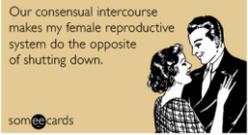
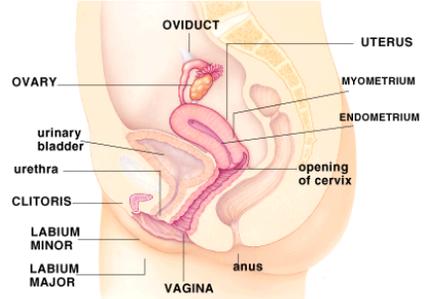


## Animal Reproduction & Development

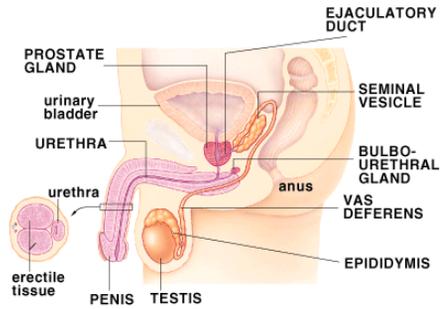


## Female Reproductive System



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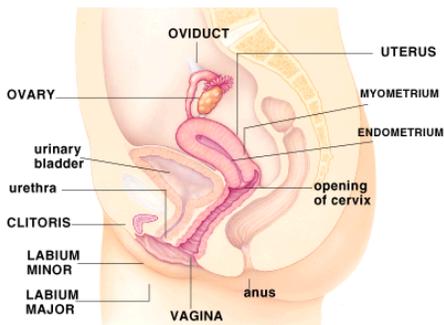
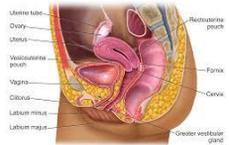
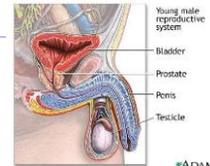
## Male Reproductive System



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## Similarities

- 2 pouches
  - ◆ Testicles
  - ◆ Ovaries
- Start out inside body
  - ◆ Testicles "descend" before birth
- Fetus begins with "starter parts" that could develop into either gender.



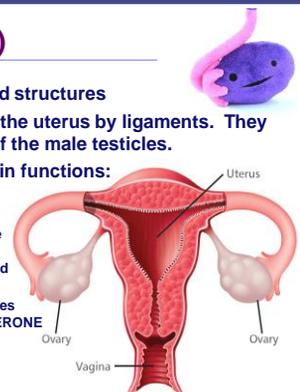
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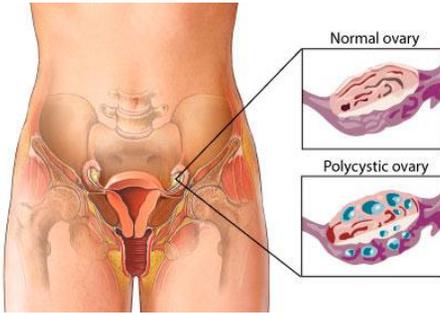
## Ovary (Ovaries)

- Two solid egg-shaped structures
- They are attached to the uterus by ligaments. They are the counterpart of the male testicles.
- Ovaries have two main functions:

#1-store and release the ova or female egg cell. Some of the ova disappear; others are dormant until each is ripened and released after puberty.

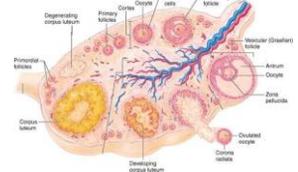
#2-produce female sex hormones ESTROGEN and PROGESTERONE





## Ova

- The female reproductive cell.
- They are the largest cells in the female body. (about the size of a grain of sand.)
- The female baby is born with all the ova she will ever have (about 200,000 in each ovary).
- About 400-500 ova mature and are released over a lifetime



