NOTES 4.1

Chapter 4 - Reproduction of Organisms
Lesson 1 - Sexual Reproduction and Meiosis

What is sexual reproduction?

Have you ever seen a litter of kittens? One kitten might have orange fur like its mother. A second kitten might have gray fur like its father. A third kitten might look like a combination of both parents. How does this happen?

The kittens look different because of sexual reproduction.

Q: What is sexual reproduction?
A: a type of reproduction in which the genetic materials from 2 different cells combine, producing an offspring

The cells that combine are called sex cells. Sex cells form in reproductive organs. There are 2 types of sex cells – egg & sperm

Q: What is an egg?
A: a female sex cell

Q: What is a sperm?
A: a male sex cell

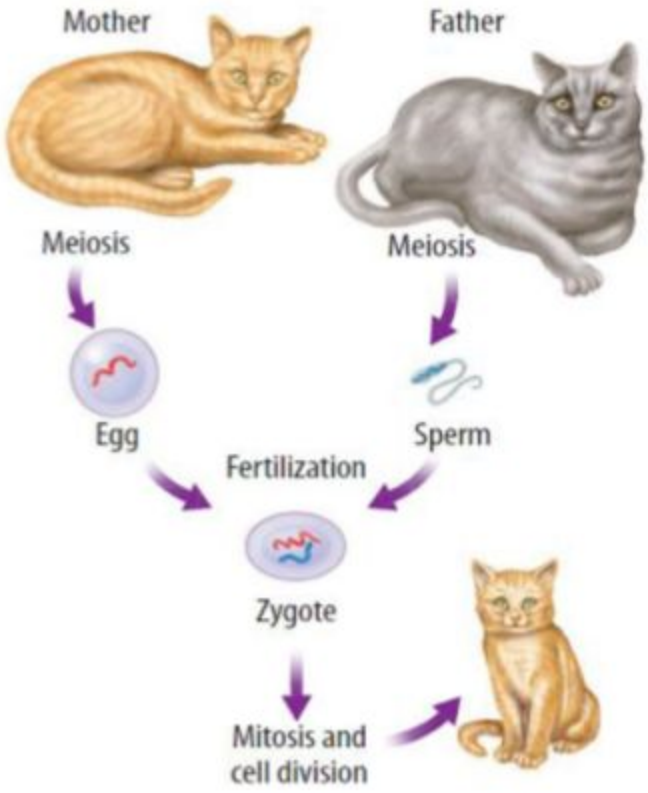


Figure 1

Fertilization occurs when an egg cell and a sperm cell join together. When an egg and a sperm join together, a new cell is formed. The new cell that forms from fertilization is called a zygote. A zygote forms into a new organism. (Figure 1)

In 1903, Walter Sutton an American geneticist, added an important piece of information to the understanding of genetics. By studying grasshoppers. Sutton discovered how sex cells form.

In his studies, Sutton compared the# of chromosomes in a grasshopper's sex cells with the# of chromosomes in the grasshopper's body cells.

12 chromosomes

sex cells

24 chromosomes

body cells

In further studies, Sutton learned that when sex cells come together – sperm & egg - the # of chromosomes would double.

Humans have [46] chromosomes (23 pairs) in each of their cells.

Therefore,

Mom gives you [23] chromosomes (egg cell)

Dad gives you [23] chromosomes (sperm cell)

You have [46] chromosomes in each of your body cells.

Diploid Cells

After fertilization, a zygote goes through mitosis and cell division, as shown in Figure 1. Mitosis and cell division produce nearly all of the cells in a multicellular organism. In the body cells of most organisms, chromosomes occur in pairs called [diploid] cells. (Figure 2)

Q: What are diploid cells?
A: cells that have pairs of chromosomes; double

Chromosomes of a Human Cell

Figure 2

Notice that all of the chromosomes are in pairs - called [homologous chromosomes]

Q: What are homologous chromosomes?
A: pairs of chromosomes that have genes for the same traits arranged in the same order

Because 1 chromosome is inherited from each parent, the chromosomes are not always identical. It is important to have the correct # of chromosomes, if a zygote has too many or too few chromosomes, it will not develop properly. The process of meiosis helps to maintain the correct # of chromosomes.

For example, the kittens you read about earlier inherited a gene for orange fur color from their mother. They also inherited a gene for gray fur color from their father. Some kittens might be orange, and some kittens might be gray. No matter what the color of a kitten's fur, both genes for fur color are found at the same place on homologous chromosomes. In this case, each gene codes for a different color.

Q: Does every organism contain the same# of chromosomes?
A: NO!

Humans → 46 chromosomes
(23 homologous pairs)

Dog → 78 chromosomes
(39 homologous pairs)

Caterpillars → 56 chromosomes
(28 homologous pairs)

Okay, so how do sex cells end up with ½ the # of chromosomes as body cells?

Through meiosis of course!

