CONCEPT: ANIMAL REPRODUCTION

- ***Sexual reproduction*** – combining genetic information of two organisms, usually by fusion of gametes
    - □ ***Fertilization*** – fusion of male and female gametes to form a zygote
        - ***Sperm*** – male gamete, generally smaller and motile
        - ***Egg*** – female gamete, generally larger and nonmotile
        - ***Zygote*** – diploid cell formed from fertilization that will develop into and organism

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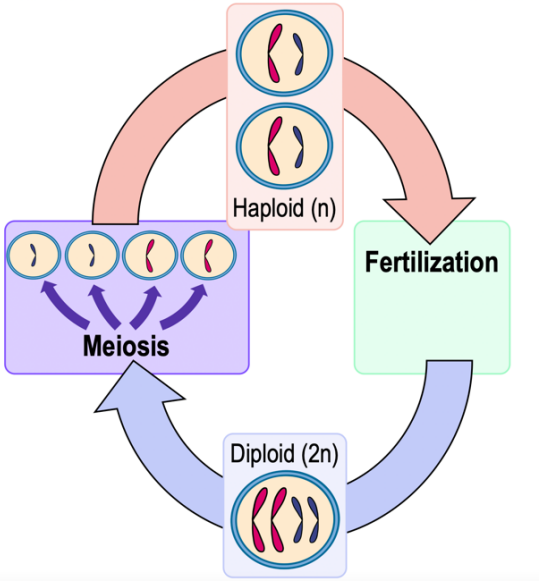
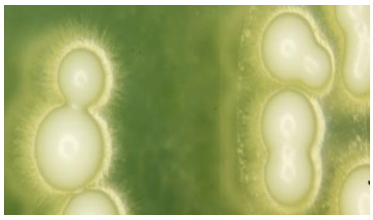
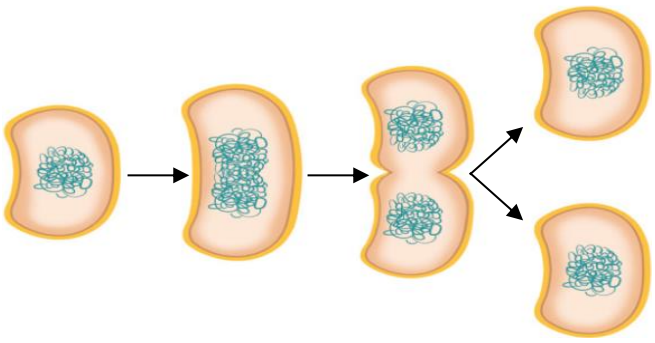
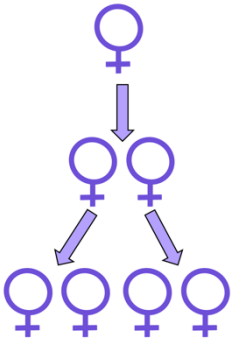


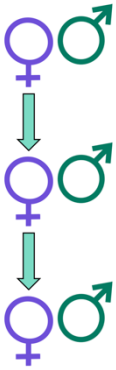
- ***Asexual reproduction*** – offspring arises from a single organism, and only receives genes from that parent
    - □ ***Budding*** – new organism develops as an outgrowth on the parent, breaking off at maturity
    - □ ***Fission*** – organism divides into two or more parts forming
    - □ ***Parthenogenesis*** – growth and development of an organism occurs without fertilization

EXAMPLE:







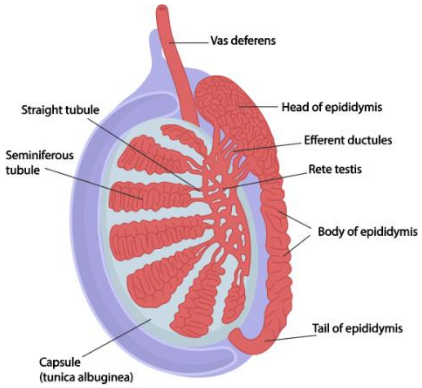


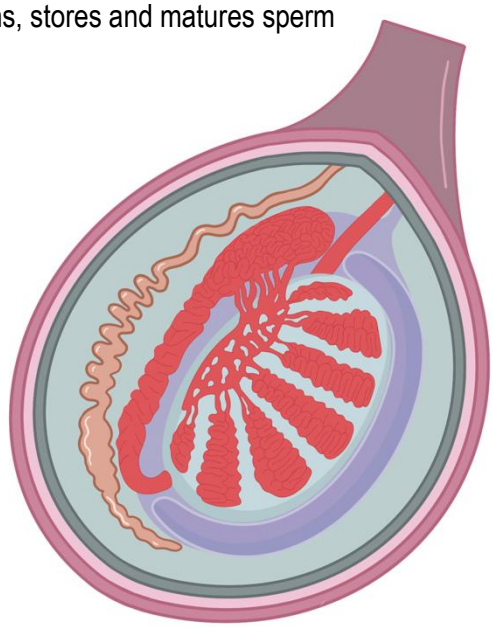
- Sexual reproduction is more energy intensive and less efficient that asexual reproduction, so why bother?
- Red queen hypothesis – organisms must constantly adapt and evolve to compete with opposing organisms
    - □ "*Now, here, you see, it takes all the running you can do, to keep in the same place.*"

