## The Basics of Reproductive Anatomy & Physiology

1. **Basic male & female anatomy**
2. **Production of reproductive hormones**
3. **Production of sperm or eggs**
4. **Common reproductive disorders**

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## The Basics of Reproductive Anatomy & Physiology

**Reading Assignments:**

1. The Reproductive System
2. Male Andropause, parts 1
3. Male Andropause, part 2
4. Cervical Cancer Vaccine
5. Genital Mutilation
6. Hormone Replacement Therapy (WHI study)

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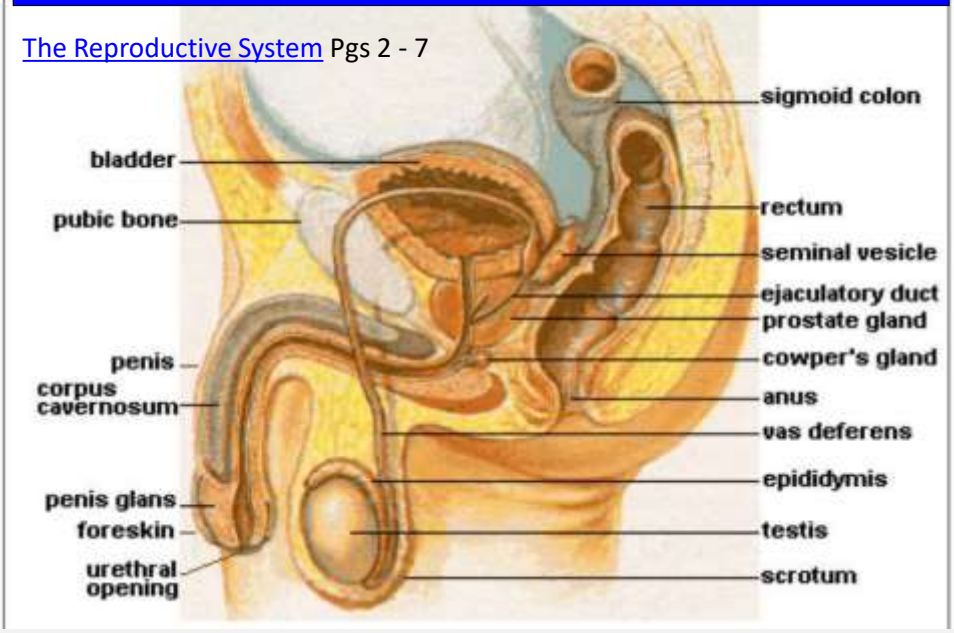
## Male Anatomy & Physiology

The Reproductive System Pgs 2 - 7

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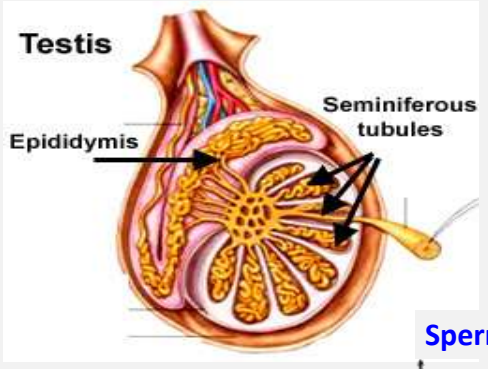


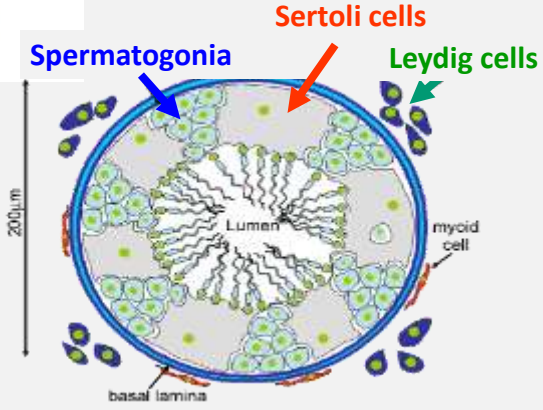


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## Male Anatomy & Physiology

_____ = paired gonads that produce sperm and testosterone

_____= coiled tubes within testes where sperm produced.

**3 cell types in seminiferous tubules:**

1. _____– respond to FSH by helping in sperm production.
2. _____- respond to LH by producing
3. _____ = go through meiosis to become sperm.

_____ = where sperm stored & mature before ejaculation.

_____ = contain testes outside of abdomen ~3° lower than body temp of 98.6.

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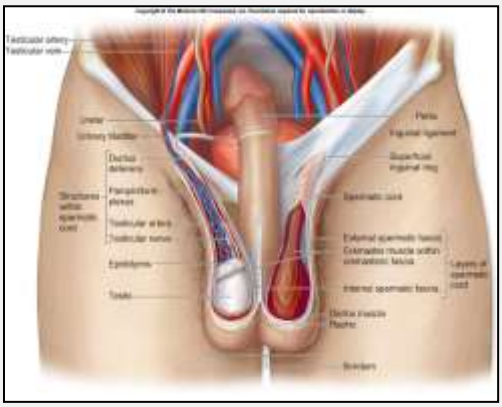
_____= muscle that lifts/lowers testes for temperature regulation.



