

General Biology 1

BIO1201 RM 1021

Syllabus & Textbook:

<https://openlab.citytech.cuny.edu/oer-biology/lecture-schedule/>

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Grade Breakdown:

Lecture (60%)

Exams (4): 22.5% Each

Pop Quizzes (?): 10% Average

Lab (40%) – Lab Instructor

<u>Letter Grade</u>	<u>Numerical Ranges</u>
A	93-100
A-	90-92.9
B+	87-89.9
B	83-86.9
B-	80-82.9
C+	77-79.9
C	70-76.9
D	60-69.9
F	59.9 and below

Reproductive Systems

Chapter 41



Anne Geddes

Outline

How Animals Reproduce

- Asexual Reproduction
- Sexual Reproduction
- Life History Strategies

Human Male Reproductive System

Human Female Reproductive System

Control of Human Reproduction

Sexually Transmitted Diseases



Asexual Reproduction

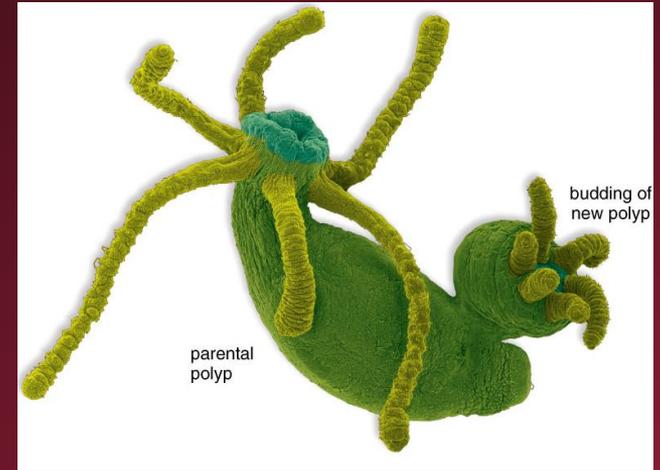
- Some animals usually reproduce asexually, but practice sexual reproduction on occasion

- Sponges, cnidarians, flatworms, annelids, echinoderms

Ex: Hydras can reproduce asexually as an outgrowth (bud) of the parent: Flatworms reproduce asexually by splitting in half: Sponges, annelids, and echinoderms can have the ability to regenerate from fragments

- Parthenogenesis

- Modification of sexual reproduction
- Unfertilized egg develops into complete individual



Sporadic Occurrence of Parthenogenesis in Poultry

PATRICIA SARVELLA

DURING a cytogenetic study on parthenogenesis in virgin chickens, two eggs in the control stock developed unexpectedly and produced offspring. Kosin *et al.*¹ reported one parthenogenetic chicken that lived for 8 days, and Olsen *et al.*² had one parthenogenetic chick that died the day after hatching.

Parthenogen Chickens

Case one

The first case of a parthenogen chicken in my stock was from a Regional Cornell randombred hen. She was being tested for the percent parthenogenesis prior to use in a study on the induction of parthenogenesis. It was surprising to find development in one egg, because virgin females of this line produced only an occasional very small membrane (<0.1 percent)³. Embryos had never been observed in eggs from virgin females in this line. The hens had been moved from a floor pen to cages five days before the fertile egg was laid. As soon as the birds could

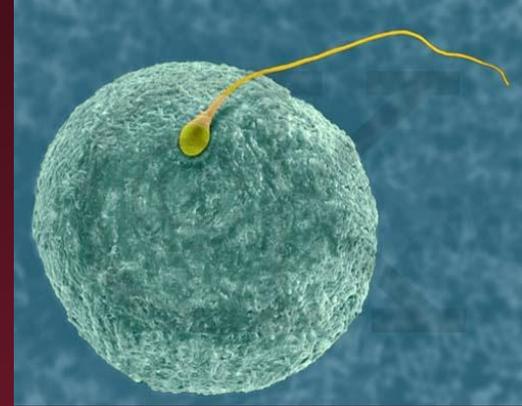
be sexed, at 6 weeks, all males were removed from the floor pen. None of the other hens treated in the same way produced eggs with development, and none of the other eggs (22) from this hen showed any signs of development. No inseminations had ever been made in that house. It was unlikely that the eggs could have come from another house, since no other eggs on the farm were being marked for pedigree hatching. The eggs from this hen were very small, as was the fertile egg. The chicken hatched by itself and looked normal. As it matured it appeared to be a male. While feathering had both male and female characteristics (Figure 1A), the comb was normal for a male, and it had large spurs like a male. The vent area resembled a female, although it could not be everted like that of a laying female (Figure 1B). The bird died at 10 months of age.

When autopsied it had two long oviducts: The right one was 17 cm long, swollen and filled with a clear fluid; the left one was 20.5 cm long, convoluted and not filled with fluid. The gonads were different from each other. The right one was small (1 X 0.5 cm), and triangular shaped. The left gonad had areas that resembled immature tubules (Figure 2) similar to the chicken X quail noninjected hybrids⁴. The areas were scattered through the left gonad, but none was seen in the right gonad; no spermatozoa were seen.

Dr. Sarvella is research geneticist in the Poultry Research Branch, Animal Husbandry Research Division, Agricultural Research Service, United States Department of Agriculture, Beltsville, Maryland 20705. The author wishes to thank Dr. L. B. Crittenden for making the skin grafts, and Dr. C. R. J. Law for the blood analysis work.

Parthenogenesis: a form of asexual reproduction where growth and development of embryos occur without fertilization

Sexual Reproduction



Egg of one parent fertilized by sperm of another

- Animals usually produce **gametes** in specialized organs called **gonads**

- Testes produce sperm
- Ovaries produce eggs



- **Copulation** is sexual union to facilitate reception of sperm

- Most animals are *dioecious* = separate sexes

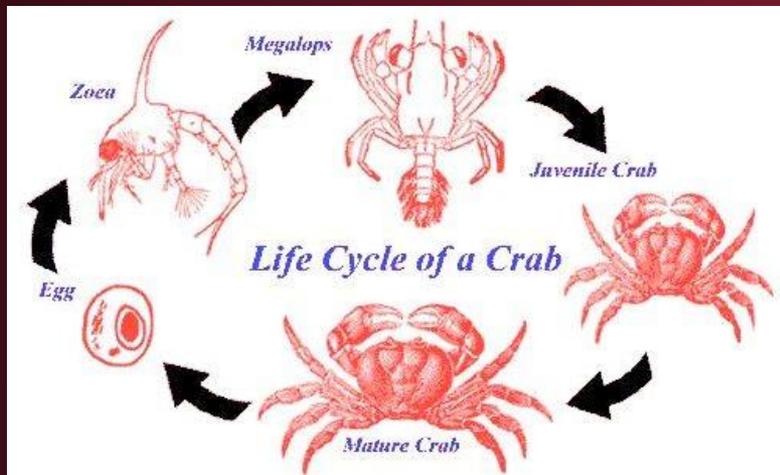
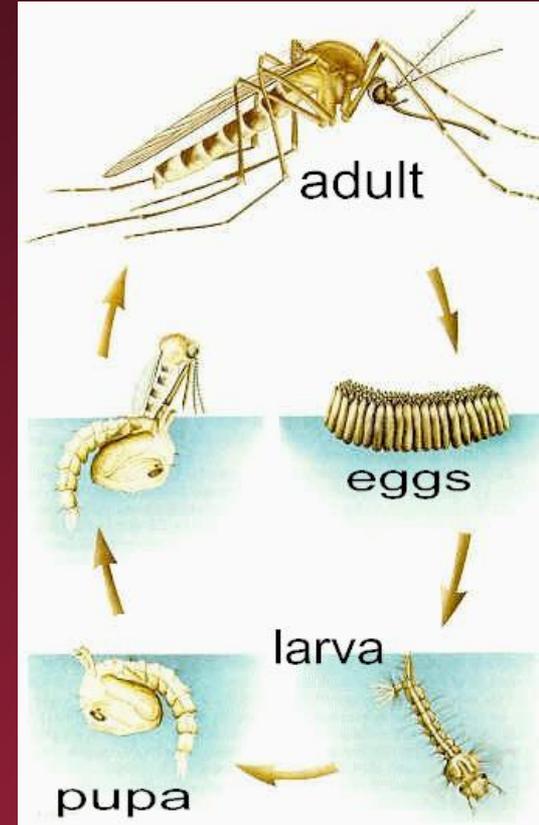
- Egg of one parent is fertilized by sperm of another

- Some animals are *monoecious* (hermaphroditic)

- Contain both male and female sex organs in a single body
- Majority practice cross-fertilization with other individuals

Life History Strategies

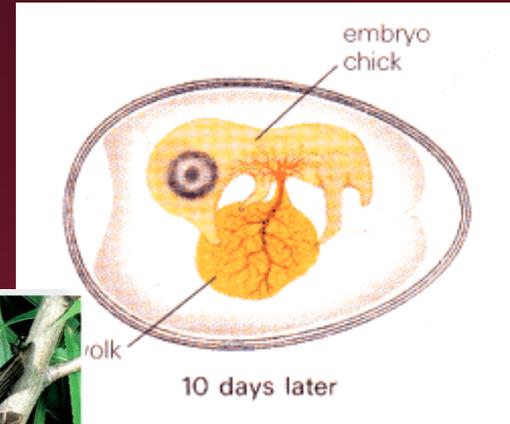
- Insect eggs produced in ovaries
 - **Yolk** is stored food to be used during development
 - Some form pupa and go through **metamorphosis**
- Many aquatic animals have a **larval stage**
 - Utilize different food source than adults



