BIO 111 - Laboratory #10: Reproduction and Development

- **Movie**: "The Miracle of Life"
  - ✓Answer the questions on the Video handout, as you watch the movie
- **Assigned pages**: Mader, S., et al. 2008. Inquiry of Life. pp. 204, 207, 214, 263-267, 268-279, and 280
  - ✓Know the GOALS (objectives and key terms) listed for each section
- **Field Trip NEXT WEEK! (State regulations require that you wear closed shoes on the field trip.)**
  - ✓**PLEASE, dress for walking outdoors; you will NOT be allowed on the bus with open shoes.**
  - ✓**MEET at the bus stop in front of MOFFET HALL; ALL buses will leave from that bus stop.**
  - ✓**BE ON TIME (field trip runs for the full length of your NORMAL LAB period); buses and treatment plant personnel are on a tight schedule. If you are late, you WILL miss the bus.**

I. Reproduction:

1. GOALS:

Objectives - at the end of laboratory #10 you should be able to:

1.) identify and state the functions of human male and female reproductive structures using the models
2.) identify and state the functions of the female reproductive structures, using the pig uterus
3.) state the key differences between human and porcine (pig) female reproductive structures
4.) identify and state the functions of the extraembryonic membranes in the porcine fetus

Key terms - you should be able to define:

HUMAN FEMALE ANATOMY		
ovary	cervix	labium minora
fallopian tube (oviduct)	vagina	labium majora
uterus	clitoris	fimbriae
HUMAN MALE ANATOMY		
testis (testes) and scrotum	bulbourethral gland	penis
epididymus	urethra	prostrate gland
vas deferens	bladder	seminal vesicle
PORCINE (PIG) FEMALE ANATOMY		
uterine horn	ovaries	chorion
uterine body	placenta	
cervix	amnion	

2. Human Male Reproduction - Anatomy

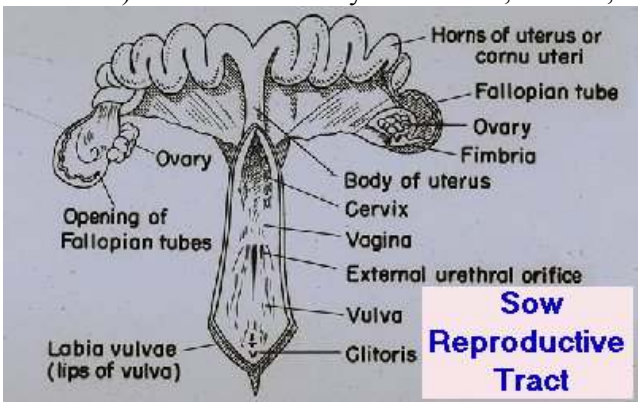
1.) **p. 204**: **Review the anatomical terms** and **use Figure 16.5** to identify the structures in the model
2.) **p. 214, Review**: **Answer** questions 4-6

3. Human Female Reproduction - Anatomy

1.) **p. 207**: **Review the anatomical terms** and **use Figure 16.8** to identify the structures in the model
2.) **p. 214, Review**: **Answer** questions 7-10, 12

4. Pig Uterus and Extraembryonic Membranes - Anatomy and Dissection Demonstration

1.) **Demonstration**, adult female pig uterus: Observe and take notes/sketch the structures
2.) Be able to identify the chorion, amnion, allantois, yolk sac, & fetus with umbilical cord attached



II. Development:

1. GOALS:

Objectives - at the end of laboratory #10 you should be able to:

1.) describe the basic stages of animal embryonic development
2.) describe the anatomy of an unfertilized chicken egg
3.) identify the four extraembryonic membranes of the chick and human
4.) compare & contrast the location & function of the extraembryonic membranes of humans & chicks
5.) list the physical characteristics present in the chick embryo at 24hrs, 48 hrs, 72hrs, and 96 hrs of development……HINT: *expect to see these slides on the practical…….*
6.) identify the age (24, 48, 72 or 96hrs) of a chick embryo (as a section on a prepared slide)
7.) list the key characteristics found in human embryos at 4, 5-6, 8, 16, and 38 weeks

Key terms - you should be able to define:

embryo	eye	allantois
head fold	margin (edge) of amnion	germinal vesicle with nucleus
neural tube	caudal fold	albumen
neural fold	ear	chalaza
primitive streak	teratogen	shell & shell membranes
somites	tail bud and limb buds	amnion
heart	amniotic cavity	brain
vitelline arteries	yolk sac	growth vs. differentiation vs. morphogenesis
vitelline veins	chorion	zygote vs. morula vs. blastula vs. gastrula

2. Development - Vertebrates

1.) **pp. 263-264** (stop at section "Sea Star Development"): Read and understand the differences between "growth", "differentiation" and "morphogenesis".

