

HOW DO LIVING THINGS SEXUALLY REPRODUCE



**BESIDES ANIMALS, WHAT OTHER
THINGS REPRODUCE SEXUALLY?**



COURTSHIP RITUALS



THINK OF A FAMILY THAT HAS BOTH BIOLOGICAL PARENTS AND HAS 2 OR MORE CHILDREN

- #1 Consider what the parents look like, what the children look like
- #2 What features do they have in common? What are different characteristics?
- #3 How do you think we end up with our characteristics?
- #4 Why do you think offspring from the same parents look different?



SEXUAL REPRODUCTION

Animals and many other living things reproduce **sexually**

- When living things reproduce **sexually**, the offspring is **unique**
- Half of the offspring's DNA comes from the **Male** parent, and the other half from the **Female** parent.
- The cells contributed by the male and female are the sex cells or **gametes**

Figure 1.14: In sexual reproduction, each of the two parents contributes characteristics to the offspring. What do you think the male and female parents of this litter might look like? What is your reasoning?



SEXUAL REPRODUCTION INVOLVES SEX CELLS

Gametes:

- Male or female reproductive cells
- Male gamete
 - *sperm cell* produced in testes
- Female gamete
 - *egg cell* (ovum) produced in ovaries



SEX CELLS

Central event of sexual reproduction:

- Contact between the gametes (sperm and egg)
- Sperm and egg (and their genetic information) combine to produce a new single cell that develops into an offspring

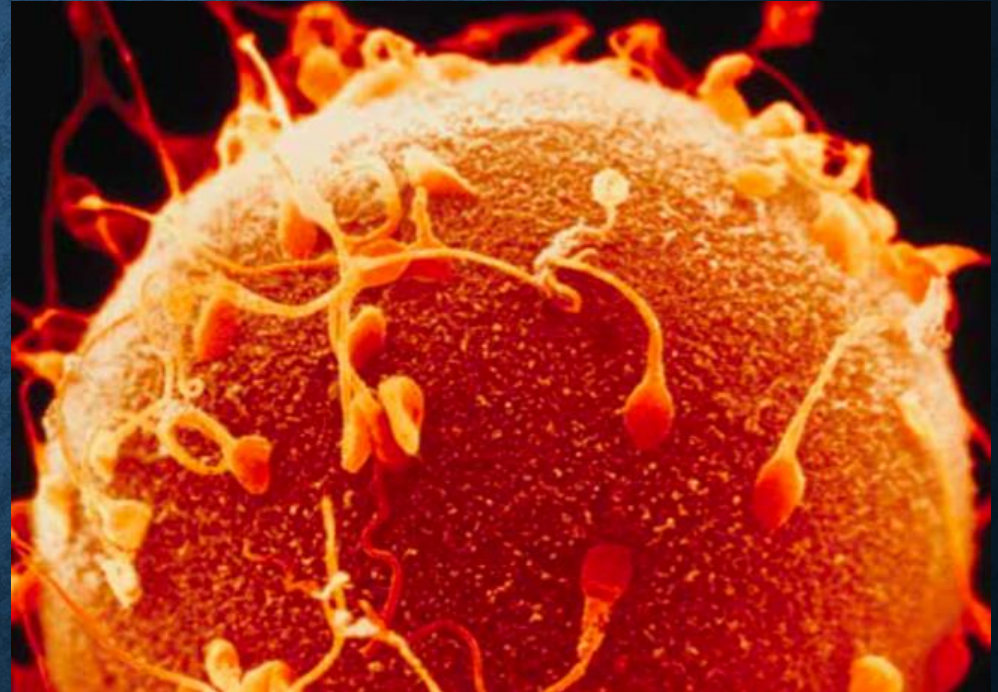
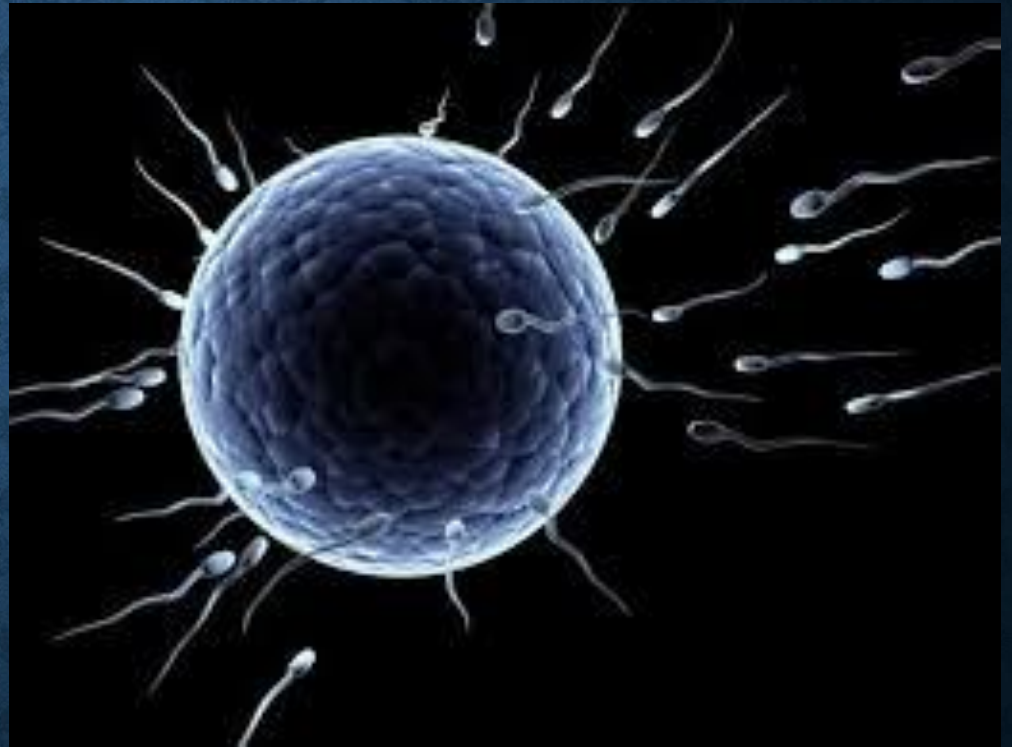


Figure 1.16: Of the many sperm that approach and surround an egg, only one can fertilize the egg.

FERTILIZATION

Fertilization:

the process in
which male and
female gametes
combine



INTERNAL FERTILIZATION

- Some organisms like Humans carry out **internal** fertilization, in which fertilization occurs inside the female.
- Nuclei of two gametes fuse together to form a single cell called a *zygote*
- Zygote contains genetic information from the sperm cell and egg cell

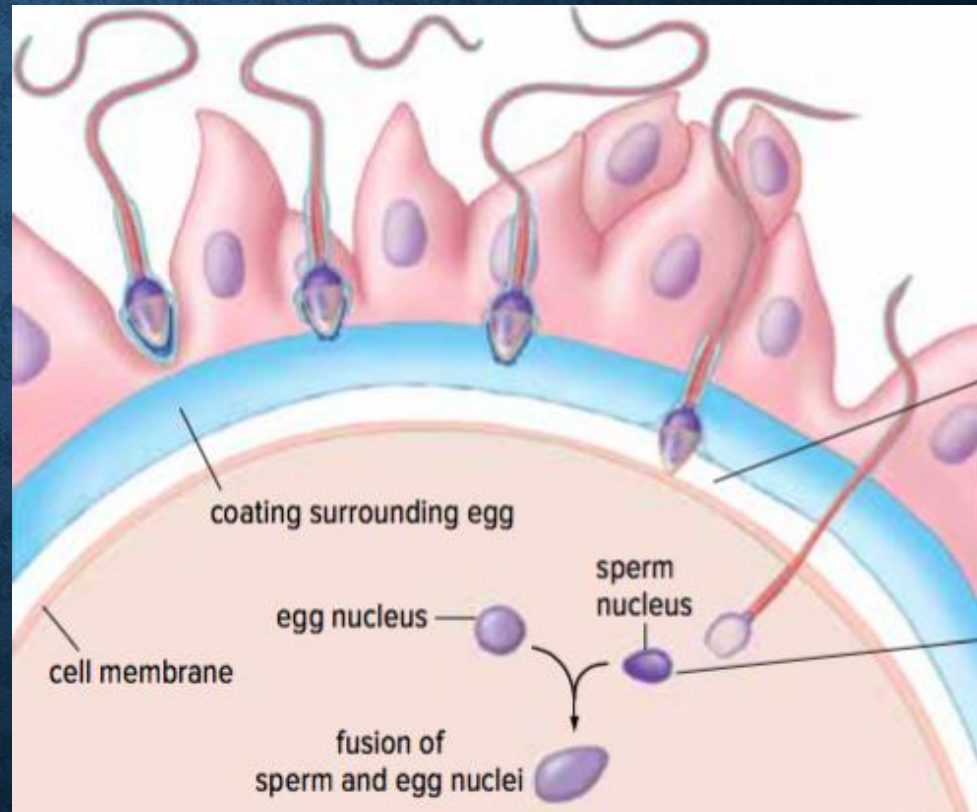


Figure 1.17: When a sperm cell fertilizes an egg cell, the two nuclei fuse and a zygote forms.

