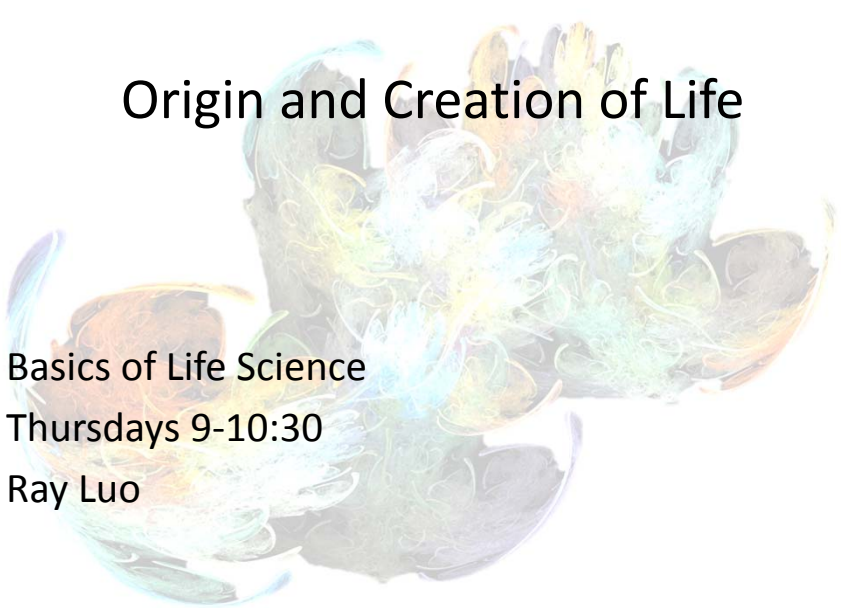



Origin and Creation of Life



Basics of Life Science
Thursdays 9-10:30
Ray Luo


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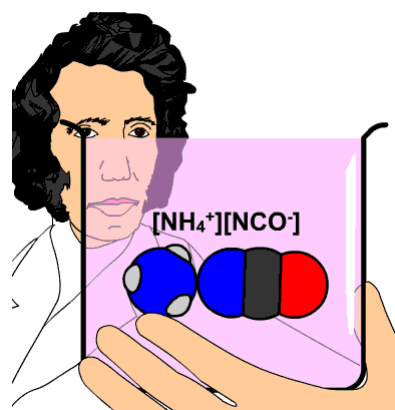
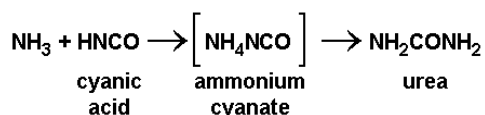
What is Life?



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Organic (life) compounds of carbon was first synthesized in urea.



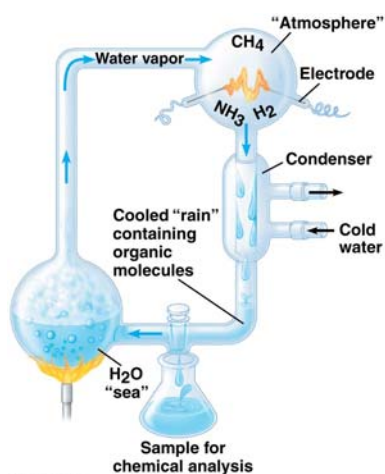
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Miller and Urey made complex organic compounds by simulating early earth.



- Water heated vaporized into an "atmosphere."
- Hydrogen gas (H_2), methane (CH_4), ammonia (NH_3), water exposed to "lightning" sparks.
- Condenser cools vapor into "rain," flow to "sea."
- Made formaldehyde, HCN, amino acids, hydrocarbons.

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Review: Origin of Life.

- What was the first organic molecule to be synthesized in the laboratory?
 - A) ammonium cyanate
 - B) hydrogen cyanide
 - C) urea
 - D) acetic acid
 - E) methane
- Which of the following molecules were NOT found by Miller and Urey during their experiment simulating early earth?
 - A) 9 of 20 amino acids
 - B) formaldehyde
 - C) racemic (left and right handed) forms of amino acids
 - D) RNA and DNA
 - E) hydrogen cyanide

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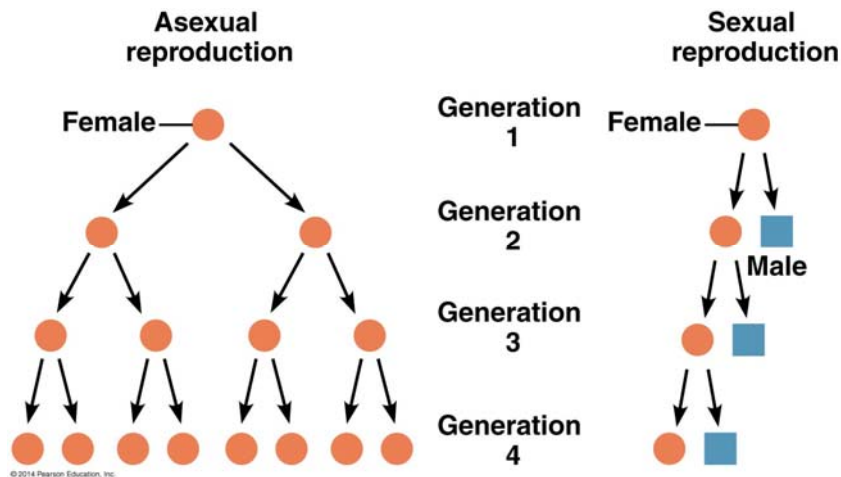
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Asexual reproduction relies on mitosis only, produces more individuals.



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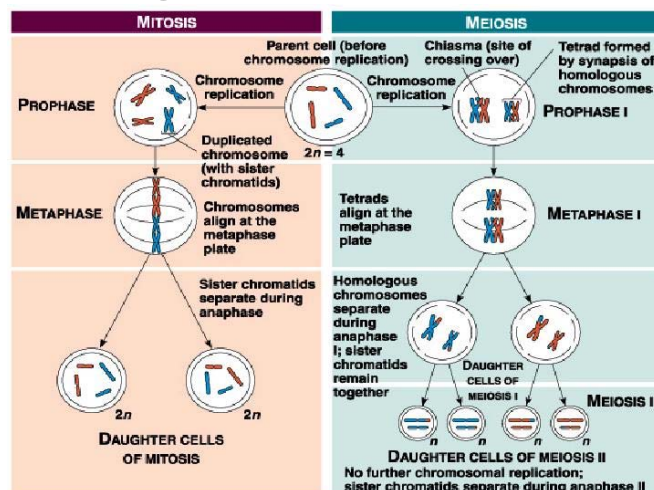
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Genetic recombination only occurs through meiosis, not mitosis.



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Forms of asexual reproduction: fragmentation to regeneration.

- Budding – part of oneself grows into another.
- Fission – divide oneself into two.
- Parthenogenesis – unfertilized egg develops into adult, e.g. haploid honeybee drones.
- Advantageous when environment is stable, adaptation not necessary, mutations low.
- Asexual when environment is favorable, sexual when stressed, e.g. water flea.

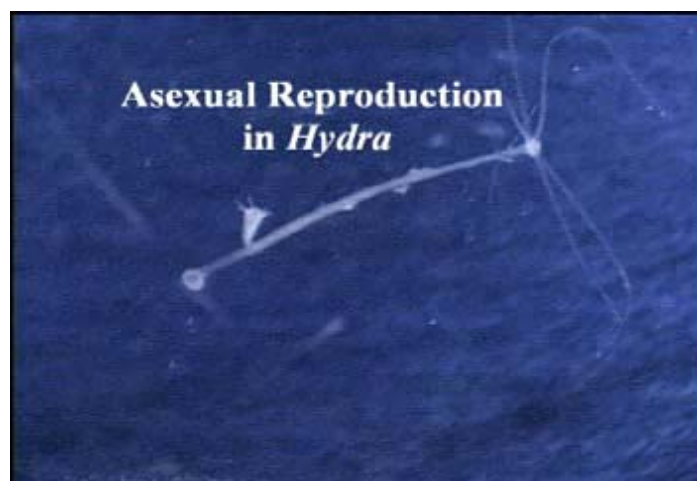
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Example of asexual reproduction: budding.



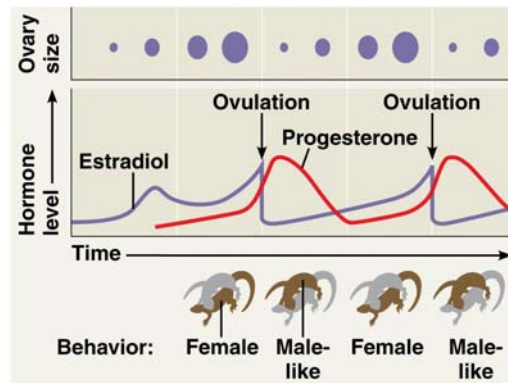
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Parthenogenetic “sex”: estradiol -> female role; progesterone -> male.



(b) The changes in sexual behavior of *A. uniparens* individuals are correlated with the cycles of ovulation.

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Kinky stuff: variations in sexual behavior in animals.

- Hermaphroditites – both male and female reproductive organs, produce eggs and sperm, arise from limited availability of mates.
- Sexual reversals – largest female in a group becomes the next single male.
- External fertilization – eggs released into environment, where males can fertilize, season-dependent spawning in frogs.
- Monogamy is rare – male making females less receptive after mating.

