**Embryology and Fetal Development**

Study Group Module

**Learning Objectives:**

Review the following Learning Objectives as an organized beginning to your study of this module. As you read the Learning Objectives, note key words that will aid you in finding the information in the texts. When you complete the module, revisit this list and check for areas that require further investigation.

• Review the mechanisms of conception.

• Identify the difference between gestational age and dating from LMP.

• Identify the Carnegie Stages of Development

• Discuss the real-life considerations regarding habit, nutrition, and lifestyle that can impact a developing embryo.

• Identify the rapidly changing occurrences in cell division and development from conception to the beginning of the embryonic period.

• Identify the embryonic and fetal periods.

• Identify the process of twinning.

• Identify the changes seen in early cell specialization through the formation of the ectoderm, mesoderm and endoderm germ layers.

• Identify the early formation and development of the neural tube, chorionic villi, endocrine and renal systems.

• Understand embryonic/fetal circulation and development.

• Understand embryonic/fetal liver development.

• Identify the growth and development of the embryonic skeletal structure.

• Identify the major changes during the fetal development period, including major organ systems growth and development.

• Identify the role of X and Y-chromosomes and the SRY gene.

• Identify the approximate size of the developing fetus during the passing weeks of gestation.

• Review the maturation of fetal lungs.

• Identify the fetal brain development that occurs between 35 and 40 weeks.

• Understand the timing of exposure to teratogens and the potential effects on a developing embryo and fetus.

• Identify the rate of birth defects in the US.

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Study Group Module: Embryology and Fetal Development

• Identify the role of folate, a water-soluble B vitamin, and its relationship to folic acid, in reducing congenital defects.

• Identify various teratogens and the harm they are known to cause.

• Define fetotoxin.

• Identify the impact of serious birth defects on global health.

• Identify the current FDA drug and biological products labeling regulations that replaces the decades-long use of “pregnancy letter categories” – A, B, C, D and X

• Review the available methods of prenatal screening of the growing embryo/fetus.

• Identify recent global rates of congenital anomalies, causes and prevention, long-term impact and estimated death rate.

• Consider how and when to present information about embryology and fetal development to your clients.

• Define the term abortion.

• Identify various methods of pregnancy termination specific to gestational age.

• Identify issues that may arise during pregnancy that contribute to decisions regarding continuing or terminating a pregnancy.

• Identify resources that can support and inform a client who is deciding about continuing or terminating a pregnancy.

• Review Stillbirth and Miscarriage module.

• Review Ectopic Pregnancy module.

**Study Sources**

The following texts are recommended for completion of this module. Use them to cross reference and build a more comprehensive understanding.

Using key words from the Learning Objectives, search the index. Read those pages listed, and read the chapter in which they are found. Establish a context for the information so that you understand how other topics are related. In addition, read the chapter headings in the Table of Contents, and flip through each text to familiarize yourself with the content of chapters. As you work through Study Group modules, you will eventually read each text in its entirety.

 • Human Anatomy and Physiology, Marieb

 • Holistic Midwifery, Vol. I, Frye

 • Varney’s Midwifery

 • Myles Textbook for Midwives

 • The Natural Pregnancy Book, Romm

 • Contraceptive Technology, Hatcher, Trussell, Nelson, Cates, Kowal and Policar

 • **See NMI website Suturing module web resources for additional information and up-to-date sources**

Study Group Module: Embryology and Fetal Development

**Related Topics**

 • Fertility and conception

 • Fetal/newborn circulation

 • Genetics

 • Meconium

 • Placenta

 • Ectopic Pregnancy

 • Prenatal testing

 • Stillbirth and Miscarriage

 • Birth defects

 • Substance Use

For historical reference, from the Physician’s Desk Reference:

**PREVIOUS TO 2016** FDA Use-in-pregnancy ratings:

**A: Controlled studies showed no risk;** adequate, well-controlled studies in pregnant women have failed to demonstrate risk to the fetus.