_____ = opening in abdominal cavity where testes descend into scrotal sac of male fetus by 7months gestation.

_____ = when one or both testes are retained within the abdomen. Abnormal! Must be removed or risk testicular cancer.

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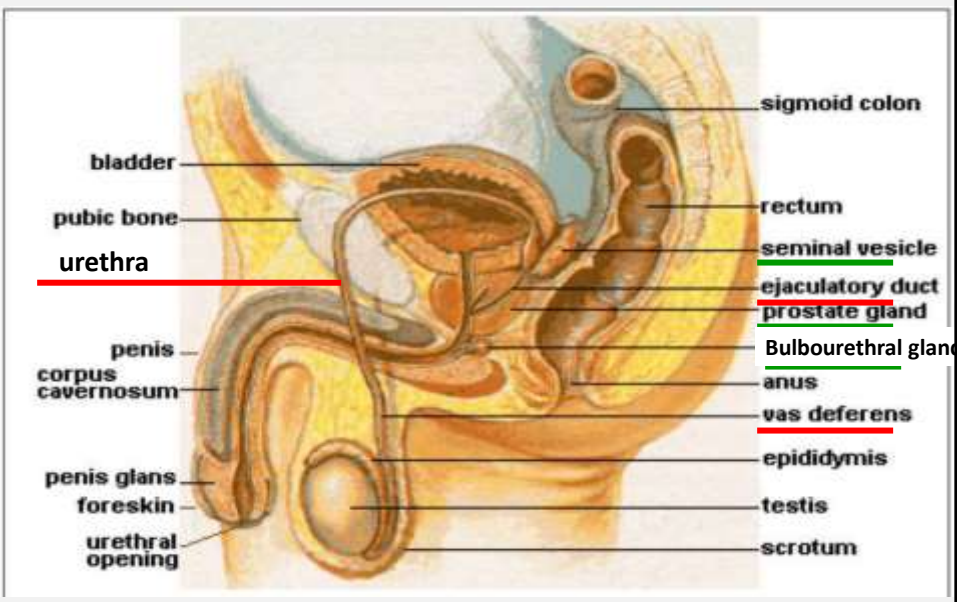
**3 Sperm Transport Tubes:** **3 Male Secretory Glands:**

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**3 Sperm Transport Tubes:**

**1.** _____ **=** transport sperm from epididymis to seminal vesicles.

**QUESTION: What is a vasectomy?**

**2.** _____ = found in prostate gland.

**3.** _____ = passageway for urine or semen, but not at same time!

**3 Male Secretory Glands:**

**1.** _____ **=** Largest glands contributing to semen.

produce:
-**alkaline mucus** (counteract vaginal acidity)
-**prostaglandin** (cause uterine contractions)
-**fructose** (energy source)

**2.** _____ – produce alkaline mucus**.**

**3.** _____- produces lubricant during sexual arousal.

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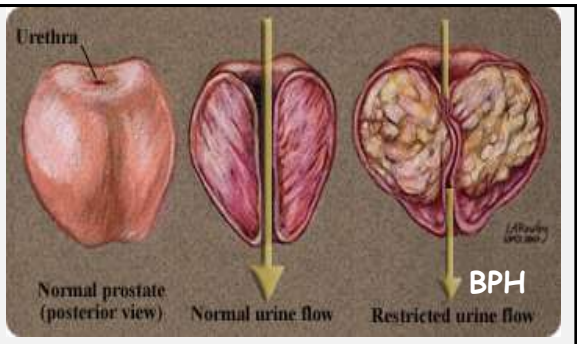
## The Prostate Gland




> _____(BPH)

- Prostate grows with age.
- non-cancerous growth of prostate.
- Can block urine or semen transport.

**Prostate cancer**

- Malignant
- Detect with **PSA** = prostate-specific antigen. High levels in blood indicate possible prostate cancer.

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## The Penis

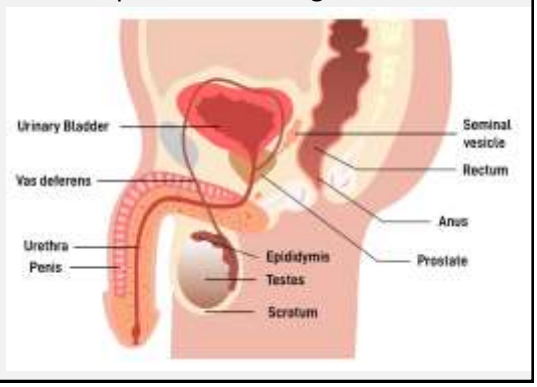
_____= upper left and right chamber

- have arterial blood supply to fill with blood.
- arteries open up (vasodilate) based on nitric oxide (NO) & cGMP.

_____= lower chamber surrounding urethra

_____**(prepuce)** = loose flap of skin covering the head (glans) penis.

_____
= surgical removal of the foreskin.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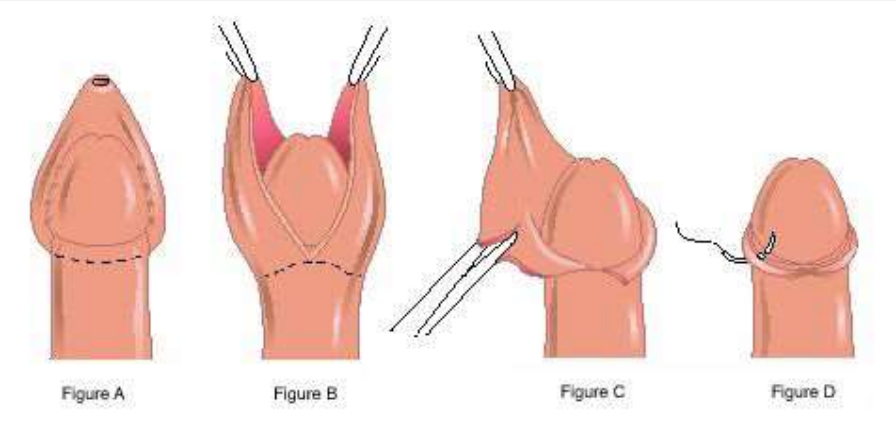
Circumcision?
To do, or not?
Click **HERE** for further reading.

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## How an erection works:

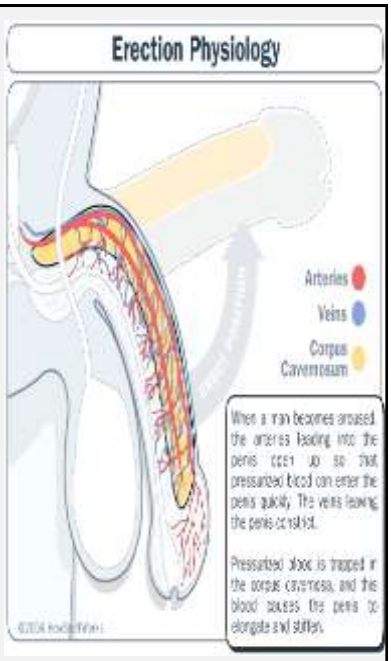
**1. Stimulation** Causes _____ release in arteries of corpus cavernosa.