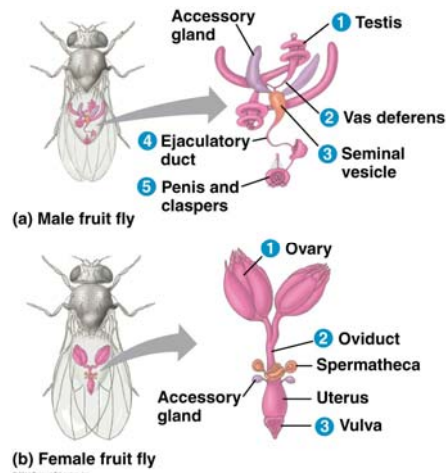
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Female flies: sperm in spermathecae until conditions are favorable.

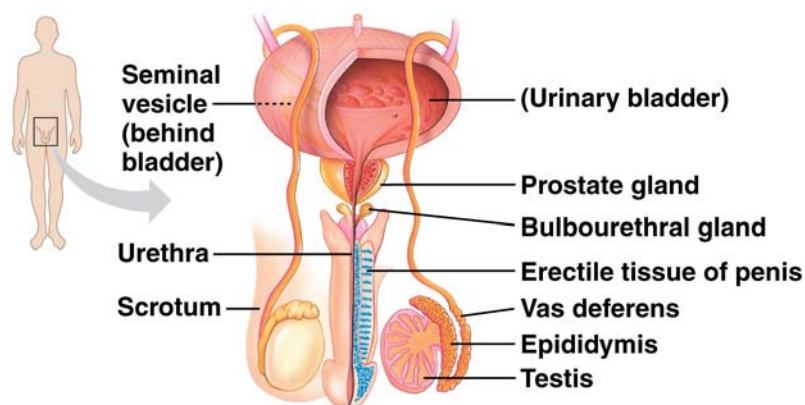


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Human males: sperm first made in seminiferous tubules, then cooled by scrotum.



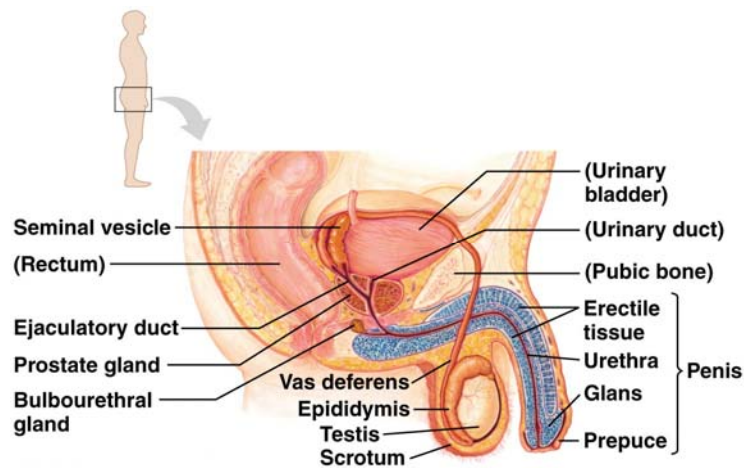
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Human males: 3 weeks sperm mature in epididymis, ejaculated vas deferens.



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Human males: sperm from testes mixed with fluids from three glands.

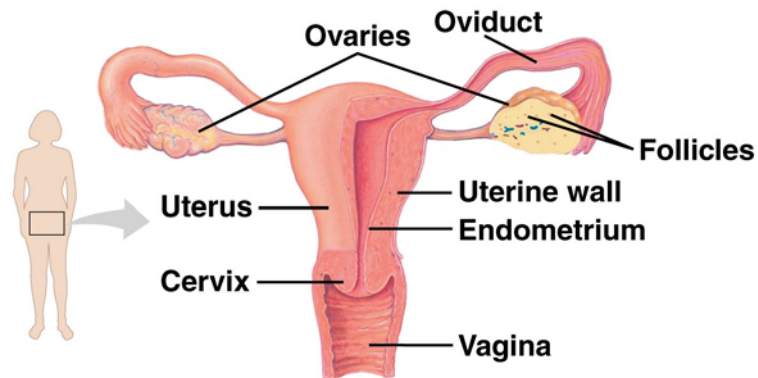
- Seminal vesicles – produce alkaline mucus, fructose, coagulant, prostaglandins -> semen.
- Prostate gland – produce citrate, cancer risk.
- Bulbourethral glands – neutralize urine in the urethra, some sperm before ejaculation.
- Penis – blood flow seals off veins during erection, Viagra (nitric oxide enabled relaxation).

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Human females: ovaries contain oocyte egg, joined to uterus by oviduct.



