



Human Reproduction

Suggested Time: 1.75 Hours

What's important in this lesson:

That males and females have similarities and differences in their development of gametes (sex cells) for reproduction. There are numerous stages during fetal development of which a couple should be aware of along with various techniques to help those individuals who have difficulty conceiving.

Complete these steps:

1. Try the Diagnostic activity to familiarize yourself with some of the terms that you will see in the lesson.
2. Get a copy of the Student Handout: Human Reproduction and work through it at your own pace. You'll need a copy of a textbook for help in places. Check your answers with your teacher where needed.
3. Try the Assessment: Human Reproduction. Make sure you have about 10-15 minutes to complete the test and give this to your teacher.

Hand-in the following to your teacher:

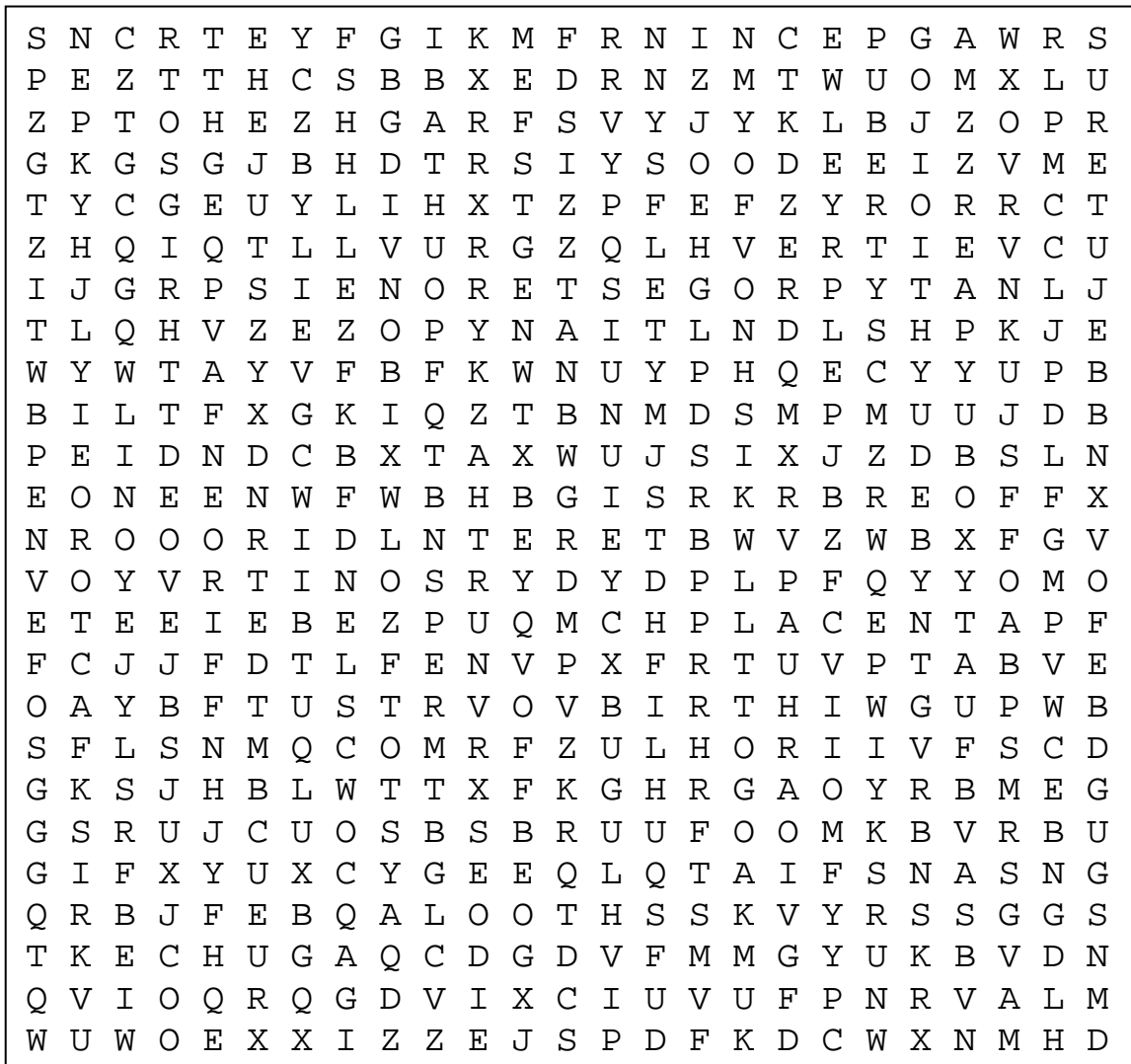
1. Diagnostic activity.
2. Student Handout.
3. Assessment and Evaluation activity.

