

## Curriculum Outcomes

**304-11** illustrate and describe the basic process of cell division, including what happens to the cell membrane and the contents of the nucleus

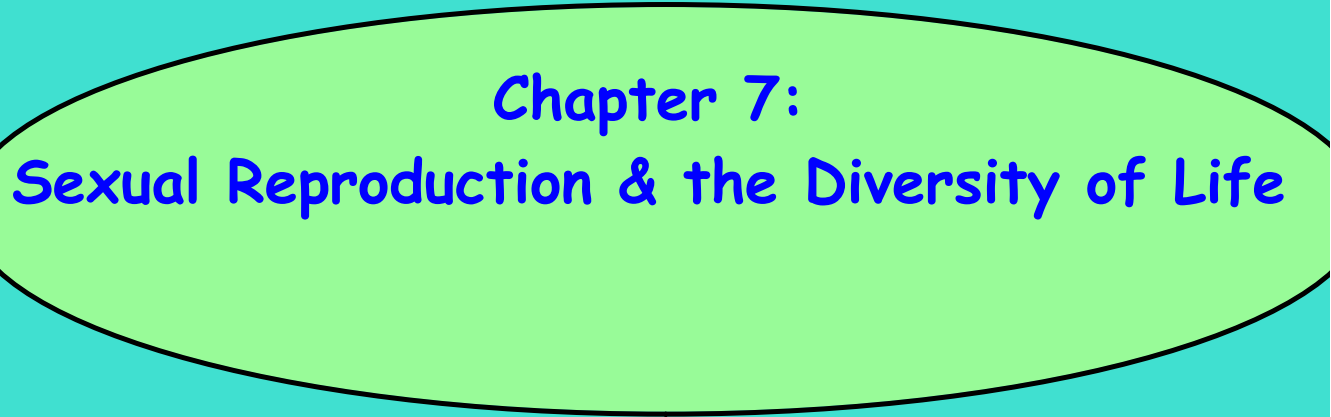
- illustrate and describe the basic processes of mitosis and meiosis

**305-5** discuss factors that may lead to changes in cell's genetic information.

- compare factors that may lead to changes in a cell's genetic information:
  - mutations caused by nature
  - mutations caused by human activities (305-5)

### **Student Friendly:**

- How are the sperm and eggs made
- What happens if a sperm or an egg gets too much, or too little material.



**Chapter 7:  
Sexual Reproduction & the Diversity of Life**



# Meiosis

Human cells contain 46 chromosomes. Imagine what would happen if a human cell containing 46 chromosomes fertilized with another 46 chromosomes. The resulting cell would contain 92 chromosomes! If cells with 96 chromosomes united, the following offspring would have 184 chromosomes, and so on. For sexual reproduction to occur, there must be a way to reduce the number of chromosomes. This is why sex cells are formed with meiosis.

Meiosis produces sex cells that have half the number of chromosomes (Human sex cells have 23 chromosomes)

The 46 chromosomes is referred to as the diploid chromosome number. It is written  $2n$ . The 23-chromosome number is referred to as the haploid chromosome number and is given the symbol  $n$ .


## Separate Sexes

Most complex animals and some plants have separate sexes (male / female)

Males - produce sperm cells (mammals have XY chromosomes)

Female - produce eggs cells (mammals have XX chromosomes)

one given by mother      one given by father



Both Males & Females have a total of 46 chromosomes  
(which is 23 pairs)

Animals with separate sexes use one of two different methods of fertilization

- 1) External Fertilization - sex cells unite outside the female's body  
ex) Female Fish release egg cell , and male release sperm
- 2) Internal Fertilization- sex cells unite inside the female's body  
ex) Humans

Let's Try

Page 205 # 6

→ full  
diploid

6) A muscle cell from a mouse has 22 chromosomes. How many chromosomes would you expect in

a) an unfertilized egg cell? 11

→ haploid

b) a zygote? 22  
(baby) diploid

c) a brain cell? 22  
diploid

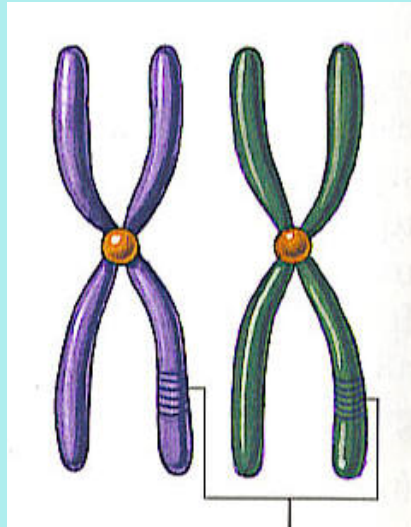
d) a sperm cell? 11

→ Share  
of  
recombine  
Chromosome

Organism that reproduce sexually show a greater range in their characteristics than those that reproduce asexually. Because the male and female sex cells come from different individuals in most species, sexual reproduction ensures a recombination of genes. Off springs carry genetic information from each parent. That may explain why you may have thick hair like your father, while your brother has thin hair like your mother.

Both parents give 23 chromosomes but they may be expressed differently in each off spring

Homologous Chromosomes carry genes that code for the same trait on the same part of the chromosome. One comes from mom and the other from dad. They are similar in shape and size.