**B: No evidence of risk in humans;** either animal findings show risk, but human findings do not; or, if no adequate human studies have been done, animal findings are negative.

**C: Risk cannot be ruled out;** human studies are lacking, and animal studies are either positive for fetal risk, or lacking as well. However, potential benefits may justify the potential risk.

**D: Positive evidence of risk;** Investigational or post-marketing data show risk to the fetus. Never-the less, potential benefits may outweigh the potential risk.

**X: Contraindicated in pregnancy;** studies in animals or humans, or investigational or post-marketing reports have shown fetal risk which clearly outweighs any possible benefit to the patient.

THE A-B-C-D-X SYSTEM IS CURRENTLY BEING REPLACED. See online sources listed on FDA sites, links are provided in Online Resources for this module on NMI Website.

Study Group Module: Embryology and Fetal Development

**Short Answer Questions**

1. What is the difference between gestational age (or conceptual age) and dating from LMP (or menstrual age)?

2. Which “age” terminology is usually applied in discussions of embryology and fetal development?

3. What is the rate of unintended pregnancy in the US?

4. What is the rate of birth defects in the United States?

5. What is folate?

a. How is folate related to folic acid?

6. What foods provide folic acid?

7. Where is hCG produced?

8. Name the types of twinning and the incidence of each.

9. At what point do twins form?

10. What developmental stages occur prior to the formation of the blastocyst?

11. What becomes of the inner cell mass in the blastocyst?

12. Where does the amnion originate?

13. What does the trophoblast become?

a. When does this change in the trophoblast occur?

14. What is the embryonic disk?

15. At what point do the germ layers begin to specialize?

16. The germ layers have formed to create an embryo.

a. In what stage of development is the embryo now?

b. How long will this stage last?

17. When does the yolk sac form?

 a. What is the function of the yolk sac?

18. Describe the allantois.

 a. When does the allantois form?

 b. What does the allantois become?

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Study Group Module: Embryology and Fetal Development

19. When does the chorionic villi form?

20. When do arm and leg buds form?

21. When do the sex organs begin to differentiate themselves visually between male and female?

22. What is the SRY gene?

23. Where does amniotic fluid come from?

24. By \_\_\_\_ weeks (from lmp) all organ systems are identifiable.

25. At what point are the fetal kidneys beginning to function?

26. When does the embryo become a fetus?

a. How large is the embryo at the time that we shift vocabulary to “fetus”?

27. What is beginning to happen to the skeletal structure by the end of the embryonic period?

28. Are digestive juices present prior to birth?

29. What is the main barrier to survival of premature babies?

30. What is the current clinical standard for attempting resuscitation of a premature infant?

31. In clinical terminology, what does the word abortion mean?

32. Define fetotoxin, fetotoxicity.

33. Define teratogen.

**Questions Requiring Longer, Thoughtful Answers & Explanations:**

1. What is the history of the Carnegie Stages of Development?

2. What opportunities do you have in your practice to discuss embryology and fetal development?

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Study Group Module: Embryology and Fetal Development

3. What resources do you use to help clients understand embryology and fetal development?

4. If a pregnancy is unplanned, unintended, and goes undetected for 6 or 8 weeks, what are the real-life considerations regarding habit, nutrition, and lifestyle that can impact a developing embryo?

5. What is the teratogen risk in the first two weeks after conception?

6. List the conditions indicated by the CHEAP TORCHES acronym.

a. Which infections on the CHEAP TORCHES list are sexually transmitted?

b. Which effect do all of the infections on the CHEAP TORCHES list have in common?

7. List five viral teratogens.

8. List five environmental teratogens.

9. List five consumable substances that are teratogens. You may include drugs in this list.

10. When is the baby most sensitive and at greatest risk to damage from teratogens?

11. How long is the central nervous system susceptible to congenital anomalies?

12. What does folic acid provide during pregnancy?

13. What conditions are related to lack of folate in the mother’s diet?

a. What are the recommended levels of folate/folic acid supplementation in preparation for pregnancy?

b. In relation to pregnancy, what is the recommended time frame for supplementation of folic acid?

14. How can we determine which type of twinning has occurred?

15. Consider the role of the bag of waters during pregnancy. What do the amnion, chorion, and amniotic fluid provide for the developing baby?

16. What do each of the germ layers eventually form:

a. Endoderm

b. Mesoderm

c. Ectoderm

17. Describe the notochord.

18. What are somites, and when and where are they found?

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Study Group Module: Embryology and Fetal Development

19. What are the major events of neurulation?

20. What is organogenesis?

21. Describe how the endoderm forms the mucosal lining of the GI tract.

22. What do the chorionic villi become?

23. Consider the risks associated with an ectopic pregnancy. How large is the embryo/fetus by the time most ectopic pregnancies are symptomatic?

24. What is happening to the intestines during the seventh week (from conception)?

25. What is the role of the Y chromosome in determining the sex of the developing fetus?

26. What is testis-determining factor (TDF)?

27. What effect does the sex-determining region Y (SRY) gene contribute to fetal development?

28. Describe the fetus at 12 weeks.

29. Describe the functional differences between HbF and HbA.

30. Although the lungs are fully formed, what must they produce before the baby can effectively breathe?

31. What is lanugo?

a. When does lanugo form?

32. What is vernix?

a. When does vernix begin to form?

33. The medical trend of early elective induction of labor has now been shown to be a problem, and ACOG has issued information to curb this decision-making by physicians and patients. March of Dimes created a campaign to urge parents to be patient and allow babies’ brains to finish their gestational growth. Describe the difference between a baby’s brain at 35 weeks gestation and later at 40 weeks gestation.

34. According to March of Dimes, what is the global impact of serious birth defects?

35. Why might a person consider termination of a pregnancy?

36. What are the information resources available in your community and online that could support a person who faces a decision about continuing or terminating a pregnancy?

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Study Group Module: Embryology and Fetal Development

37. What resources are available for emotional and psychological support for a person facing a decision about continuing or terminating a pregnancy?

38. Describe the options currently available for terminating a pregnancy.

**Skills Review:**

Following are excerpts from the NMI forms for assessment of midwifery skills, which include all skills identified and required by NARM. Review the following skills and consider how they each relate to the content of this module. If you are currently working with a preceptor, take this opportunity to focus on these areas. During Supervised Primary Care you will formally evaluate these skills together using the NMI form Preceptor Evaluation/Student Self-Assessment of Midwifery Skills.

1. Midwifery Counseling, Education and Communication:

J. Provides education, counseling and/or referral, where appropriate for:

9. Environmental risk factors

3. Maternal Health Assessment:

C. Estimates due date based upon:

4. Changes in mucus condition or ovulation history

5. Date of positive pregnancy test

6. Date of implantation bleeding/cramping/pelvic congestion

7. Changes in the cervix

8. Changes in the uterus

9. Auscultation of the fetal heart

10. Date mother reported quickening

11. Measurement of fundal height

12. Palpation of body parts

113. Calendar date of conception or unprotected intercourse

K. Recognizes and responds to potential prenatal complications by

11. Identifying and referring tubal (ectopic) pregnancy

**Study Group Module Evaluation Sheet**

We’d like to know what you think of the course work we ask you to complete. Please comment on as many modules as you can, and return this form to NMI.

Thank you!

Name of Module: Embryology and Fetal Development

Your Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. What did you like about this module?

2. Were there any surprises for you in this module?

3. Was there anything in this module that was particularly challenging for you?

4. What will completing this module bring to your midwifery practice?

5. Do you feel you met this module’s states learning objectives?

6. Did the learning activities enable you to meet the learning objectives?

7. Were the suggested learning resources (books and materials) adequate to meet the learning objectives?

8. Did you utilize additional resources?

9. Any comments/Suggestions for improving this module?

Thank you!