CONCEPT: ONCOGENES AND TUMOR SUPPRESSORS

● Mutations give cancer cells certain properties:

1. Self-sufficiency to grow without growth signals
2. Insensitivity to anti-growth signals
3. Apoptosis evasion
4. Unlimited replication
5. Angiogenesis
6. Invasion and metastasis in other tissues
7. Genetic instability

● **Oncogenes** are _____ genes that become overexpressed and support cancer

□ **Proto oncogenes** are the normal (not mutated) versions of oncogenes

- Become oncogenes through mutations, or through gene amplification

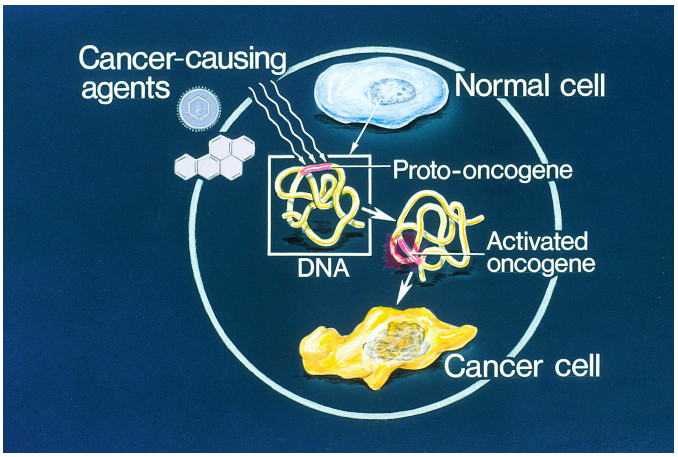
□ Activity gain results in cell proliferation, cell survival, and tumor development

□ Oncogenes are generally

- Growth factors
- Receptors that stimulate growth-signaling pathways
- GTP binding proteins
- Protein kinases (receptor or non-receptor)
- Transcription factors
- Regulators of the cell cycle or apoptosis

□ **Ras** is an oncogene GTPase that is mutated in 20% of _____ cancers

EXAMPLE:



● **Tumor suppressors** are genes that when mutated result in activity loss and _____ to cancer

□ Activity loss results in cell proliferation, cell survival, and tumor development

□ The transcription factor **p53** is a great example of a tumor suppressor

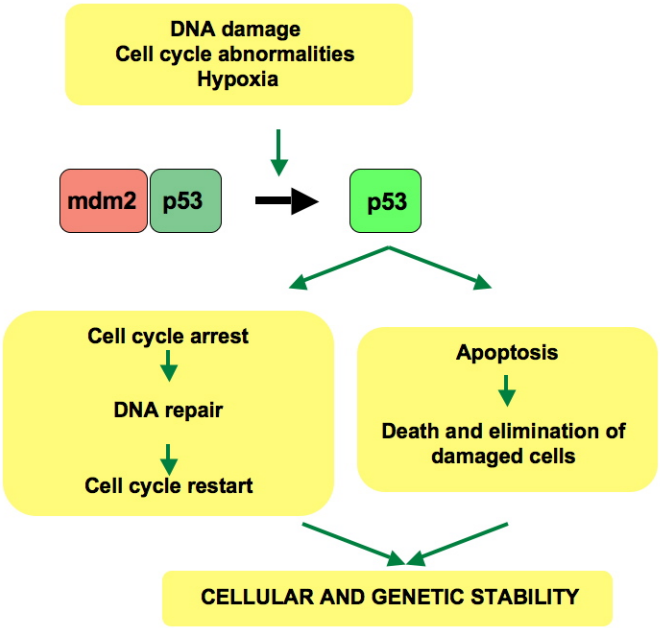
- Normally p53 responds to DNA damage and helps the cell repair itself

- When mutated, the cell can't respond properly to DNA damage - leads to genetic instability

□ **Retinoblastoma** is a tumor suppressor that regulates the cell _____

- Mutated form can be inherited

EXAMPLE:



PRACTICE:

1. True or False: Tumor suppressors are mutated genes that results in higher amounts of gene activity.
    a. True
    b. False

2. Which of the following properties is not one given to cancer by gene mutations?
    a. Ability to evade apoptosis
    b. Unlimited replication
    c. Self-sufficiency from growth signals
    d. Genetic Stability