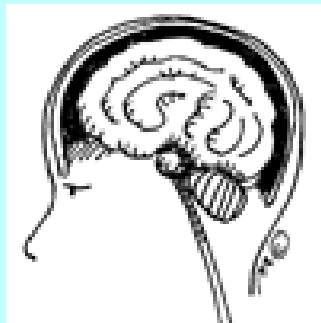
## Meiosis

Appearance is determined by the way the genes from your homologous chromosomes interact

Organisms that reproduce sexually contain two types of cells

- 1) Somatic Cells → uses mitosis  
any cells that are not sperm or egg
- 2) Reproductive Cells → sperm or egg  
→ uses meiosis

- 1) Cells that divide by mitosis are known as somatic cells.  
muscle, brain cells

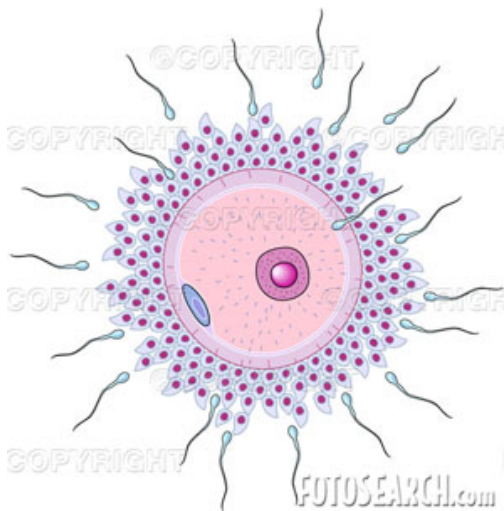


They are diploid, which means that they have the full amount of chromosomes. symbol for diploid is  $2n$ .

Humans

→ 46 chromosomes

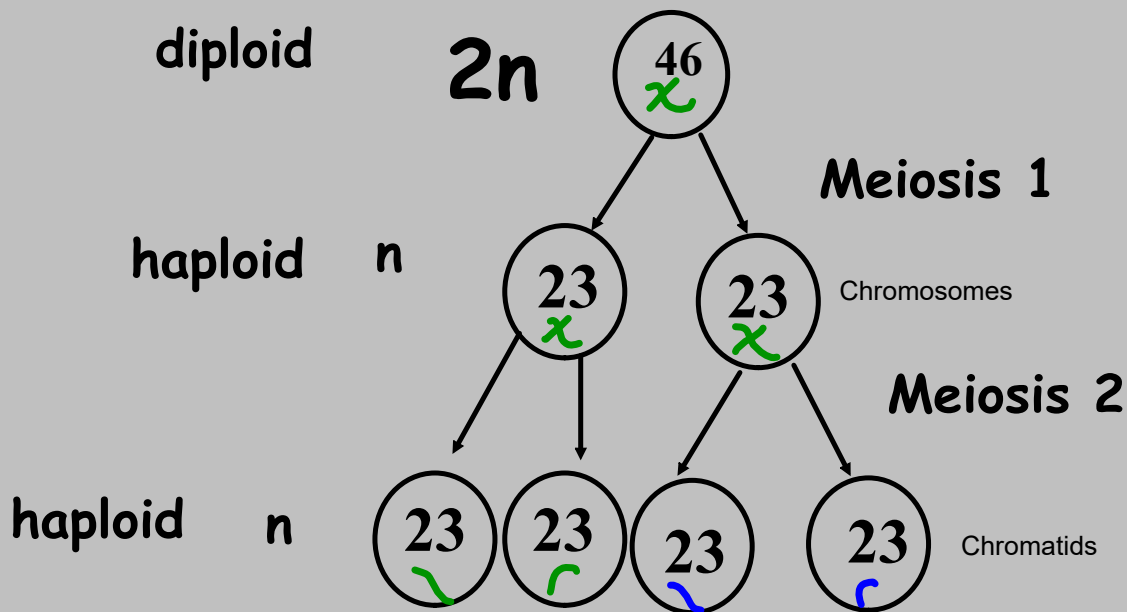
- 2) Reproductive cells produce sex cells that contain only half the number of chromosomes through a process called meiosis.



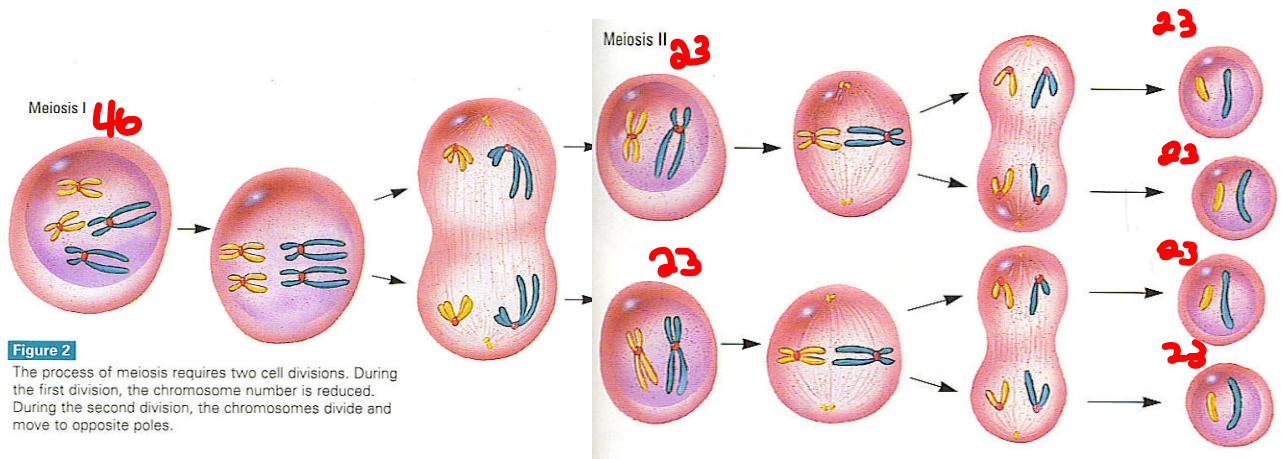
**They are haploid, which means they only have half the chromosome number. Also called  $n$**