2.) **Demonstration Dissection - Chick Embryos (we start with the egg in the shell, see Fig. 20.5)**

(1.) **48 hr chick embryo demonstration (under dissecting scope)**: use the description and Figure 20.7 (p. 272) to identify the structures

(2.) **96 hr chick embryo demonstration (under dissecting scope)**: use the description and Figures 20.9 and 20.10 (pp. 276-277) to identify the structures….is the heart beating?

(3.) Chick embryo development, 24hr (day 1) through 96hrs (day 4 days): note the changes at:

24 hrs (Day1):	48hrs (Day 2):	72 hrs (Day3):	96 hrs (Day4):

3.) **Human Development**

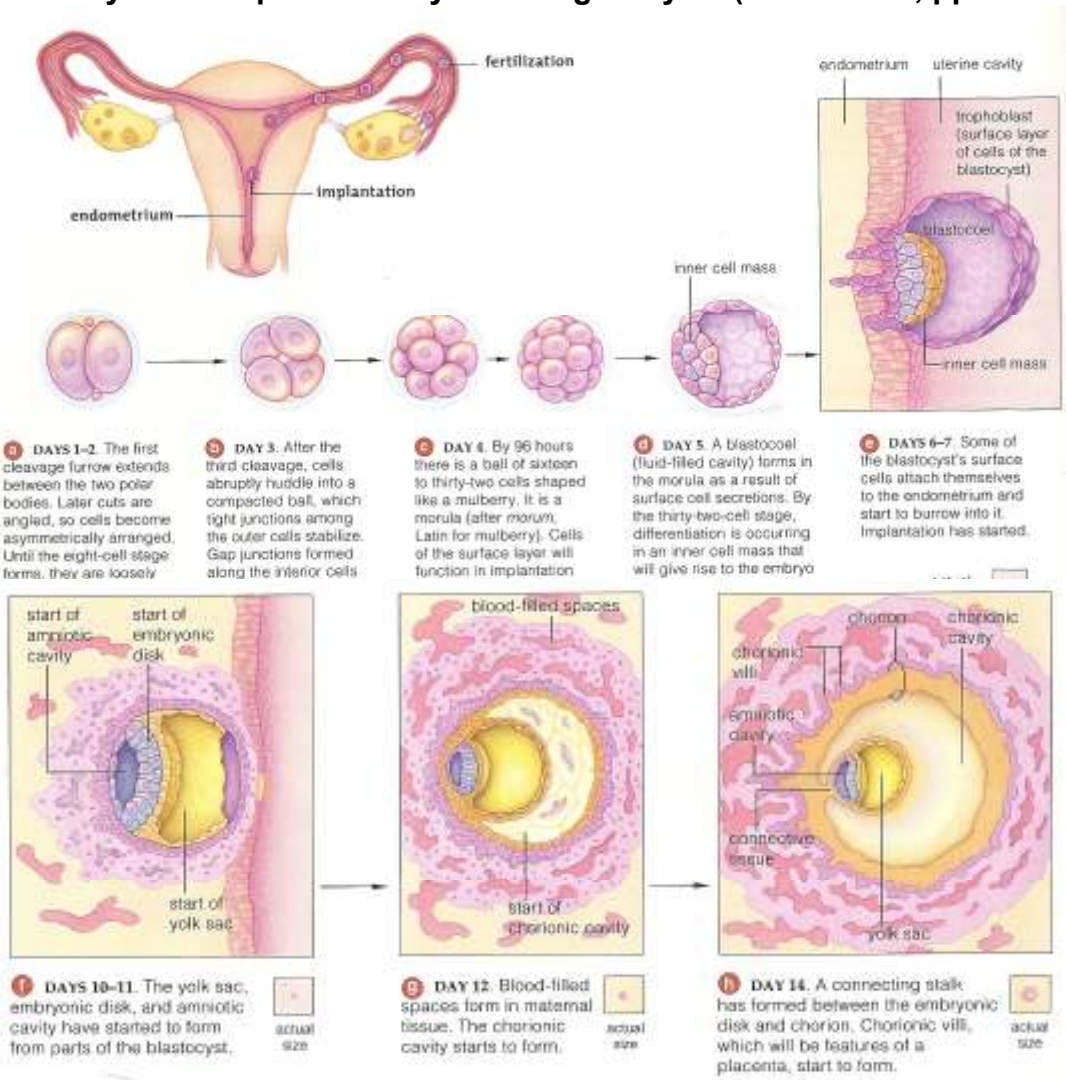
(1.) **Extraembryonic membrane development**: Use Fig. 20.10 and the attached sheet, "Human Development - Day 1 through Day 25" to IDENTIFY & COMPARE the extraembryonic membranes of the human with the extraembryonic membranes of the chick (Fig. 20.4, p. 269)

