

Visualizing and Understanding Meiosis

Meiosis is the process of cell division in which sex (reproductive) cells are made. The process of meiosis is more complicated than mitosis because genetic variation in each of the resulting cells is generated.

Materials:

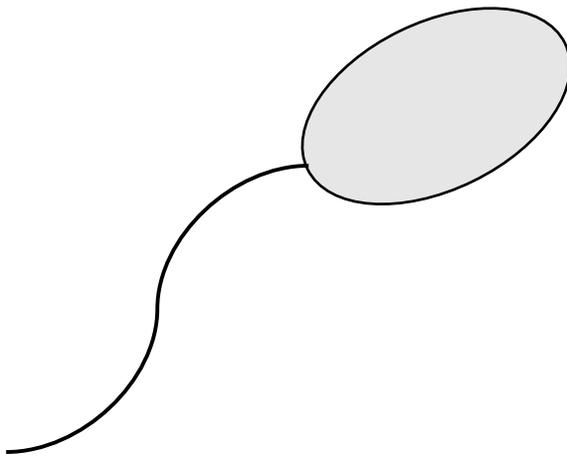
- Pipe-cleaners (use matching coloured pairs) or straws
- Paper clip or clips
- Gene paper indicating various genes

Procedure:

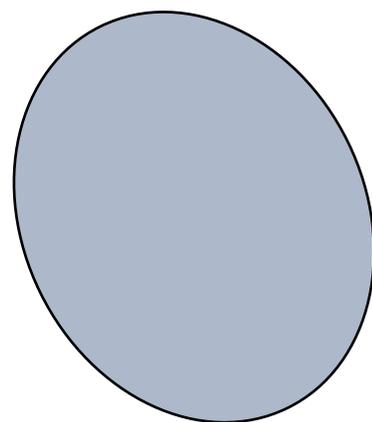
It is important that you follow along with the appropriate drawings to fully understand the mechanism of meiosis. Simply following the instructions may not fully allow you to understand.

1. Your **parents'** generation (P):

Create your father's sperm cells and mother's egg cell.



Use 1 pipe cleaner with the gene "Blue eyes (b)"

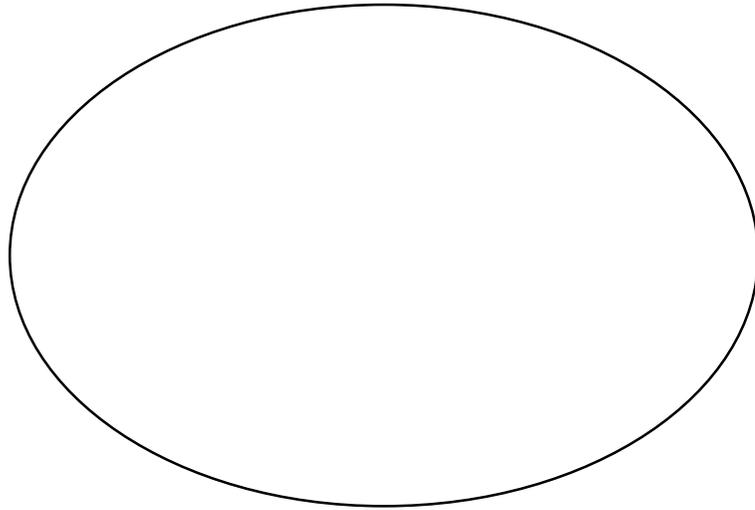


Use 1 pipe cleaner with the gene "Brown eyes (B)"