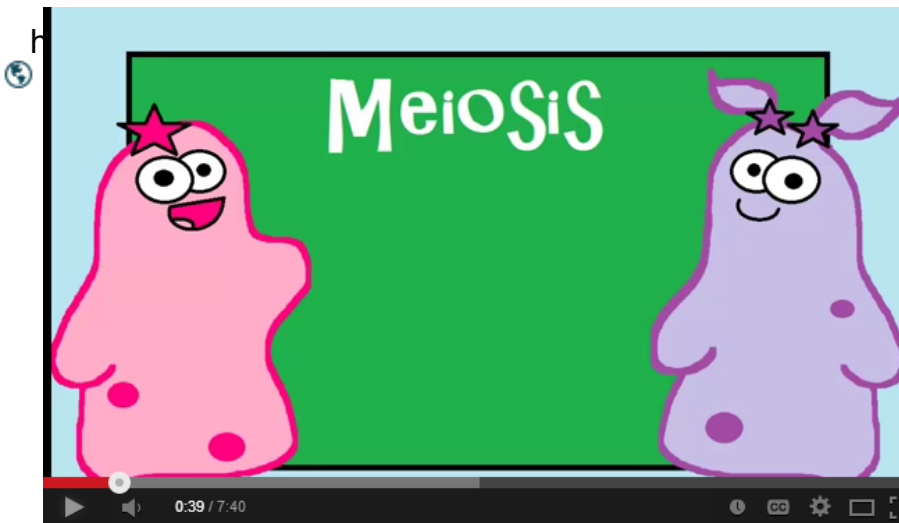
Meiosis has two stages. In the first stage, you go from 46 chromosomes to 23 chromosomes (the homologous chromosomes go to opposite poles). In the second part, the chromosomes divide (just like mitosis). The end result is 4 daughter cells that are all haploid.





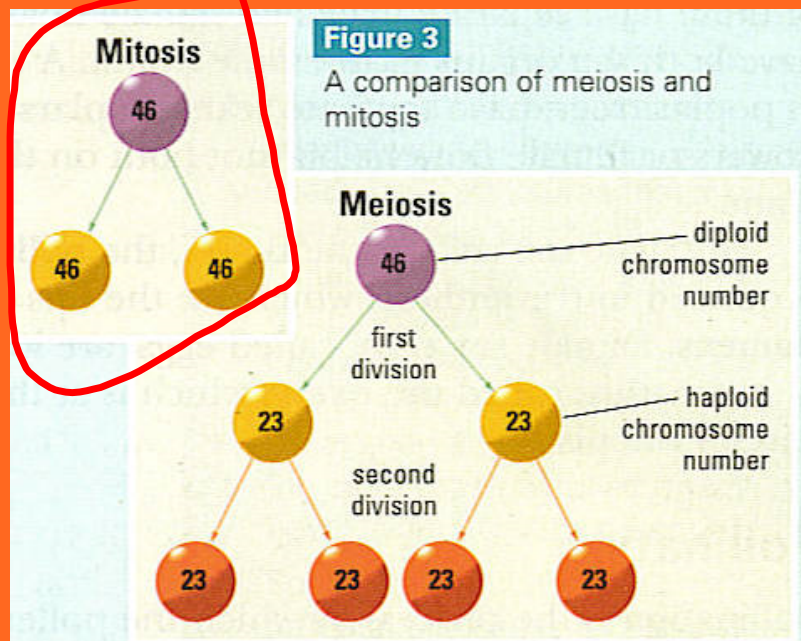


**Figure 2**  
The process of meiosis requires two cell divisions. During the first division, the chromosome number is reduced. During the second division, the chromosomes divide and move to opposite poles.



Meiosis: The Great Divide  
<https://www.youtube.com/watch?v=VzDMG7ke69g>





## Meiosis

[http://www.pbs.org/wgbh/nova/miracle/divi\\_flash.html](http://www.pbs.org/wgbh/nova/miracle/divi_flash.html)



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### Student Friendly:

- How are the sperm and eggs made
- What happens if a sperm or an egg gets too much, or too little material.

## Chromosomes in Babies

- 23 chromosomes from mother
- 23 chromosomes from father

Father determines the sex of an offspring

Female Baby → will have  $X X$  pair of chromosomes  
 ← come from mom      ← came from Dad

22 other pairs (44 other chromosomes)

Male Baby → will have  $x y$   
 → 22 other pairs      ← Dad gave 'Y'  
 ↳ 44 total chromosomes not related to your sex





page 207  
Questions 4-8

1) How do somatic cells and reproductive cells differ from each other? How are they similar?

**Somatic cells have a full complement of chromosomes(46 humans) vs. reproductive cells have half complement of chromosomes(23).**

**Similar - have some chromosomes in common.**

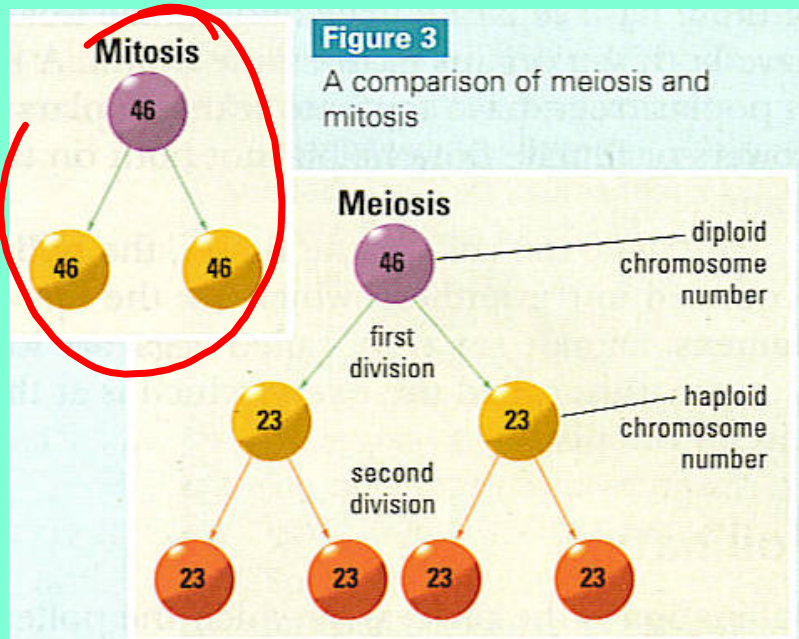
2) What are homologous chromosomes?

