Lecture for Friday

Dr. Prince

Have a safe and STD free Spring Break

THE GENETIC BASIS OF THE BIG "C"

and

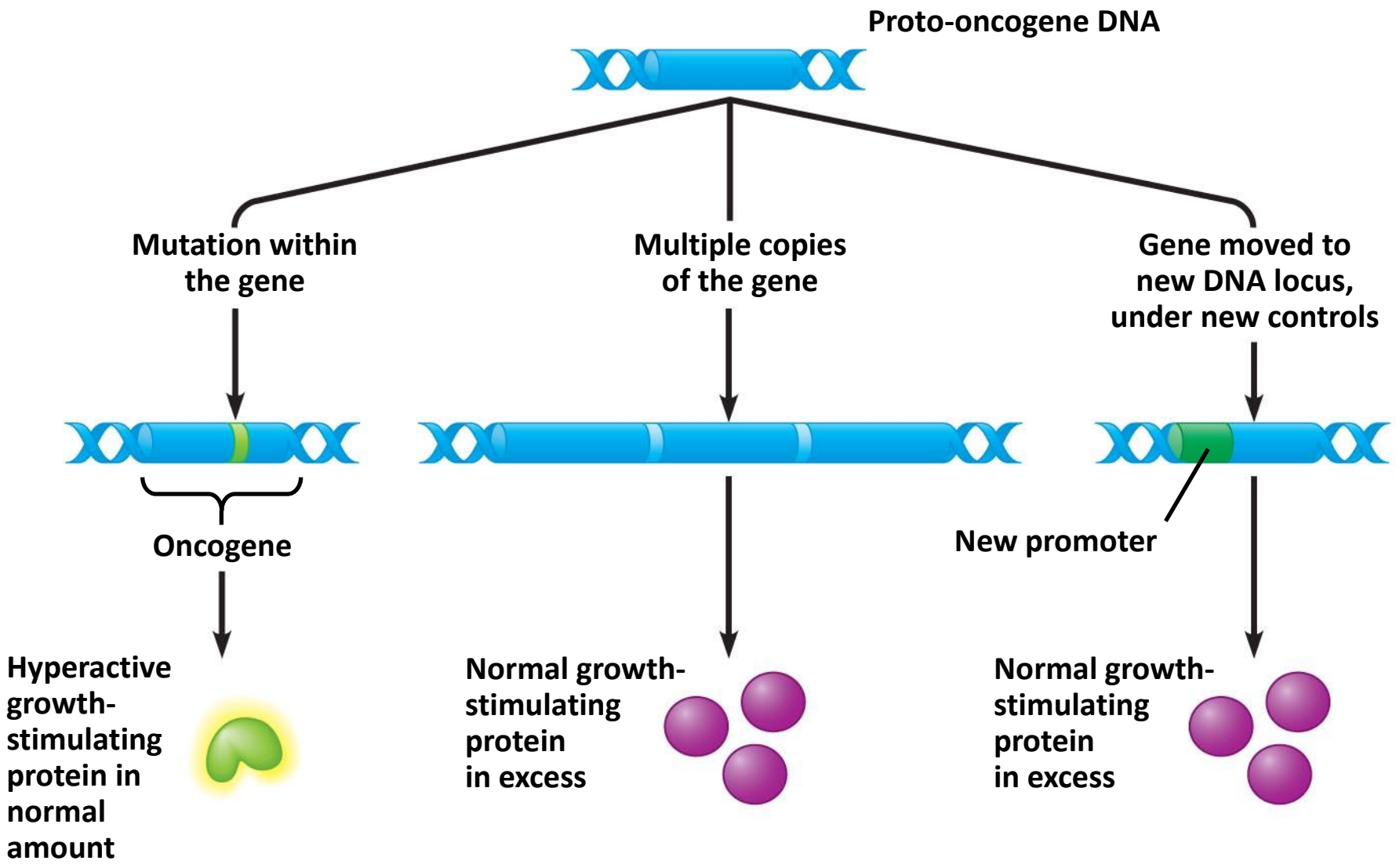
I DON'T MEAN CASH!

