

Basic Inheritance

Learning Goals:

- to explain the difference between mitosis and meiosis.
- to describe why meiosis is necessary to create gametes (eggs and sperm)
- to describe simple inheritance and calculate the probability of particular traits showing up in offspring.
- to explain how certain diseases and genetic defects can occur in newborns.
- to practice sifting through sources to find main ideas at a level that can be presented in an elementary classroom.

Possible resources:

1. <http://ghr.nlm.nih.gov/handbook/howgeneswork/cellsdivide>
2. Search meiosis vs mitosis there's a nice animation called "Comparison of Meiosis and Mitosis" from mcgraw-hill.
3. <http://learn.genetics.utah.edu/content/begin/tour/mitosis.swf>
4. Also can try the "dirty socks demo"
5. www.messybeast.com/genetics-basics.htm,

Mitosis vs. Meiosis

1. What are the main differences between the two (purpose and process)?

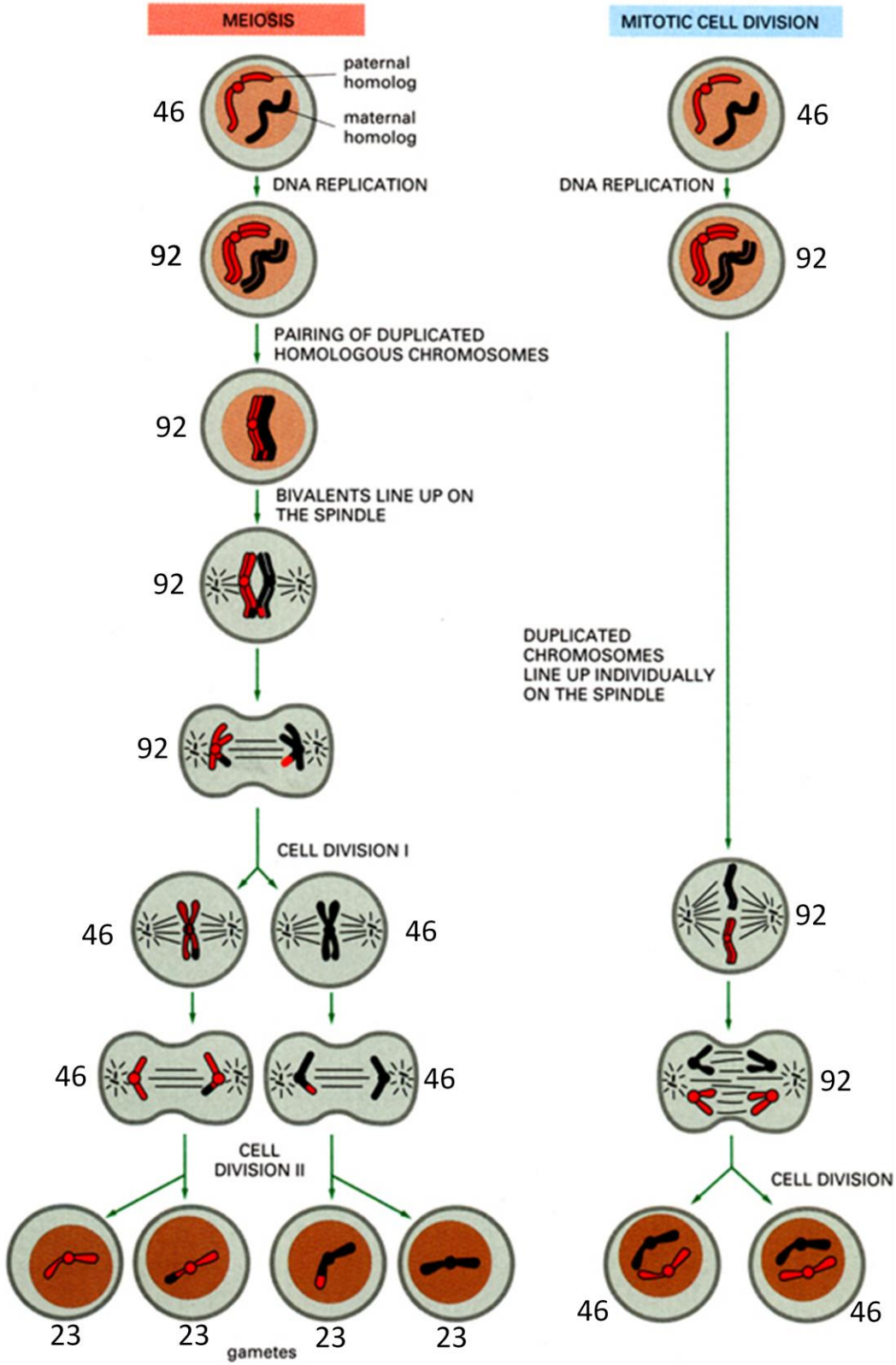
Mitosis is a fairly simple process of a cell duplicating itself. It happens in plants and animals. First it duplicates all 46 chromosomes and then the cell splits with 46 in each. This creates two *identical* cells.

