

Introduction

Gametogenesis in Humans

Gametogenesis is the formation of specialized sex cells, or **gametes**. There is generally a small, motile male gamete called a **sperm**, and a much larger, nonmotile female gamete called an **egg**.

Spermatogenesis in Males

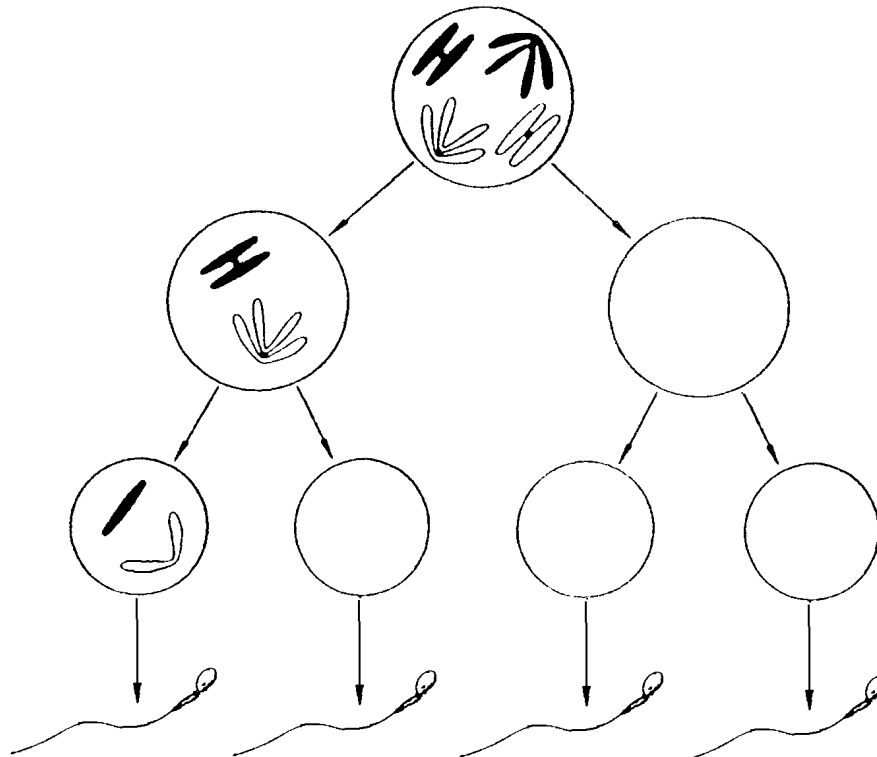
Spermatogenesis, the production of sperm, occurs in the male **gonads**, the **testes**. In some animals, sperm develop only during specific mating seasons. In others, including humans, sperm are produced all year long.

The sperm develop from unspecialized cells called **spermatogonia**. Spermatogenesis begins with the formation of **primary spermatocytes** from spermatogonia. The first meiotic division of the primary spermatocytes produces two **secondary spermatocytes**. The second meiotic division of the two secondary spermatocytes produces four **spermatids**. The spermatids develop into mature sperm sometimes called spermatozoa but there is no further cell division.

They consist of a head, which contains a **haploid** nucleus, and a flagellum, which serves as a means of locomotion. At the junction of the head and the flagellum is a collar containing many mitochondria. ATP produced in the mitochondria serves as a source of energy for the beating of the flagellum.

Procedure

- A. In the diagram below, label the following: primary spermatocyte, secondary spermatocyte, spermatids, and mature sperm. Fill in the missing chromosomes in the blank circles below, and indicate **where** and **when** the first and second meiotic divisions occur.