Cancer

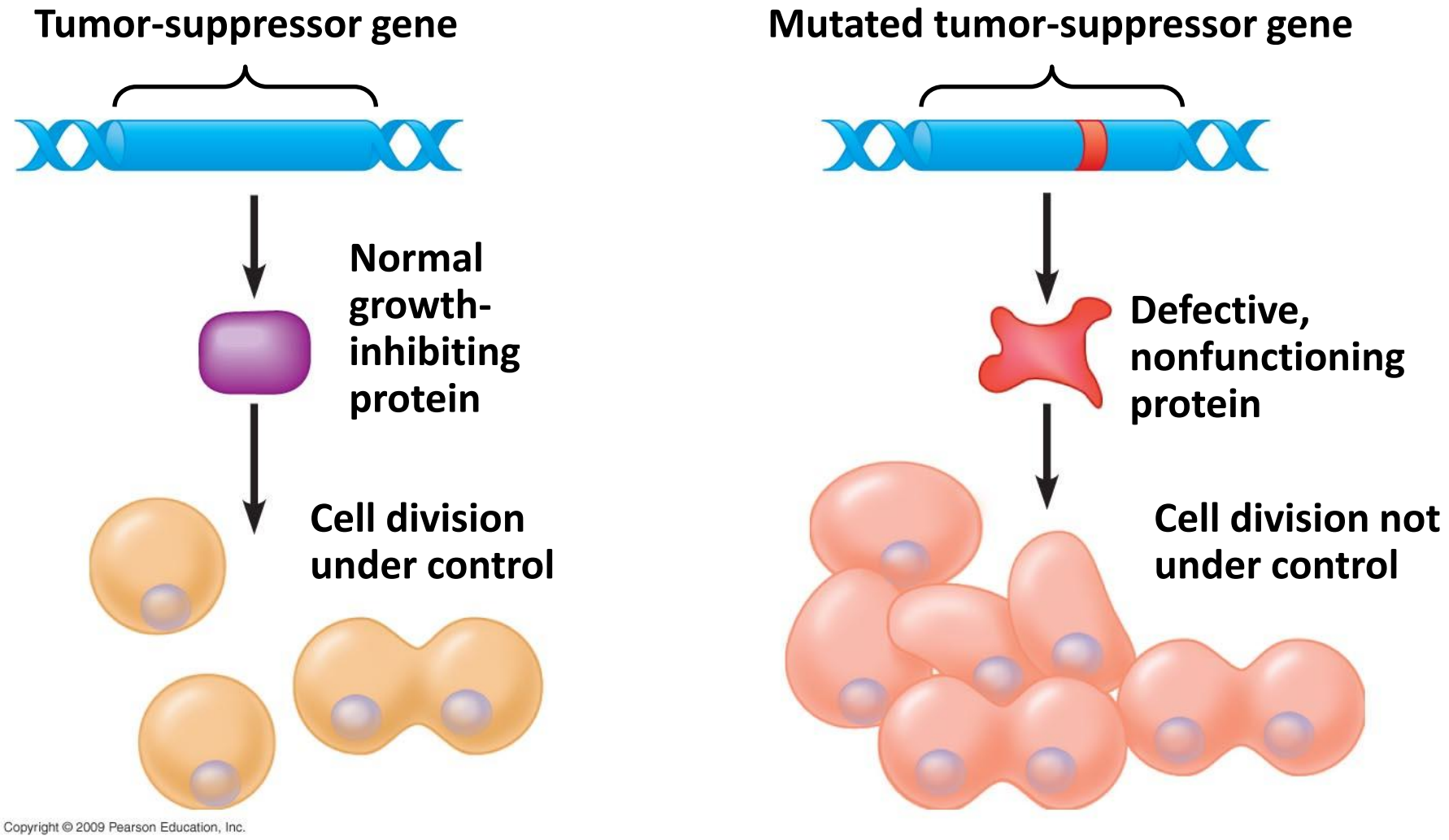
- Mutations in two types of genes can cause cancer
  - **Oncogenes**
    - **Proto-oncogenes** normally promote cell division
    - Mutations to oncogenes enhance activity
  - **Tumor-suppressor genes**
    - Normally inhibit cell division
    - Mutations inactivate the genes and allow uncontrolled division to occur