**Homologous chromosomes - chromosomes that are similar in size, shape, and gene arrangements. Each one of the 23 chromosomes that you receive from your dad matches one from your mom.**

3) Describe the two divisions of meiosis.

**During the first division, called meiosis I, the homologous chromosomes move to opposite poles. It is during this division that diploid cells separate into two haploid cells. Meiosis I is often called reduction division because the chromosomes number is reduced by half. The diploid or  $2n$  chromosome number following the first division. The second phase, called meiosis II, is marked by the division of the double-stranded chromosome.**

4) Use Figure 3 to compare meiosis and mitosis.



<b>Mitosis</b>	<b>Meiosis</b>
<b>One division</b>	<b>Two division</b>
<b>Two cells produced</b>	<b>Four cells produced</b>
<b>Cells are identical to parent</b>	<b>Cells contain half the chromosome number of the parent</b>

## 5) Why is meiosis necessary?

**If meiosis didn't occur, the combination of sex cells would produce a zygote with double the chromosomes, next generation would double again and so on...**

6) A dog has 78 chromosomes in each somatic cell. How many chromosomes would you find in each of its sex cells?

**Dog cell 78 chromosomes -  
sex cell 39 chromosomes**

7) Do homologous chromosomes have the same number of genes? Explain why or why not.

**Yes, they have the same number of genes. In addition, genes that code for the same characteristics are located in the same position along homologous chromosomes. Each parent contributes one of the homologous chromosomes.**



8) Do homologous chromosomes have identical genes? Support your answer.

**Genes code for the same characteristic but they may not be identical. For example, if the genes on homologous chromosomes of a fruit fly zygote are mapped, you find the gene coding for eye colour is located in the same position on a chromosome contributed by the male and female sex cells. However, the gene itself may be different. The male might contribute a gene for red eye-colour while the female contribute a gene for white eye-colour.**

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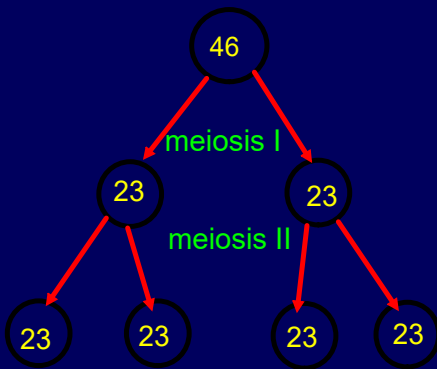
- What happens if a sperm or an egg gets too much, or too little material.
- How can genetic disorders be detected prior to birth by genetic screening

# Making a Baby

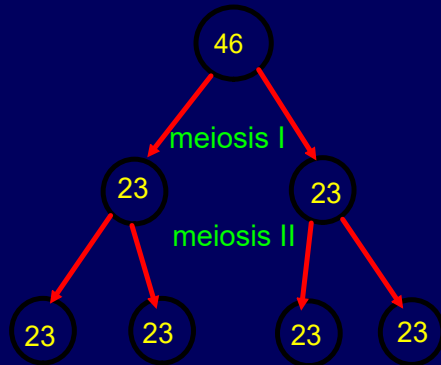
Please copy down

When a reproduction occurs correctly:

Male



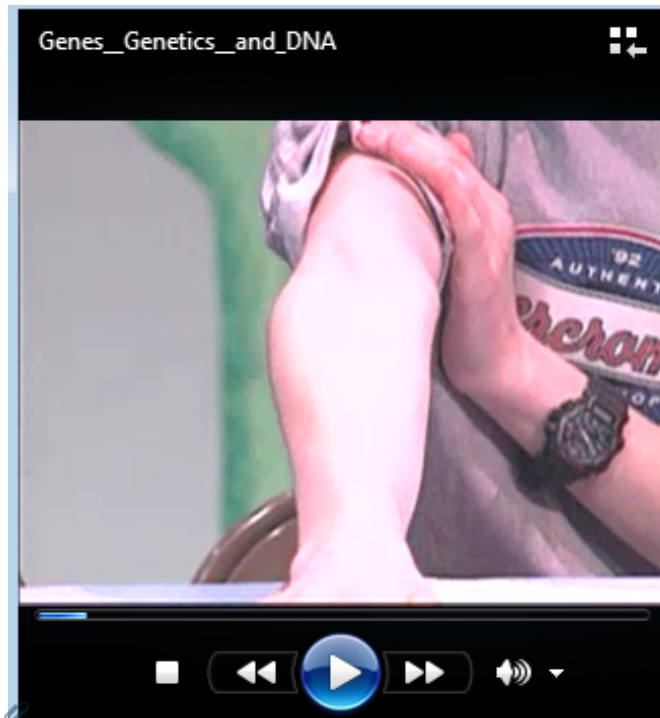
Female



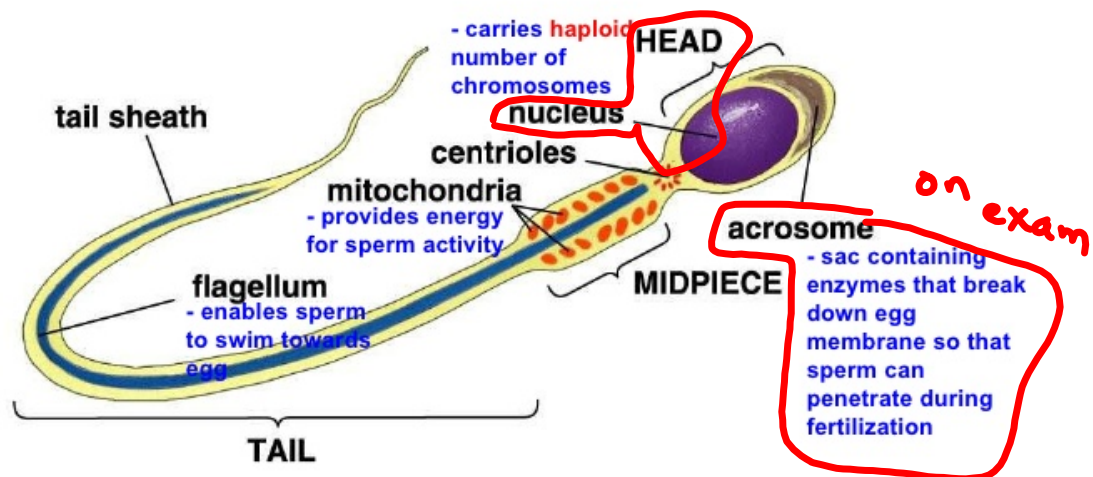
So when parents reproduce only one egg and one sperm is required

Baby





# Sperm Anatomy



*on exam*

Testes - are the primary reproductive organ for males mammals.

- produce and nourish sperm
- Have seminiferous tubules that are lined with reproductive cells (46 chromosomes) that produce sex cells(23) by meiosis *occurs*

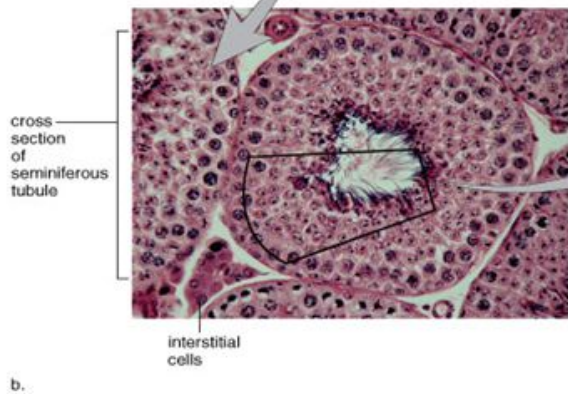
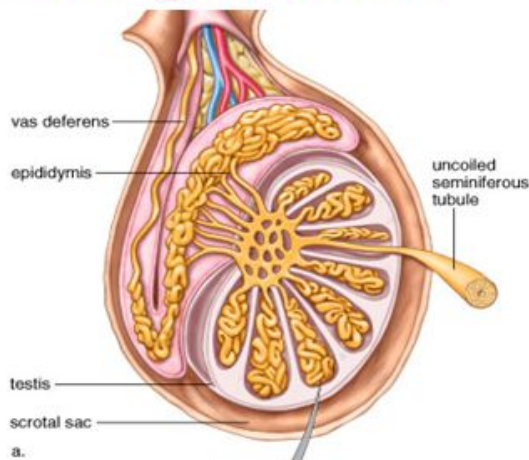
The immature sperm cell then moves to the epididymis to further develop, gaining a tail and reducing cytoplasm.

-Sperm that is not released for reproduction will die within a few days and are replaced by newer cells.

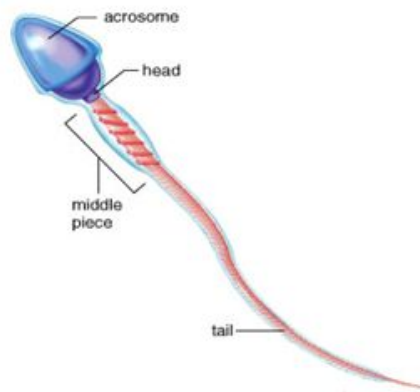
- males produce millions of sperm each day

[https://www.youtube.com/watch?v=-XQcnO4iX\\_U](https://www.youtube.com/watch?v=-XQcnO4iX_U)

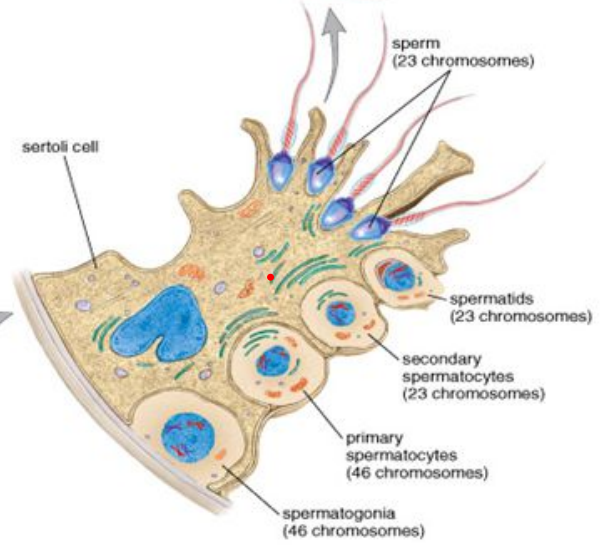
# Male gametes:



inies, Inc. Permission required for reproduction or display.



d.

