Researcher Finds New Method to Create Cancer Drugs

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When fixing a car, it's a good idea to have more than one type of wrench. Similarly, when doctors treat cancer patients, they like to have different "tools" available. Cancer tumors can be big or small. Some tumors grow very fast, while others grow slowly. Now, a University of Missouri researcher has developed a method that would make it easier for doctors to pick and choose different radiopharmaceuticals to treat different types and sizes of cancer and tumors.

"We're giving doctors more tools, which will enable them to tailor their treatments to each patient and be more effective," said Cathy Cutler, associate research professor at the University of Missouri Research Reactor Center. "Patients don't come to their doctors with the same tumor. It's important that we find ways to treat each individual tumor based on its characteristics. Does it grow fast or slow? Is it large or small? Where is it located, and how is it spreading?"

Currently, oncologists have a fairly limited supply of radiopharmaceutical treatments at their disposal. For the past several years, researchers have been attempting to develop a "menu" of different radiopharmaceuticals that could be used for cancer treatments. However, researchers have faced several challenges during the process. Older methods of creating the drugs took a very long time and were not consistent. The finished products varied in quality; impurities might have been introduced, and several liters of waste were generated. It also was difficult to produce the drugs in large quantities.

With her new method, Cutler has overcome all of these problems. In the past, researchers would irradiate the same element to obtain the necessary radioisotope. For example, if a doctor requested using the radioisotope Lutetium-177, researchers would irradiate Lutetium-176. However, not all of the Lutetium-176 would be converted to the radioactive isotope, and scientists were unable to separate the radioactive isotopes from the non-radioactive isotopes because both compounds are chemically the same. This resulted in a drug that had, on average, only 20 percent of the intended radioactive components.

To overcome this inefficiency, Cutler tried a different route, identifying metals that have two stages of radioactive decay. For example, when Ytterbium-176 is irradiated, it becomes Ytterbium-177, but it quickly decays to the desired Lutetium-177. Due to the chemical differences between Ytterbium and Lutetium, scientists can separate these two different elements, thus creating a drug that has nearly 100 percent of the intended radioactive isotope. This allows doctors to deliver a much more effective radioactive dose to the cancer site.

Cutler's new method also produced a product in a very predictable, consistent time. Previously, it might have taken scientists more than eight hours for the radioisotope to be ready for use, and that time varied widely. Cutler has cut the time in half, and the drugs are now ready in five hours almost consistently.
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Cutler also has reduced the amount of radioactive waste associated with producing these drugs. With the old methods, enough waste was generated to fill several liters. With her new method, Cutler is generating only a few milliliters to produce the same amount of material. At the same time, she also has reduced the amount of mineral impurities that could be found in some samples. This reduction of impurities can help the drug be much more efficient.

Cutler has been working on separations for more than 10 years, and this new method for about two years. Her research has been funded with grants from the National Institutes of Health and the Elsa U Pardee Foundation. She is currently seeking a patent for the new method.

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