CONCEPT: OVERVIEW OF CANCER

● Cancer is a disease that arises due to _____ cell growth and division

□ Unregulated **proliferation,** which is cell growth and division, causes cancer

- Unregulated **apoptosis** (programmed cell death) also causes cancer

□ Multiple mutations within somatic cells leads to cancer

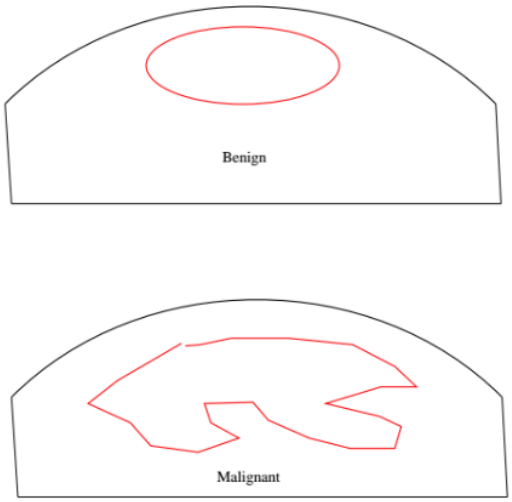
□ Cancers are genetically unstable, with a variety of mutations and chromosomal aberrations

□ There are two types of tumors

- **Benign** tumors have abnormal proliferation, but remain in a single area

- **Malignant** tumors **metastasize** to other areas of the body

EXAMPLE:



□ **Tumorigenesis** is the development of a malignant _____

- Requires more than one mutation

- Affects **signal transduction pathways** which are regulation protein networks that control cell activities

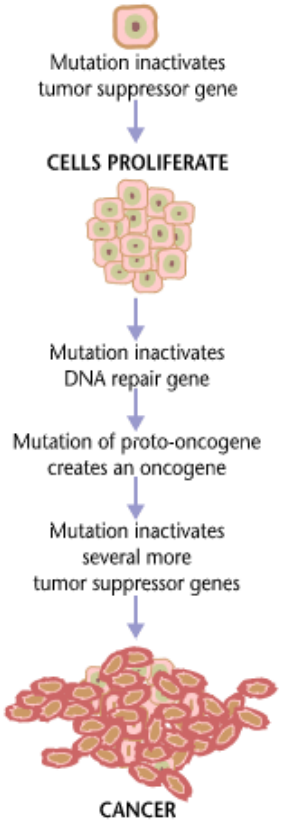
□ Cancer is **clonal** meaning that it derives from a single cell

- Genetic aberrations are passed onto progeny cells

- Cancer **stem cells** exist for some cancers, which proliferate and create more tumor cells

- Stem cells have the ability to self-renew and produce more of themselves

EXAMPLE:



Causes of Cancer

● Cancerous mutations can develop through many _____

1. Viruses can introduce mutations or aberrant genes that activate cancer causing genes

    - Human papillomavirus E6 and E7 proteins can lead to cancer

2. Epigenetic changes to the chromatin histone proteins can cause gene misregulation

    - Cause over-activation or under-activation of important regulatory genes

3. Environmental substances can lead to mutations (Ex: cigarette smoke)

● Misregulation of the cell cycle is one way these mutations can _____ in a single cell

□ The cell cycle has uses **cylins** and **cyclin-dependent kinases** to regulate the cell cycle

- These proteins control passage through cell cycle *checkpoints*

□ Important cell cycle checkpoints include:

- G_1 to S transition – which is partially controlled through *retinoblastoma*

- This checkpoint ensures DNA damage is repaired before replication

- G_2 to M transition – is controlled through CDC2 cyclin dependent kinase and cyclinB

- This checkpoint ensures DNA replication has gone correctly

EXAMPLE: