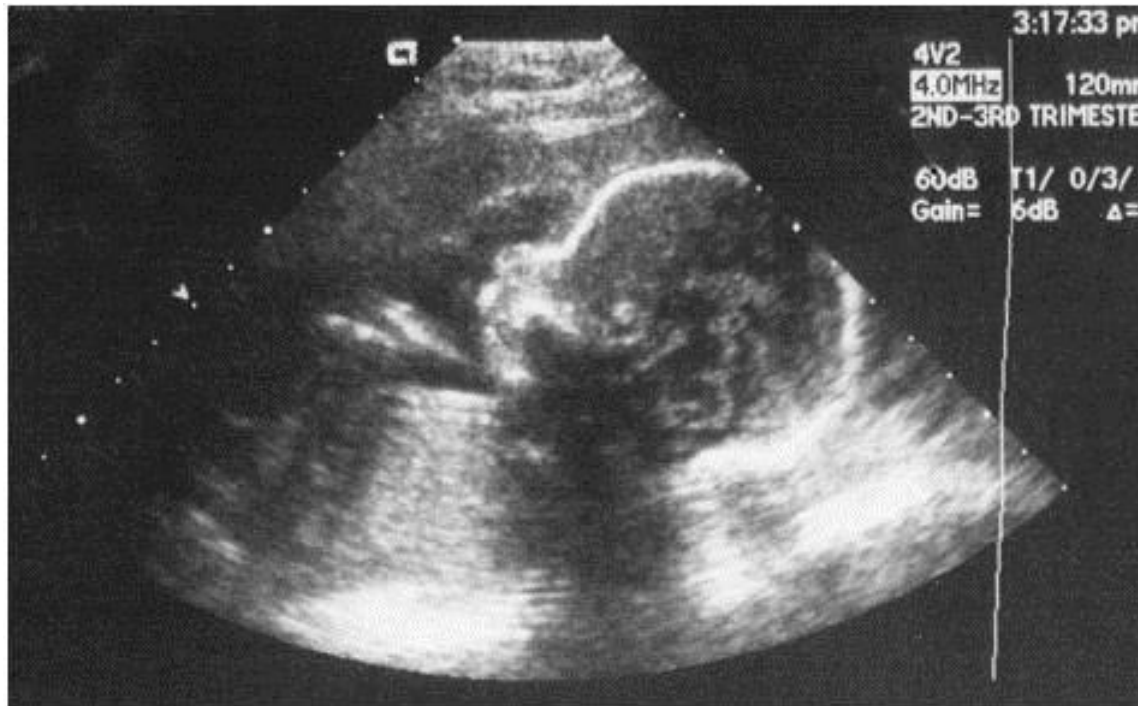


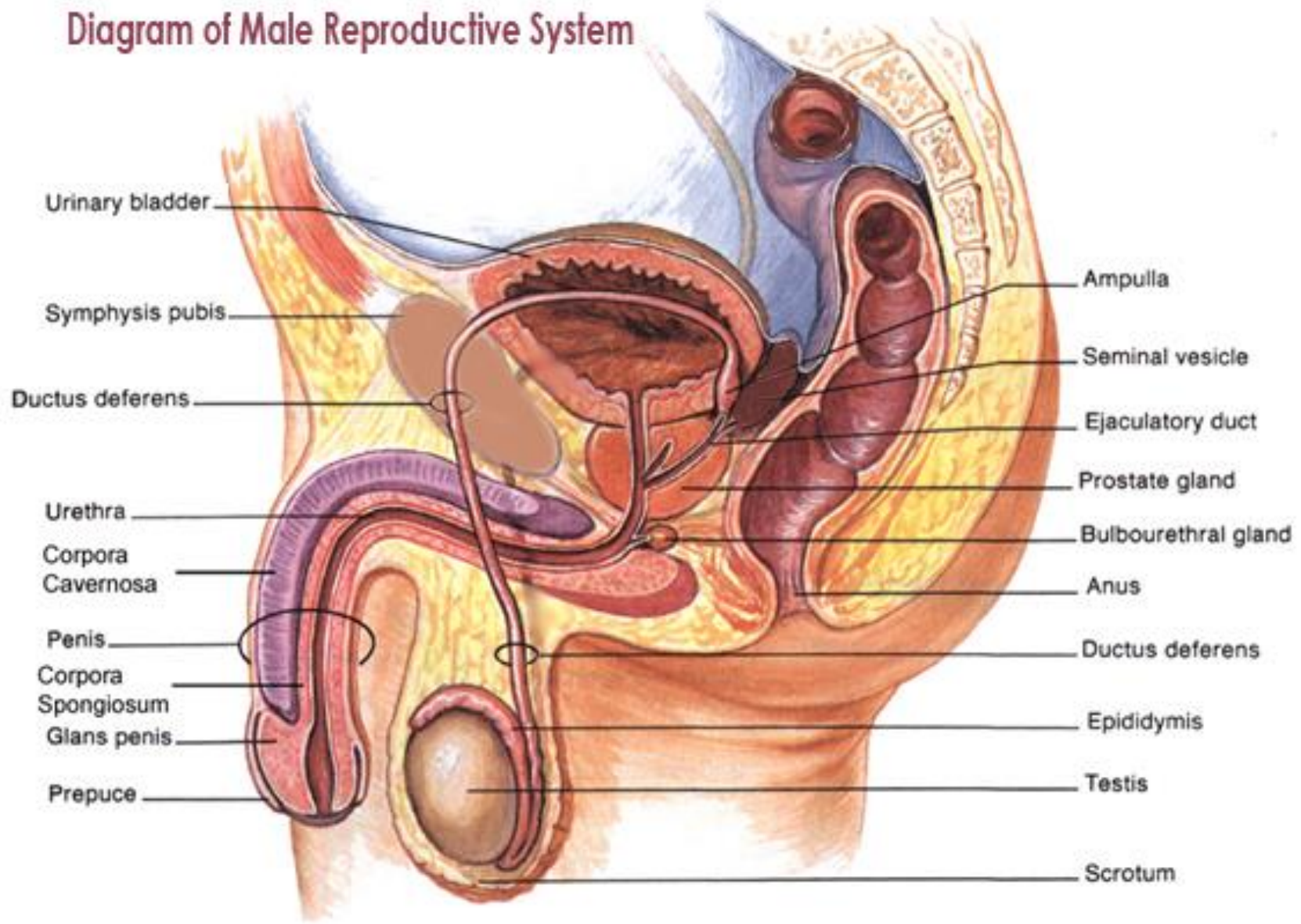
Reproductive System



Male Reproduction Anatomy

- Testes
 - Seminiferous tubules
- Epididymis
- Vas deferens
- Ejaculatory duct
- Urethra
- Prostate gland
- Seminal vesicles
- Bulbourethral gland
- Penis
 - Corpus cavernosum and Corpus spongiosum
 - Glans penis
 - Prepuce

Diagram of Male Reproductive System



Male Reproductive Anatomy

- Testes = male gonad
 - Seminiferous tubules = site of sperm formation
- Epididymis = site of sperm maturation
- Vas deferens = transports sperm to meet with the ejaculatory duct
- Ejaculatory duct = sperm mixes with semen
- Urethra = transport urine and semen out of the body

Male Reproductive Anatomy

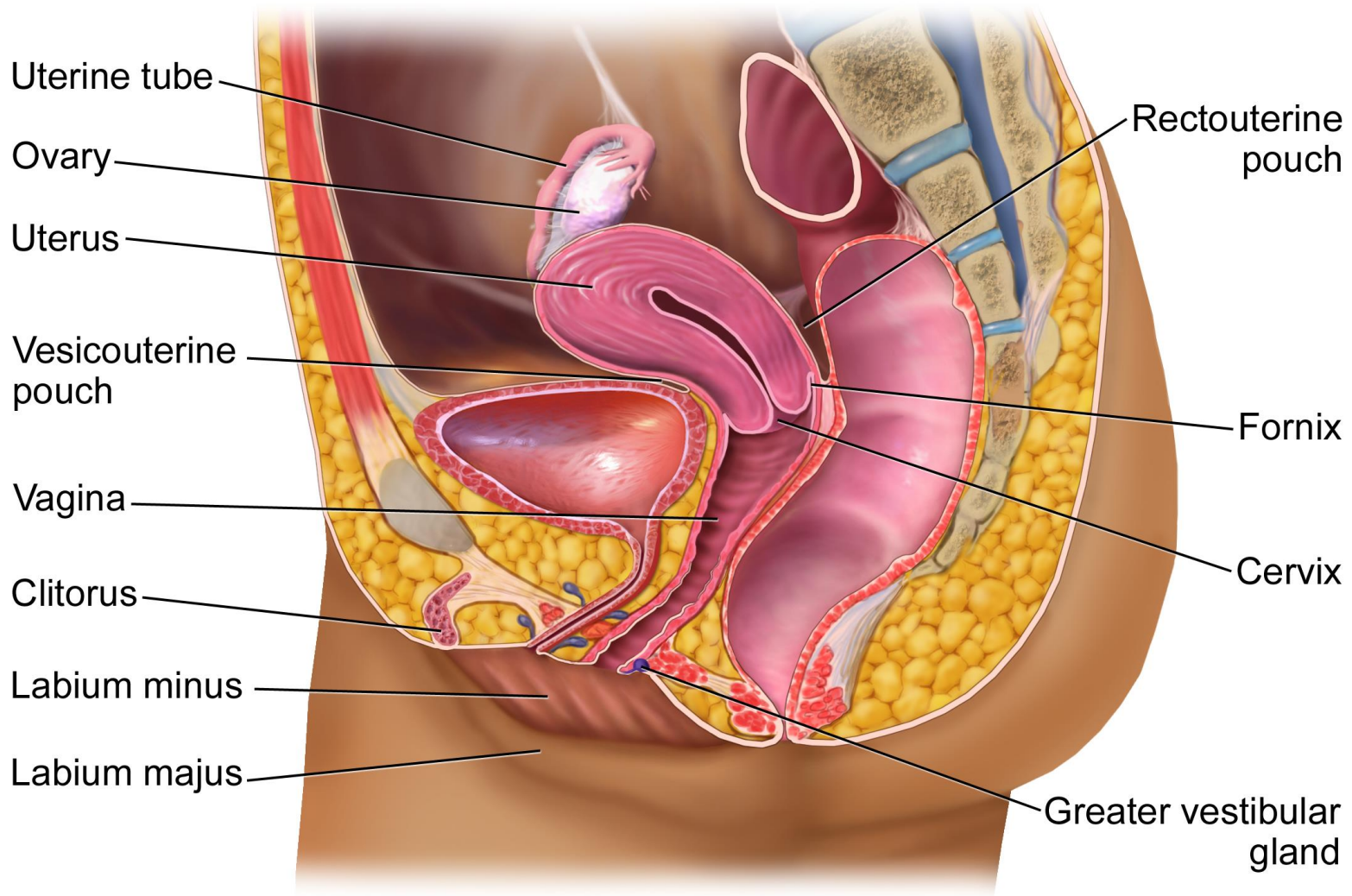
- Prostate gland = produces semen to help with the motility of sperm
- Seminal vesicles = produces semen
- Bulbourethral gland = neutralizes the urethra and produces semen

