Fertilization: A Dramatic Tale!

From the point of view of either the egg or the sperm your task is to write a dramatic tale! You will follow the journey of your main character (egg or sperm) through its epic struggle to find one another! Your tale will begin with development and end at fertilization. Along the way there can be DRAMA....HUMOUR.....LOVE....and maybe even TRAGEDY! It's up to you! The journey to fertilization in a rough road and you are here to tell its tale!

Your story can be written and supplemented with illustrations

OR

Can be in the form of a Comic

What you will be marked on

1. Content
    a. The story is related to the assigned topic (fertilization) and tells the tale of either the egg OR the sperm from development to fertilization
    b. This project is not simply "telling the facts" but creating a story to supplement the process (ie A tragic love story between the sperm and his long lost crush egg or A fight to win the race between rival sperm

2. Creativity
    a. Story and Illustrations should be ORIGINAL!
        i. The quality of drawings will not be judged (ie no need to be a good artist, you just need to TRY
    b. Possible themes for the story (BE CREATIVE)
        i. Drama
        ii. Comedy
        iii. Love
        iv. Tragedy

3. Use of Class Time
4. Effort in the project

You can work in group of MAXIMUM two or individually

PROJECT DUE:

Fertilization: A Dramatic Tale!

Teacher Name: Ms. Hemingway

Student Name: _____

CATEGORY	4	3	2	1
Use of Class Time	Used time well during each class period. Focused on getting the project done. Never distracted others.	Used time well during each class period. Usually focused on getting the project done and never distracted others.	Used some of the time well during each class period. There was some focus on getting the project done but occasionally distracted others.	Did not use class time to focus on the project OR often distracted others.
Creativity	Several of the illustrations reflect a exceptional degree of student creativity in their creation and/or display.	One or two of the illustrations used reflect student creativity in their creation and/or display.	The illustrations are made by the student, but are based on the designs or ideas of others.	No illustrations made by the student are included.
Storyline	The story contains many creative details and/or descriptions that contribute to the reader's enjoyment. The author has really used his imagination.	The story contains a few creative details and/or descriptions that contribute to the reader's enjoyment. The author has used his imagination.	The story contains a few creative details and/or descriptions, but they distract from the story. The author has tried to use his imagination.	There is little evidence of creativity in the story. The author does not seem to have used much imagination.
Content	The entire story is related to the assigned topic and allows the reader to understand much more about the topic.	Most of the story is related to the assigned topic. The story wanders off at one point, but the reader can still learn something about the topic.	Some of the story is related to the assigned topic, but a reader does not learn much about the topic.	No attempt has been made to relate the story to the assigned topic.
Effort	Effort is evident throughout project	Effort is shown in most of the project	Some effort given	Minimal effort

4.1 The Male Reproductive System

LEARNING TIP

Examine the title, headings, and graphics in Chapter 4. Review the Key Ideas and Chapter Preview. What connections can you make to your prior knowledge? What information will be new to you? What topics do you need to focus your attention on?

You have learned that the male sex cell is the sperm cell. You have also learned that human eggs are fertilized inside the female's body. Where do human sperm come from, and how do they get to the egg? The male reproductive system is designed for two purposes: to produce sperm and to deliver the sperm to the egg. Humans have primary and secondary sexual characteristics. Primary sexual characteristics include all the structures that produce sperm cells and deliver them to the female. Secondary sexual characteristics are not necessary for sexual reproduction.

Secondary Sexual Characteristics

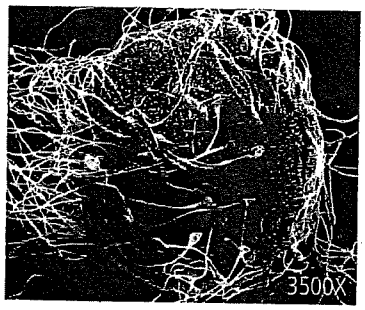
Whereas the primary sexual characteristics of males are present at birth, the secondary sexual characteristics do not develop until puberty. **Puberty** is the period in the development of a human during which he or she becomes sexually mature and able to reproduce. In males, puberty usually begins between ages 11 and 13 and continues until about age 18. Puberty begins when hormones released from the pituitary gland in the brain stimulate the testes to produce more of the male sex hormone **testosterone**. The secondary characteristics in males include a growth spurt; emergence of facial, underarm, and pubic hair; and the deepening of the voice. These secondary characteristics distinguish males from females, but do not have a direct role in reproduction. It is the primary sexual characteristics that have a direct role in reproduction. The primary sexual characteristics in males include the reproductive organs that produce sperm and allow the sperm to reach the female.

