

# BIOL 211: Vertebrate Embryology and Laboratory 2011 Syllabus

## Embryology Course Information

**Lecture:** Mon., Wed., and Fri. in CW 105; Lecture 9:00–9:50 am.

**Lab:** Tuesday and Thursday in AH 107; Lab Sec. A 9:30–10:55 and Lab Sec. B 11:00–12:25

- Lecture and Lab are co-requisites and must be taken concurrently.
- Embryology is a **Group I** Biology Elective. The course is offered only during the fall semester.

**Goals:** The lecture course is a study of human embryology with emphasis on the fundamental developmental processes shared by vertebrate embryos. Topics include gametogenesis, fertilization, and development of the embryo from zygote through the differentiation of the neural tube. The second half of the course is devoted to the development of selected human organ systems including the nervous system, sense organs, and the cardiovascular, digestive, respiratory, and urogenital systems. The required laboratory complements the lecture material with a comparison of frog, chick, and pig embryos. Histological, preserved, and selected living materials

are studied to illustrate gametogenesis, fertilization, and development of the vertebrate embryo from zygote through the differentiation of organ systems in amphibian, avian and mammalian embryos.

BIOL 211 is recommended for biology majors and other students interested in human anatomy. BIOL 211 is especially recommended for students planning post-graduate work in the health professions (e.g., pre-medical students) as well as for students interested in zoology and veterinary medicine. Embryology is designed to be taken first semester of the sophomore year.

*The course has been structured to afford you every opportunity to master the required material and to demonstrate your success in that endeavor. Students who enroll in this course are seeking rigorous pre-professional preparation. Nevertheless, you need not feel intimidated by the demanding career path you have selected. I am here to help you overcome any difficulties you may have with the course material and to help you do your best work. You will also find learning resources at the course web site.*

**Prerequisites:** BIOL 111 and 112 (Principles of Biology I and II and labs) and CHEM 113. Students who have not achieved grades of “C” or better in the prerequisite courses are advised to repeat the necessary courses before attempting further course work in biology. Completion of BIOL 211 and lab with grades of “C” or better is a recommended prerequisite for BIOL 212 (Comparative Anatomy) offered spring semester.

**Prerequisites by Topic:** The prerequisite year of college biology with laboratory should include an introduction to the evolution, cell biology, anatomy, physiology, genetics, and development of vertebrates. The prerequisite courses should also include the use of compound and dissecting microscopes, identification of animal tissues and organs from microscope slides and photo-micrographs, interpreting detailed diagrams of vertebrate anatomy, and dissection of a representative vertebrate.

**Professor:** Dr. Anna E. Ross, Professor of Biology. **Home page:** <http://www.cbu.edu/~aross>

**Embryology Course Web Page:** <http://www.cbu.edu/~aross/embhome.htm>

- **Office:** AH 111
- **Office Phone:** 321-3436
- **E-mail:** aross@cbu.edu
- **Office hours:** Monday, Tuesday, Thursday, & Friday 2:00–4:30.

*Additional times by appointment (use the posted schedule).*

## Required Materials

**Text:** Moore, K. L. and T. V. Persaud. 2008. *The Developing Human. Clinically Oriented Embryology.* 8<sup>th</sup> ed. Saunders. ISBN 978141-6037064 *or* (2003) 7<sup>th</sup> ed. ISBN 9780721694122

**Laboratory Manual:** Schoenwolf, G. C. 2009. *Laboratory Studies of Vertebrate and Invertebrate Embryos.* 9<sup>th</sup> ed. Prentice Hall. ISBN 9780321556943 *or* (2001) 8<sup>th</sup> ed. ISBN 9780138574345

**Laboratory Atlas (Recommended):** Wright, Shirley. 2005. *Photo Atlas of Developmental Biology* 1<sup>st</sup> ed. Morton. ISBN 9780895826299

**Required Supplement:** Ross, Anna E. 2011. *Biology 211 Lecture and Laboratory Course Supplement.* Purchase the current edition at the CBU Print Shop in Kenrick. [\$30]

**Medical Dictionary:** Choose one. For example:  
• *Stedman's Medical Dictionary.* 28<sup>th</sup> ed. 2006. Williams and Wilkins. ISBN 9780781733908

**Students must provide their own disposable gloves (latex or nitrile examination gloves)**

- No wireless devices (cell phones, pagers, PDAs or calculators), no programmable calculators, and no devices with ear plugs are allowed during exams, quizzes, labs or classes. Students are encouraged to use laptop computers during class or lab but only for directly course-related tasks.

## Student Responsibilities

A cooperative and open atmosphere is expected during all class and lab meetings. Students are encouraged to study together. The lab room (AH 107) will be available during [posted hours](#) for required review and study. ☆ You will want to spend at least two hours per week working in AH 107 in addition to the scheduled class and lab sessions.

You will need to read the appropriate text and lab material *before* you come to lecture or lab. You will need your textbook and supplement during all lecture meetings and most labs. You will need your lab manual and Supplement for all lab meetings. You are expected to check your CBU email regularly and you are responsible for course announcement sent via email.

**Attendance:** You are responsible for all information presented during lecture and lab sessions. Lecture and lab attendance are both required. Laboratory sessions will require the entire scheduled period; do not plan to leave lab before the scheduled time. Arriving late for class or lab is rude; tardiness will not be tolerated. If you miss lecture or lab for any reason, *you are expected to inform me and you are responsible for making up the missed work immediately and on your own time* (you must have me verify that you have made up any missed lab work). If you are ever absent, *contact a classmate immediately* because you will be held responsible for the material as well as for announcements of quiz coverage, exam dates, etc. Unexcused absences will lower your grade (for example, you will receive a zero if you miss a quiz). In accordance with CBU policy, you will be withdrawn or fail a course for excessive absence.

In a laboratory course, there is simply no substitute for being there. Much of the benefit of the course is derived from your active participation during the lab meetings. You will learn more by working with your classmates doing the lab work than can be assessed by any quiz or exam. In fact, your active participation in lab is so important that no quiz or exam scores could possibly be high enough to compensate for missing the experience of being present in the laboratory. *Therefore, you must complete all of the labs to pass the course.*

## Exams and Grades

Your grade will be determined by your own achievement. There is no curve.

You can easily determine your standing in the course at any time (calculate the percentage of available points that you have earned). Bonus points can be earned on each exam. Therefore, with **thorough preparation**, it is possible to score higher than 100% on an exam. The lab course grade is based on a 500 point total and the lecture course grade is usually based on a 640 point total.

Grading scale: 90.0-100% = A,  
80.0-89.9% = B, 70.0-79.9% = C,  
60.0-69.9% = D, below 60.0% = F.

- No exam or quiz may be dropped. Makeup lecture or lab exams will only be available under extraordinary circumstances. ☆ ***If you miss an exam without prior arrangement or fail to schedule a makeup exam with me within one hour of the scheduled exam time, it is likely that you will not be eligible for a makeup exam and you will receive a zero for the missed exam.*** It may be impossible to make up a missed lab exam unless you have made prior arrangement. Ordinarily, a student will be granted no more than one makeup exam for the course. Ordinarily, there will be no make ups for a missed lecture or lab quiz.

If you need special consideration, please ask. An honor system is in effect for all exams and quizzes. This means zero tolerance of cheating or attempted cheating. You may neither receive nor give assistance on an examination or quiz. ☆ **In this course, you may not access or use old exams or quizzes in any form.** You may not use or possess notes on specific exam or quiz questions or answers (including [Moodle](#)). **The last day to review your previous lecture exams is the last day of class.**

## Grades and Evaluation in the Lecture Course:

There will be five lecture exams plus an objective, **comprehensive**, final lecture exam. Each exam counts 100 points. You are responsible for reviewing your graded exams and you will be expected to learn from any errors you make. In-class lecture quizzes (5-10 pts. each) *may be unannounced or given on very short notice* and will count a total of 40 points. (There may be additional Moodle or in-class quizzes for bonus points.) In-class quizzes may be given at either a lab or a lecture meeting.