Male Reproductive Anatomy

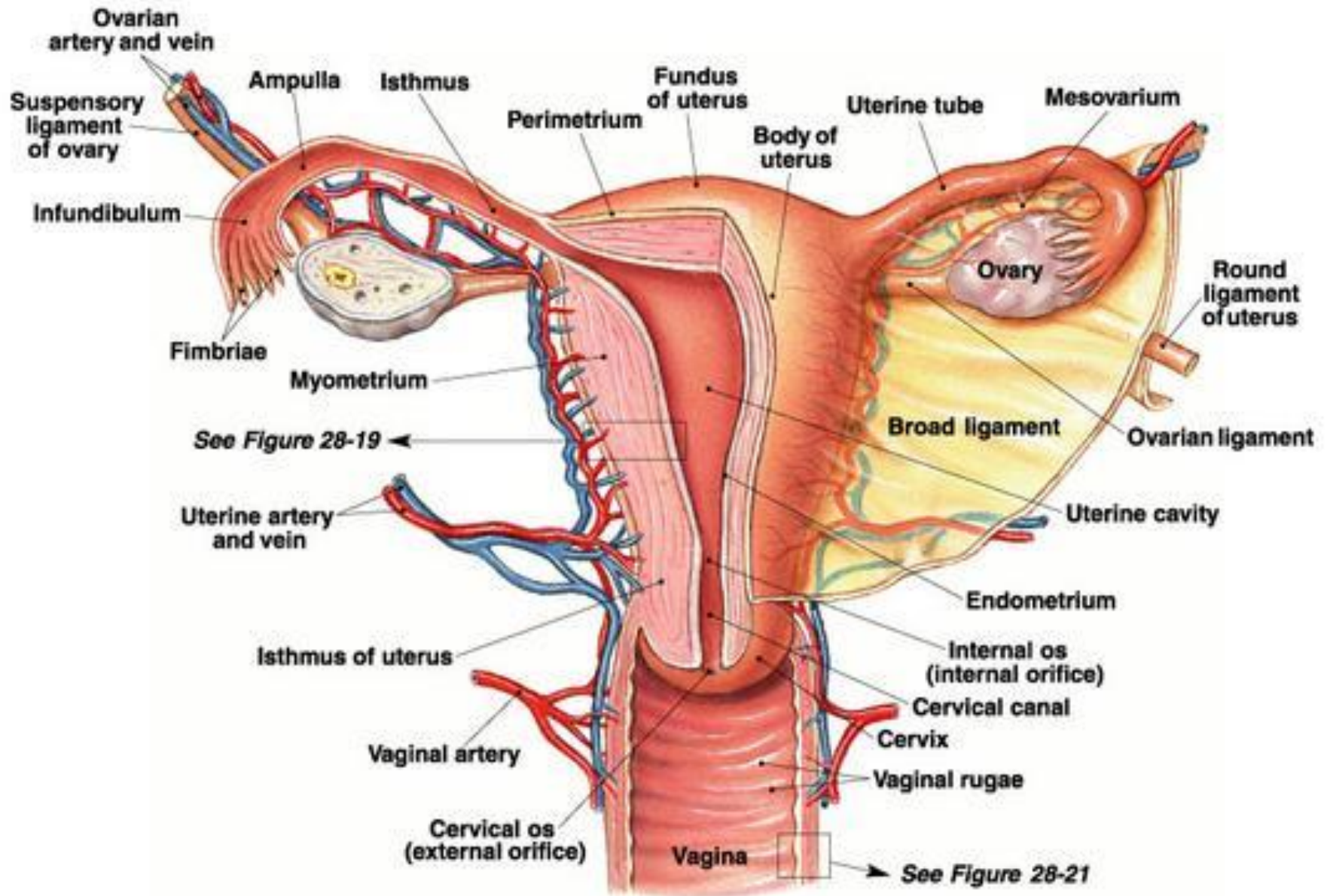
- Penis = male external genitalia
 - Types of tissue that make up the penis are corpus cavernosum and spongiosum
 - Glans penis = head of the penis
 - Prepuce = foreskin
- Scrotum = holds the testes
- Perineum = skin between scrotum and anus

Female Reproduction Anatomy

- Ovary
 - Follicular cells and corpus luteum
- Fallopian / Uterine tubes
 - Fimbrae
- Uterus
 - Cervix
 - Endometrium, Myometrium, and Perimetrium
- Vagina
 - Hymen
- Vulva
 - Clitoris
 - Labia majora and minora
 - Vestibule



The Female Reproductive System



Posterior view

Female Reproduction Anatomy

- Ovary = female gonad
 - Follicular cells = produces the egg
 - Corpus luteum = remains behind to release hormones
- Fallopian / Uterine tubes = transports egg to the uterus and site of fertilization
 - Fimbriae = fingerlike projections that create a current to bring egg into the fallopian tubes

Female Reproduction Anatomy

- Uterus = site of fetal development
 - Cervix = opening into the uterus
 - Endometrium – sheds during menses
 - Myometrium – muscle layer that causes contractions
 - Perimetrium – outer layer

Female Reproduction Anatomy

- Vagina = birth canal
 - Hymen = thin membrane just inside the vaginal opening
- Vulva = all external genitalia
 - Clitoris = sexual pleasure
 - Labia majora and minora = folds that surround the vestibule
 - Vestibule = contains the urethra and vaginal openings

Gamete Formation

- **Spermatogenesis** – occurs within the seminiferous tubules of the testes
 - Before puberty, mitosis occurs to make more stem cells
 - After puberty, **Follicle Stimulating Hormone (FSH)** stimulates meiosis to make spermatids which will develop into mature sperm

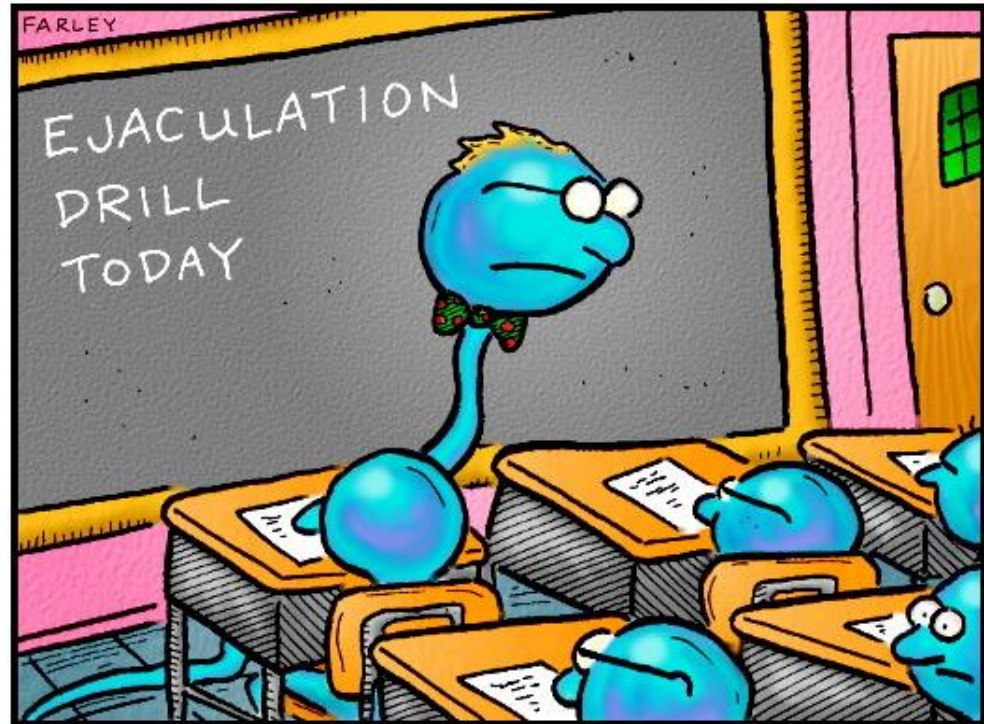
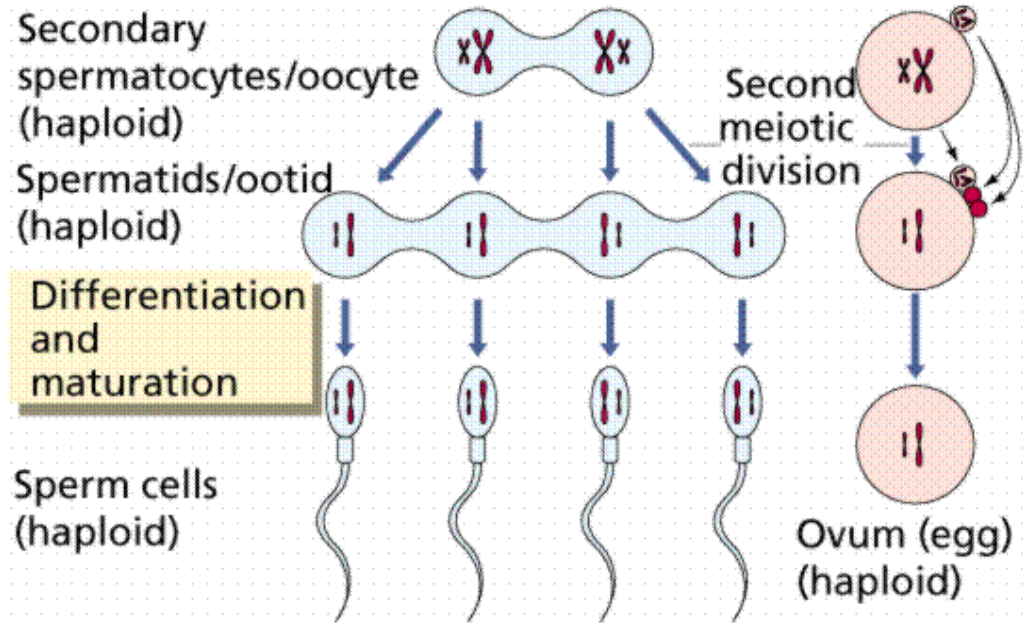
- Another hormone involved in puberty is **Luteinizing Hormone (LH)** which stimulates the gonads to release testosterone (starts secondary sex characteristics)
 - Deepening of voice, hair development, enlarged skeleton and muscles