If you would like to learn more about puberty in males, go to **www.science.nelson.com**

Structure of a Human Sperm Cell

The design of the human sperm cell, shown in Figure 1, tells you about its function. The sperm cell is very streamlined and built to move. It consists of a head, a middle piece, and a tail. The head contains the haploid nucleus with 23 chromosomes. At the front of the head is an entry capsule. It is packed with chemicals that allow the sperm cell to enter the egg. The middle piece is directly behind the head and is packed with mitochondria, which provide the sperm with energy. The whip-like tail is called the flagellum and propels the sperm.

Did You KNOW



Not Equal

The human sperm cell is dwarfed by the much larger egg cell. In humans, the egg cell is approximately 100 000 times larger than the sperm cell. It would take over 300 sperm cells to cover the outer surface of the egg if laid side by side.

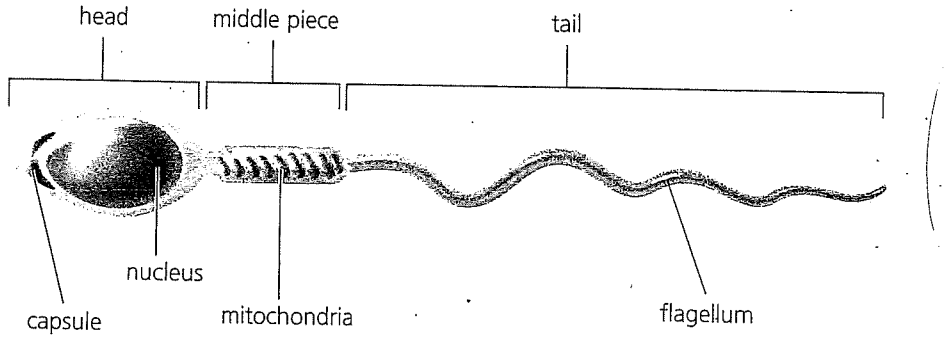


Figure 1 Human sperm cell

Male Reproductive Structures

The male reproductive system is shown in Figure 2. During puberty, these primary sexual characteristics mature and enable males to reproduce. There are two testes that hang outside the abdominal cavity. The testes are enclosed in a protective sac, called the **scrotum**. The **testes** produce and nourish the developing sperm, and also produce testosterone. Each testis contains a mass of coiled tubes called **seminiferous tubules**, which contain diploid cells that undergo meiosis to produce haploid sperm cells. Sitting above each of the testes is the **epididymis**, where mature sperm are stored.

Did You ***KNOW***

Cool Sperm

Most mammalian sperm cells, including human sperm cells, cannot be produced at normal body temperature. Therefore, the testes in the scrotum hang outside the abdominal cavity, where the temperature is about two degrees cooler. Whales and bats are the only mammals that permanently retain the testes in the abdominal cavity.

