Fetal Programming In Embryology Development
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Pre – Instructions

Chapter twenty four in Marieb and Hoen covers Nutrition, and Chapter Twenty eight covers Pregnancy and Human Development. Please read these chapters before advancing to the assigned website. Chapter 28 provide a detailed introduction to Embryology. Please follow the objectives from Chapter 28 to assist in understanding Fetal Programming and Development. The following table provides objectives for each section of Chapter twenty eight in Marieb. The website is provided for you. The Chapters in Pregnancy and Human Development be helpful Tools;

Objectives: This Table is found on:

From Egg to Zygote (1114-1117)
- Art Labeling: The Placenta and Associated Structures (fig. 28.7, p. 1121)
- Activity: Embryonic Membranes and the Placenta
- Memory: Embryonic Development
- Web Link: Fertilization

Events of Embryonic Development: Zygote to Blastocyst Implantation (1117-1122)
- Case Study: Genetics/Pregnancy and Human Development
- Web Link: Blastocyst Implantation

Events of Embryonic Development: Gastrula to Fetus (1122-1132)
- Web Link: Visible Embryo

Events of Fetal Development (1133)
- Case Study: Congenital Defect
- Web Link: Fetal Development: The First Trimester

Effects of Pregnancy on the Mother (1133-1135)
- Web Link: Signs and Symptoms of Pregnancy
- Web Link: High Blood Pressure in Pregnancy

Parturition (Birth) (1135-1137)
- Activity: Oxytocin and Labor Contractions
- Web Link: Positive Feedback Mechanisms during Childbirth

Adjustments of the Infant to Extrauterine Life (1137-1138)
- Web Link: Current Research on Child Development
Abstract

David Barker at Southampton originated the term, **fetal programming**, to describe his findings from epidemiological studies that linked health problems in middle-aged adults with low birth weight. In studying their medical problems, Dr. Barker found that heart disease and diabetes were more common among people who were born with lower birth weights. He suggested that deprivation prenatally, due to poor nutrition, alcohol and drug use, and other factors, like poverty, caused changes in the fetus and the way its organs developed. These changes, later in life led to a higher risk of certain kinds of disease. (Cole, 2010).

There are several advances in Nutritional Sciences which document the important linked between maternal and nutrition and fetal development. According to Wu (2004) Fetal Programming describes that the alterations in fetal nutrition and endocrine status may result in modified developmental adaptation change the structure, physiology and metabolism of the offspring. Fetal programming is the process through which variation in the quality or quantity of nutrients consumed during pregnancy exerts permanent effects upon the developing fetus (Langley-Evans, 2009). The goal of this project assess Anatomy and Physiology critical thinking using technology, scientific journals and group participation.
After completing this exercise: Undergraduate Students who have Completed Anatomy and Physiology should be able to:

1) **Assess how maternal nutrition affects embryonic development**
2) **Identify important stages in embryogenesis**
3) **Communicate embryology pathways on black board discussion**
4) **Understand scientific papers which discuss Nutritional Programming**

**Audience:**

This Project Is Intended for Undergraduate College Students Who have completed Anatomy and Physiology One.

**Time Line:**

Group discussion (website) for this activity will include One Week Mon, Tues, Wed and Thurs. Students will discuss the papers on discussion Board, and Thurs. The following week (Mon thru Fri) will continue with Discussion on Blackboard (Mon & Tues) from the Journal papers and in class presentation on Thurs.