Meiosis Review

- Purpose: To get cells that have half the amount of DNA as the parent cell – diploid to haploid cells
 - Prophase, Metaphase, Anaphase, Telophase twice
- Prophase I is extremely important for the diversity of life
 - Homologous chromosomes find their match
 - The DNA is so close together that crossing over occurs (mixing of DNA)
 - This creates a unique mixture of DNA in each sperm and egg cell

Spermatogenesis

- Primary spermatocyte starts meiosis
- Secondary spermatocyte forms from first division
- After 2nd division, early spermatids form
- After Meiosis, spermatid cells get flagella added and a decrease in cytoplasm - sperm



Sperm School

Male Erection, Orgasm, and Ejaculation

- Sexual stimulation causes parasympathetic nerve impulses to release nitric oxide to dilate arteries in penis
- Erection
 - Blood accumulates in the erectile tissue and penis swells and elongates
- Orgasm
 - Culmination of sexual stimulation and includes emission and ejaculation

Male Erection, Orgasm, and Ejaculation

- Emission
 - Movement of sperm from testes to glands
- Ejaculation
 - Increased pressure in erectile tissue helps force semen through the urethra in rhythmic contractions
- After ejaculation, blood vessel constrict and penis returns to its flaccid state
- Semen contains citric acid, free amino acids, fructose, enzymes, phosphorylcholine, prostaglandin, potassium, and zinc

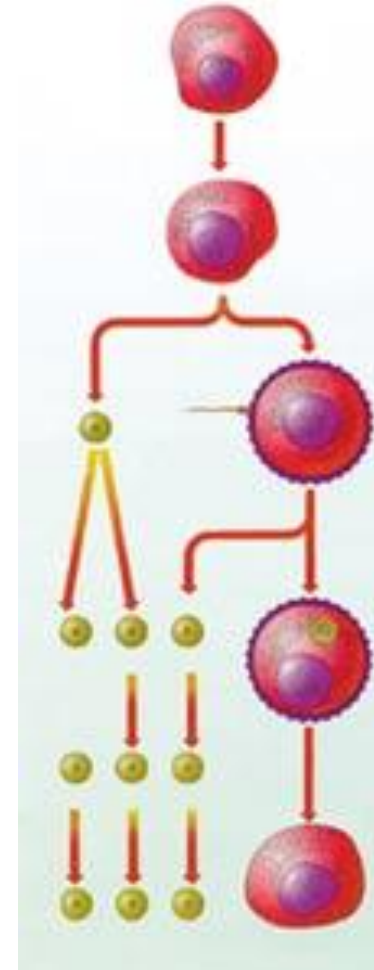
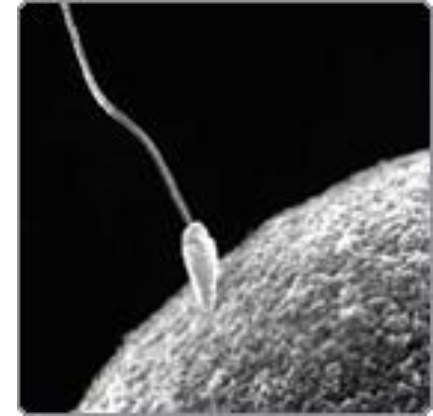
Ovarian and Menstrual Cycle

- Monthly release of an egg = ovarian cycle
- Cyclic changes in the endometrium = menstrual cycle
 - Each women is fertile for about 45 years of her life

- **Estrogen** and **Progesterone** work together to regulate the menstrual cycle and estrogen coordinates the appearance of the secondary sex characteristics
 - LH and FSH also contribute to changes
- At **menopause**, estrogen levels decline and menstruation stops
 - Can lead to osteoporosis and other complications

Gamete Formation

- Oogenesis – occurs in the ovaries
 - Egg cells develop within a follicle in the ovary when stimulated by FSH
 - Before birth, mitosis grows the numbers of immature primary oocytes
 - At puberty, meiosis occurs and one egg cell is produced with 3 polar bodies (unequal division of the cytoplasm)
 - Second division occurs only if egg is fertilized

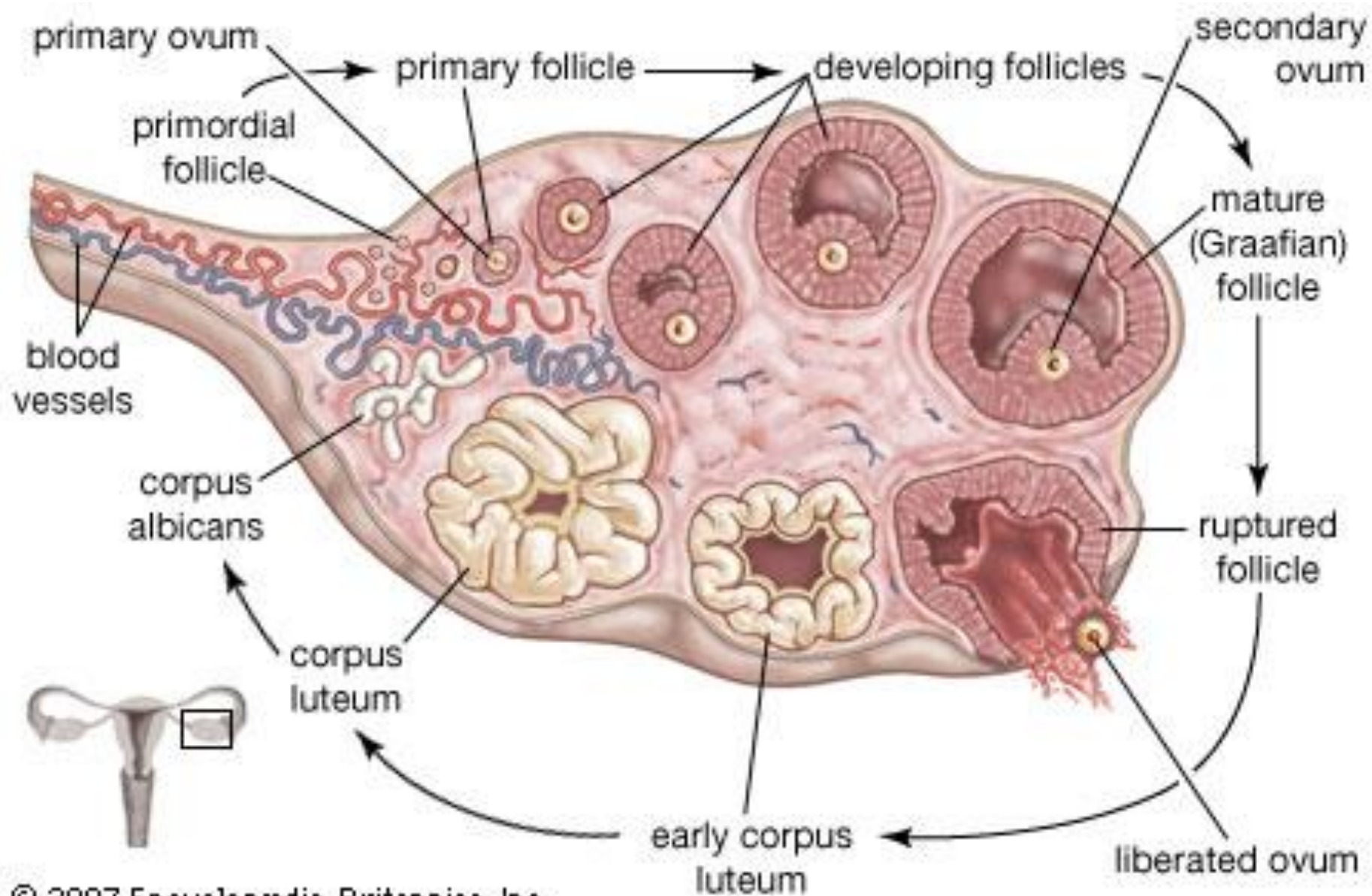


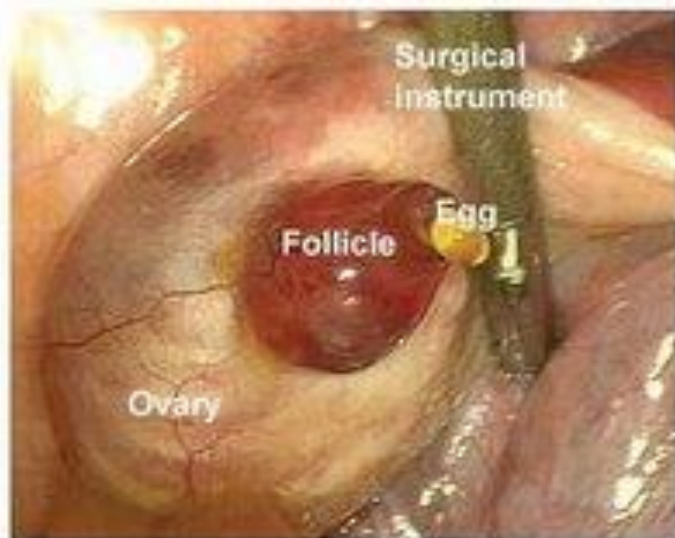
Oogenesis

- Primary oocyte starts meiosis
- Result is 1 polar body and secondary oocyte
- No fertilization = no 2nd meiosis
- Fertilization = another polar body and an ovum (egg)
- Polar bodies eventually breakdown