Lecture exams are comprehensive, but specific topics emphasized on each exam are given. (Any necessary changes will be announced.) Each exam covers material from lecture, text, handouts, supplement, digital resources, and lab. See the lecture slides for details on exam format and coverage. Lecture exams include questions requiring detailed, specific written responses (5-20 points each) as well as short answer and objective questions. Exam questions often require well-labeled diagrams and always require *detailed* and *precise* responses employing the specialized terminology introduced in the course (lecture and lab). All questions on the 100 point comprehensive final lecture exam are objective. Satisfactory completion of a few [Moodle](#) assignments and/or ungraded assignments may also be required to pass the course.

## Grades and Evaluation in the Laboratory Course:

There will be five lab exams (100 points each). If there are any lab quizzes, their value will be added to the 500 lab course points. No lab exam or quiz may be dropped. Lab exams will be practical covering the identification of structures and their developmental origins. It may be impossible to make up a missed lab exam; there will be no make ups for missed lab quizzes.

<u>2011 Date</u>	<u>Lecture Topic</u>	<u>Text</u>	<u>Tuesday and Thursday Laboratory</u>
Aug 22 M	Embryology: Terms	1	
23 Tu	<i>Lab meets as scheduled.</i>		[1] Microscope use; Begin <i>Suppl. Ex. 1</i> ;
24 W	Embryology: Terms	1	Reprod. Anat.; <i>Digital images</i> Meiosis
25 Th			[2] <i>Suppl. Ex. 1 Grasshopper testis</i>
26 F	Embryology: History & Concepts	1	Reprod. Anat.; <i>Digital images</i> Meiosis
Aug 29 M	Embryology Terms and Concepts	1-2	[3] Spermatogenesis: <i>Suppl. Ex. 1</i>
30 Tu			<i>Grasshopper testis Digital images</i> Meiosis
31 W	Spermatogenesis	2	[4] Spermatogenesis: <i>Suppl. Ex. 2</i>
Sep 1 Th			<i>Frog, Rat, Human Digital images</i>
2 F	Oogenesis [ <b>Q1</b> ]	2	(Repr/Dev Worksheet due)
Sep 5 M	(Holiday)		
6 Tu			[5] Oogenesis: <i>Suppl. Ex. 3 Cat ovary</i>
7 W	Meiosis (Ch. 20: nondisjunction)	2, 20	(Anat Worksheet due) <i>Digital images</i>
8 Th			[6] Meiosis and Fertilization:
9 F	Reproductive Cycles [ <b>Q2</b> ]	2	<i>Suppl. Ex. 4 Ascaris Digital images</i>
Sep 12 M	<b>LECTURE EXAM 1</b> (Chs. 1-2 & 20 in part)		
13 Tu			[7] Cleavage: <i>Suppl. Ex. 5 Starfish</i> ;
14 W	Fertilization & Cleavage	2	<i>Schoenwolf manual Ch. 1 Urchin</i>
15 Th			[8] Frog: Early embryo. <i>Schoenwolf Ch. 3,</i>
16 F	Blastulation & Gastrulation	3	<i>A-G, I-K. [Live &amp; preserved embryos]</i>
Sep 19 M	Gastrulation	3-4	
20 Tu			[9] Frog: Early embryo
21 W	Gastrulation & Germ Layers	3-4	<i>Schoenwolf Ch. 3, A-G, I-K.</i>
22 Th			[10] <b>LAB EXAM 1</b> (Comprehensive to date)
23 F	Germ Layer Formation	3-5	
Sep 26 M	Implantation [ <b>Q3</b> ]	3-7	
27 Tu			[11] Frog: 4 mm., serial c.s., rep.
28 W	Fetal Membranes, Placenta	7	sag. sec. <i>Schoenwolf Ch. 3, H-K.</i>
29 Th			[12] Frog: 4 mm., serial c.s.
30 F	Review of Chs. 3, 4, 5, and 7 [ <b>Q4</b> ]		[Continue live frog embryos]
Oct 3 M	Nervous System	17	
4 Tu			[13] Frog: 4 mm., serial c.s.
5 W	<b>LECTURE EXAM 2</b> (Chs. 2-7, 17-in part,		
6 Th	reading assignments)		[14] <b>LAB EXAM 2</b> (4 mm and live frog)
7 F	Nervous System	17	
Oct 10 M	Nervous System	17	
11 Tu			[15] Chick: 33-hr. w.m. <i>Schoenwolf</i>
12 W	Nervous System	17	<i>Ch. 4 A-D, H-P.</i>
13 Th			[16] Chick: 33-hr. c.s., 18 & 24-hr.
14 F	Nervous System	17	w.m. <i>Schoenwolf Ch. 4 A-P.</i>