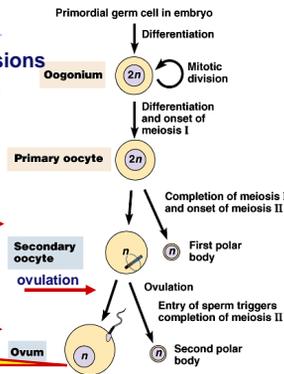
## Oogenesis

- Unequal meiotic divisions
  - ◆ unequal distribution of cytoplasm
  - ◆ 1 egg
  - ◆ 2 polar bodies

Meiosis 1 completed during egg maturation

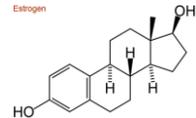
Meiosis 2 completed triggered by fertilization

Put all your egg in one basket!

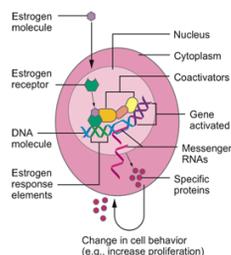


## Female Sex Hormones:

- Estrogen is responsible for the secondary sex characteristics and the sex drive in females. It spurs the onset of puberty and is responsible for **ovulation**.
- Progesterone builds up the lining of the uterus called the endometrium in preparation for a fertilized ovum
- LH and FSH stimulate secondary oocyte development during menstruation for the next cycle

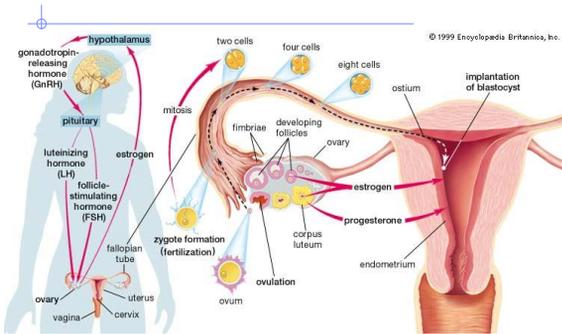


## Estrogen Receptors Trigger Gene Activation



## Ovulation

- When the egg is released from the ovary.
- At the age of puberty
- The ovum moves to the surface of the ovary in bursts out
- The ova falls into the fallopian tube and waits for fertilization
- This happens every 28 days
- It happens at about the 14<sup>th</sup> day of the cycle



## After Ovulation

- Egg pushed along by cilia through fallopian tubes
- Few days travel time to arrive in uterus

- **Cervix** – Opening between uterus & vagina—strongest muscle in the female body



- ◆ Normally tiny and plugged by mucus
- ◆ At birth – muscles pull open (dilation) cervix to allow baby to pass through = Labor

## Menstrual Cycle

- Complex combination of 10-12 chemicals (hormones)
- Usually one egg once a month
- All about timing!
  - ◆ Uterus must be ready when egg gets there in case it was fertilized
  - ◆ If no fertilization, tear down lining of uterus and rebuild for next month



## 28-Day Cycle (average)

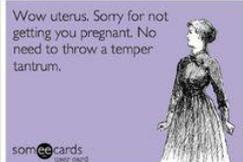
- Three Stages
  1. Tear Down
  2. Rebuild
  3. Extra nutrients/blood for potential baby
- No Baby?
  - ◆ Back to #1



## Day 1

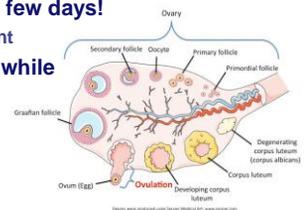
- First menstrual blood & tissue
- No baby = breaks down lining of uterus
- 5-7 days of blood/tissue exits body