**2.** NO causes production of a chemical messenger called cGMP).

3. _____ causes arteries to relax & they open wide (**vasodilate)** allowing blood into spongy chambers.

**4.** Fluid pressure of blood causes erection.

5. When stimulation done, or after ejaculation, cGMP is broken down by enzyme (_____). Erection ends.

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**Erectile Dysfunction (ED)** = inability to achieve or maintain an erection.

**Many possible causes:**

**Treatments:**

**1. Counseling if psychological**

**2. Pharmacological (drugs)**

A) _____

B) ED drugs (ex. Viagra, Cialis, Levitra)

**3. Surgical options:**

A) _____implanted into penis. Can manually straighten rod for erection.

B) _____= implant fluid reservoir into abdomen, pump into scrotum, and tubes into penis. Squeeze the pump to push fluid into tubes for erection. Hit a release valve to return fluid to reservoir to end erection.

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## How ED Drugs work (Viagra, Cialis, Levitra):

_____= a chemical that inhibits phosphodiesterase.

So …, what would giving one of these drugs do to cGMP levels in the corpus cavernosa?

_____

What would that do to arteries in the penis? _____

What would that do w/respect to an erection? _____

**Viagra, Cialis, & Levitra work this way.**

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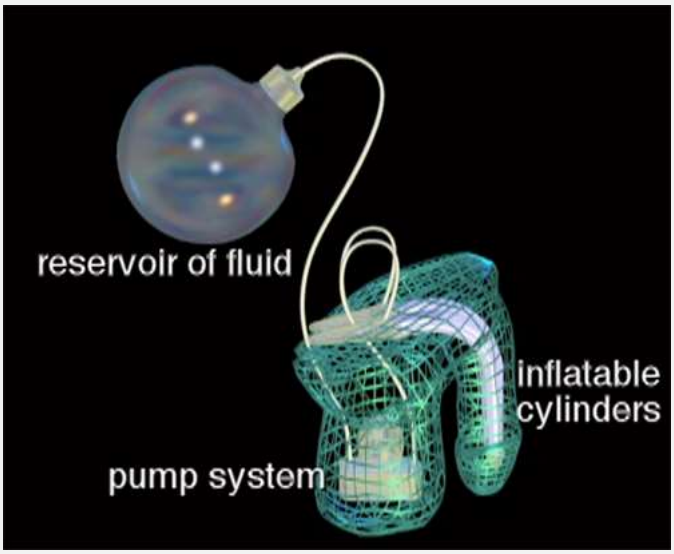
**ED surgical options: Inflatable penile implant or Semi-rigid malleable rod**

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## Steroidogenesis in males & females:

_____ = production of sex steroids in males & females.

**The BRAIN controls steroidogenesis!**

- _____ = brain structure that controls it.
- Hypothalamus secretes _____ = gonadotropin-releasing hormone.
- GnRH tells anterior pituitary (in brain) to secrete _____ (see next slide!)
- **LH** tells testes to make testosterone & ovaries to make estrogen.
- **FSH** tells testes to mature sperm & ovaries to mature eggs.

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## Steroidogenesis in males & females:

**LH (luteinizing hormone)**
> stimulates testes (**leydig cells**) to make _____.

> Stimulates ovaries to make _____

**When levels of testosterone, estrogen, or progesterone are high it inhibits pituitary release of LH & FSH as part of negative feedback to control hormone levels.**

**FSH (follicle-stimulating hormone) -** stimulates sperm or egg maturation

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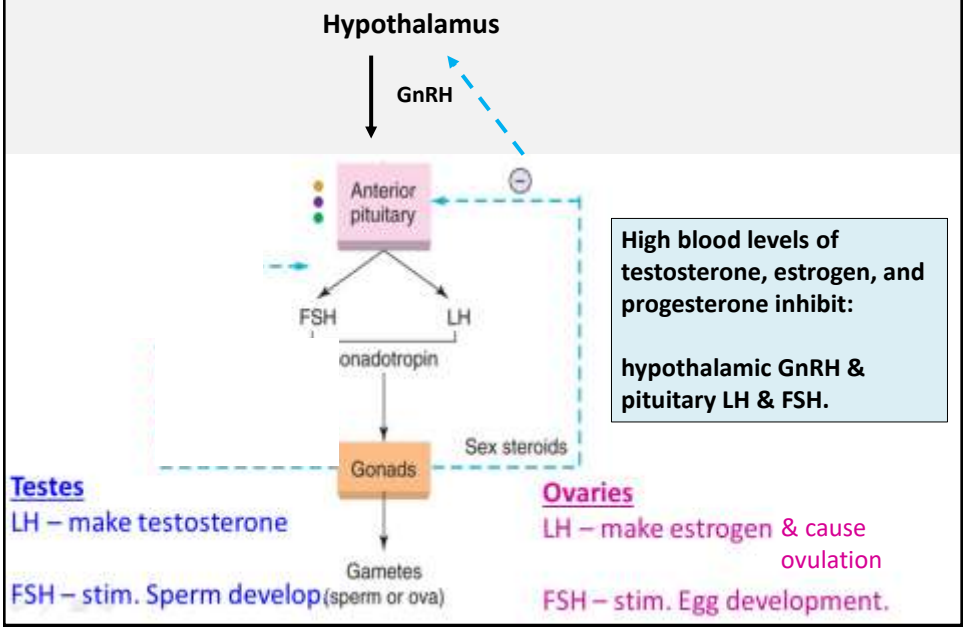
## Steroid **regulation** in males & females:

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## Making sperm

_____ = production of eggs or sperm.

> _____ = production of sperm in seminiferous tubules of testes. Is driven by testosterone (controlled by brain).