**Fall 2011 Embryology Lecture and Lab Schedule**

<u>2011 Date</u>	<u>Lecture Topic</u>	<u>Text</u>	<u>Tuesday and Thursday Laboratory</u>
Oct 17–21	(Fall Break)		(Fall Break)
Oct 24 M	Nervous System	17	
25 Tu			[17] Chick: 24-hr. w.m., 24-hr. c.s.
26 W	Nervous System [Q5]	17	<i>Schoenwolf Lab manual Ch. 4 A-P.</i>
27 Th			[18] <b>LAB EXAM 3</b> (Early chick devel.)
28 F	Nervous System	17	
Oct 31 M	N.S. & Sense Organs: Eye [Q6]	17-18	
Nov 1 Tu			[19] 48-hr Chick. <u>Live embryos</u> <i>Schoenwolf Ch. 7 Ex4.2, 4.3, and 4.8.</i>
2 W	Sense Organs: Eye	18	
3 Th			[20] 48-hr. Chick <i>Schoenwolf Ch. 4 Q-R.</i>
4 F	<b>LECTURE EXAM 3</b> (Chs. 17 and 18-in part)		
Nov 7 M	Sense Organs: Ear	18	
8 Tu			[21] 48-hr. Chick <i>Schoenwolf Ch. 4 Q-R.</i>
9 W	Integumentary System	19	
10 Th			[22] 48-hr. Chick <i>Schoenwolf Ch. 4 Q-R.</i>
11 F	Cardiovascular System	13	
Nov 14 M	Cardiovascular System	13	
15 Tu			[23] <b>LAB EXAM 4</b> (Live & 48-hr. chick)
16 W	Cardiovascular System [Q7]	13	
17 Th			[24] Pig, 10 mm., dissection, w.m., sag. sec.; <i>Schoenwolf Ch. 6 A-E</i>
18 F	Cardiovascular System	13	
Nov 21 M	Digestive System	11	
22 Tu			[25] Pig, 10 mm. <i>Schoenwolf Ch. 6</i>
23 W	<b>LECTURE EXAM 4</b> (Chs. 18, 19, and 13)		
24 Th			(Holiday)
25 F	(Holiday)		
Nov 28 M	Digestive System	11	
29 Tu			[26] Pig, 10 mm. <i>Schoenwolf Ch. 6</i>
30 W	Respiratory System	10	
Dec 1 Th			[27] Pig, 10 mm. <i>Schoenwolf Ch. 6</i>
2 F	Coelom and Mesenteries	8	
Dec 5 M	Pharyngeal Apparatus	9	
6 Tu			[28] Pig, 10 mm. <i>Schoenwolf Ch. 6</i>
7 W	Urogenital System	12	
8 Th			[29] Pig, 10 mm. <i>Schoenwolf Ch. 6</i>
9 F	<b>LECTURE EXAM 5</b> (Chs. 11, 10, 8, 9, and 12)		
Dec 12–16	<b>FINAL LECTURE EXAM</b> (100 points)		<b>LAB EXAM 5</b> (10 mm. & dissected pig)