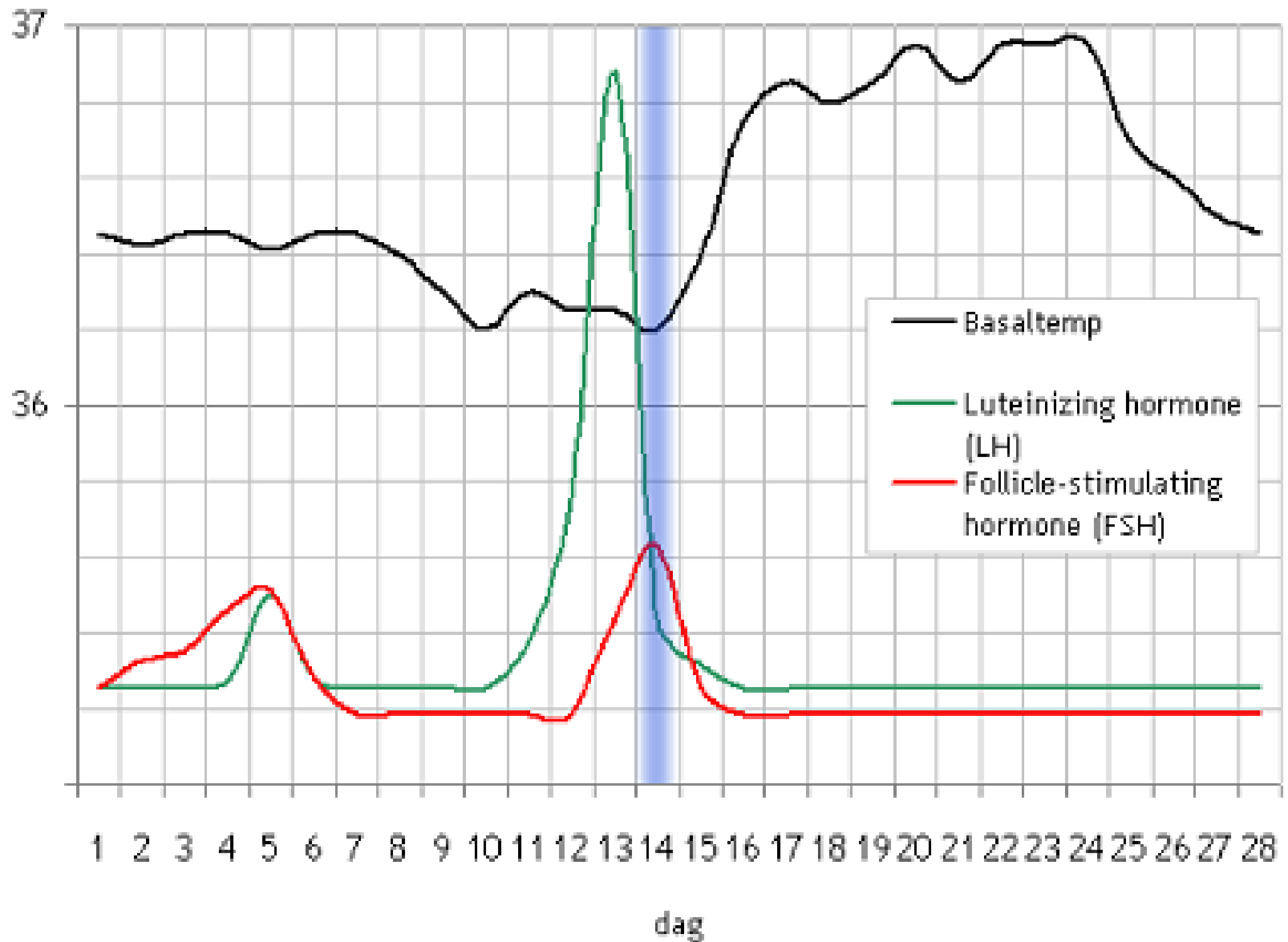
Ovarian cycle

- Primary follicle forms
- Follicular cells forms – contains primary oocyte
 - Filled with follicular fluid
- Ovulation occurs (ruptures ovary)
 - Secondary oocyte forms and 1 polar body forms
- Corpus luteum breaks down only if fertilization did not occur
 - If pregnant, corpus luteum will release hormones to start the development process





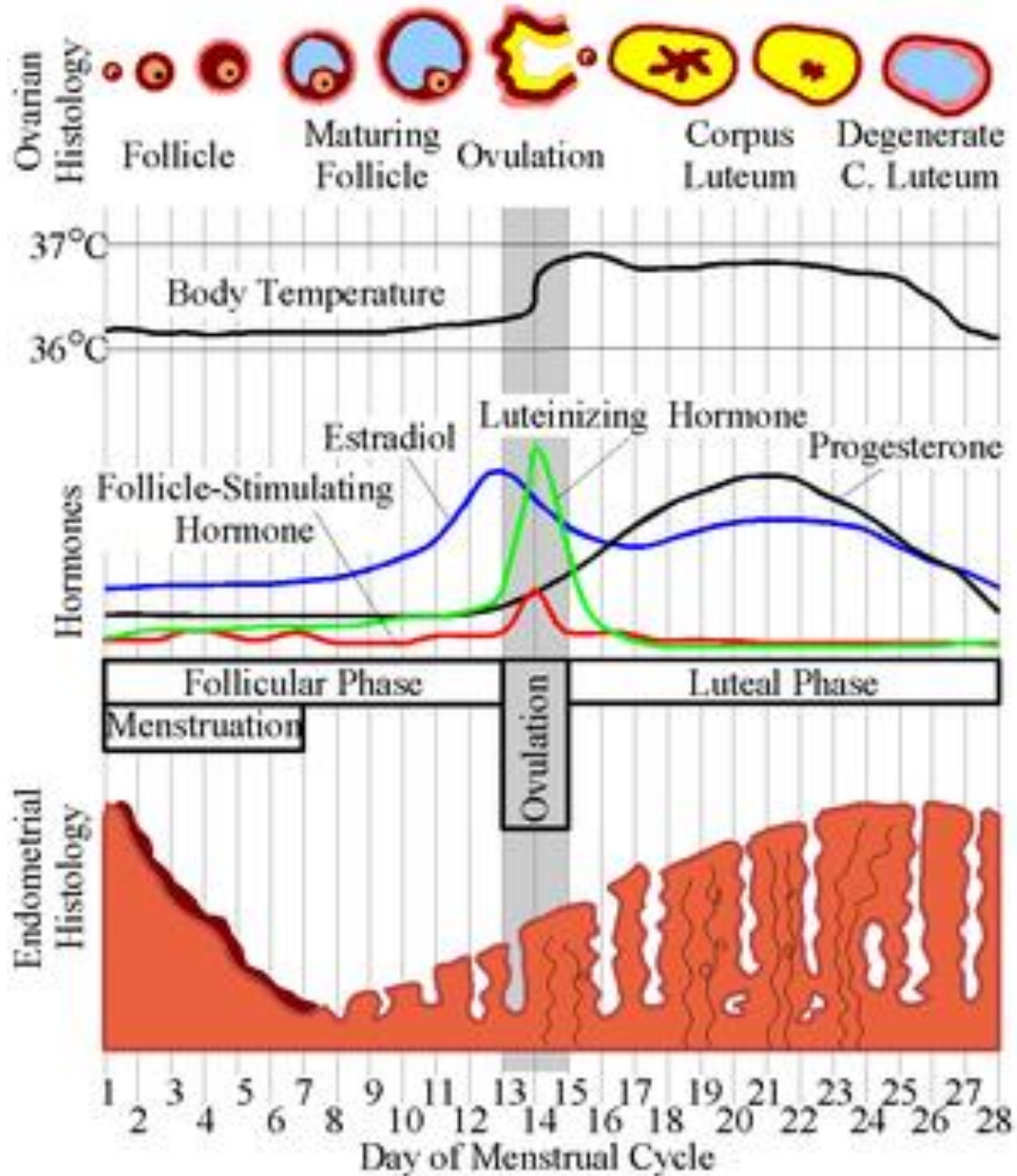
- Ovulation
- Human Ovulation Captured



Menstrual Cycle

- Coincides with ovulation
 - Increase blood and nutrients to endometrium
- If egg is fertilized, it will implant 7 days after ovulation
 - Uterine lining is continuing to thicken
- If egg is not fertilized, then endometrial lining is shed = period or menses

Cycle takes about 28 days from menses to menses



(Average values. Durations and values may differ between different females or different cycles.)

Female Erection, Lubrication, and Orgasm

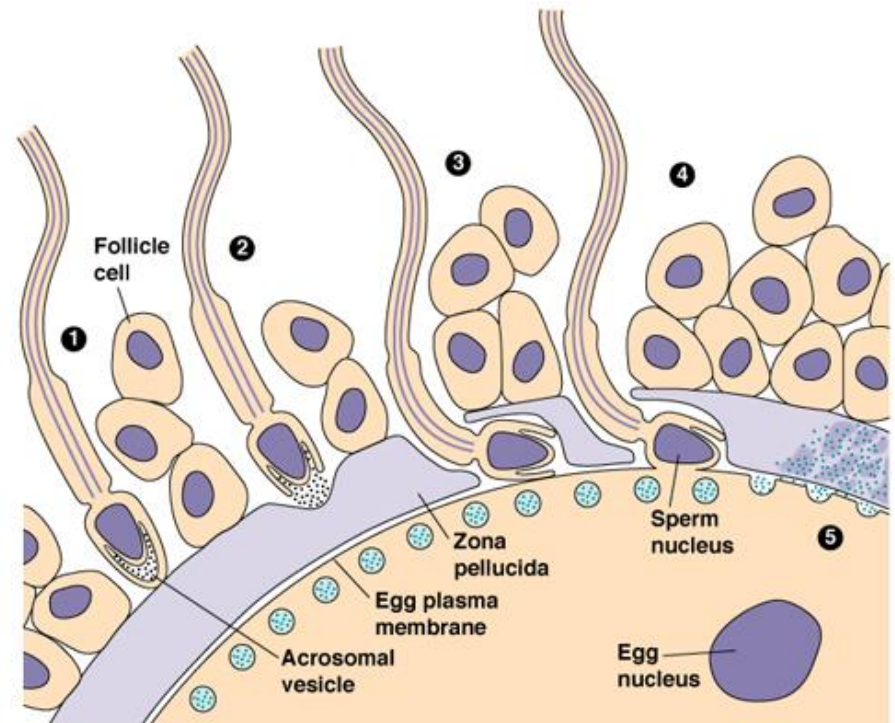
- Erection
 - When sexually stimulated, the parasympathetic nerve impulses triggers the release of nitric oxide to dilate blood vessels in the clitoris
- Lubrication
 - Impulses will also stimulate the vestibular glands to release a lubrication to facilitate insertion of the penis into the vagina
- Orgasm
 - Just prior to an orgasm, the vagina swells and fills with blood to increase the friction on the penis
 - The rhythmic contractions are helping to aid the transport of sperm into upper end of the fallopian tubes

