CONCEPT: MICROTUBULES AND CELL DIVISION

● Microtubules are extremely important in cell division

□ Many types of microtubules are responsible for _____ the cell during division

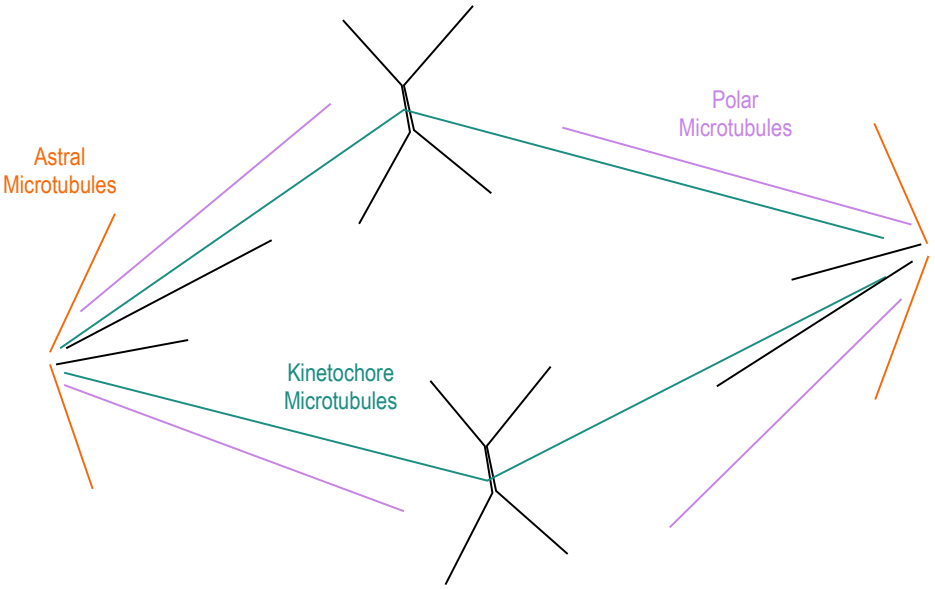
- **Kinetochore microtubules** attach to condensed chromosomes at centromeres

- **Chromosomal microtubules** connect chromosomal ends to *chromokinesin*

- *Polar microtubules* do not attach to chromosomes, but stabilize other microtubules

- **Astral microtubules** extend outward from centrosomes to cell periphery

EXAMPLE: Types of microtubules



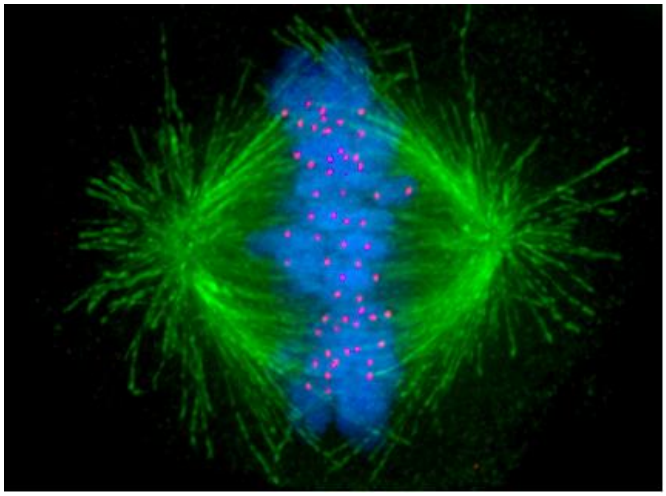
● The *mitotic spindle* and *contractile ring* are formed by microtubules during cell division

□ **Mitotic spindle** is responsible for segregating replicated chromosomes into different daughter cells

- Takes an hour for cellular microtubules to be disassembled and reorganized to form mitotic spindle

□ **Contractile ring** is responsible separating the two daughter cells after division

EXAMPLE: Mitotic spindle created by microtubules (Green)



● Microtubules are important for each _____ of mitosis

□ *Interphase:* microtubules are long and stretched throughout the cell

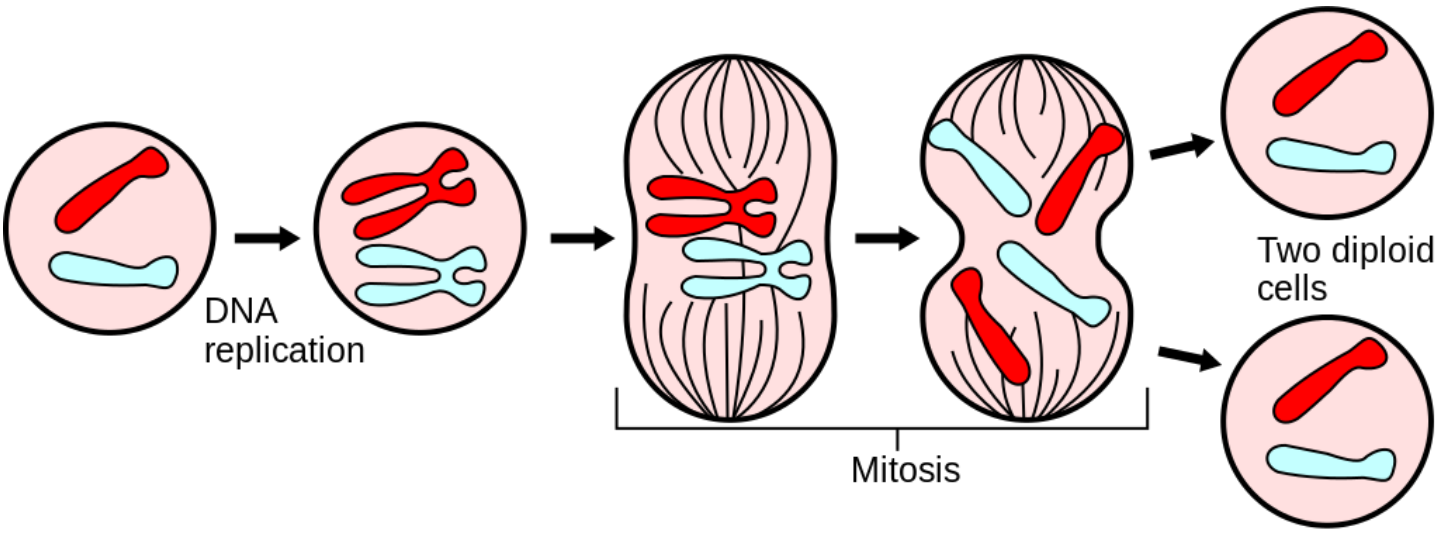
□ *Prophase:* microtubules are moved to opposite sides of the cell and form mitotic spindles

□ *Metaphase:* Microtubules organize chromosomes in center of cell

□ *Anaphase:* Sister chromatids separate and move to opposite poles

□ Motor proteins are responsible for many of the microtubule movement in mitosis

EXAMPLE: Microtubules during Mitosis



PRACTICE:

1. True or False: Microtubules are rarely used during cell division.
    a. True
    b. False

2. Which of the following microtubules attach to centromeres?
    a. Kinetochore
    b. Chromosomal
    c. Polar
    d. Astral

3. Which of the following microtubules do not attach to chromosomes?
    a. Kinetochore
    b. Chromosomal
    c. Polar