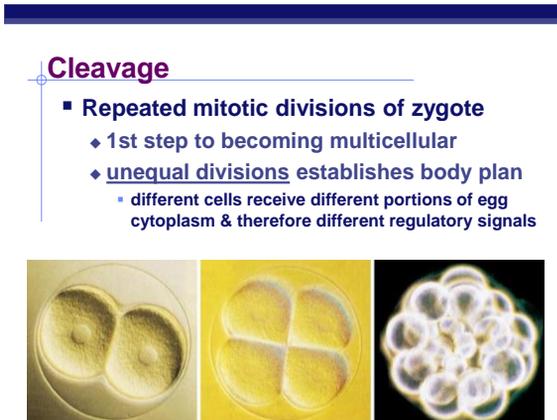
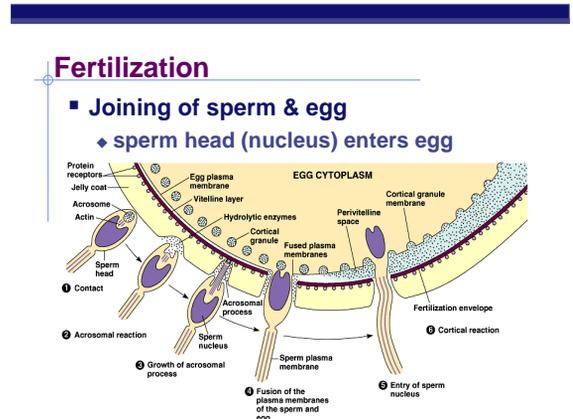
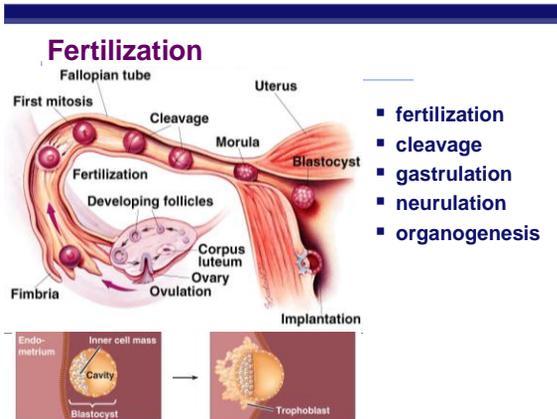
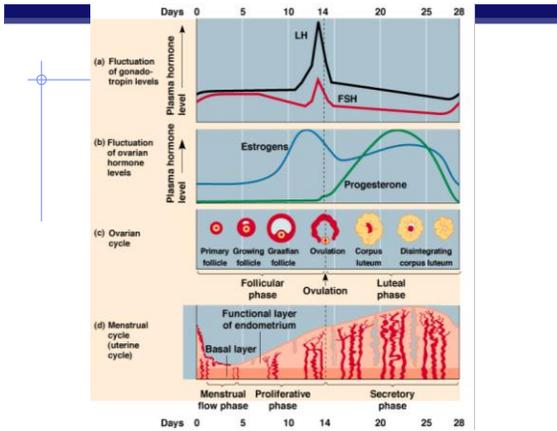
### Menstruation



## ~Day 14

- Ovulation = Egg released
- Temp spikes slightly
- Most fertile in next few days!
  - ◆ Able to get pregnant
- Egg gets fertilized while traveling through fallopian tubes.



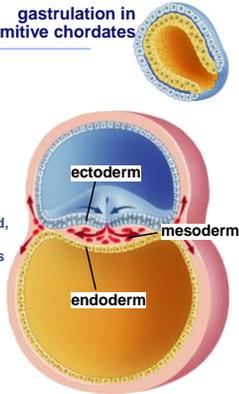


## Gastrulation

gastrulation in primitive chordates

### Establish 3 cell layers

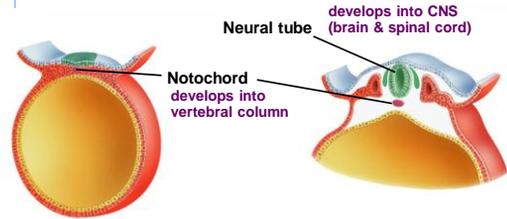
- ◆ **ectoderm**
  - outer body tissues
    - ◆ skin, nails, teeth
    - ◆ nerves, eyes, lining of mouth
- ◆ **mesoderm**
  - middle tissues
    - ◆ blood & lymph, bone & notochord, muscle
    - ◆ excretory & reproductive systems
- ◆ **endoderm**
  - inner lining
    - ◆ digestive system
    - ◆ lining of respiratory, excretory & reproductive systems