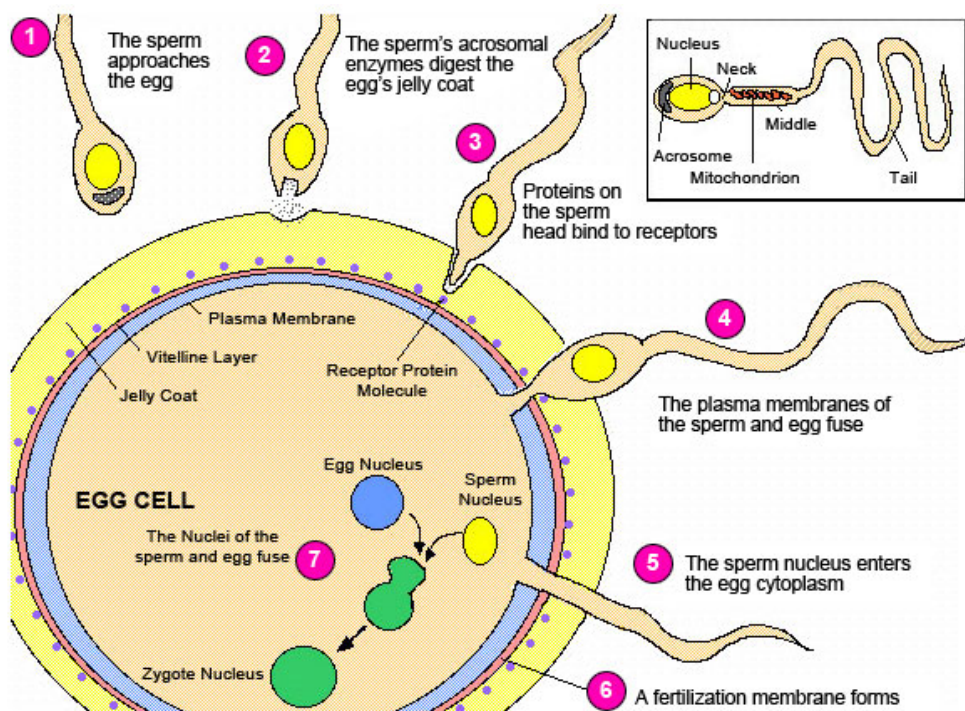


c.

## Fertilization

Exam (MC)

-Each egg is fertilized by one sperm. [The sperm uses the stored chemical in the acrosome to enter the egg, but the egg permits only one head to enter and the body remains outside. As soon as one sperm enters then the egg puts a chemical barrier so no other sperm can get through.] ]



Up until 7 weeks following fertilization human male and female embryos look identical. Then a chemical messenger, "a hormone", is sent from the brain to stimulate the development of the sexual structures

After birth the reproductive organs in both male and females produce low levels of sex hormones until puberty.

*on Exam*

**Puberty**- is a period of rapid growth and sexual maturity.

- occurs between 9- 15 years of age
- hormones are released from the pituitary gland that increase testosterone in males and estrogen & progesterone in females

-males can produce sperm for the rest of their life (some males 90 can father children)



## Female Reproduction System

- more complicated than the males

Exam

Egg

- larger than the sperm cell
- packed with nutrients so that when it is fertilized it can divide quickly.
- build barrier after it is fertilized by sperm
- develops one egg at a time (1 a month) -
- develops in the ovary

Ovary contains small groups of cells, called follicles. These follicles have 2 types of cells

- 1) reproductive cells that produce eggs and
- 2) nutrients producing cells that provide chemicals to help the egg grow.

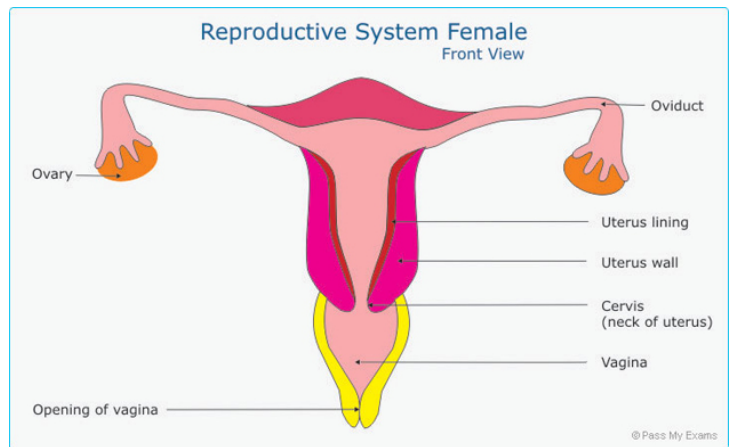
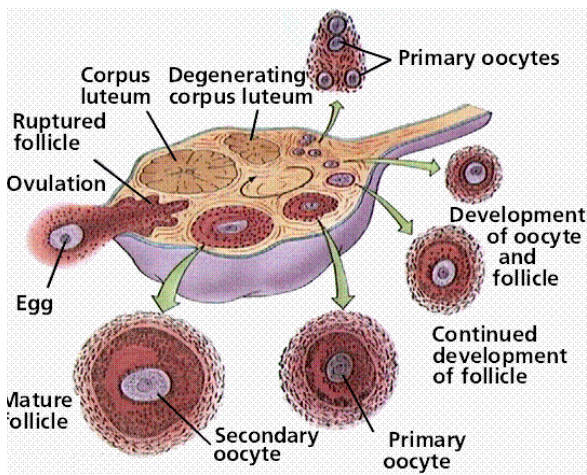
- females are born with 400 000 immature follicles

-As a follicle develops, the reproductive cell, that contains 46 chromosomes, will undergo meiosis. (It will form 1 large egg, with 23 chromosomes, and 3 other tiny cells that disintegrate.)

-Now the nutrient cells will surround the egg and help it grow. It will grow until it will rupture the follicle and be released into the oviduct.

-The egg must be fertilized in the oviduct if there is to be a zygote.

- If fertilized it will embed in the endometrium wall and start mitosis. If it is not fertilized then the endometrium is shed in a process called menstruation.



