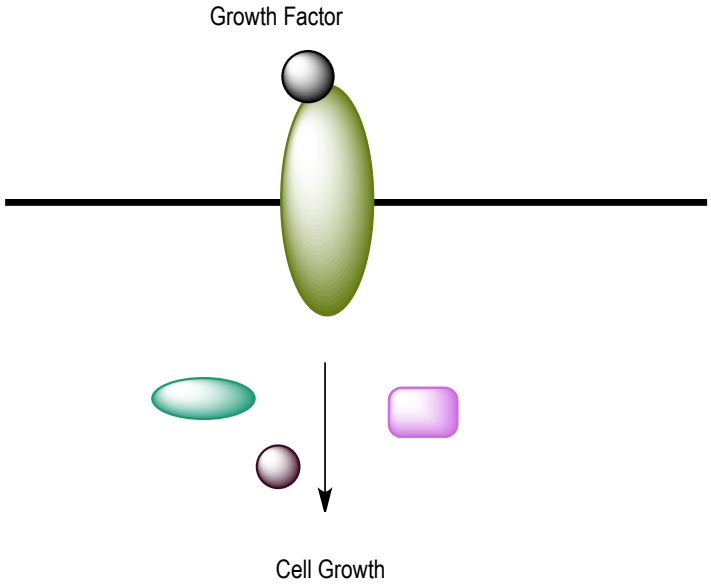
CONCEPT: CONTROL OF CELL SIZE

- There are three _____ factors that play a role in cell division, size, and survival
  - □ **Mitogens** stimulate cell division by removing negative controls that block cell cycle progression
    - Trigger wave of G_1/S Cdk activity
  - □ **Growth factors** stimulate cell growth by promoting protein synthesis and inhibiting degradation
  - □ **Survival factors** stimulate cell survival by suppressing apoptosis
  - □ It is important to understand the difference between these three and not confuse them
    - Cell growth does not mean the same thing as cell _____

EXAMPLE: Growth factor stimulates cell growth

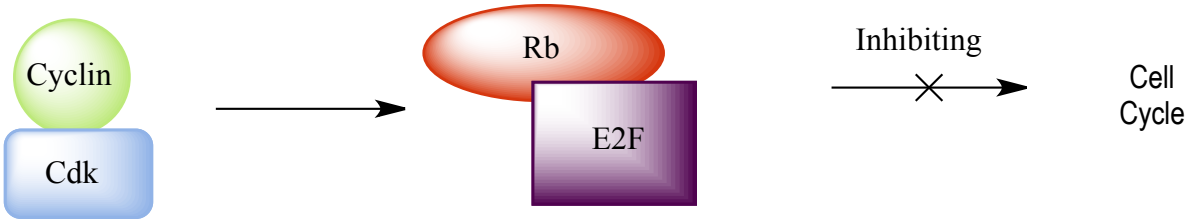


- Mitogens and Growth factors stimulate a variety of intracellular proteins that control cell size and the cell cycle
  - □ Mitogens stimulate G_1 Cdks which enter the cell into the growth phase of the cell cycle
    - Without them the cell enters into G_o
  - □ **E2F** transcription factor is activated by a variety of mitogens and growth factors (PDGF, EF)
    - E2F is a transcription factor that actives genes to promote S-phase entry
    - Inhibited by *retinoblastoma protein* (Rb) binding
  - □ **RAS-MAPK** signaling pathway can also activate transcription factors that support growth

□ DNA damage repair pathway can pause the cell cycle and result in cell growth

- PI3K-AKt pathway

EXAMPLE: E2F and retinoblastoma protein inhibit the cell cycle and cell growth



PRACTICE:

1. Which of the following factors is not responsible for controlling cell division, size, or survival?
    a. Growth factors
    b. Survival factors
    c. Integrins
    d. Mitogens

2. Which of the following proteins is a transcription factor that activates genes to promote entrance into S phase?
    a. Mitogens
    b. RAS-MAPK
    c. PI3K-AKT
    d. E2F