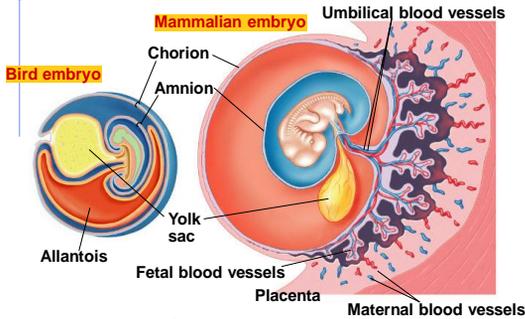
## Neurulation

### Formation of notochord & neural tube

- ◆ develop into nervous system

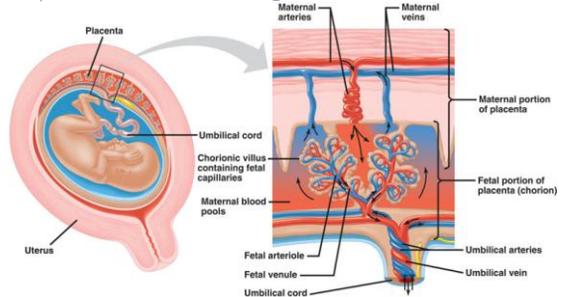


## Organogenesis



## Placenta

### Materials exchange across membranes



## Human fetal development

4 weeks



7 weeks



## Human fetal development

10 weeks



## Human fetal development



12 weeks

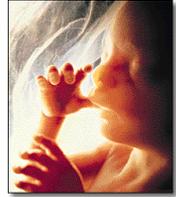
20 weeks

## Human fetal development

- The fetus spends much of the 2<sup>nd</sup> & 3<sup>rd</sup> trimesters just growing ...and doing various flip-turns & kicks inside amniotic fluid



Week 20



## Human fetal development

- 24 weeks (6 months; 2nd trimester)

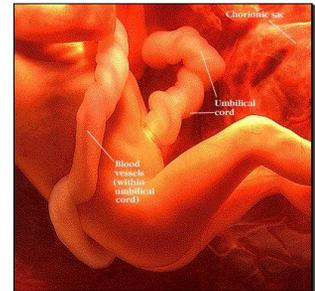
fetus is covered with fine, downy hair called **lanugo**. Its skin is protected by a waxy material called **vernix**



## Human fetal development

- 30 weeks (7.5 months)

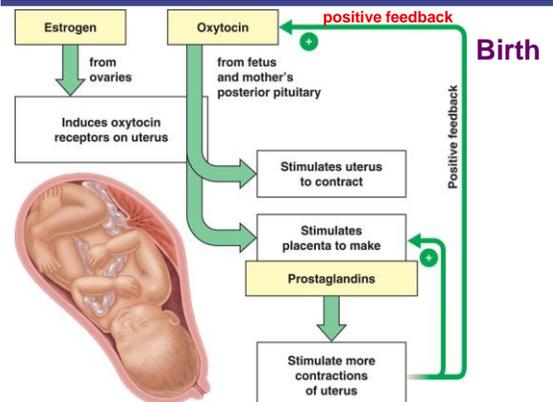
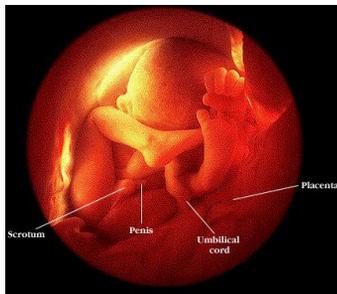
umbilical cord