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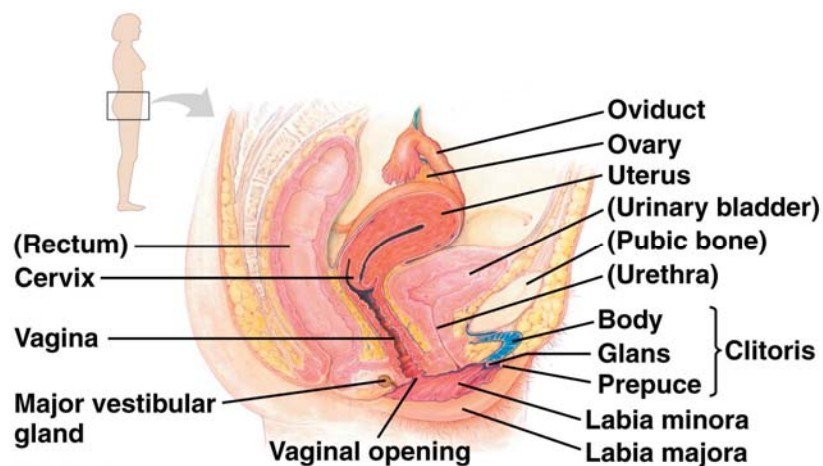
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Human females: vagina opens to outside at vulva, protected by labia.



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Human females: vestibular glands secrete mucus for lubrication.

- Endometrium – lining of uterus, blood filled, nourishes egg following ovulation (delivery of oocyte via fallopian tubes), opens at cervix.
- Clitoris – sensitive, aroused during sex.
- hymen – thin tissue ruptured upon first intercourse.
- Mammary glands – produces milk in females.

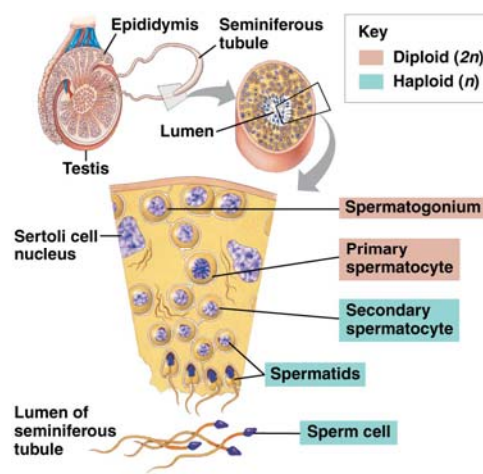
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Spermatogenesis: spermatocyte (2n) move from outer to inner tubules.



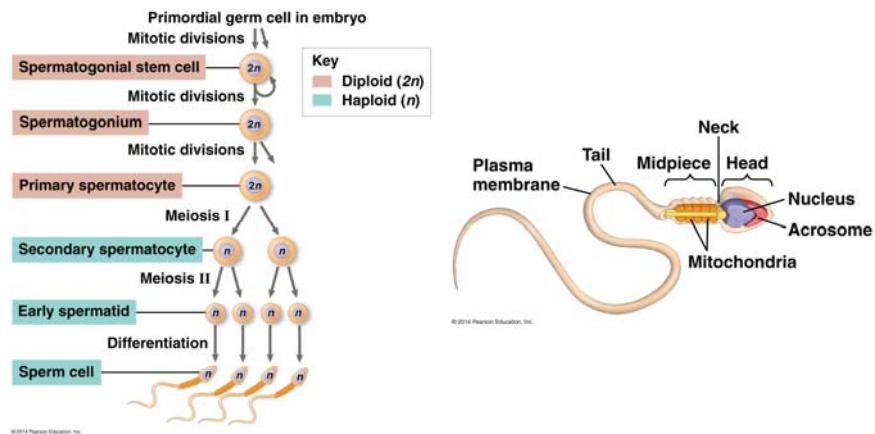
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Spermatogenesis: spermatid (n) gains acrosome head for digestion, flagella.

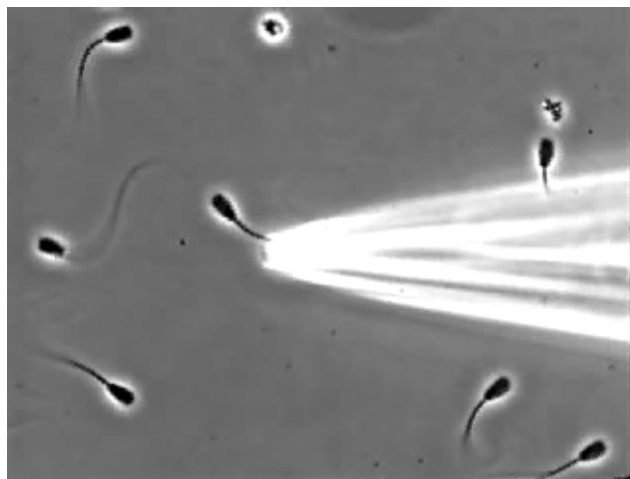


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The humble lives of human sperm.