CONCEPT: ANIMAL REPRODUCTION

- ***Genitalia*** – sex organs
    - □ ***Gonad*** – organs that produce gametes
- ***Testes*** – male gonads that produce sperm
    - □ ***Scrotum*** – skin pouch that contains the testes
    - □ ***Seminiferous tubules*** – coiled tubes in testes where sperm are produced
    - □ ***Epididymis*** – tube that connects testicle to vas deferens, stores and matures sperm

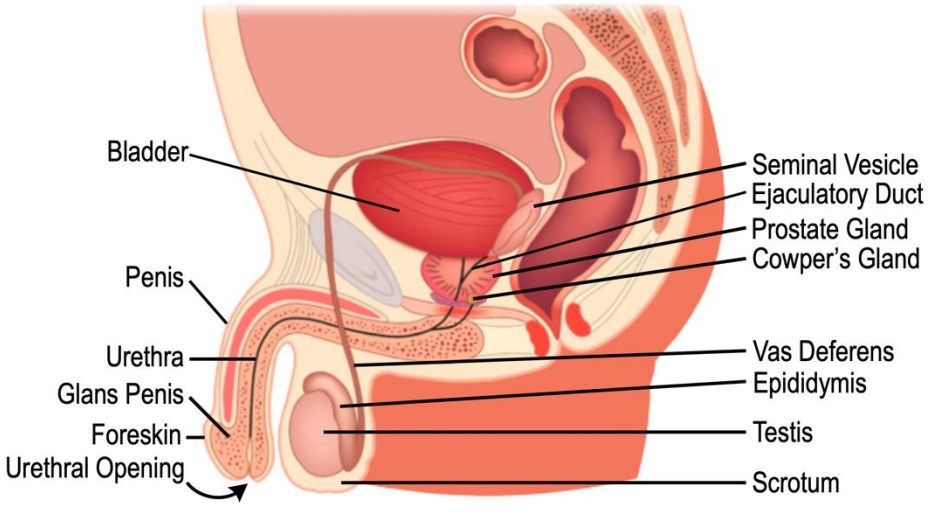
EXAMPLE:





- ***Penis*** – male sex organ used for internal fertilization
    - □ Glans – bulbous structure at the end of the penis
    - □ Prepuce – skin surrounding and protecting the glans
    - □ ***Urethra*** – tube for urine and sperm
    - □ Baculum – penis bone present in some animals
- ***Semen*** – male reproductive fluid containing sperm
    - □ ***Seminal vesicles*** – produces fluid containing fructose and mucus, connects with ejaculatory duct
    - □ ***Prostate gland*** and ***bulbourethral gland*** also secrete fluids into the semen
- ***Ejaculation*** – sperm are moved from each epididymis, through the vas deferens, to be expelled via the urethra as semen
    - □ ***Vas deferens*** – muscular duct that connects to the ejaculatory duct
    - □ ***Ejaculatory duct*** – sperm mixes with accessory fluids, moves semen to urethra

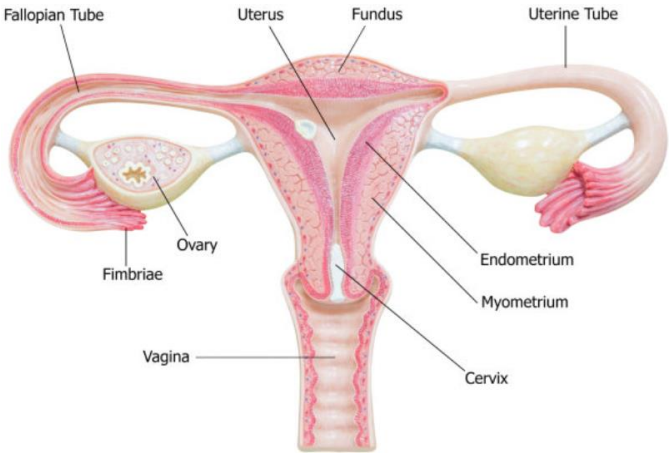
EXAMPLE:

