MEET DR. JESSICA FAGERSTROM, A MEDICAL PHYSICIST

Jessica works in a field that applies concepts in physics and engineering to questions in medicine. She specializes in radiation therapy physics, which means she helps treat patients who have cancer, using radiation.

Have you ever heard of any superheroes from comic books or movies that got their powers from radiation? It turns out that ionizing radiation, the kind of radiation that can damage DNA, can have some pretty big effects on our health. That's why radiation can be a powerful tool when it comes to treating cancer. Medical physicists working in radiation therapy make sure that radiation is delivered safely and effectively to target tumor cells. And while medical physicists don't work with radioactive spiders or big green hulking heroes, they do perform a very important job to make sure that patients get the care they need.

Dr. Fagerstrom earned her Ph.D. at the University of Wisconsin-Madison, and her previous work took her to Hawaii where she was a clinical physicist at Queen's Medical Center. She enjoys volunteering with young students, encouraging the next generation to pursue a career path in Medical Physics and other STEM professions. She also loves hiking, running marathons, and snorkeling with her husband, family, and friends.

"I love my job because I get to use fascinating science and cutting edge technology, to help people who are sick feel better. I also get to work with an absolutely fantastic team of people every day. On a daily basis, I know that our team is making a real difference in people's lives. I definitely recommend Medical Physics as a career for anyone who loves learning and helping people!"
- Dr. Jessica Fagerstrom

A DAY IN THE LIFE OF A MEDICAL PHYSICIST

Dr. Jessica Fagerstrom is a Medical Physicist who is passionate and committed to treating cancer patients with the highest quality healthcare. Can you find some of the terms she uses in her practice?

T	Z	R	C	H	Y	C	E	L	L	S	D	Y	Y	X	P
Y	S	T	A	B	E	G	L	W	W	K	R	P	G	E	H
T	X	I	N	D	E	A	R	V	M	W	S	A	O	N	Y
E	R	X	C	E	I	A	L	E	C	N	O	R	L	I	S
F	A	J	E	I	M	O	M	I	N	A	F	E	O	C	I
A	Y	B	R	Z	S	T	L	S	N	E	F	H	N	I	C
S	S	D	T	I	N	Y	N	O	T	G	I	T	H	D	S
V	Q	P	R	Q	X	N	H	I	G	G	C	N	C	E	H
S	T	N	E	I	T	A	P	P	O	Y	E	O	E	M	N
Z	T	Y	A	E	S	Z	N	Z	L	P	A	I	T	H	D
S	N	O	T	O	R	P	P	P	D	A	P	T	T	L	H
U	Y	U	M	Y	F	B	M	S	H	T	C	A	V	T	I
M	M	T	E	Y	P	A	R	E	H	T	O	I	D	A	R
S	I	O	N	I	Z	I	N	G	K	X	D	D	D	V	P
Y	E	I	T	L	R	Q	O	E	H	K	H	A	W	E	T
M	A	L	I	G	N	A	N	T	S	Q	M	R	D	D	M

- medical physicist
- radiation therapy
- radiotherapy
- malignant
- cells
- cancer treatment
- technology
- patients
- radiology
- medicine
- beams
- energy
- x rays
- protons
- physics
- ionizing
- drs office
- appointment
- healing
- safety

Please note: some words are found when spelled backwards!

MODELING RADIOACTIVE DECAY

Medical Physicists use radiation therapy to help cancer patients. In this activity you will explore an important concept in radiation science: **radioactive decay.** You can follow along with Jessica as she models radioactive decay by visiting eugenesciencecenter.org/nextgenstem.

Materials:

- 50 M&M's (can be substituted with 50 pennies or 50 puzzle pieces)
- Cup large enough to hold your 50 M&M's
- Tray or flat surface to spread out your M&M's
- Pencil
- Data Collection Sheet from this workbook

Procedure:

1. Put 50 M&M candies into your cup. The 50 M&M's are recorded as Trial 0 on the Data Collection Sheet. All of the M&M's are radioactive.
2. Shake the cup and spill out the M&M's onto a flat surface.
3. Pick up ONLY the candies with the "m" showing - these are still radioactive. Count the "m" candies as you return them to the cup. Move the candies that are blank on the top to the side - these have now decayed to a stable state. (If using pennies or puzzle pieces, count the pennies that are 'heads-up' or puzzle pieces that are 'picture-up.')
4. Record the number of "m" candies you returned to the cup under Trial 1 in your Data Collection Sheet.
5. Shake the cup with the radioactive M&M's. Spill them onto a flat surface.
6. Pick up ONLY the candies with the "m" showing - these are still radioactive. Count the "m" candies as you return them to the cup. Move the candies that are blank on the top to the side - these have now decayed to a stable state.
7. Record the number of candies you returned to the cup under the next Trial.
8. Repeat steps 5 through 7 until all the candies have decayed or until you have completed Trial 7.
9. Plot the results as a line graph on your Data Collection Sheet. Is the line straight or curved?

