Talk to your neighbors about:
- How does your body repair itself?
- How does your body grow?
- Do you think you have the same cells you were born with?
CELL REPRODUCTION

CELL CYCLE, BINARY FISSION, MITOSIS & MEIOSIS
(a) **Reproduction.** An amoeba, a single-celled eukaryote, is dividing into two cells. Each new cell will be an individual organism (LM).

(b) **Growth and development.** This micrograph shows a sand dollar embryo shortly after the fertilized egg divided, forming two cells (LM).

(c) **Tissue renewal.** These dividing bone marrow cells (arrow) will give rise to new blood cells (LM).
DNA

- Genetic information - genome
- Packaged into chromosomes

Figure 12.3
An average eukaryotic cell has about 1,000 times more DNA than an average prokaryotic cell.

The DNA in a eukaryotic cell is organized into several linear chromosomes, whose organization is much more complex than the single, circular DNA molecule in a prokaryotic cell.
All eukaryotic cells store genetic information in chromosomes.

- Most eukaryotes have between 10 and 50 chromosomes in their body cells.
- Human cells have 46 chromosomes.
- 23 nearly-identical pairs
1) What are the functions of cell division? (Hint there are three main functions)
2) Which structures in the nucleus stores genetic information?
3) How many chromosomes does a human have in their normal body cells?
What are the functions of cell division? (Hint there are three main functions)

- Reproduction in some organisms (unicellular)
- Growth
- Repair

Which structures in the nucleus stores genetic information?
- Chromosomes

How many chromosomes does a human have in their normal body cells?
- 46 (23 pairs)
Eukaryotic cells divide by mitosis.
Each new cell receives one copy of every chromosome that was present in the original cell.
Produces 2 new nuclei that are both genetically identical to the original cell.
BINARY FISSION

- Most cells reproduce through some sort of **Cell Division**
- Prokaryotic cells divide through a simple form of division called **Binary Fission**
- 3 step process
  - Single “naked” strand splits and forms a duplicate of itself.
  - The two copies move to opposite sides of the cell
  - Cell “pinches” into two new and identical cells called **"daughter cells"**. (Cell wall then forms if applicable)
The process by which eukaryotic cells reproduce themselves, resulting in daughter cells that contain the same amount of genetic material as the parent cell.

Occur in body cells (somatic cells)
CELL DIVISION OCCURS IN A SERIES OF STAGES OF PHASES
How do mitosis and binary fission compare???
Animated Mitosis Cycle

http://www.cellsalive.com/mitosis.htm

- Prophase
- Metaphase
- Anaphase
- Telophase
• Nuclear envelope disappears
• Centrioles appear and begin to move to opposite end of the cell.
• Spindle fibers form between the poles.
PROPHASE

Animal Cell

Plant Cell

Spindle fibers

Centrioles

Photographs from: http://www.bioweb.uncc.edu/biol1110/Stages.htm
• Chromatids (or pairs of chromosomes) attach to the spindle fibers.
• Line up in the middle of the cell
METAPHASE

Animal Cell

Plant Cell

Photographs from: http://www.bioweb.uncc.edu/biol1110/Stages.htm
• Chromatids (or pairs of chromosomes) separate and begin to move to opposite ends of the cell.
ANAPHASE

Animal Cell  Plant Cell

Photographs from: http://www.bioweb.uncc.edu/biol1110/Stages.htm
• Two new nuclei form.
• Chromosomes appear as chromatin (threads rather than rods).
• Mitosis ends.
TELOPHASE

Animal Cell

Plant Cell

Photographs from: http://www.bioweb.uncc.edu/biol1110/Stages.htm
CELL CYCLE

1. Interphase
2A. Mitosis: Prophase
2B. Mitosis: Metaphase
2C. Mitosis: Anaphase
2D. Mitosis: Telophase
3. Cytokinesis

Centrioles
Spindle fiber
Chromatids
Centromere
1) What are the phases of mitosis (hint: there are 4)
2) Describe the major events that happen in each phase.
1) What are the phases of mitosis? (Hint: there are four)
   - Prophase
   - Metaphase
   - Anaphase
   - Telophase

1) Describe the major event that happens in each step.
   - Prophase = spindle fibers form, nuclear envelope disappears
   - Metaphase = chromatids line up at center of cell
   - Anaphase = chromatids are pulled to opposite ends of the cell
   - Telophase = 2 new nuclear envelopes appear, mitosis ends
TIME TO WRITE

- Use the guided notes to create a mitosis foldable.
- Once you are finished share your paper with a partner.
- Make any necessary changes.
MEIOSIS

- Similar in many ways to mitosis
- Several differences
  - Involves 2 cell divisions
  - Results in 4 cells with 1/2 the normal genetic information
VOCABULARY

- **Diploid (2N)** - Normal amount of genetic material (somatic cells)
- **Haploid (N)** - 1/2 the genetic material. (gametes)
- Meiosis results in the formation of haploid cells.
- In Humans, these are the **Ova** (egg) and **sperm**.
- Ova are produced in the **ovaries** in females
- Process is called **oogenesis**
- Sperm are produced in the **testes** of males.
- Process is called **spermatogenesis**
Meiosis occurs in 2 phases; **Meiosis I**, & **Meiosis II**.

**Meiosis I.**
- Prior to division, amount of DNA doubles
CROSSING OVER

- During prophase 1, homologous chromosomes come together.
- Areas of homologous chromosomes connect at areas called **chiasmata**.
Crossing Over of genes occurs now

- Segments of homologous chromosomes break and reform at similar locations.
- Results in new genetic combinations of offspring.

This is the main advantage of sexual reproduction.
PAUSE AND THINK

- What is the difference between haploid and diploid?
- Where are ova and sperm made?
- How many phases of meiosis occur?
- What is crossing over and when does that occur?
What is the difference between haploid and diploid?

- Haploid (n) contains half the number of chromosomes
- Diploid (2n) contains two sets of chromosomes

Where are ova and sperm made?

- Testes and ovaries

How many phases of meiosis occur?

- 2 divisions

What is crossing over and when does that occur?

- Leads to genetic diversity, Prophase I
MEIOSIS I

- Does this look familiar?
- Can you explain what is happening?
DNA does not double.

Chromosomes randomly line-up along metaphase plate like regular mitosis.

During anaphase 2, **CENTROMERES BREAK** and each chromosome is pulled to opposite sides of the cell.

Nuclei reform and cytokinesis usually occurs (although it is often unequal).
OVERVIEW OF MEIOSIS
COMPARISON OF MITOSIS & MEIOSIS

Mitosis

DNA replication

Mitotic division 1

Meiotic division 1

Homologous chromosomes at the same level on equatorial plate

Mitotic division 2

Meiotic division 2

Homologous chromosome lineups individually at the equatorial plate

Cell division

Cell division 1

Cell division 2
Press Pause, Think, & Share

1) When does crossing over occur? What benefit does it create over asexual reproduction?
2) How many times does the nucleus divide in Meiosis?
3) How many cells are produced from Meiosis?
1) When does crossing over occur? What benefit does it create over asexual reproduction?
   - Prophase I
   - Due to crossing over species have genetic diversity

1) How many times does the nucleus divide?
   - Twice, during Meiosis I and II again in Meiosis II

1) How many cells are produced from Meiosis?
   - 4 different, haploid, gamete cells
Time to Write

Use the guided notes to complete the meiosis side of the foldable.

Once you are finished share your paper with a partner.

Make any necessary changes.