Questions for the teacher:

Diagnostic/Introductory Activity:
Unit 2 Lesson 4



Human Reproduction



The following word lists are terms of importance in human reproduction. Find twelve of these words in the word search above.

BIRTH
EGG
EMBRYO
FERTILIZATION
FETUS
INVITRO

oviduct
PLACENTA
PROGESTERONE
PUBERTY
RISK FACTOR
SPERM

TESTES
TESTOSTERONE
TRIMESTER
UTERUS
ZYGOTE



Human Reproduction

The goal of Sexual Reproduction is to produce an offspring that is different from its parents. This occurs through the union of gametes (sex cells) which are specialized cells commonly called sperm and egg in most organisms. They have half the number of chromosomes compared to all other cells in the body. Once these cells are joined together the new cell will have a complete set of DNA. At this point the new cell is called a zygote. It is a new individual that has half of its father's and half of its mother's genetic information.

Human Sex Development

Puberty

Puberty is the time of your life when your body starts to change from a child into an adult. These changes are controlled by hormones that are produced in the pituitary gland. The hormones have different effects on both the male and female bodies and trigger the reproductive organs of the body to start producing their own hormones. This new set of hormones triggers the development of gametes in both genders along with secondary sex characteristics (ex. Body and facial hair, voice deepening etc).

Male Sex Development

The male gonads (reproductive organs) are called the testis. As far as reproduction is concerned the two most important products made in the testis are: sperm and testosterone.

Testosterone triggers the sperm to mature. The sperm is well-designed for its job: it is streamlined which allows it to move well and lightweight since it has very little cytoplasm around the nucleus. This lack of cytoplasm limits the energy available for the sperm. Sperm die within a few days and are removed by white blood cells. New sperm continually replace old ones and are produced throughout the male's lifetime (even males over 90 years old have fathered children)

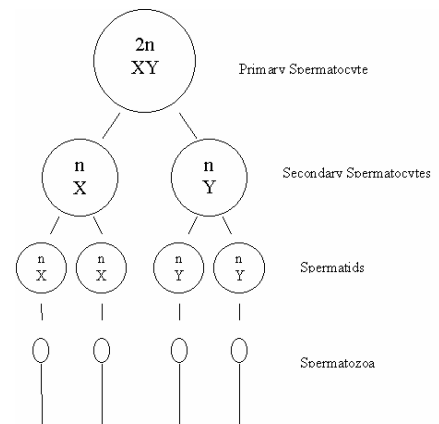


Fig. 1: Spermatogenesis

1) Draw and label the parts of a sperm. Use your book pg. 83 Science Power, pg. 214 Science 9 or pg. 102 Concepts and Connections to help you.



Female Sex Cell Development

The female reproductive system is more complicated than the male system as it not only must produce the eggs but the female also nurtures the embryo from the time of conception to birth. These processes are controlled by a number of hormones including estrogen and progesterone. The ovary is the major reproductive organ. There are two ovaries and it is here that the eggs mature in specialized groups of cells called follicles. Just like the sperm, the egg is well designed for its job. It is much larger than the sperm, and is packed with nutrients so it can be used for energy during mitosis once the egg has been fertilized. Once fertilization of the egg occurs, it also produces a barrier to prevent other sperm from entering, so the zygote will not end up with too much DNA and have potential genetic problems. Females do not produce new eggs throughout their adult life. At puberty there are approximately 400 000 immature follicles but this number continually decreases as the woman ages. This is due to the fact that usually only one follicle will develop each month until the woman reaches menopause. The rest will break down and are absorbed into the ovary. Once the egg is mature it is released from the follicle by a process called ovulation and moves towards the oviduct (or fallopian tube)