Life History Strategies

- Reptiles and birds are **oviparous**; provide eggs with plentiful yolk

- Development takes place in shelled egg containing **extra-embryonic membrane**
- Parents often tend eggs and young



- Mammals are **viviparous** (Live-born)

- Care of zygote and embryo
- **Placental** mammals eliminate need for shelled egg



Life History Strategies

- **Ovoviviparous**
- **animals retain their eggs and release young able to fend for themselves**
- **No direct nourishment from mother (or father)**



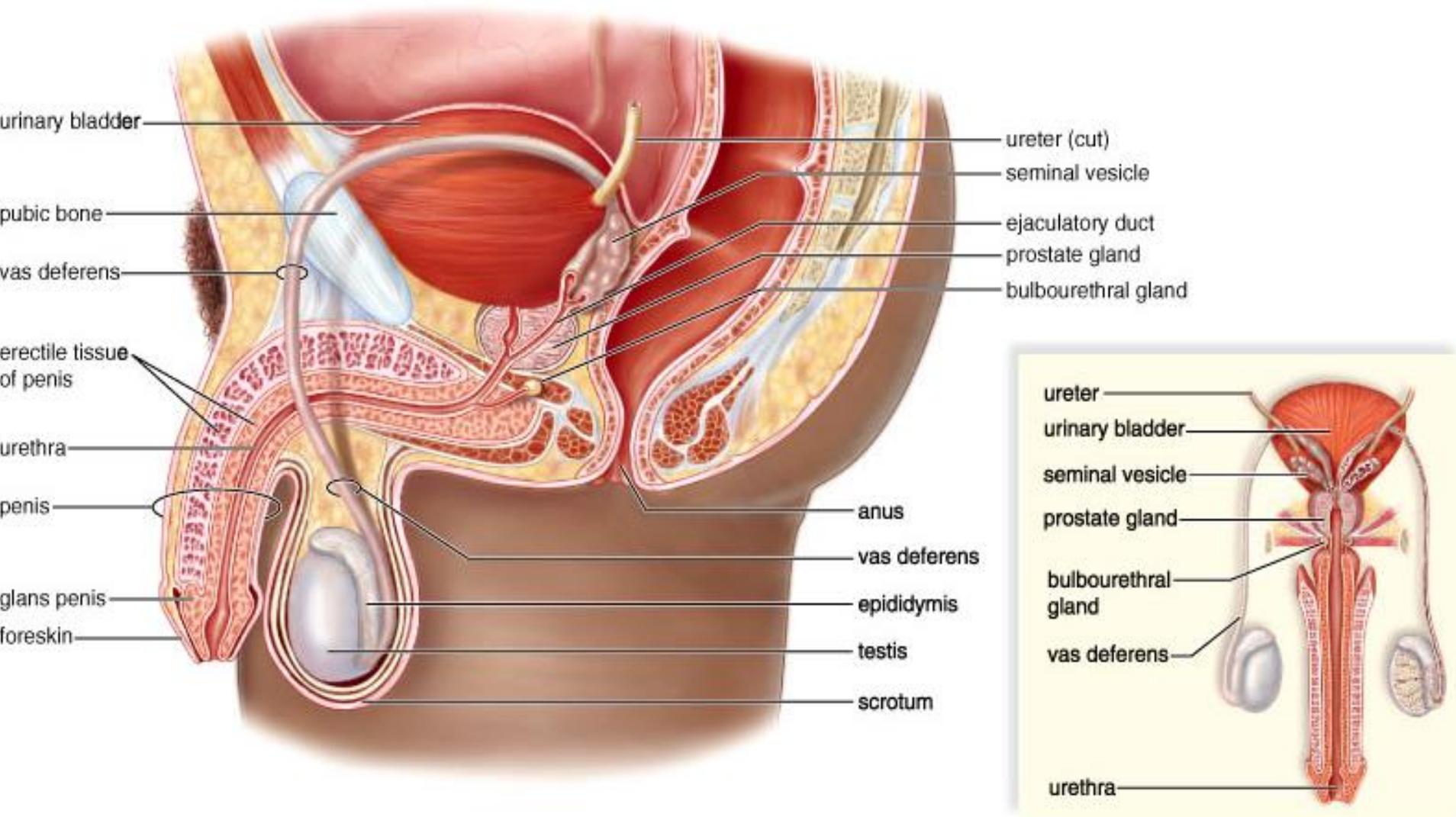
Male Reproductive System (Human)

-Male gonads (gamete producing structure)

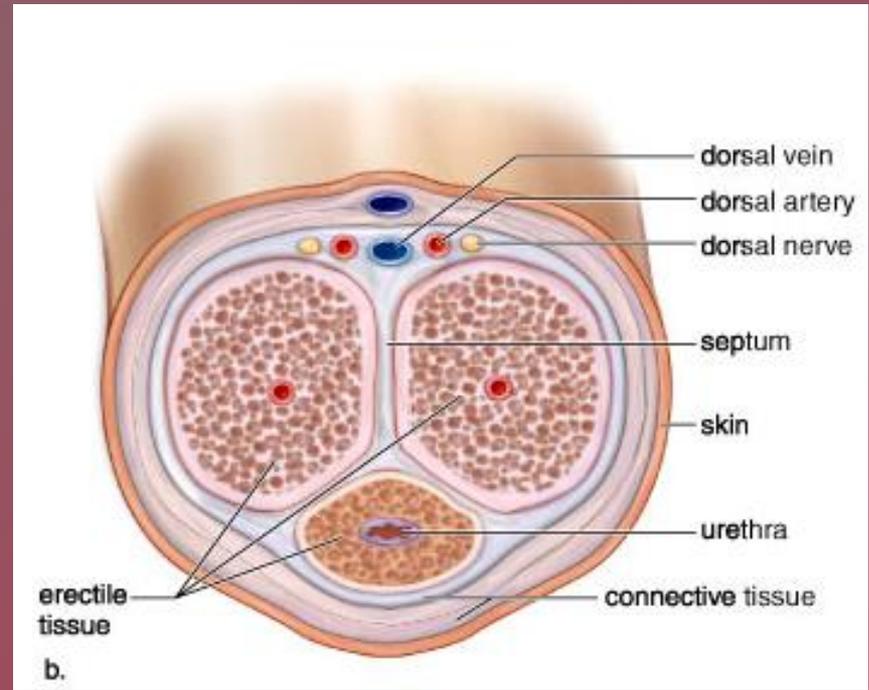
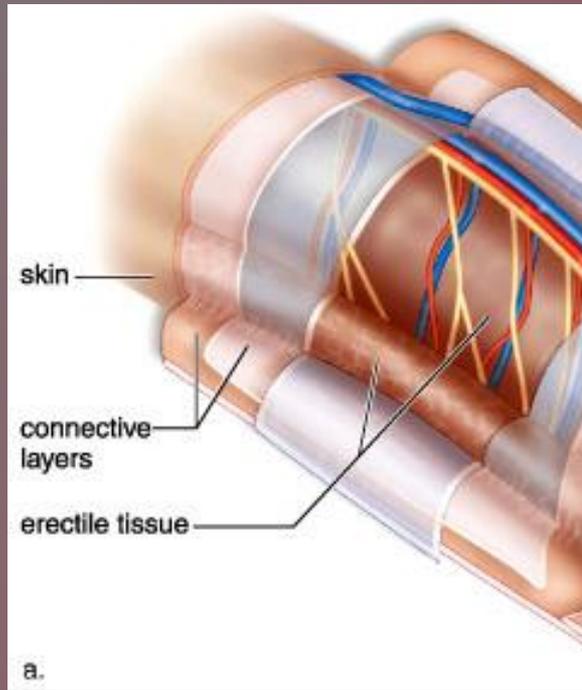
- Paired testes suspended in scrotum
- Sperm
 - Produced by testes
 - Mature within epididymides
 - Propelled into *vas deferentia* by muscular contractions

Male Reproductive System	
<i>Organ</i>	<i>Function</i>
Testes	Produce sperm and sex hormones
Epididymides	Sites of maturation and some storage of sperm
Vasa deferentia	Conduct and store sperm
Seminal vesicles	Contribute fluid to semen
Prostate gland	Contributes fluid to semen
Urethra	Conducts sperm (and urine)
Bulbourethral glands	Contribute fluid to semen
Penis	Organ of copulation

The Male Reproductive System



Penis Anatomy



-Penis is cylindrical organ hanging in front of scrotum

- Three cylindrical columns of spongy, erectile tissue
- Blood flow stiffens penis and increases its size
- Seminal fluid contains

