Modeling Chromosomes in Meiosis

You are going to model the process of meiosis in a Chromoseratops cell.

You may work alone, with a partner or in a group of 3. Groups of 4+ are too big.

We are going to model meiosis in a fictitious male reptilobird (reptile-bird thingy, it's pretend) called *"Chromoseratops meiosus."* The genome of *Chromoseratops meiosus* is **2n = 6.** This means there are 3 pairs of chromosomes, for a total of 6 chromosomes. There are two pairs of autosomes (one shorter chromosome, #1 and one longer chromosome, #2) and one pair of sex chromosomes (X and Y). The chromosomes have the same genes (letters) at the same locus (location). The genes have dominant and recessive alleles (uppercase and lowercase letters) that code for traits. Don't concern yourself with the traits at this point (we'll do more with *Chromoseratops meiosus* as we move into the genetics unit).

Remember, **maternal and paternal refers to the parents of the individual in which the meiosis is occuring** (so, for example, if this was your body doing meiosis, the maternal chromosome would have come from your mom and the paternal would have come from your dad).

Materials you will need:

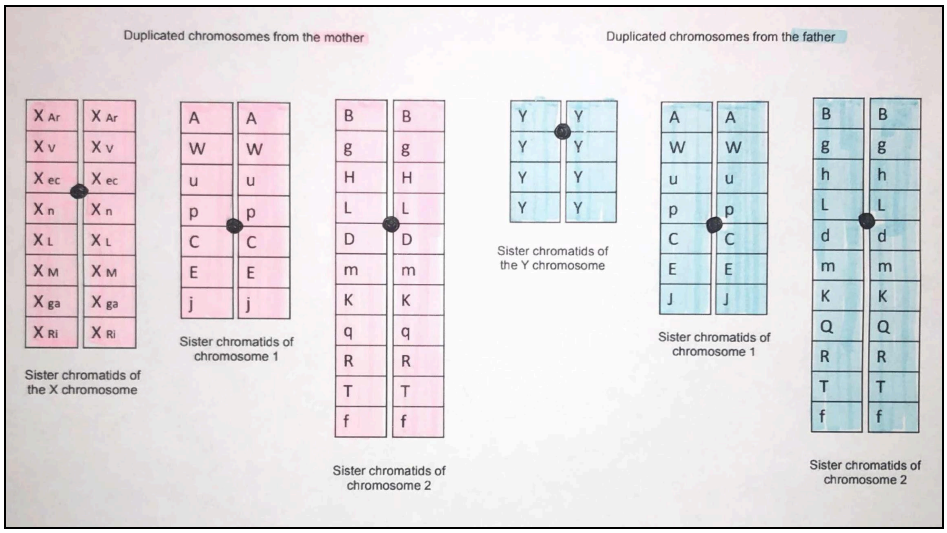
- Scissors
- White board
- Two colors of highlighter
- Chromosome strips
- Tape

Setting up the model:

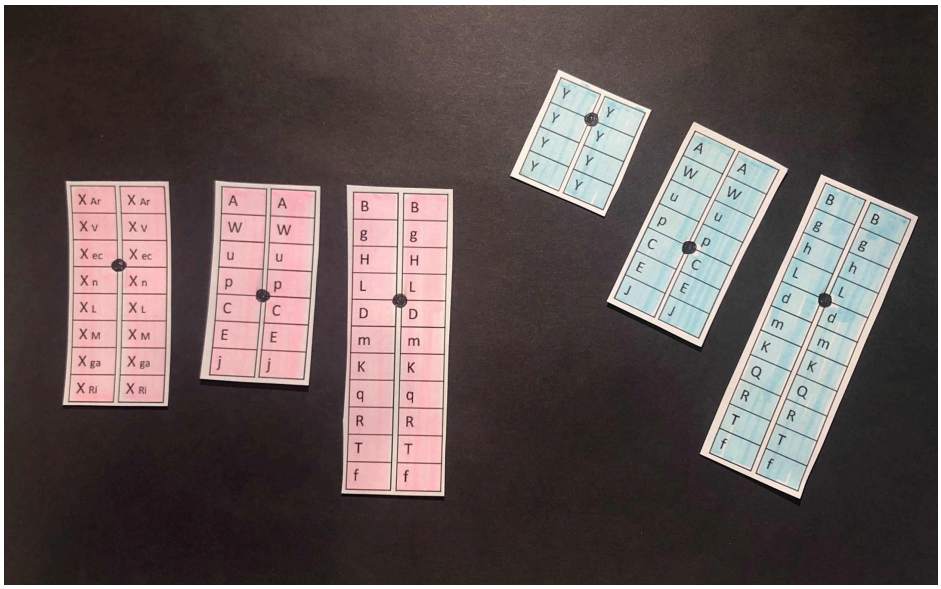
- We are going to start with the cell in prophase 1. That means DNA replication has already occurred (in S phase of interphase) and so the chromosomes are X shaped (replicated chromosomes made of two sister chromatids).