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**Spermatogenesis** = production of sperm in seminiferous tubules of testes.

**Spermatogonia** (2n) = primitive sperm cells that become primary spermatocytes.

↓

**Primary spermatocyte (2n)**

↓ = cells that undergo meiosis 1

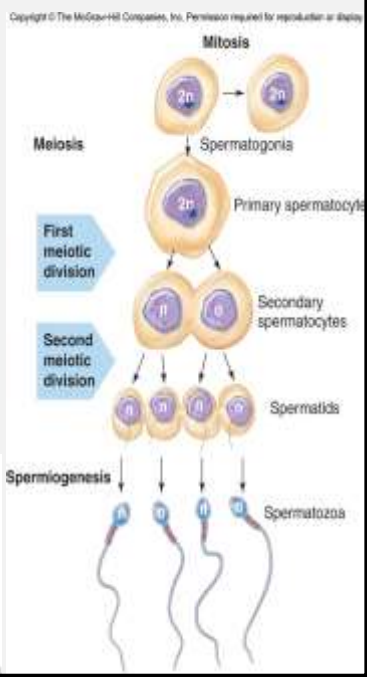
**Secondary spermatocytes** (1n)

↓ = cells that undergo meiosis 2

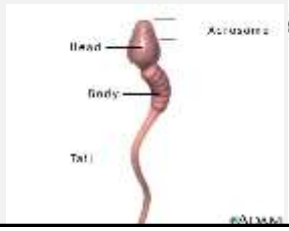
**Spermatids** (1n) = immature sperm cells.

↓

**Spermatozoa** (1n) = mature sperm cells.




Click **HERE** for YouTube video on spermatogenesis.

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**Male Fertility** – need ~ 20 million sperm / ml of semen. Of these sperm, 40% must have normal movement (good swimmers!) and 60% must have normal shape (morphology)

CAUSES OF MALE INFERTILITY?

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## Review

- Male reproductive anatomy & physiology
- - reproductive structures
- How an erection works
- BPH, prostate cancer, ED, ED drugs
- Spermatogenesis
- Male fertility and infertility

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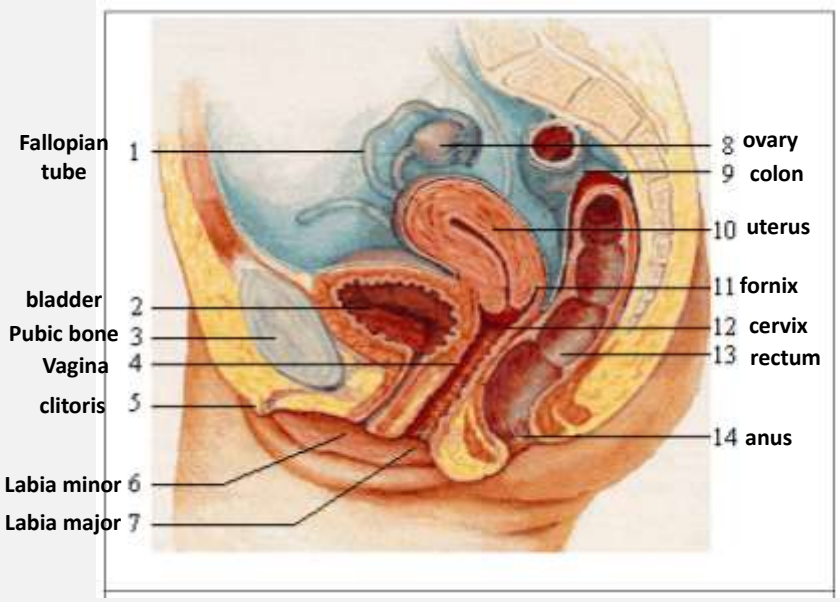
## The Basics of Female Reproductive A & P




The Reproductive System Pgs 8 - 11

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## The Basics of Female Reproductive A & P

_____ = paired gonads making eggs, estrogen, & progesterone.

_____ = muscular copulatory & birth canal.

**External genitalia:**

> _____= labia major & minor

> _____= erectile tissue with sensory nerves (similar to head of penis)

_____ = muscular sac capable of supporting developing fetus.

> _____= paired tubes that can transport fertilized egg from ovaries to uterus.

> _____ = entryway into uterus from vagina.

> _____ = secretory layer of uterus. Where embryo implants

> _____ = muscular layer of uterus, responds to oxytocin & prostaglandin.

The Reproductive System Pgs 8 - 11

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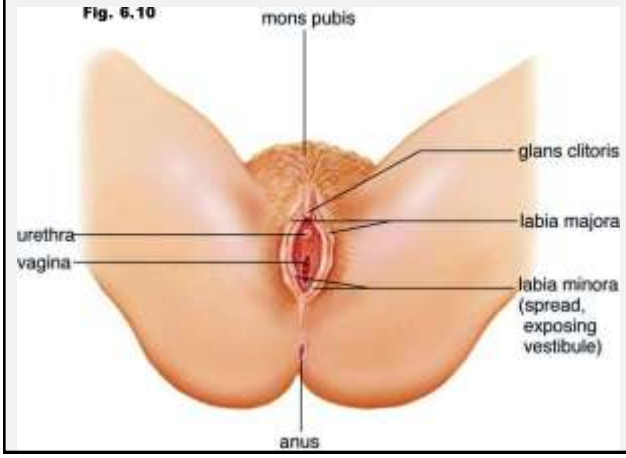
## External Genitalia

**Clitoris** = equivalent of glans penis. Same sensory nerves & erectile tissue
**Labia minor** = smaller inner labia
**Labia major** = larger outer labia
_____ = tissue surrounding urethral & vaginal openings. Prone to tearing during childbirth!




Question:
What is an **episiotomy**?