FERTILIZATION (CONTINUED)

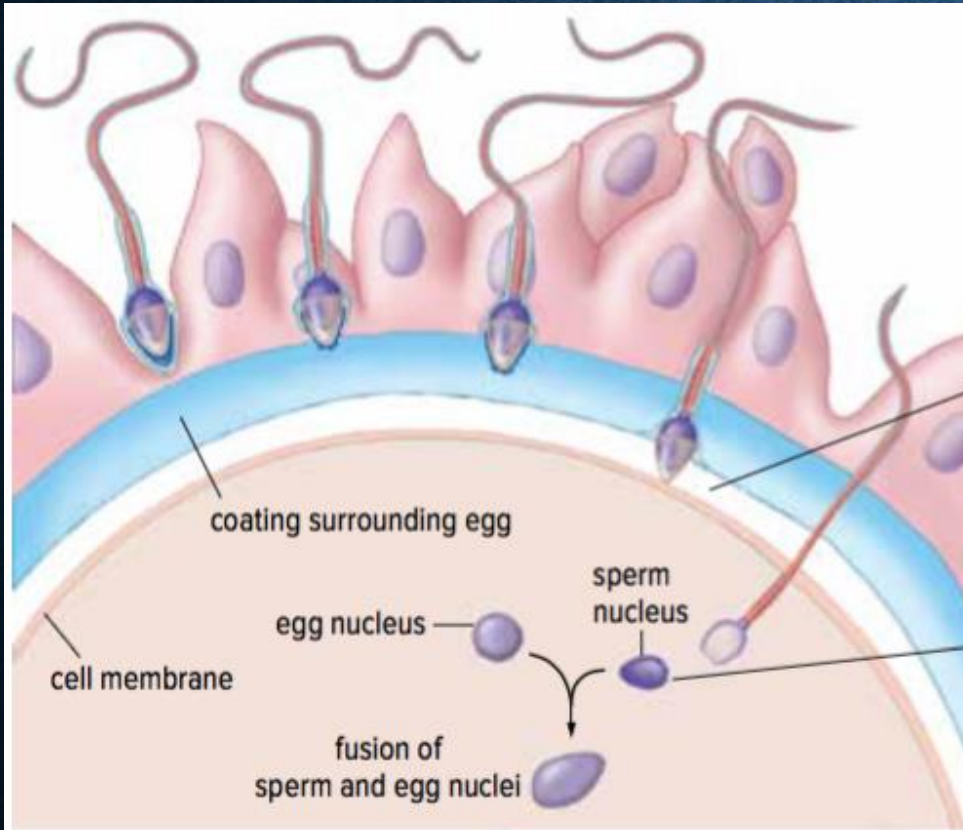


Figure 1.17: When a sperm cell fertilizes an egg cell, the two nuclei fuse and a zygote forms.

Sperm cells reach a jelly-like coating surrounding the egg cell and release substances that digest a path through the coating. This helps sperm cells get closer to the cell membrane of the egg.

The head of one sperm cell eventually enters the egg cell, where the sperm nucleus fuses with the egg nucleus.

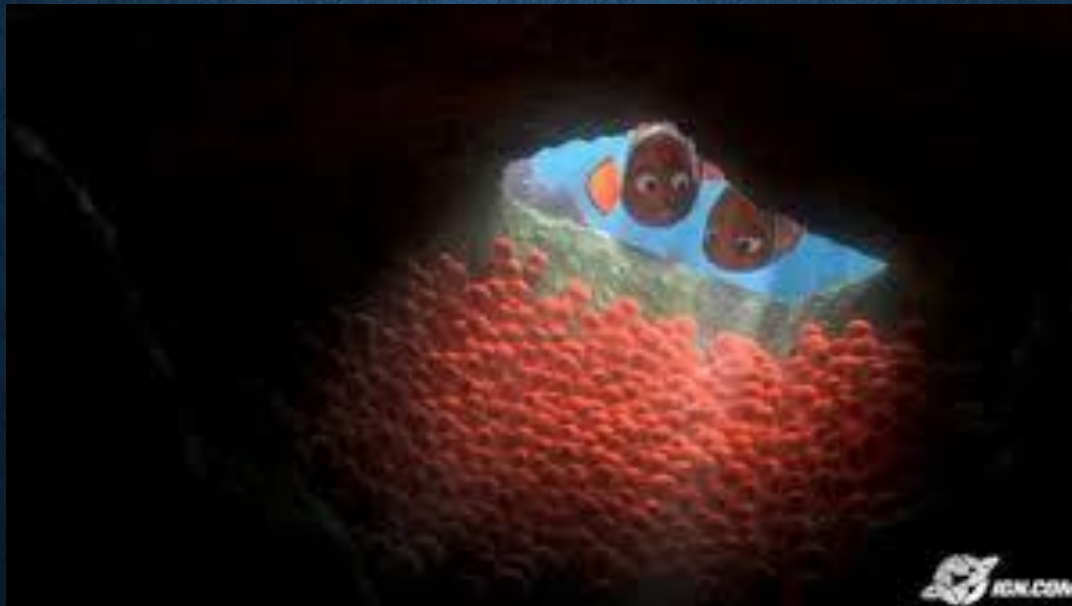
EXTERNAL FERTILIZATION

- Some species, like salmon, carry out **external** fertilization.
- In this process, the female deposits **unfertilized** eggs and males release **sperm** over the eggs



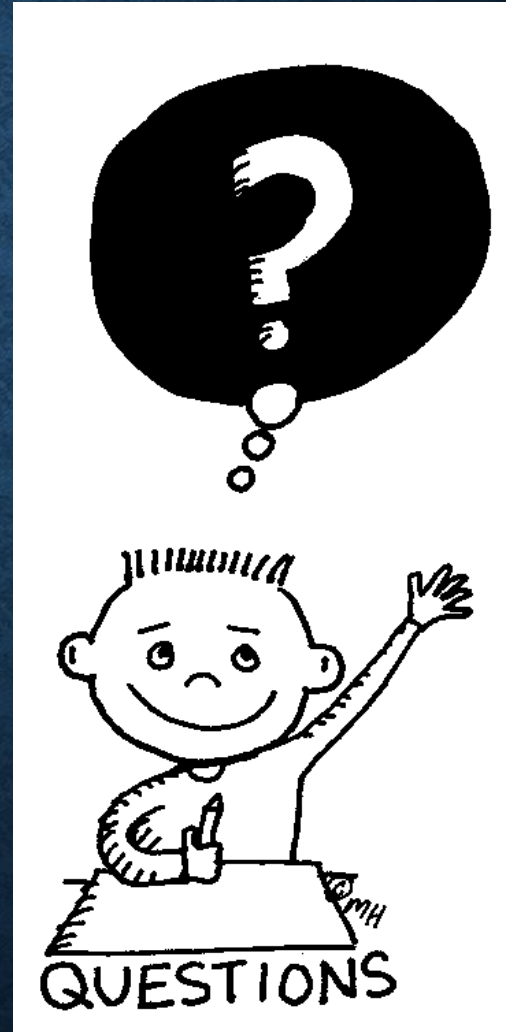
ACTIVITY!

- Comparing Internal and External Fertilization



QUESTION!

- How do we reproduce sexually but still keep the same number of chromosomes in our cells



CHROMOSOMES

- Each species has a particular # of chromosomes in its cells.
 - Gold Fish = 94
 - Fruit Flies = 8
 - Humans = 46



CHROMOSOME NUMBER

Humans have 46 chromosomes that are organized into 23 pairs

- Chromosomes that are paired are called *homologous chromosomes*
- During fertilization, each parent contributes one chromosome of each pair
- Homologous chromosomes have similar features and carry similar genetic information

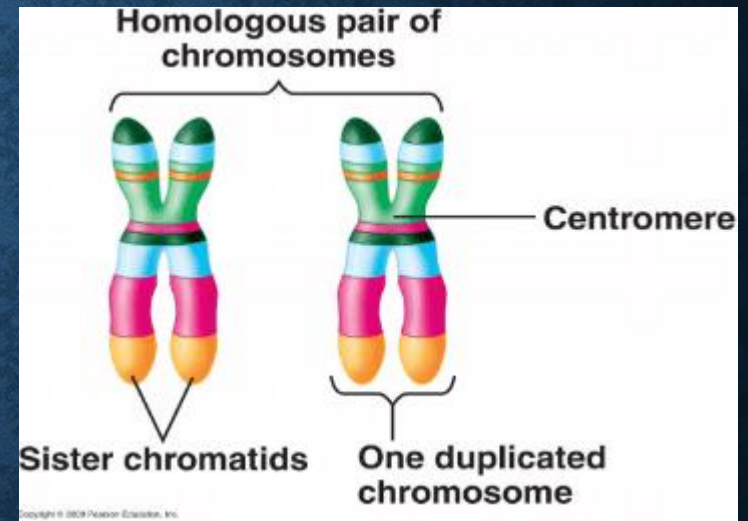
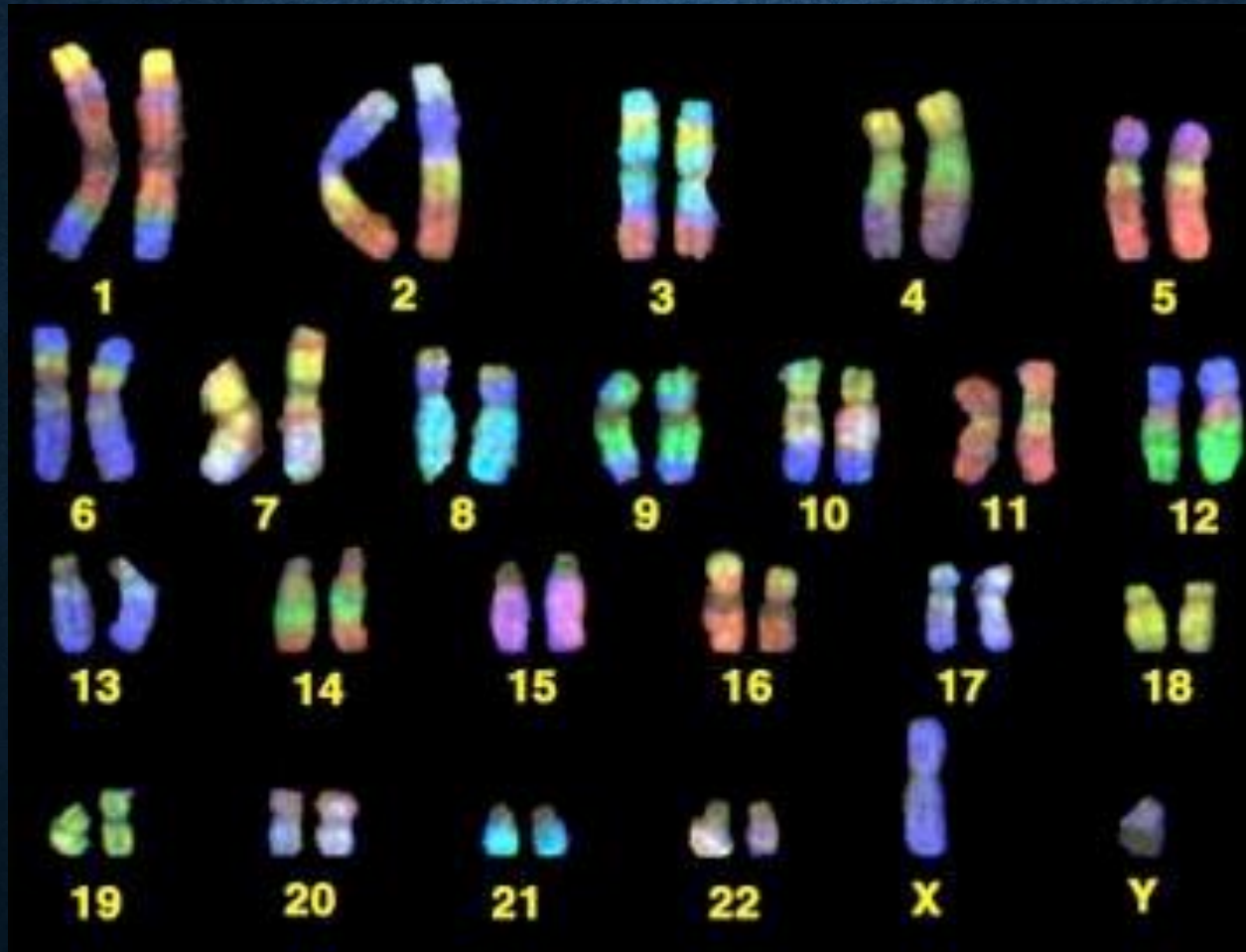