- Sperm

- Secretions from

- Seminal vesicles
- Prostate gland, and
- Bulbourethral gland

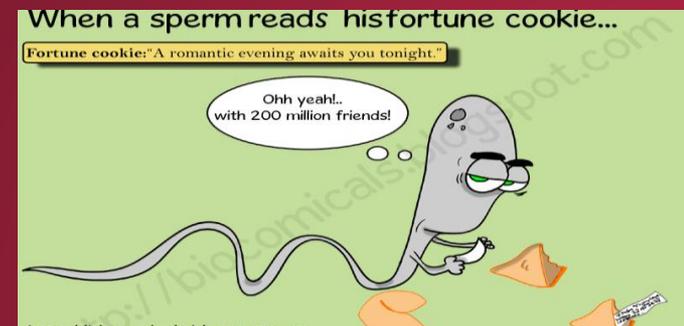
Ejaculation

Emission - First phase of ejaculation

- Nerve impulses sent to epididymides and *vasa deferentia*
- Sperm enters ejaculatory duct
- Secretions released

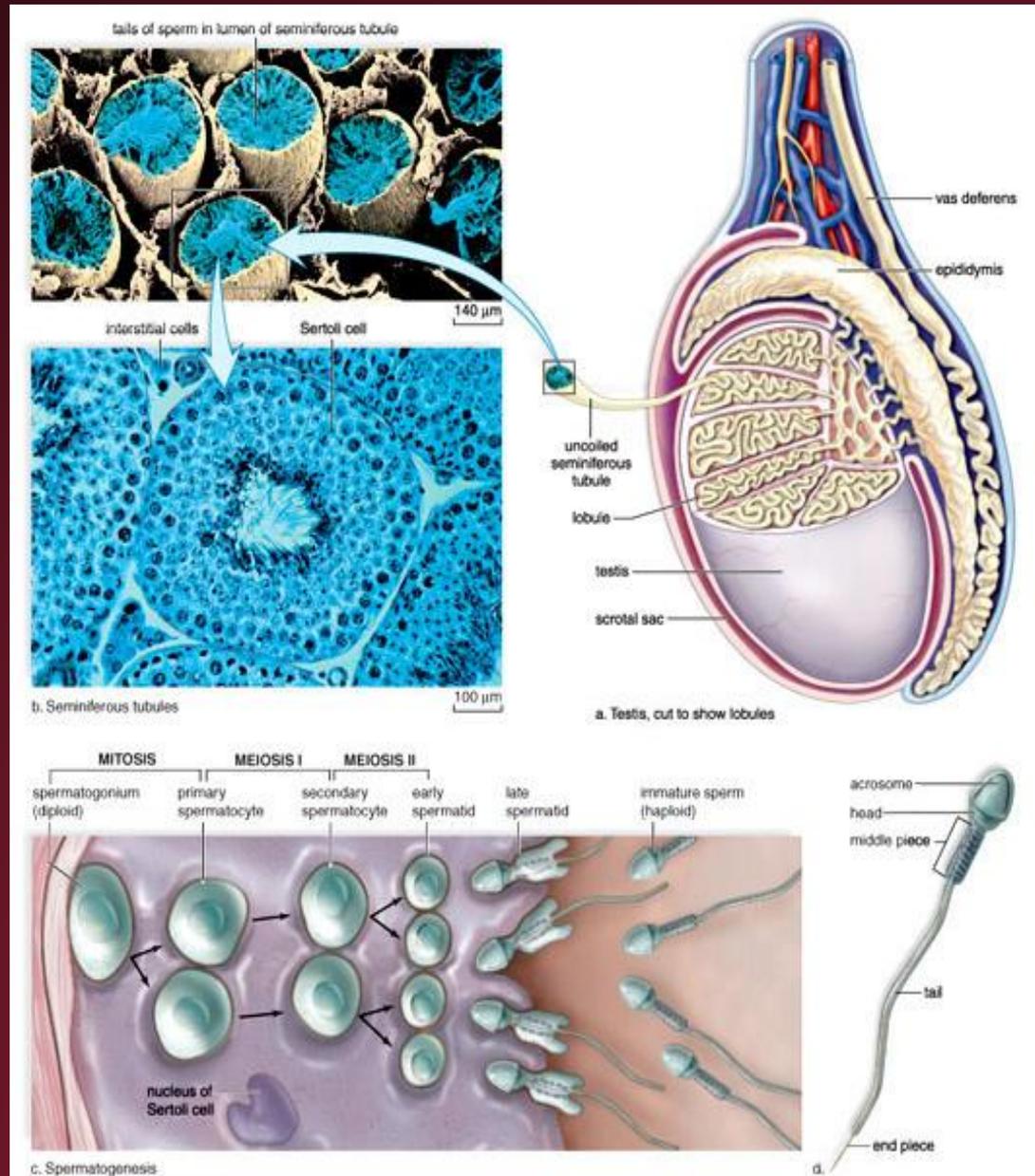
Expulsion

- Rhythmical muscle contractions
 - Expel semen in spurts from opening of urethra
 - Contractions are part of male orgasm

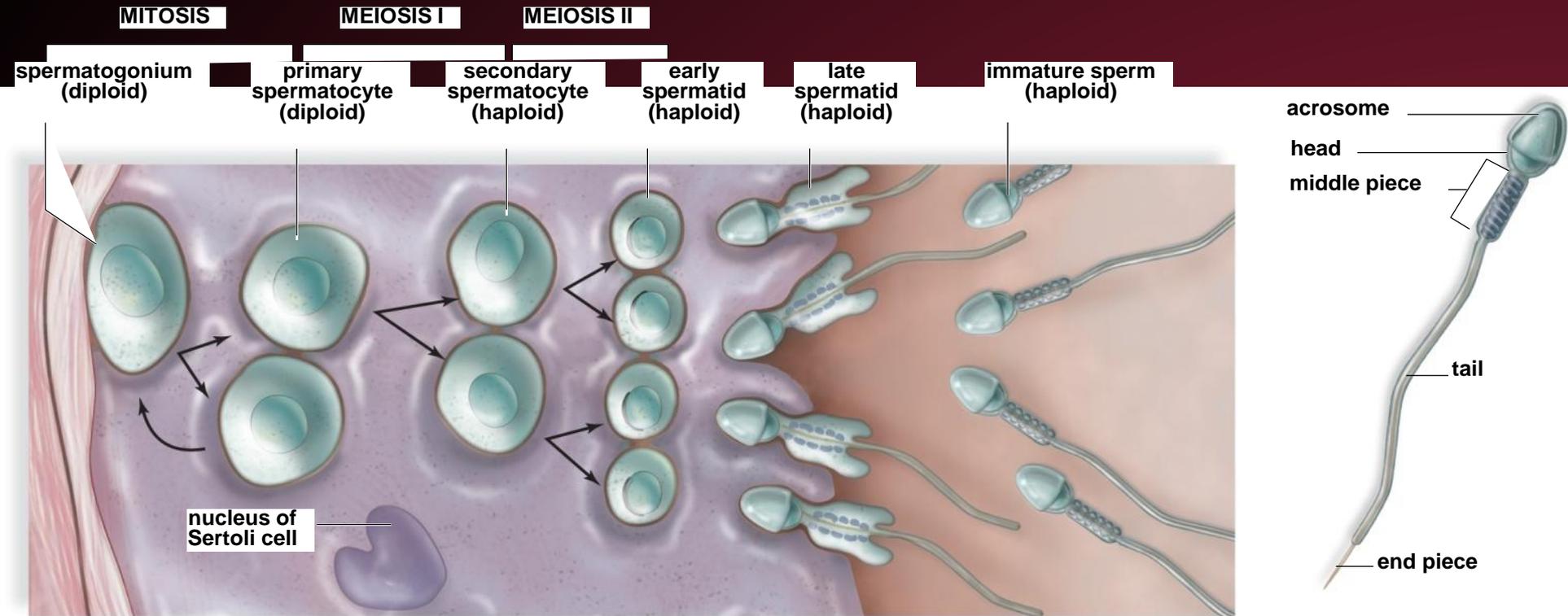


Testes and Spermatogenesis

- Testes contain coiled **seminiferous tubules** where **meiosis** occurs
- Mature sperm have three distinct pieces
 - Head
 - Acrosome
 - Mid-piece
 - Tail
- Normal human ejaculate contains several hundred million sperm cells