2. Your parents sex cells will make YOU.

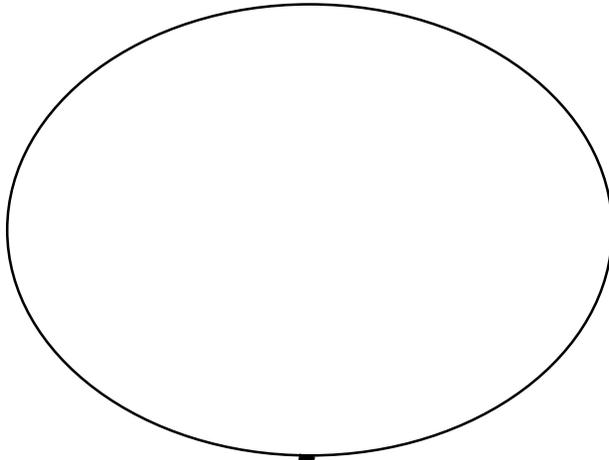
This is **your** generation (F1).

Inside each of your somatic cells (any cell except sex cells) will have 1 copy of the Blue eyes (b) and Brown eyes (B).



Create your somatic cells by drawing the pipe-cleaners with BOTH sets of genes from your parents

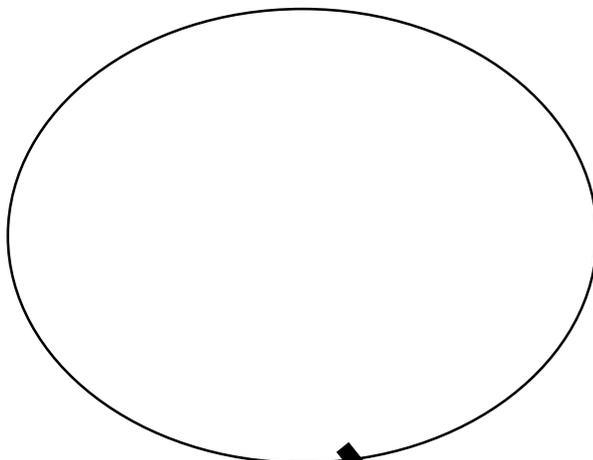
3. You will now make some sex cells (sperm or egg) via *meiosis*.



Re-draw the pipe-cleaners (chromosomes with genes) from the somatic cells from Step #2.



Meiosis will now happen!



The 1st step of meiosis is for the chromosomes (pipe-cleaners) to line up side by side.

The chromosomes are called "*homologous chromosomes*" because they are chromosomes of the *same* trait from both parents.

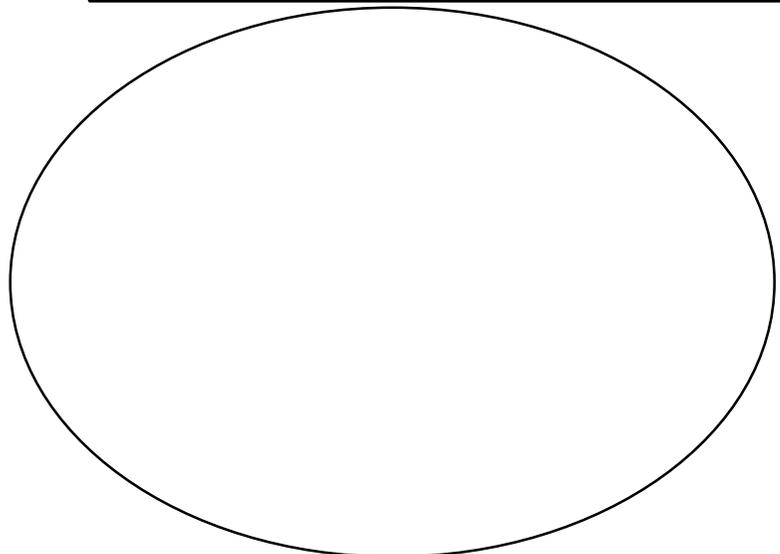
Each chromosome is then replicated. Add another pipe-cleaner to each to have 4 *pipe-cleaners* right now with 2 pairs of each *chromatid*.

