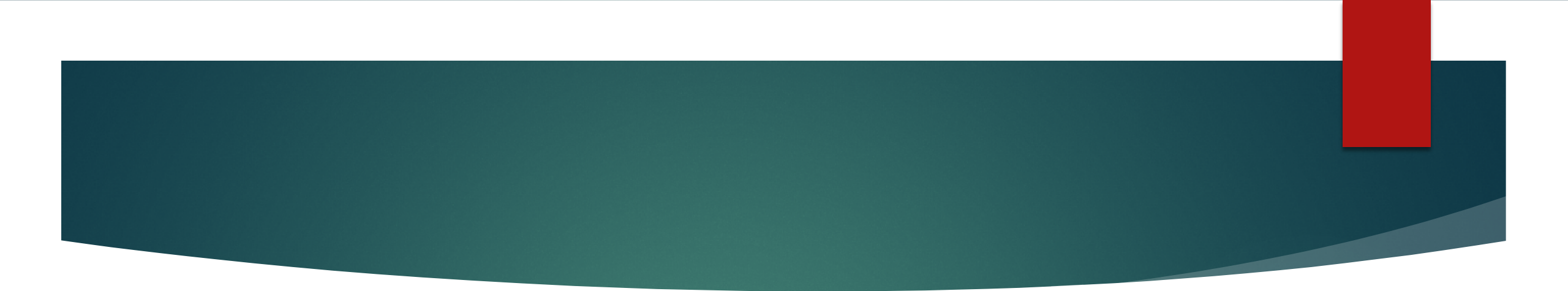
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- ▶ Fertilization, or the formation of a zygote, takes place in the **oviduct**.
  - ▶ The developing embryo normally arrives at the uterus after several days, and **implants itself in the uterine lining**.

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- ▶ The uterus is a thick-walled, muscular organ about the **size and shape of an inverted pear**.
  - ▶ The oviducts join the uterus at its upper end, at the lower end the cervix connects with the **vagina at nearly a right angle**.

# FEMALE UROGENITAL SYSTEM (MIDSAGITTAL VIEW)

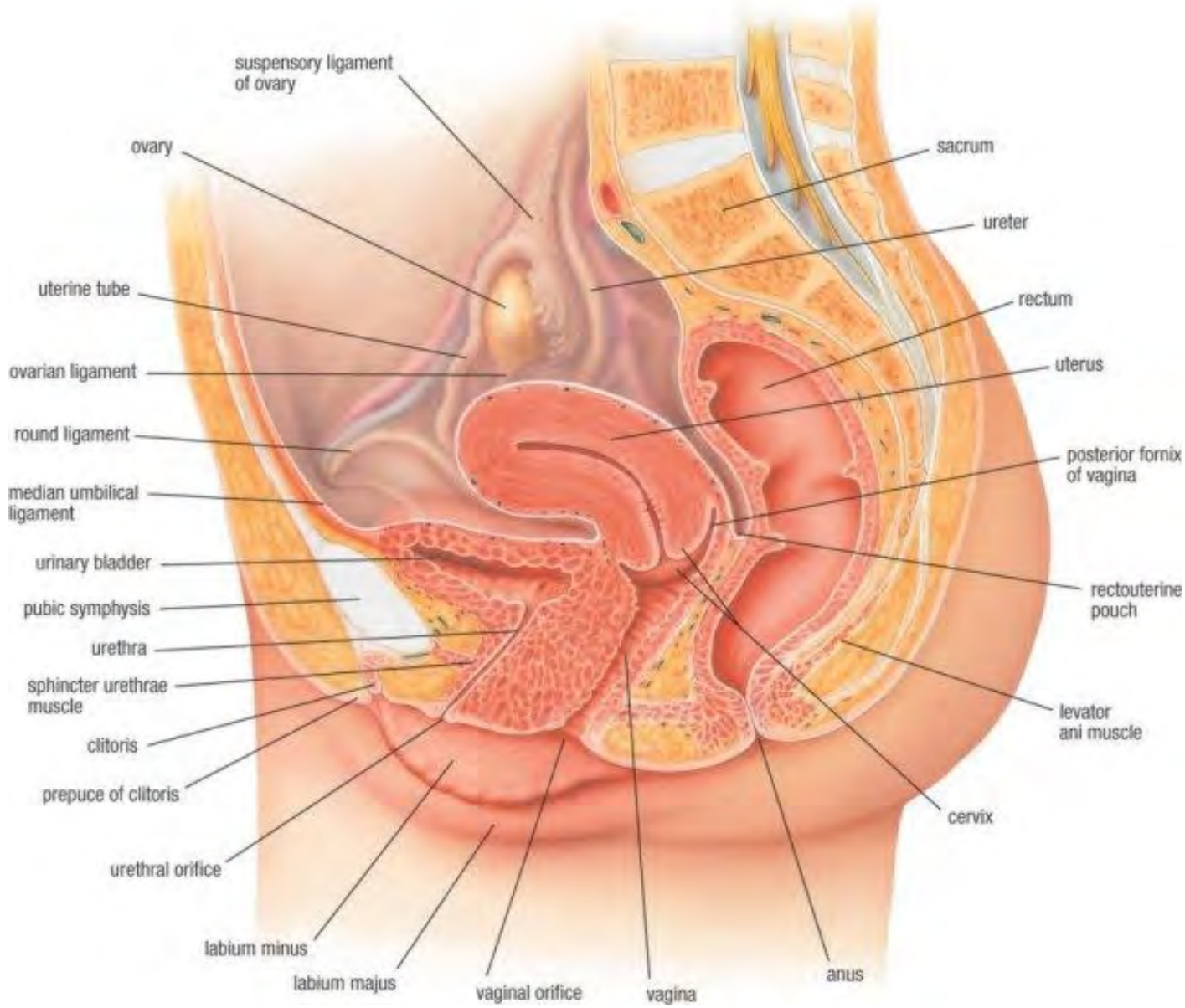




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- ▶ Development of the embryo normally takes place in the **uterus**.
    - ▶ The lining of the uterus, **called the endometrium**, participates in the formation of the placenta.
  - ▶ A small opening in the cervix leads to the **vaginal canal**.
  - ▶ The vagina is a tube that lies at a 45 degree angle to the small of the back.
    - ▶ It serves as the **birth canal**, facilitates sexual intercourse, and acts as the exit for menstrual flow.