SPERMATOGENESIS



c. Spermatogenesis

d. Sperm

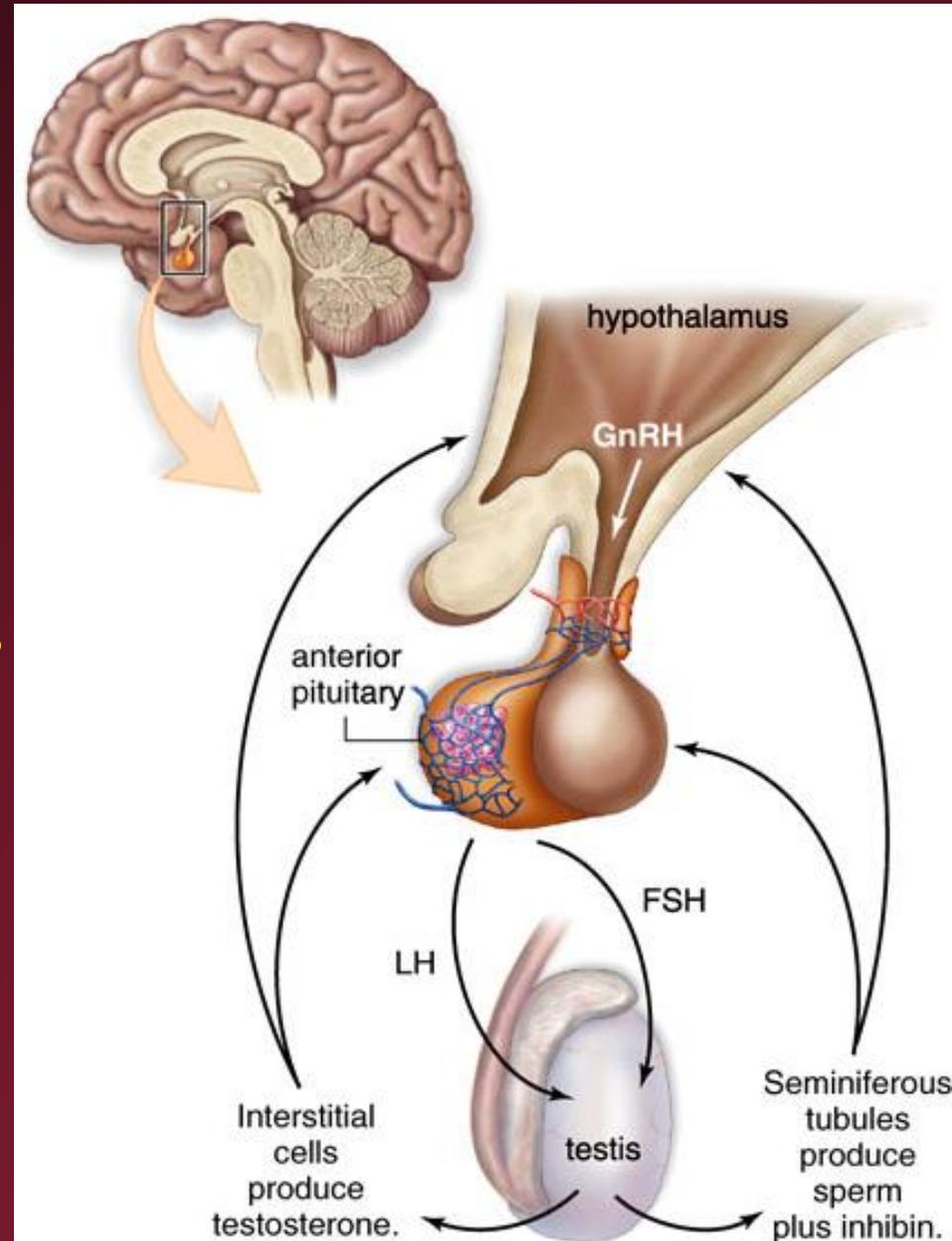
Production of Sperm in seminiferous tubules - Tubes packed with cells undergoing spermatogenesis

- Spermatogonia divide to produce primary spermatocytes
- Primary spermatocytes undergo meiosis I to produce secondary spermatocytes
- Secondary spermatocytes undergo meiosis II to produce four spermatids, each of which matures into a sperm cell
- Consists of three parts: head (acrosome and nucleus); middle piece; tail

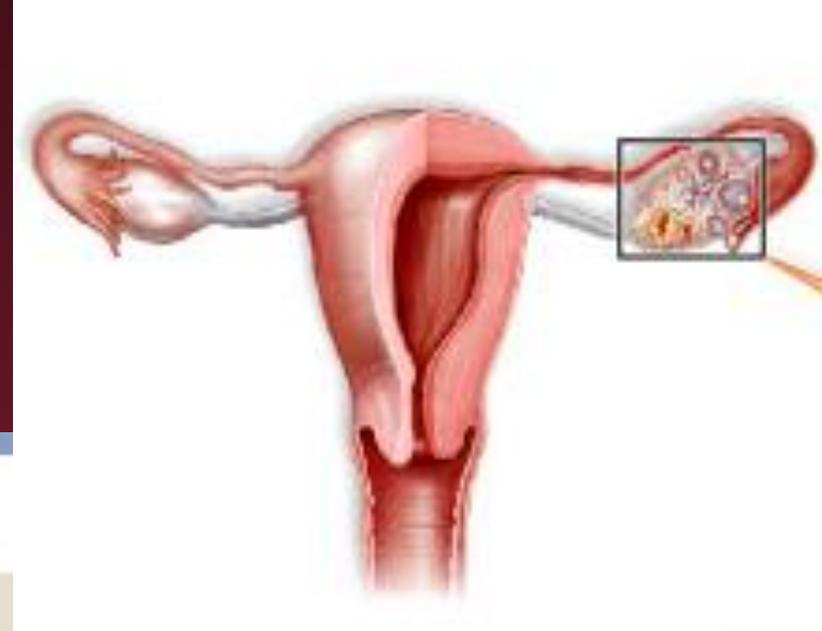
Hormonal Regulation in Males

Hypothalamus has ultimate control of testicular sexual function

- Gonadotropic Releasing Hormone GnRH
 - Promotes spermatogenesis
 - Occurs in seminiferous tubules
- Follicle Stimulating Hormone FSH
 - Controls production of testosterone
 - Testosterone produced by interstitial cells of testis
- Lutenizing Hormone LH



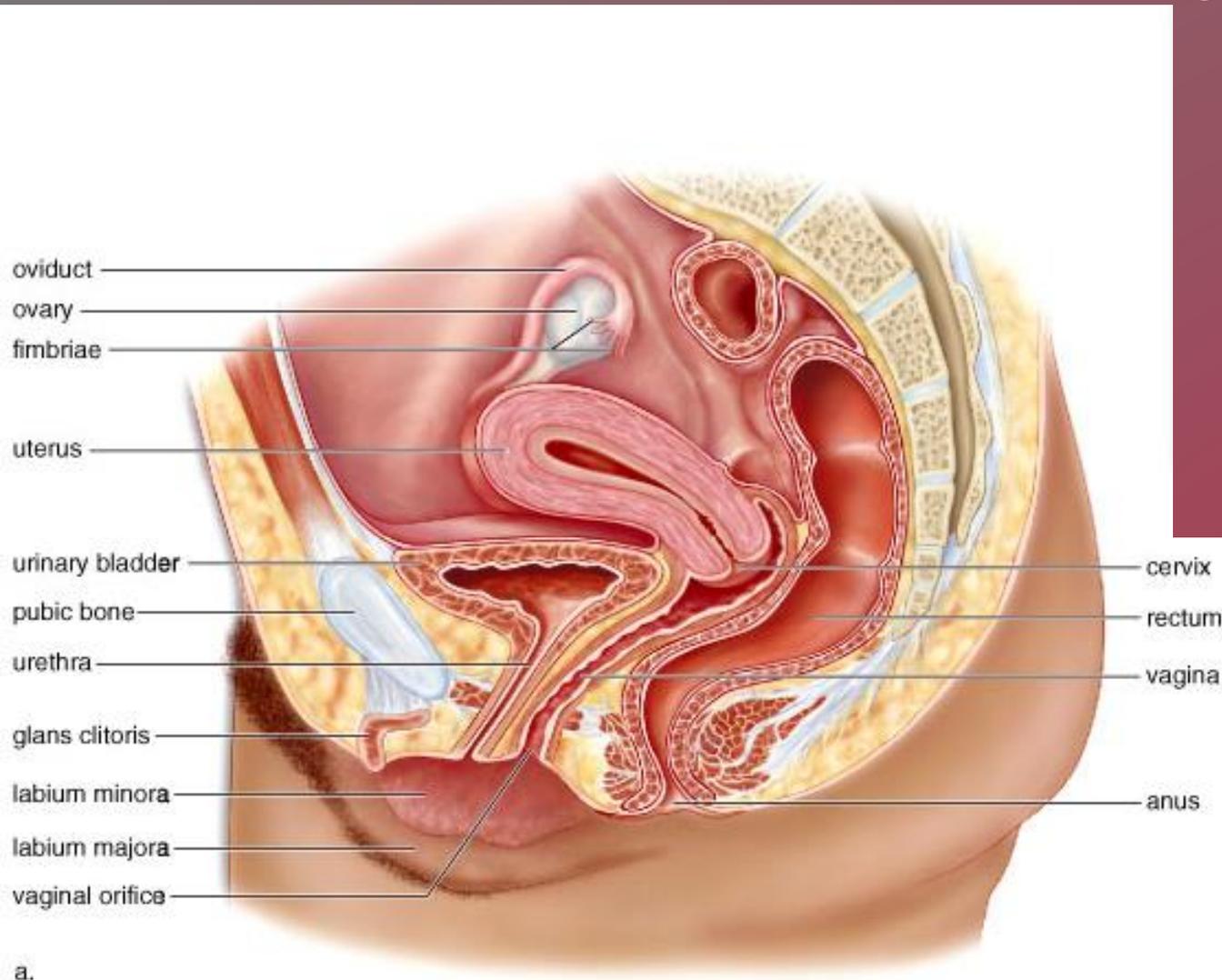
Female Reproductive System (human)