Fertilization

- Male ejaculates due to contraction of muscle in the testicles, which forces sperm out of the body
 - 2 to 5 mL of fluid with 40 to 600 million sperm
- Sperm seek out egg (1 to 2 hours to reach the egg) and will fight to be the first to enter the egg
 - Egg is only viable for 24 hours
 - Sperm can't naturally fertilize an egg and must go through capacitation which involves weakening the cell membrane
- After one sperm has entered the egg, the outer layer of the egg becomes impenetrable to any other sperm

Fertilization

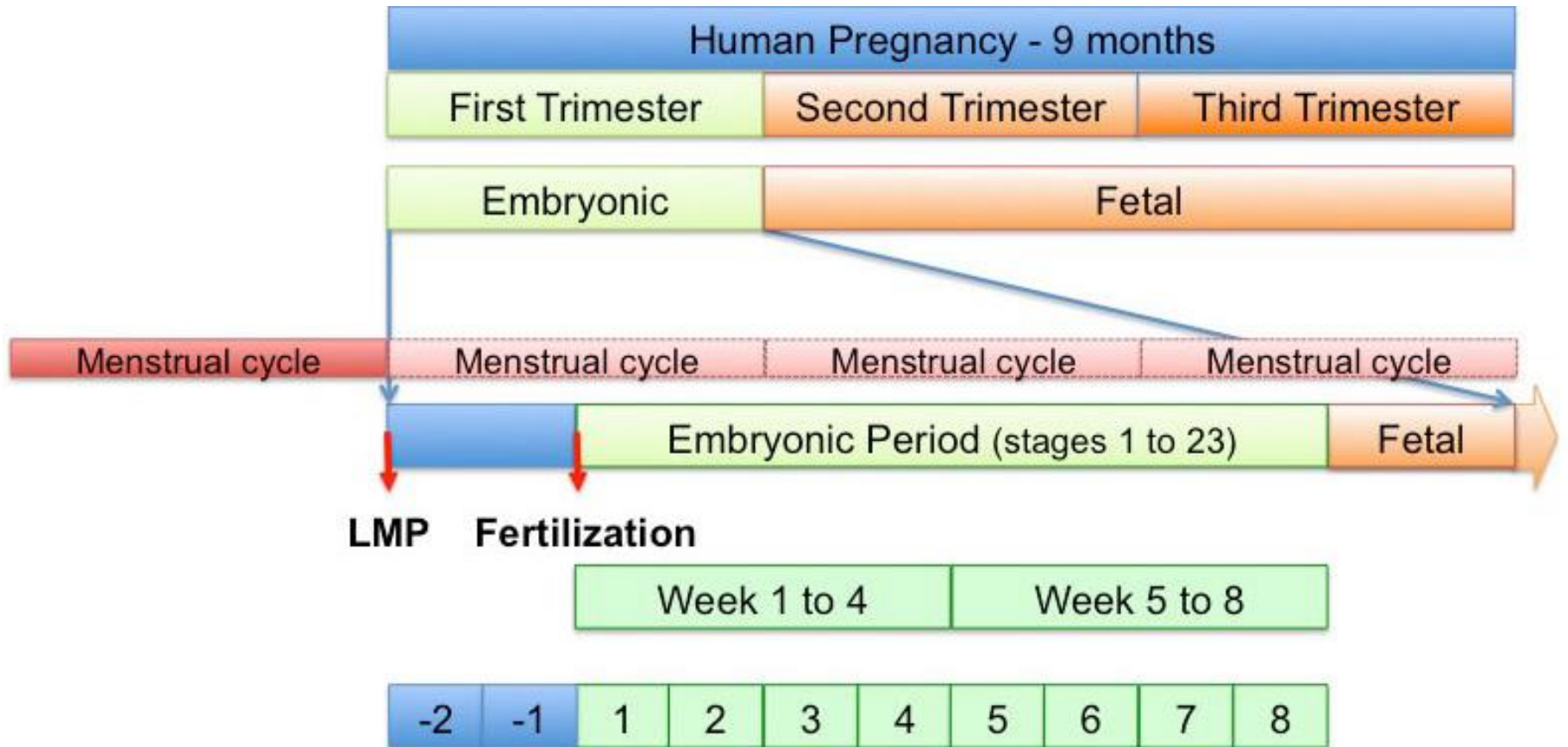
- Cell that forms is a **zygote** – everyone exists as a single cell for 24 hours before first division



Pregnancy

- Gestation Calculation
 - First pregnancy: 274 days, just over 39 weeks
 - Subsequent pregnancies: 269 days, 38.4 weeks
- Trimesters
 - First Trimester - embryonic period (organogenesis)
 - Second and Third Trimester - fetal period (growth)

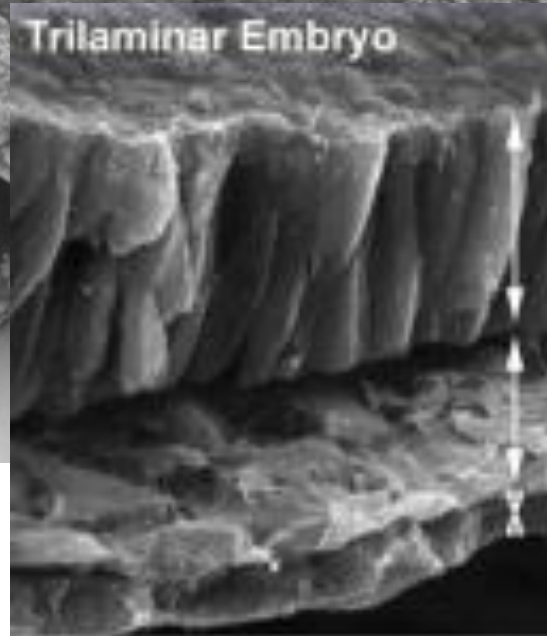
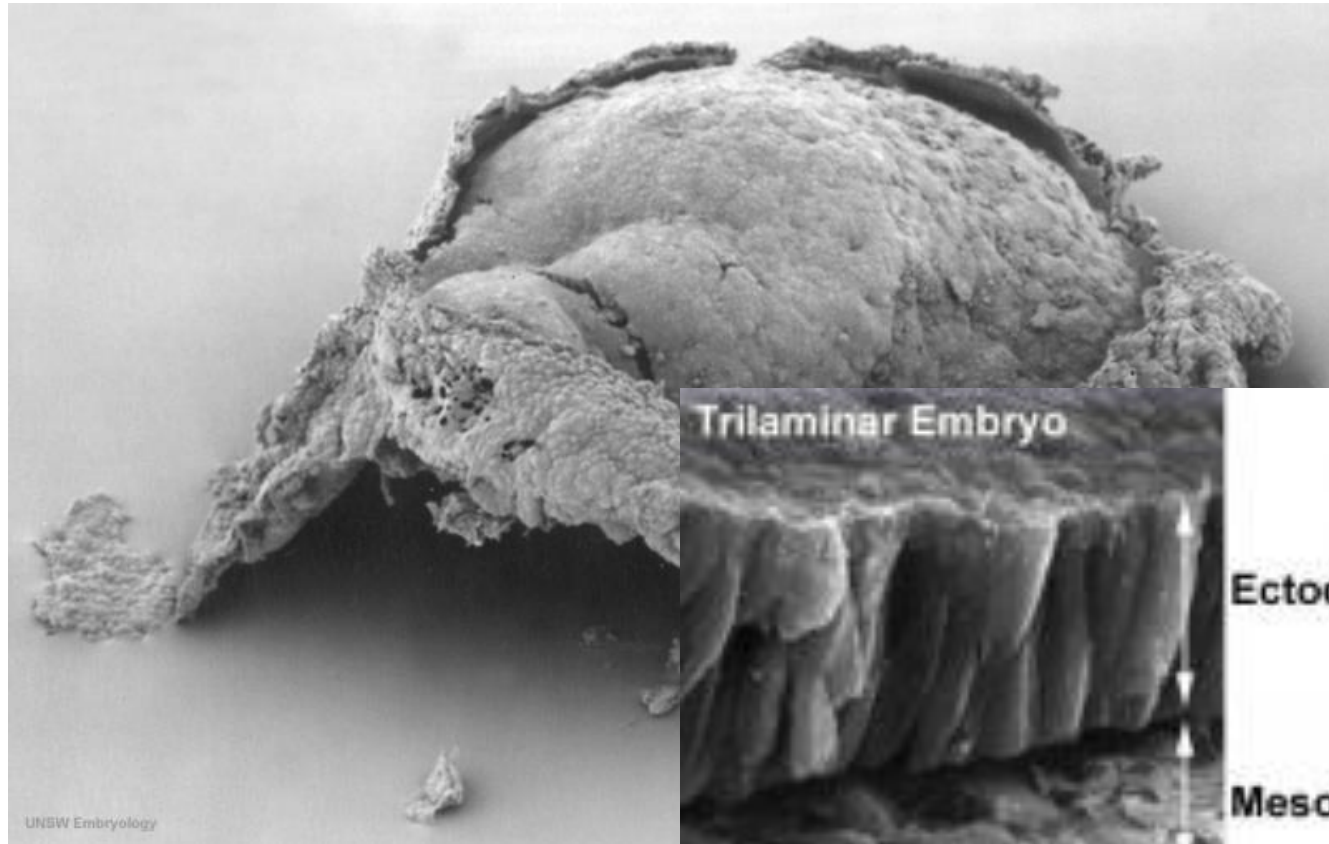
Human Development Timeline



Prenatal Period

- First: the zygote forms a blastula – hollow ball of cells
 - This occurs through rapid cell division called cleavage
- By day 7 (week 1): blastocyst has attached to endometrial lining – outer cells will form the amnion, chorion, umbilical cord, and placenta, while the inner cells will form the fetus

