DCU study uses onion-like nano structures to target cancer cells

by Vish Gain

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Prof Silvia Giordani and her team have shown how the novel delivery system can be used to target aggressive pancreatic cancer cells resistant to drugs.

A team of researchers in Ireland have devised a new method to target drug-resistant pancreatic cancer cells using onion-like carbon nano structures coated with medication.

Led by Prof Silvia Giordani of Dublin City University (DCU), the team has found a more precise way to deliver medicines to pancreatic ductal adenocarcinoma (PDAC) cells, a cancer cell type known for its aggression and its resistance to treatments.

Giordani, who is based at DCU's School of Chemical Sciences, said that despite a relatively low rate of four or five cases per 100,000 people, PDAC poses a "significant" global challenge because of its typically late diagnosis and poor response to existing therapies.

The pancreas is a gland in the digestive system that is approximately 6in long and lies deep inside the abdomen. Its function is to produce digestive enzymes that break down food so that it can be absorbed into the lymph and bloodstreams. The pancreas also make hormones such as insulin, which controls sugar levels in the blood.

According to the Irish Cancer Society, pancreatic cancer affects almost 600 people in Ireland each year. The most common type of pancreatic cancer is adenocarcinoma, and treatment methods include surgery, chemotherapy and radiotherapy.

For patients with PDAC, Giordani says that the five-year survival rate is only 8pc, making it the fourth most frequent cause of cancer-related premature mortality.

Published in the Journal of Colloid and Interface Science, the DCU study uses a new drug delivery system based on nano-onions, tiny spheres made of carbon that have several layers just like an onion. Each sphere is tiny – so much so that the team suggests it would take 12,000 of them to span the width of a single human hair.

"Carbon nano-onions are great for drug delivery because of their size and structure. Their surface can be loaded with medication, and their small size lets them travel easily within the body to reach specific areas. Also, they are biocompatible, meaning they can work well inside the body without causing harm or being rejected," explained Giordani.

"The traditional methods of taking medicine, like pills and injections, can be imprecise. They often affect the whole body instead of just the area needing treatment, which can cause side effects. Our improved drug delivery methods target specific areas of the body more accurately, reducing side effects and potentially making treatments more effective."

Following the success of the study, the DCU team believes a similar approach can be used to treat other drug-resistant cancers and diseases by delivering medicines directly to the cells and bypassing resistance mechanisms.

"We can make an analogy that carbon nano-onions act as vehicles that deliver therapeutic cargo," Giordani went on.

"By carefully adjusting their surface chemistry, we can direct them towards a specific target; much like inputting 'specific type of infected cell' into their GPS coordinates, we can precisely target various diseases, not just cancer."