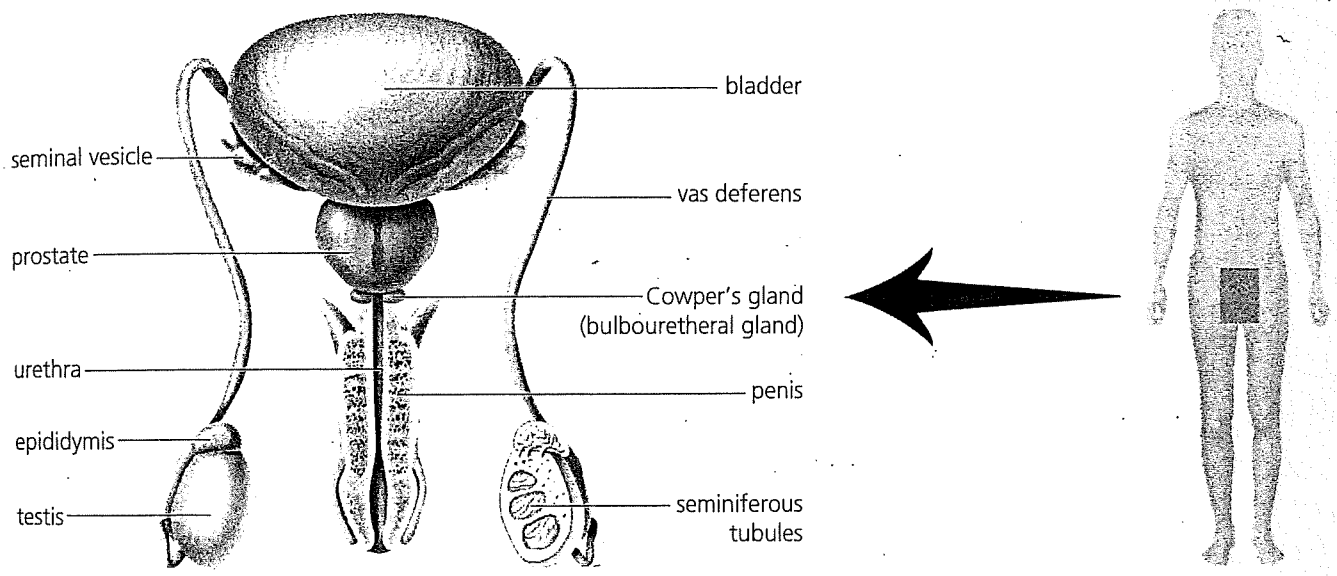


Figure 2 The male reproductive system

The Path of the Sperm Cell

Mature sperm travel to the outside through two tubes. Attached to the epididymis is the **vas deferens**, a tube that carries the sperm to the urethra. The **urethra**, which is part of both the excretory and reproductive systems, transports both sperm and urine outside the body. Note that urine from the bladder cannot travel through the urethra at the same time as sperm. The **penis** is the organ that contains the urethra. It enters the female during sexual intercourse. Muscular contractions propel the sperm cells along. The sperm cells, together with other fluids, are ejaculated out of the erect penis when it is inside the female.

LEARNING TIP

Diagrams help you clarify information visually. As you study Figures 2 and 3, look back and forth between the figures and the boldface words in the text.

LEARNING TIP

Did you notice that Section 4.1 includes many new terms? To help you with your studying, try using index cards. On one side of a card, write a term. On the other side, write a brief definition.

Male Accessory Glands

Sperm cells need a fluid in which to swim, as well as nutrients to provide energy for the journey. The seminal vesicles, prostate gland, and Cowper's glands (also called bulbourethral glands) (Figure 2) are accessory glands that secrete seminal fluid. Seminal fluid provides sugar for energy, protects the sperm from the acidic female reproductive tract, and provides the fluid for swimming. The sperm and the seminal fluid together make up **semen.**

Sperm Production and Development

Sperm cells start out as diploid cells on the inside surface of a seminiferous tubule (Figure 3). They increase in numbers by undergoing mitosis several times. These cells are gradually pushed closer to the centre of the tubule. They then undergo meiosis to become haploid cells. Even though they are haploid, they don't yet look like mature sperm. In order to develop into sperm, they need lots of nutrients. Special support cells provide nourishment to the developing sperm. When the sperm cells are almost mature, they have reached the centre of the tubule. The sperm cells then move to the epididymis, where they finish maturing.

Sperm cells have a short life cycle. It takes from 65 to 75 days for a sperm cell to mature. Males with a healthy reproductive system can produce 200 to 300 million sperm each day. Even though only one sperm cell fertilizes an egg, millions of sperm are needed because many die on the way. Sperm that are not released die within a few days and are broken down by white blood cells. New sperm cells continually replace the old sperm cells. Males can produce sperm even into old age, but the number of mature sperm decreases with age. Only mature sperm can reach and fertilize an egg.

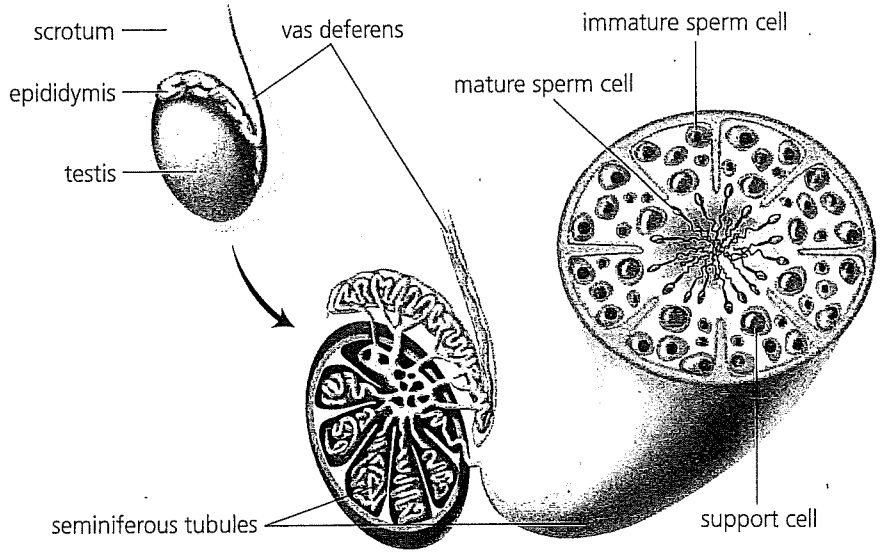


Figure 3 Sperm cells are produced in the testes, stored in the epididymis, and travel through the vas deferens.

4.2 The Female Reproductive System

Both males and females contribute gametes to the reproductive process. As you learned in Chapter 3, however, mammalian females have another vital role. Because fertilization is internal, they must nurture the fertilized egg from conception to birth. They give birth to the next generation.