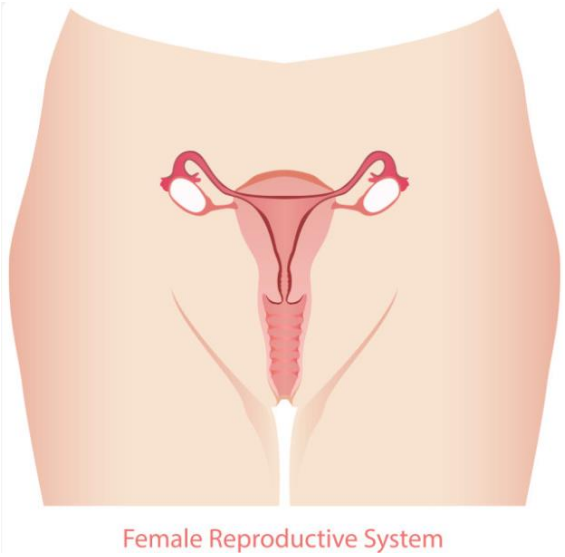


CONCEPT: ANIMAL REPRODUCTION

- ***Ovaries*** – female gonads where eggs are held for periodic release
    - □ ***Oviducts*** – passageways that leads from the ovaries to external environment
        - ***Fallopian tubes*** – mammalian oviducts that lead from ovaries to uterus
- ***Uterus*** – womb within which a fetus develops
    - □ ***Cervix*** – connects vagina to uterus, normally a narrow tube, greatly dilates during birth
    - □ ***Endometrium*** – inner epithelial tissue of uterus, periodically shed during menstruation, forms placenta

EXAMPLE:

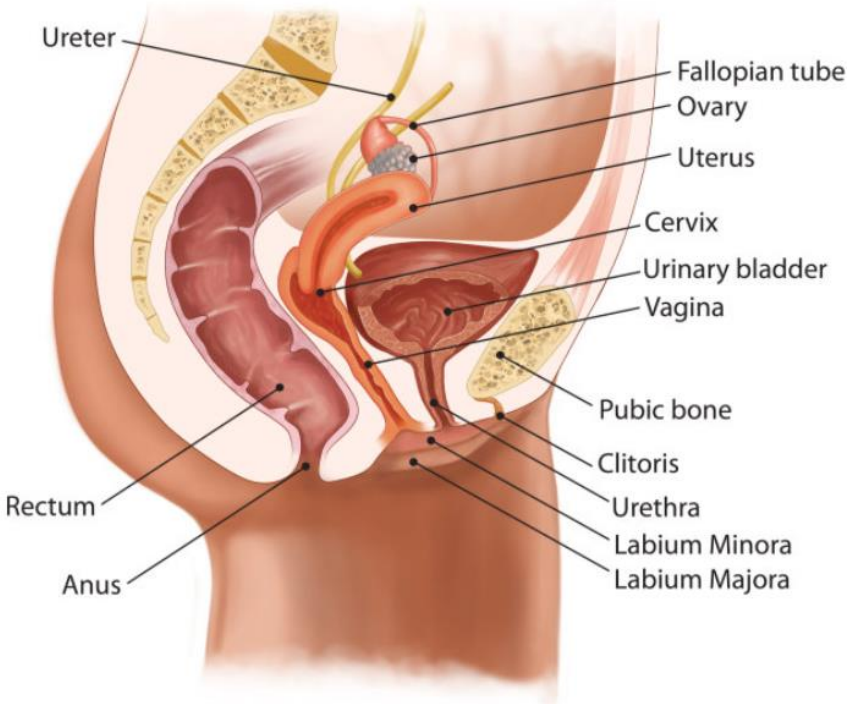




Female Reproductive System

- ***Vagina*** – muscular, elastic chamber that serves as the birth canal
- ***Vulva*** – external structures of female genitalia
    - □ Labia majora – encloses and protects the rest of the vulva
    - □ Labia minora – encloses vaginal and urethral opening
    - □ ***Clitoris*** – glans surrounded by erectile tissue, covered by prepuce