MODELING RADIOACTIVE DECAY

What's Happening?

You may have noticed that about half of your M&M's decayed to a stable state while the other half stayed radioactive during each trial. This phenomenon models what happens to radioactive material over time.

Radioactivity is a feature of certain types of matter. All matter is made of chemical elements, and elements are made of atoms. Most atoms are stable. That is, they do not change over time. Radioactive atoms, however, do change over time. Small particles and energy fly out of them naturally. The particles and energy that are released are a form of radiation.

The atoms are changed a little bit each time they release something. They keep giving off particles and energy until they are changed into a stable form. That process is called **decay**. The amount of time that each type of atom takes to decay varies greatly. It can be less than a second or millions of years. The measure of that rate is called a **half-life**. A half-life refers to the time required for one half of a group of atoms to decay into a stable form.

When scientists show radioactive decay in a line graph, it always shows the same shape of a curved line. This type of curve on a graph is called **exponential decay**.

This activity is adapted from one designed by the American Nuclear Society.

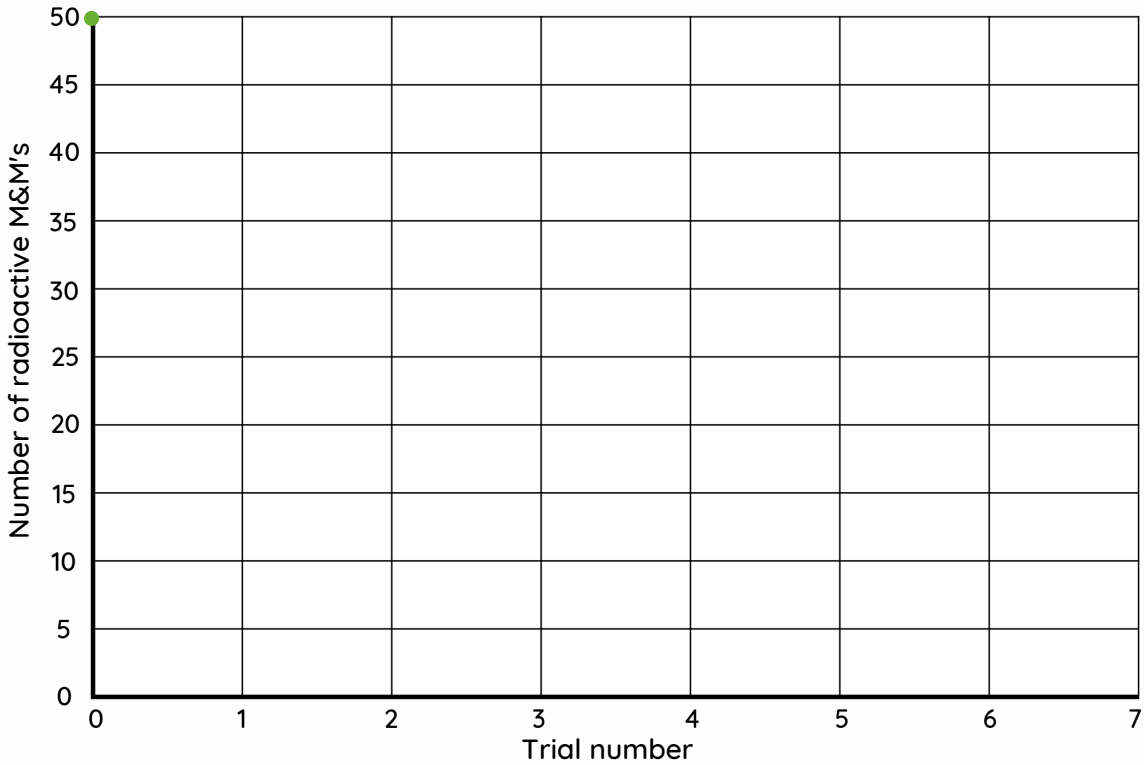
DATA COLLECTION SHEET: MODELING RADIOACTIVE DECAY

Record the number of M&M's with the "M" showing

Trial 0	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	Trial 6	Trial 7
50							

Plot your results on a line graph below. Is the result a straight or curved line?

M&M'S VS TRIAL



If you were to repeat this experiment, do you think you would see similar results? Why or why not?_____

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Still Curious? Try researching these topics:

- Carbon-14 Dating
- Radiation therapy
- Nuclear energy
- Exponential population growth