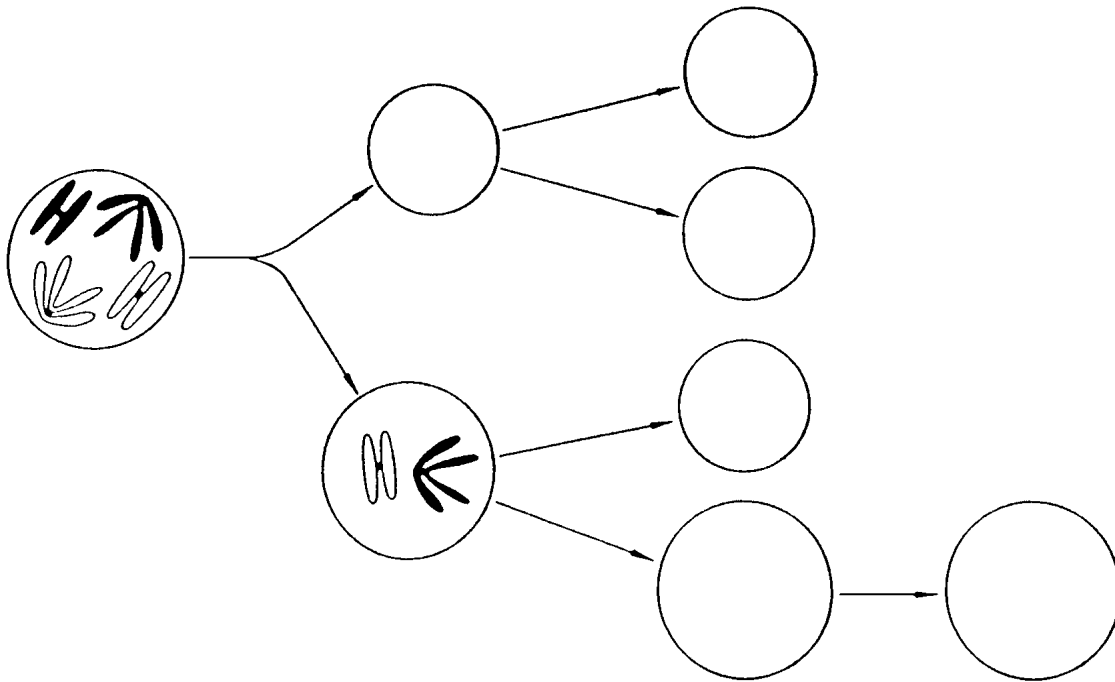


Oogenesis in Females

Oogenesis, the production of eggs, or ova, occurs in the female gonads, the **ovaries**. Mature eggs develop from **oogonia**, which enlarge to form **primary oocytes**. The primary oocyte undergoes the first meiotic division producing one **secondary oocyte** and one small cell called a **polar body**. The secondary oocyte undergoes the second meiotic division, producing one **ootid** and one polar body. The polar body from the first meiotic division may also divide, forming two more polar bodies. All polar bodies disintegrate. The ootid grows into a mature **ovum**. The ovum is a nonmotile cell that contains stored food in the cytoplasm. This food is sometimes referred to as **yolk**. It is the only food source for the developing embryo until its arrival at the **endometrium** of the **uterus**. Polar bodies do not have enough cytoplasm to develop into a viable embryo.

A female will begin the formation of eggs before she is born, approximately six months since her conception. However, she will arrest meiosis at **prophase I**, and all of her potential eggs will have to wait until she begins **puberty** and her first menstrual cycle begins. Each month, she will allow the continued development of a **follicle** in her ovaries. The primary oocyte, which is locked up at prophase I, will continue meiosis and divide into a secondary oocyte and one polar body. At this point the two cells will be released from the ovary in a process called **ovulation**. These cells have continued meiosis and once again become arrested. Each cell has stopped its development at metaphase II and will not finish meiosis unless a sperm has found the secondary oocyte and **fertilization** occurs. At that point, the secondary oocyte will finish dividing and become an egg and another polar body. This process usually takes place in the upper region of the **Fallopian tube**.

- B. In the diagram below, label the primary oocyte, the secondary oocyte, polar bodies, ootid, and mature ovum. Draw the missing chromosomes in the blank circles, and indicate where and when the first and second meiotic divisions occur.