<https://www.youtube.com/watch?v=RFDatCchpus>

10 min

Read page 218 & 220-221 And answer question a to i

a) no the women would reach menopause. No more eggs are developed by in the ovary. Sperm cells continue to be reproduced well into a man's later years.

b)  $50 - 13 = 37$

$37 \text{ reproductive years} \times \frac{365 \text{ days}}{\text{year}} \times \frac{1 \text{ cycle}}{28 \text{ days}} = 482 \text{ ovulation}$

c) it would not be possible; she give birth once a month. A woment does not ovulate while she is pregnant.

d) on the inside wall of the uterus

e) The endrometrium provides the baby with nutrients.

f) Follicle cells develop in the ovary.

g) Progesterone levels only begin to rise after ovulation because it is formed by the corpus luteum, which forms from the follicle cells following ovulations

h) Progesterone in birth control prevents ovulation. If no egg leaves ovary, the women cannot become pregnant.

i) If an egg were releases into the oviduct during pregnancy then the women would become pregnant with 2 different children of different ages.

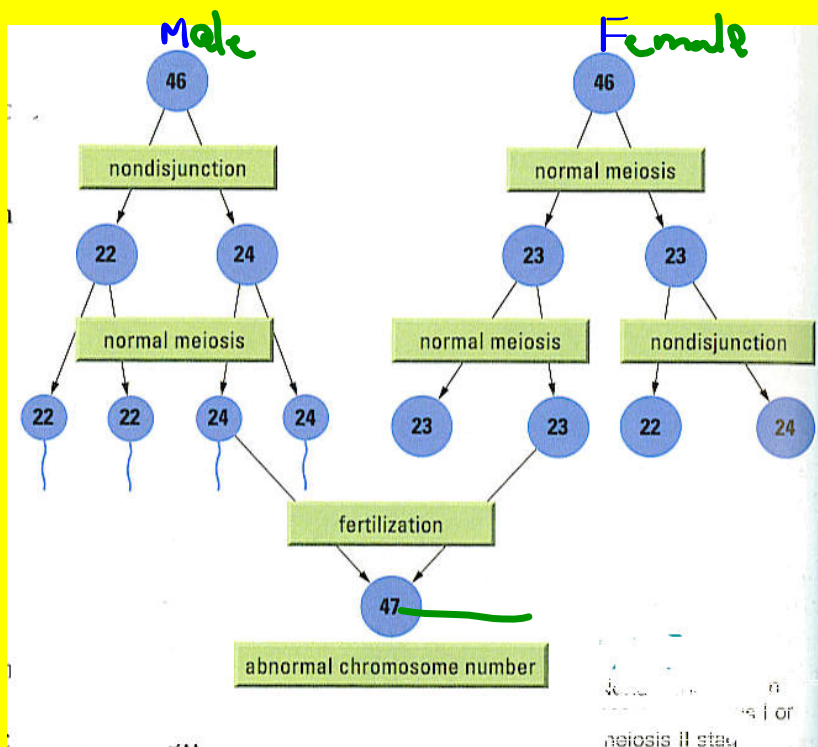
## Atypical Meiosis

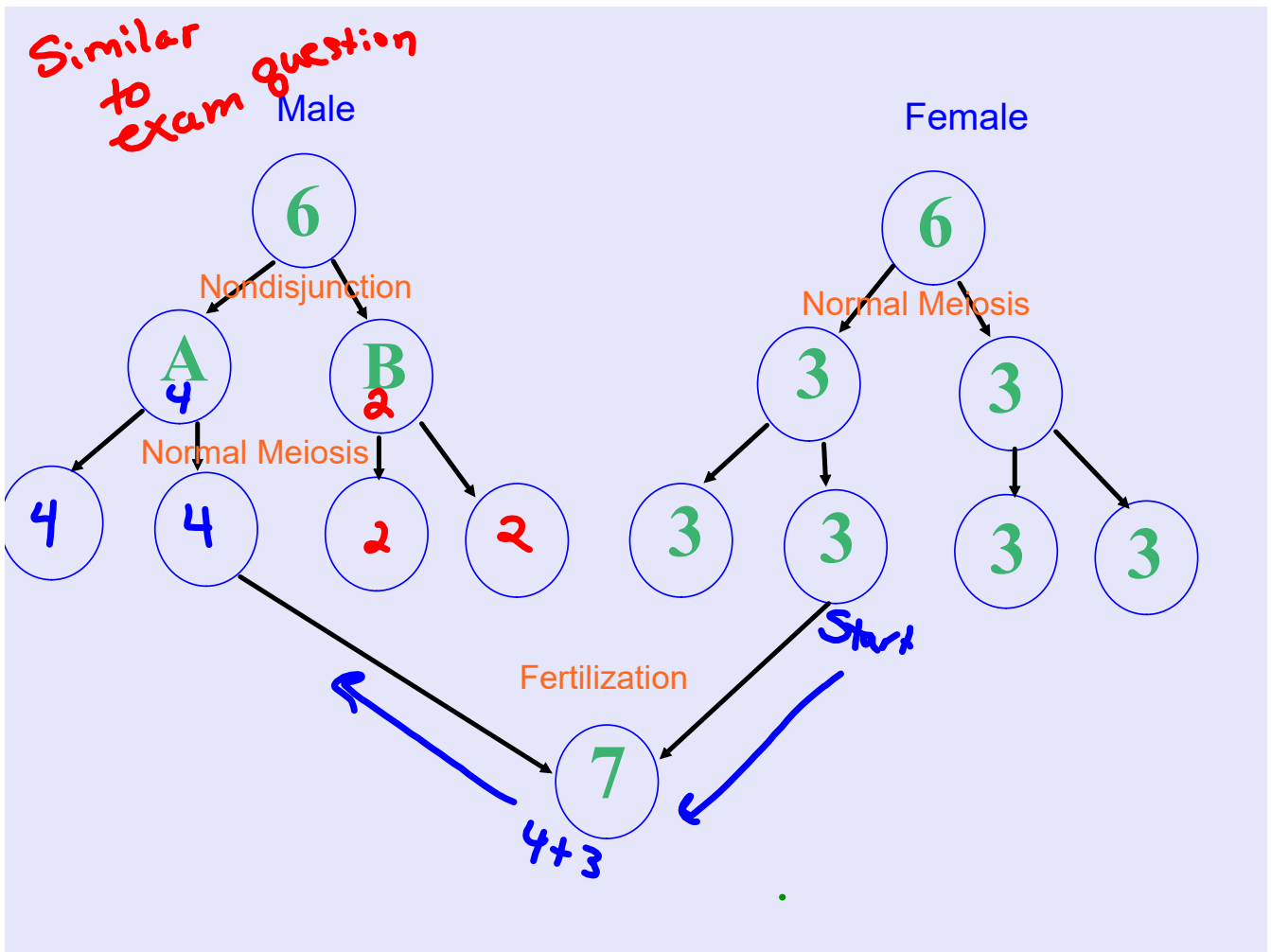
Most processes of the body can go wrong, including cell division. If errors occur during division of somatic cells, such as a skin cell or liver cell, it may not harm the organism, which has many other cells.