Figure 1.18: In a pair of homologous chromosomes, the female parent contributes one chromosome, and the male parent contributes the other.

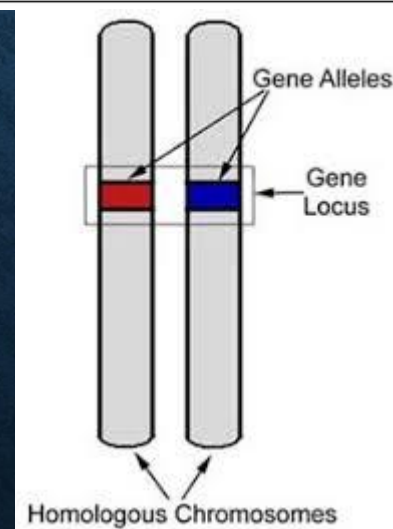
HUMAN KARYOTYPE



VERSIONS OF A GENE

- **Alleles:** different forms of the same gene
 - *Eg. A homologous chromosome will have two different alleles for the same gene*

Gene	Alternative Alleles
 Eye colour	 Brown  Blue  Emerald  Grey
 Hair colour	 Blonde  Red  Brown  Black

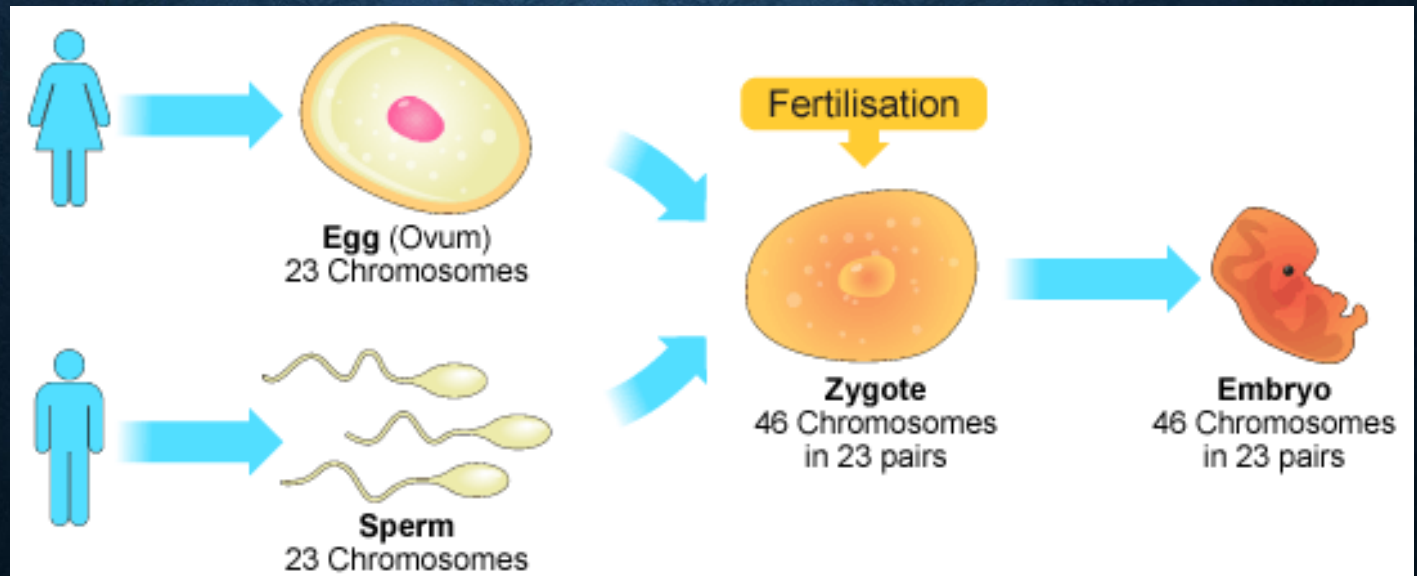


LETS GO BACK TO THE QUESTION...

- If sexual reproduction involves the fusing (combination) of genetic material from two individuals, then why doesn't the offspring have twice the number of chromosomes as their parents
- **Activity: Halves of a Whole**

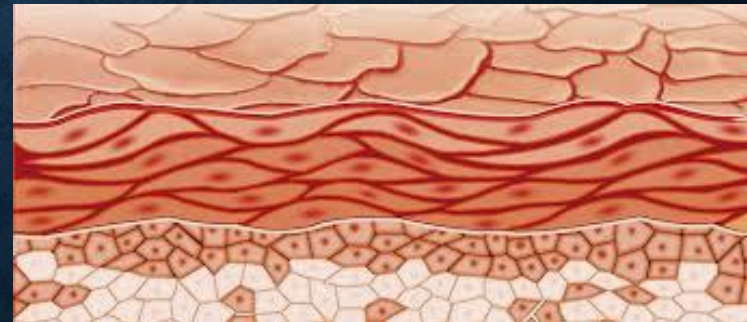
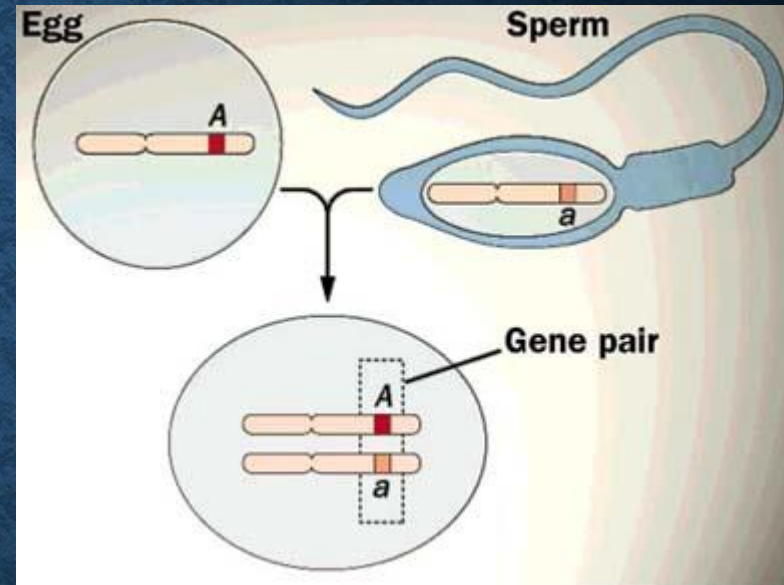
SEXUAL REPRODUCTION

- Since gametes combine in sexual reproduction, each gamete must have half the number of chromosomes than other body cells.
- This ensures the correct number of chromosomes in each offspring from generation to generation.