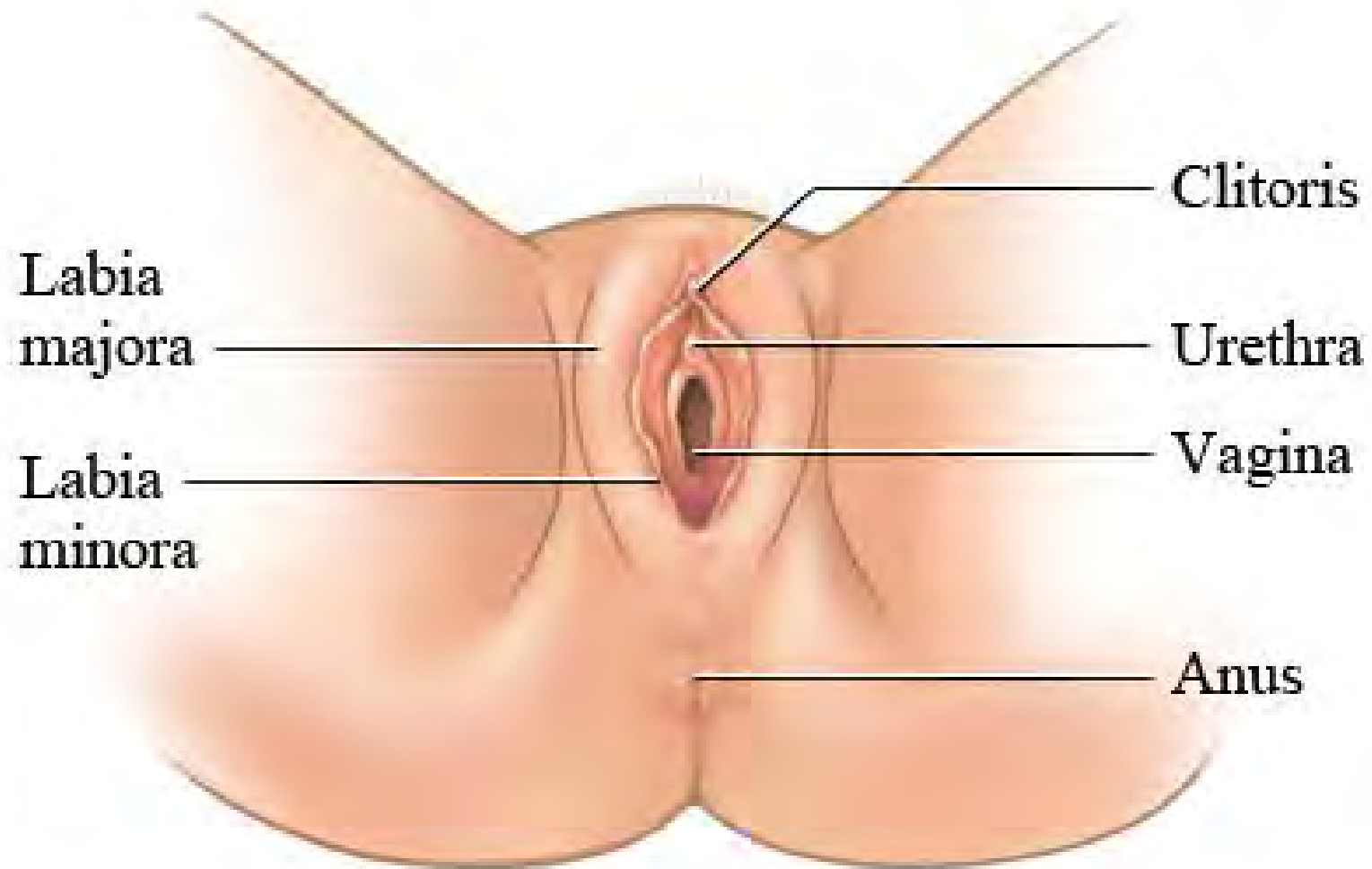


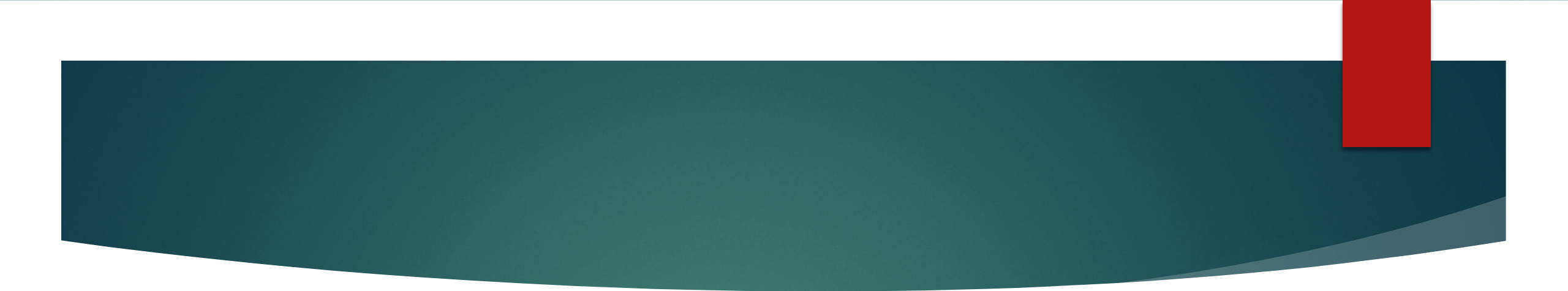
# FEMALE UROGENITAL SYSTEM (MIDSAGITTAL VIEW)



# External Genitals

- ▶ The external organs of the female are collectively known as the **vulva**.
  - ▶ There is the **outer labia majora**, and the inner **labia minora**.
  - ▶ The **glans clitoris** the external part of the clitoris.
  - ▶ Below the clitoris is the **urethra**, and below that is the **vagina**.



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- ▶ The urinary and reproductive systems in the female are **entirely separate**.
  - ▶ The urethra carries only urine, and the vagina serves only as the **birth canal and the organ for sexual intercourse**.

# Orgasm in Females

- ▶ Upon sexual stimulation, the labia minora, the vaginal wall, and the clitoris become **engorged with blood**.
  - ▶ The breasts also swell and the nipple become erect.
  - ▶ The vagina expands and elongates, blood vessels in the vaginal wall release **small droplets of fluid that lubricate it**.
  - ▶ Orgasm occurs at the **height of sexual response**.