Mutations in genes that control cell division CANCER

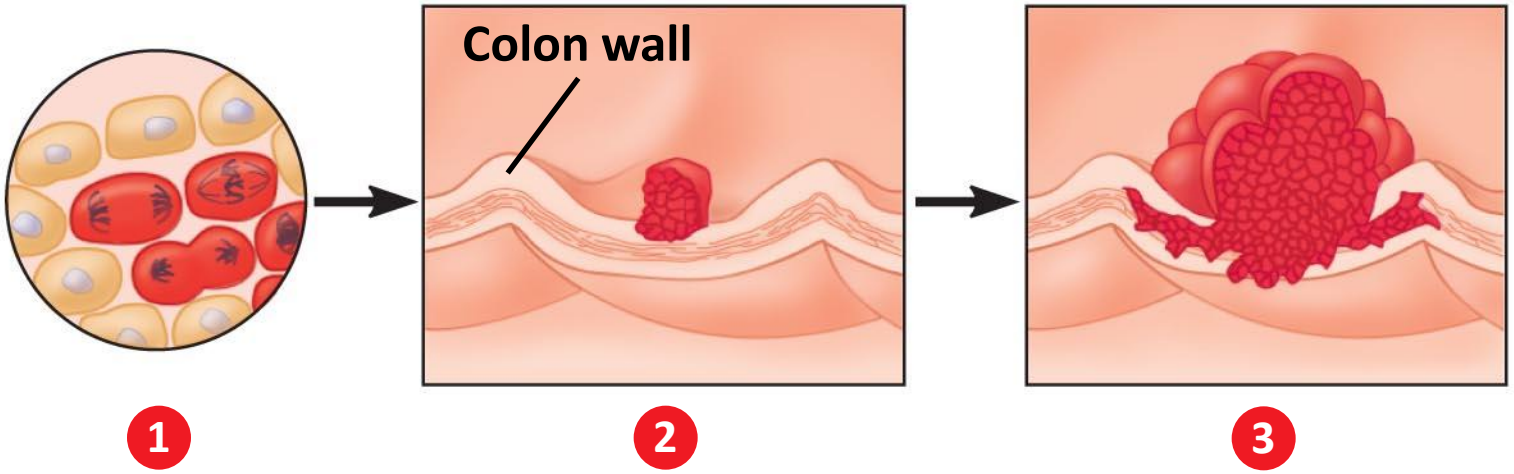
- Oncogenes
  - Promote cancer when present
  - Can be inserted by viruses
  - Can be mutated versions of genes that promote cell division
- Converting a proto-oncogene to an oncogene can occur by
  - Mutation
  - More copies of the gene
  - Change in the promoter gene resulting in increased transcription