(2.) **pp. 277-279, key characteristics found in human embryos at 4, 5-6, 8, 16, & 38 weeks**: Read the description and use 20.11 in your lab manual and the attached sheet, "Human Development - Week 4 - Week 38" to recognize these stages in human development

(3.) **Factors that can Adversely Affect Human Embryonic Development**: Review the attached sheet (page 5 pf this handout) to learn the definition of a "**teratogen**". You are not going to be quizzed on the information in the table (Figure 44.21) but note that there are specific periods of teratogen sensitivity for all periods of development.

4.) **p.280, Review**: Answer questions 1-10

Human Embryo Development – Day 1 Through Day 25 (lecture text, pp. 786-788):



a DAYS 1–2. The first cleavage furrow extends between the two polar bodies. Later cuts are angled, so cells become asymmetrically arranged. Until the eight-cell stage forms, they are loosely

b DAY 3. After the third cleavage, cells abruptly huddle into a compacted ball, which tight junctions among the outer cells stabilize. Gap junctions formed along the interior cells

c DAY 4. By 96 hours there is a ball of sixteen to thirty-two cells shaped like a mulberry. It is a morula (after *morum*, Latin for mulberry). Cells of the surface layer will function in implantation

d DAY 5. A blastocoel (fluid-filled cavity) forms in the morula as a result of surface cell secretions. By the thirty-two-cell stage, differentiation is occurring in an inner cell mass that will give rise to the embryo

e DAYS 6–7. Some of the blastocyst's surface cells attach themselves to the endometrium and start to burrow into it. Implantation has started.

f DAYS 10–11. The yolk sac, embryonic disk, and amniotic cavity have started to form from parts of the blastocyst.

actual size

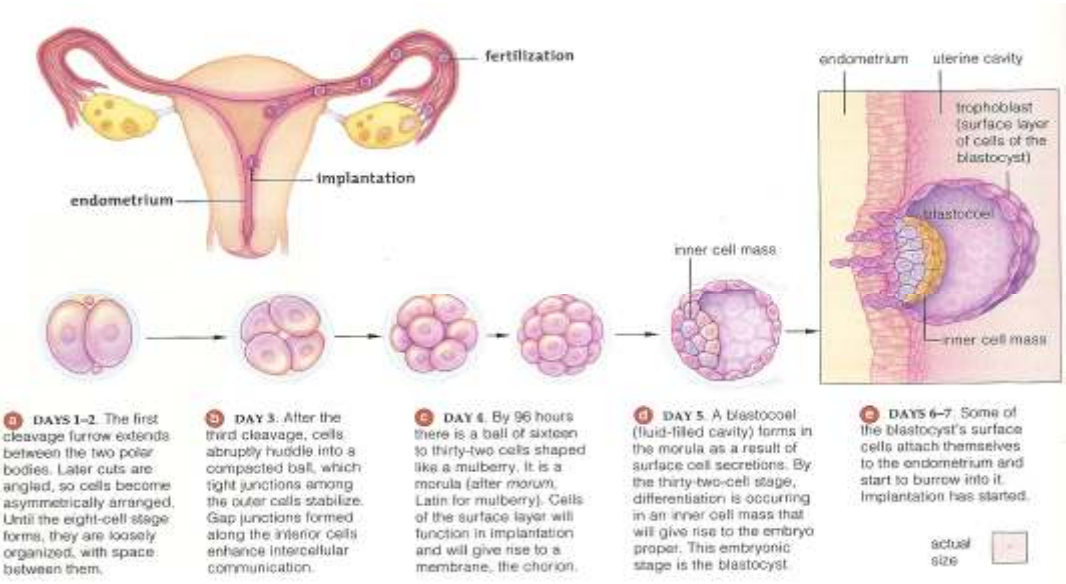
g DAY 12. Blood-filled spaces form in maternal tissue. The chorionic cavity starts to form.