Time Line for Completion of Project: This Undergraduate Project is a learning exercise to assess Critical Thinking and development; The entire Project should be completed in two weeks, with a summary of the journal and presentation handed in for each group by the weekend.
There are Three Phases to this Learning project: The first phase will consist of the discussions on Blackboard after visiting the website the second phase will include discussion on Black Board to reflect on Fetal Programming Journals, the Third Phase will include Classroom Presentations, which reflect the journals discussed on blackboard by each group. In order to Receive full credit of this learning experience. All students must be actively engaged in all Phases of this Project to receive full credit. Evaluation will be based on a 30% for each Phase (Discussion from Website, the Discussions from Journal papers and, Presentations). The remaining points will be from the final synopsis reports turned in at the completion of the presentation. The Final reports should be no more than 3 paragraphs, and provide a synopsis of the relevance in Fetal Programming, Nutrition and Embryology. (1 report turned in for each group)

PHASE 1 of PROJECT:
ALL STUDENTS : Must visit this website to participate in three interactive discussions of Fetal Programming

http://www.bioscience.org/atlas/fert.htm/develhum/fetdev.htm

Students must keep in mind the following questions on the web site to add to the discussion board
1) What is Fetal Programming and why is it important?
2) Are there any Ethics involved with Fetal Programming
3) What Examples of embryology development and nutrition intervention are provided in the website
**PHASE 2 of Project**

There will be 5 groups in which each group will: **have Seven Students per group**

*Instructions for Blackboard Assignment:*

Each Group will Assess by Discussion on Blackboard how specific Nutrition Elements Iron, Sulfur, Vitamin B12, Folic acid, Vitamin A, Vitamin E, and Zinc play a role in Embryonic Development

**KEEP IN MIND:**

The purpose of this project is to identify fetal programming during Embryology development.

**Five scientific papers are presented on the discussion board**

1. Biological Mechanisms that might Underlie Iron Effects of Fetal Growth and Preterm Birth, Allen, Lindsay (2001), University of California

2. Sulfur Amino Acid Metabolism in Pregnancy, the Impact of Motioning in the Maternal Diet, William D. Rees, Fiona A. Wilson, and Christopher A. Maloney, The Rowett Research Institute, Bucksburn

3. Regulation of Fetal Growth by the Somatotropic Axis: Endogenous thyroid hormones modulate pituitary somatotroph differentiation during chicken embryonic development L Liu1 and T E Porter1, 2 (2004)1Department of Animal and Avian Sciences, University of Maryland, College Park, Maryland 20742, USA


**Black Board Discussion Assignment**
Each assigned group will pose dialogues on the discussion board which address the impact of maternal nutrition on embryology development.

The scientific papers are posted under the Course Documents in Blackboard. Once each group has posted a detailed response to their assigned paper, each group will present an in-class demonstration on embryology development stages.

There are Five Groups and Five Assigned Papers. Each Group of seven will:

Read the paper assigned in their group. Once each group has completed reading the paper assigned in their group, each group will begin discussion on Blackboard, which provides synopsis of each paper. Students must participate in this discussion.

For each of the following with corresponding papers:

Group 1: Iron Effects of Fetal Growth: Embryogenesis
Group 2: Sulfur Amino Acid Metabolism in Pregnancy: Gestational Stage
Group 3: Regulation of Fetal Growth by the Somatrophic Axis: 16 weeks Gestation
Group 4: Maternal Nutrition and Fetal Development: Events of Fetal Development
Group 5: Modest thyroid hormone insufficiency during development induces a cellular malformation in the corpus callosum: a model of cortical dysplasia

**PHASE 3 of Assignment:**

In Class Presentation: Questions to be addressed during Presentation

After the discussion Board Assignment, Students are required to do a presentation for 3 minutes. The presentation can include Power Point, Poster Board, or White Board. Each group must address the questions directly related to their paper assigned.

Instructions for Presentations

The Presentation should address the Embryology development and also Fetal programming during the process: Powerpoint, Transparency, U-Tube, Board, White Board, Poster Board are all acceptable visual aids. This is a demonstration so please no direct reading from sheets of paper.
**Group 1: Please Read the Paper “Iron Effects of Fetal Growth”**
As a group summarize the important features in the paper and answer the following questions in class during the presentation:
1) What are the stages of Embryogenesis?
2) What role does iron play in this pathway?

**Group 2: Please Read the Paper “Sulfur Amino Acid Metabolism in Pregnancy:”**
As a group, summarize the important features in the paper and answer the following question in class during the presentation:
1) What is Protein Turnover?
2) What effect does Sulfur have on this development?
3) What effect does Sulfur and methionine have on fetal development? Explain the mechanism.