Female Reproductive Organs

<i>Organ</i>	<i>Function</i>
Ovaries	Produce egg and sex hormones
Oviducts (fallopian tubes)	Conduct egg; location of fertilization
Uterus (womb)	Houses developing embryo and fetus
Vagina	Receives penis during copulation and serves as birth canal

Female Reproductive System



- External genital organs are collectively known as the **vulva**

- Mons pubis and labia minora and labia majora are on either side of urethral and vaginal openings
- Clitoris has a shaft of erectile tissue and is capped by pea-shaped gland

Ovaries

-Ovaries release ova and produce estrogen and progesterone

-Ovarian Cycle

- **Follicular Phase**

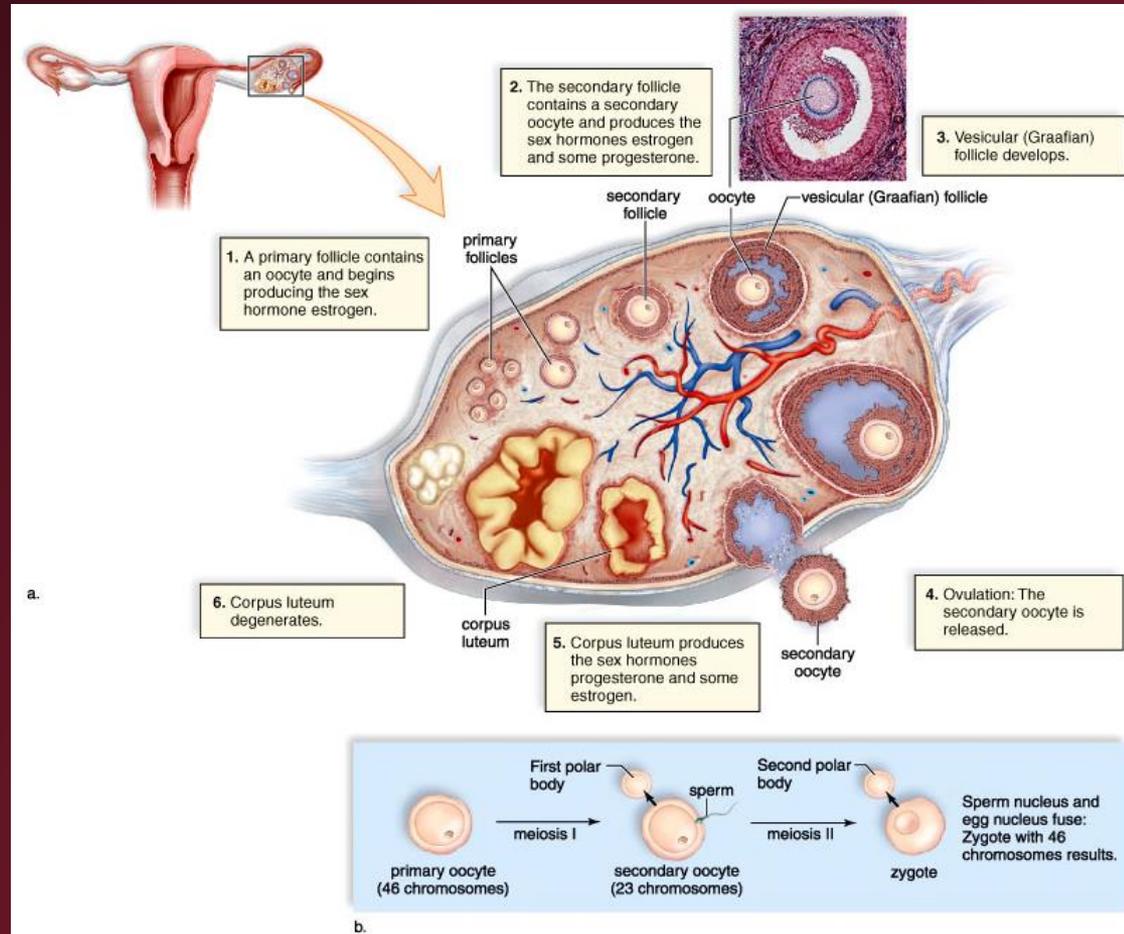
- FSH promotes development of follicle
- Follicle then secretes estrogens

- **Ovulation**

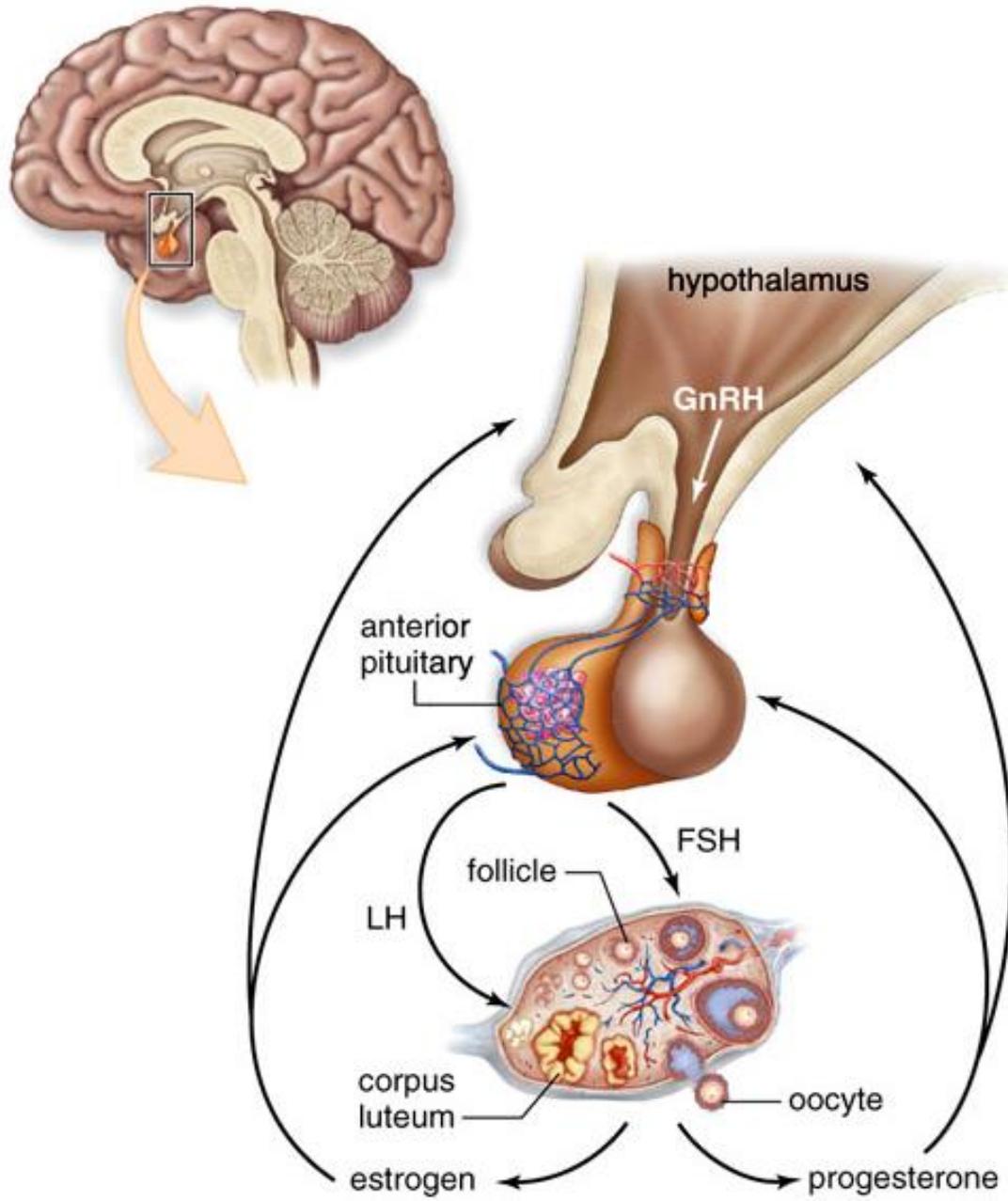
- Release of secondary oocyte from a vesicular follicle
- Follicle develops in corpus luteum
- Degenerates if no pregnancy

- **Luteal Phase**

- LH promotes development of corpus luteum
- Corpus luteum then secretes progesterone