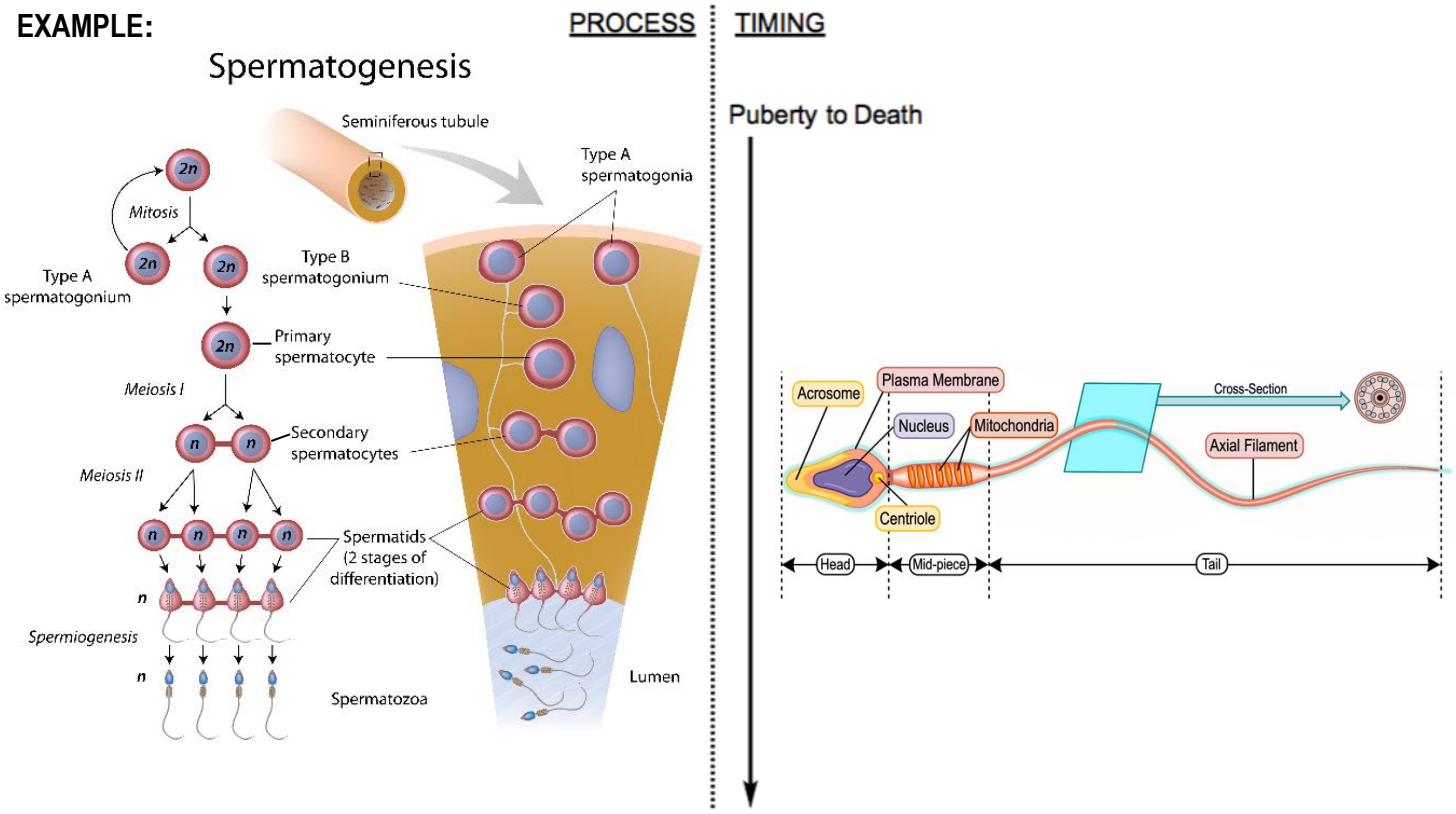
EXAMPLE:



CONCEPT: ANIMAL REPRODUCTION

- ***Gametogenesis*** – production of gametes
    - □ ***Spermatogenesis*** – production of sperm via mitosis and meiosis
- ***Spermatogonia*** – undifferentiated male germ cells in the testes, undergo mitosis to form primary spermatocytes
    - □ ***Primary spermatocytes*** – diploid male germ cells found in seminiferous tubules
    - □ ***Secondary spermatocytes*** – haploid germ cells, form when primary spermatocytes undergo meiosis
    - □ ***Spermatids*** – undeveloped male gametes that form from the mitotic divisions of secondary spermatocytes
    - □ ***Spermatozoa*** – motile sperm, form from spermatids that mature in seminiferous tubules
        - ***Acrosome*** – enzyme-filled structure at tip of sperm that allows it to penetrate barriers around the egg
        - ***Flagella*** – microtubule projection that allows the sperm to swim

EXAMPLE:

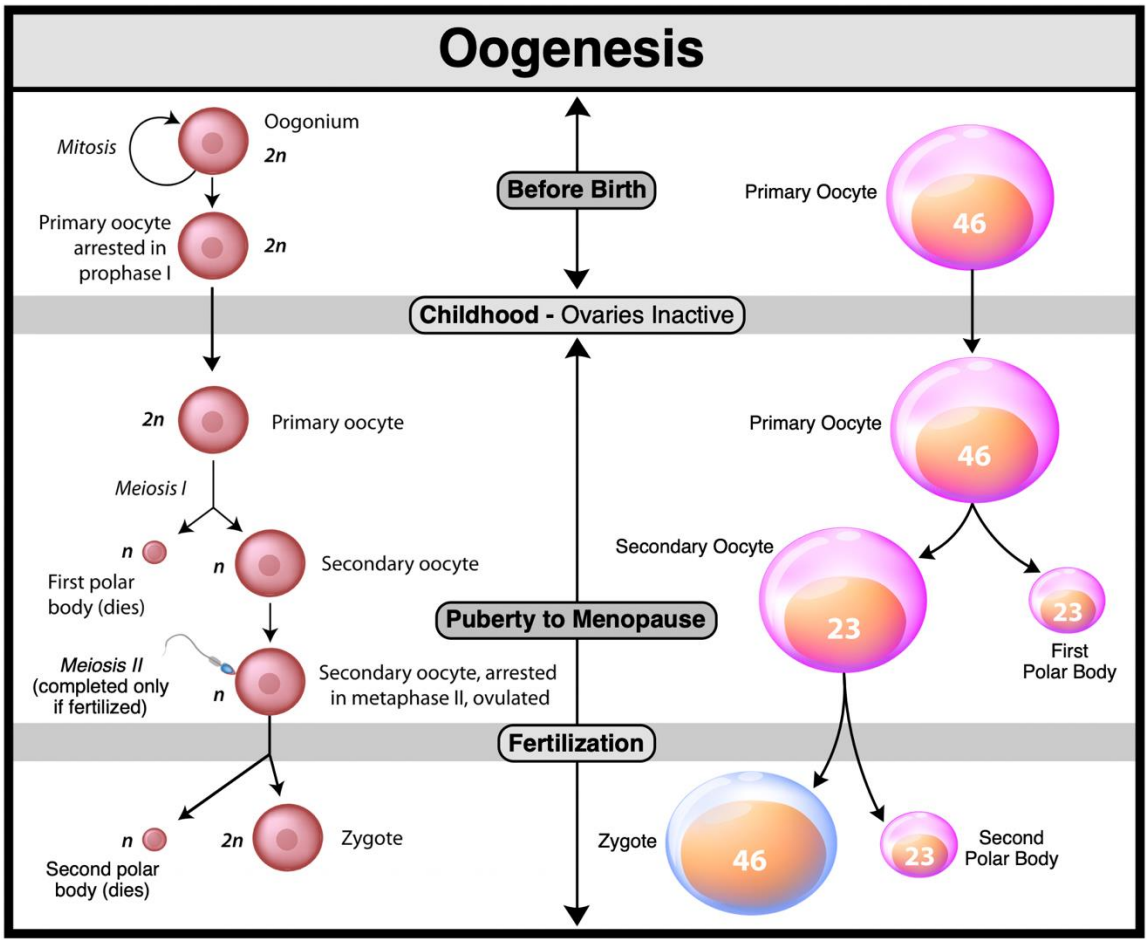


- Spermatogenesis begins at puberty, and continues throughout life
- ***Gonadotropin releasing hormone*** (***GnRH***) – tropic hormone released by hypothalamus
- Anterior pituitary releases LH and FSH when stimulated by GnRH
    - □ ***Luteinizing hormone*** (***LH***) – stimulates Leydig cells adjacent to seminiferous tubules to secrete testosterone
        - ***Testosterone*** – androgen sex hormone that helps with spermatogenesis
    - □ ***Follicle stimulating hormone*** (***FSH***) – stimulate Sertoli cells to help with spermatogenesis
    - □ ***Inhibin*** – hormone secreted by Sertoli cells that inhibits release of FSH

CONCEPT: ANIMAL REPRODUCTION

- ***Oogenesis*** – production of an ovum via mitosis and meiosis
  - □ ***Ovum*** – female gamete, or egg cell
    - ***Corona radiata*** – outer layer that sperm must penetrate to fertilize egg
    - ***Zona pellucida*** – layer of glycoproteins inside the corona radiate
  - □ Oogenesis begins before birth, continues after puberty, and stops after menopause
- ***Oogonia*** – female diploid germ cell, divide by mitosis and begin meiosis prior to birth
  - □ ***Primary oocytes*** – cells arrested in prophase I of meiosis, each contained within a follicle
  - □ ***Follicle*** – structure encasing the primary oocyte that influences menstrual cycle
    - Each month: FSH causes follicle to mature, primary oocyte completes meiosis I, and begins meiosis II
    - Follicle ruptures to release ovum, and forms corpus luteum
    - ***Corpus luteum*** – temporary endocrine structure that releases lots of progesterone and some estradiol
  - □ ***Secondary oocytes*** – cells arrested at metaphase II of meiosis II, will complete meiosis II if fertilized by sperm
  - □ ***Polar bodies*** – small haploid cell formed as a result of unequal cytokinesis during oogenesis
    - Each of the meiotic divisions of the oocyte results in a polar body that does not develop

