What is Fertilization and Early Development?

Worksheet

Fertilization is the union of a haploid sperm and haploid egg to form a diploid zygote; the zygote then undergoes rapid mitotic divisions called cleavage, forming a solid morula and then a hollow blastocyst that implants in the uterus.

Questions

1. What structure results directly from the fusion of sperm and egg?

A) Blastocyst
B) Morula
C) Zygote
D) Trophoblast

2. What prevents more than one sperm from fertilizing an egg?

A) The acrosome reaction
B) The cortical reaction
C) Meiosis
D) Implantation

3. What are the two cell layers of a blastocyst?

A) Ectoderm and endoderm
B) Inner cell mass and trophoblast
C) Morula and zygote
D) Cortex and medulla

4. About how many days after fertilization does the human blastocyst implant?

A) Same day
B) 1-2 days
C) 6-7 days
D) 30 days

5. A zygote undergoes 3 rounds of cleavage with no growth between divisions. How many cells result?

6. Trace the timeline from fertilization to implantation in a human pregnancy.

7. An ejaculate contains about 200-300 million sperm, yet only one fertilizes the egg. How does the egg prevent more than one sperm from fusing?

8. Define: What is fertilization?

9. Define: What is cleavage?

10. Define: What is a blastocyst?

Answer Key

1. C) Zygote - Fertilization directly produces the diploid zygote; the morula and blastocyst form later through cleavage.

2. B) The cortical reaction - The cortical reaction hardens the zona pellucida immediately after the first sperm fuses, blocking polyspermy.

3. B) Inner cell mass and trophoblast - The blastocyst has an inner cell mass (becomes the embryo) and an outer trophoblast (becomes the placenta).

4. C) 6-7 days - After traveling and developing for about a week, the blastocyst implants into the endometrium around day 6-7.

5. Start: 1 cell (the zygote) Round 1: 1 2 cells Round 2: 2 4 cells Round 3: 4 8 cells After 3 cleavage divisions there are 2^3 = 8 cells, still within the original egg volume

6. Day 0: fertilization occurs in the ampulla of the fallopian tube Days 1-3: cleavage produces a morula (16-32 cells) while it travels toward the uterus Days 4-5: a fluid-filled cavity appears, forming the blastocyst (~100-200 cells) Days 6-7: the blastocyst implants into the endometrium

7. Most of the 200-300 million sperm are lost to the acidic vaginal environment and the cervix Only a few hundred reach the egg in the fallopian tube The first sperm to fuse triggers the cortical reaction This reaction hardens the zona pellucida within seconds, blocking any additional sperm (prevents polyspermy)

8. The fusion of a haploid sperm and haploid egg to form a diploid zygote.

9. Rapid mitotic cell divisions of the zygote that increase cell number without increasing overall size, producing a morula.

10. A hollow, fluid-filled ball of cells formed after cleavage, made of an inner cell mass (future embryo) and an outer trophoblast (future placenta).