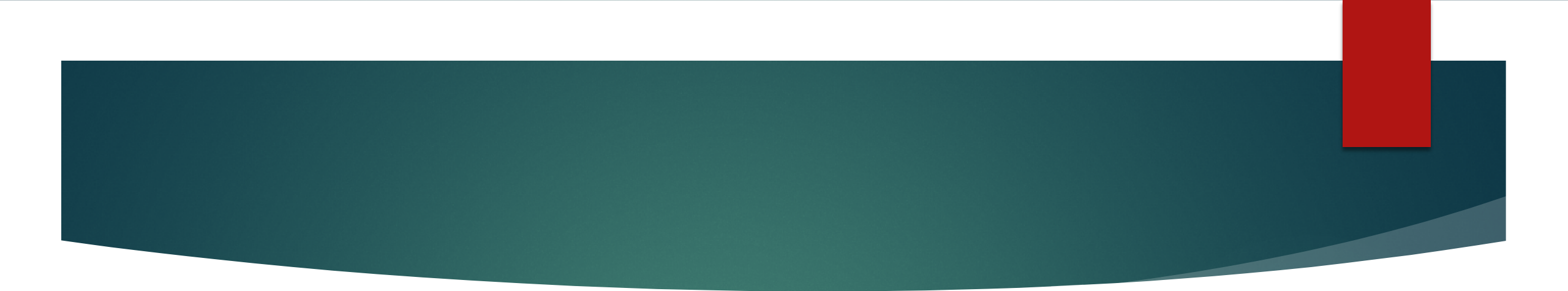


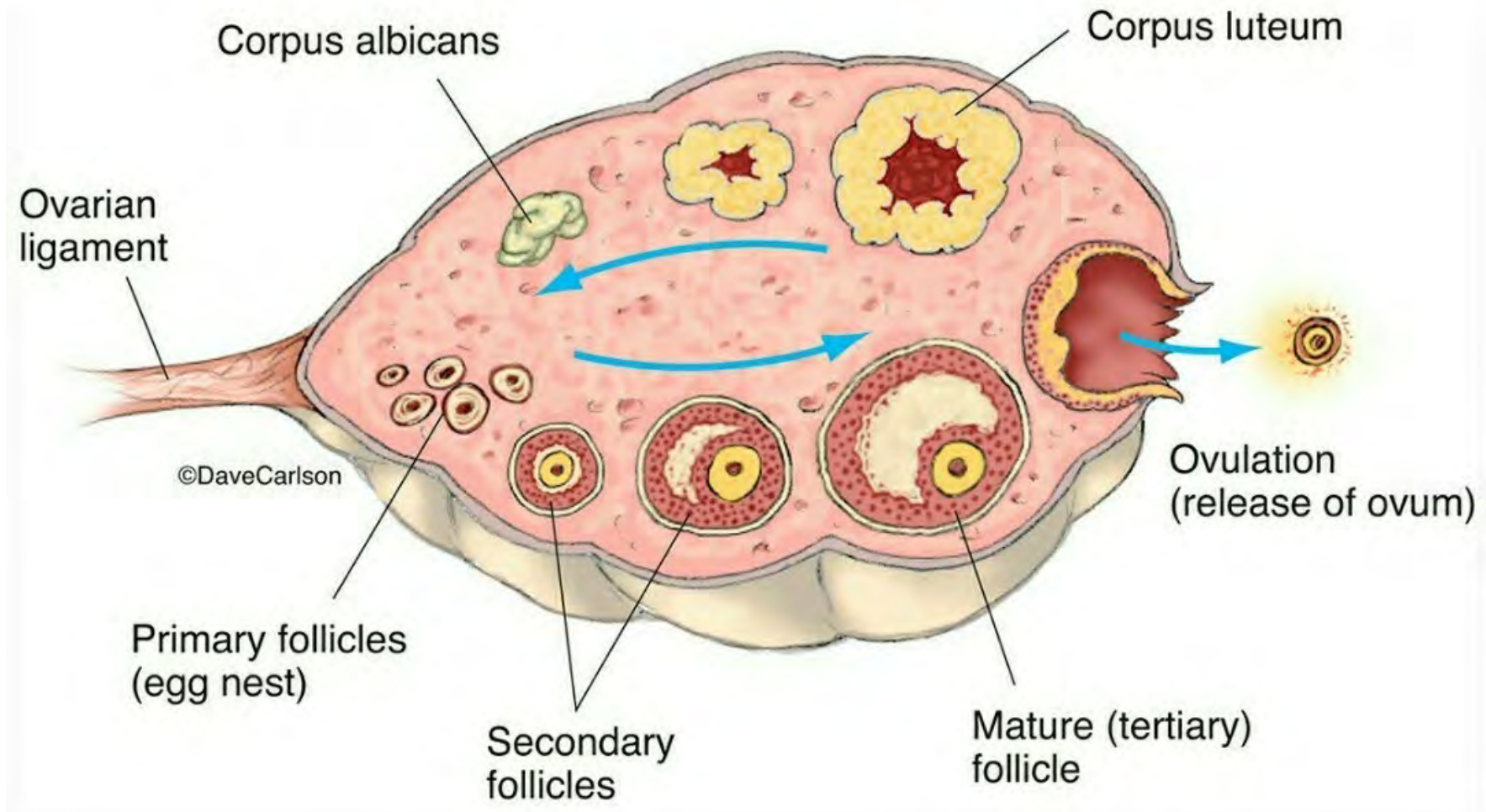
## 9.3 – OVARIAN & UTERINE CYCLES

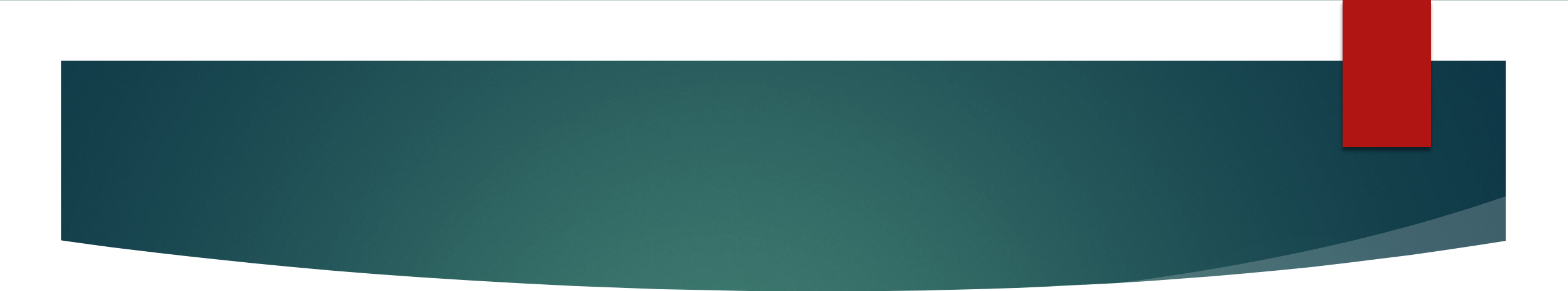
- ▶ Hormone levels cycle in females on a monthly basis, and the **ovarian cycle drives the uterine cycle**.

# The Ovarian Cycle

- ▶ The ovary is made up of an **outer cortex and an inner medulla**.
  - ▶ The cortex has many follicles that contain an **immature egg**.
  - ▶ A female is born with all the ovarian follicles she will ever have, approximately **700,000**.
  - ▶ However only approximately **400 of these will ever mature**.
  - ▶ Because these immature eggs are present at birth **they age as the woman ages**.

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- ▶ The ovarian cycle occurs as a follicle changes from a **primary to a secondary vesicular follicle**.
    - ▶ As a follicle matures, **oogenesis is initiated and continues**.
    - ▶ The vesicular follicle bursts, releasing the secondary oocyte. **This is ovulation**.
    - ▶ Once a vesicular follicle has lost the secondary oocyte, it develops into a **corpus luteum**.

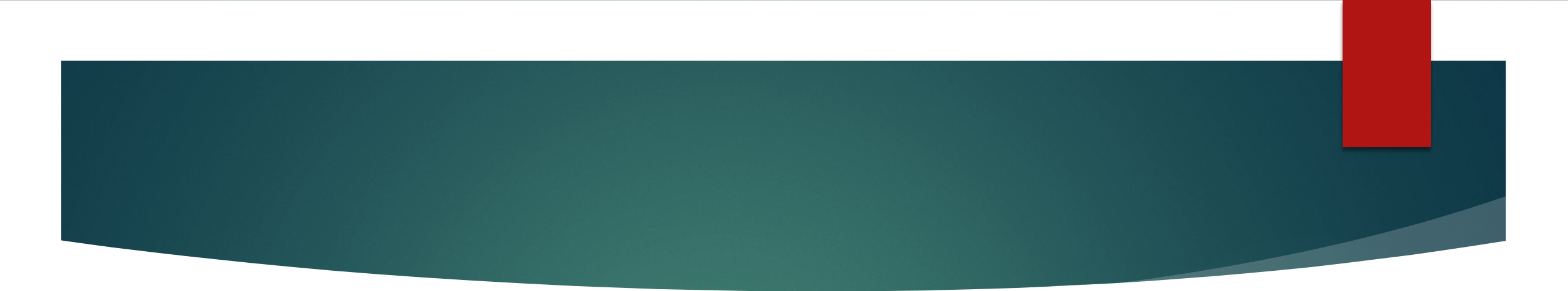


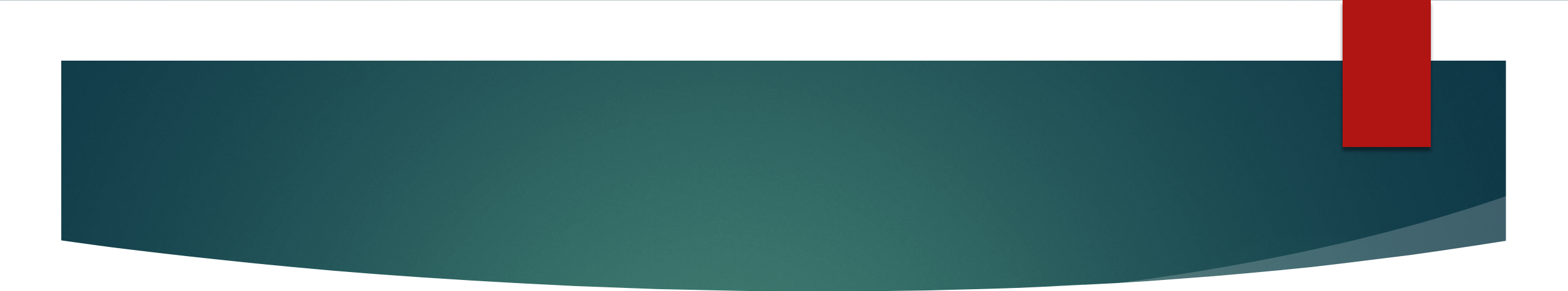
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- ▶ The secondary oocyte enters a **uterine tube**.
  - ▶ If a sperm enters the secondary oocyte, **fertilization occurs**.
  - ▶ When the sperm nucleus unites with the egg nucleus, **a zygote is produced**.
  - ▶ If zygote formation does not occur, the corpus luteum begins to degenerate **after 10 days**.