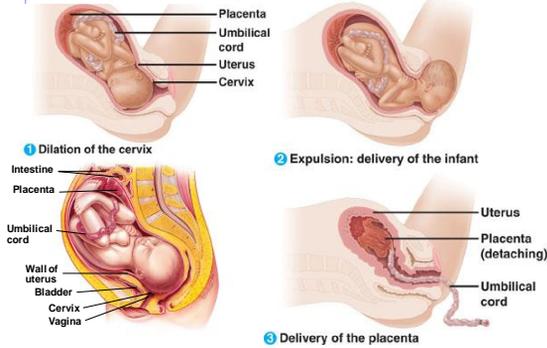
## Getting crowded in there!!

- 32 weeks (8 months)

The fetus sleeps 90-95% of the day & sometimes experiences REM sleep, an indication of dreaming



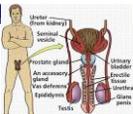
## Birth (36 weeks)



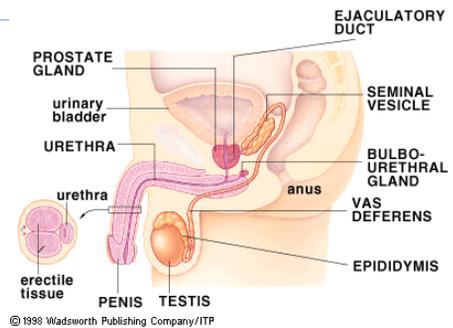
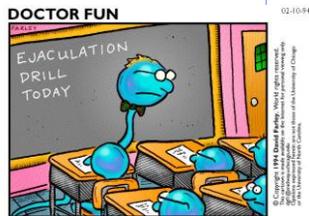
## The end of the journey!



Questions??

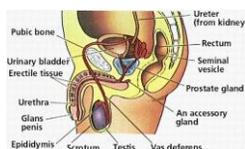
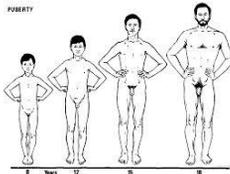


## The Male Reproductive Tract and Birth Control



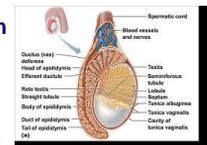
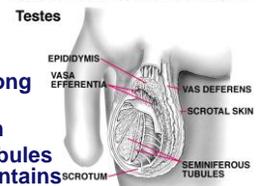
## Male reproductive development

- Puberty
- Burst of hormones activate maturation of the gonads: testes
- Begins: 9 – 14 yrs of age

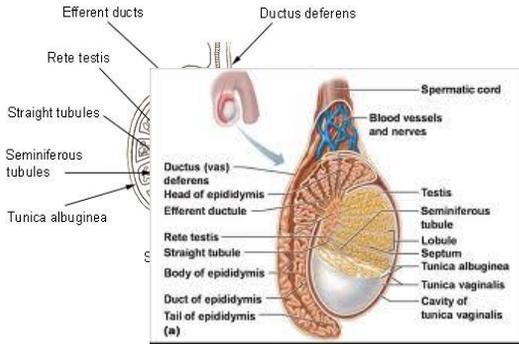


## Testes

- Each testis is an oval structure about 5 cm long and 3 cm in diameter
- Located in the scrotum
- There are about 250 lobules in each testis. Each contains 1 to 4 -seminiferous tubules that converge to form a single straight tubule, which leads into the rete testis.
- Interstitial cells produce male sex hormones, are located between the seminiferous tubules within a lobule.

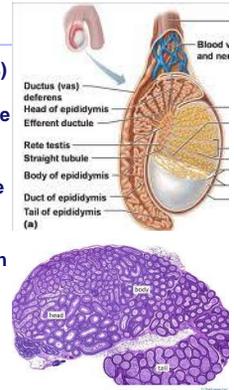


### Sagittal section of a testis and Epididymis



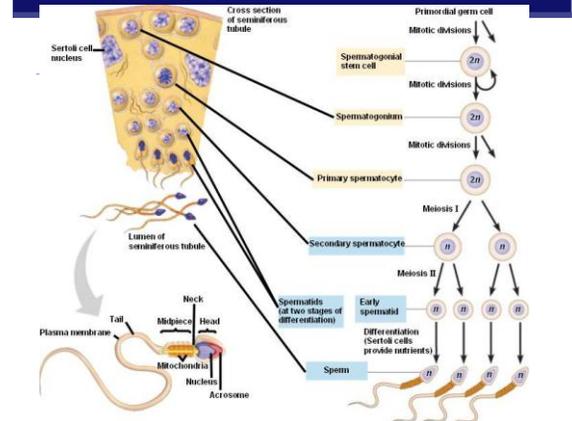
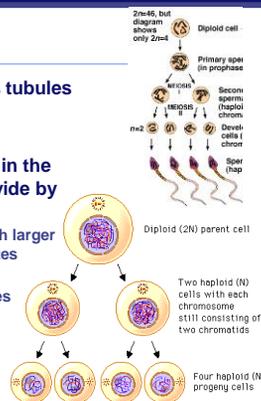
### Epididymis

- a long tube (about 6 meters) located along the superior and posterior margins of the testes.
- Sperm that leave the testes are immature and incapable of fertilizing ova.
- Sperm mature and become fertile as they move through the epididymis.
- Mature sperm are stored in the lower portion, or tail, of the epididymis



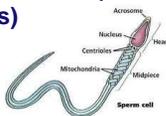
### Spermatogenesis

- Begins in seminiferous tubules of the testes
- Takes 65 to 70 days
- Diploid spermatogonia in the germinal epithelium divide by mitosis
  - ◆ The ones that grow much larger are primary spermatocytes
  - ◆ Haploid division makes secondary spermatocytes
  - ◆ Divide into two haploid spermatids



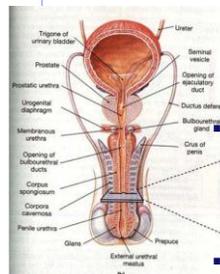
### Sperm development

- Spermatids line up with heads attached to tubules
- Sperm are nourished and developed by Sertoli cells (nurse cells)



### Accessory Glands

- Seminal vesicles: Each has a short duct that joins with the vas deferens to form an ejaculatory duct, which empties into the urethra.
  - ◆ Makes a fructose, protein rich fluid
- Prostate: short ducts from the prostate gland empty into the prostatic urethra.
  - ◆ secretions thin, milky colored, and alkaline and enhance the motility of the sperm.
- Bulbourethral glands: sexual stimulation releases an alkaline mucus-like fluid

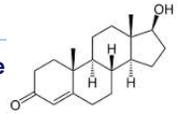


## Semen

- Sperm cells bathed in fluid mostly from seminal vesicles
- volume in a single ejaculation may vary from 1.5 to 6.0 ml
- 50 to 150 million sperm per milliliter of semen
- Sperm counts <10 to 20 million/ml usually present fertility problems

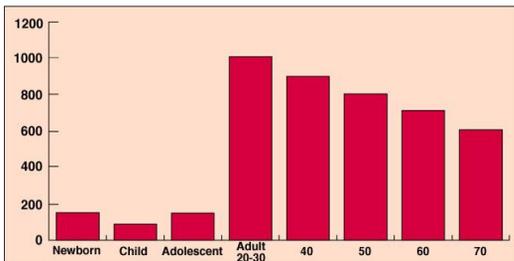
## Hormones

- Follicle-stimulating hormone (FSH) stimulates spermatogenesis
- Interstitial Cell Stimulating Hormone (ICSH) stimulates the production of testosterone
- testosterone stimulates the development of male secondary sex characteristics & spermatogenesis.



Bayer/Shainberg/Galliano Dimensions Of Human Sexuality, 6e. Copyright © 1998. The McGraw-Hill Companies, Inc. All Rights Reserved.