Tumor-suppressor genes



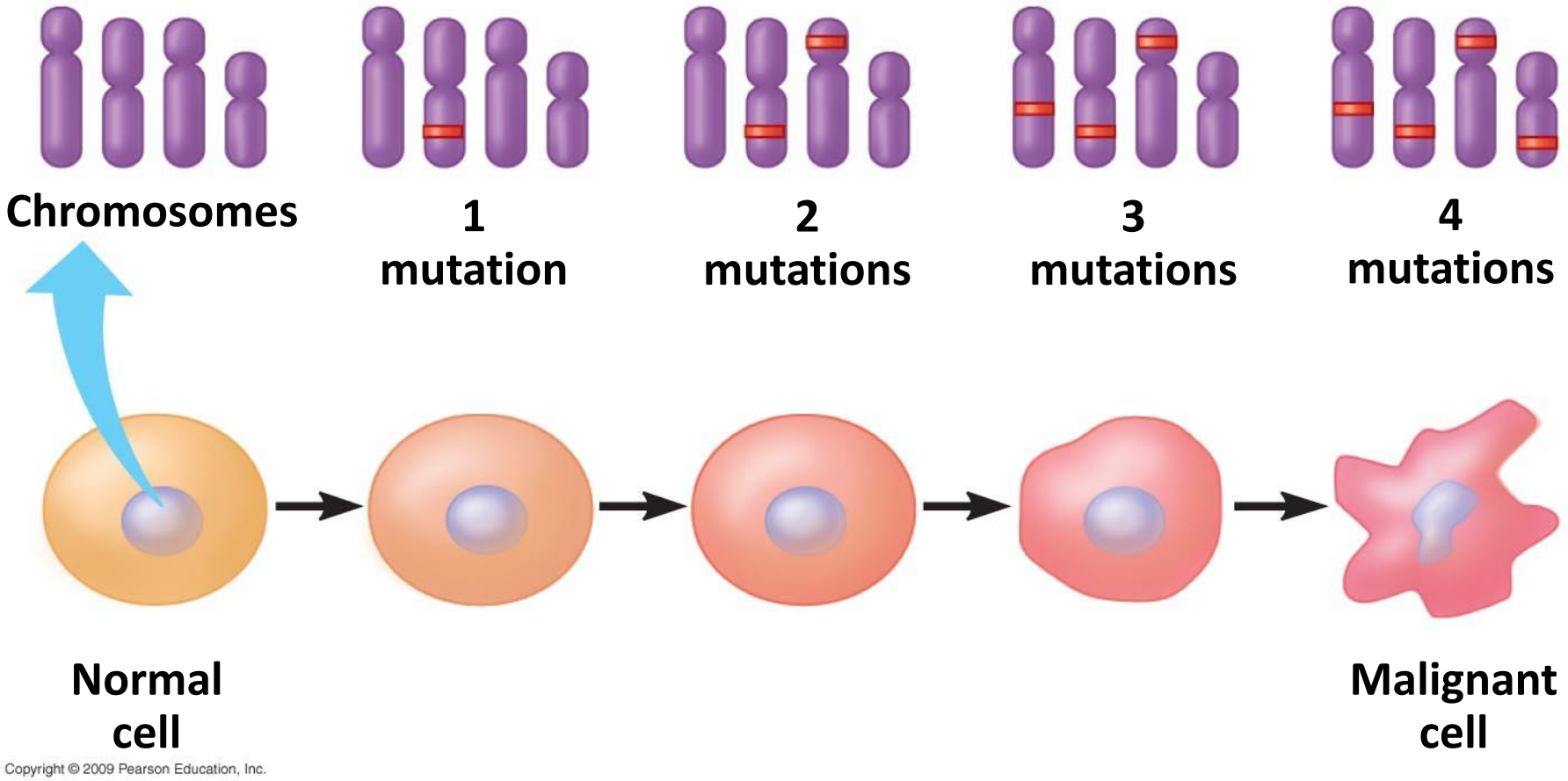
One possible scenario for colorectal cancer