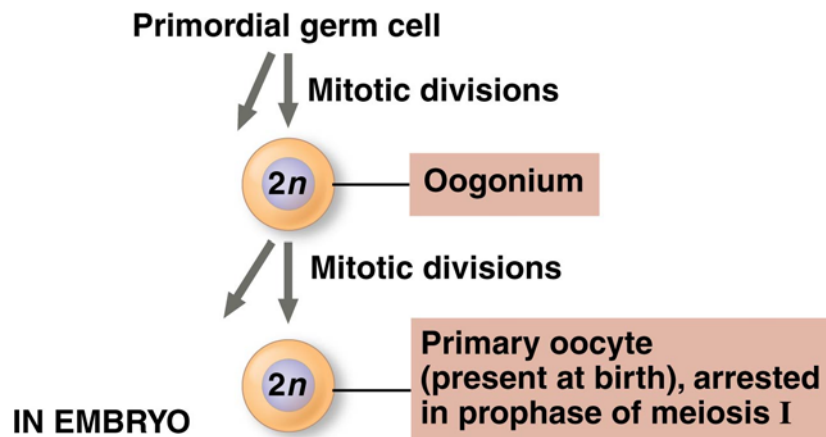


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Oogenesis: all eggs women have are present at birth in follicle form.



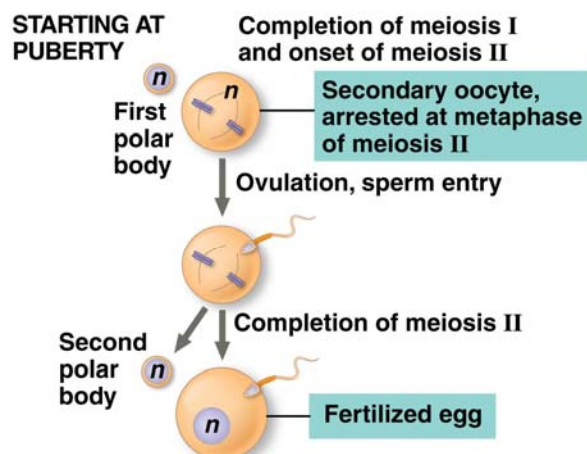
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Oogenesis: at puberty FSH stimulates growth of one follicle per month.



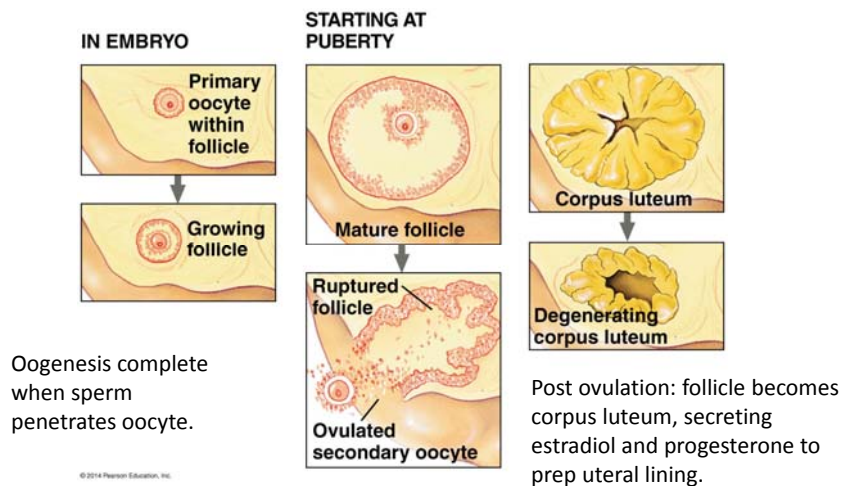
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Oogenesis: unequal cell divisions generate polar bodies.



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Hormonal regulation of sex, sexual characteristics, and reproduction.

- Gonadotropin-releasing hormone (GnRH) from hypothalamus directs anterior pituitary.
- Follicle-stimulating hormone (FSH) and luteinizing hormone (LH) from anterior pituitary stimulate sex hormone production.
- Androgens (testosterone) – voice, facial hair, muscles, aggressiveness, spermatogenesis.
- Estrogens (estradiol) – breasts, fat deposit.