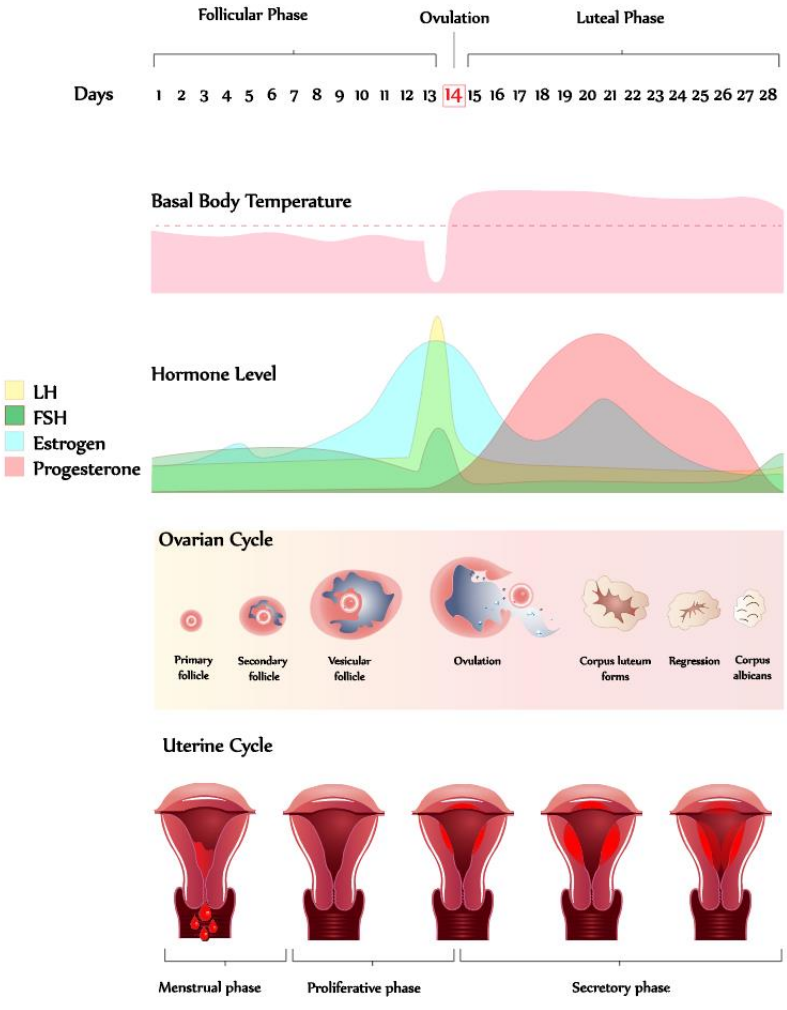
EXAMPLE:



CONCEPT: ANIMAL REPRODUCTION

- ***Menstrual cycle*** – regular cycle in female reproductive system, can be divided into ovarian and uterine cycles
    - □ ***Menopause*** – time in females' lives that menstrual cycle ceases
- ***Ovarian cycle*** – cyclic changes in the follicles of the ovaries
    - □ ***Follicular phase*** – first part of ovarian cycle, follicle matures and gets ready to release the ovum
        - FSH stimulates follicle maturation, follicle will secrete estradiol
    - □ ***Ovulation*** – release of ovum from follicle into fallopian tube, occurs in the middle of ovarian cycle
        - Maximal estradiol concentrations trigger an LH spike that causes ovulation
    - □ ***Luteal phase*** – final part of ovarian cycle, follicle transforms into corpus luteum
        - Progesterone from corpus luteum maintains uterine lining, provides negative feedback to FSH and LH
        - Corpus luteum will degrade in the absence of pregnancy
- ***Uterine cycle*** – cyclic growing and shedding of endometrial lining
    - □ ***Menstruation*** – first part of uterine cycle, endometrium is shed
    - □ ***Proliferation phase*** – second part of uterine cycle, endometrium grows
    - □ ***Secretory phase*** – final part of uterine cycle, uterus prepares for implantation
- ***Estrous cycle*** – uterus reabsorbs endometrium in the absence of pregnancy, occurs in some animals other than humans