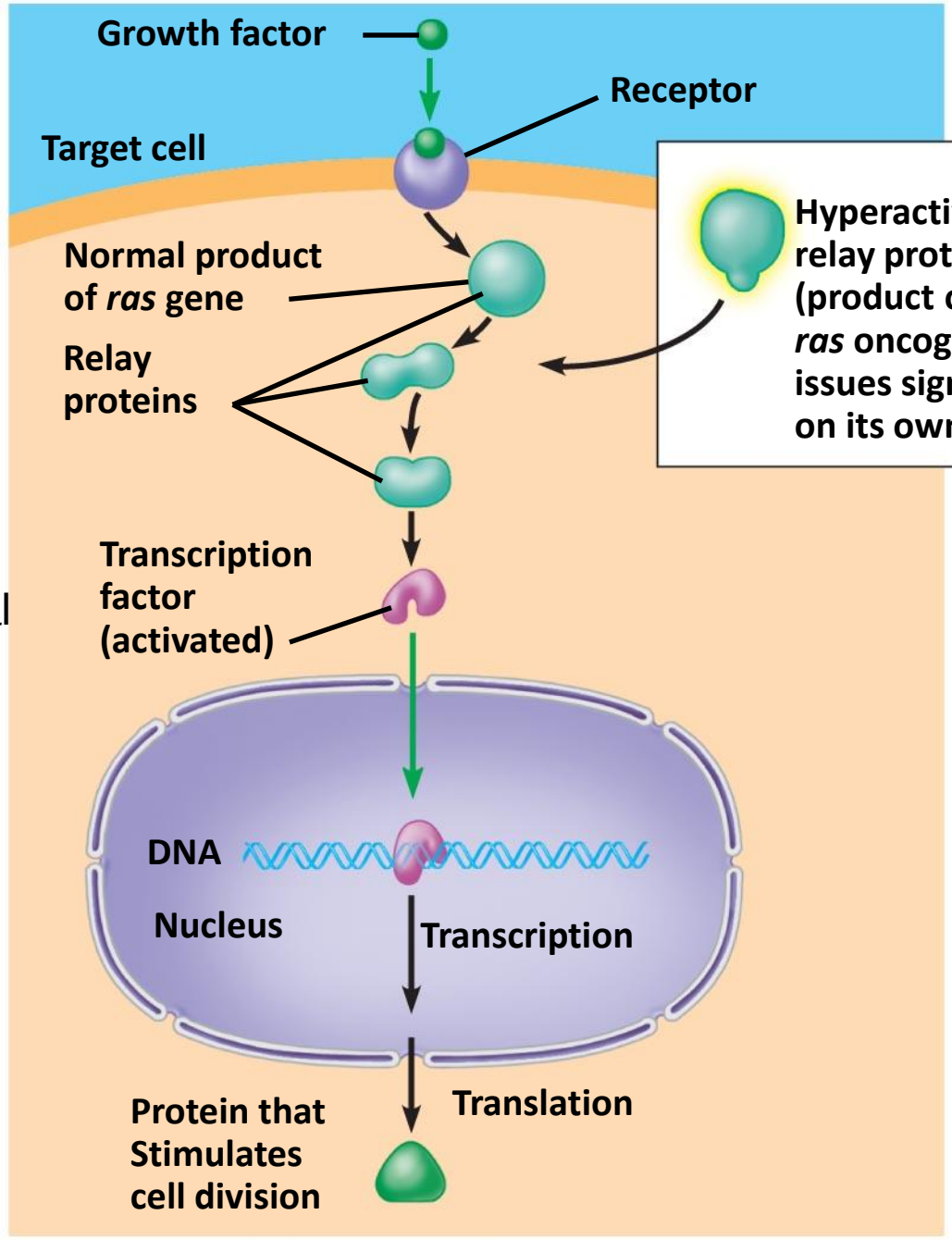
	1	2	3
Cellular changes:	Increased cell division	Growth of polyp	Growth of malignant tumor (carcinoma)
DNA changes:	Oncogene activated	Tumor-suppressor gene inactivated	Second tumor-suppressor gene inactivated

Promote cancer when both copies are mutated

Four or more mutations are usually required to produce a cancer cell



Product of *ras* proto-oncogene relays a signal when growth hormone binds to receptor

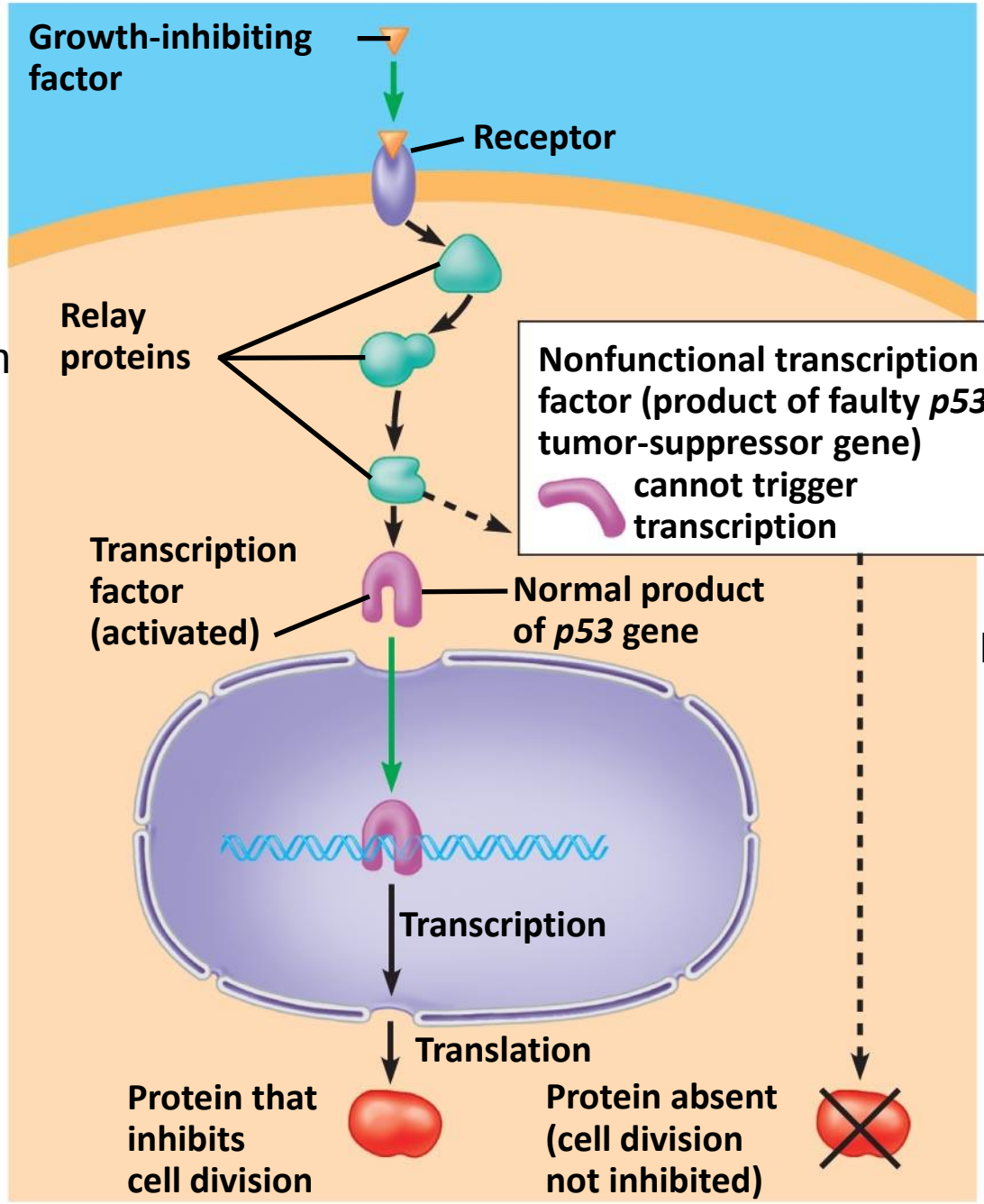


Faulty proteins

Product of *ras* oncogene relays the signal in the absence of hormone binding, leading to uncontrolled growth

Faulty proteins

Product of ***p53*** tumor-suppressor gene is a transcription factor that **normally activates genes** for factors that **stop cell division**



No functional *p53*, cell division continues because the **inhibitory protein is not produced**

Lifestyle choices can reduce the risk of cancer

- **Carcinogens** are cancer-causing agents that damage DNA and promote cell division
  - X-rays and ultraviolet radiation
  - Tobacco
- Healthy lifestyle choices
  - Avoiding carcinogens
  - Avoiding fat and including foods with fiber and antioxidants
  - Regular medical checkups