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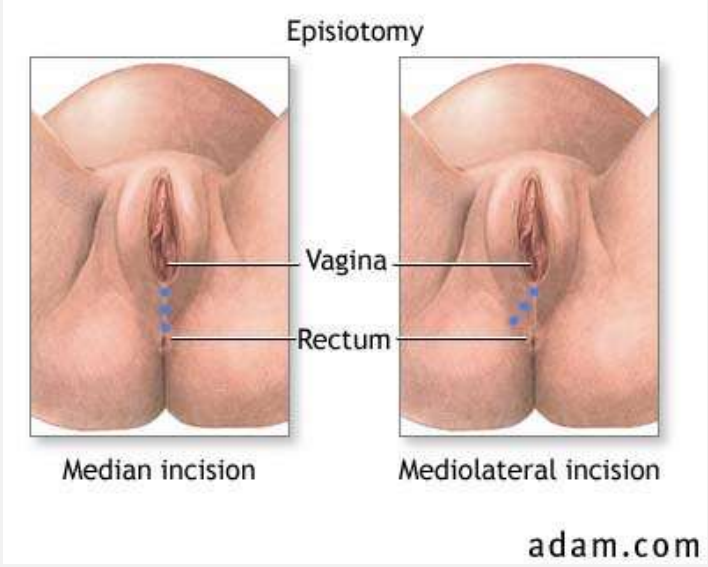


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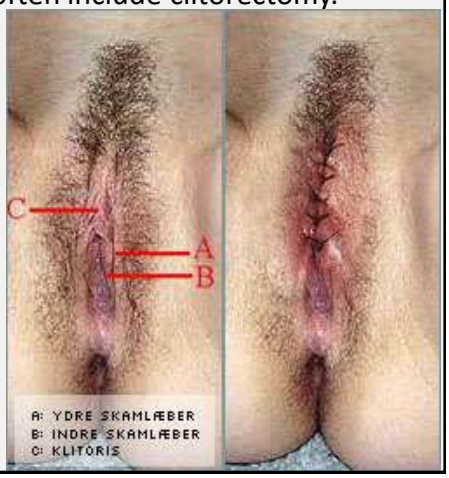
_____ **(**see reading assignment online**)**

= surgical removal of clitoris (C in photo)

_____ = removal of labia minor and suturing (stitching) of labia major partially closed (narrow opening left for menstrual flow).A & B in photo. Can often include clitorectomy.

*See reading assign.:*
*"*Genital Mutilation *"*

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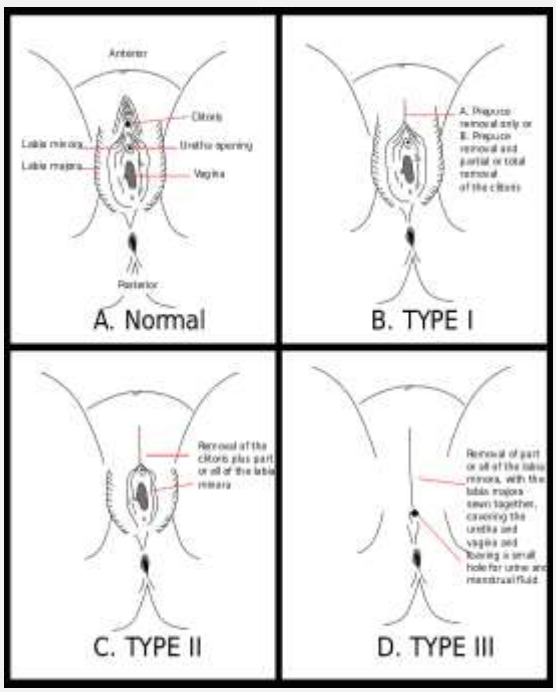


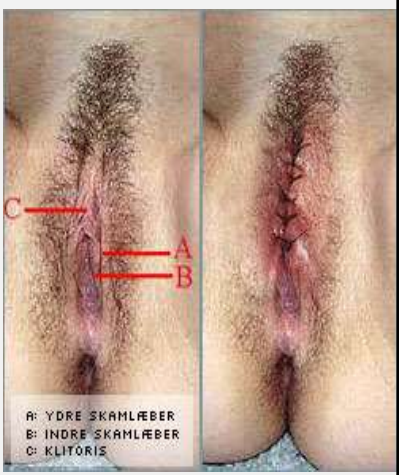


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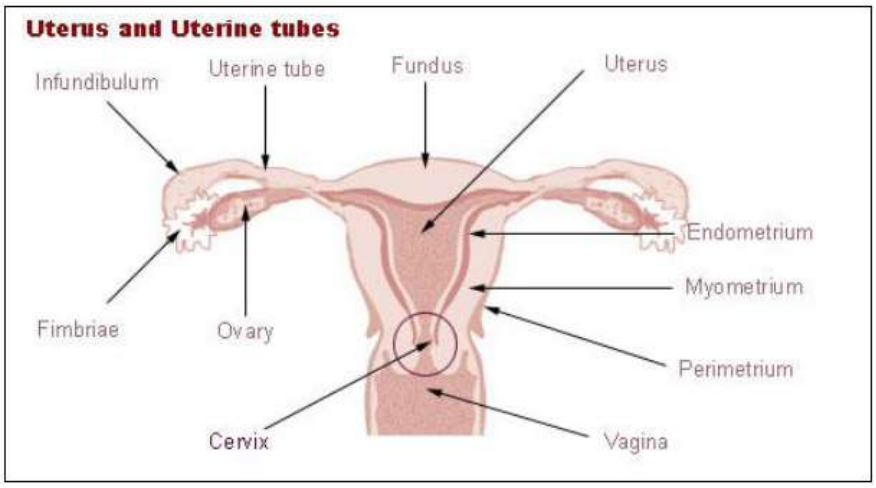


Figure 27.7. Uterus

http://commons.wikimedia.org/wiki/File:Illu_cervix.jpg

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**Human uterus: normal Vs menstrual**