actual size

h DAY 14. A connecting stalk has formed between the embryonic disk and chorion. Chorionic villi, which will be features of a placenta, start to form.

actual size

Figure 44.17 *Animated!* From fertilization through implantation. A blastocyst forms, and its inner cell mass will give rise to a disk-shaped early embryo. Three extraembryonic membranes (the amnion, chorion, and yolk sac) start forming. A fourth membrane (allantois) forms after the blastocyst is implanted.



a DAYS 1–2. The first cleavage furrow extends between the two polar bodies. Later cuts are angled, so cells become asymmetrically arranged. Until the eight-cell stage forms, they are loosely organized, with space between them.

b DAY 3. After the third cleavage, cells abruptly huddle into a compacted ball, which tight junctions among the outer cells stabilize. Gap junctions formed along the interior cells enhance intercellular communication.

c DAY 4. By 96 hours there is a ball of sixteen to thirty-two cells shaped like a mulberry. It is a morula (after *morum*, Latin for mulberry). Cells of the surface layer will function in implantation and will give rise to a membrane, the chorion.

d DAY 5. A blastocoel (fluid-filled cavity) forms in the morula as a result of surface cell secretions. By the thirty-two-cell stage, differentiation is occurring in an inner cell mass that will give rise to the embryo proper. This embryonic stage is the blastocyst.

e DAYS 6–7. Some of the blastocyst's surface cells attach themselves to the endometrium and start to burrow into it. Implantation has started.

actual size

Human Embryo Development – Week 4 Through Week 39 (lecture text, pp. 790-791):