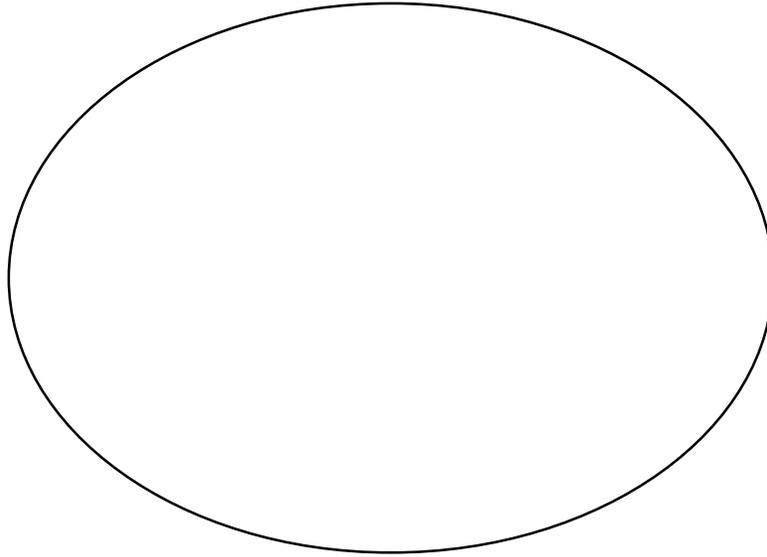


During prophase 1 of meiosis 1, "Crossing over" occurs.

Crossing over is what gives the genetic variation.

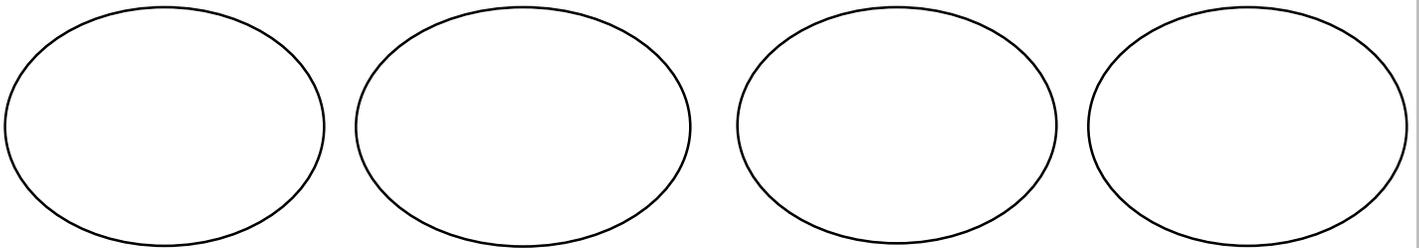
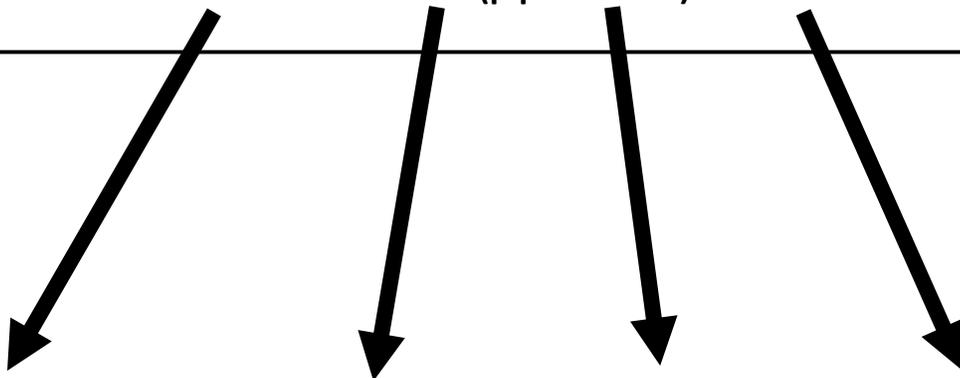
Exchange the Gene Paper from one colour chromosome to another.





Re-draw your cell after Crossing over (previous step)
At this point, you should have 4 pipe-cleaners but with different *gene paper* in 2 *chromatids*.