However, if something goes wrong during meiosis in a reproductive cell, the resulting embryo is in serious trouble: all of its cells will be affected.

Sometimes during meiosis, a mistake happens, in which chromosomes get stuck and do not separate. As a result the reproductive cells don't get the right number of chromosomes. This is called **nondisjunction**.

As a result one daughter cell will have too many chromosomes while the other has too little





NOT  
on test or Exam

Note:

Cells that lack genetic information or  
have too much information will not  
function properly

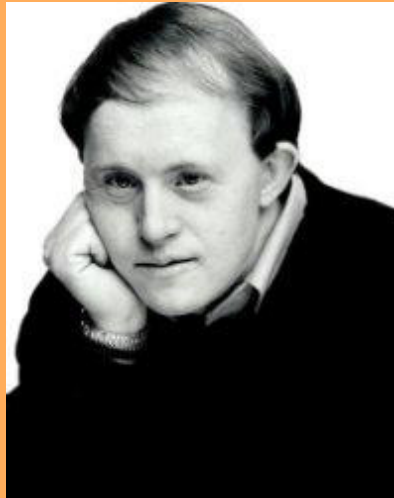
In humans, PG 222



**This type of problem can come from either the mother or the father. The resulting imbalance of genetic material gives the fertilized egg too little or too much genetic information.**

### Examples of nondisjunction include

DOWN SYNDROME: an extra 21st chromosome, a trisomic disorder where a person has too much genetic information. Many varying traits such as full face, short, large forehead. Affects 1 in 600 babies. Mothers over 40 years of age have a 1 in 40 chance of having a Down Syndrome baby.



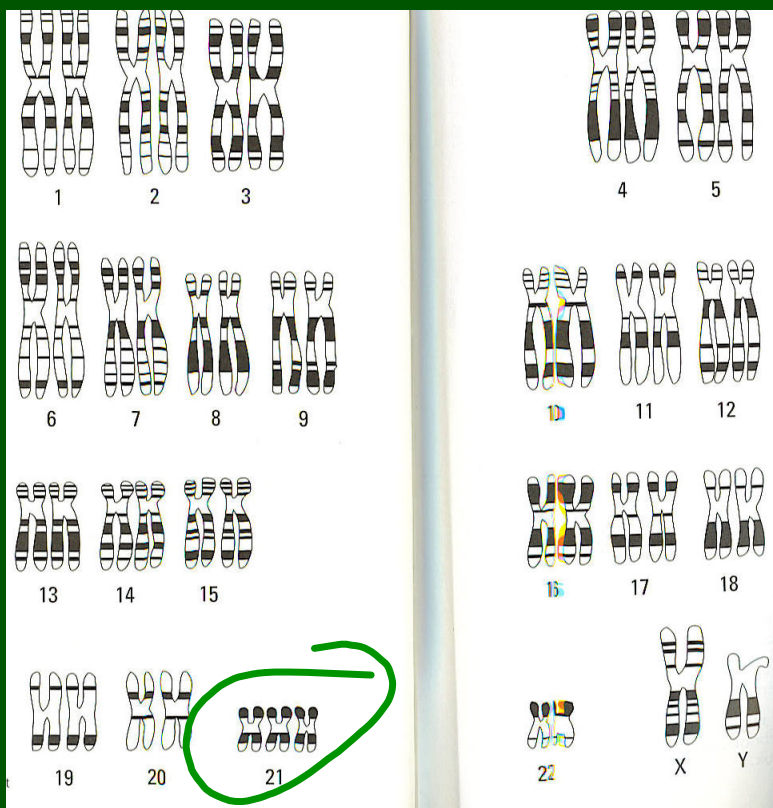
Xx	Xx	Xx	-	-	-
Xx	Xx	Xx	-	-	-
			-	-	-

23 pairs  
↓  
22 reg pair  
1 sex chromosome pair





Just Like You-Down Syndrome



**The chances of having a child with a chromosomal inheritance error become greater as women grow older .**

**Down Syndrome Occurrence and Mother's Age**

- **Women in their 20s who become pregnant have about a one-in-1,230 chance of having a pregnancy affected with Down syndrome.**
- **At age 30, it's one in 690.**
- **By age 35, the chances increase to one in 270.**
- **At age 40, the risk is one in 78.**
- **At age 45, chances are one in 22.**

## Attachments

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Genes\_\_Genetics\_\_and\_DNA.mp4