Hormonal Control of Ovaries



Uterine Cycle

Sex hormones produced in ovarian cycle affect **endometrium**

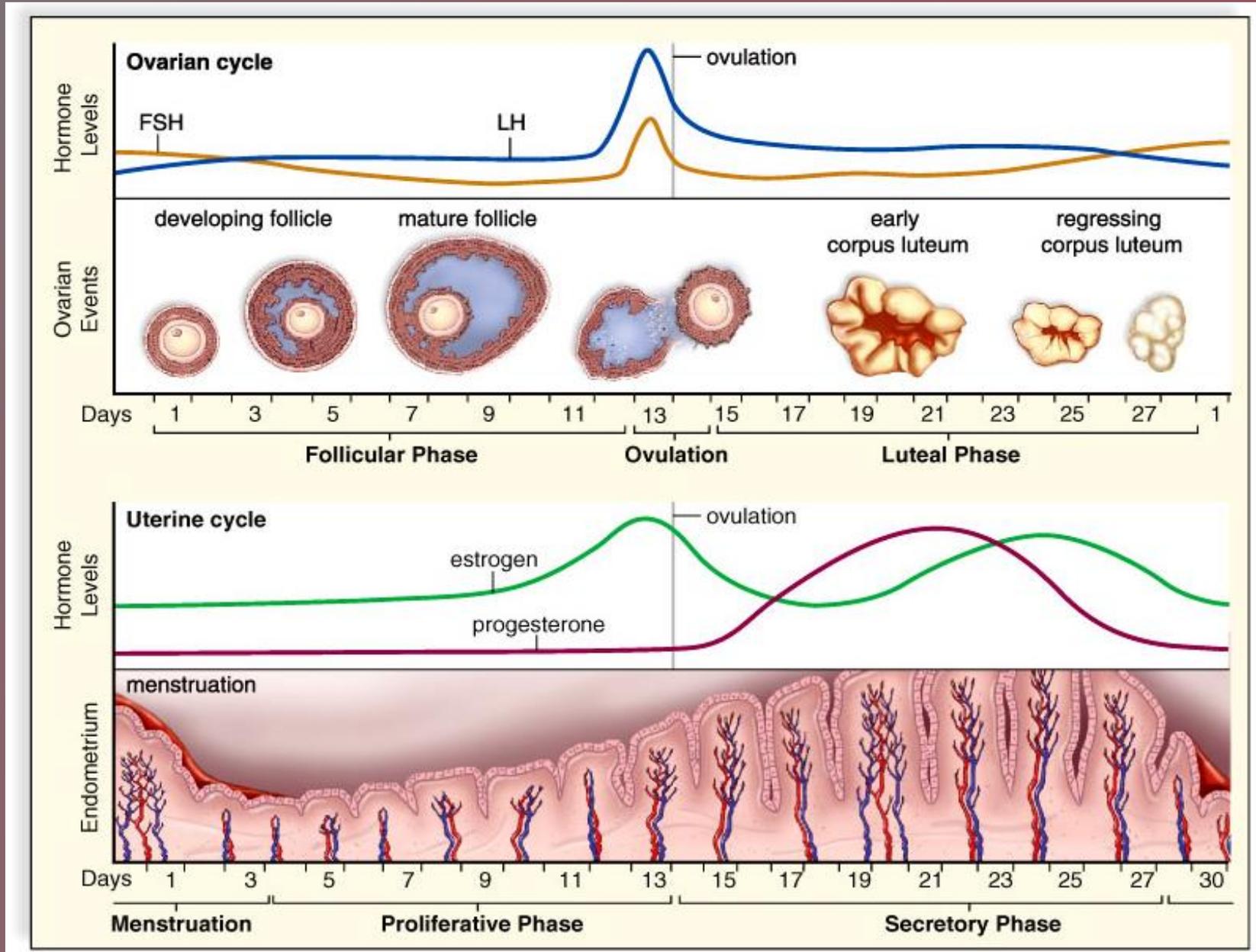
- Days 1-5:
 - Endometrium disintegrates
 - Menses pass out vagina during **menstruation** (periods)
- Days 6-13:
 - Endometrium thickens
 - Ovulation usually occurs on 14th day
- Days 15-28:
 - Endometrium doubles in thickness

Ovarian and Uterine Cycles (Simplified)

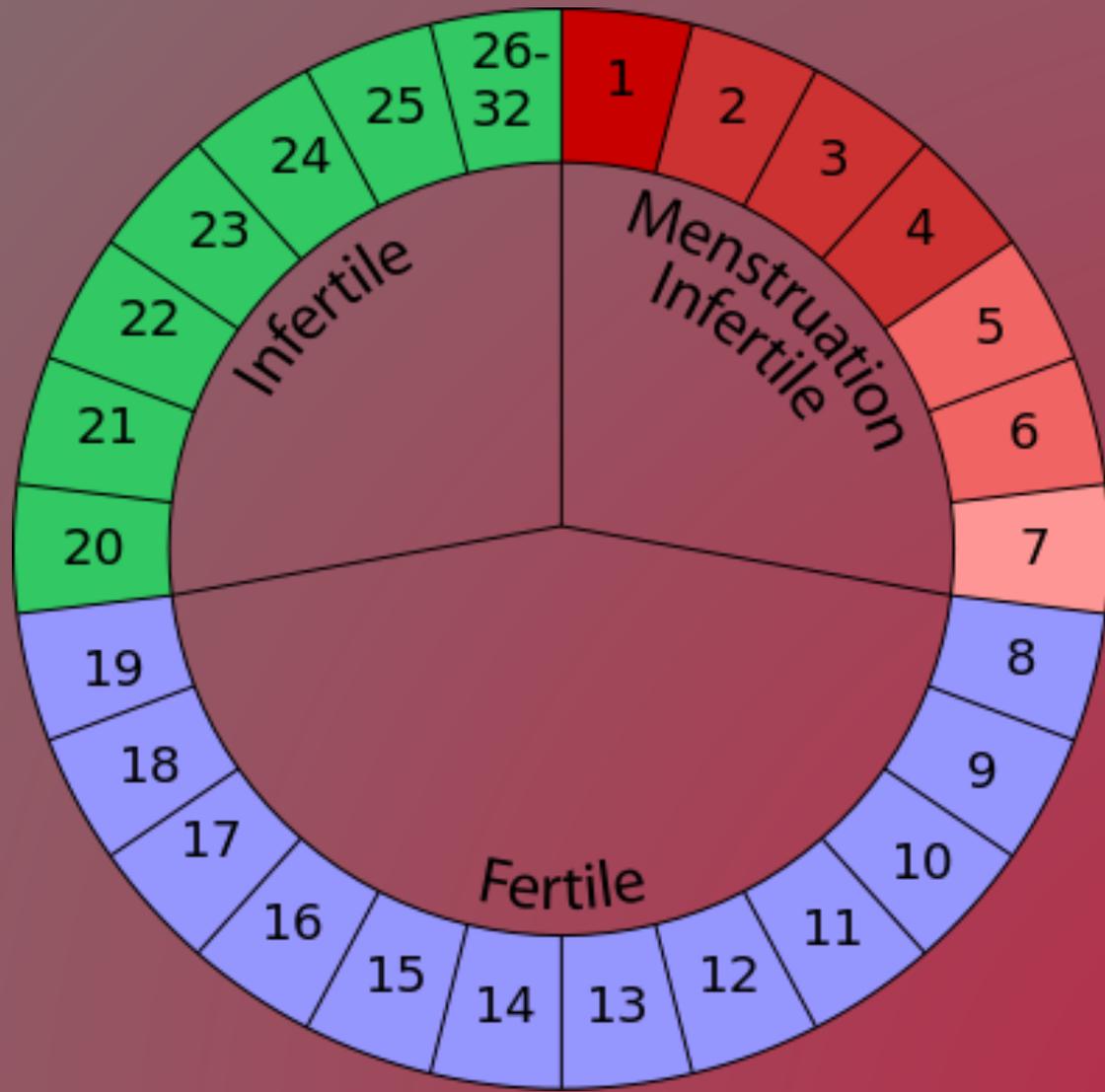
Ovarian Cycle	Events	Uterine Cycle	Events
Follicular phase—Days 1–13	FSH Follicle maturation Estrogen	Menstruation—Days 1–5 Proliferative phase—Days 6–13	Endometrium breaks down Endometrium rebuilds
Ovulation—Day 14*	LH spike		
Luteal phase—Days 15–28 C	LH Corpus luteum Progesterone	Secretory phase—Days 15–28	Endometrium thickens and glands are secretory