Animals that reproduce sexually undergo meiosis to form *gametes* (sperm cells and eggs). Meiosis is a more complicated process for several reasons. 1. The chromosomes cross after duplicating to 96. 2. The cell splits once and then those 2 new cells split again. 3. The resulting 4 daughter cells are all different from one another.

All answers for humans.	Mitosis	Meiosis
# of divisions	1	2
# of daughter cells	2	4
Daughter cells differ or same?	The 2 daughter cells are identical	Each daughter cell is unique
# chromosomes in daughter	46	23
When does it happen?	In nearly every process of plants and animals including A-sexual reproduction	In men, all the time after they mature. In women starts as fetus then resumes if an egg is fertilized.
Purpose in body?	To create more cells (growing leaves, new tissue, basically everything)	Reproduction only. Eggs and Sperm.

MEIOTIC DIVISION I

MEIOTIC DIVISION II



2. Why can't gametes (sperm and egg cells) form through mitosis?

If they did, the gametes would each have 46 chromosomes. Then when a sperm and egg merge, the result would be 92 chromosomes in one embryo. That would be a genetic disaster and could not develop. 1% of miscarriages are the result of an embryo with 3 sets (69) chromosomes and every once in a while a baby is born with 3 sets but they never make it more than a couple of days.

4. Why are only two chromosomes shown in the first cell above?

To make the drawing simple to draw and easier for the reader to see what happens with one pair of chromosomes throughout the process. There really are 23 pairs (46) chromosomes doing what the two above are shown doing.

5. Label the number of chromosomes that are actually present (not just shown) in the cells at each stage in the diagram for people.

See diagram

6. Sperm and egg formation both are done via Meiosis. What are some of the specific differences between the process of forming sperm cells versus egg cells if any?

Sperm are formed through Meiosis in a continuous process from beginning to end. Eggs start the first stage of meiosis when the woman is just an embryo herself. Then when she begins puberty, her eggs begin to mature one at a time. If an egg is fertilized, it will undergo the second stage of meiosis.

Sperm end up with 4 healthy sperm with each meiosis and with eggs only one of the daughter cells becomes the embryo and the other three are called "polar bodies" and die out. This may be because all of the cell (except the chromosomes) goes to one of the daughter cells to nourish the baby.

7. Possible problems with mitosis?

Sometimes when the cell splits one daughter cell gets two chromosomes and the other gets none of that type. This can result in cancer. Chromosomes may also become damaged with parts broken off, wrongly copied, duplicated or reattached wrongly (looped or reversed). The effects range from no noticeable effect to lethal (especially if it happens in the early stages of an embryo which is rapidly dividing and where early mistakes are multiplied many, many times). These mistakes are called somatic mutation because they affect the body cells and not the gamete cells.

8. Possible problems with meiosis?

Problems with chromosomes separating in either stage can result in more or less genetic material than normal in the gametes. Sometimes this causes harmless new characteristics other times it causes serious disease such as Down's syndrome depending what bits are missing or extra.