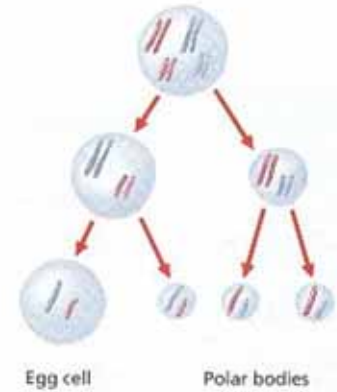


Fig. 2: Oogenesis

2) Compare the sperm and the egg. How are they similar? How are they different? Consider size, shape, number, formation, length of life, and release.

Comparison	Sperm	Egg
Similarities		
Differences		



3) The diagram off to the side shows the female reproductive system. If the ovaries of a woman are removed, can she still give birth to a baby? Support your answer.

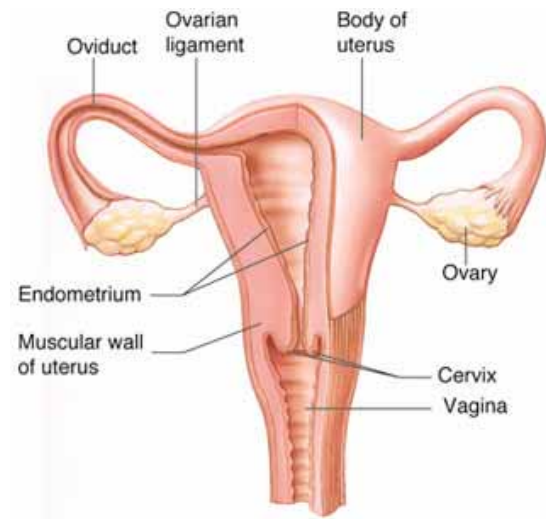


Fig. 3: The Female Reproductive System

Human Conception and Implantation

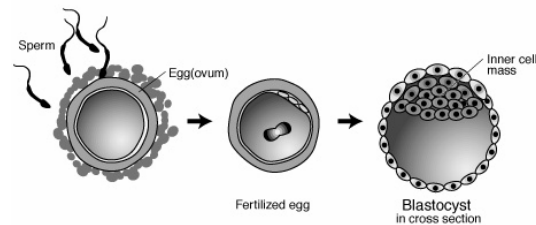


Fig. 4: Fertilization and early development

Conception or fertilization occurs when the head of the sperm breaks through the egg's membrane. The tail of the sperm gets severed and only the head of the gamete can enter. Only one sperm can enter an egg, due to the fact that once one enters a chemical reaction takes place making the egg's membrane impenetrable.

Conception takes place in the oviducts (tubes from the ovaries to the uterus), and it takes the zygote 24-36 hours to reach the uterus, during that time the zygote is undergoing mitosis. By time it reaches the uterus the zygote is made up of more than 100 cells and is a hollow sphere. When the ball of cells implants in the uterine wall it is now called an embryo and pregnancy is considered to have begun.