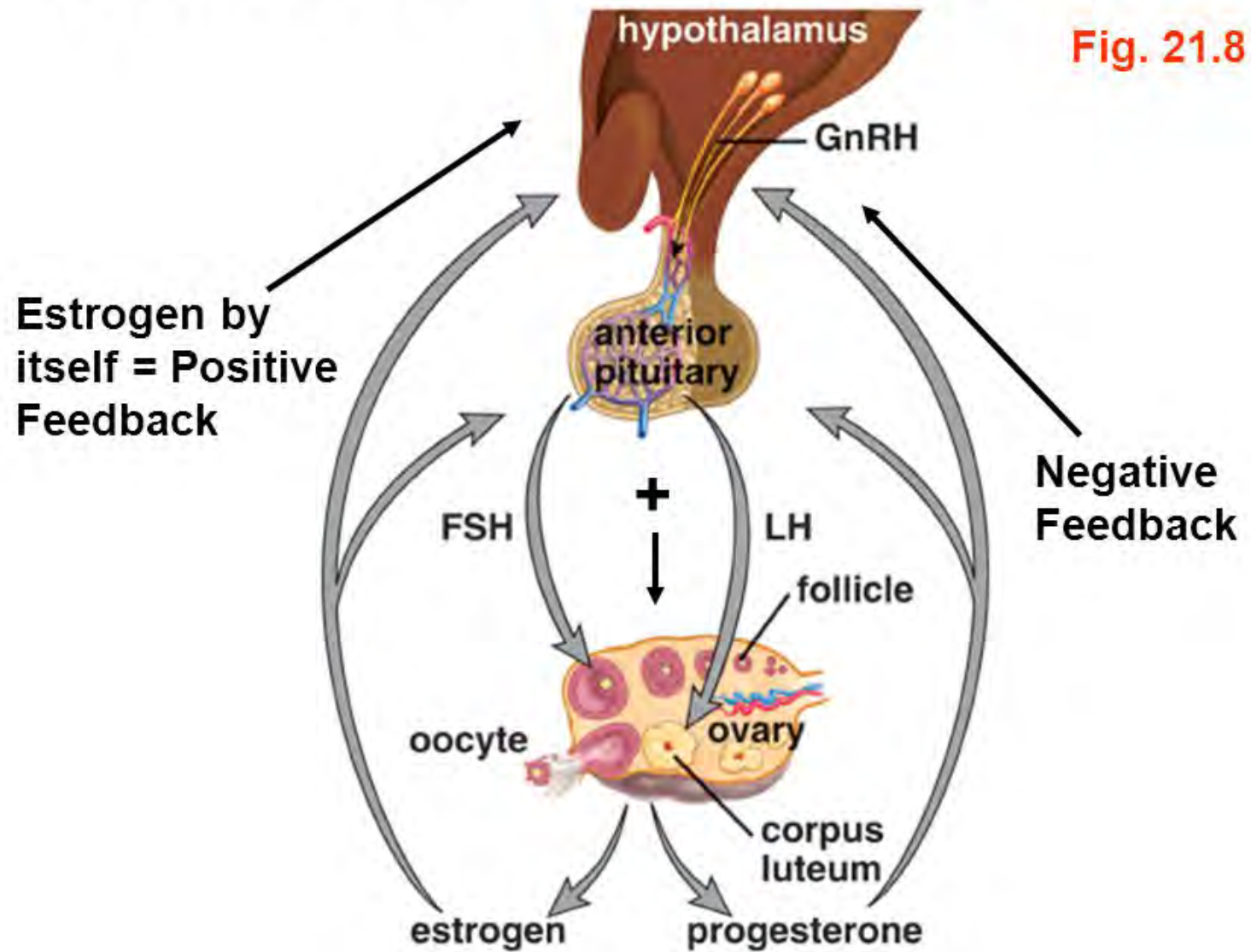
# *Phases of the Ovarian Cycle*

- ▶ The ovarian cycle is commonly divided into two phases.
  - ▶ The first half is the **follicular phase**.
  - ▶ The second is the **luteal phase**.
- ▶ During the follicular phase, FSH produced by the anterior pituitary, promotes the development of a **follicle in the ovary**, which secretes some **estrogen and progesterone**.

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- ▶ As the estrogen level rises, it exerts negative feedback control over the secretion of FSH so the **follicular phase comes to an end.**
  - ▶ An estrogen spike causes a sudden secretion of a large amount of **GnRH from the hypothalamus.**
  - ▶ This is positive feedback the leads to a surge of **LH, which causes ovulation.**

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- ▶ Now the luteal phase begins.
    - ▶ During this phase, LH promotes the **development of the corpus luteum**, which secretes progesterone and estrogen.
    - ▶ As the level of progesterone rises, it exerts feedback over LH secretion so that the **corpus luteum begins to degenerate**.
    - ▶ As the luteal phase comes to an end, the low levels of progesterone and estrogen **cause menstruation to begin**.

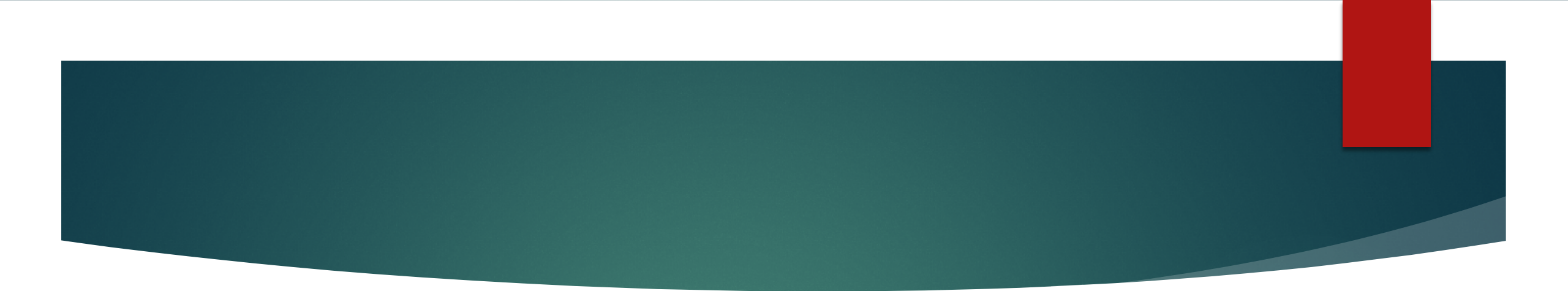
# Hormonal control of ovaries



# The Uterine Cycle

- ▶ The female sex hormones estrogen & progesterone have numerous functions.
  - ▶ One of their functions is to affect the **endometrium**, causing the uterus to undergo a cyclical series of events known as the **uterine cycle**.
- ▶ **28 day cycles** are divided as follows:

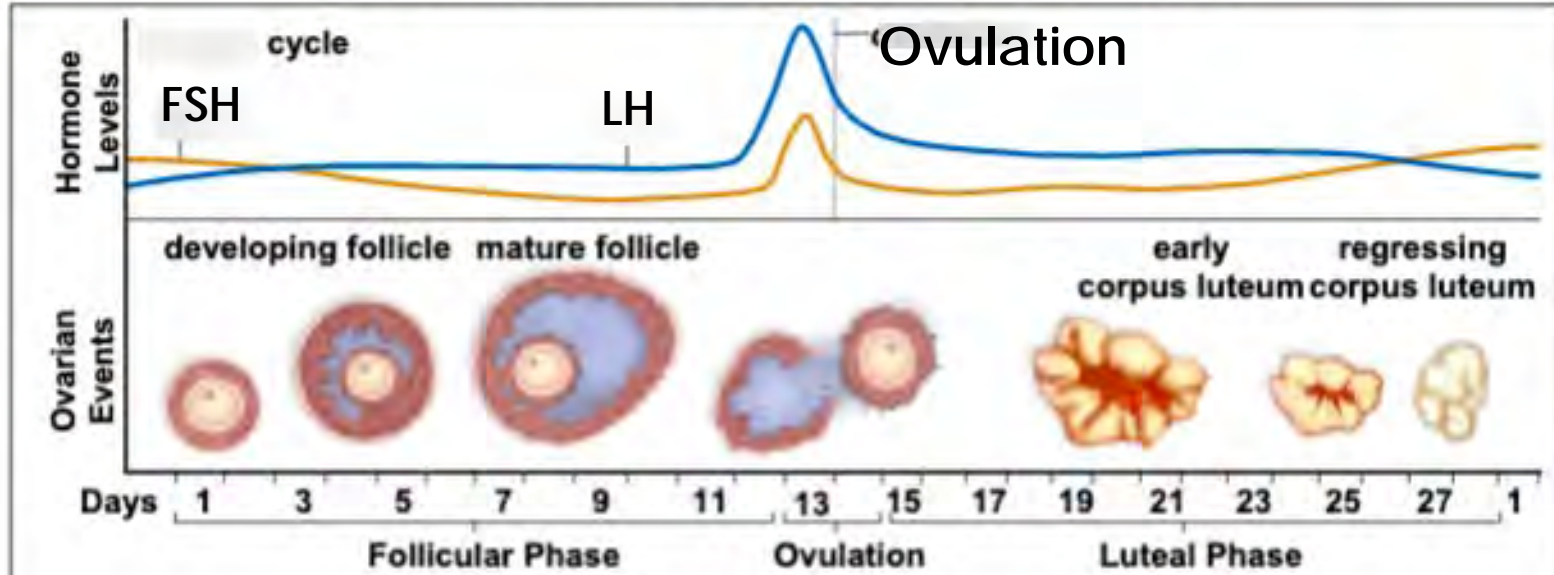


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- ▶ *Days 1-5*: a low level of female sex hormones in the body causes the **endometrium to disintegrate, and blood vessels rupture.**
  - ▶ On day 1 of the cycle, a flow of blood and tissues passes out of the vagina during **menstruation.**

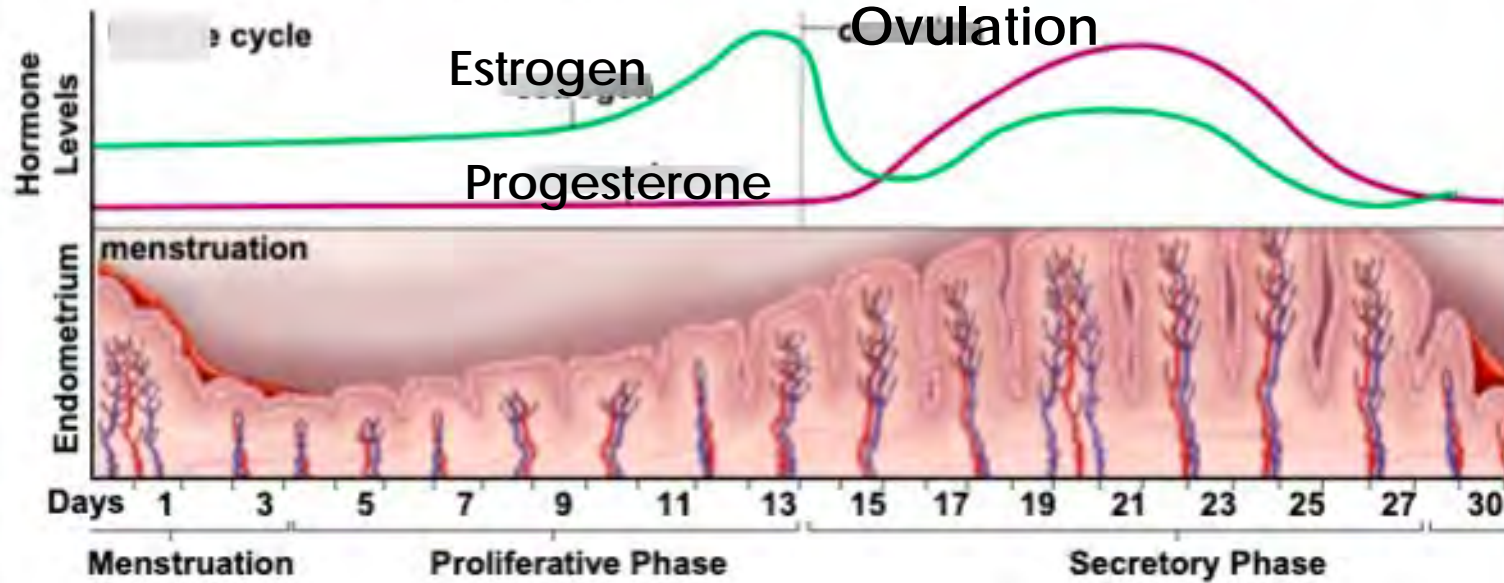
# Hormones in the ovarian and uterine phases

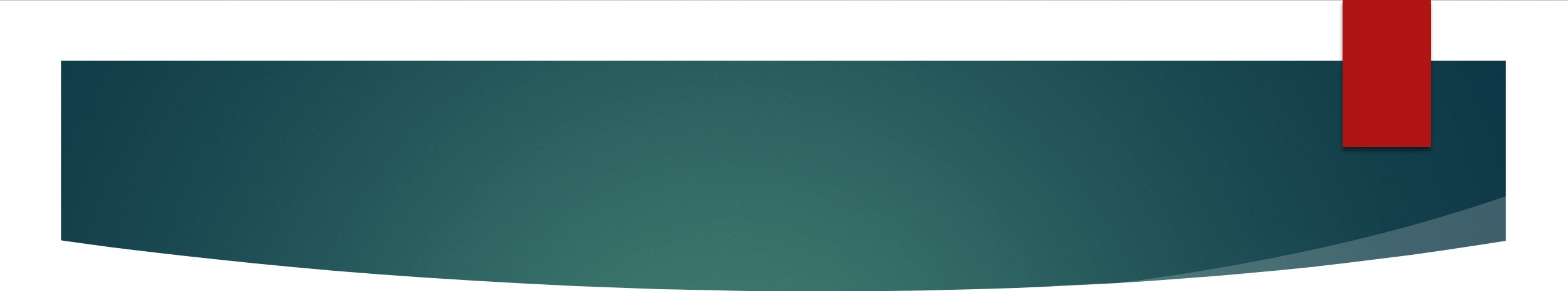
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Ovarian cycle



Uterine cycle



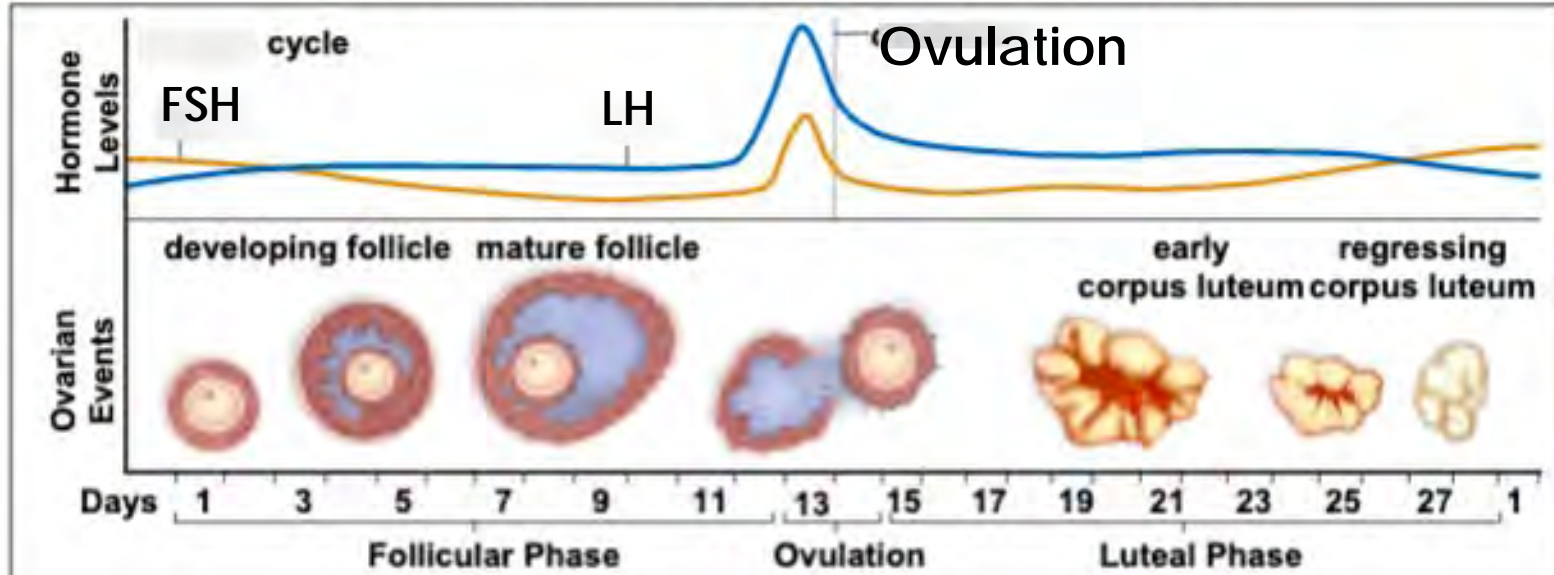
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- ▶ *Days 6-13*: increased production of estrogen by a new ovarian follicle in the ovary causes the **endometrium to thicken**.
    - ▶ This is called the **proliferative phase**.