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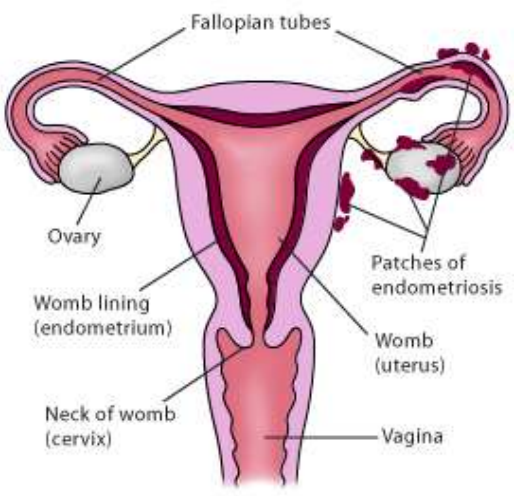
_____ = when endometrial tissue of uterus wanders out of uterus to different locations. Still responds to progesterone by proliferating, and then shedding when progesterone declines each menstrual cycle. *Painful!

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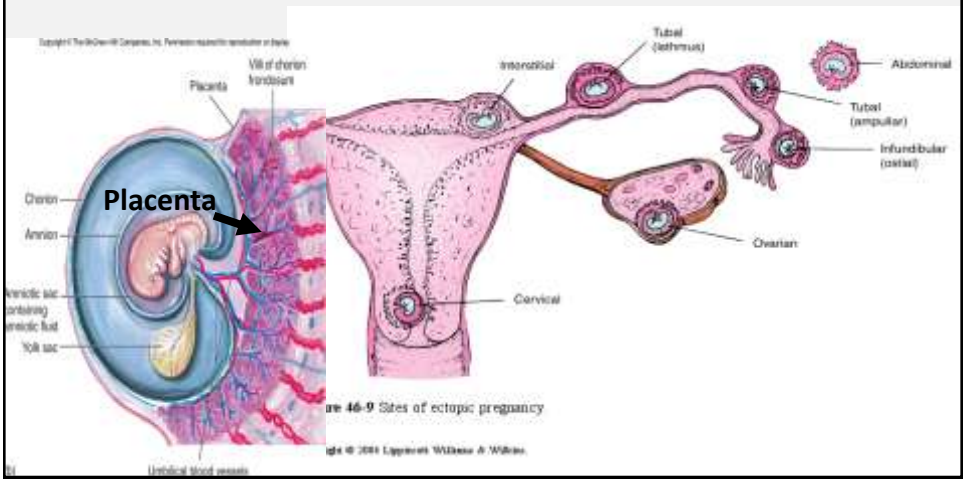
## The Fallopian Tubes

_____= pregnancy "out of place" (basically anywhere except within the uterus). Frequency of 2% among females. ***http://www.aafp.org/afp/2000/0215/p1080.html***

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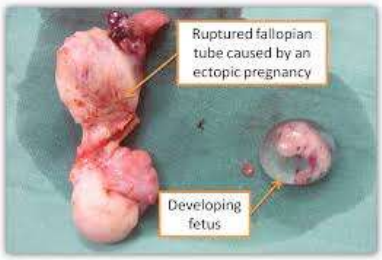
## The Fallopian Tubes

**Danger of an ectopic pregnancy** = only the uterus & its strong ligaments can support weight of growing fetus. **Only endometrium** capable of forming a fully functional placenta. All other tissues not compatible for pregnancy. Embryo CANNOT survive, and mother could die (bleed out).



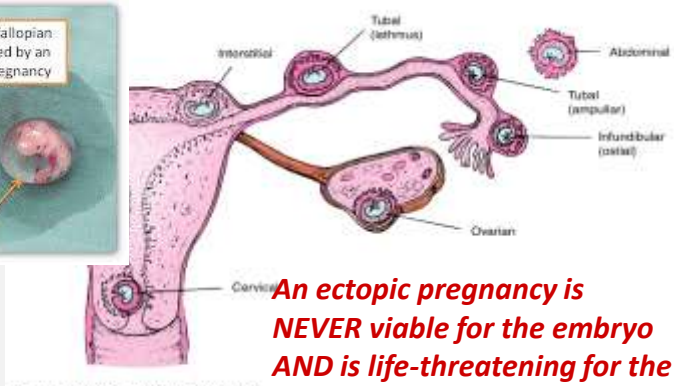




Figure 46-9 Sites of ectopic pregnancy

***An ectopic pregnancy is NEVER viable for the embryo AND is life-threatening for the mother***

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## The Cervix

= entryway to uterus.

> normally ~ 2.5 cm in diameter.
> Can dilate during childbirth over 10 cm!

Let's look at an analogy, shall we??

**Question: What is a PAP smear?**


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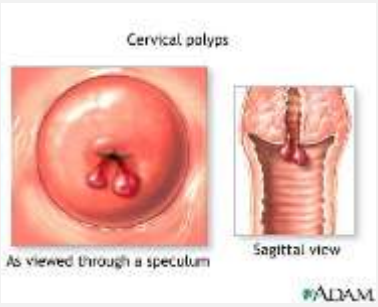
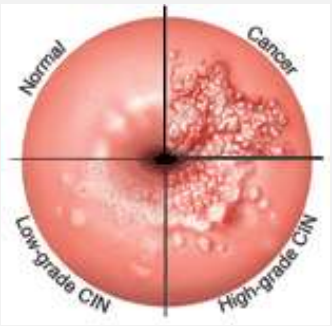
**HPV –** human papilloma virus. Present in 50% of sexually active adult population. Can cause polyps and warts at site of contact.
Can lead to increased risk for cancer.

**Cervical cancer stages**




Labial warts




Cervical warts

Throat cancer?

Penile warts

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## HPV Vaccine - 2006

- **Gardasil** marketed by Merck & **Cervarix** by GlaxoSmithKline
- Both are set of 3 vaccinations.