Secondary Sexual Characteristics

In females, puberty usually begins between ages 10 and 12 with a growth spurt that includes the development of mammary glands, or breasts. If a woman gives birth, the **mammary glands** produce milk to nourish the baby. Other changes during puberty include the growth of underarm and pubic hair and a widening of the hips (pelvic girdle). As well, the primary sexual organs mature at this time.

If you would like to learn more about puberty in females, go to www.science.nelson.com

Egg Production and Development

The human egg, also called the ovum, is well designed for its functions. It is much larger than the sperm because it contains many nutrients that will be used in cell division once the egg is fertilized. The egg also has an outer barrier that prevents more than one sperm from entering.

Unlike the male, the female has all her sex cells at birth. She may be born with as many as two million eggs, but most will degenerate, leaving approximately 400 000 at puberty. Once sexual maturity is reached during puberty, a single egg matures and is released each month.

The primary female reproductive organ is the **ovary**, where egg cells mature and are released (Figure 1). Females have two ovaries located in the lower portion of the abdominal cavity. The ovaries have many **follicles**, each containing a single immature egg. The follicles also contain cells that nourish and protect the developing egg. The ovaries produce the female sex hormones, **estrogen** and **progesterone**.

LEARNING TIP

As you study Figure 1, ask yourself, "What does this show?" Relate the information in Figure 1 to the information in the text.

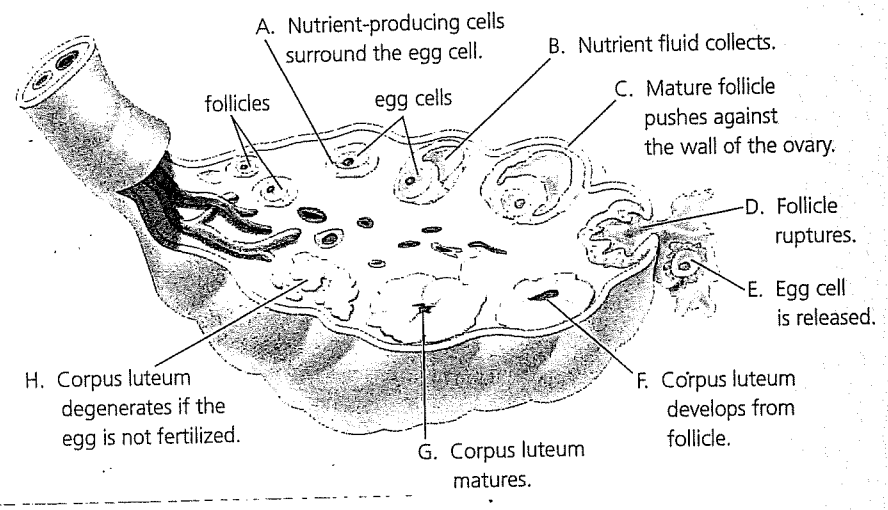


Figure 1 The ovary contains follicles, which contain eggs. Once the eggs mature, they are released from the ovary.

The Menstrual Cycle

The **menstrual cycle** is the female reproductive cycle. It begins at the onset of puberty. The menstrual cycle lasts approximately 28 days, although it can vary in length from 20 to 40 days in different women. The length of the cycle can change throughout a woman's reproductive life. In each cycle, usually a single egg matures and is released. The menstrual cycle keeps repeating until **menopause**, when it stops. Menopause most often occurs in women between 40 and 50 years of age.

Several follicles develop during each reproductive cycle, but usually only a single follicle and egg reach maturity in either ovary. Occasionally, both ovaries release an egg, which can result in twins if both eggs are fertilized. As the follicle matures, nutrient-producing cells develop around the egg cell (Figure 1). The cells will divide and form a nutrient-rich cavity. Once the egg matures, it will burst through the wall of the ovary. This release from the ovary is called **ovulation**. The empty follicle is called the **corpus luteum**. The corpus luteum matures and produces the hormones estrogen and progesterone.

LEARNING TIP

Make connections to your prior knowledge. Ask yourself, "What do I already know about the menstrual cycle?" Consider the information you have read, observed, and/or experienced.

The Path of the Egg

After ovulation, the egg is propelled by finger-like projections that surround the opening to the oviduct. The **oviduct** (also called the **fallopian tube**) is a tube that transports the egg to the uterus (Figure 2). Peristalsis, which is wave-like muscular contractions, and tiny cilia move the egg through the oviduct. Figure 2 shows the two ovaries and the two oviducts. The **uterus**, also called the **womb**, is the organ that will receive the embryo if the egg is fertilized. The lining of the uterus is called the **endometrium**. It is rich in nutrients, blood vessels, and mucus, and provides the nourishment for the embryo. The **cervix** is the muscular opening between the uterus and the vagina. The **vagina** receives the male penis and sperm during sexual intercourse, and it is the birth canal through which a baby comes out. The opening to the vagina is directly behind the opening to the urethra. Unlike males, whose urethra transports both urine and semen, the female urethra only transports urine.

