Survey of Embryonic Development

**Developmental Stages of Sea Urchins and Humans**

1. **Define zygote.** *Fertilized egg.*

2. **Describe how you were able to tell by observation when a sea urchin egg was fertilized.** *A fertilization membrane is present beneath the outer jelly coat.*

3. **Use the key choices to identify the embryonic stage or process described below.**

   Key:  
   - a. cleavage  
   - b. morula  
   - c. zygote  
   - d. fertilization  
   - e. blastula  
   - f. gastrulation

   **d** 1. fusion of male and female pronuclei  
   **b** 2. solid ball of embryonic cells  
   **a** 3. process of rapid mitotic cell division without intervening growth periods  
   **c** 4. combination of egg and sperm  
   **f** 5. process involving cell rearrangements to form the three primary germ layers  
   **e** 6. embryonic stage in which the embryo consists of a hollow ball of cells

4. **What is the importance of cleavage in embryonic development?** *It provides a large number of smaller cells for morphogenesis.*

   How is cleavage different from mitotic cell division, which occurs later in life? *During cleavage there are no intervening growth periods between the successive divisions. Therefore the cells get smaller and smaller, but the embryonic mass remains essentially the same size.*

5. **The cells of the human blastula (blastocyst) have various fates. Which blastocyst structures have the following fates?**

   - **inner cell mass** 1. produces the embryonic body
   - **trophoblast** 2. becomes the chorion and cooperates with uterine tissues to form the placenta
   - **inner cell mass** 3. produces the amnion, yolk sac, and allantois
   - **yolk sac** 4. produces the primordial germ cells (an embryonic membrane)
   - **allantois** 5. an embryonic membrane that provides the structural basis for the body stalk or umbilical cord

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6. Using the letters on the diagram, correctly identify each of the following maternal or embryonic structures.

- j amnion
- g chorion
- b decidua basalis
- f endoderm
- i body stalk
- h chorionic villi
- a decidua capsularis
- e mesoderm
- d ectoderm
- c uterine cavity

7. Explain the importance of gastrulation. It involves the migration, movement, and rearrangement of embryonic cells, so that a three-layer embryo (three primary germ layers) is formed.

8. What is the function of the amnion and the amniotic fluid? The amnion is a protective, fluid-filled sac that surrounds the embryo. The fluid "buffer" protects the embryo from physical trauma and prevents adhesion formation.

9. Describe the process of implantation, noting the role of the trophoblast cells. The trophoblast cells overlying the inner cell mass adhere to the endometrium. The trophoblast cells then secrete enzymes that erode the endometrial lining to reach the vascular supply beneath it.

10. How many days after fertilization is implantation generally completed? ______ What event in the female menstrual cycle ordinarily occurs just about this time if implantation does not occur? Menses, because this is usually the 14th day after ovulation.
11. What name is given to the part of the uterine wall directly under the implanting embryo? \textit{Decidua basalis}

That surrounding the rest of the embryonic structure? \textit{Decidua capsularis}

12. Using an appropriate reference, find out what \textit{decidua} means and state the definition. \textit{That which “falls off” or is subject to periodic shedding.}

How is this terminology applicable to the deciduas of pregnancy? \textit{After birth they slough off and are flushed out of the uterus.}

13. Referring to the illustrations and text of \textit{A Colour Atlas of Life Before Birth: Normal Fetal Development}, answer the following:

Which two organ systems are extensively developed in the \textit{very young} embryo?

\begin{itemize}
  \item \textit{nervous system}
  \item \textit{circulatory system}
\end{itemize}

Describe the direction of development by circling the correct descriptions below:

\begin{itemize}
  \item proximal-distal
  \item distal-proximal
  \item caudal-rostral
  \item rostral-caudal
\end{itemize}

Does bodily control during infancy develop in the same directions? Think! Can an infant pick up a common pin (pincer grasp) or wave his arms earlier? Is arm-hand or leg-foot control achieved earlier?

\textit{Yes. Arm-hand control occurs before leg-foot control is achieved.}

14. Note whether each of the following organs or organ systems develops from the (a) ectoderm, (b) endoderm, or (c) mesoderm. Use an appropriate reference as necessary.

\begin{itemize}
  \item \textit{c} 1. skeletal muscle \textit{a} 4. respiratory mucosa \textit{b} 7. nervous system
  \item \textit{c} 2. skeleton \textit{c} 5. circulatory system \textit{c} 8. serosa membrane
  \item \textit{b} 3. lining of gut \textit{a} 6. epidermis of skin \textit{b} 9. liver, pancreas
\end{itemize}

\textbf{In Utero Development}

15. Make the following comparisons between a human and the pregnant dissected animal structures.

\begin{tabular}{|l|l|l|}
\hline
\textbf{Comparison object} & \textbf{Human} & \textbf{Dissected animal} \\
\hline
Shape of the placenta & Disc-shaped & (depends on animal) \\
Shape of the uterus & Pear-shaped & Y-shaped \\
\hline
\end{tabular}

16. Where in the human uterus do implantation and placentation ordinarily occur? \textit{High in the uterus.}

17. Describe the function(s) of the placenta. \textit{Provides nutrients and oxygen to the fetus, removes fetal wastes, and produces the hormones of pregnancy.}
What embryonic membranes has the placenta more or less “put out of business”? *Yolk sac and allantois.*

18. When does the human embryo come to be called a fetus? *Ninth week of development.*

19. What is the usual and most desirable fetal position in utero? *Head down.*

Why is this the most desirable position? *The largest fetal dimension is the skull. Therefore, if the skull is used as a wedge, the rest of the body is delivered easily. Also, if difficulties are encountered, the baby can be suctioned and given oxygen even before delivery is completed.*

**Gross and Microscopic Anatomy of the Placenta**

20. Describe fully the gross structure of the human placenta as observed in the laboratory. *Smooth on the side from which the umbilical cord issues. Torn, rough, and bloody on the side that was united with maternal tissues. Blood-rich.*

21. What is the tissue origin of the placenta: fetal, maternal, or both? *Both*

22. What are the placental barriers that must be crossed to exchange materials? *The membranes of the villi and capillary walls of the fetal vascular supply.*