**Only Gardasil is:**

- Effective against 4 strains HPV – 2 which cause cancer & 2 which cause warts
- Tested & recommended for 9-26 yr old girls AND boys
  (younger is better - before sexual exposure!)
- Can get up to 21-26 yrs but protection goes down w/sexual exposure.

See reading assign.: Cervical cancer vaccine


**Source: www.cdc.gov/hpv/vaccine**

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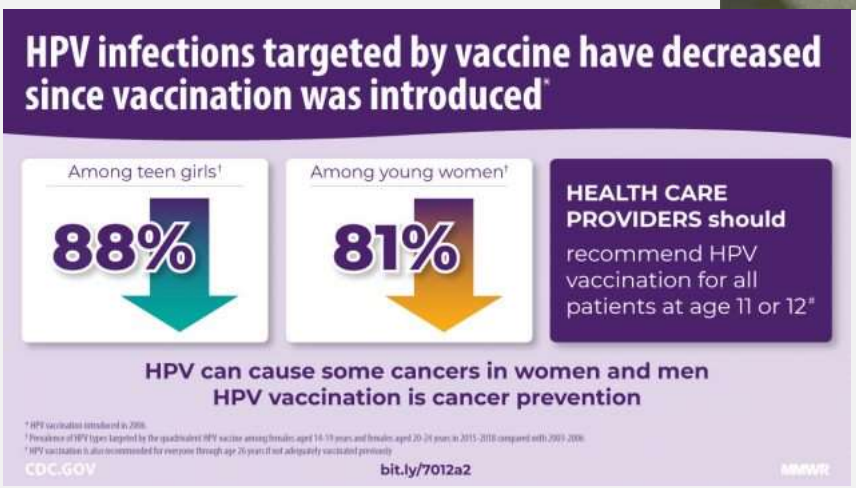
Since 2018 ….


https://www.cdc.gov/mmwr/volumes/70/wr/mm7012a2.htm#F1_down

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## Maturation of eggs

_____ = production of eggs in ovaries. All the eggs a woman will ever have were in her fetal ovaries (before she was ever born!).

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## Oogenesis:

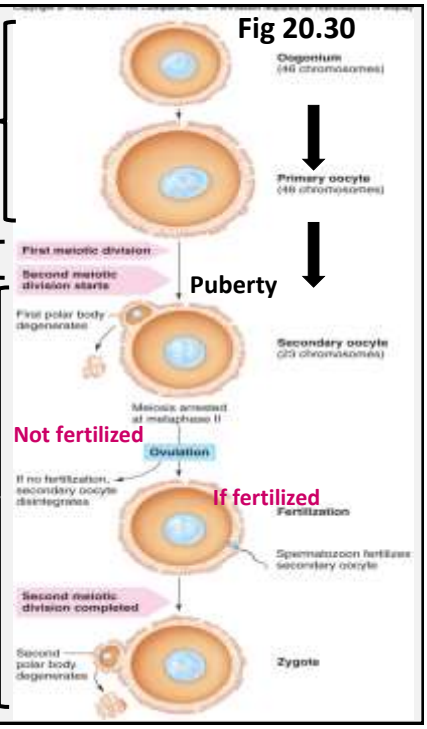
**Oogonium** (2n)

↓

**Primary oocyte** (2n)

Happens between embryonic stage and childhood.

Embryonic and fetal period:




### After puberty: once/month

**Secondary oocyte** (1n) = egg that gets ovulated from the "**graafian follicle**"

- graafian follicle becomes **corpus luteum** (CL) "which produces progesterone ~14 days

_____ = hormone released from CL that maintains uterus in pregnancy-friendly state. Prevents egg development and ovulation.

Monthly, from puberty to menopause:

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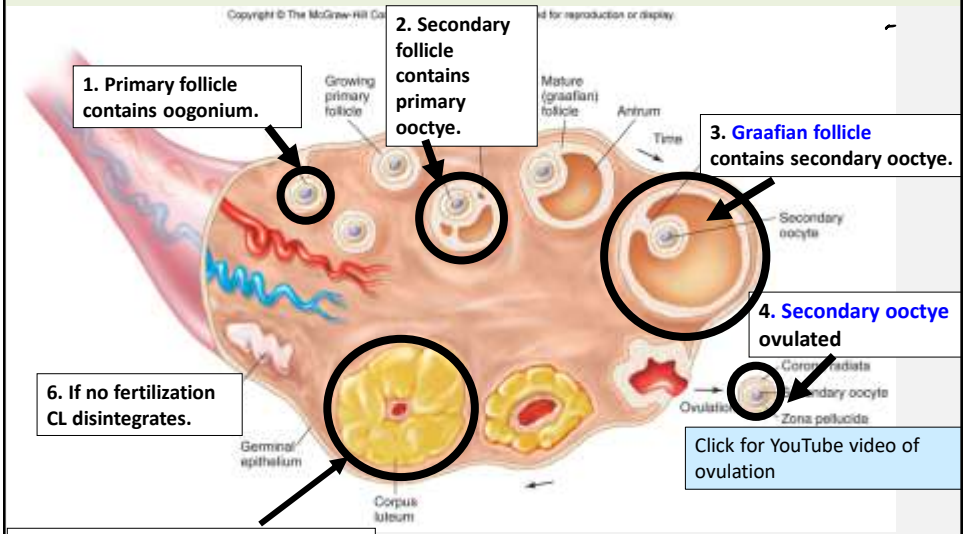
The **Ovaries** have **follicles** that contain a developing egg (**oocyte**). Once a month one follicle & egg mature. A **secondary oocyte** is ovulated. The remaining follicle becomes the **corpus luteum** & produces **progesterone**. Click **HERE** for YouTube video (4.04min)