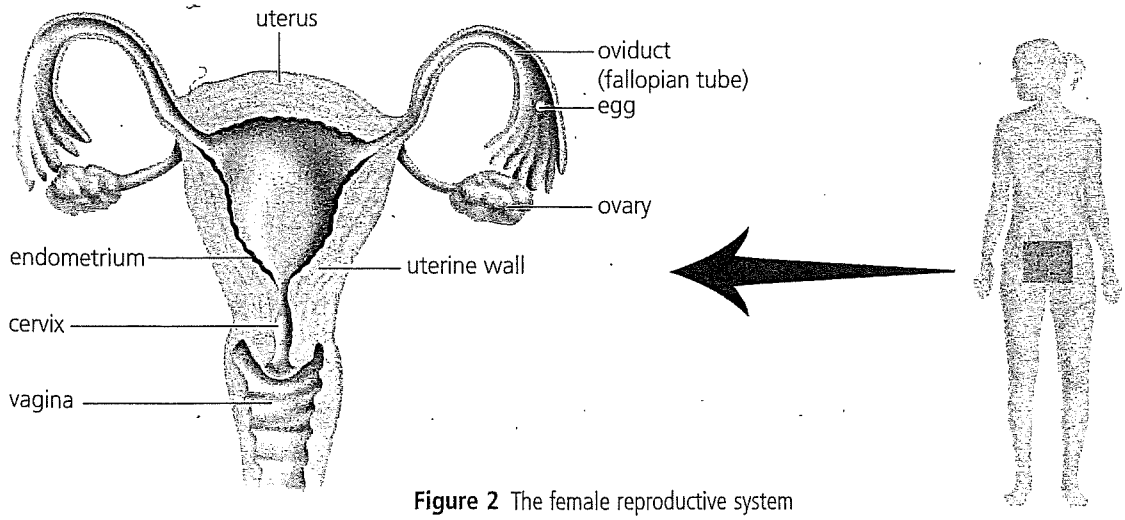


Figure 2 The female reproductive system

Depending on whether the egg is fertilized, one of two events will happen: menstruation or pregnancy.

Menstruation

If no sperm are present in the oviduct, then the egg continues to the uterus and is discharged out of the vagina. Since no zygote has implanted in the uterus, the endometrium stops developing and is shed. **Menstruation** is the shedding of the endometrium. This marks the first stage of each menstrual cycle (Figure 3), the **flow phase**. Because the endometrium is so rich in blood vessels, menstruation looks like blood is being released. Since no zygote has implanted, a new follicle starts to develop in the second phase, the **follicular phase**. Once the follicle has developed, the third phase, ovulation, occurs. In ovulation, the egg leaves the ovary and travels toward the uterus. Once the egg is released, the final stage, the **luteal phase**, begins, and the empty follicle develops into the corpus luteum. The corpus luteum releases the hormone progesterone, which stimulates the endometrium to develop in preparation for the fertilized egg. During pregnancy, progesterone will also prevent any other eggs from maturing. Table 1 summarizes the events in the menstrual cycle.

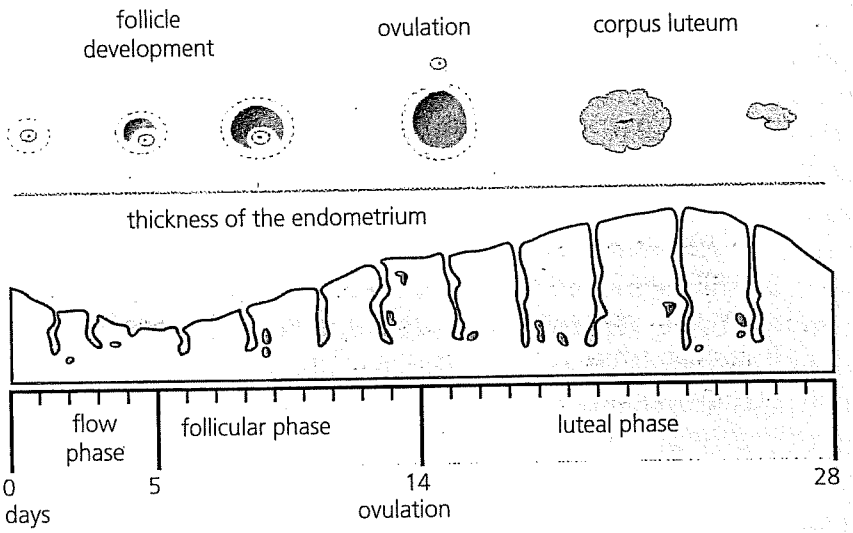


Figure 3 This graph summarizes the events of the menstrual cycle in the ovary and the uterus.