- Note:**
- ✓ You must take exams and quizzes in the section for which you are enrolled.
  - ✓ Exam dates will be as scheduled unless a change is announced and the majority of the class agrees.
  - ✓ Quiz dates are approximate. Lecture and Lab Quizzes may be unannounced.
  - ✓ Minor changes in the scheduling of topics may be announced during the semester.

**Keep a Record of Your Exam and Quiz Scores:**

Lecture Exam 1 \_\_\_\_\_/100  
 Lecture Exam 2 \_\_\_\_\_/100  
 Lecture Exam 3 \_\_\_\_\_/100  
 Lecture Exam 4 \_\_\_\_\_/100  
 Lecture Exam 5 \_\_\_\_\_/100  
 Lecture Final \_\_\_\_\_/100

Lab Exam 1 \_\_\_\_\_/100  
 Lab Exam 2 \_\_\_\_\_/100  
 Lab Exam 3 \_\_\_\_\_/100  
 Lab Exam 4 \_\_\_\_\_/100  
 Lab Exam 5 \_\_\_\_\_/100  
**Lab Avg.** = Points Scored/Total  
 Lab Total = 500 points.

**In-class Lecture Quizzes** (5-10 points each)

Points Scored / Total	Points Scored / Total
Lect. Q#1 _____ / _____	Lect. Q#5 _____ / _____
Lect. Q#2 _____ / _____	Lect. Q#6 _____ / _____
Lect. Q#3 _____ / _____	Lect. Q#7 _____ / _____
Lect. Q#4 _____ / _____	Lect. Q#8 _____ / _____

**Moodle Bonus Quizzes**

*Max 5 bonus points each*  
 Unit 1 \_\_\_\_\_  
 Unit 2 \_\_\_\_\_  
 Unit 3 \_\_\_\_\_  
 Unit 4 \_\_\_\_\_  
 Unit 5 \_\_\_\_\_

**Lect Avg.** = Points Scored/Total (*total does not include bonus points*)  
 Lecture Total = 600 points plus in-class quizzes (Total = 640 points).  
 Note: Moodle Quiz scores are added to your earned lecture points.

**SUMMARY OF HUMAN PRENATAL DEVELOPMENT**

First Week

1. The fertilized ovum undergoes a series of cell divisions to give rise to a solid cluster of cells known as the morula.
2. The morula is transformed into a hollow ball of cells called the blastocyst containing a fluid filled cavity, the blastocoel. It is in the form of a blastocyst that the conceptus reaches the uterine cavity on about day 4 or 5 following ovulation.
3. Sometime during day 6, the "shell" of the blastocyst, the trophoblast, touches and adheres to the inner lining layer of the uterus, the endometrium. With this, implantation begins.

Second Week

1. By the end of the week, the conceptus is covered by simple, unbranched primary and secondary villi, and the chorion is developing.
2. The walls of the amnion are forming.
3. The amnion and chorion become separated by cells which form the body stalk.
4. Cells in the chorion begin to differentiate to form primitive blood vessels and blood cells.

Third Week

1. The mother experiences her first missed period, a certain tenderness and/or tingling sensation in the breasts, more frequent urination, perhaps constipation.
2. There is an increase in concentration of chorionic gonadotropin in the serum and urine with reaction to "pregnancy tests" becoming positive by the end of the week.
3. The allantois begins forming. This structure will later give rise to the umbilical arteries and veins.
4. The notochord, the precursor of the backbone, forms during this time.
5. The first intra-embryonic blood vessels appear, and there is definite indication of heart development.