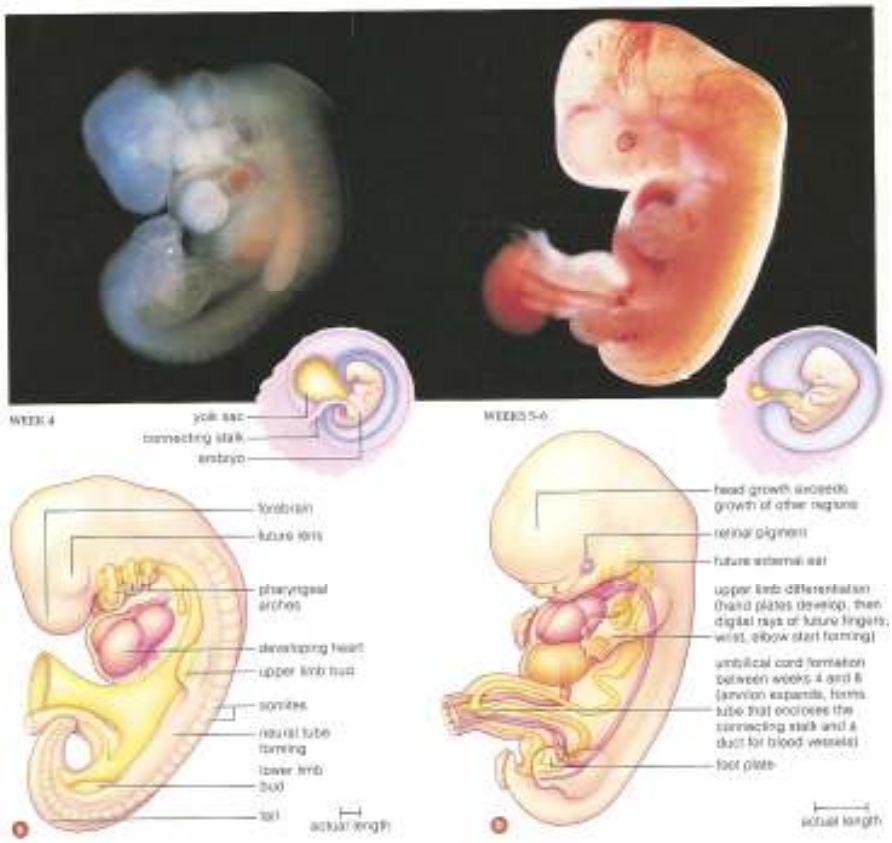
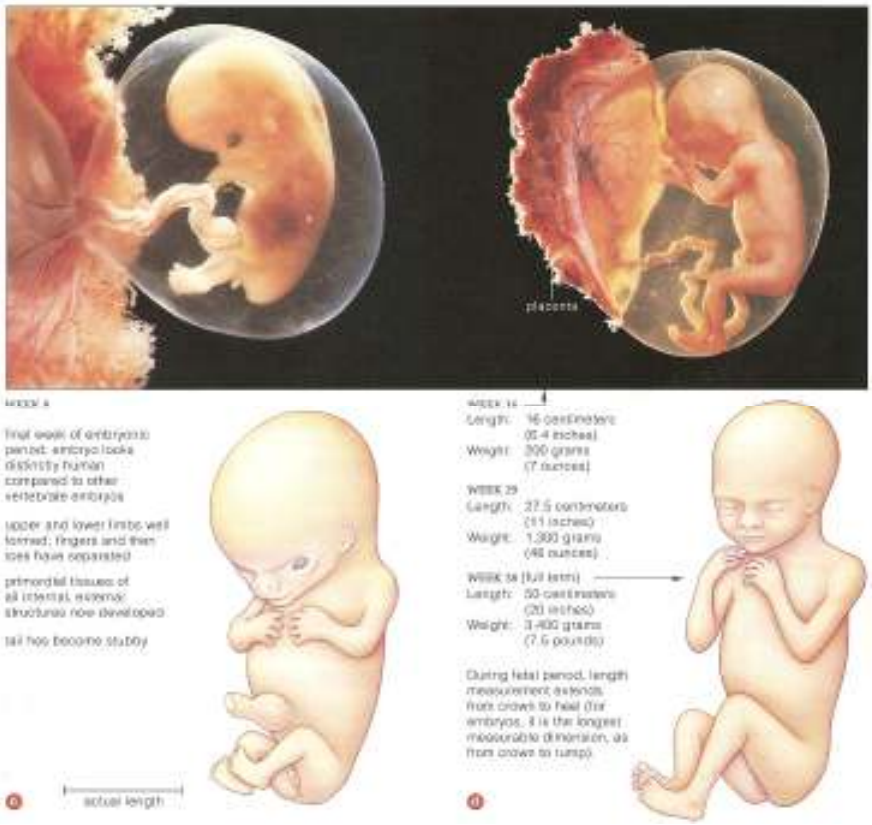


Figure 44.20 Human embryo at successive stages of development



44.13 Mother as Provider, Protector, Potential Threat

LINKS TO SECTIONS 18.5, 34.13, 40.5, 41.8

Each pregnant female is committing much of her body's resources to the growth and development of a brand-new individual. From fertilization until birth, her future child is at the mercy of her diet, health habits, and life-style.

NUTRITIONAL CONSIDERATIONS

When a mother-to-be eats a well-balanced diet, her embryo gets all the proteins, carbohydrates, and lipids it requires for growth and development (Section 41.8). However, her own body's demands for vitamins and minerals increase as the placenta preferentially absorbs them for the fetus from her blood. Medically supervised increases in her uptake of B-complex vitamins before and during early pregnancy reduce the embryo's risk of severe neural tube defects. Folate (folic acid) is especially important in this regard.

Dietary deficiencies adversely affect many developing organs. For example, the brain expands most in the weeks just before and after birth. Poor nutrition during this span may impair intelligence and other functions later in life.

A pregnant female must eat enough to gain twenty to twenty-five pounds, on average. If she does not, her newborn may be seriously underweight, at greater risk of postdelivery complications and, in time, impaired brain function.