LEARNING TIP

Tables help you identify specific information quickly. As you study Table 1, look at the headings. The headings will help you focus on what is important in the table.

Table 1 A summary of the female menstrual cycle

Phase	Description of events	Hormones produced	Day (approximate)
flow phase	Endometrium is shed (menstruation).	none	1–5
follicular phase	Follicles in ovaries develop. Endometrium re-forms.	Estrogen is produced by follicles.	6–13
ovulation	Egg is released from ovary.		14
luteal phase	Corpus luteum forms. Endometrium thickens.	Estrogen and progesterone are produced by the corpus luteum.	15–28

Pregnancy

If the egg is in the oviduct and sperm are present, then fertilization can occur. One sperm penetrates the outer membrane of the egg while it is in the oviduct. The two haploid nuclei fuse to produce the zygote with 23 pairs of chromosomes. The zygote begins dividing as it continues its journey through the oviduct. About one week after fertilization, the mass of cells, now called an embryo, reaches the uterus, where it will implant into the endometrium. Pregnancy begins when the egg is fertilized and continues until the baby is born, approximately nine months later. Embryonic development happens during pregnancy. **Embryonic development** is an orderly series of changes that an embryo undergoes to become a fully formed baby. You will learn more about pregnancy and embryonic development in the next section.

TRY THIS: Determining the Number of Eggs Released in a Lifetime

Skills Focus: predicting, recording

Materials: calculator

1. A female has approximately 400 000 eggs available at puberty.
2. Predict the number of eggs that you think a human female will release in her lifetime. Record your prediction.
3. If one egg is released approximately every 28 days, calculate how many eggs would be released in one year. Record your answer.
4. Using the approximate age of 12 for when puberty begins, and the approximate age of 50 for when menopause occurs, calculate the number of eggs released. Record your answer.

A. What event would reduce the number of eggs released from puberty to menopause?

B. Approximately how many eggs have been released in a woman aged 40, who has given birth to four children?

C. Why do you think there is such a difference between the number of available eggs and the number of eggs released?

Female Accessory Glands

Another conspicuous feature that characterizes female mammals is the presence of mammary glands. Humans and other primates have two glands, while other mammals may have multiple glands. The number of mammary glands is related to the number of offspring that are produced in one pregnancy. During pregnancy, high levels of estrogen and progesterone stimulate the mammary glands to develop more milk ducts. Shortly after birth, progesterone decreases and another hormone, called prolactin, causes milk to be produced to feed the baby. Each breast contains many milk-producing lobes, each with a duct that leads to the nipple. In most mammals, milk is the sole source of nutrition for some time after birth.

LEARNING TIP

Did you notice that Section 4.2 includes many new terms? Check the Glossary at the back of this textbook to find the meanings of terms that you are unsure of.

Name: KEY
Block: _____

The Human Reproductive System

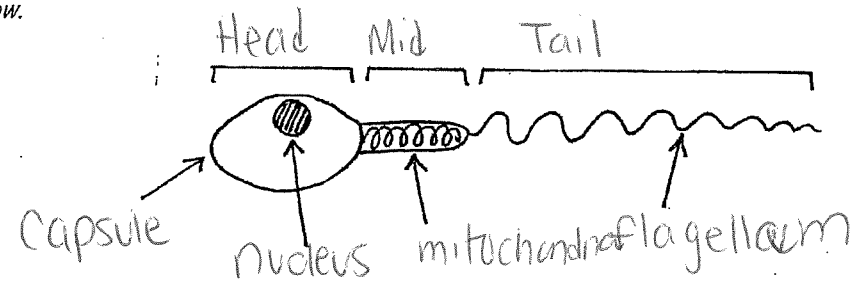
... the long wait is over ☺

We're probably pretty clear on how human reproduction occurs. What you may not know much about is what the reproductive **structures** are and how **they work.**

The male **sex cell** is a Sperm cell. The whole purpose of the male reproductive systems is to produce sperm AND to deliver sperm to the egg.

Here's a picture of the friendly human sperm!

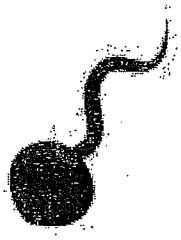
Please label the head, middle piece, tail, capsule, nucleus, mitochondria, and flagellum of the sperm diagram below.



Human males have both primary and secondary sex characteristics.

