

Cell Cycle Regulation

- Two different molecules regulate whether or not a cell undergoes mitosis
 - **Cyclins** (proteins)
 - **Cyclin-dependent kinases (CDKs)** (proteins that need cyclins to keep producing)
- In **G₁, cyclin and CDKs** signal the beginning of the cycle
- This allows regulation of how frequent the cell will undergo mitosis
- There are many checkpoints throughout the cycle, need the protein there to continue in the cycle
- Both CDK and cyclin is needed to continue the cycle, without one, it cannot continue

Checkpoints

There are multiple checkpoints throughout the cycle to ensure that the cell division is proper and successful

G_1 Checkpoint

- Checks for
 - size
 - nutrients
 - growth factors
 - DNA damage
- Happens before G_1 , before the beginning of the cycle

G_2 Checkpoint

- Checks for
 - DNA damage (after replication)
 - DNA replication completeness
- Happens after S to check if DNA synthesis is good and complete

Spindle (Metaphase) Checkpoint

- Checks for
 - All spindles are attached to the chromosomes
- Makes sure all the DNA is present in both cells

Cell death

- When something is wrong with the cell cycle or just the cell, it needs to be removed.
- This process is called **Apoptosis**
- This only happens when the cell is **beyond repair**
- May lead to cancer if apoptosis is not executed properly

Steps

1. Something is detected as wrong
2. Begins Apoptosis
3. Cells shrink and shrivel
 1. Digested by Lysosomes in a controlled process
4. The cell is split up into smaller pieces
5. White blood cells take and reuse the discarded pieces

Other uses for Apoptosis

- Removal of tissues like tails in tadpoles
- Organ sculpting
- Removing the skin between fingers when humans are being birthed