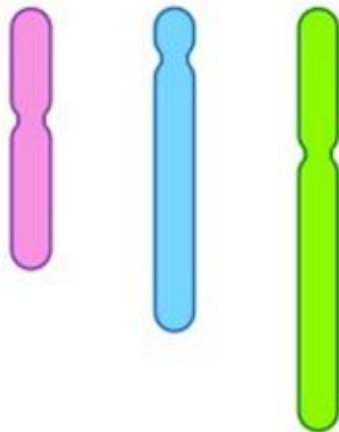
HAPLOID AND DIPLOID

- Cells with half the normal number of chromosomes are called **haploid**
 - Gametes (egg and sperm) are **haploid** cells
- Our body cells have the full number of chromosomes, so they are called **diploid** cells



Haploid (n)

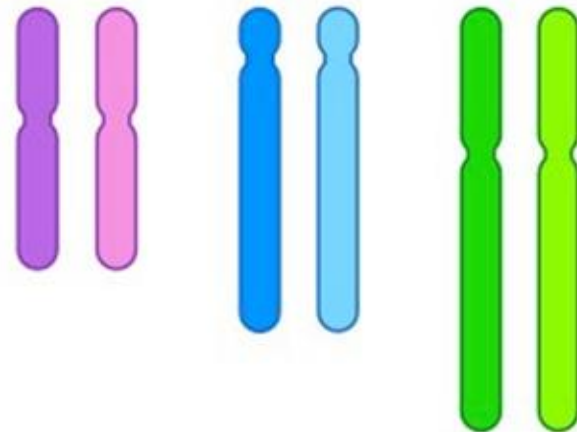
One copy of each chromosome



Three non-homologous
chromosomes

Diploid (2n)

Two copies of each chromosome



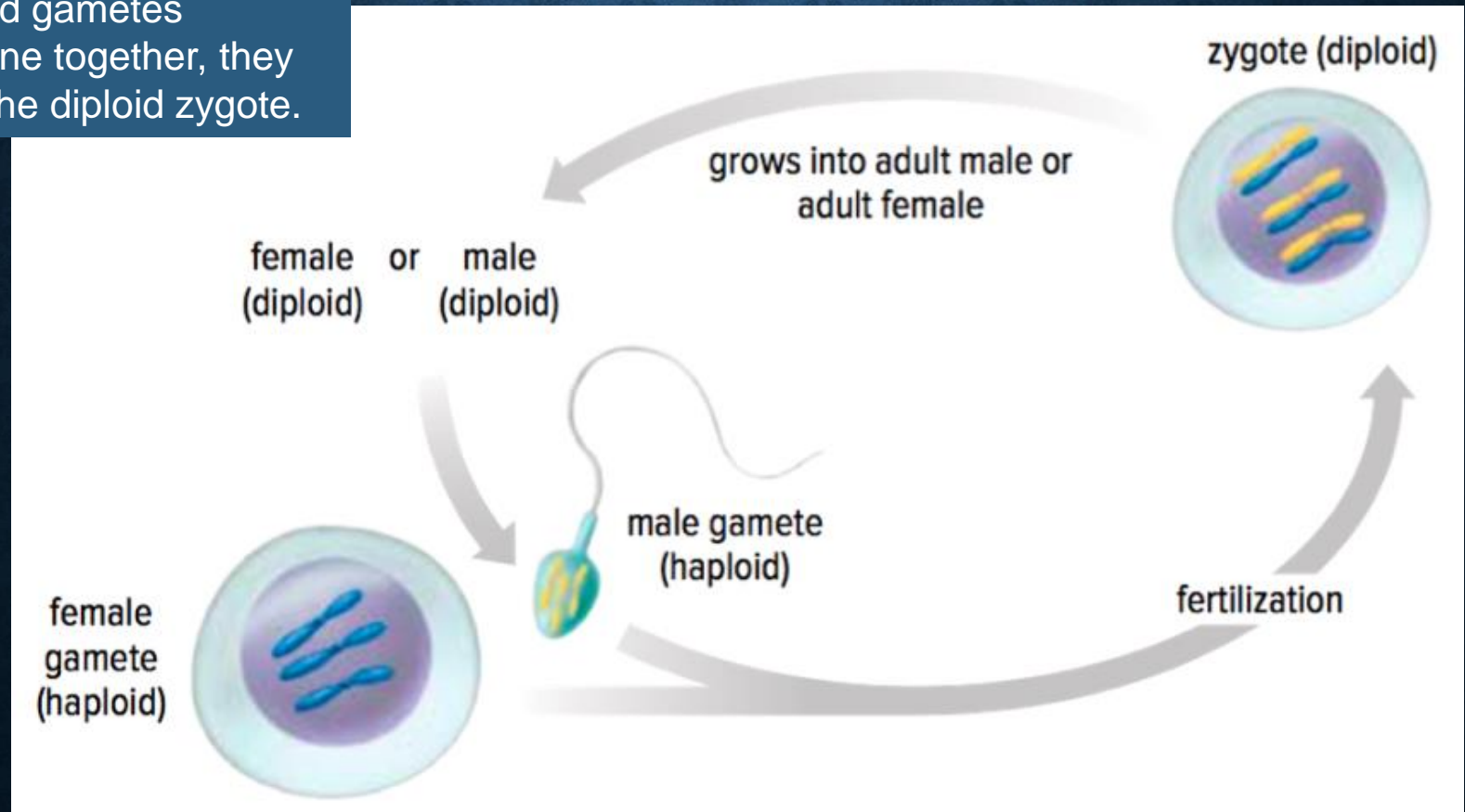
Three pairs of homologous chromosomes
(of maternal and paternal origin)

FILL IN THE BLANK

- Using pg 49 in your textbook fill out and colour the diagram

NUMBER OF CHROMOSOMES IN CELLS: HAPLOID AND DIPLOID (CONTINUED)

Figure 1.19: When haploid gametes combine together, they form the diploid zygote.



**HOW DO DIPLOID ORGANISMS
PRODUCE HAPLOID GAMETES?**

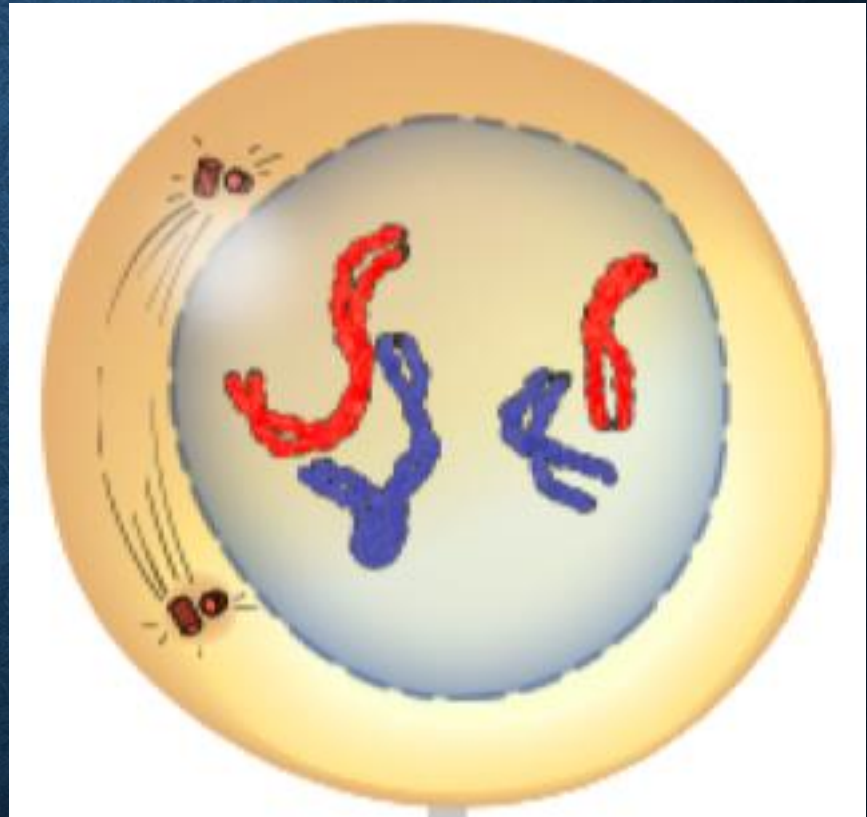
MEIOSIS

Cells that produce gametes undergo a type of cell division called *meiosis*

- **Meiosis:** a diploid cell divides twice to produce four haploid cells
- Offspring are genetically different from parents and from one another (gametes from parents are not genetically the same)
- Process of splitting the homologous chromosomes

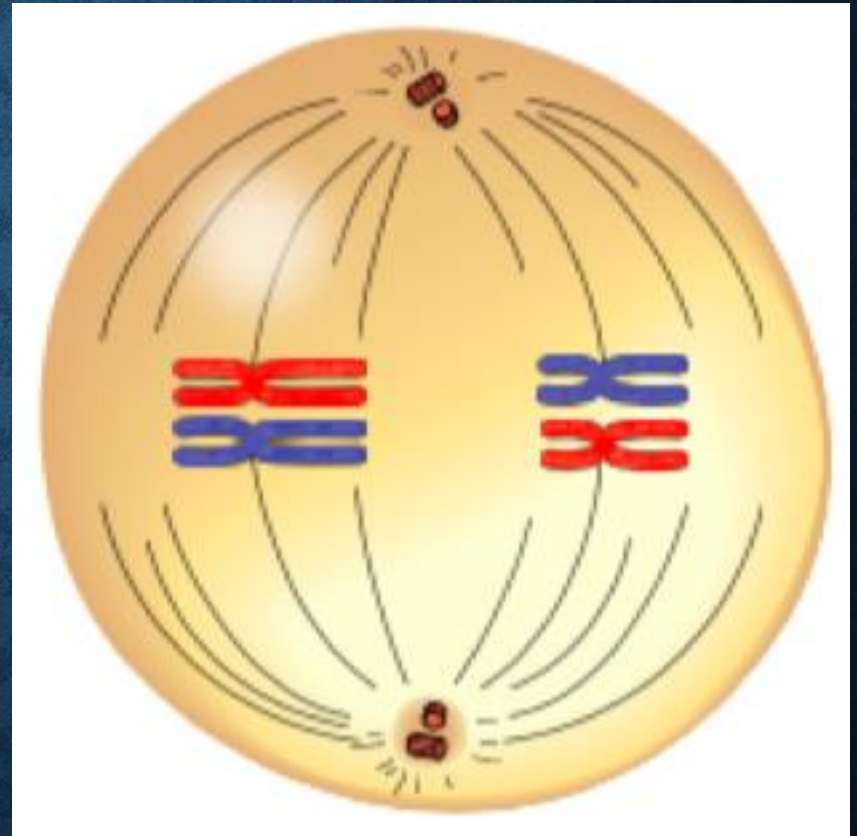
MEIOSIS: PROPHASE I

- Nuclear membrane begins to disappear
- DNA condenses into duplicated chromosomes
- Homologous chromosomes are paired