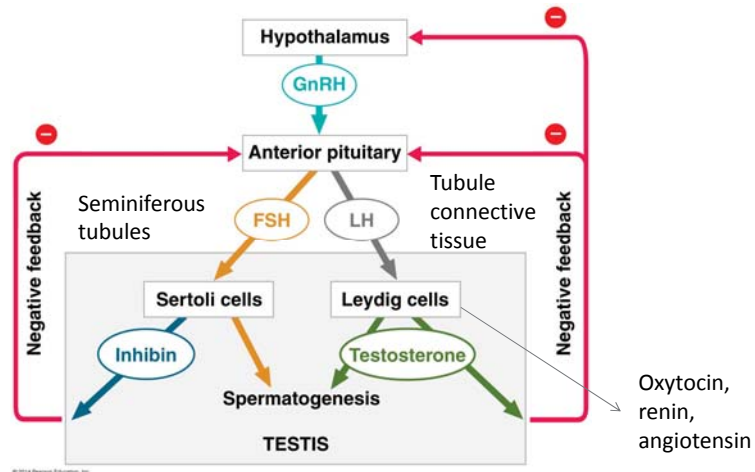
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Hormonal control of male sex system utilizes negative feedback.

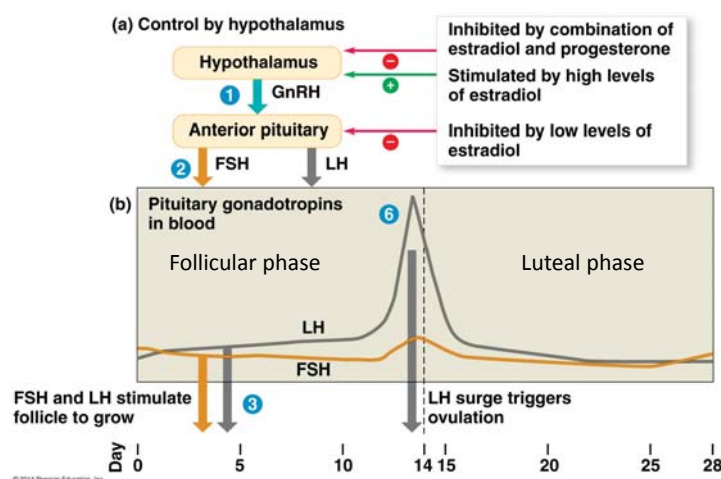


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Female ovarian cycle: low FSH and LH stim low estradiol -> neg feedback.

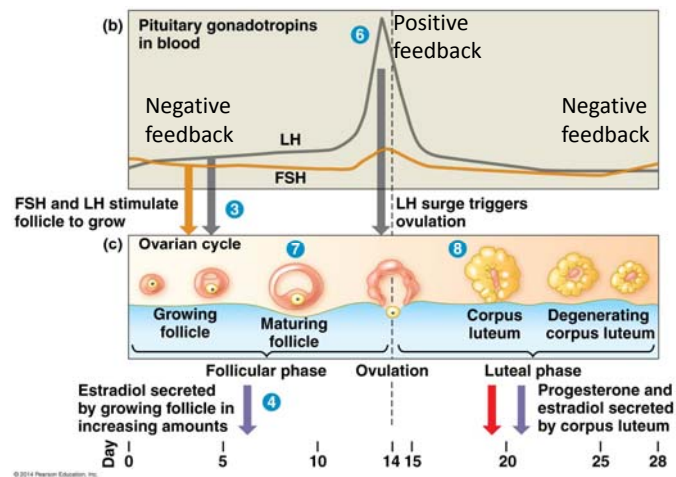


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Female ovarian cycle: sharp rise of estradiol leads to stim of GnRH and LH.

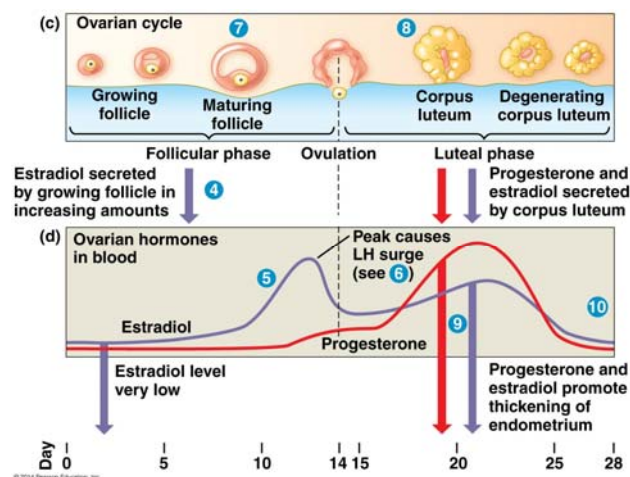


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Female ovarian cycle: follicle rupture and ovulation, LH → corpus luteum.