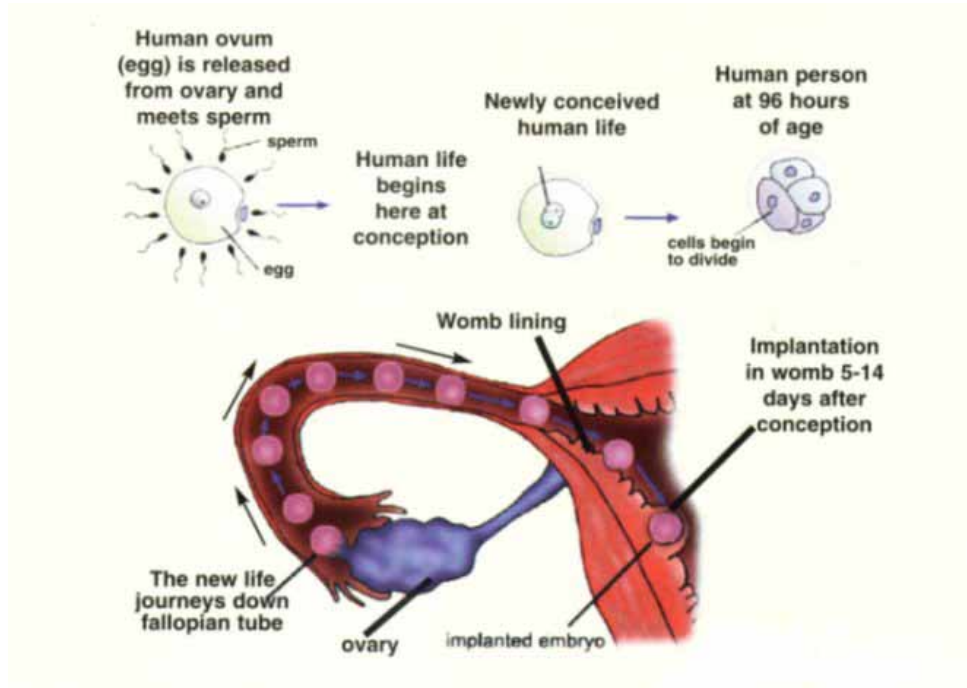


Fig. 5: Diagram showing conception and implantation

Blood vessels from the embryo and those from the endometrium of the mother form the placenta. Nutrients and oxygen diffuse from the blood vessels of the mother across the placenta into the blood vessels of the embryo. Wastes diffuse in the other direction eventually, entering the mother's circulatory system which will help dispose of these wastes along with her own.

Around the third month of pregnancy the placenta begins producing progesterone. These high levels of progesterone prevent the woman from further undergoing ovulation, therefore she cannot become pregnant again until after the baby is born. It also keeps the endometrium healthy and stops the uterus from contracting.

- 4) Ectopic pregnancies occur when the embryo becomes implanted in the oviduct rather than the uterus. Why is this a dangerous situation?

- 5) Predict what would happen during pregnancy if the placenta became damaged and could not maintain the progesterone levels. Give reasons for your prediction.

Student Handout: Unit 2 Lesson 4



Pregnancy and Birth

Pregnancy is divided into three trimesters. Each trimester is three months in length. The first one starts at the fertilization of the egg.

First Trimester (Week 1 to 12)

During the first trimester the embryo grows from the size of the fertilized egg to 7-8 cm.

By the end of week four (1st month):

- A large brain is visible
- A basic heart has formed and has begun to beat
- The limbs bud that will form the arms and legs.
- A very primitive nervous system has begun to form

By the end of week eight (2nd month) the embryo is now called a fetus and the following has occurred:

- Head and facial features develop
- All the major organ systems have started to form and may have started to function
- The nervous system responds to stimuli
- Estimated size is 30 mm or about the size of a cashew nut.

By the end of week twelve (3rd month) the following may be seen:

- External parts of the fetus continue to take shape, ex. Hair, nails, teeth start to form
- The face has a more human appearance by the tenth week.
- Some primitive reflexes present. Ex. Sucking thumb
- Moves freely (not yet felt by mother).
- It is only about 100 mm long and weight is just over 50 g.

During this time a woman may not realize she is pregnant. Some signs of pregnancy are: no menstrual period, nausea or vomiting, tender enlarged breasts and frequent urination. The best way to confirm pregnancy is through a pregnancy test. Miscarriages or spontaneous abortions occur most often during this trimester. The risk of birth defects is also greatest during this time since all of the fetus' essential internal and external structures are developing.

Second Trimester (Week 13 – 24)

By the end of the second trimester the fetus can be 350 mm (9-10 inches) in length and weighs approximately 680g. During this time the fetus is growing fast.