* Assuming a 28-day cycle

Female Hormone Levels During the Ovarian and Uterine Cycles



Days of Fertility



Sperm Survive 5 - 7 days inside a woman

Pregnancy

- Ovulation, Fertilization and Pregnancy

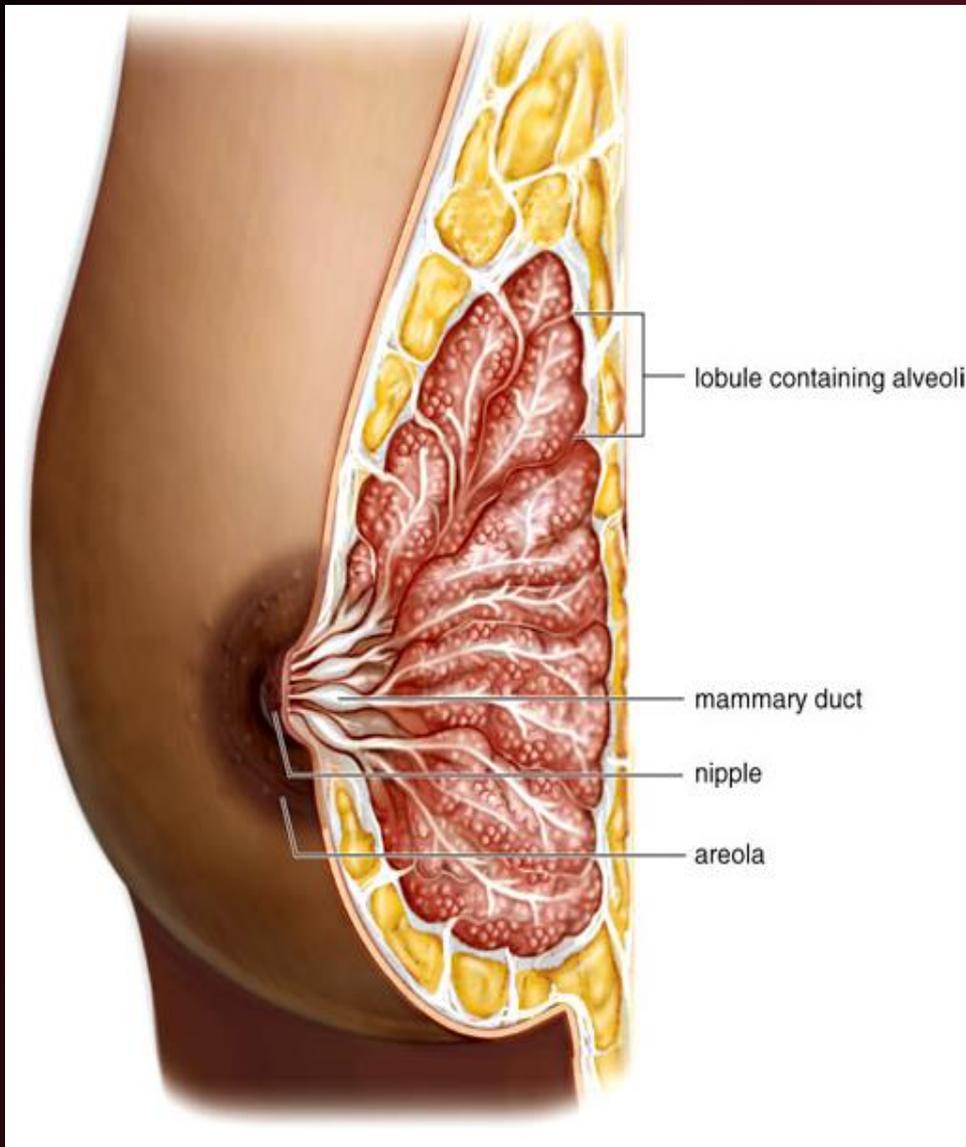
- An oocyte (egg) bursts from an ovary into coelom
- Swept into oviduct by currents in coelomic fluid
- Fertilization normally occurs in oviduct
- Ciliary movement moves zygote to uterus
- Embryo embeds in uterine lining (endometrium)

- Placenta: Originates from both maternal and embryonic tissues.

Produces

- Human Chorionic Gonadotropin (HCG)
- Maintains the corpus luteum until the placenta begins its own hormone production (estrogen and progesterone that shut down the anterior pituitary → no menstruation)

Female Breast



Each breast contains between 15 and 24 lobules, each with its own mammary duct

- Lactation caused by prolactin
- **Colostrum** produced until milk production begins
- Milk production begins a few days after delivery of a baby

Common Birth Control Methods

Name	Procedure	Methodology	Effectiveness	Risk
Abstinence	Refrain from sexual intercourse	No sperm in vagina	100%	None
Vasectomy	Vasa deferentia cut and tied	No sperm in seminal fluid	Almost 100%	Irreversible sterility
Tubal ligation	Oviducts cut and tied	No eggs in oviduct	Almost 100%	Irreversible sterility
Oral contraception	Hormone medication taken daily	Anterior pituitary does not release FSH and LH	Almost 100%	Thromboembolism, especially in smokers
Contraceptive injections	Injections of hormones	Anterior pituitary does not release FSH and LH	About 99%	Presently none known
Contraceptive implants	Tubes of progestin (form of progesterone) implanted under skin	Anterior pituitary does not release FSH and LH	More than 90%	Presently none known
Intrauterine device (IUD)	Plastic coil inserted into uterus by physician	Prevents implantation	More than 90%	Infection (pelvic inflammatory disease, PID)
Diaphragm	Latex cup inserted into vagina to cover cervix before intercourse	Blocks entrance of sperm to uterus	With jelly, about 90%	Presently none known
Cervical cap	Latex cap held by suction over cervix	Delivers spermicide near cervix	Almost 85%	Cancer of cervix
Male condom	Latex sheath fitted over erect penis	Traps sperm and helps prevent STDs	About 85%	Presently none known
Female condom	Polyurethane liner fitted inside vagina	Blocks entrance of sperm to uterus and prevents STDs	About 85%	Presently none known
Coitus interruptus	Penis withdrawn before ejaculation	Prevents sperm from entering vagina	75%	Presently none known
Jellies, creams, foams	These spermicidal products inserted before intercourse	Kills a large number of sperm	About 75%	Presently none known
Natural family planning	Day of ovulation determined by record keeping, various methods of testing	Intercourse avoided on certain days of the month	About 70%	Presently none known
Douche	Vagina and uterus cleansed after intercourse	Washes out sperm	Less than 70%	Presently none known

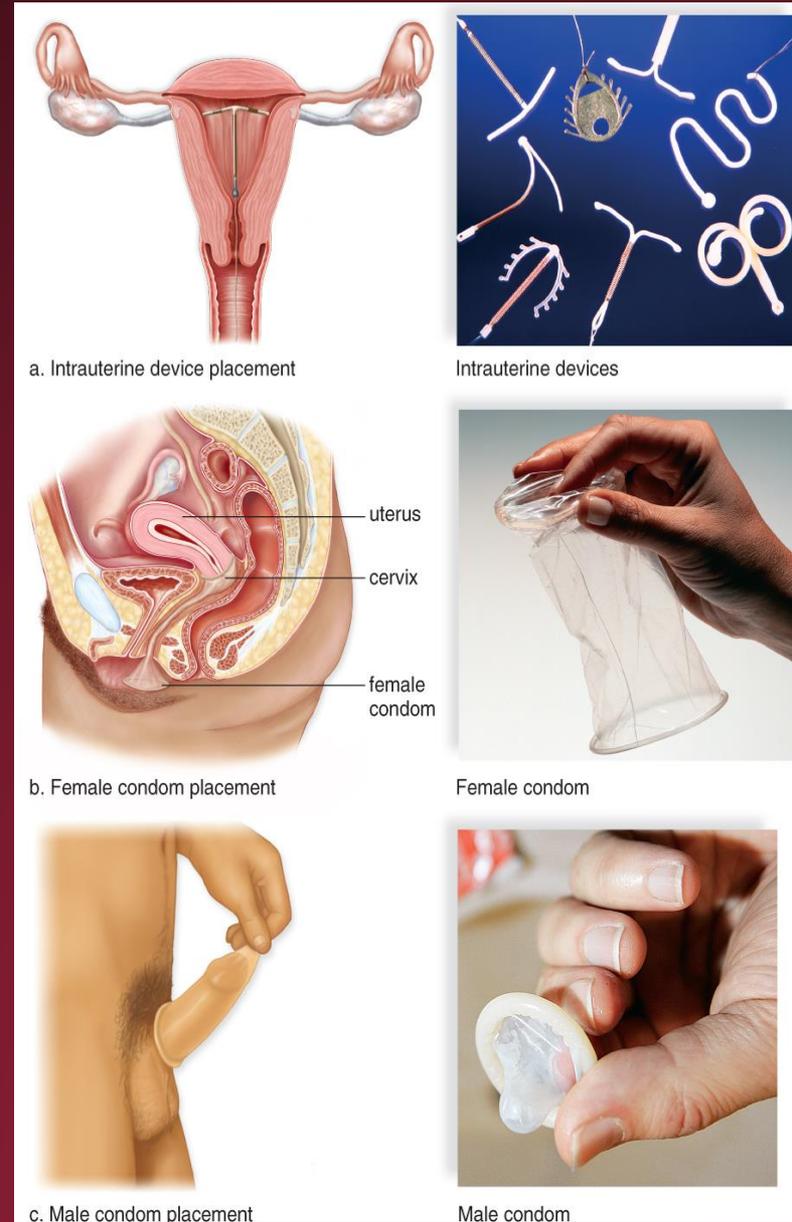
Control of Human Reproduction

Traditional Birth Control Methods

- The most reliable method of birth control is **abstinence**
 - No sexual intercourse
- Traditional birth control regimens either **prevent fertilization** or stop a fertilized egg from **implanting**
 - Male and female condoms
 - Contraceptive vaccines

Morning-After Pills

- Medications that **can prevent pregnancy** after **unprotected intercourse**
 - Preven – upsets normal uterine cycle
 - Makes it difficult for the embryo to implant within the endometrium
 - Plan B
 - Ulipristal acetate

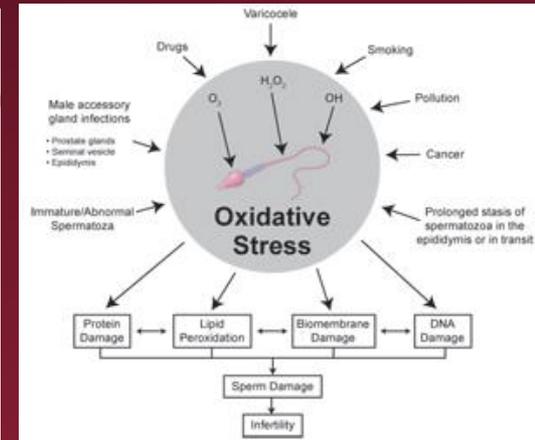


Infertility

- Inability of a couple to achieve pregnancy after one year of regular, unprotected intercourse
- May be attributed to the male (40%), the female (40%), or both (20%)