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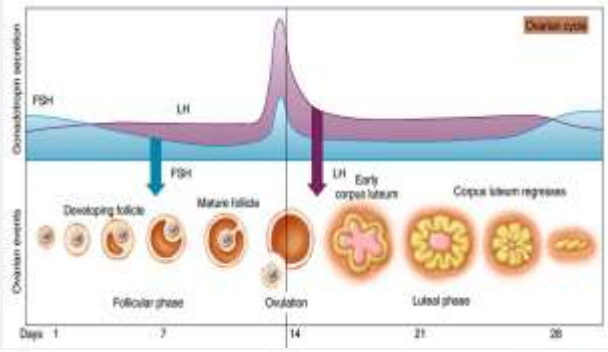
## Ovarian cycle

**Days: 1- 13 =**
Egg development from **FSH**

**Day 14** = **ovulation** (**LH high**)

**Days 15-28** - CL makes



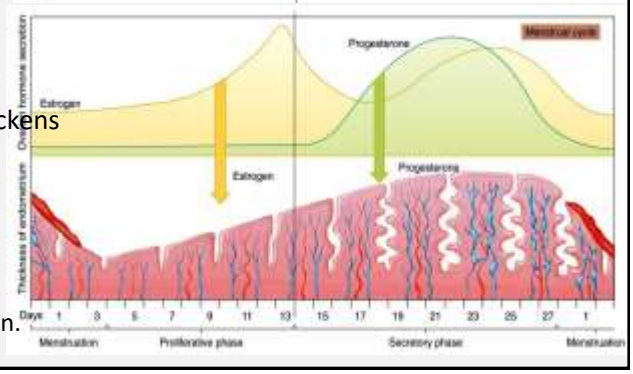

## Menstrual cycle

Days: **1- 5** = **menstruation**

**15 – 28 =** endometrium thickens
Because of **progesterone**

After day 28, if no fertilized egg, CL disintegrates

Endometrial lining breaks down.

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## IF no fertilization:

- Corpus luteum breaks down and stops progesterone secretion @day 28.
- Without progesterone, uterine lining breaks down.
- Menstrual flow – egg and lining shed
- Endometrium secretes _____, which causes uterine cramping to expel blood and tissue.


## IF fertilization:

- Embryo makes _____
  within 1 week (the hormone pregnancy tests detect this in the urine)
- This hormone "rescues" corpus luteum – it keeps making progesterone ~ 1month (until placenta forms and takes over progesterone production).

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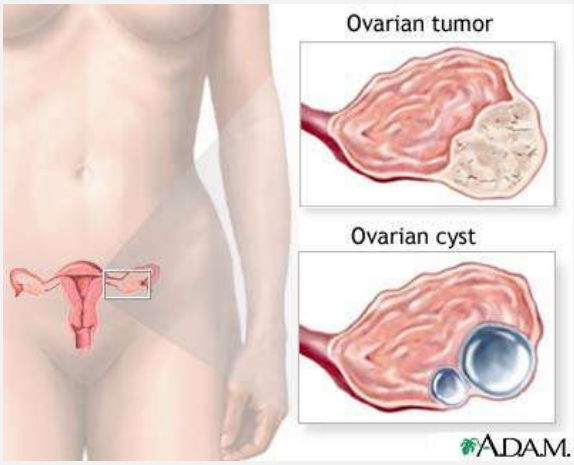
_____= condition in which follicles in ovary fill with fluid (cysts). Painful condition that decreases fertility.

Treatment:

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**Ovarian cancer**

**↑ risk factors include:**
> Genetics (close female relative had it)
> Have had more ovulations in life
(never been on hormonal birth control or been pregnant)
>Have mutation in the BRCA gene
> Polycystic ovarian syndrome
> hormonal problems

**↓ risk factors include:**
> not have genetics
> no mutation in BRCA gene
> fewer ovulations in life
(never on birth control, never pregnant)

**Question: Why do you think having been on birth control lowers risk of ovarian cancer??**

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**Question: Why do you think having been on birth control lowers, or having been pregnant, decreases the risk of ovarian cancer??**

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## Ovarian and Breast Cancer and genetic predisposition:

**Angelina Jolie**

_____= tumor suppressor gene that normally suppresses tumor growth (a good thing!)

**Mutation in this Gene** – means the gene does not suppress tumors. Mutation in this gene associated with increased risk for ovarian & breast cancer.

**Can get blood test for it.**

_____**= cancer antigen 125**
increased levels of this in blood associated with ↑ risk of ovarian cancer (separate from BRCA gene)

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| Risk of Cancer in Individuals Wth a BRCA1 or BRCA2 Mutation | | | |
|---|---|---|---|
| Cancer Type | General Population (No Mutation) | Individuals With Mutation | |
| | | BRCA1 | BRCA2 |
| Breast | 12% | 50-80% | 40-70% |
| Ovarian | 1-2% | 24-40% | 11-18% |
| Male Breast | 0.10% | 1-2% | 5-10% |
| Prostate | 15% (N. Europe Origin) | up to 30% | up to 39% |
| | 18% (African American) | | |
| Pancreatic | 0.50% | 1-3% | 2-7% |

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_____ = end of woman's reproductive cycle.
Ovaries **suddenly** stop producing eggs, estrogen, & progesterone (age 50 or so).

Symptoms:
> moodiness
> hot flashes
> vaginal dryness
> osteoporosis (thinning of bones)
> ↑ libido (due to testosterone from adrenal glands)
> ↑ facial hair growth in some women (hirsutism)

_____ = gradual decline in man's reproductive function. Testosterone and sperm production slowly decline from age 40 & on.

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**Fertility in Women** best from 16 – 40. Declines after 40.

**CAUSES OF FEMALE INFERTILITY:**

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## Review

- Female reproductive anatomy & physiology
- - reproductive structures
- Ectopic pregnancy, endometriosis, polycystic ovarian syndrome, episiotomy.
- HPV, warts, cervical cancer, HPV vaccine, breast & ovarian cancer, mutations in the BRCA gene, CA125 test.
- Genital mutilation
- Oogeneis
- Menstrual cycle (follicle & uterine cycles)
- Role of hCG in rescuing corpus luteum in pregnancy
- Menopause & Andropause
- Fertility and infertility in women

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