**Group 3: Please Read the Paper “Regulation of Fetal Growth by the Somatrophic Axis”**, as a group, summarize the important features in the paper and answer the following in class during the presentation:
1) What is significant during the sixteenth week of development of the fetus?
2) What vitamins are important to be critical for up regulation of insulin sensitivity?
3) How can IUGR (Intrauterine Growth Restriction) related to this stage of development? What nutrient may be important for preventing IUGR? Intrauterine Growth restriction can be defined as the a fetus whose estimated weight is below the 10th percentile for its gestational age and whose abdominal circumference is below the 2.5th percentile.
**Group 4:** Please read the paper “Maternal Nutrition and Fetal Development: As group, Summarize the important features in the paper and answer the following in class during the presentation

1) What are significant stages of fetal development that can impact Intrauterine Growth Factor?

(How does fetal development impact other developing organs?)

2) Discuss some important components of maternal nutrition which can effect fetus growth and placenta development.

**Group 5:** Please read the paper “Modest thyroid hormone insufficiency during development induces a cellular malformation in the corpus callosum: a model of cortical dysplasia. As a group, summarize the important features in the paper, and answer the following questions in class during presentation

1) Discuss how subtle decreases in maternal thyroid hormone during gestation can impact fetal brain development.
Bio Synthesis Folate Acid Synthesis

Research over the last 20 years has suggested a relationship between maternal diet and the health of an affected infant, and recent evidence has confirmed that folic acid, a water soluble vitamin, found in many fruits (particularly oranges, berries and bananas), leafy green vegetables, cereals and legumes, may prevent the majority of neural tube defects (Mark Hill 2010)

2) Methionine and folic acid cycles.

the balance of methionine relative to other amino acids in the maternal diet is critical, as fetal growth is not only retarded by diets that are deficient but also by those containing excess. Diets with an inappropriate balance of methionine can adversely affect both short-term reproductive function and the long-term physiology of the offspring

3) Iron Storage: The embryonic period in humans begins at fertilization (12-24hrs after ovulation, generally between the 2nd and 3rd week of gestational age) and continues until the end of the 10th week of gestation (8th week by embryonic age). The fetus begins storing iron, calcium, and phosphorus.

4) Fetal Growth: Macronutrient balance can affect fetal growth; it is documented that patterns of fetal growth in early and late pregnancy may be linked to the maternal intake of carbohydrates and low dairy intake (Godfrey, 1996)

During prenatal growth and development, periods of rapid cell division occur at different times in the various tissue of the body. The Nutrient and hormones may effect development, and alter expression of genes.
5) Maternal Nutrition and Fetal Development: Events of Fetal Development

The first trimester of pregnancy is the time during which organogenesis takes place and tissue patterns and organ systems are established. In the second trimester the fetus undergoes major cellular adaptation and an increase in body size, and in the third trimester organ systems mature ready for extrauterine life. In addition, during that very last period of intrauterine life there is a significant increase in body weight. In contrast to the postnatal endocrine control of growth, where the principal hormones directly influencing growth are growth hormone (GH) and the insulin-like growth factors (IGFs) via the GH–IGF axis, fetal growth throughout gestation is constrained by maternal factors and placental function and is coordinated by growth factors. In general, growth disorders only become apparent postnatally, but they may well be related to fetal life. Thus, fetal growth always needs to be considered in the overall picture of human growth as well as in its metabolic development (Mullis, 2008)
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Resources

Allen, Lindsay (2001) Biological Mechanisms That Might Underlie Irons Effects on Fetal Growth. Department of Nutrition, University of California


Coles, C(2010 ) What is fetal Programming Maternal Substance Abuse and Child Development Program Department of Psychiatry and Behavioral Sciences Emory University School of Medicine, Georgia.


Hill, Mark (2010) UNSW Embryology Endocrine Development


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Reese, W Sulfur Amino Acid Metabolism in Pregnancy: Gestational Stage