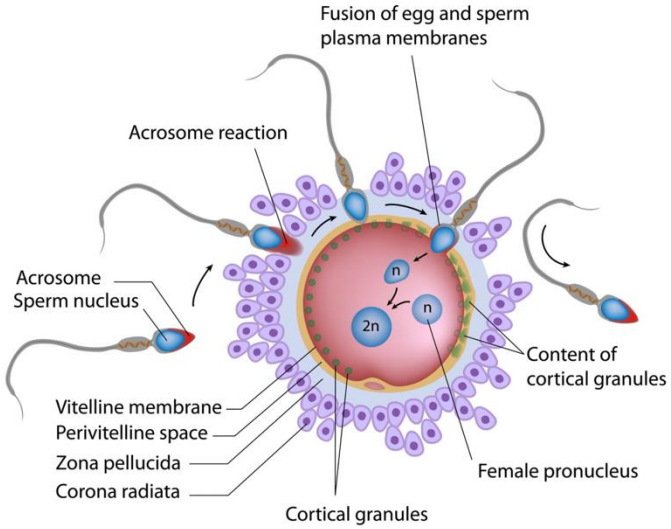
EXAMPLE:



CONCEPT: ANIMAL REPRODUCTION

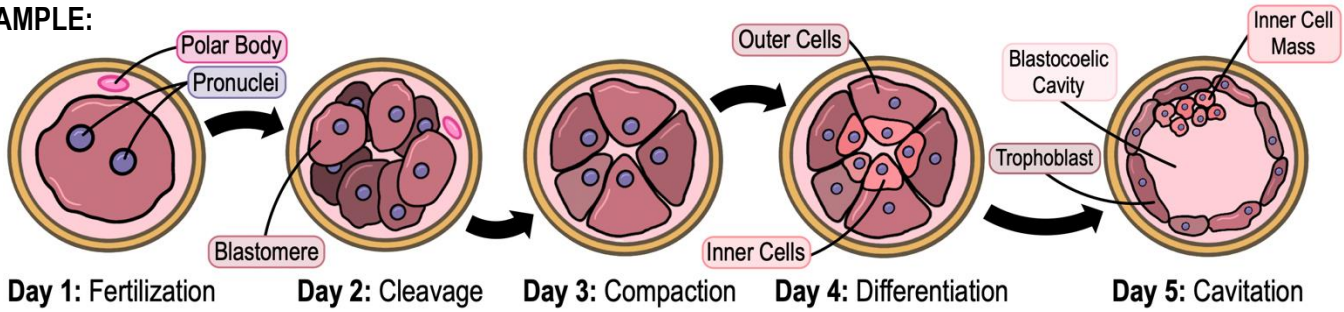
- ***Conception*** – fertilization of human egg with sperm forming a zygote
    - □ Sperm move through the cervix, and into the oviduct to fertilize the ovum
    - □ Upon sperm entering the ovum, it completes meiosis II, then fuses with the sperm

EXAMPLE:



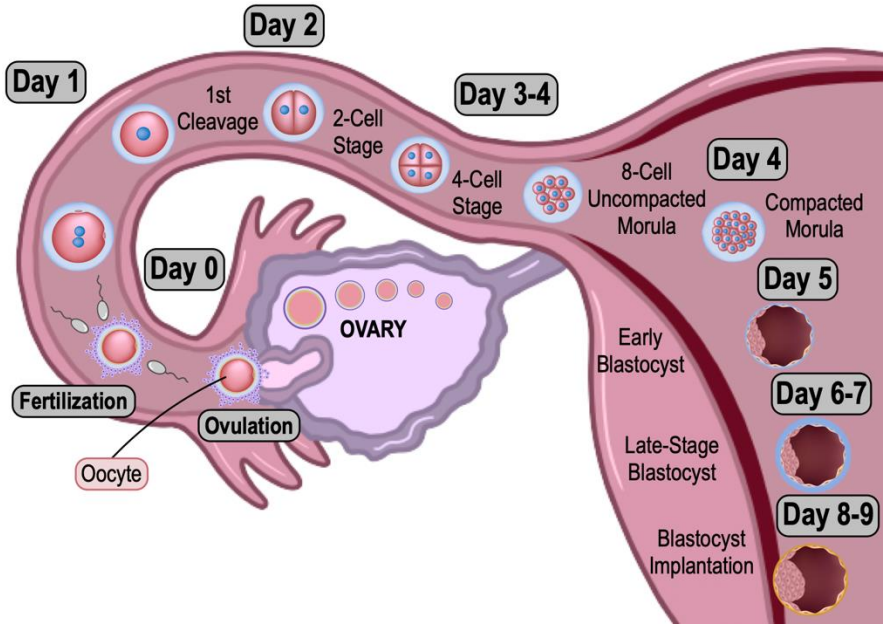
- ***Blastocyst*** – hollow ball of cells that forms from cleavage of the zygote in the fallopian tube
    - □ ***Cleavage*** – cells split in two without getting bigger

