

## Understanding Meiosis and its Genetic Variation

Gather the following materials

- Gather 8 straws – 2 pairs of same colour (4 purple, 4 red, )

Objective:

Your task here is to understand how chromosomes and ultimately your traits are passed down from your parents to producing your own offspring. Once you have completed this assignment, you should be able to understand how homologous chromosomes are duplicated and separated, exchange in genetic material through crossing over, and the division into haploid cells during meiosis II.

Procedure:

1. Work with your partner
2. The sperm and the egg cell on the attached paper are your parents' sperm and egg cell.
3. Inside each of the sperm and egg, you would have the following
  - a. Male – One chromosome would account for Long Finger nails (Long nails – designated as “L” ex. Red with a L)
  - b. The second chromosome would account for Bulging biceps (Biceps – designated as “b” ex. Purple with “b”)
  - c. Female – One chromosome would account for Long Finger nails (Long nails – designated as “l” – ex. red with a “l”)
  - d. The second chromosome would account for Thin biceps (Thin Biceps – designated as ‘B’. ex. purple with “B”)

**Build** the chromosomes for your parents' sperm and egg cell. Label each chromosome with a paper clip and paper. Ask Mr.Yeung to check your configuration

Check \_\_\_\_\_

Is the sperm and egg cell haploid or diploid? \_\_\_\_\_

4. The sperm and the egg cell will now **fertilize**....



Cue the Baby Making Music!

**Build** the configuration of the somatic cell (any type of cells except sex cells) found in the offspring named **Jack**.

How many total chromosomes are there? \_\_\_\_\_

5. Now the offspring (Jack) will undergo meiosis in his testes to produce sperm cells
6. The first step before meiosis begins is for chromosome duplication. Duplicate your chromosomes by creating a sister chromatid for each of them.
7. Attach a paper clip and label on EACH chromatid with proper designations "L, or b etc..."
8. **Align** the homologous chromosomes beside each other. Ask Mr.Yeung to check  
Check \_\_\_\_\_

What are your homologous chromosome pairings? \_\_\_\_\_ and \_\_\_\_\_  
\_\_\_\_\_ and \_\_\_\_\_

How many chromatids are there? \_\_\_\_\_

9. Here comes the main point of meiosis, crossing over!
  - a. Take your pair of homologous chromosomes and switch the label of one chromatid with the chromatid of the homologous pair.  
The pair of sister chromatids should have different alleles (traits).
10. After crossing over, the homologous pairs will separate into two cells.
11. The chromosomes split again, generating 4 sperm cells.

Build the configuration found in each of the sperm cells found in Jack.

Ask Mr.Yeung to check

Check \_\_\_\_\_

How many chromosomes are found in each sperm? \_\_\_\_\_

Is the sperm cell haploid or diploid? \_\_\_\_\_

Are all the 4 sperm cells genetically different? \_\_\_\_\_

If the sperm cell is haploid, how come all other cells (somatic cells) are diploid? Where is the other half of the chromosomes from? \_\_\_\_\_.

Repeat the process but now perform one with Jack's mate (Ellen).

1. Ellen's parents have the following alleles
  - a. Male – One chromosome would account for Short Finger nails (Short nails)
  - b. The second chromosome would account for Thin biceps (Thin Biceps)
  - c. Female – One chromosome would account for Short Finger nails (Short nails)
  - d. The second chromosome would account for Thin biceps (Thin Biceps)

Create Ellen's chromosomes and have them undergo meiosis for 4 egg cells.

Choose one of the egg cells (the other three will be degenerates)

What traits are found in the single egg cell? \_\_\_\_\_

Now fertilize Ellen's egg with Jack's sperm cell.

What chromosomes are found in Jack and Ellen's offspring? \_\_\_\_\_

Show Mr. Yeung Jack and Ellen's offspring

Congratulations! That is how traits are passed down. Next day, we will talk about WHICH gene will be expressed (shown) based on Mendel's laws.

### **Questions to think about:**

What is the primary purpose of meiosis?

Where does meiosis occur? How is it different than mitosis?

What happens during crossing over?

What's the difference between chromatids, chromosome, and homologous chromosomes?