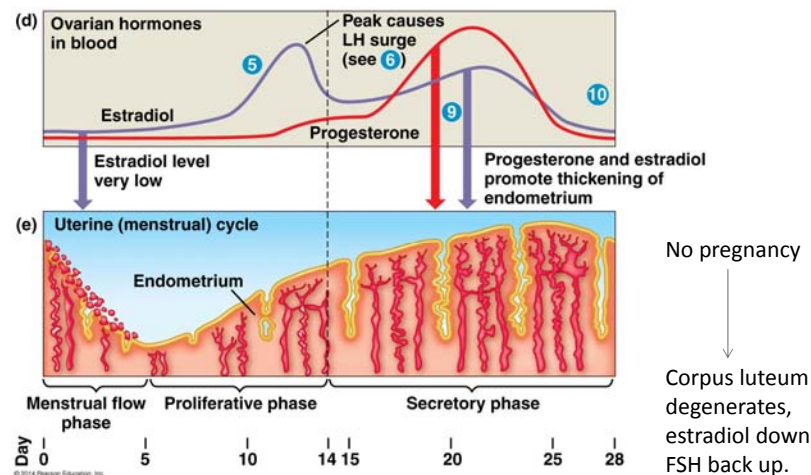


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Female ovarian cycle: progesterone and estradiol prevents another egg.



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Female menstrual cycle: follicular proliferative, luteal secretory phases.

- Menstruation – flow, or shedding of endometrium from uterus.
- Endometriosis – ectopic growth of uterine tissue leads to bleeding into stomach area.
- Menopause – ovaries lose response to FSH LH.
- Other mammals have estrus cycles where uterus resorbs endometrium.
- Vasocongestion (blood fill) and myotonia (muscle tension) characterize sex response.

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Review: Creating life.

Asexual reproduction results in greater reproductive success than does sexual reproduction when _____.

- A) pathogens are rapidly diversifying
- B) there is some potential for rapid overpopulation
- C) a species is expanding into diverse geographic settings
- D) a species is in stable and favorable environments

Which of the following is TRUE regarding hormonal control of the female ovarian cycle?

- A) Menstruation is triggered by negative feedback from testosterone.
- B) Anterior pituitary hormone release is negatively controlled by inhibin.
- C) Ovulation is triggered by positive feedback via LH and estradiol hormones.
- D) Progesterone levels are reduced during and after ovulation.

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The miracle of birth in human beings.

**Obstetric ultrasound
on a 20-week
human fetus**

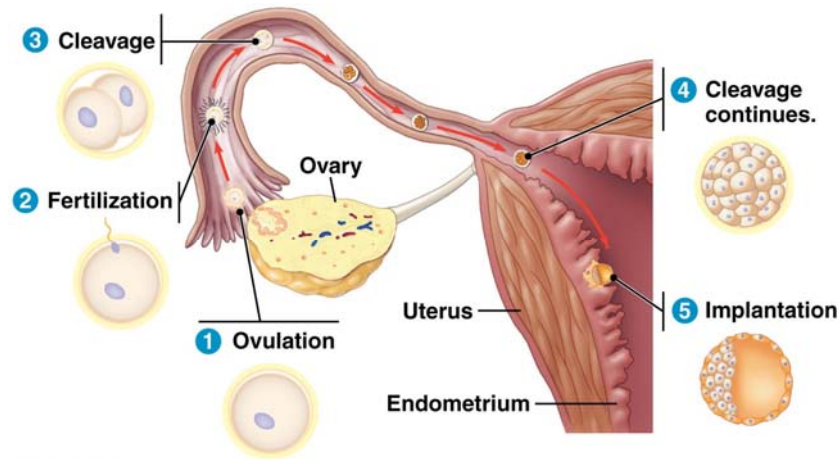
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Cleavage post conception produces blastocyst, implanted in endometrium.



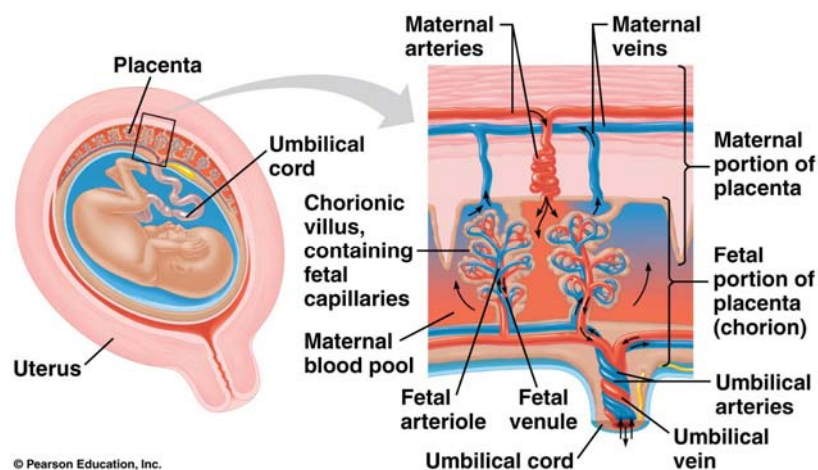
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First trimester: hCG, trophoblast of blastocyst + endometrium -> placenta.