Human at Day 7



Embryonic Stage

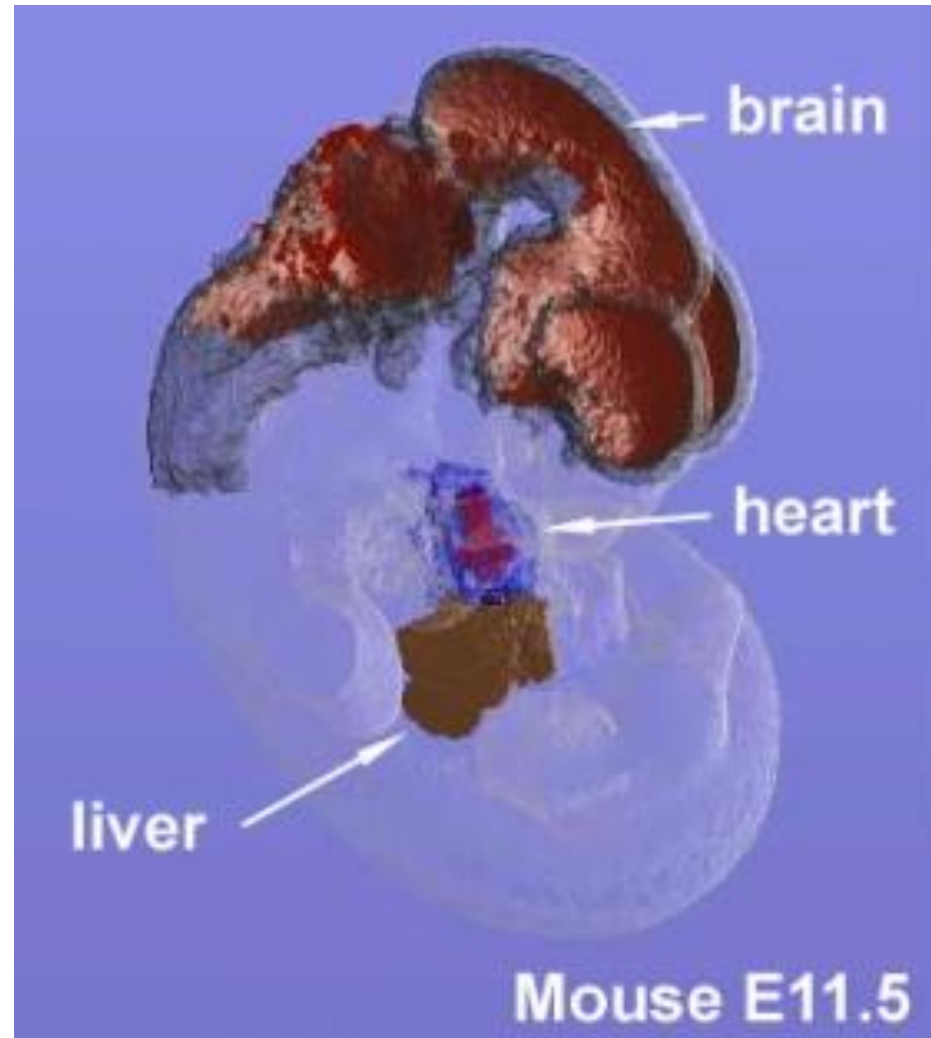
- About the time of implantation, the mass of cells begins the embryonic stage
- Cells surrounding the embryo form the placenta and the amnion
 - Organ that exchanges and filters nutrients, gases, and wastes between the maternal blood and embryo blood
- Germ layers form from inner cell mass at week 2:
 - Endoderm: digestive tract and mucous membranes
 - Mesoderm: bones, muscles, other organs
 - Ectoderm: skin, hair, nails, and nervous system

Embryonic Stage

- The umbilical cord also forms with 2 other extra-embryonic membranes
 - Yolk sac = forms blood cells early in development and also later becomes sex cells
 - Allantois = also forms blood cells and becomes the arteries and veins of the umbilical cord in week 3

Embryonic Stage

- Week 3: Chorion forms and maternal and embryonic blood vessels start to move closer together
- By the end of month 1 (week 4) the fetus has developed a neural tube, head with a jaw, arm and leg buds, and a heart beat
- All the major organs systems have begun development by the end of month 1
- Fetus is $\frac{1}{4}$ of an inch long



Embryonic Stage

- Week 5-7: head grows rapidly, face develops, upper and lower limbs elongate, fingers and toes form
- The term embryo will continue until the end of week eight
 - Embryo will now be referred to as a fetus until birth and is about 1 ¼ inches long

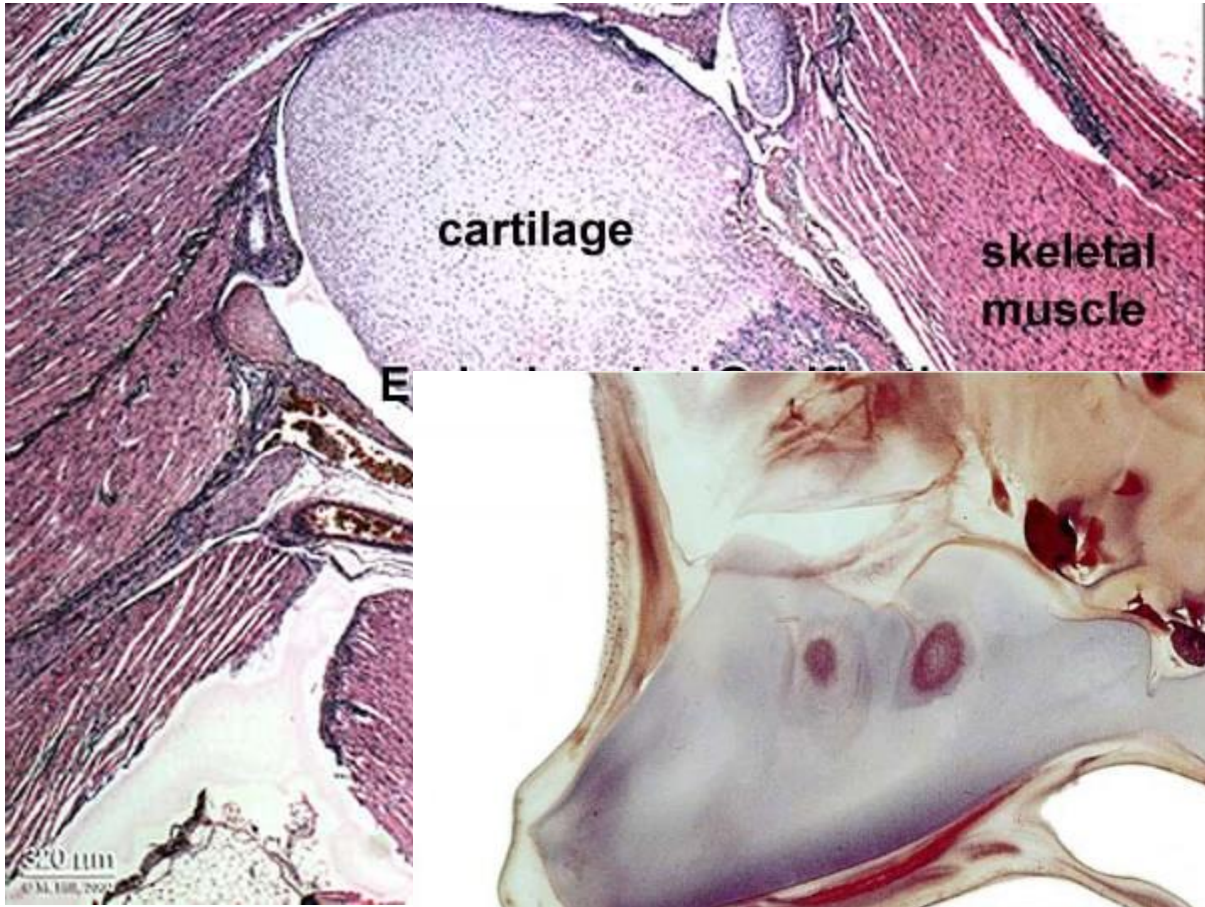
7 weeks



Fetal Stage

- Month 3: body lengthening accelerates as head growth slows, ossification centers begin in the bones
 - By week 12, external reproductive organs are distinguishable

- Month 4: body grows rapidly to amount 8 inches, skeleton continues to ossify, fetus can be startled, respond to loud noises and turn away from light shown on the pregnant women's belly

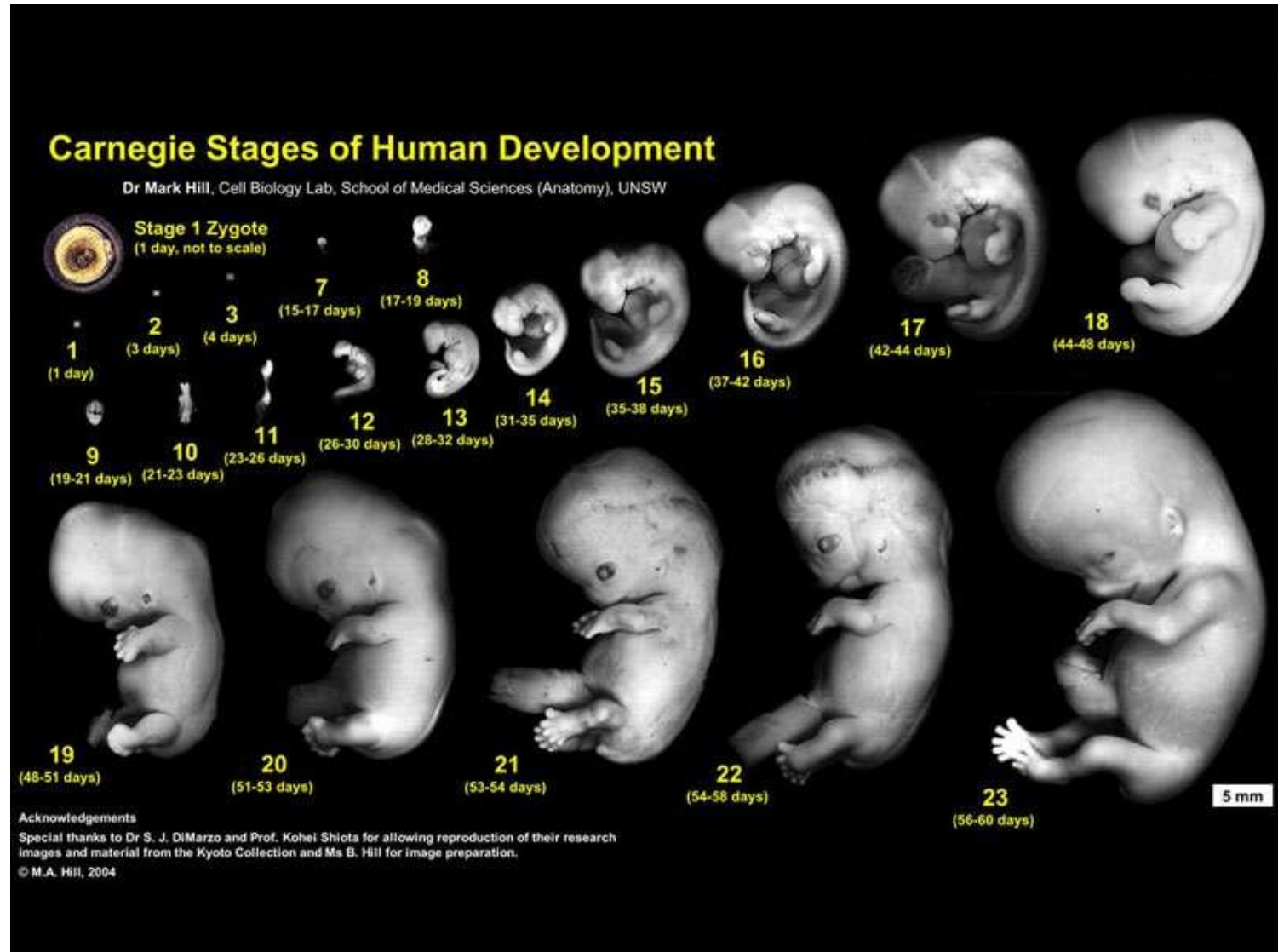


Fetal Head (12 week)