- Add dots to represent the centromere holding together the sister chromatids. Here's where to draw the centromeres:
    - X chromosome - between genes Xec and Xn
    - Y chromosome - between the top two Y genes
    - Chromosome 1 - between genes P and C
    - Chromosome 2 - between genes L and D

- Color code the strips so we can distinguish maternal from paternal chromosomes. Highlighted the maternal chromosomes pink and the paternal chromosomes blue.

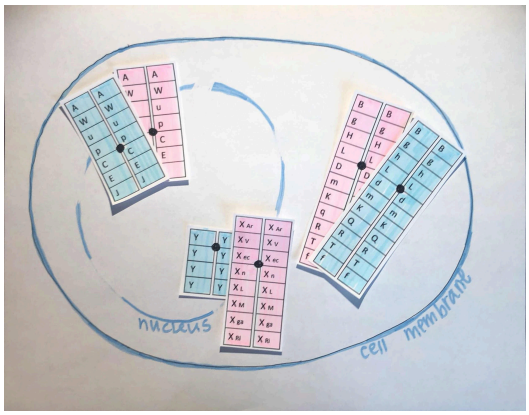
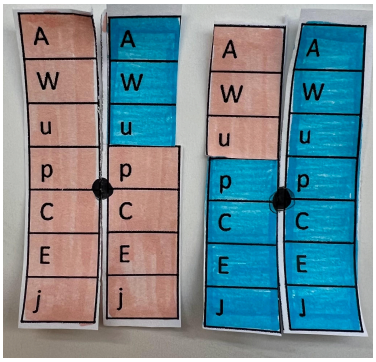


- Cut out the chromosome strips so they look like this:



OK … we're ready to model meiosis!

Phase:	What to show in the picture:	What to say on the slide:
Prophase I *5 points*	Draw a cell (with the nuclear membrane breaking down). Then model the chromosomal events of Prophase I, including synapsis and **crossing over of at least one autosome homologous pair.**	• State the ploidy of the cell (diploid or haploid with how many total chromosomes?) • Outline why the chromosomes have genetically identical sister chromatids. • Outline the events of prophase 1

	 *NOTE: this example doesn't show crossing over…. Yours will!!* ***You can choose where you want to have the chiasma form on the autosomes during crossing over.*** *Remember, crossing over occurs between <u>non-sister</u> homologous chromatids. Cut between the genes (along the line), not <u>through</u> a letter! Make sure you cut at the same location on both chromatids that are crossing-over, and* ***tape the chromatid pieces together*** *at the right spot.* *Crossing over would look something like this:*  *Sex chromosomes crossing over is a little complicated and is ignored here for the sake of keeping the exercise simple.*	• Identify a tetrad, sister chromatids and non-sister chromatids • Describe the process and consequence of crossing over
Metaphase I: *5 points*	Draw the outline of the cell membrane then model the chromosomal events of Metaphase I. The image doesn't have the chromosomes, but yours will!	• Outline the events of metaphase 1 • State how metaphase 1 of meiosis is different from metaphase in mitosis. • Describe the process and consequence of independent assortment

		• Explain how many possible chromosome combinations could result from independent assortment in this cell
Anaphase I: *5 points*	Model the chromosomal events of Anaphase I.	• Outline the events of anaphase 1 • State how anaphase 1 of meiosis is different from anaphase in mitosis. • Describe the process and consequence of segregation of alleles • Outline the consequences of nondisjunction occurring in anaphase 1
End of Meiosis I: *5 points*	**Show two cells as they would appear at the end of cytokinesis 1.** The DNA is in the nucleus of each cell. *FROM HERE THROUGH ANAPHASE II YOU WILL HAVE TWO CELLS*	• State the ploidy of the cell that results after cytokinesis I (diploid or haploid with how many total chromosomes?) • Outline the events of telophase 1 and cytokinesis 1, distinguishing between the two phases.
Metaphase II: *5 points*	**Show the arrangement of chromosomes at Metaphase II**	• Outline the events of prophase 2 and metaphase 2 • Explain how meiosis II is similar to mitosis
Anaphase II: *5 points*	**Show two cells as they proceed through anaphase II.** You'll need to use scissors at this point to separate the sister chromatids.	• Outline the events of anaphase 2 • Outline the consequences of nondisjunction occurring in anaphase 2
End of Meiosis II: *5 points*	**Show four cells as they would appear at the end of cytokinesis II.** The DNA is in the nucleus of each cell. You can fold the chromosomes so they fit within the nucleus	• State the ploidy of the cell that results after cytokinesis II (diploid or haploid with how many total chromosomes?) • Outline the events of telophase 2 and cytokinesis 2,

		distinguishing between the two phase ● Have you modeled the making of egg or sperm cells? How do you know? ● Describe the genetic variation between the gamete cells that are made.