Now, your cell will enter divide and divide again in meiosis II where it will divide into 4 *haploid* (contains only 1 set of the gene traits) sex cells.
Each cell below will now have 1 chromosome (pipe cleaner) with 1 set of traits (haploid).



These are 4 sperm cells or 4 egg cells but in egg cells, only 1 is released and the other 3 are degenerated.
Notice how each cell contains a different set of traits compared to the parents.

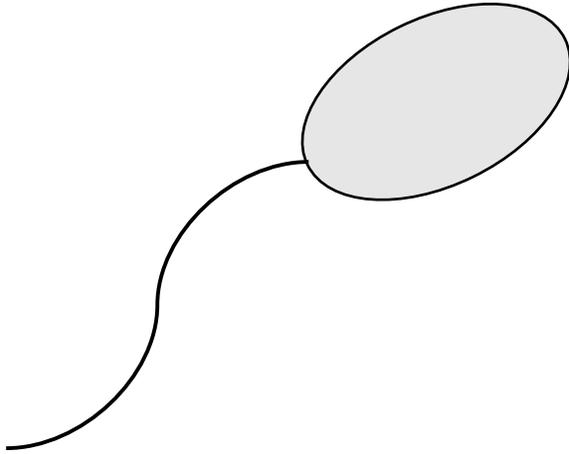
Questions to think answer and hand-in:

1. What is the primary purpose of meiosis?
2. Where does meiosis occur? How is it different than mitosis?
3. What happens during crossing over?
4. Without using google, answer the following question in your own words or what you have learned from the activity.
What's the difference between chromatids, chromosome, and homologous chromosomes?
5. What is the difference between a diploid and a haploid cell?

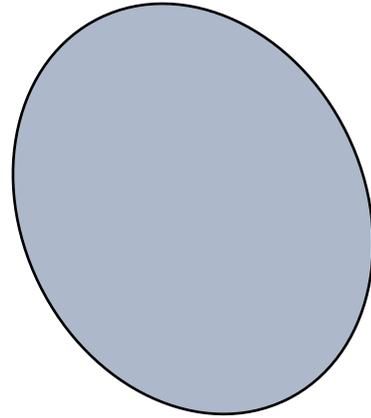
For the next one, we are going to use 2 different traits to show Mendel's Law of Independent Assortment

Your **parents'** generation (P):

Create your father's sperm cells and mother's egg cell.



Use 1 pipe cleaner with the gene "Blue eyes (b)"
Use 1 pipe cleaner with the gene "No Muscle growth(m).

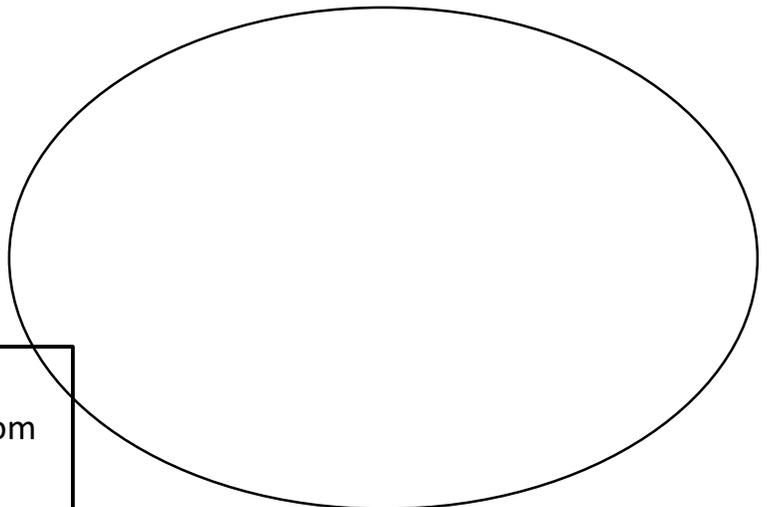


Use 1 pipe cleaner with the gene "Brown eyes (B)"
Use 1 pipe cleaner with the gene "Muscle growth (M)

4. Your parents sex cells will now make YOU.

This is **your** generation (F1).