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First and second trimesters:
organogenesis, progesterone, active.



(a) 5 weeks



(b) 14 weeks



(c) 20 weeks

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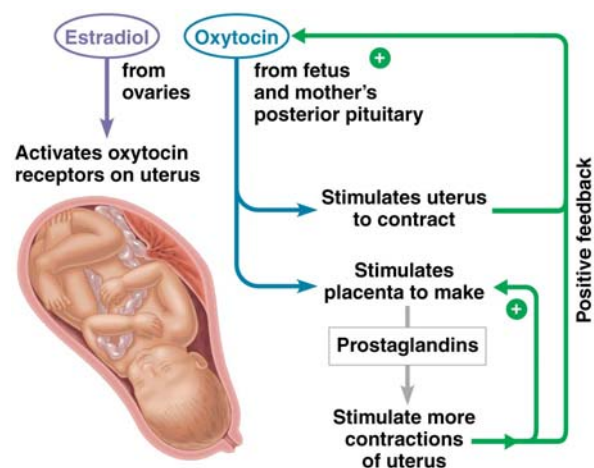
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Labor: prostaglandins and oxytocin
participate in positive feedback.



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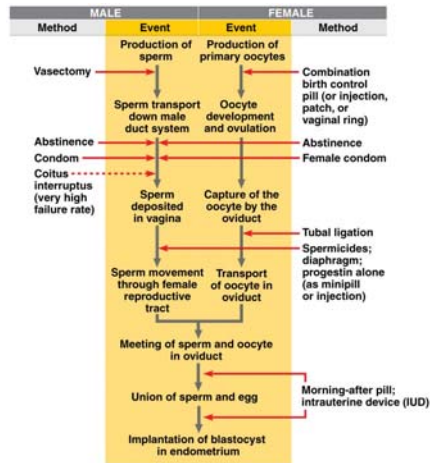
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Contraception: IUD and pill are most effective; for guys, abstinence.



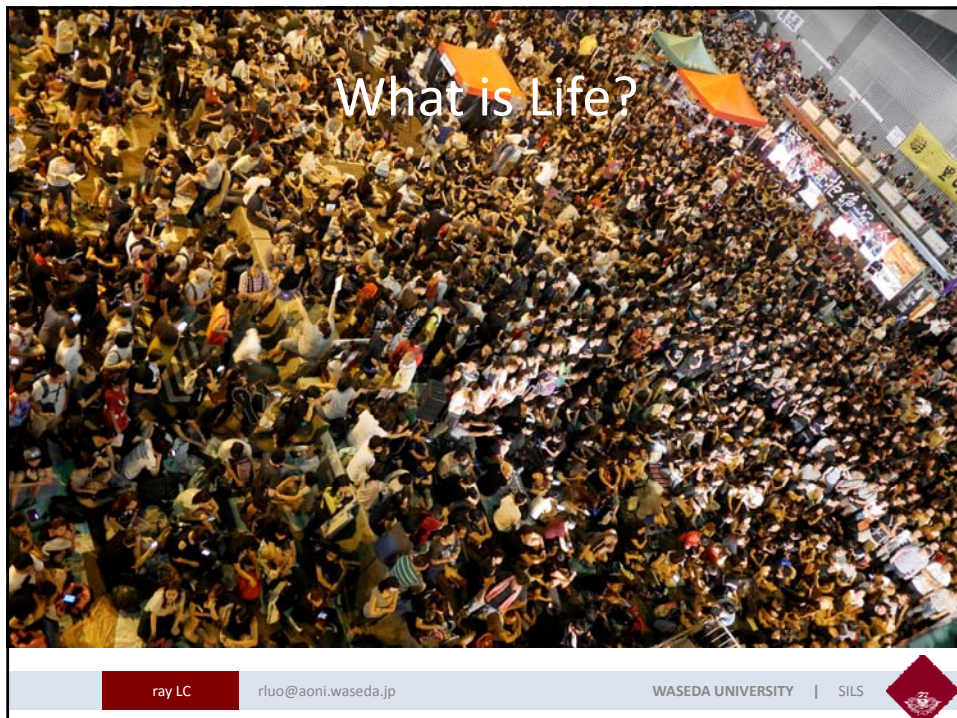
- IUD: placed in uterus.
- The Pill: synthetic progesterin - negative feedback to prevent GnRH and FSH, LH.
- Progesterin: thicken cervical fluid, ovulation freq down.
- RU486: abortion pill, blocks progesterone receptors in uterus.

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