Meet a Scientist:

Dr. Lorinda K. Anderson

Dr. Anderson is a scientist at CSU. Almost every cell in our body divides in a process called mitosis (and the activity in this lesson is about that process). Some specialized cells divide using a more complex process called meiosis. Cells that divide by meiosis make gametes - special cells from the father and mother that fuse together to make babies. Dr. Anderson's lab uses both plants and animals to study this complex cell division. Your DNA is packaged in 46 chromosomes, and you inherited 23 (= one set of chromosomes) from your mother and 23 from your father. During meiosis, each of the 23 matching chromosomes from your mom and dad recognize one another and come together, gene-for-gene, along their entire length. This is totally different than mitosis and is part of what makes meiosis special. During this time, a section of your dad's DNA can swap with your mom's DNA, and that same section of DNA from your mom's chromosome will swap to your dad's chromosome. After meiosis, your dad's chromosome could contain bits of your mom's chromosome, and that bit of dad's DNA is now found in exactly same place where your mom's DNA was! These DNA swaps are an important reason why we are all unique (except identical twins) and are also important in plant and animal breeding. Using powerful microscopes, Dr. Anderson and her lab examine the chromosomes to see where these swaps occur. They are trying to understand why some areas of chromosomes are more likely to make swaps than other areas.

- Photo from: http://www.frontiers-in-genetics.org/ and http://www.eastcentral.edu/
- Sketch from: sciencebuddies.org

4-H Projects:
Any animal project (live stock, horses, dogs, etc.), especially if you are raising young animals. This is how they grow—by adding cells to all the organs in their bodies. Plants and fungus grow this way, too.

STEM Connections

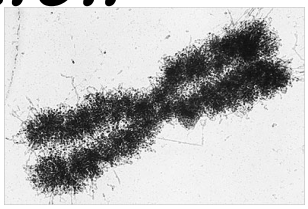
Colorado State University Extension

Connecting the Science, Technology, Engineering, and Math concepts to our everyday lives. *By Dr. Barbara J. Shaw*

DNA Duplication

Learning the Basics

DNA is extremely stable because of the its double stranded helix structure. The base pairs can unzip, giving access to the DNA code. Access is needed for making proteins and making copies of DNA.



DNA packaged into a chromosome

Your DNA is packaged in 46 chromosomes. You inherit 23 chromosomes from your mother and 23 chromosomes from your father, and therefore you have 23 pairs of chromosomes, for a total of 46. The matching pairs of chromosomes code for specific traits, like how your earlobes attach. The information for the earlobes could be different from each parent, for example, attached from your mom and detached from your dad (see the sketch on the left).

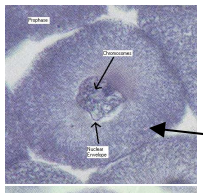
Detached Attached

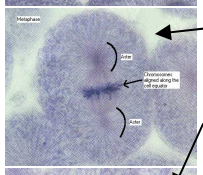
Most of the cells in your body occasionally need to be replaced. The first thing that has to happen is the DNA is copied (called replicated). After it has been copied, then the cell itself needs to split in two, making sure that the two cells each receive a complete set of your DNA. To accomplish that, DNA goes through very specific steps in a process called mitosis.

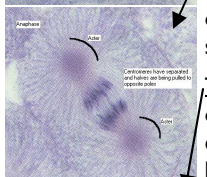
Different organisms have different number of chromosomes. We are going to use the roundworm *Ascaris magalocephalus* because it only has 2 pair of chromosomes, but you could do this with all 23 pair of your chromosomes!

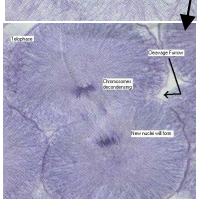
EXPLORE IT - DESIGN IT - DO IT

The steps that somatic (body) cells take to divide and make a new cell are:









Interphase: This is a cell that is doing its normal cell business. During this phase, if the cell gets a signal to divide, it will replicate (copy) the DNA. The dark part of this cell is the nucleus with its DNA.

Prophase: The DNA begins to condense into the chromosomes that we can see as it prepares for cellular division.

Metaphase: The chromosomes match (by size of the Twizzlers) one from mom and one from dad (one red and one blue Twizzler) along the equator (midline) of the cell.

Anaphase: A complete set of the chromosomes (1 long red, 1 long blue, 1 short red and 1 short blue) begin to move towards one pole (one side of the cell), while the other set of chromosomes moves towards the opposite side.

Telophase: The chromosomes have completely separated to opposite sides of the cell. Both sides have identical sets of chromosomes (1 long red, 1 long blue, 1 short red and 1 short blue in our model).

Cytokinesis: In animal cells, the cell membrane starts to pinch in, and new membrane forms along that pinch. When this process has completed, there are now two identical cells, and they are both identical to the original cell.

Interphase: The cell is back to normal cell business.

Materials:

- Twizzlers Rainbow Twists
- Scissors—wash
- Wax paper

Directions:

- Tear a large piece of wax paper (the cell) and do all your work on it.
- Pick 3 red Twizzlers. Cut 1 Twizzler in half. You have 4 red Twizzler pieces, 2 whole and 2 half sticks. Use 1 long and 1 short, and set the others aside.
- Pick 3 blue Twizzlers. Cut 1 Twizzler in half. You have 4 blue Twizzler pieces, 2 whole and 2 half sticks. Use 1 long and 1 short, and set the others aside.
- Interphase: Red Twizzlers represent mom chromosomes blue Twizzlers represent dad chromosomes. Long are Chromosome 1. Short are Chromosome 2.
- DNA replicates (match the identical length and color of Twizzlers; place them together)
- Prophase: DNA condenses into chromosomes (we can now see them). Put everything on the wax paper.
- Metaphase: DNA lines up along the center of the cell (line paired Twizzlers across the center of the wax paper.
- Anaphase: DNA moves towards the opposite sides of the cell (move 1 long and 1 short red and 1 long and 1 short blue to one side of the wax paper, and move the remaining Twizzlers on the opposite side.
- Telophase: DNA is on opposites of the cell. Notice that both sides have exactly the same color and length of Twizzlers—they match.
- Cytokinesis: The cell pinches off to form 2 cells (tear the wax paper in half between the Twizzlers at each end of the wax paper.
- Interphase: The 2 cells are now identical to each other, and identical to the original cell before replication.
- Eat and enjoy!