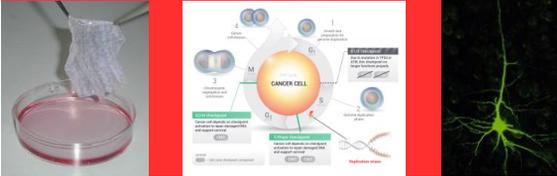


4.7 Regulation of Cell Cycle



ENDURING UNDERSTANDING

IST-1 Heritable information provides for continuity of life.

IST-1.D Describe the role of checkpoints in regulating the cell cycle.

□ A number of internal controls or checkpoints regulate progression through the cycle.

Cell Cycle Checkpoints

- Three main checkpoints
 - G1
 - Restriction point in animals
 - G2 (MPF- maturation promoting factor)
 - M (anaphase is checkpoint)

Specialized Cells

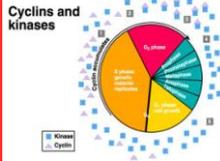
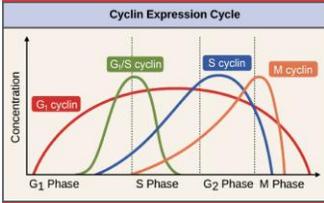
- Some cells (e.g., skin cells) divide continuously throughout life.
- Other cells (e.g., skeletal muscle cells and nerve cells) are arrested in the G1 stage.
- Still other cells, such as cardiac muscle cells, are arrested in the G2 Stage.

IST-1.D Describe the role of checkpoints in regulating the cell cycle.

□ Interactions between cyclins and cyclin-dependent kinases control the cell cycle.

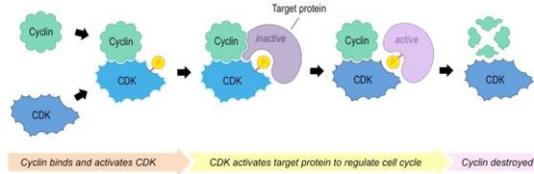
Cyclin Proteins

- Cycle at different concentrations in cell division
- Combine with cyclin-dependent kinases, which in turn activate protein enzymes; one destroys cyclin (MPF).



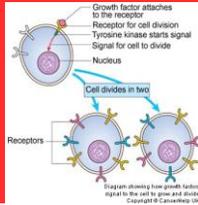
Cdks

- Kinases that combine with cyclins become activate proteins that regulate the passage of cells through the various stages of the cell cycle.
- Kinases remove a phosphate group from ATP and add it to another protein.
- The recipient protein (which may be another kinase) becomes activated.
- Kinases of cell cycle are cyclin dependent because they activate when they combine with cyclin.



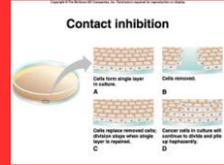
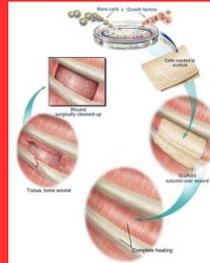
Platelet-derived Growth Factors

- Activate signaling pathway involving gene expression, cell cycle and many other processes.
- PDGF is mainly believed to be an important mitogen for connective tissue, especially for fibroblasts that serve in wound healing.
- PDGF has important roles in embryonic development, cell proliferation, cell migration, blood vessel formation (angiogenesis), and the growth of blood vessels from already existing blood vessel tissue.



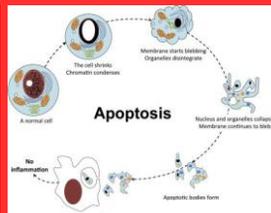
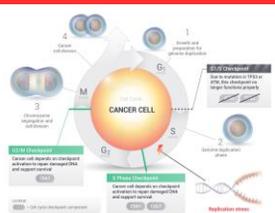
Other Factors

- Growth factors (regulatory substances) may be necessary.
- Cell density (density –dependent inhibition)
- Cell size is main indicator of cell division.



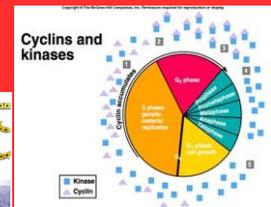
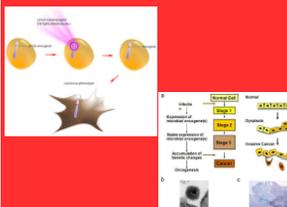
IST-1.E Describe the effects of disruptions to the cell cycle on the cell or organism.

- Disruptions to the cell cycle may result in cancer and/or programmed cell death (apoptosis).



Cancer

- Oncogenes
 - Cancer-causing genes
 - May code for cyclins that no longer function as they should.
 - Ordinarily a cyclin combines with its kinase only when a growth factor is present.
 - Cyclin that has gone awry combines with its kinase when growth factor is absent, resulting in a tumor.



Cancer

- Tumor-suppressor genes
 - A family of normal genes that instruct cells to produce proteins that restrain cell growth and division.
 - Loss of such proteins allows a cell to grow and divide in an uncontrolled fashion.
- Benign tumors stay at original site.
- Malignant tumors have the ability to metastasize.