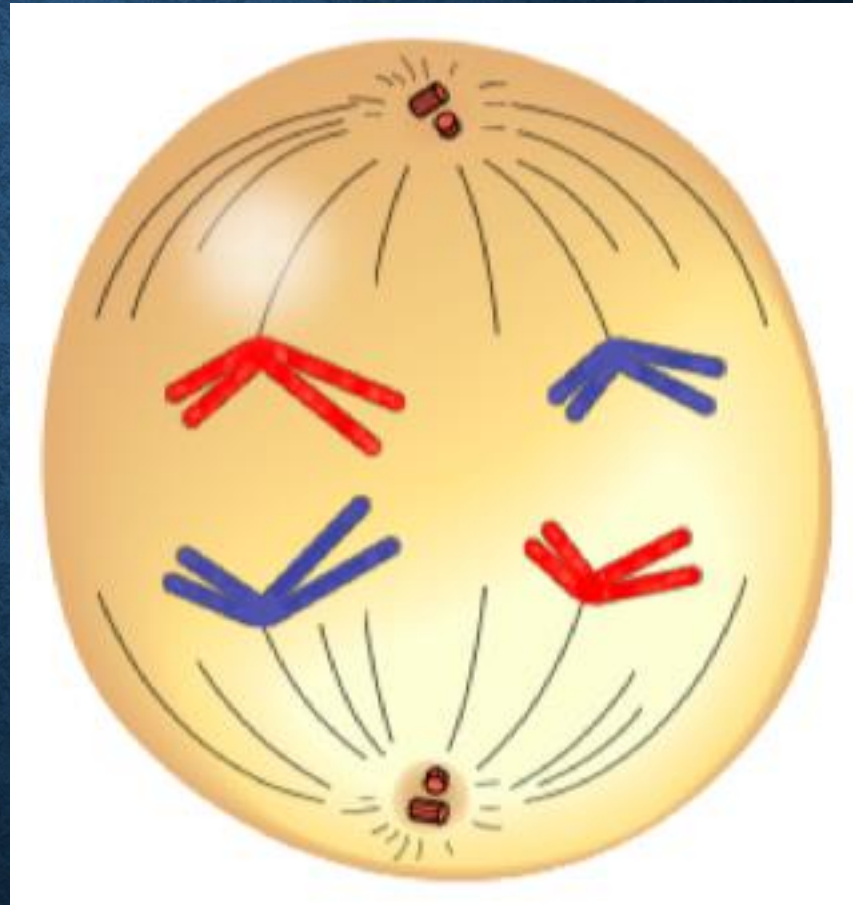
MEIOSIS: METAPHASE I

- Spindle fibres guide chromosome movement
- Homologous chromosome pairs line up along the middle of the cell



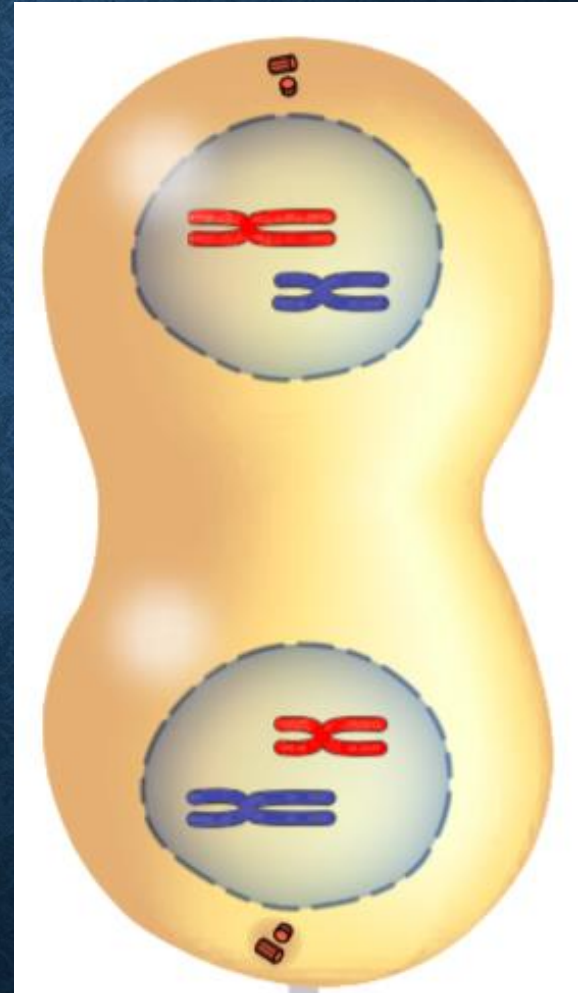
MEIOSIS: ANAPHASE I

- Homologous chromosome pairs separate and go to each end of the cell



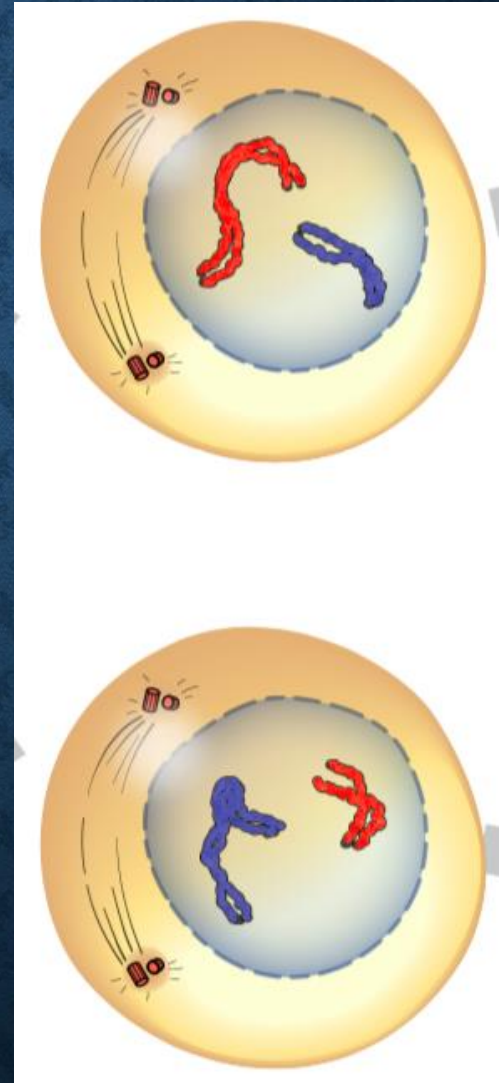
MEIOSIS: TELOPHASE I

- Two nuclei form
- Each nucleus contains a complete copy of the cell's DNA
- Cell divides, forming two cells



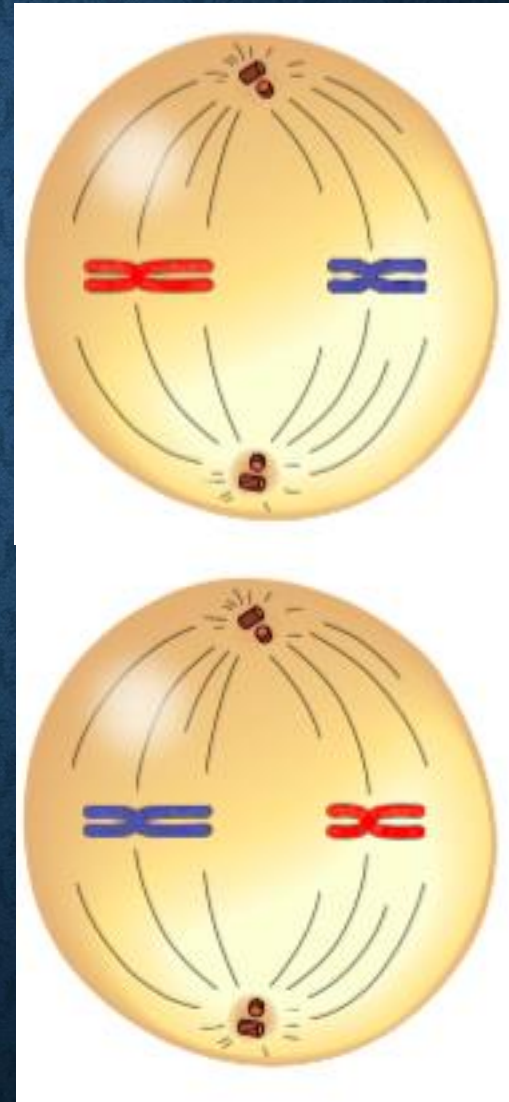
MEIOSIS: PROPHASE II

- Nuclear membrane begins to disappear
- DNA exists as chromosomes



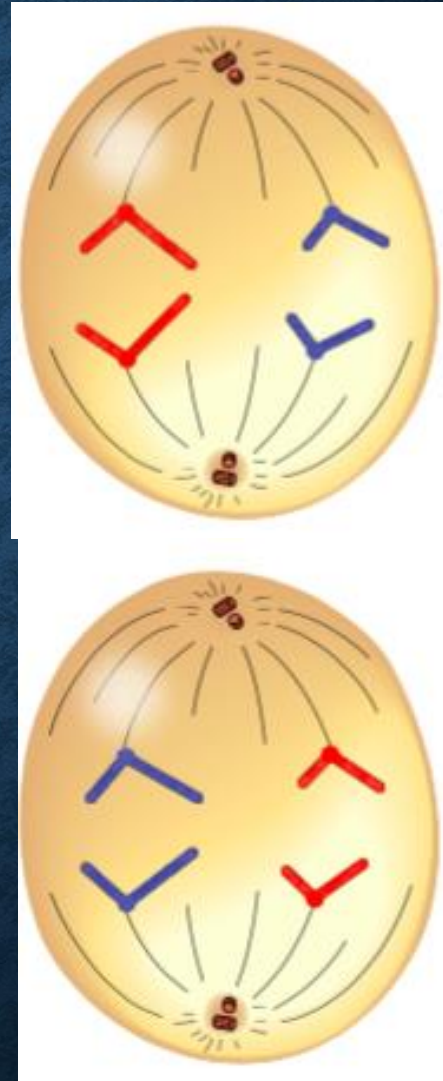
MEIOSIS: METAPHASE II

- Chromosomes line up along the middle of the cell



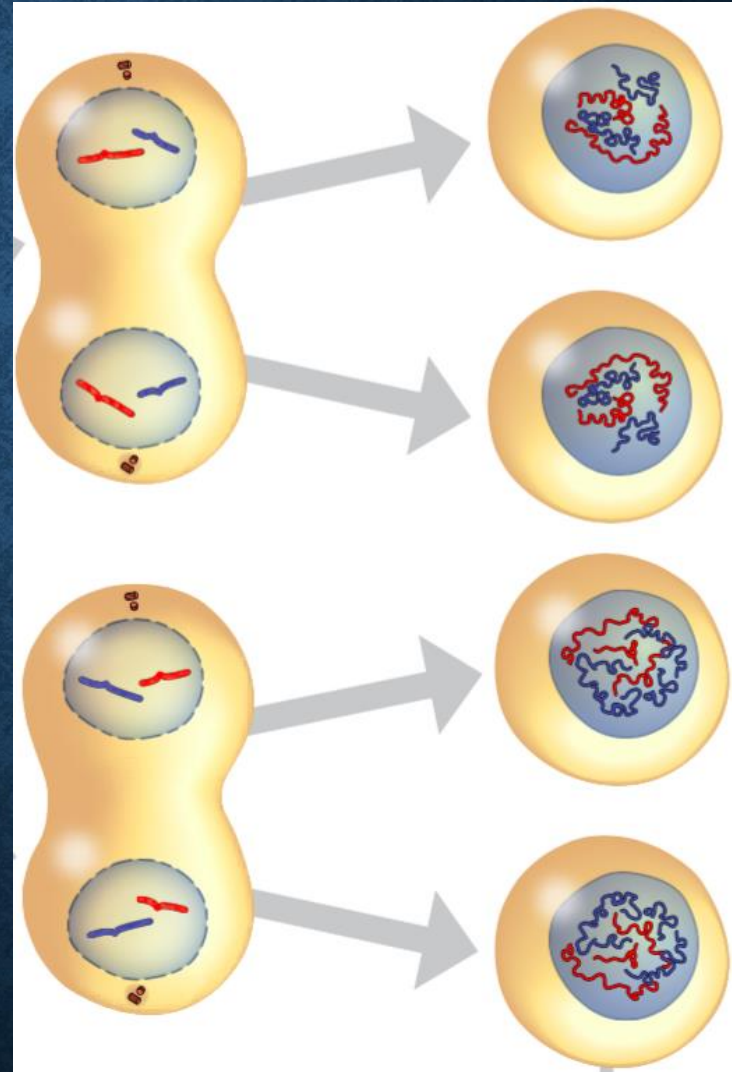
MEIOSIS: ANAPHASE II

- Copies of DNA are separated and go to each end of the cell



MEIOSIS: TELOPHASE II

- Four nuclei form
- Cell divides, forming four new cells
- Each cell has HALF of the original DNA



MEIOSIS: FIRST CELL DIVISION SUMMARY

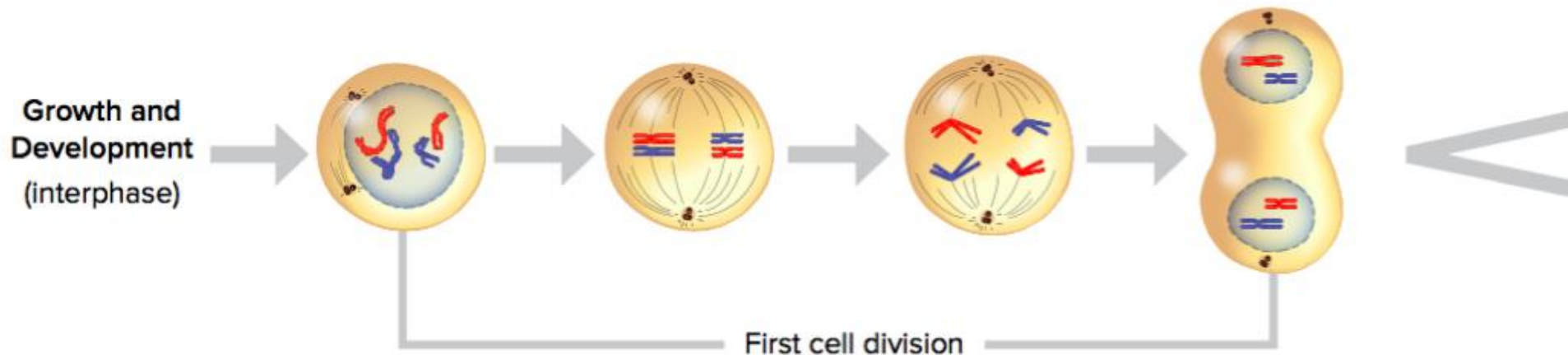
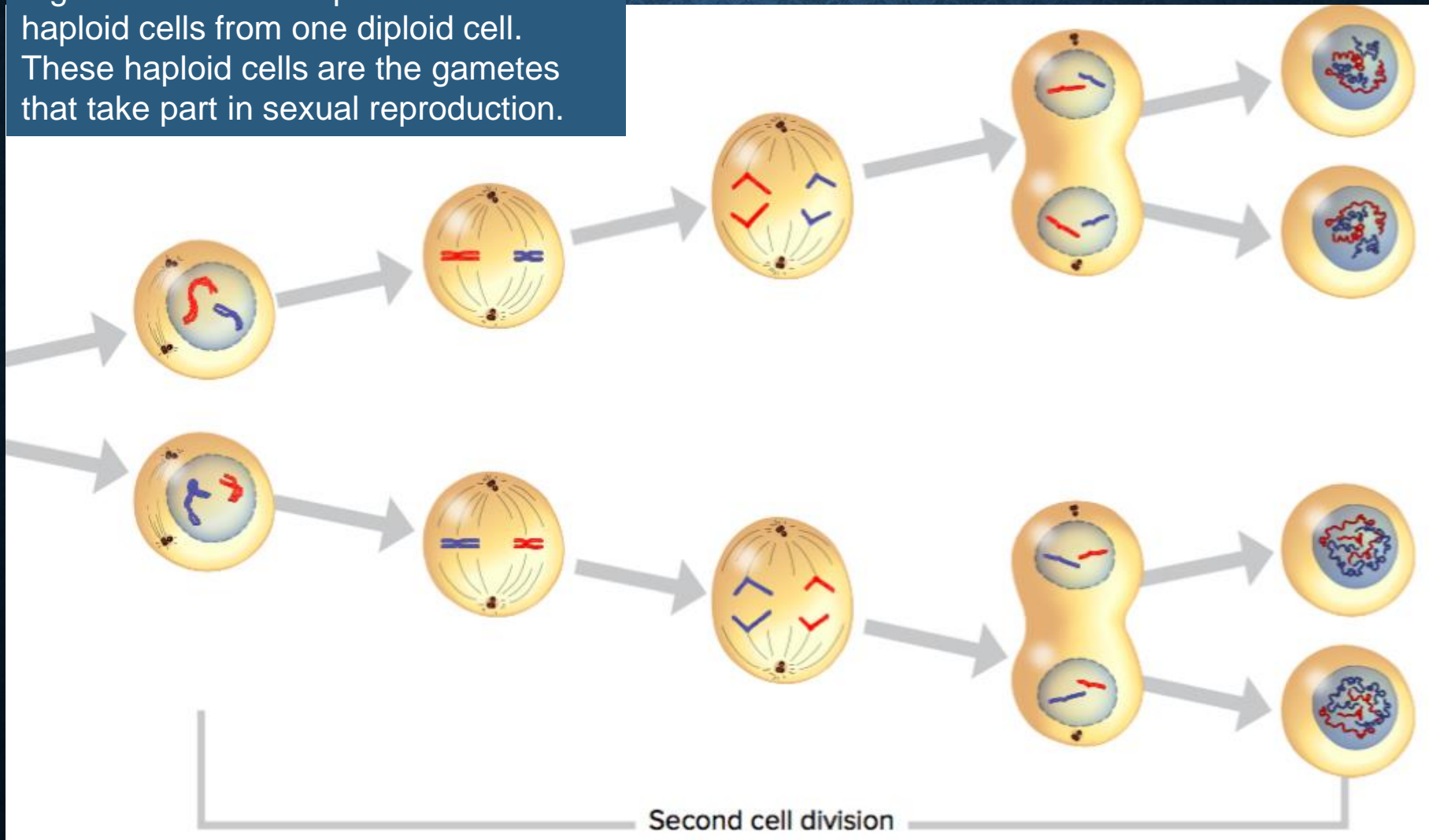


Figure 1.20: Meiosis produces four haploid cells from one diploid cell. These haploid cells are the gametes that take part in sexual reproduction.

MEIOSIS: SECOND CELL DIVISION SUMMARY

Figure 1.20: Meiosis produces four haploid cells from one diploid cell. These haploid cells are the gametes that take part in sexual reproduction.