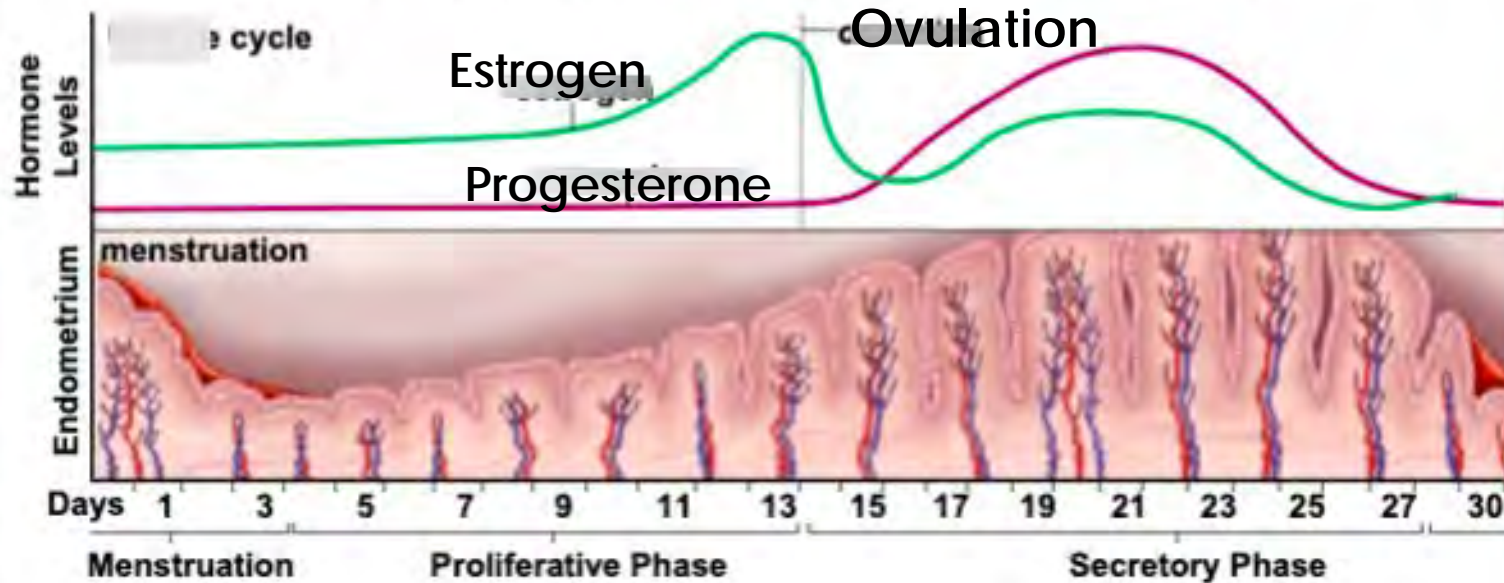
# Hormones in the ovarian and uterine phases

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Ovarian cycle

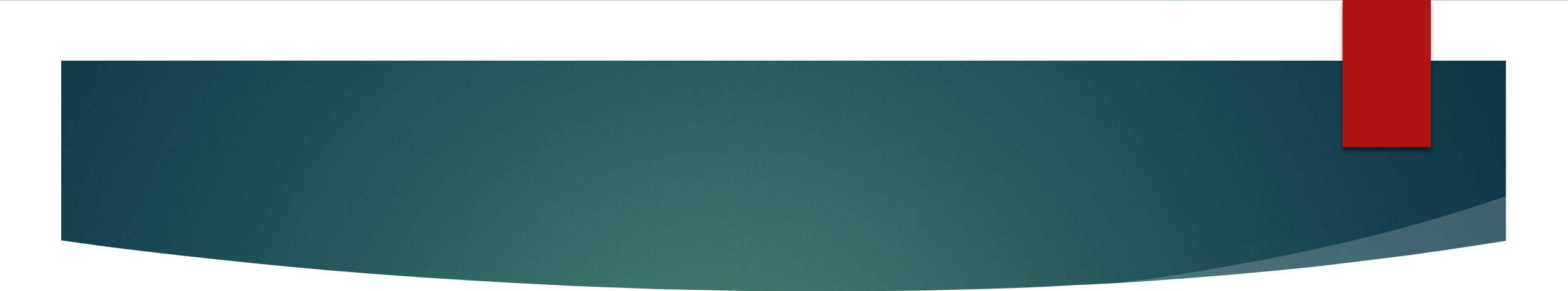


Uterine cycle



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- ▶ *Day 14*: ovulation usually occurs in the ovary.

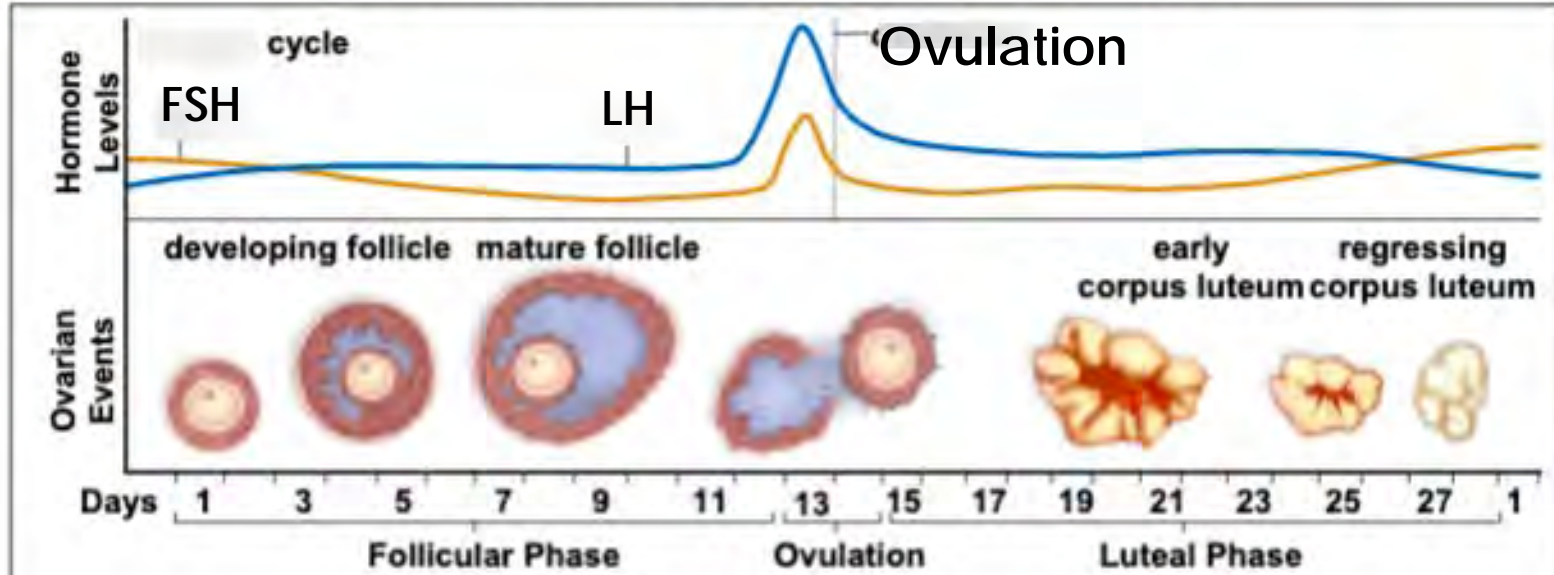


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- ▶ **Days 15-28:** increased production of progesterone by the corpus luteum in the ovary causes the **endometrium to double or triple in thickness.**
    - ▶ This is called the **secretory phase** of the uterine cycle.
    - ▶ The endometrium is now prepared to **receive the embryo.**
    - ▶ If this does not occur, the level of sex hormones results in the endometrium **breaking down during menstruation.**