EXAMPLE:



- ***Implantation*** – embryo adheres to the wall of the uterus

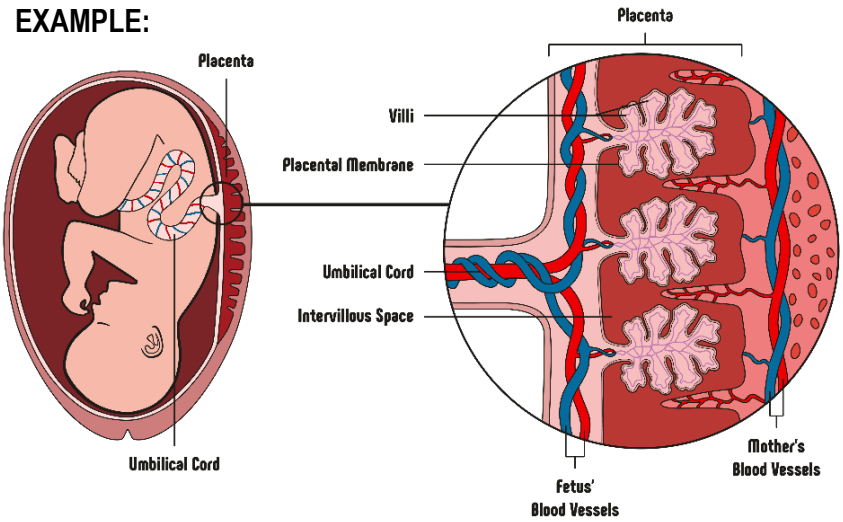
EXAMPLE:

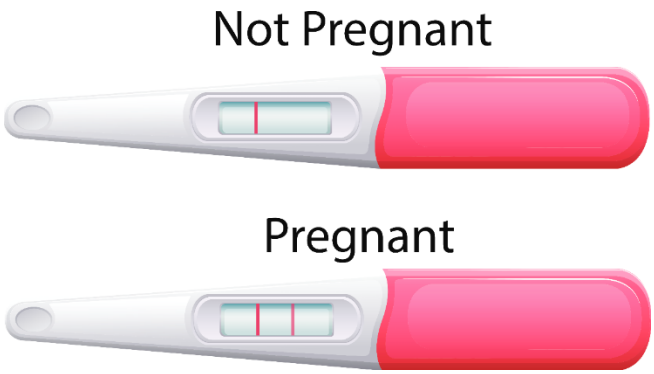


CONCEPT: ANIMAL REPRODUCTION

- ***Gestation*** (pregnancy) – carrying one or more embryos in the uterus
- Pregnancy is divided into trimesters, during the first trimester:
    - □ ***Human chorionic gonadotropin*** (***hCG***) – hormone secreted following implantation
        - Prevents degeneration of the corpus luteum, and halts menstrual cycle
    - □ ***Trophoblast*** – outer layer of blastocyst that grows into endometrium to form placenta
    - □ ***Placenta*** – organ that allows for exchange of materials, nutrients, and wastes between mother and fetus
        - ***Umbilical cord*** – connects fetus to placenta, contains two arteries and a vein
        - Oxygen exchange with fetus occurs through placenta
    - □ ***Fetus*** – embryo develops into fetus when it has adult structures in rudimentary forms
        - ***Organogenesis*** – development of organs

EXAMPLE:





- Oviparous – parent lays egg, embryo is nourished by yolk in egg
- Ovoviviparous – eggs remain inside parent until ready to hatch, embryo is nourished by yolk
- Viviparous – embryo nourished inside parent, give birth to live offspring
- ***Labor*** – uterine contractions that expel fetus from uterus
    - □ ***Oxytocin*** – stimulates uterine contraction
    - □ Pressure from head on cervix stimulates oxytocin release, creating a positive feedback loop
- ***Monotremes*** – egg-laying mammals that do not give birth to live offspring
- ***Marsupials*** – birth underdeveloped offspring that remain in a distinctive pouch containing the mammary-gland nipple
- ***Placental mammals*** (***eutherians***) – mammals that give birth to live, developed offspring after long gestation period
- ***Lactation*** – secretion of milk by mammary glands
    - □ Prolactin stimulates milk production; oxytocin stimulates secretion in response to suckling