MEIOSIS WORKSHEET

- Complete the tables on the process of meiosis

ACTIVITY

- **“It’s in the Cards”**

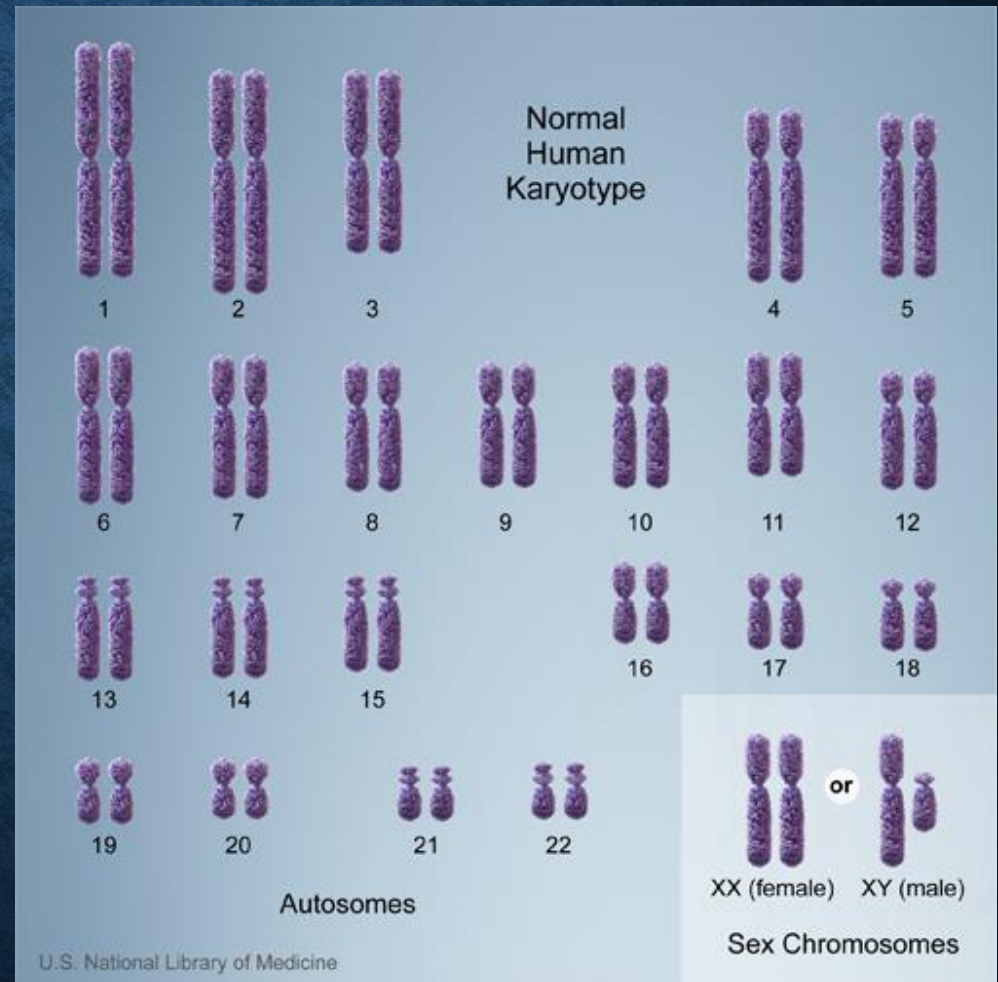


MITOSIS VS MEIOSIS

- How is meiosis similar to mitosis?
- How is it different?
- Complete worksheet

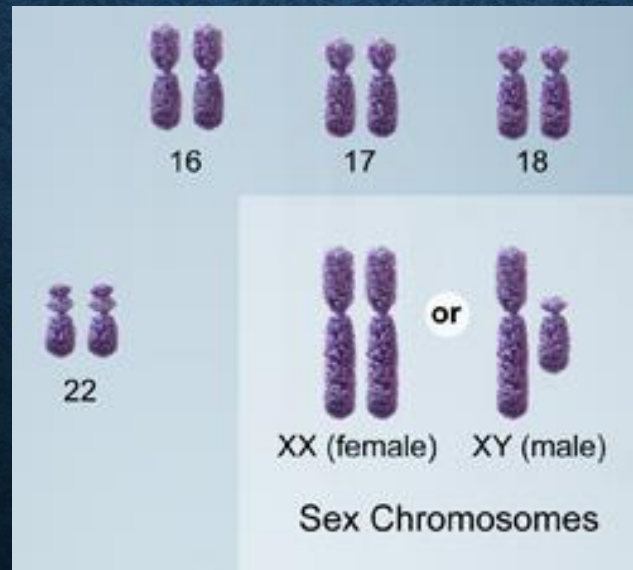
KARYOTYPE

- The arrangement of an organism's chromosomes from one body cell



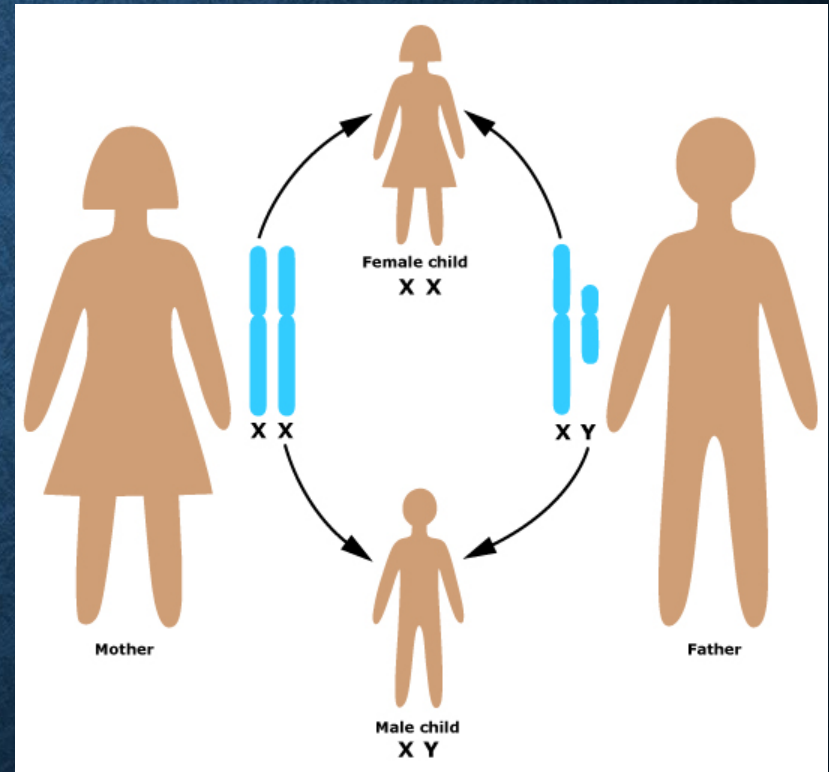
SEX CHROMOSOMES

- Sex chromosomes determine the gender of an individual
- Control the primary and secondary sexual characteristics of humans
- Consist of an X chromosome and Y chromosome



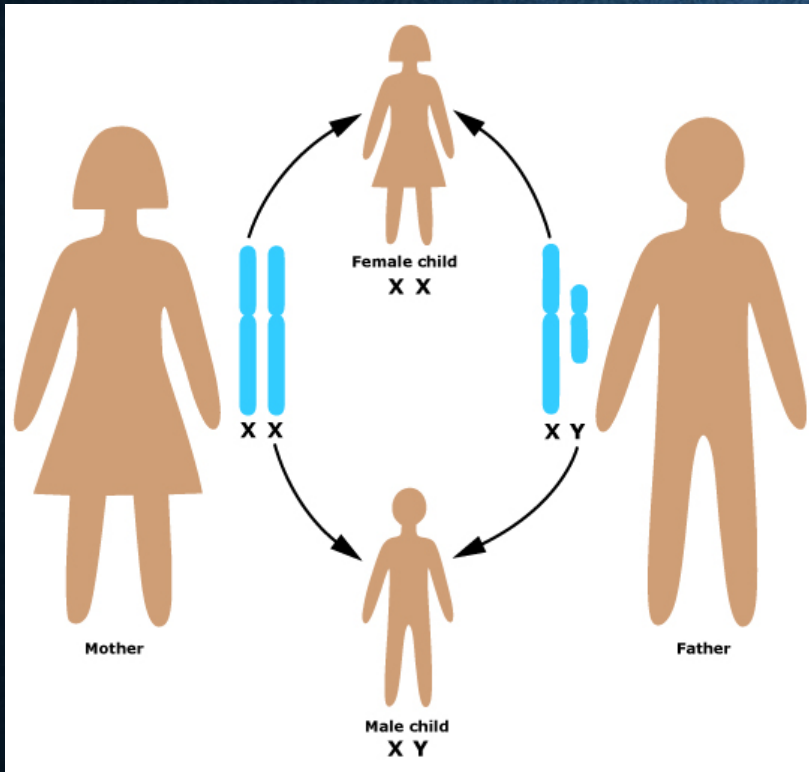
FEMALES

- Have two X chromosomes
- Meiosis
 - Can only produce gametes with an X chromosome
 - All eggs have one X chromosomes