Primary Characteristics:

- You are born with these
- They include the male reproductive organs



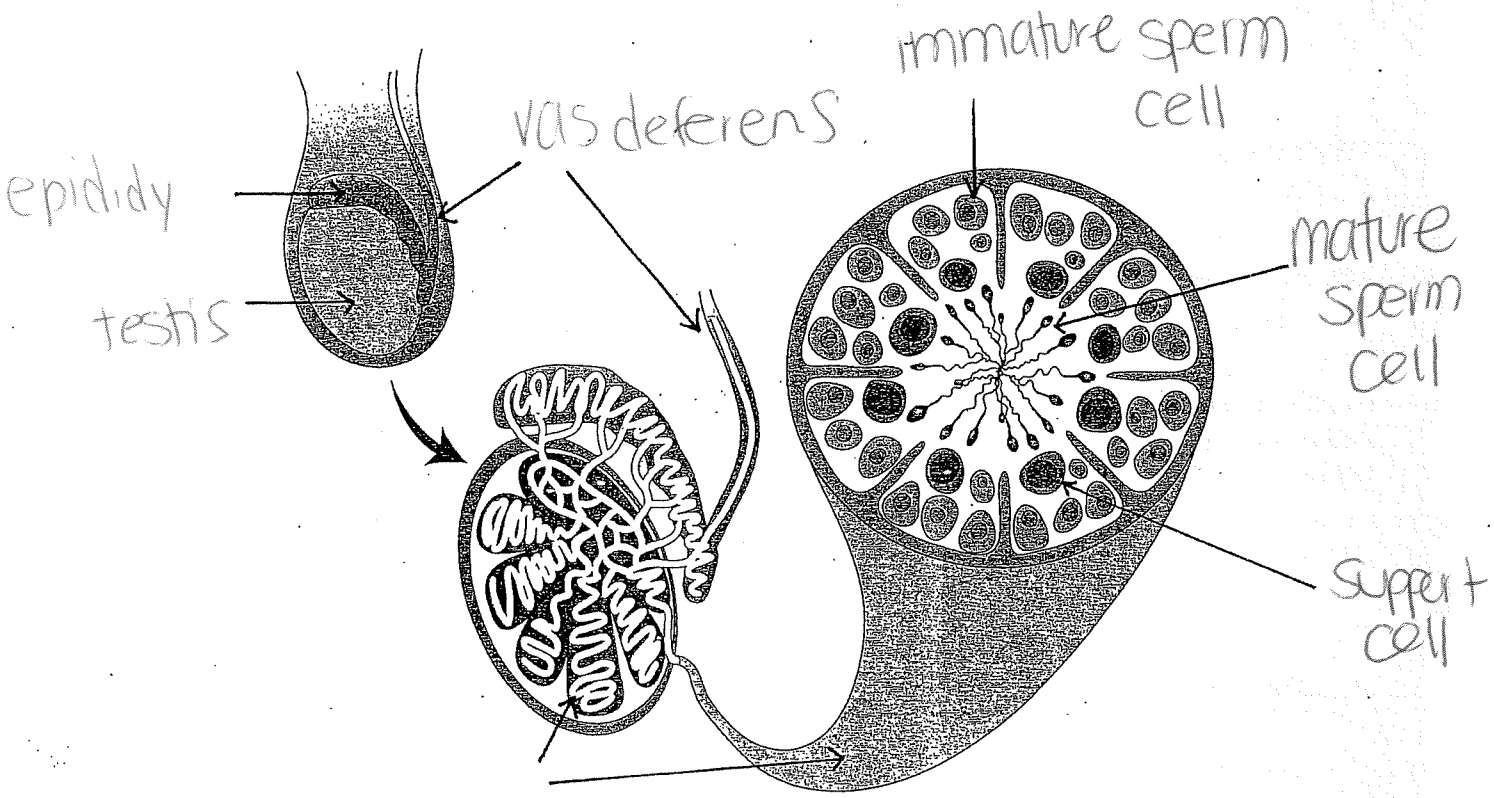
Secondary Characteristics:

- Develop during puberty
- Puberty occurs when the hormone testosterone is produced
- Some secondary sex characteristics are: deep voice, body hair, muscle development, growth spurt

Where are sperm produced??

- Sperm start as diploid cells that divide into haploid cells during meiosis
- This happens in the seminiferous tubules (you'll see where those are in a minute)
- The sperm cells then move to the epididymis to mature
- It takes about 65-75 days for a sperm cell to mature. Males produce up to 300 million sperm every day!!

Here's a closer look at where sperm are produced. We'll label this together and discuss what each of the parts do.



