

Equator University of Science and Technology

Anatomy Department

Course: General Histology and Embryology FHS 1102

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Tutorial (2)

Gametogenesis

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1. A primary spermatocyte contains 46 chromosomes and undergoes meiosis.

- a) How many chromosomes should each secondary spermatocyte contain?
- b) How many chromosomes should each mature sperm contain?
- c) How does meiosis ensure that the chromosome number is maintained after fertilization?

2. A primary oocyte completes meiosis I and produces a secondary oocyte and a first polar body.

- a) How many chromosomes should each cell contain?
- b) Are the chromosomes in the secondary oocyte still duplicated?
- c) Why does cytokinesis during oogenesis produce cells of unequal size?

3. A male has normal spermatogenesis, but during meiosis I, the homologous chromosomes of chromosome 18 fail to separate.

- a) What is this error called?
- b) What types of sperm could be produced after meiosis II?
- c) If an abnormal sperm fertilizes a normal ovum, what chromosomal abnormality could result?

4. During oogenesis, a primary oocyte undergoes meiosis I normally, but during meiosis II, the sister chromatids of chromosome 13 fail to separate.

- a) What is the name of this meiotic error?
- b) What chromosome number would be expected in the abnormal ovum?
- c) What chromosome number would be expected in the polar body produced from the affected division?

5. A sperm cell is found to contain 22 autosomes and two X chromosomes.

- a) Is this a normal sperm?
- b) During which meiotic division could this sperm have been produced?
- c) If this sperm fertilizes a normal ovum containing one X chromosome, what would be the chromosome complement of the zygote?

6. A sperm contains 22 autosomes and no sex chromosome.

- a) How could such a sperm arise during spermatogenesis?
- b) What type of meiotic error is most likely responsible?
- c) If this sperm fertilizes a normal ovum containing an X chromosome, what sex chromosome complement would the zygote have?

7. During prophase I of meiosis, homologous chromosomes pair and exchange segments of DNA.

- a) What is this process called?
- b) Between which chromosomes does it normally occur?
- c) What is the genetic significance of this process?

8. A primary spermatocyte undergoes meiosis and produces four sperm cells. However, all four sperm cells are genetically different from one another.

- a) Identify two major meiotic mechanisms responsible for this genetic variation.
- b) Explain how crossing over contributes to genetic variation.
- c) Why is genetic variation important in sexually reproducing organisms?

9. A secondary oocyte is arrested at metaphase II and is released from the ovary.

- a) At what stage of meiosis did the primary oocyte become a secondary oocyte?
- b) Has meiosis II been completed at the time of ovulation?
- c) What event normally triggers completion of meiosis II?

10. A couple has a child with 47 chromosomes, including an extra copy of chromosome 18.

- a) What chromosomal abnormality is present?
- b) What syndrome is associated with this abnormality?
- c) How could nondisjunction during gametogenesis produce this condition?