UNSW Embryology



First Trimester Development

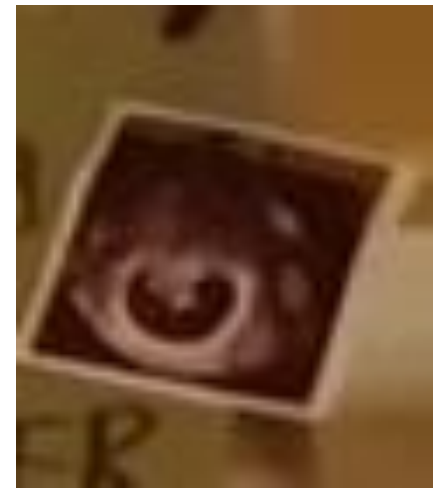


- Ultrasound





12 weeks



21.5 weeks



Fetal Stage

- Month 5: growth slows, limbs are full length, skeletal muscles contract and the mother can feel the fetus move, hair begins to grow on the head, secretions from the sebaceous glands cover the fetus
- Month 6: fetus gains weight, eyebrows and eyelashes develop, skin is thin and translucent

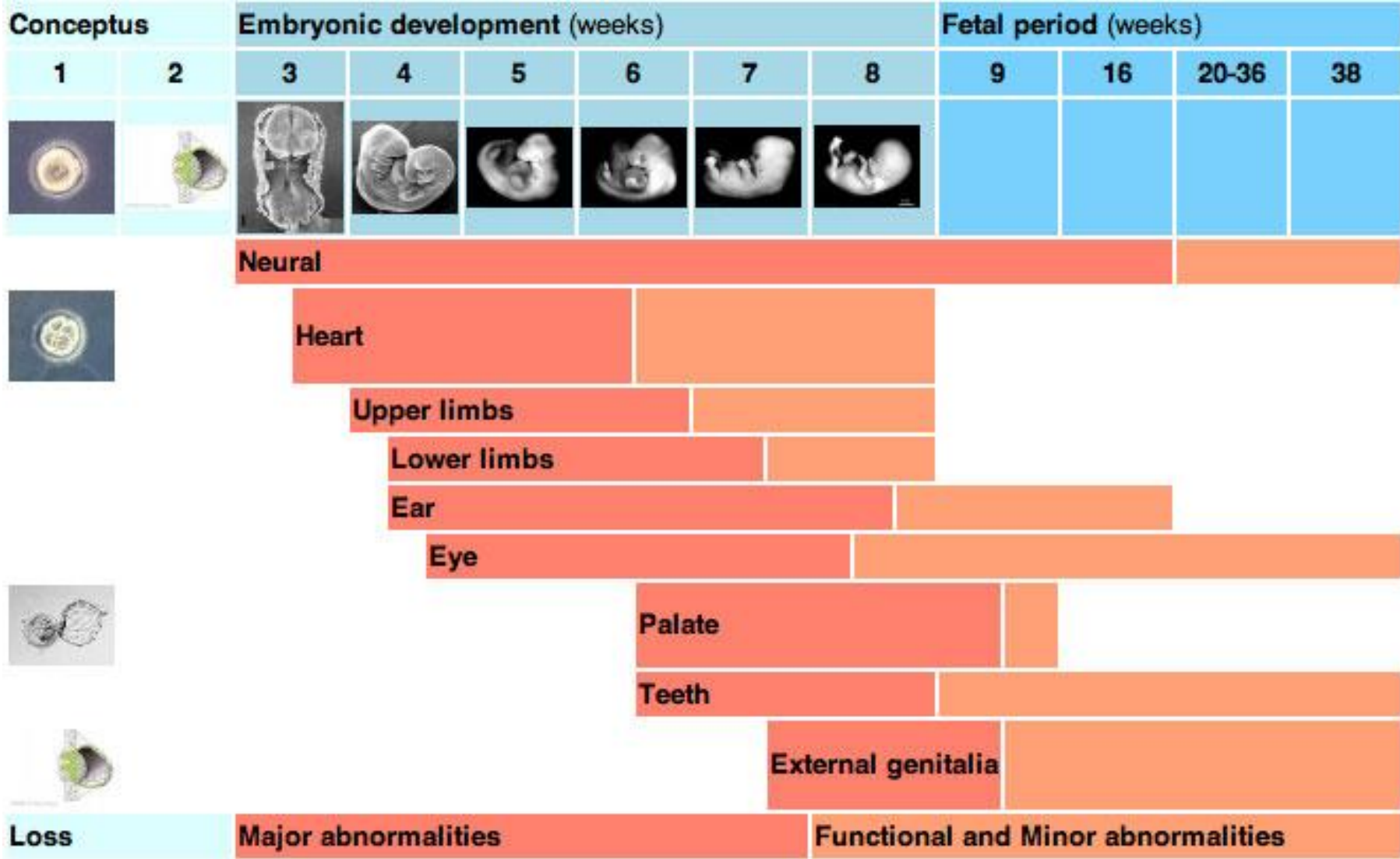
Fetal Stage

- Month 7: fat deposits in skin, eyelids (which fused in month 3) reopen, fetus is about 16 inches long
- Final trimester is month 8-10: brain cells rapidly form networks, testes descend into the scrotum, digestive and respiratory systems form last
- Full term: 19-20 inches and 6-8 pounds

Fetal Stage

- Fetal circulation
 - Blood bypasses the lungs while sending a small amount to sustain the lung tissues
 - Half the blood enters the liver and the rest is bypassed
 - Blood in the heart can move through a hole in the atrial septum

Human Critical Periods of Development



Stages of Development

- [Stages: Animation](#)
- [Stages: Videos](#)

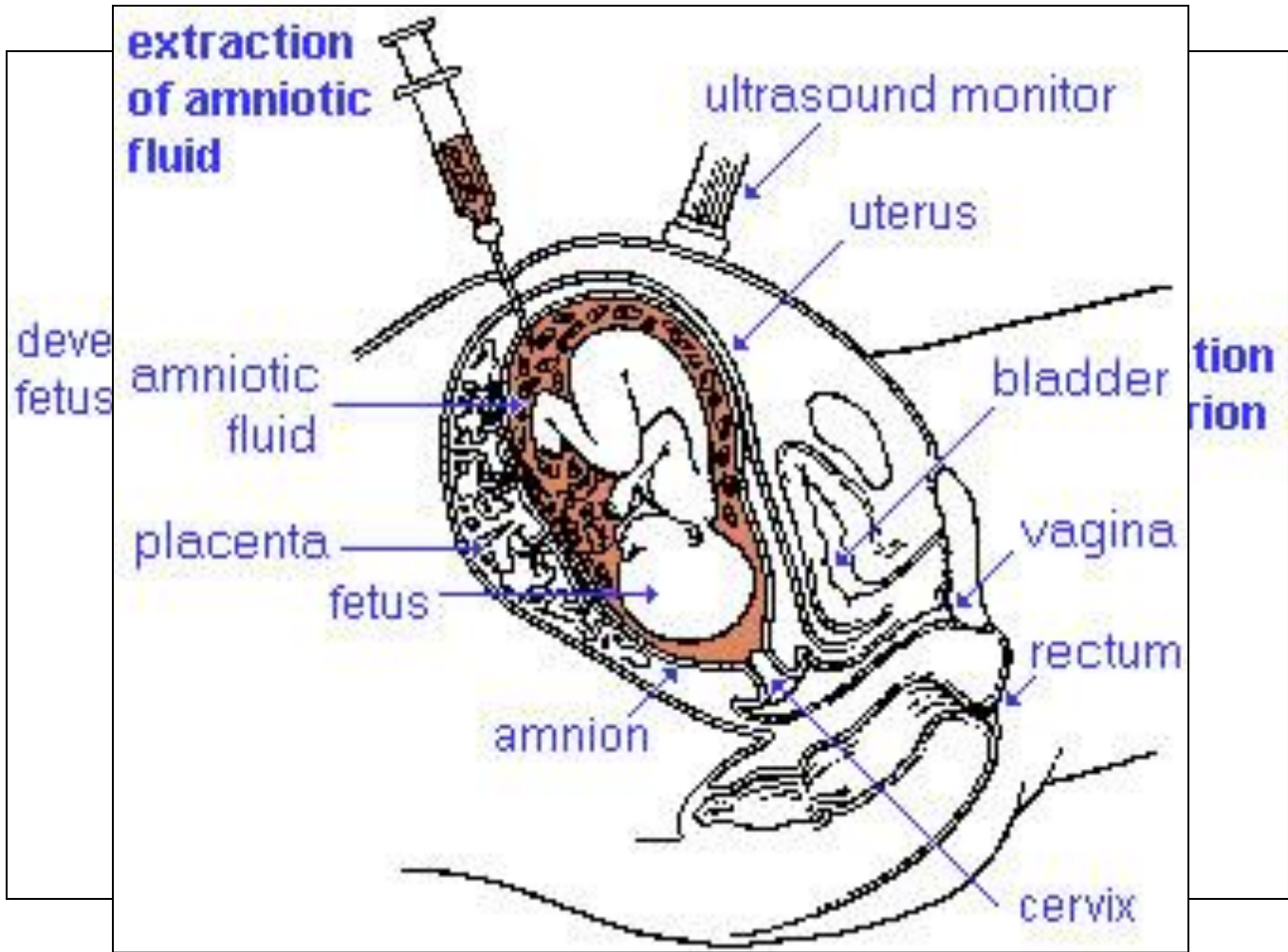
Ectopic Pregnancy

- Condition in which the fetus develops anywhere other than the uterus
 - 1 in 50 pregnancies
- Locations:
 - Fallopian tubes (98%)
 - Ovaries, cervix, or abdominal cavity (2%)