MALES

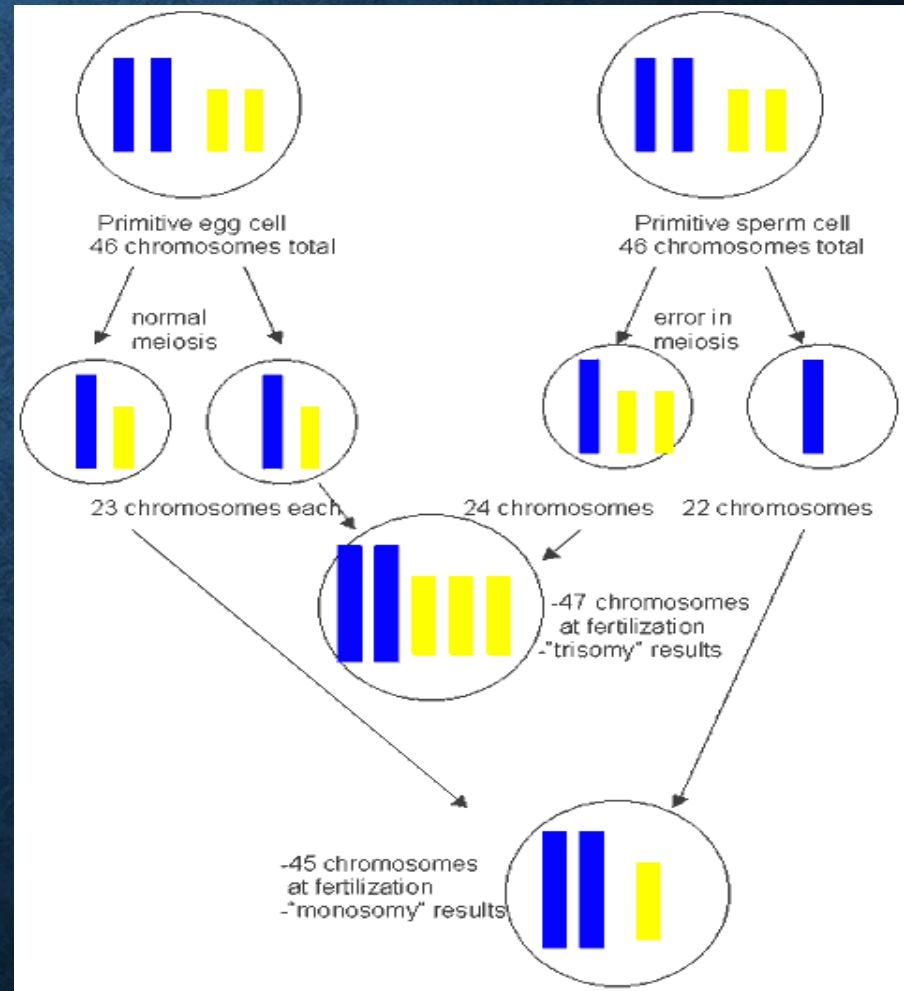
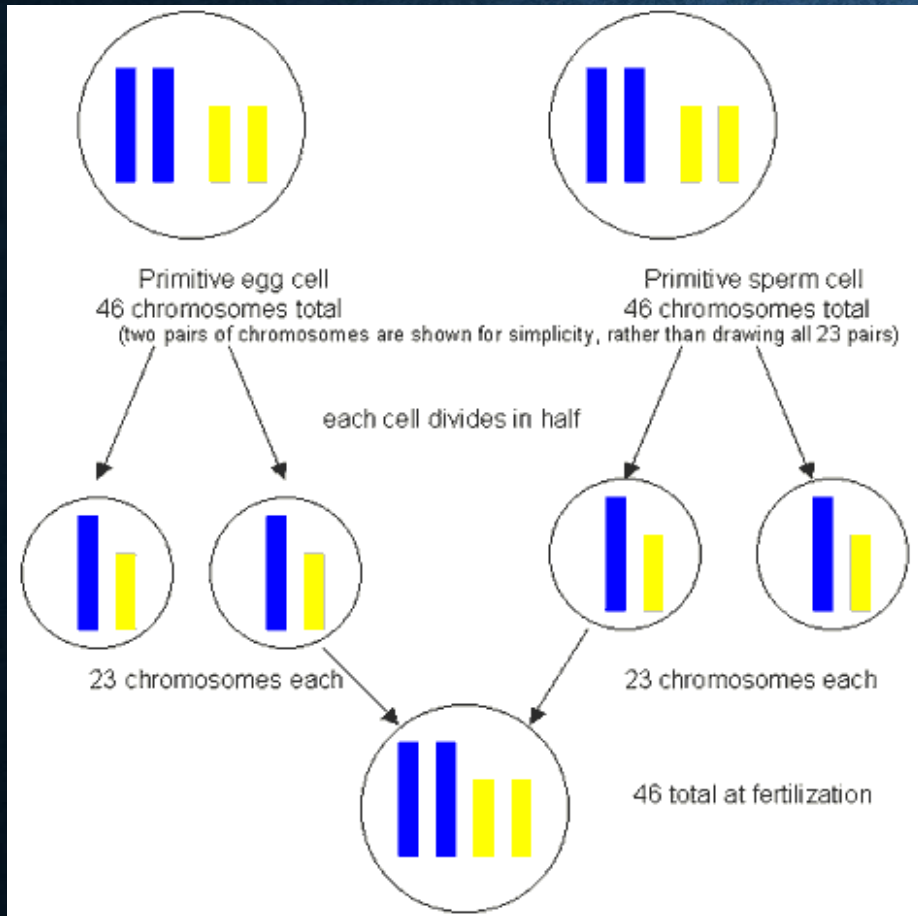
- Have one X chromosome and one Y chromosome
- Meiosis
 - Can produce gametes with either Y chromosome or X chromosomes
 - Half of the sperm will have X and other half will have Y



WHAT HAPPENS WHEN MEIOSIS GOES WRONG???

- Occasionally errors in meiosis can occur
- Many of these errors result in gametes that do not survive
- However if they do survive and reach fertilization they will produce a zygote
- Since every cell in an offspring is produced from the one zygote cell, all of the cells in the offspring will contain the error

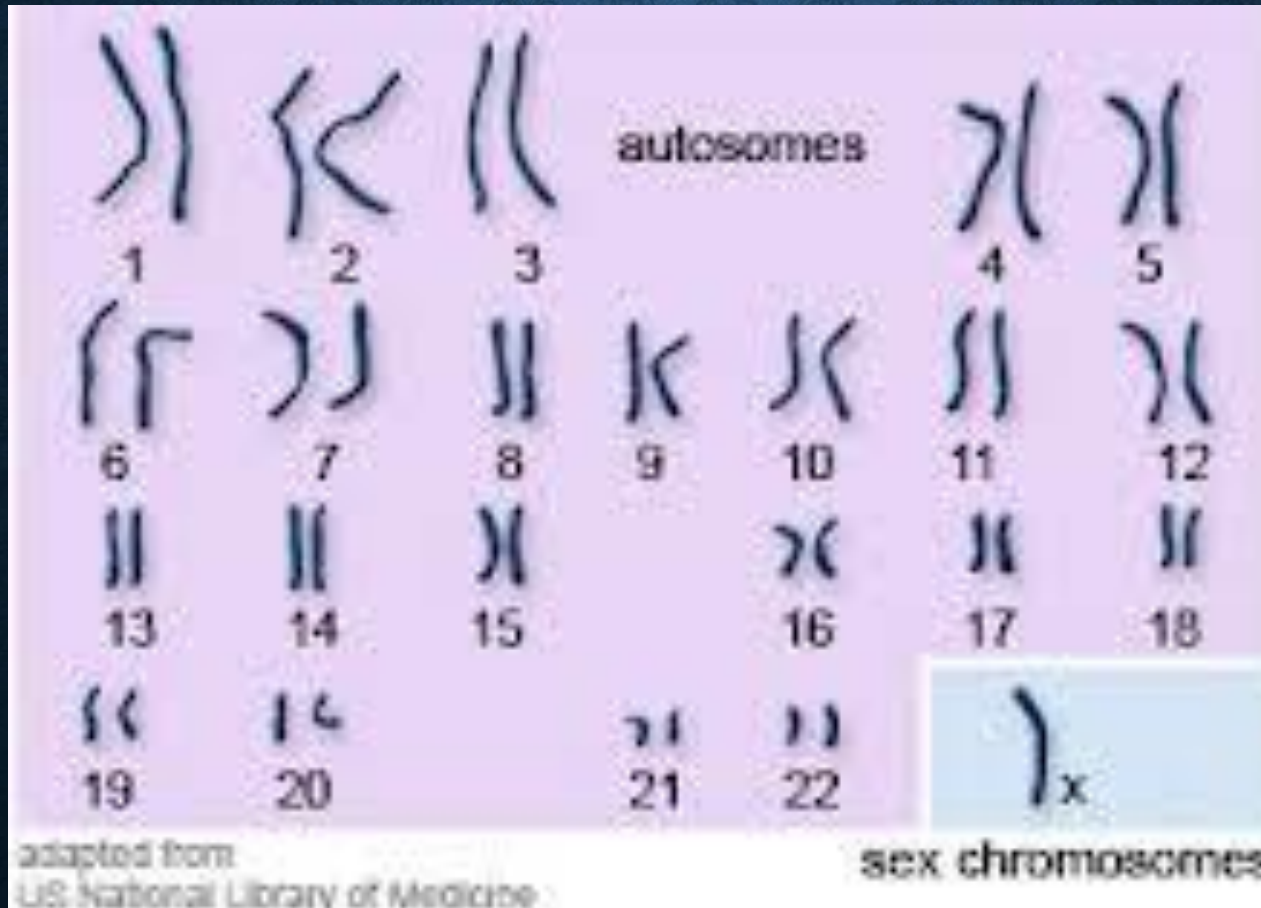
REGULAR VS ATYPICAL



WHAT CAN THIS RESULT IN?

- Down Syndrome
 - 47 chromosomes
- Sex Chromosome Disorders
 - Turners Syndrome
 - Female born with only one X chromosome
 - Do not develop at puberty/cannot reproduce
 - Klinefelter Syndrome
 - Males born with two X chromosomes
 - Cannot reproduce

WHAT DISORDER DOES THIS PERSON HAVE?



CREATE YOUR OWN KARYOTYPE

- Obtain two sheets of paper
 - 1 normal karyotype
 - 1 abnormal
 - Cut and paste the normal first then the abnormal
 - Compare and contrast to determine what gender/disorder you have been given.