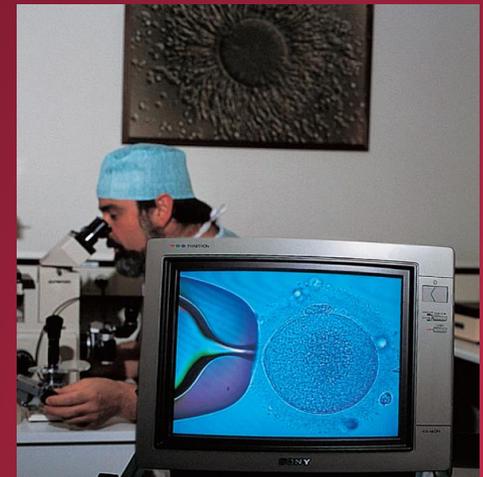
Common Causes of Infertility

- Females - Endometriosis
- Males - Low Sperm Count



Assisted Reproductive Technologies

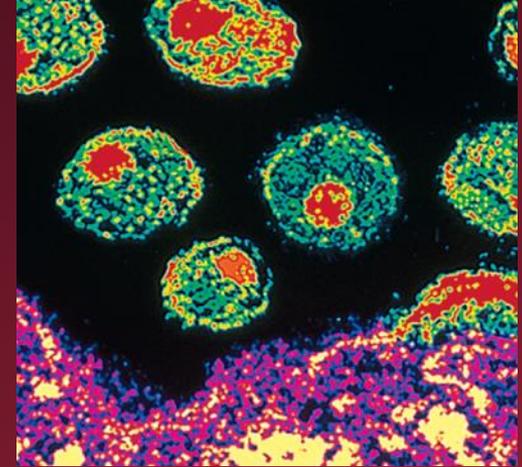
- Artificial Insemination by Donor (AID)
- In Vitro Fertilization (IVF)
- Gamete Intrafallopian Transfer (GIFT)
- Intracytoplasmic Sperm Injection (ICSI)



Sexually Transmitted Diseases STDs

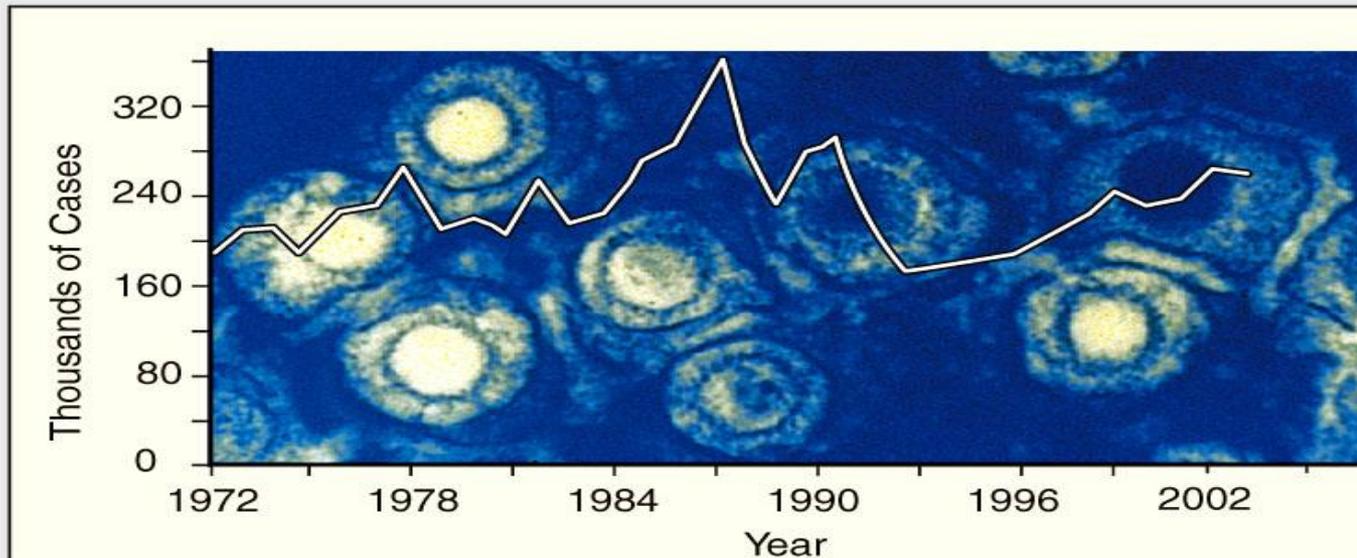
AIDS

- Human Immunodeficiency Virus (HIV)
 - Attacks helper T cells
 - Transmitted by sexual contact
 - No Cure



Genital Warts

- Human Papillomaviruses (HPV' s)
- No cure, but can be treated effectively



Sexually Transmitted Diseases

More viruses...

- Genital Herpes

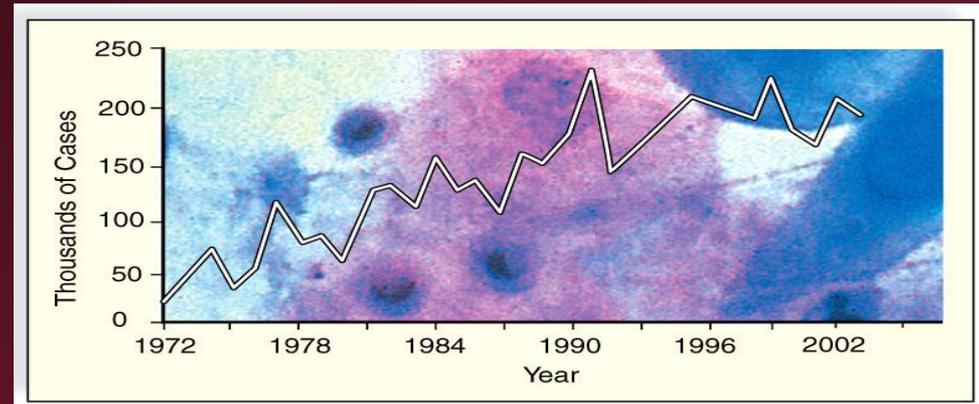
- Simplex Virus

- Type I - Cold sores and fever blisters
- Type II - Ulcerations on genitals

- Hepatitis viruses

- A, E - Sewage-contaminated drinking water
- B, C, D – Blood transfusion & bodily fluids, sexual contact

Genital Herpes



Protozoa

- 'Trichs' Trichomoniasis
Trichomonas vaginalis

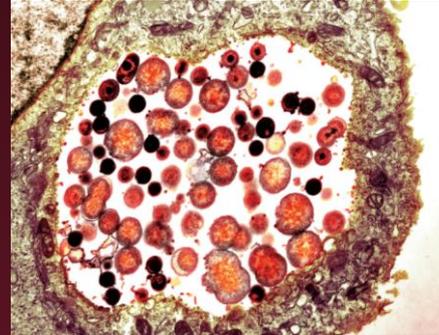


Sexually Transmitted Diseases

Bacteria...

Chlamydia

- *Chlamydia trachomatis*

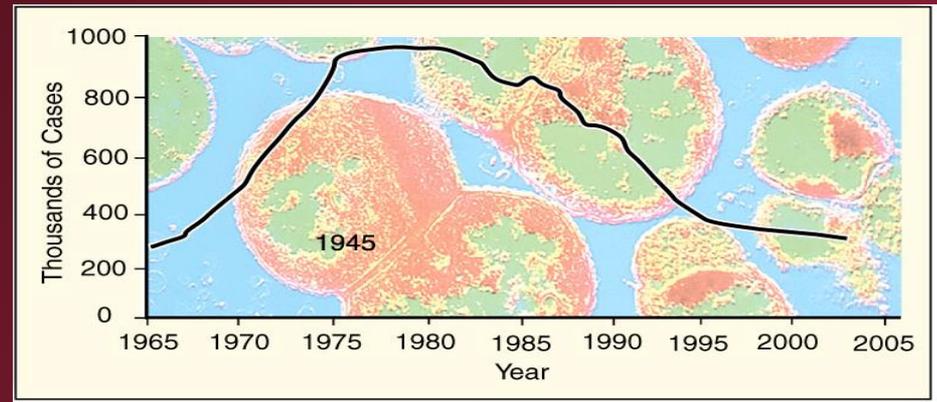


'Chlams'

Gonorrhea

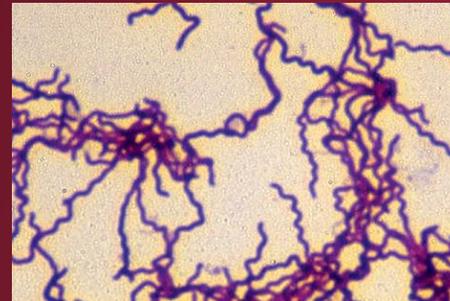
- *Neisseria gonorrhoeae*

Gonorrhea



Syphilis

- *Treponema pallidum*



Treponema pallidum
(spirochete)