- Risk factors:
 - Previous history
 - Previous surgery on fallopian tubes
 - Pelvic infections (possibly caused by STD's such as Chlamydia or Gonorrhea)
 - Endometriosis (formation of uterine tissue in a place other than the uterus) or fibroid tumors
 - Sometimes can happen without any risk factors
 - Cigarette smoking

Detecting Chromosomal Defects

- Chorionic Villus Sampling
- Amniocentesis
- Preimplantation Genetic Diagnosis



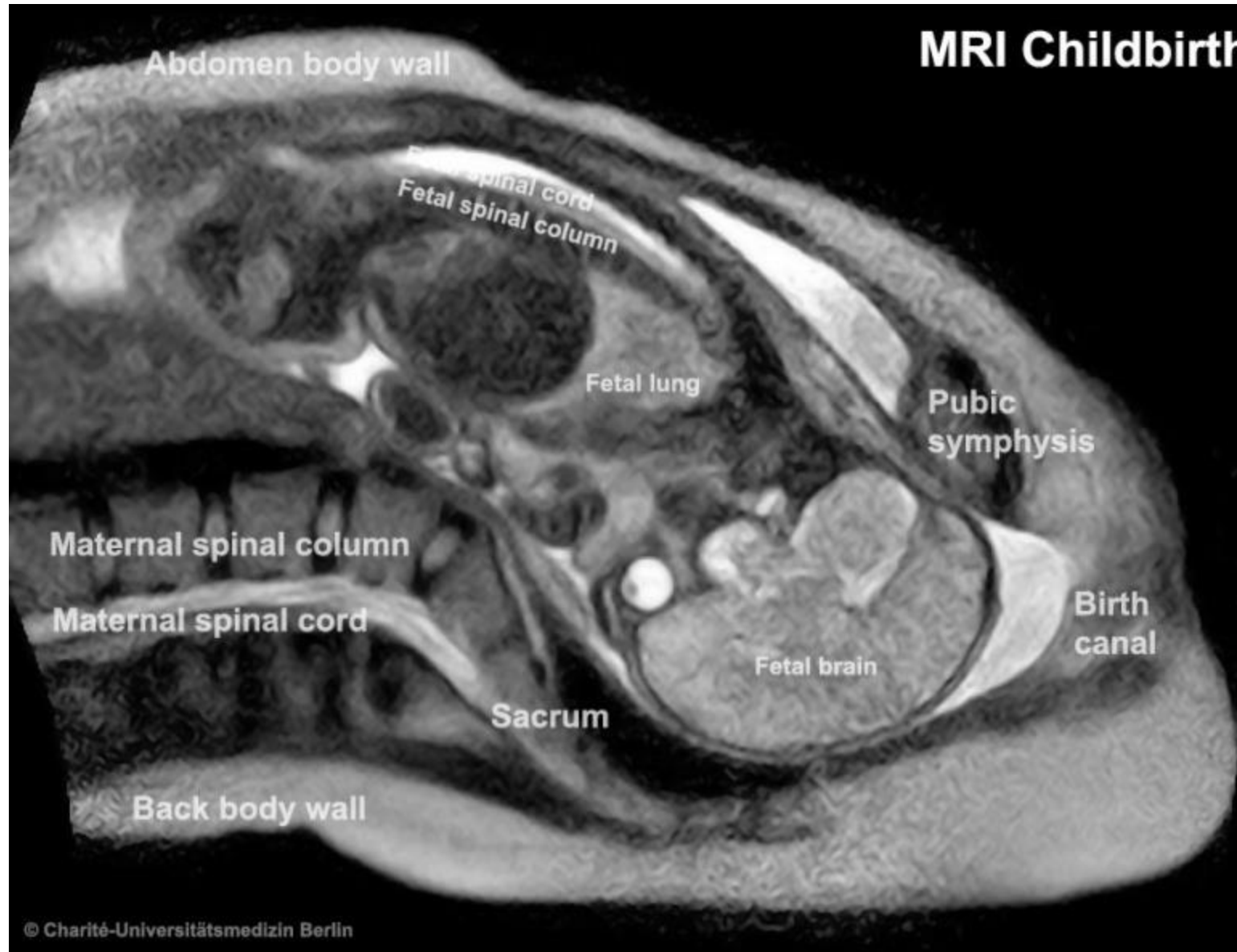
Twins

- Identical twins – division of the growing blastocyst
 - Can share a placenta, amnion, or chorion
- Fraternal twins – fertilization of two eggs
- [Video](#)

Childbirth

- Occurs roughly 280 days after last menstrual period
- Stage 1: Dilation – cervix expands to 10cm to accommodate the babies head, water breaks – rupture of amnionic sac
- Stage 2: Expulsion – increase urge to push, contractions increase, baby is expelled from the body
- Stage 3: Placental Stage – “afterbirth” includes the removal of the placenta from the uterine wall

MRI Childbirth



Mammary Glands

- Gland:
 - Specialize in the secretion of milk following pregnancy
 - Contains 15-20 lobes
 - Glands in males don't develop at puberty
- Breast overlies the pectoralis muscles
- Nipple forms the tip and the areola surrounds each nipple

Contraception

- Different methods can be used at different stages of baby development
 - Stopping the release of the sex cells: vasectomy and birth control pills or skin progestin implants
 - Prevent transport of sperm into the female: coitus interruptus (withdrawl method), rhythm method
 - Have a high failure rate
 - Mechanical barriers: male and female condoms, diaphragm, cervical cap

Contraception

- Chemical barriers: creams, foams, and jellies with spermicidal properties
 - Have a high failure rate
- After egg fertilization: morning after pill, intrauterine devices (IUD)
- After implantation of the egg: Abortion – drugs and surgery
- 100% protection: abstinence

Cancers

Male

- Prostate
- Testicular
- Penile

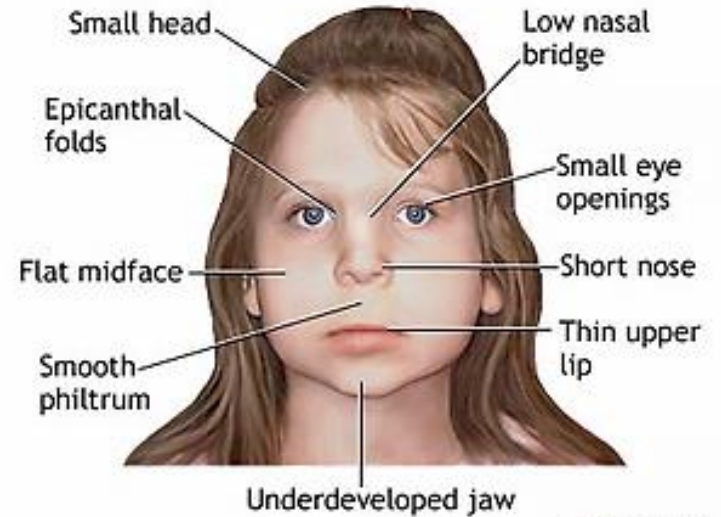
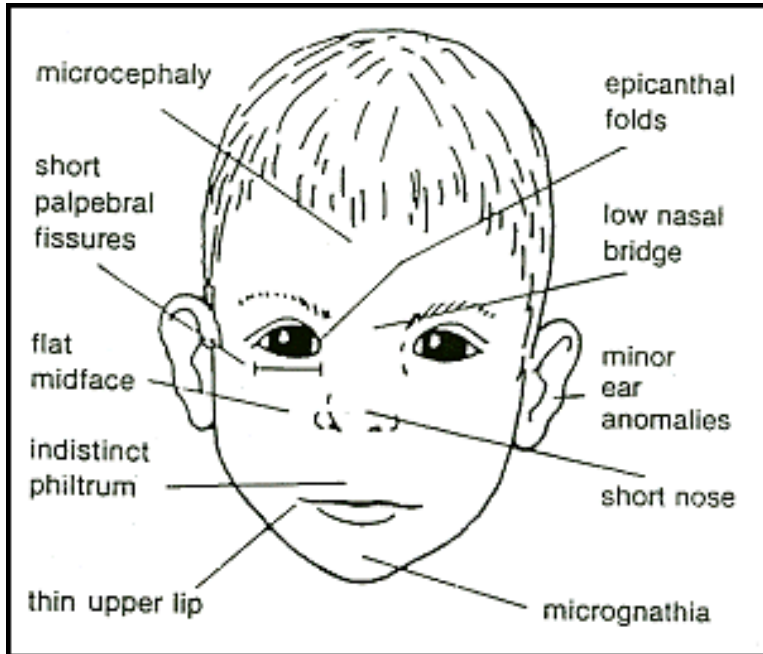
Female

- Breast
- Ovarian
- Uterine
- Cervical
- Vaginal
- Vulvar

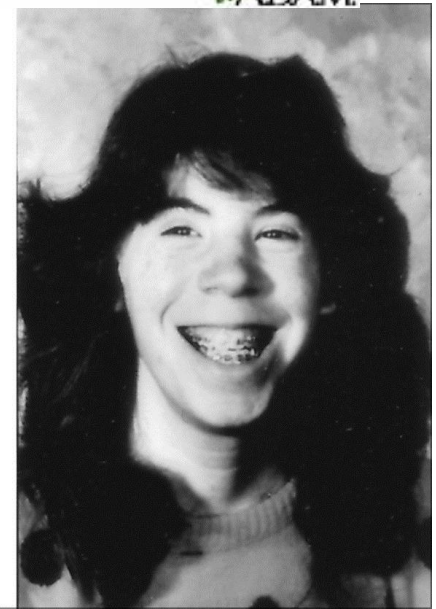
Fetal Alcohol Syndrome (FAS)

- In addition to lower birth weight, infants of mothers who consume large amounts of alcohol during pregnancy may exhibit a pattern of physical anomalies.
- Classification identifies an association between lower levels of drinking and less extensive fetal involvement. (between 2 and 3 per 100 births)
- CFAS features may not be specific to alcohol. Using drugs or not gaining enough weight (less than 5 pounds) may also cause the symptoms.

Fetal Alcohol Syndrome



ADAM.



Videos

- [5 Minute Vaginal Birth](#)
- [Animation](#)
- [Baby Center Child Birth](#)

Resources

- http://php.med.unsw.edu.au/embryology/index.php?title=Foundations_Lecture_-_Introduction_to_Human_Development#Week_1_Development