TABLE 11.21 CANCER IN THE UNITED STATES

Cancer	Risk Factors	Estimated Number of Cases in 2007
Prostate	African heritage; possibly dietary fat	218,900
Lung	Tobacco smoke	213,400
Breast	Estrogen	180,500
Colon, rectum	High dietary fat; smoking; alcohol	153,800
Lymphomas	Viruses (for some types)	71,400
Urinary bladder	Cigarette smoke	67,200
Melanoma of skin	Ultraviolet light	59,900
Kidney	Cigarette smoke	51,200
Leukemias	X-rays; benzene; virus (for one type)	44,200
Uterus	Estrogen	39,000
Pancreas	Tobacco smoke; obesity	37,200
Mouth and throat	Tobacco in various forms; alcohol	34,400
Ovary	Obesity; many ovulation cycles	22,400
Stomach	Table salt; cigarette smoke	21,300
Liver	Alcohol; hepatitis viruses	19,200
Brain and nerve	Trauma; X-rays	20,500
Cervix	Sexually transmitted viruses; tobacco	11,200
All others		179,400

Essays to Study for Test

10 Points Each + 20 points worth of Multiple Choice Questions

1. Describe who was Mendel **(5 points)** and why he is important in the study of biology **(5 points)**.
2. List and describe both of Mendel's laws **(5 points each)**.
3. Be able to work out a dihybrid cross on a Punnett square (5 points for correct answer and 5 points for explanation of work).
4. Explain why a test cross is done (5 points) and then explain how a test cross is done (5 points).
5. Explain the Hershey-Chase experiment and what we learned from it. (5 points for the procedure and 5 for the "what we learned from it")
6. Explain Gene Expression (protein synthesis) with a focus on both Transcription (5 points) and Translation (5 points).
7. Explain the "What should I wear" lecture I relation to control of gene expression (Give me 5 important points from that lecture in reference to control of gene expression for 2 points each).
8. What life style choices reduce the risk of cancer? (Mention 5 for 2 points each)

You should now be able to

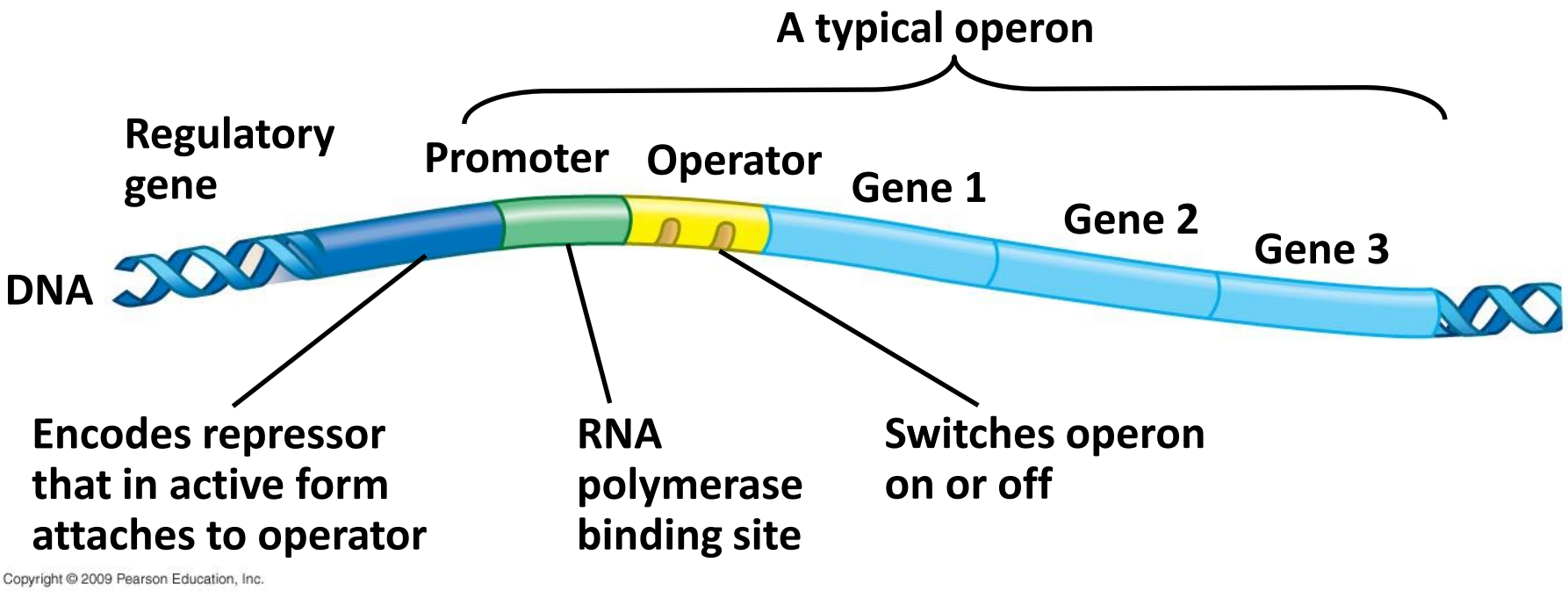
1. Explain how prokaryotic gene control occurs in the operon
2. Describe the control points in expression of a eukaryotic gene
3. Describe DNA packing and explain how it is related to gene expression
4. Explain how alternative RNA splicing and microRNAs affect gene expression
5. Compare and contrast the control mechanisms for prokaryotic and eukaryotic genes