INFECTIOUS DISEASES

Remember, IgG antibodies in a pregnant female's blood cross the placenta and protect the embryo or fetus from all but the most serious bacterial infections (Section 39.5). Some viral diseases are dangerous in the first six weeks after fertilization, a crucial time of organ formation.

Suppose the female contracts *rubella* (German measles) in this critical period. There is a 50 percent chance that some organs will not form properly. For instance, if she is infected while embryonic ears are forming, her newborn may be deaf (Figure 44.21). If she is infected at any time from the fourth month of pregnancy onward, this particular disease will have no notable effect. A female may avoid the risk entirely by getting vaccinated against the virus before pregnancy.

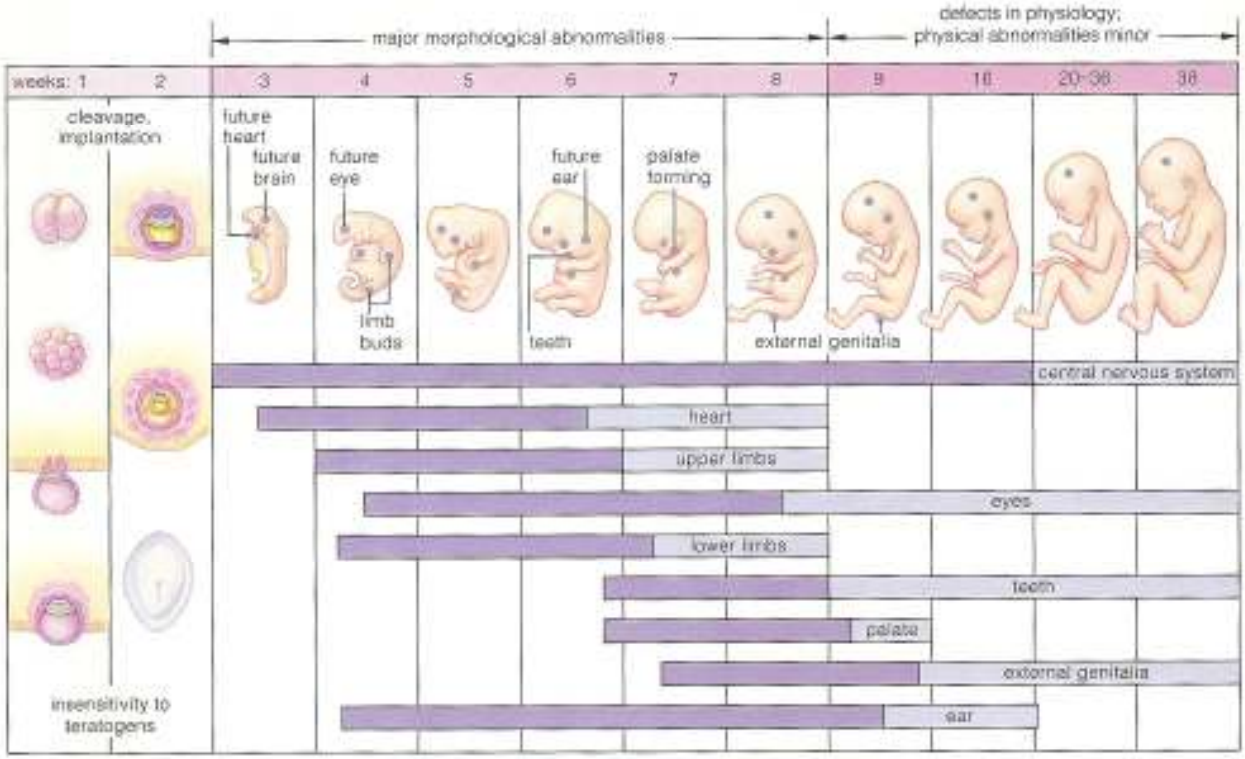


Figure 44.21 Teratogen sensitivity. Teratogens are drugs, infectious agents, and environmental factors that invite embryonic or fetal deformities, usually after organs form. They adversely affect growth, tissue remodeling, and tissue resorption. *Dark blue* signifies the highly sensitive period; *light blue* signifies periods of less severe sensitivity to teratogens. For example, the upper limbs are most sensitive to damage during weeks 4 through 6, and somewhat sensitive during weeks 7 and 8.