

TREATING CANCER FROM THE INSIDE OUT

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YOUNG REVIEWERS:



SANYA
AGE: 10



TAPPAN
MIDDLE
AGES: 12–13



VICTOR
AGE: 9

BRACHYTHERAPY

A type of radiation therapy in which something radioactive is placed inside or right next to a tumor.

In this article, we will talk about a special treatment that doctors can use to help people who have cancer. This kind of treatment is called brachytherapy. Brachytherapy uses little pieces of materials that give off radiation to treat cancer from the inside out. We will explore what radiation is, what it means when something is radioactive, and why radiation can be used for cancer treatment. We will discuss different types of brachytherapy, because sometimes doctors use small, implanted capsules and sometimes they use a special robot. Toward the end of the article, we will see how this treatment can be used for different kinds of cancers.

A SPECIAL WAY TO TREAT CANCER

In this article, we are going to talk about a special way to treat cancer from the inside out. This kind of treatment is called **brachytherapy**. The word “brachy” in Greek means “short” because healthcare providers use brachytherapy to treat bad cells that are very short distances away. This can be a useful tool to help people who are sick with cancer.

RADIATION

Energy, in the form of tiny, invisible particles or light, that travels from place to place.

CANCER

When cells start growing and dividing too much, it can make people sick. Sometimes cancer can spread around a person's body, which can be very unhealthy.

WHAT IS RADIOACTIVITY?

The world around us is made of very little bits of matter, called atoms. Atoms come together to make up everything. Some atoms are unusual because they are unstable, like a tower made of building blocks in which some of the blocks are wiggling and shaking. These unstable atoms seem like they have too much energy inside. To become more stable, they let some of this energy go. When the atoms release energy, the building blocks in the tower settle down and the whole tower is less shaky. What does it look like when an atom lets some of its extra energy go? Well, we cannot actually see it happen, but we know that tiny, invisible waves or particles are released. This is called **radiation**. Atoms releasing energy like this are called radioactive. We are going to talk about how radiation can be a really helpful tool for some people who are sick.

WHY RADIATION CAN HELP PEOPLE WHO ARE SICK

You may have heard the word "**cancer**", but what exactly is it? Sometimes people get sick when some of their cells grow and divide too much. Sometimes these unhealthy cells also spread to other parts of their bodies. These unhealthy cells can get out of control, and that can stop the person's body from functioning properly. In some ways, cancer is a little like when weeds take over a vegetable garden. If a gardener does not stop the weeds from spreading, those weeds can take over the garden and make it very hard for the vegetables to grow. Fortunately, there are some ways that healthcare providers can stop cancer cells from getting out of control. One of those ways is by using radiation [1]. With radiation, healthcare providers want to be very careful to treat unhealthy cells and avoid the healthy cells as much as possible. Radiation with brachytherapy is one way to do that.

BRACHYTHERAPY: A TOOL FOR FIGHTING CANCER

Imagine you are camping at night, and you are sitting inside a tent. You want to read a book, but it is too dark. If someone outside the tent shines a flashlight at the book, that might help—you might be able to do some reading, especially if the person with the flashlight is not too far away. If the person with the flashlight gets *very close* to the tent, it will probably be easier to read your book. If you have a flashlight with you *inside* the tent and you hold your flashlight right up next to the pages of the book, then you are really in business! Brachytherapy is a little like this flashlight, because doctors deliver a dose of radiation right up close to tumor cells instead of treating them from farther away [2].

There are several ways to treat cancer using radiation. You can read about using x-rays from a linear accelerator to treat cancer in

another [Frontiers for Young Minds article](#). When healthcare providers use beams of radiation from outside the patient, like with the linear accelerator, that is a little like shining the flashlight from outside of the tent. This is a great option, especially if doctors can aim the beam very carefully at the target. Another way to treat cancer with radiation is by using little pieces of radioactive metal. If doctors put the radioactive source right into the tumor that they are trying to treat, the cancer cells will get a high dose of radiation. This is what is done in brachytherapy.

RADIATION SEEDS AND EXTRA SPECIAL ROBOTS

There are several ways healthcare providers can deliver brachytherapy treatments [3]. The first one that we will talk about is to use lots of little capsules, called seeds. Even though they are called seeds, these are a lot different than the kind of seeds you use in your garden! These seeds are pretty small—they are each about the size of a grain of rice. A doctor can surgically implant these seeds directly inside a tumor. The seeds stay in place inside and, because they are radioactive, they release radiation right where the cancer is. You can see a picture of some brachytherapy seeds in [Figure 1](#), and a picture showing treatment using seeds is shown in [Figure 2](#).

Figure 1

Brachytherapy seeds, with a penny next to the seeds to show how big they are. Brachytherapy seeds are small capsules that can be implanted inside a tumor. They are radioactive, so they give off radiation inside a tumor to treat cancer (photograph courtesy of the Oak Ridge Associated Universities through the Museum of Radiation and Radioactivity, used with permission. <https://orau.org/health-physics-museum/collection/brachytherapy/seeds.html>, Copyright Oak Ridge Associated Universities, 2023).



