Targeting a cure: Research looks at developing a bull's-eye therapy to combat lung cancer

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A Kansas State University professor is trying to create a patient-friendly treatment to help the more than 220,000 people who are diagnosed with lung cancer each year.

Masaaki Tamura, associate professor of anatomy and physiology, and his research team are working on several projects that use nanoparticles to treat and directly target the "bull's-eye": cancer cells.

It's estimated that nearly 156,940 people will die from lung-related cancer this year, according to the American Cancer Society. Lung cancer-related deaths are higher than the next three common cancer-related deaths combined: colon, breast and pancreatic cancers.

Given lung cancer's high mortality rate, Tamura has focused his research on peptide nanoparticle-based gene therapy, which is the process of treating diseases by introducing therapeutic genes. His research team is collaborating with University of Kansas researchers to develop a way to treat cancer other than current chemotherapy practices.

"We want to generate a safe patient-friendly therapy," Tamura said.

Cancer develops from our own bodies, Tamura said, which makes it very difficult for traditional chemotherapy to distinguish cancer cells from healthy cells. As a result, chemotherapy often kills both cancer cells and

healthy cells, which is why patients often experience whole body reactions to treatment, such as hair loss, diarrhea and vomiting. If the chemotherapy treatment damages intestines, it often has fatal consequences for patients.

Tamura has found the potential for safer therapy in cationic peptide nanoparticles. This small peptide helps transfer an important gene called angiotensin II type 2 receptor, which helps to maintain cardiovascular tissue. By attaching this receptor gene to peptide nanoparticles, Tamura hopes to create a form of treatment that can directly target cancer cells without damaging healthy cells.

"The peptide itself is a very safe material and it has no harmful effects," said Tamura, who is one of the first researchers to use the peptide for cancer treatment. "The gene is actually already expressed in our body -- everybody has this gene."

Here is how the cancer treatment works: The receptor gene containing the nanoparticles spreads to only cancer tissue since the blood vessels in cancer tissues are flimsy. The nanoparticles help the receptor gene kill the cancer cells. The immune system is then stimulated to prevent the cancer from growing back.

"This is very exciting because our own immune system can prevent cancer growth," Tamura said.

While the receptor gene works well for tumors that are easier to reach in the body, cancers that are deep within the body, such as gastric or pancreatic cancers, are more difficult to treat. Sometimes the gene needs help targeting and reaching the cancerous cells. That's where the peptide comes in. It can guide the receptor gene directly to the cancer cells so treatment can begin.

Working with lungs also provides a special advantage. If the researchers can develop some sort of spray that contains the peptide, it can help the peptide go straight into the lungs. It's noninvasive to go through the lungs and makes it easier for the peptide to enter the circulatory system and travel to other cancerous tissue.

The cationic peptide was developed by a KU research team led by Cory Berkland, an associate professor of pharmaceutical chemistry. After developing the peptide, they turned to Tamura and his team for help evaluating, testing and developing the peptide nanoparticle therapy. The two schools have been working together on the project for three years. Researchers hope to develop their targeted peptide procedure into a treatment that humans can use.

"It has really been nice for the two schools to work together on this project because Kansas is such a hotbed for the biomedical industry right now," Tamura said.

Tamura is also involved in Kansas State University research of the cancer therapeutic possibilities of umbilical cord matrix stem cells. He is on a team of university researchers who have received a patent addressing procedures used to gather stem cells from umbilical cords -- a less controversial source of stem cells that are effective at treating cancer. These stem cells do not generate any additional tumors and can travel deep inside the inflammatory tissue where cancer is located.

Provided by Kansas State University