

## EXTENSION ACTIVITY:

# What's Your Risk?

4a

## Extension Lesson Summary:

In this extension to Lesson Four, students will continue to apply their knowledge of cell cycle controlling genes and the multi-step process of cancer development. An additional layer of complexity is introduced in the "What's Your Risk" game by asking students to now consider how environmental, behavioral and preexisting conditions impact cancer development.

## Materials:

- Cell Cycle & Cancer Cause and Effect Cards, in bags from Lesson Four
- Risk Factor Game Pieces, in a paper bag
- Student Page: Development of Cancer Concept Map

## Advance Preparation:

- Print Student Page: What's Your Risk (one per student)
- Prepare *What's Your Risk?* Cards by printing them on colored paper and possibly laminating for future use. (one bag per group)

## Procedure and Discussion Questions with Time Estimates:

1. **(15-20 min)** This activity is very similar to the "What Happens When Genes Lose Control?" activity from Lesson Four, with the addition of a third bag of "risk factors"
  - a. In each of 4 rounds students will draw one card from the proto-oncogene bag, one card from the tumor suppressor gene bag and one card from the risk factor bag. Combining the results of all three cards students then choose the correct effect card. They should record their results on their Student Page. *TEACHER NOTE: For a negative risk factor the mutation is specific to the type of gene (tumor suppressor or proto-oncogene) specified on the card. For positive behaviors the student may use the card to eliminate a mutation on either the tumor suppressor gene or the proto-oncogene).*
  - b. Students should continue to work in their group to complete the "What's Your Risk" student page.

## Assessment Suggestions:

- Collect Student Page: What Happens When Genes Lose Control?



# Game Pieces: What's Your Risk?

You always wear broad spectrum sunscreen that protects against UVA and UVB rays and is SPF 30 or higher. You also reapply at least every two hours.

**This behavior prevents one mutation.**

Skin cancer is the most common of all cancer types. More than 3.5 million skin cancers are diagnosed each year in the United States. Both UVA and UVB rays cause DNA damage.

**You frequently use tanning beds and never wear sunscreen.  
This leads to a mutation in a proto-oncogene.**

According to the American Cancer society being overweight or obese likely raises a person's risk of getting at least 13 types of cancer. Your weight affects your immune system, levels of certain hormones and proteins, and how the body's cells grow and divide.

**You are one of the 2/3 of Americans who are overweight.  
This leads to a mutation in a tumor suppressor gene.**

You are healthy eater. You pay attention to portion size and approximately 50% of your diet consists of fruits and non-starchy vegetables. You limit the amount of added sugars, white bread, cakes, cookies and fried foods in your diet.

**This behavior prevents one mutation.**

Tobacco smoke contains more than 7,000 chemicals and compounds. Hundreds of these are toxic, and at least 69 are cancer causing.

**You are a smoker. This behavior causes one mutation in a tumor suppressor gene.**

Your mother and sister have breast cancer. You see a genetic counselor and find out that you have a mutation in your BRCA-1 gene.

**You have one mutation in a tumor suppressor gene.**

Research indicates that the more alcohol a person drinks (particularly the more a person drinks on a regular basis) the higher his/her risk is of developing an alcohol associated cancer. Based on data from 2009, about 19,500 cancer deaths were cancer related. Alcohol related cancers include head and neck cancer, esophageal cancer, liver cancer and breast cancer.

**You are a heavy alcohol drinker. This behavior causes one mutation in a tumor suppressor gene.**



# Game Pieces: What's Your Risk?

Research shows that people who use both alcohol and tobacco have much greater risks of developing cancers of the oral cavity, pharynx (throat), larynx and esophagus than people who use either alcohol or tobacco alone. The risks associated with using both tobacco and alcohol are multiplicative which means that they are greater than would be expected from adding the individual risks associated with alcohol and tobacco together.

**You are a heavy drinker and smoker. This behavior causes two mutations; one in a proto-oncogene and one in a tumor suppressor gene**

Radioactive materials that decay spontaneously produce ionizing radiation, which has enough energy to strip away electrons from atoms or break some chemical bonds. The damage caused by radiation can affect the genes controlling the cell cycle.

**You worked in the reactor at the Fukushima nuclear power plant during the earthquake and were exposed to large doses of radiation. This exposure caused two mutations. One in each copy of your tumor suppressor gene.**

You realize that avoiding tobacco (or deciding to stop using it) is one of the most important health decisions you can make.

**You are a non-smoker. This behavior prevents one mutation.**

In addition to helping you control your weight, physical activity may lower the risk of breast and colon cancer.

**You get at least 150 minutes a week of moderate aerobic activity or 75 minutes a week of vigorous physical activity. This behavior prevents one mutation.**

Cancer prevention includes protection from certain viral infections. Human papillomavirus (HPV) is a sexually transmitted virus that can lead to cervical and other genital cancers.

**You receive the HPV vaccine (Gardasil). This prevents one mutation.**

Age is a risk factor for cancer.

**You are 65 years old. You have one mutation in a tumor suppressor gene.**



# What's Your Risk?

Predict the possible outcome of the cell (the effect) based on the events on your three scenario cards (the causes).

	CAUSE	EFFECT
Round 1		
	CAUSE	EFFECT
Round 2		
	CAUSE	EFFECT
Round 3		
	CAUSE	EFFECT
Round 4		