- Most organ systems can function immaturely
- The skeleton is becoming bone

Student Handout: Unit 2 Lesson 4



- External sex organs can be seen so that sex can be determined
- Body is covered by a fine hair
- Head hair and eyebrows begin to form along with fingernails and toenails developing
- Can kick, somersault and grasp with his hands by 16 weeks.
- "Quickening" - mother feels fetal movements.
- May swallow amniotic fluid and urinate back into it. The fluid is completely replaced and cleaned about every three hours
- Skin is reddish and wrinkled
- If born after 23 weeks the fetus may survive

Third Trimester (Week 25 – 40)

During this period of time the fetus is growing rapidly:

- The development of all internal organs and body parts is completed.
- The main goal at this time is to increase body mass.
- Also at this time the fetus is very active as it alternates between sleep and wake cycles.
- Fine body hair starts to disappear
- Lungs are capable of breathing air
- Skin is paler and less wrinkled

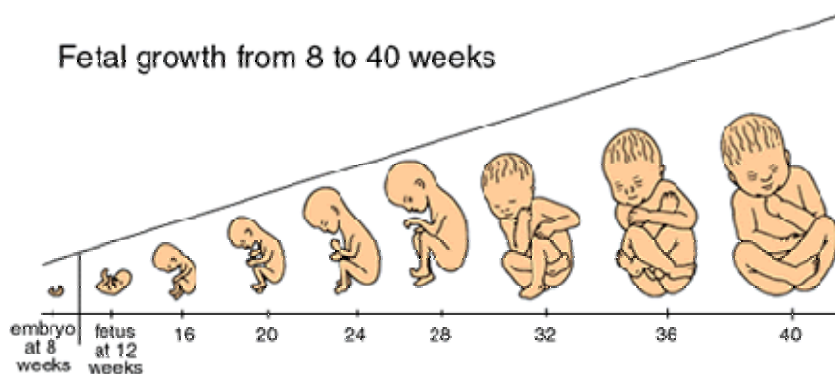


Fig. 6: Fetal growth from 8 to 40 weeks

- 6) When does an embryo become a fetus?
- 7) In which trimester do most miscarriages occur?

Student Handout: Unit 2 Lesson 4



8. Many women are not aware of their pregnancy until the third month. From what you know about all the development that occurs during this time, choose two factors from the following list and write some advice you would give an expectant mother about both of these factors.

Factors:

alcohol, tobacco, caffeine, drugs (over the counter such as aspirin, prescription such as antibiotics and illegal), Radiation form X-rays, Raw or undercooked food and the use of saunas and hot tubs.

Information may be obtained by using Science 9 Concepts and Connections pg. 110, library or websites such as:

March of Dimes: http://www.marchofdimes.com/professionals/681_1206.asp

CDS: <http://www.cdc.gov/ncbddd/bd/faq1.htm>

Environmental Causes of Birth Defects:

<http://www.yale.edu/ynhti/curriculum/units/1982/7/82.07.07.x.html>

10 risk factors that every pregnant woman should be aware of:

http://articles.worldvillage.com/10_risk_factors_that_every_pregnant_woman_should_be_aware_of.html

Birth

Although the process can often at times look messy and unorganized to the new parents, the process is highly organized and sequenced.

- The cervix begins to dilate
- The membranes surrounding the baby are forced in to the vagina (birth canal).
- At this time the “water breaks” and the fluid moistens and lubricates the vagina.
- Once the cervix has dilated enough (9-10cm) the uterine walls start to contract and push the baby out.
- Once the head and shoulders of the baby are free of the birth canal the baby slips out freely.
- The placenta is then delivered.
- The umbilical cord is tied off so that the baby will start to breathe on its own, it is also cut to free it from its connection to the mother.

Hormones are very important to this process. If the hormone levels are interrupted then the process can be long and drawn out. Relaxin is produced by the placenta prior to labour. It relaxes the ligaments in the pelvis allowing them to loosen making the process easier (and perhaps without tearing for the mother). As labour starts the hormone oxytocin is secreted by the pituitary gland. This hormone causes uterine contractions needed to push the baby out. After the placenta is delivered the secretions of estrogen and progesterone stop, if the mother does not breast feed her menstrual cycle will start again in a few months after birth.



Human Reproductive Technology

Many couples are unable to have a baby for various reasons. Reproductive technologies use scientific and medical advances to alter these processes. The technologies used for a couple depend upon why they cannot conceive or carry a baby to full term.