Q: What is meiosis?
A: the process where the # of chromosomes is reduced by ½ to form sex cells - sperm and egg; 1 diploid cell divides and makes 4 haploid sex cells

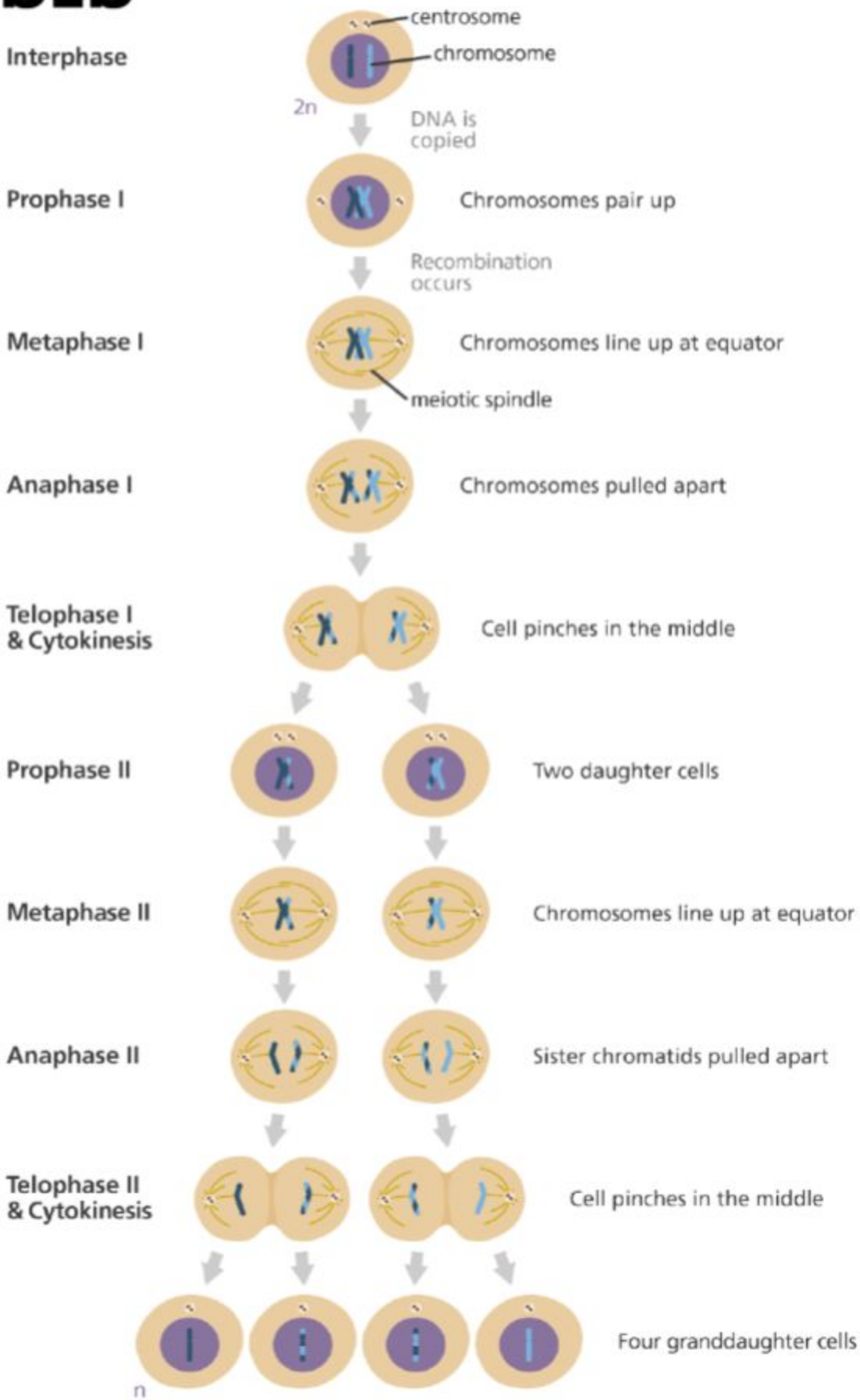
Haploid Cells

Sex cells have only 1 chromosome from each pair of chromosomes – called haploid.

Q: What are haploid cells?
A: cells that have only 1 chromosome from each pair

Recall that mitosis involves 1 division of the nucleus and cytoplasm. meiosis involves 2 divisions of the nucleus and the cytoplasm. These 2 divisions are phases called Meiosis I and Meiosis II. Meiosis results in 4 haploid cells, each with 1/2 the # of chromosomes as the original cell.

Meiosis



4 cells; 23 chromosomes each

n = haploid 2n = diploid

Why is meiosis important?

- for reproduction
- forms the correct haploid number of chromosomes therefore the correct diploid number of chromosomes in organisms when sex cells join
- leads to genetic variation – so organisms aren't all the same

How do mitosis and meiosis differ? →

Comparison of Types of Cell Division

Characteristic	Meiosis	Mitosis and Cell Division
Number of chromosomes in parent cell	diploid	diploid
Type of parent cell	reproductive	body
Number of divisions of nucleus	2	1
Number of daughter cells produced	4	2
Chromosome number in daughter cells	haploid	diploid
Function	forms sperm and egg cells	growth, cell repair, some types of reproduction

Advantages of Reproduction

- genetic variation among offspring
- offspring inherit 1/2 their DNA from each parent inheriting different DNA means that each offspring has a different set of traits

Genetic Variation

- exists among humans - your friends
- occurs in all organisms that reproduce sexually
- might be an advantage if the environment changes – ability to survive
- might help keep an organism from getting infected by a disease

Selective Breeding

- breeding certain individuals within a population because of the traits they have - a farmer might choose plants with the biggest flowers and stems to reproduce and grow
- used to produce many types of plants and animals with certain traits

Disadvantages of Reproduction

- takes time and energy - organisms have to grow and develop until mature enough to produce sex cells
- organisms have to find mates - searching for a mate takes time and energy
- can be limited by certain factors - predators, diseases, or harsh environmental conditions