Figure 1

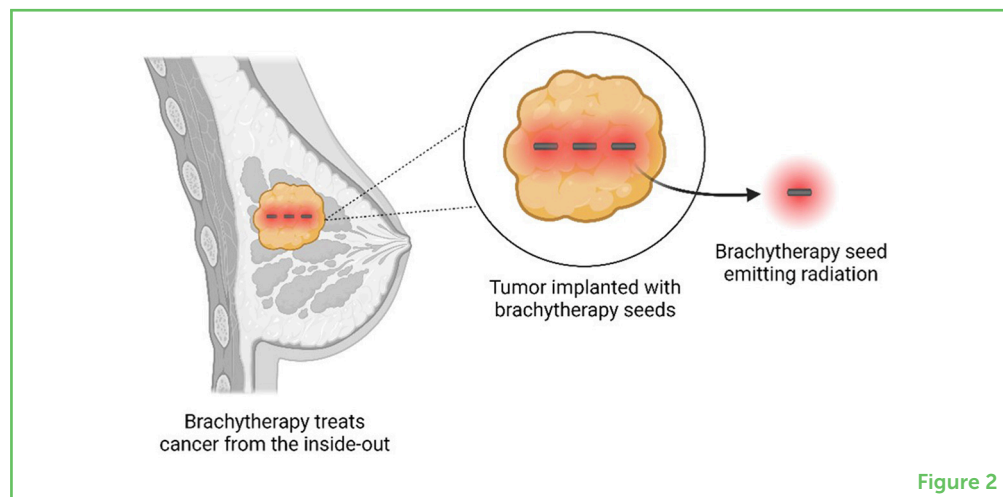
AFTERLOADER

A robot that controls the delivery of some kinds of brachytherapy.

In another type of brachytherapy, healthcare providers can use a robot called an **afterloader** that controls where the radioactive source is placed in the patient. This robot can move the source through special tubes into the inside of a patient. When the treatment is over, the robot

Figure 2

Radioactive brachytherapy seeds implanted in a breast tumor. The seeds emit radiation, which can kill the tumor cells that are near the seed (image produced using BioRender.com).



removes the source from the patient. When the radiation source is not being used for treatment, it sits inside a container inside the robot. That container is made of lead so that it blocks radiation. The afterloader can be controlled from outside the treatment room, so the doctor and other members of the healthcare team can be outside of the room while the source is outside of its special container and is being used to treat the patient. This makes delivering radiation safer for the medical team, because they are not exposed to radiation each time they treat a patient. You can see a picture of the brachytherapy robot in Figure 3.

WHAT TYPES OF CANCERS CAN BE TREATED WITH BRACHYTHERAPY?

Brachytherapy can be used to treat lots of kinds of cancer. For example, doctors can use brachytherapy to help people who need radiation treatment for their breasts, lungs, skin, or eyes. Brachytherapy can be used to treat cancer in men's prostates or in women's reproductive systems. Sometimes a person will need more than one kind of treatment. For example, doctors sometimes use special drugs or surgery in addition to radiation therapy. Sometimes patients even get more than one kind of radiation treatment, like when they get treated from the outside-in and then from the inside-out. When a person is going to be treated with brachytherapy, they will work with a doctor called a **radiation oncologist**. These doctors know a lot about treating cancer with radiation. The patient's doctor will help decide the best type of treatment for the patient, and the doctor will also come up with a plan for how best to treat the cancer. This doctor will work with a big team of people at the hospital to help make sure the patient is treated safely [4].

RADIATION ONCOLOGIST

A doctor who uses radiation to treat patients who have cancer.

Figure 3

An afterloader robot used for brachytherapy. This robot can be used to send a radioactive source to the inside of a tumor, and then pull it back out when the treatment is done. The robot is about 4 feet tall, or a little over a meter (photo courtesy of Ximin Du).



Figure 3

SUMMARY

In this article, we talked about one way that doctors can treat cancer. Brachytherapy is a type of radiation therapy, in which radiation is delivered right up close to harmful cancer cells. Sometimes radiation is even delivered right inside a tumor. Doctors can use little radioactive capsules called seeds, or they can use a special robot to deliver brachytherapy treatment. Whichever way brachytherapy is delivered, it can be a useful tool to help people who have cancer.

ACKNOWLEDGMENTS

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YOUNG REVIEWERS

SANYA, AGE: 10

My name is Sanya and I am currently in 5th grade. My hobbies are sketching, reading mystery novels, beach time with friends, baking, and traveling with my family. I love hearing and reading about new discoveries in technology and health.



TAPPAN MIDDLE, AGES: 12–13

This article was reviewed by Amykay, Andrea, Keira, and MarySol, a small group of cheery and bright 7th graders in Ms. Frantom's science class at Tappan Middle School in Ann Arbor, Michigan, USA. Tappan students achieve at high levels under the facilitation of skilled, effective, and culturally competent educators. We completed this review with the help of our UofM mentor, Dr. Pamela Wong.

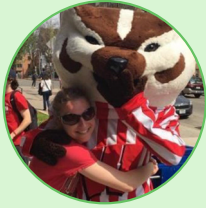


VICTOR, AGE: 9

Victor likes math and science. He also wonders about the magic of the world, how and why things happen. His passion is to understand how diseases happen, how the body works, and why we get ill sometimes because our body is on "failing system" mode. When he grows up he wants to be a scientist because then "you can play in the lab and test hypothesis".



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Dr. Fagerstrom is a medical physicist, which means she works in a field that applies physics to questions in medicine. She is part of a team of healthcare workers who make sure patients are treated safely with radiation. Her Ph.D. in medical physics is from the University of Wisconsin, and her M.Ed. in science curriculum and instruction is from the University of Washington. She is board certified through the American Board of Radiology. *jfagerst@uw.edu



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