You should now be able to

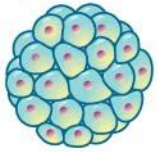
6. Distinguish between terms in the following groups: promoter—operator; oncogene—tumor suppressor gene; reproductive cloning— therapeutic cloning
7. Define the following terms: Barr body, carcinogen, DNA microarray, homeotic gene; stem cell; X-chromosome inactivation
8. Describe the process of signal transduction, explain how it relates to yeast mating, and explain how it is disrupted in cancer development

You should now be able to

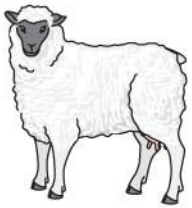
9. Explain how cascades of gene expression affect development
10. Compare and contrast techniques of plant and animal cloning
11. Describe the types of mutations that can lead to cancer
12. Identify lifestyle choices that can reduce cancer risk



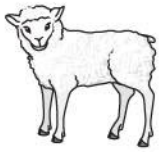
Nucleus from donor cell



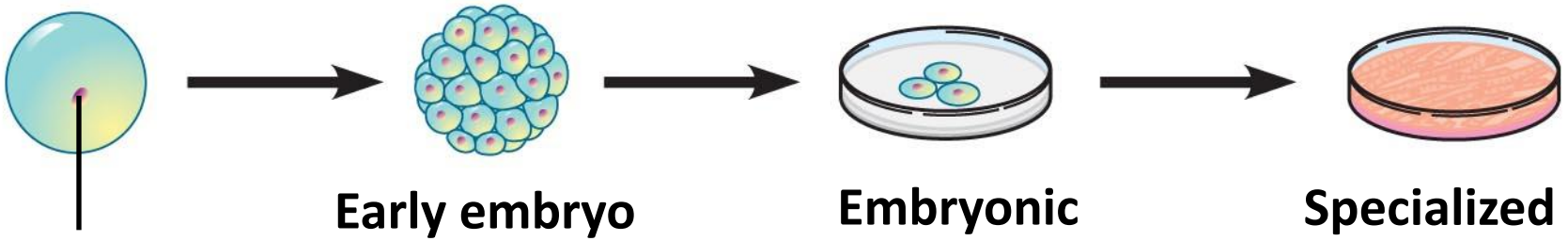
Early embryo resulting from nuclear trans-plantation



Surrogate mother



Clone of donor



Nucleus from donor cell

Early embryo resulting from nuclear trans-plantation

Embryonic stem cells in culture

Specialized cells