

## Section 15.1: Review Answers

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1. Students should include three of the following:
  - release of an egg from an ovary
  - release of sperm into the female reproductive tract
  - a quantity of sperm must survive the acidic environment of the female reproductive tract
  - a quantity of sperm must be in the same oviduct as the egg
  - sperm must encounter the egg within 12-24 hours of its release
  - acrosome enzymes from the sperm must dissolve some of the jelly-like coating on the egg to allow a sperm to penetrate the egg
  - a sperm must enter the egg

2. A fertilized egg has 23 pairs of chromosomes (46) rather than the 23 that the sperm and egg carry. The fertilized egg has a much longer life span than the limited life of the sperm (measured in days) or the egg (measured in hours). The fertilized egg, now known as a zygote, can undergo mitotic divisions (cleavage) and grow and develop into a new organism.

3. During implantation, the blastocyst (a hollow structure with two types of cells inside) attaches to the endometrium by secreting enzymes from the trophoblast cells (outer layer) to digest some of the tissues and blood vessels. This allows for the nesting of the blastocyst within the endometrium.

4. zygote → morula → blastocyst → gastrula

The *zygote* is formed by the union of the sperm and egg within the oviduct. As cleavage occurs, more cells are formed. The *morula* is the resulting mass of 16 cells that enters the uterus. As it absorbs fluid from the uterus, two different groups of cells form and the structure becomes known as the *blastocyst*. After implantation, the cells in the blastocyst continue to develop and differentiate into three layers in a process known as gastrulation, and the result is known as the *gastrula*.

5. The three primary germ layers are:

- *ectoderm*: the outer layer; develops into structures such as the outer skin (epidermis), hair, nails, sweat glands, and mammary glands, as well as nerve tissue, pituitary gland, adrenal medulla, and tooth enamel.
- *mesoderm*: the middle layer; develops into the dermis of the skin, cellular lining of the blood vessels, lymphatic vessels, body cavities, muscle, connective tissue (bone, cartilage, blood), adrenal cortex, heart, kidneys and ureters, spleen, and internal reproductive organs.
- *endoderm*: the inner layer; develops into the cellular lining of the respiratory and digestive tracts, as well as the lining for the urinary bladder and urethra. It also develops most of the liver, gall bladder, pancreas, thymus, tonsils (partial), and the parathyroid and thyroid glands.

6. (a) hCG maintains the corpus luteum within the ovary so that the production of estrogen and progesterone will continue. This maintains the endometrium (to nourish the embryo/fetus) and prevents menstruation.

(b) hCG uses the circulatory system to travel; this would allow for detection within the blood. Excess hormones are filtered by the kidneys and excreted through the urine.

7. The table, concept map, or labelled diagram should show the following: the extra-embryonic membranes (amnion, yolk sac, allantois, chorion), the placenta, and the umbilical cord. (Students could use **BLM 15.5** to complete the diagram and their notes.)

- *amnion*: the sac that becomes fluid-filled to protect the embryo/fetus.

- *yolk sac*: contributes to the formation of the digestive tract and the first blood cells.
- *allantois*: develops to become the foundation of the umbilical cord and the bladder.
- *chorion*: this membrane encloses all the other extra-embryonic membranes and embryo. It will form the fetal portion of the placenta.
- *placenta*: a structure that allows nutrients and gases to diffuse from the mother's blood system to that of the embryo/fetus because they are so close together. It has nutritional, excretory, respiratory, endocrine, and immune functions.
- *umbilical cord*: two arteries transport wastes and oxygen-depleted blood from the fetus to the placenta and one vein brings oxygen-rich blood to the fetus.

8. (a) Trophoblastic nutrition reaches its peak at 3 weeks and ends at 12 weeks.  
 (b) Placental nutrition begins at 4 weeks.  
 (c) The shape indicates the gradual and continual increase in the nutrition provided to the developing fetus throughout the pregnancy.  
 (d) Trophoblastic and placental nutrition are about equal at 8 weeks.
9. Developing human embryos do not have a significant amount of yolk as part of their supporting tissues because they stay inside the mother's body and obtain their nutrition from her body via the placenta as the pregnancy progresses. Chick embryos must have their nutrition with them inside the egg because they develop outside the mother's body.

10.

Time Period	Place of Occurrence	Major Events
12 - 24 hours after ovulation oviduct	oviduct	■ fertilization (the formation of the zygote); sperm and egg nuclei fuse to form 23 pairs of chromosomes
within 30 hours after fertilization	oviduct	■ mitotic division (cleavage) begins
3-5 days after fertilization	uterus	■ morula enters the uterus; begins to fill with uterine fluid; blastocyst develops as two different groups of cells form
5th to 7th day	uterus	■ blastocyst attaches itself to the endometrium

Time Period	Place of Occurrence	Major Events
10th to 14th day	endometrium (in the uterus)	<ul style="list-style-type: none"> <li>■ implantation proceeds as blastocyst sinks into the uterine wall; trophoblast begins to secrete hCG</li> </ul>
second week	endometrium	<ul style="list-style-type: none"> <li>■ implantation completed; amniotic cavity forms and fills with fluid and the embryonic disks form (two layers)</li> </ul>
	endometrium	<ul style="list-style-type: none"> <li>■ gastrulation (formation of three primary germ layers: endoderm, mesoderm, ectoderm); blastocyst now known as a gastrula</li> <li>■ morphogenesis begins, forming distinct structures of the developing organism</li> </ul>
third week	uterus / endometrium	<ul style="list-style-type: none"> <li>■ neurulation occurs, marking the start of organ formation</li> <li>■ notochord forms; nervous system begins to develop; heart begins beating around day 18</li> </ul>
fourth week	uterus	<ul style="list-style-type: none"> <li>■ rapid growth and differentiation; blood cells and vessels are forming; buds for appendages appear; head is visible with hints of eyes, ears, nose</li> </ul>
fifth week	uterus	<ul style="list-style-type: none"> <li>■ eyes open; brain cells are differentiating</li> </ul>
sixth week	uterus	<ul style="list-style-type: none"> <li>■ brain development continues; limbs lengthen and flex; gonads begin to produce hormones to influence development of external genitalia</li> </ul>

Time Period	Place of Occurrence	Major Events
seventh and eighth weeks	uterus	<ul style="list-style-type: none"> <li>■ organs are formed; nervous system is coordinating body activities; skeleton is formed of cartilage; eyelids developed and cover eyes to protect them; external genitalia forming</li> </ul>
end of eight weeks	uterus	<ul style="list-style-type: none"> <li>■ embryo now considered to be a fetus, with 90 percent of its organs and structures developed; organism looks recognizably human</li> </ul>