Some quick questions:

1. What happens to sperm cells that are not used? die w/i a few days by WBC

2. (a) Name the structures of the male system that sperm do NOT go through:
Seminal vesicles, Cowpers gland, prostate

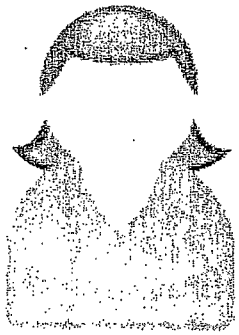
(b) What is the name given to these structures: accessory glands

3. Describe the composition and importance of semen. fluid, have sugar which is energy for sperm, protects from acidity and liquid to swim

4. Why do you think the male testes are outside the body?
Keep testes cool (increases sperm production)

Name:_____
Block:_____

The Female Reproductive System



The female sex cell is an egg. The whole purpose of the female reproductive system is to nurture the fertilized egg from fertilization to birth.

Females also have primary and secondary sex characteristics. Primary characteristics include the female reproductive organs.

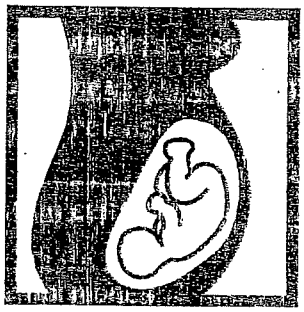
Secondary Characteristics:

- Develop during puberty
- Puberty occurs when the hormone estrogen is produced
- Some secondary sex characteristics are: wider hips, breast develop. body hair

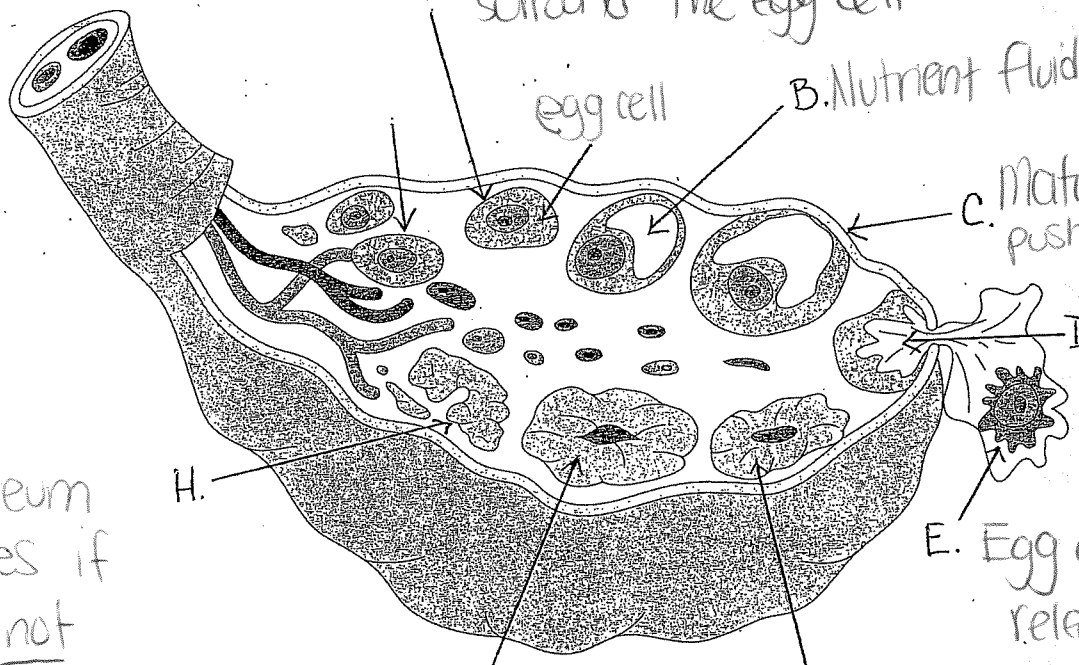
Use your text (pages 112-113) to complete the blanks below and the diagram on the next page).

The Egg:

- Human egg also called an ovum.
- It is larger than a sperm because it contains many nutrients that will be used once the egg is fertilized.
- It has a special outer layer that prevents more than one sperm from fertilizing the egg.
- Females are born with all their sex cells at birth!
- By puberty, a female has about gazillion eggs. 400,000
- Every month, 1 egg is released
- Egg cells mature in the ovary. The immature eggs are contained in follicle that contain cells that nurish and protect the developing eggs.
- The ovaries also produce the hormones estrogen and progesterone.



So... what happens in the ovaries as the eggs develop?? Take a look at the ovary on this page. Use page 112 in your text to label what happens at each phase of egg development.



A few quick questions:

1. What is the menstrual cycle? How long does it last? Reproductive cycle
   Shedding of endometrium, lasts 28 days
2. Define menopause. halting of menstrual cycle, no more eggs
3. When does ovulation occur? Explain. Day 14, halfway through 28 day cycle (Release egg)
4. What is the corpus luteum? Results from empty follicle