## Testosterone Production Throughout Life



## The Influence of Testosterone



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## Birth Control

- Can be anti-implantation or contraceptive (prevent fertilization)
- Either chemical (usually in the female body) or mechanical
- ◆ Barriers



## The birth control pill

- Steroid hormones that suppress ovulation
- Synthetic rather than natural for longer chemical life in the body
- Combinations of progesterone and estrogen most common—different concentrations for different needs
- DOES NOT PREVENT STI'S!!



## Morning After Pill

- Prevents implantation after unprotected sex
- Many reasons why it might be necessary—failed BC, sexual assault, etc.
- Works for about 72 hours after fertilization/unprotected sex



Questions?

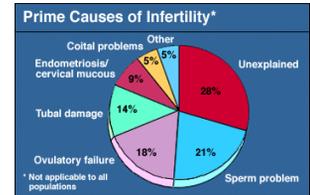


## Infertility and In-Vitro Fertilisation



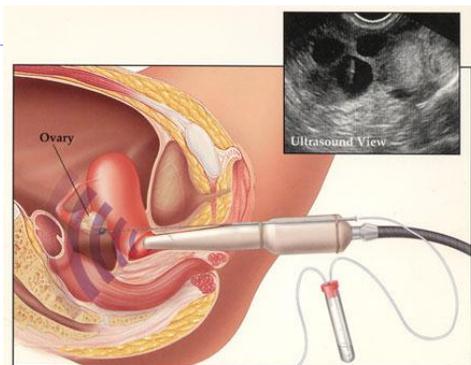
## Infertility

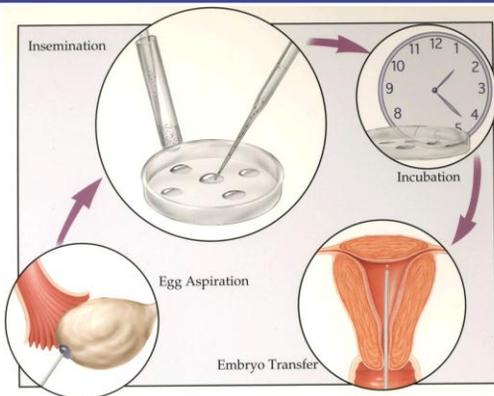
- 50% female reproductive tract
- 35% male related
- 15% inexplicable (curses? BAD vibrations? Who knows...)



## IVF

- Ovulation stimulated by high doses of hormones
- Secondary oocytes collected via a tube through the cervix, uterus, and fallopian tubes
- Sperm collected, cleaned, and provided nutrients to activate them
- Fertilized in vitro
  - ♦ 10,000 sperm added to ovum OR injected with a microneedle (intracytoplasmic sperm injection)
- Three days later, two fertilized zygotes are inserted via a tube through the cervix and uterus
  - ♦ Increases likelihood of implantation, but no triplets/etc
  - ♦ Ethical issues with excess fertilized zygotes





### Fertilized embryos may...

- Be frozen for future treatment of IVF
  - ◆ If a woman's ovaries might be damaged
  - ◆ 70% survival for many years
  - ◆ Reduces need for uncomfortable oocyte collection procedures later
- Other ethical issues (male might no longer want children years later)



### Sperm Banks

- Sperm are cryopreserved and can be organized by donor traits
- Allows long-time storage for a man who might lose fertility
- Sperm source for women with infertile partners, same-sex partners, or who want to have a child alone



### Other infertility issues

- Women:
  - ◆ Ovulation disorders (hormones to treat)
  - ◆ Endometriosis (endometrium blocks other organs—may need surgery)
  - ◆ Blockages in fallopian tubes (IVF/surgery)
  - ◆ Antibodies to sperm (IVF)
- Men:
  - ◆ Abnormal sperm (IVF and ICSI)
  - ◆ Low sperm count (surgery if blockage/IVF)



Questions?