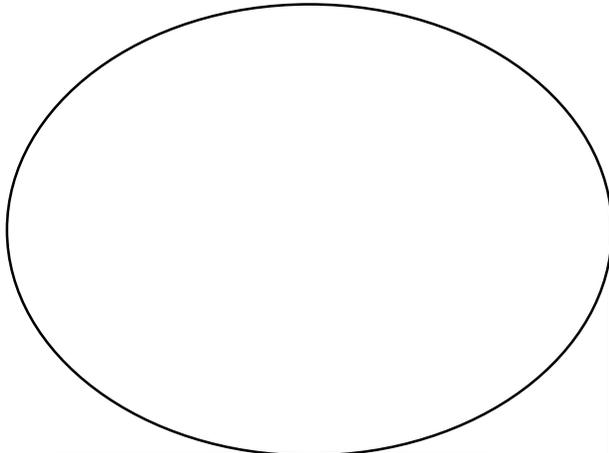
Inside each of your somatic cells (any cell except sex cells) will have 1 copy of the Blue eyes (b), Brown eyes (B), Muscle Growth (M) and No muscle growth (m).



Create your somatic cells by drawing the pipe-cleaners with BOTH sets of genes from your parents

5. You will now make some sex cells (sperm or egg) via *meiosis*.

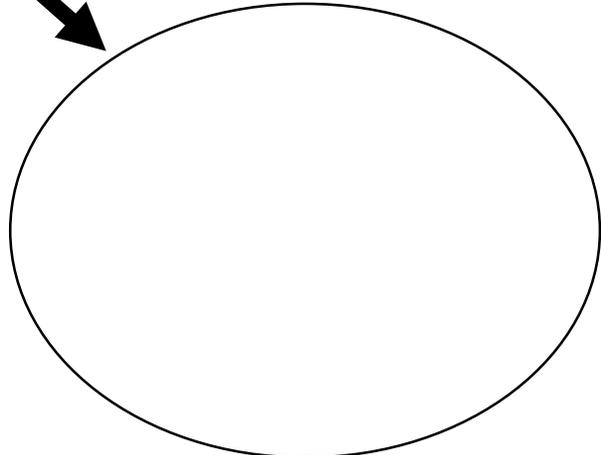
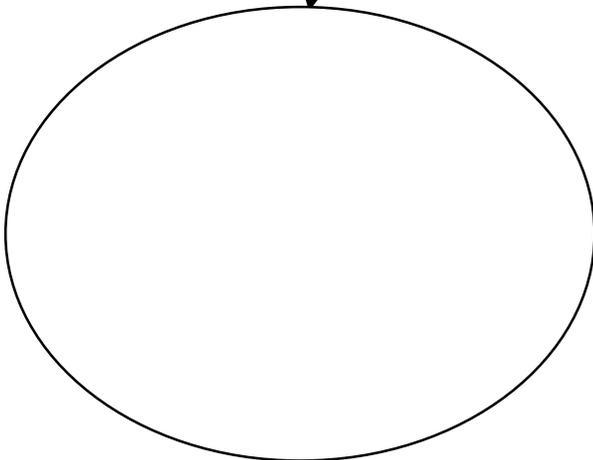
Re-draw the pipe-cleaners (chromosomes with genes) from the somatic cells from Step #2.



Meiosis will now happen!

During the 1st stage of Meiosis I, crossing over will occur between homologous chromosomes. Switch the gene paper from homologous chromosomes (B with b) and (m with M) from one pipe cleaner to the other.