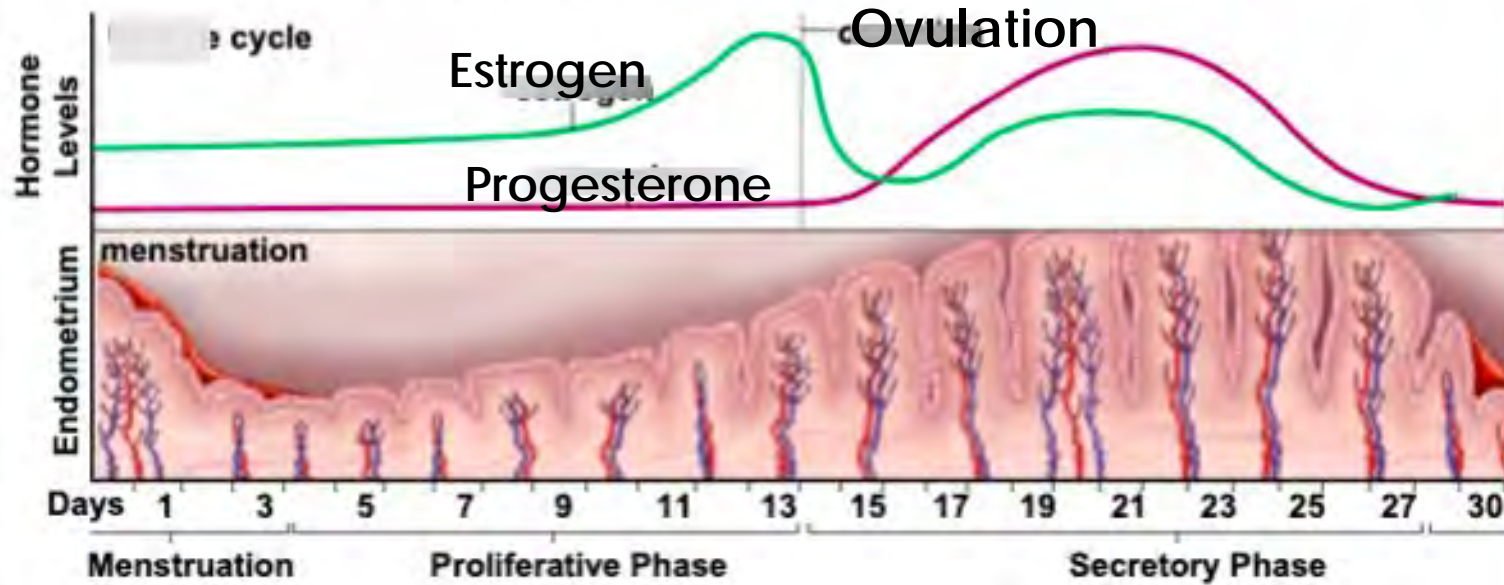
# Hormones in the ovarian and uterine phases

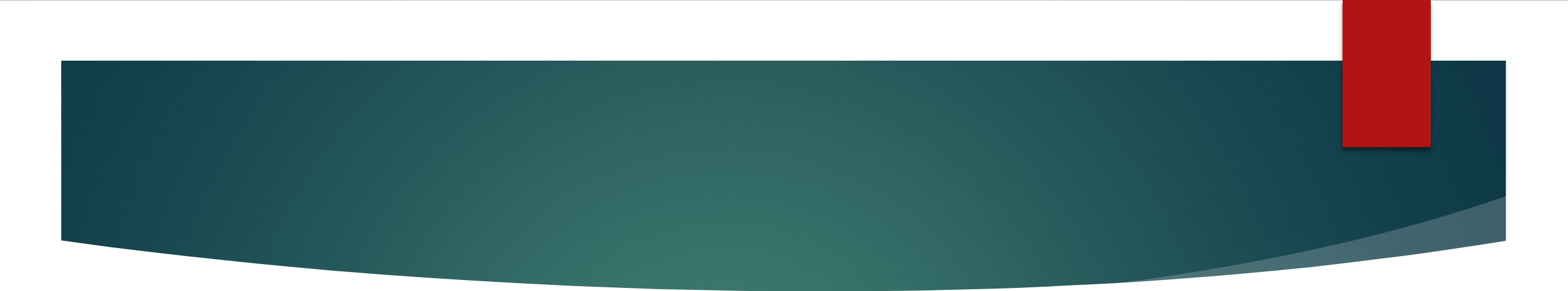
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Ovarian cycle



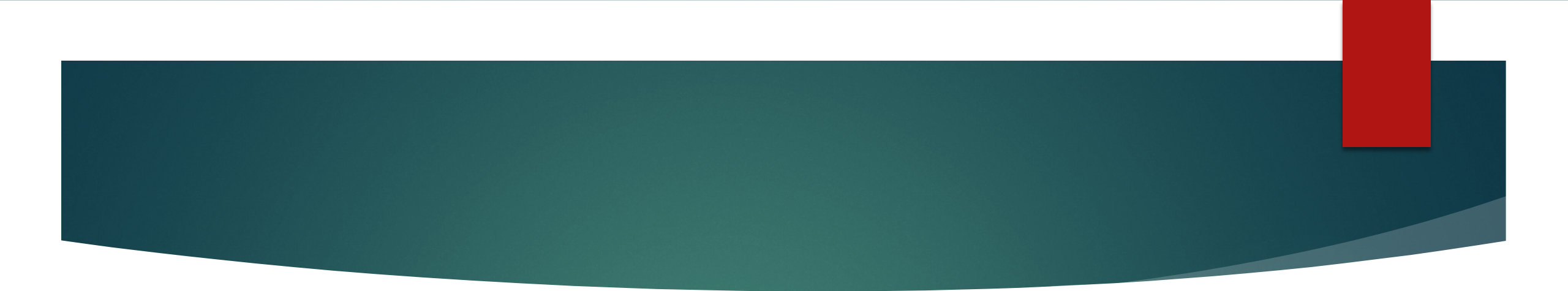
Uterine cycle



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- ▶ Estrogen and progesterone affect not only the uterus but **other parts of the body as well.**
    - ▶ Estrogen is largely responsible for **secondary sex characteristics** in females.
    - ▶ In general, females have a more rounded appearance than males because of greater **fat accumulation under the skin.**
    - ▶ The pelvic girdle becomes **wider and deeper.**
    - ▶ Both estrogen and progesterone are **required for breast development.**

# Menstruation

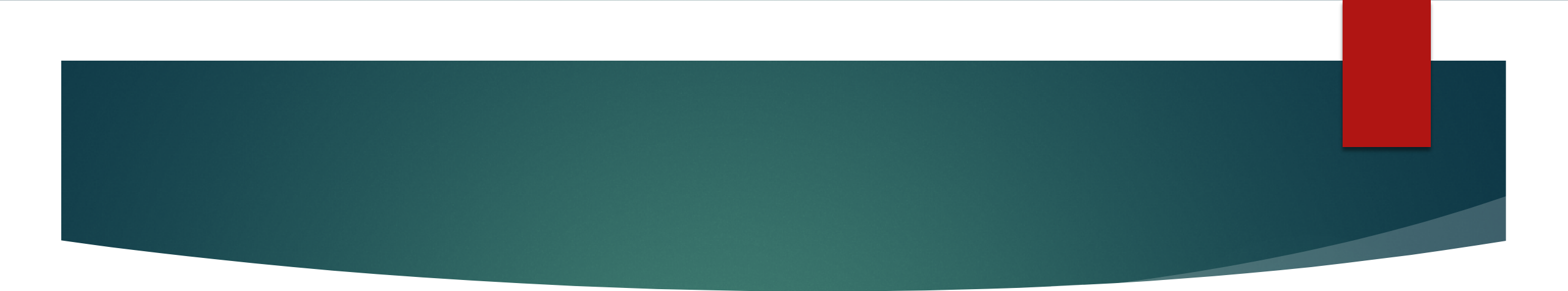
- ▶ During menstruation, arteries constrict, and the **capillaries weaken**.
  - ▶ Blood spilling from the damaged vessels **detaches layers of the lining**.
  - ▶ Endometrium mucus, and blood descend from the uterus and through the vagina.
  - ▶ Normally menstruation lasts from **3-10 days**.
  - ▶ Some **abdominal cramping, breast tenderness, and moodiness** are normal during the menstrual period.