Reasons for Infertility

Female	Male
Insufficient egg production	Insufficient sperm production
Missing or defective reproductive structures (uterus, ovaries)	Missing or defective reproductive structures
Blockage in the oviducts	Weak or deformed sperm

Fertility drugs – This technology is used when a woman is unable to release eggs. The fertility drugs may stimulate her hormones. These drugs increase the chance that more than one egg will be released so often multiple births occur.

Artificial Insemination – This technology is used when a male has a low sperm count. Sperm cells are transferred directly into the oviducts of the woman following ovulation.

In Vitro Fertilization – This technology is used by some women who have difficulty conceiving for various reasons including blocked oviducts. Hormones are given to the woman to stimulate the release of eggs. During ovulation the mature eggs are removed from the ovary and placed in a Petri dish where they are fertilized by the partner’s sperm. Following a brief incubation period, one or more embryos are transferred into the uterus. Since this technology is expensive, stressful and fertilized eggs do not always transplant successfully sometimes excess eggs are removed and frozen where they can be thawed and fertilized at a later time. These zygotes could be implanted into the same mother or donated to another woman who is unable to ovulate.

Cytoplasmic transfer: A technique in which cytoplasm from a donor egg is drawn into a pipette containing a single sperm from the male partner, after which that donated cytoplasm and the sperm are injected into the patient's egg.

- 9) a) Explain why the old term “test-tube baby” of a child produced from In Vitro Fertilization is not accurate.

- b) Describe the process of invitro fertilization.



Modified True/False

Indicate whether the sentence or statement is true or false. If false, change the identified word or phrase to make the sentence or statement true.

- _____ 1) Pregnancy in humans normally takes 40 weeks.
- _____ 2) Sperm are produced in the testes from childhood to puberty.
- _____ 3) Fertilization takes place in the ovary.
- _____ 4) Nutrients and oxygen are transferred to the developing fetus across the placenta.

Multiple Choice

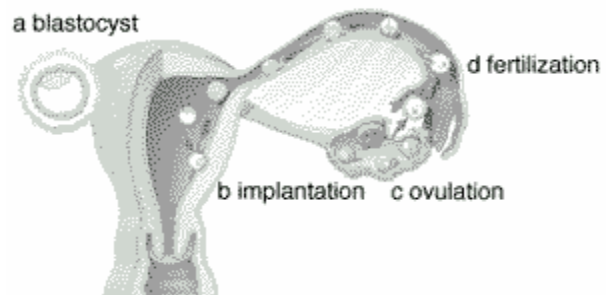
Identify the letter of the choice that best completes the statement or answers the question.

- 5) Which hormone do the testes produce?
a. estrogen b. progesterone c. testosterone d. none of the above
- 6) What is the first stage of human development called?
a. zygote b. fetus c. embryo d. gastrula
- 7) Which of the following events occur during the second trimester?
a. The skeleton begins to form.
b. The nervous system begins to function.
c. The brain grows rapidly.
d. All of the above events occur.
- 8) Which of the following is *not* dangerous to the developing fetus?
a, exercise b. cigarette smoke c. alcohol d. caffeine

Matching

9) Development from ovulation to implantation.

- _____ i. Occurs six to 10 days after fertilization in the uterus.
- _____ ii. An egg (ovum) is released.
- _____ iii. Pregnancy begins.
- _____ iv. Hollow ball of cells with a group of inner cells.
- _____ v. Occurs in the oviduct.



Assessment and Evaluation: Unit 2 Lesson 4



10) Stages of pregnancy.

- A
- ___ i. Oxytocin is produced, which stimulates labour.
 - ___ ii. Limbs, eyes, and spine begin to form.
 - ___ iii. There is a rapid increase in overall size.
 - ___ iv. Fetal movement can be detected.
 - ___ v. The development of all internal organs is complete.

- B
- a first trimester
 - b second trimester
 - c third trimester
 - d birth

Short Answer

11. a) What is the purpose of the tail on a sperm cell?

b) Why are sperm with more than one tail ineffective at fertilizing an egg?

12. a) During what stage of pregnancy is the fetus most vulnerable? Explain.

b) Name a substance that can harm a developing fetus. Explain its effect.

13. Give one example of a cause of infertility in females and in males.

14. What procedure assists a woman to become pregnant if she has oviducts that are improperly formed? Describe the process.