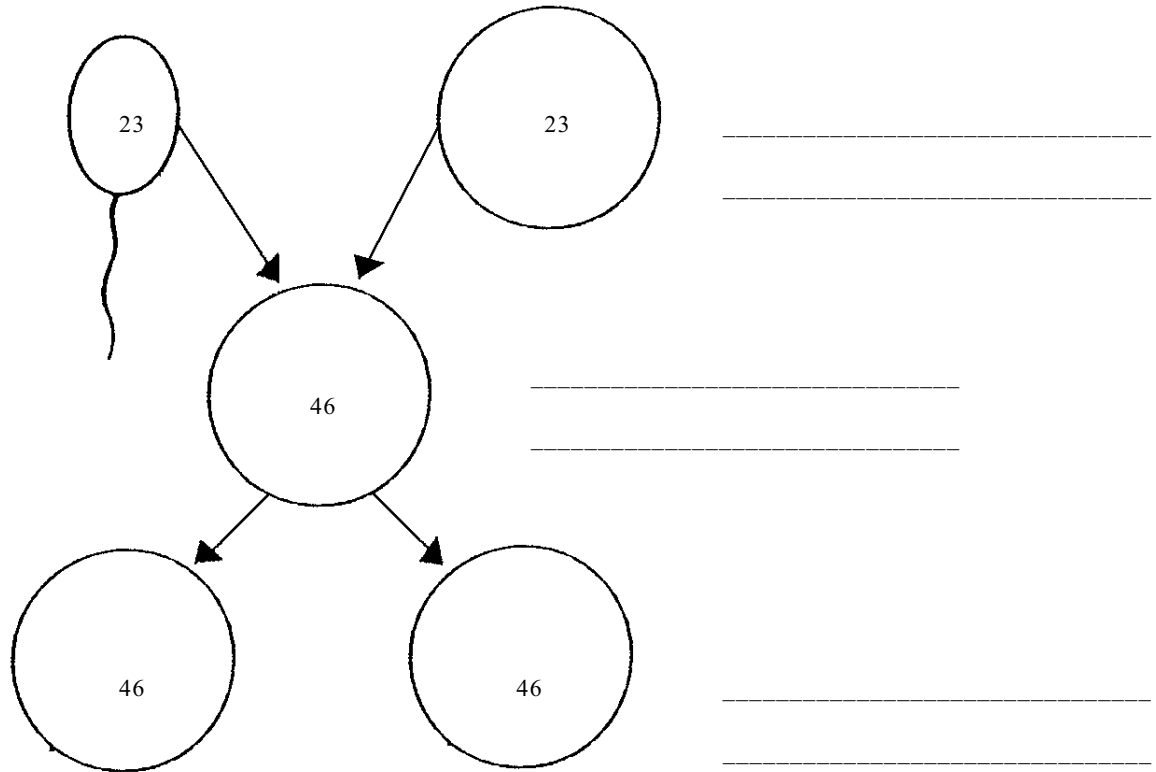


1. Eggs are produced by a type of gametogenesis called _____.
2. The ovum is larger than the polar bodies because it contains a greater amount of _____.

Fertilization in Females

Fertilization is the union of two gametes. In humans, the gametes are of different sizes and shapes, therefore they are referred to as **heterogametes**. The egg, the female gamete, is one of the larger cells and is not capable of moving on its own and a sperm, the male gamete, is very small but quite able to swim through a watery environment. Fertilization occurs when a sperm penetrates the cell membrane of the secondary oocyte. The haploid sperm nucleus unites with the haploid ovum nucleus, forming a diploid zygote nucleus. Fertilization is also called **syngamy**.

- C. In the diagram below, label the gametes, the zygote, the somatic (body) cells. Show on the diagram where mitosis and meiosis, and fertilization has taken place. Label the gametes as n and the zygote and body cells as $2n$.



3. What is fertilization?

4. Gametes that are similar in appearance are called isogametes. Those gametes that are unlike in appearance are called _____.

5. The female gamete is called an _____, while a male gamete is called a _____.

6. The union of two sex cells forms a _____.

7. On the back of this page, write a paragraph explaining the importance of the two different types of cell divisions, mitosis and meiosis.