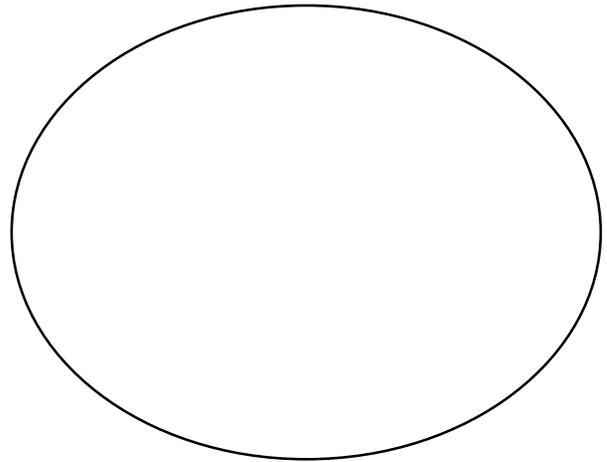
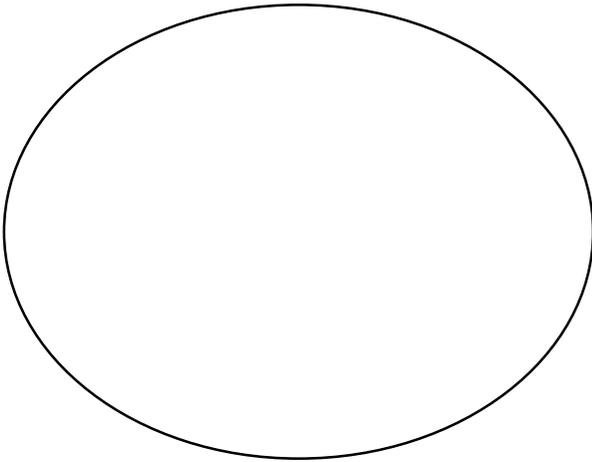
After the 1st stage, the 1 cell will be divided into 2 cells.



Separate your homologous chromosomes into the 2 cells. The chromosome with eye colour should be separated from the other chromosomes with eye colour.

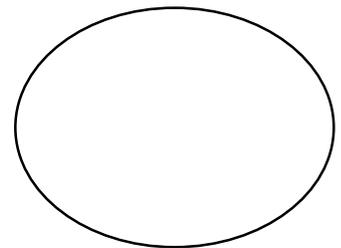
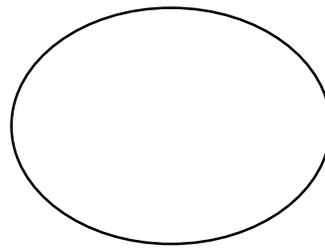
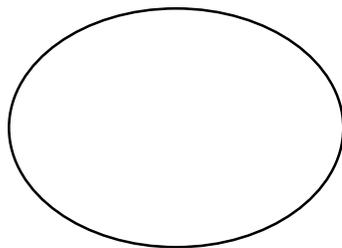
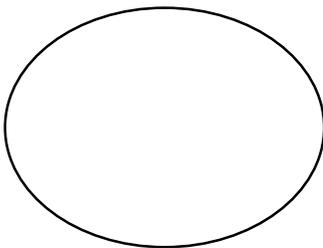
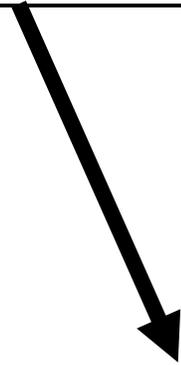
Randomly choose the combination of genes. This is Law of Independent assortment – the genes for eye colour and muscle growth separate independently from each other.

Redraw the chromosomes from the previous step (2 cells)



Now, your cell will enter divide and divide again in meiosis II where it will divide into 4 *haploid* (contains only 1 set of the gene traits) sex cells.

Each cell below will now have 1 chromosome (pipe cleaner) with 1 set of traits (haploid).



Re-draw each of your sex cells with the appropriate number of chromosomes. Each sex cell should be *haploid* (1 set of genes) with 1 chromosome accounting for eye colour and 1 chromosome for muscle growth.