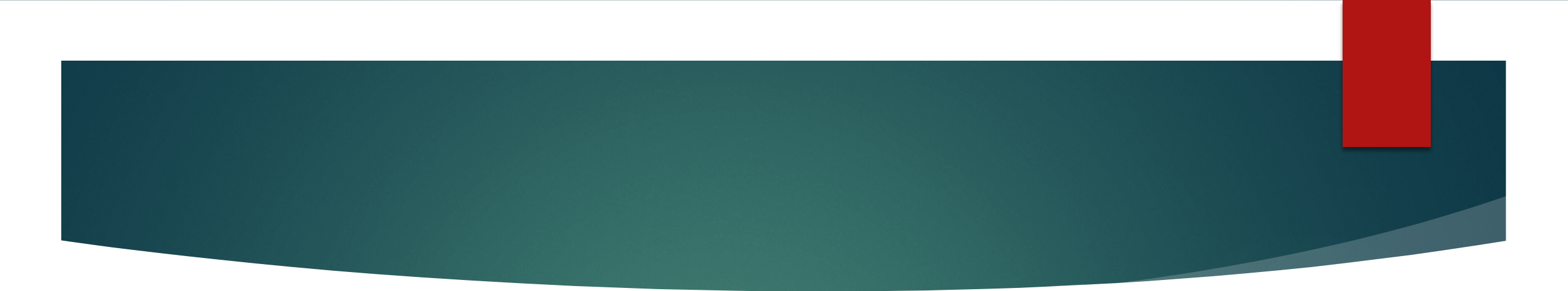
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- ▶ In the uterus, **prostaglandins cause muscles to contract.**
  - ▶ They are implicated in the **pain and discomfort** of menstruation experienced by some women.



# Fertilization & Pregnancy

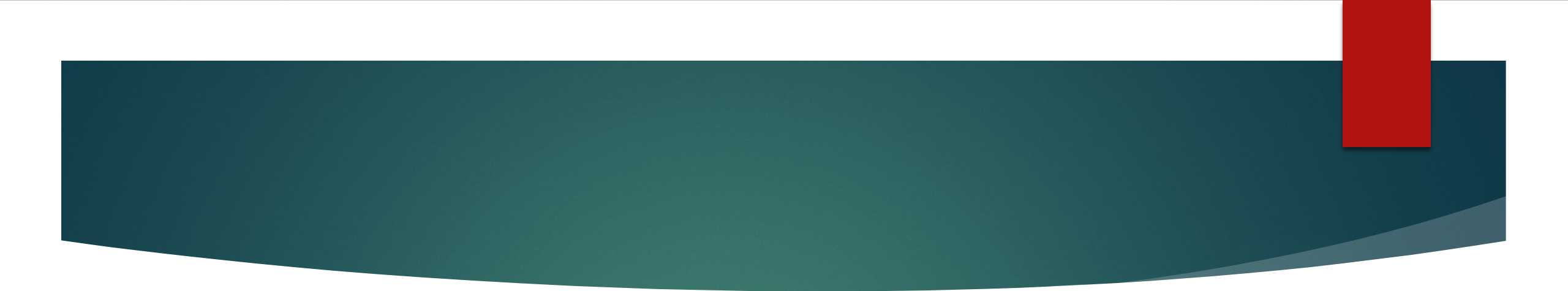
- ▶ If fertilization does occur, an embryo begins development even as it travels **down the uterine tube to the uterus.**
- ▶ The endometrium is now prepared to receive the developing embryo and **implants several days following fertilization.**

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- ▶ The placenta, which sustains the developing embryo and later fetus **originates from both maternal and fetal tissue.**
  - ▶ At first the placenta produces **human chorionic gonadotropin (HCG)**, which maintains the corpus luteum in the ovary until the placenta begins its own production of **progesterone and estrogen.**

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- ▶ Progesterone and estrogen produced by the placenta have two effects:
    - ▶ They shut down the anterior pituitary so that **no new follicle in the ovaries matures**
    - ▶ They maintain the endometrium so that the **corpus luteum in the ovary is no longer needed.**

# Birth

- ▶ The uterus has contractions during the last trimester of the pregnancy.
  - ▶ The onset of true labour is marked by the uterine contractions that **occur regularly every 10-15 minutes**.
  - ▶ A positive feedback mechanism regulates the **onset and continuation of labour**.
  - ▶ Uterine contractions are induced by stretching of the cervix, which also brings about the **release of oxytocin**.

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- ▶ Oxytocin stimulates **uterine contractions**, which push the fetus downwards, and the **cervix stretched even more**.
  - ▶ The cycle repeats itself until the **baby is born**.

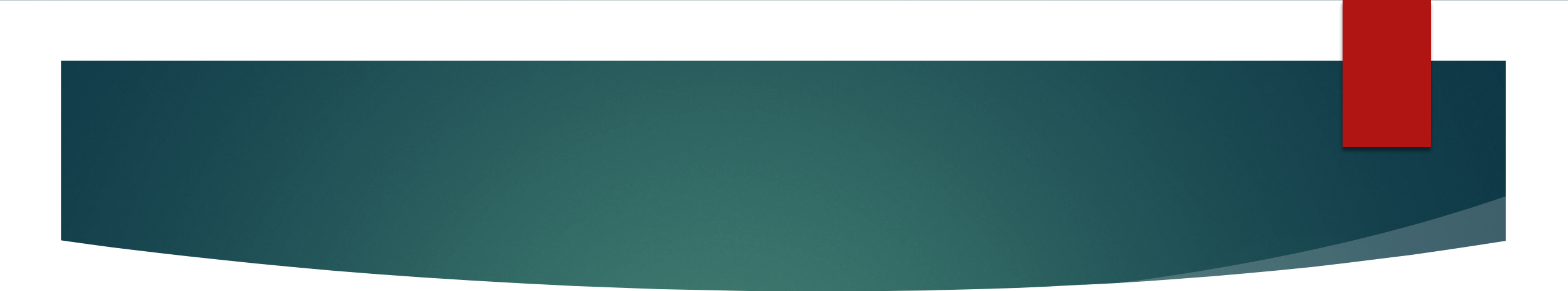


# Lactation

- ▶ During pregnancy, the breasts enlarge as the **ducts and alveoli increase in number & size.**
  - ▶ Usually no milk is produced during **pregnancy.**
  - ▶ The hormone prolactin is needed for **lactation to begin.**
  - ▶ It takes a couple of days for milk production to begin after birth.
  - ▶ In the meantime, breasts produce colostrum: **a thin, yellow, milky fluid rich in protein including antibodies.**

# Menopause

- ▶ Menopause, the period in a woman's life during which the **ovarian and uterine cycles cease**, usually between 45-55 years of age.
  - ▶ The ovaries become unresponsive and no longer secrete **estrogen and progesterone**.
  - ▶ A woman is not considered to have completed menopause until **menstruation is absent for a year**.

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- ▶ The hormonal changes during menopause often produce physical symptoms such as:
    - ▶ **Hot flashes, dizziness, headaches, insomnia, sleepiness, and depression.**