Graphene Oxide ‘Swiss Army knife’ fights cancer

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Cancer research is a noble cause. Graphene Oxide has joined the fight, read on to find out how…

Cancer cells

The world health organisation (WHO) defines cancer as a generic term for a large group of diseases that can affect any part of the body. One defining feature of cancer is the rapid creation of abnormal cells that grow beyond their usual boundaries. These can then invade adjoining parts of the body and spread to other organs. This process is referred to as metastasizing. Metastases are a major cause of death from cancer.

So, cells that don’t stop growing cause cancer. Ordinary cells have an auto-destruct switch but in cancer cells this switch doesn’t work.

The auto-destruct switch

Our bodies contain structures we call organs. Similarly cells have structures inside them called organelles. Mitochondria are one of these organelles and are present within most cells. This is where processes such as respiration and energy production occur. Mitochondria are also where programmed cell death takes place. When cells become cancerous their mitochondria ignore the programmed death signals (called Apoptosis) and cancerous tumours form.

To activate the auto-destruct switch any treatment must first pierce the cell wall. Then once inside the cell it has to find

and pierce the mitochondria and then switch on the programmed death signal to kill the cancer cell.

Cancer treatment strategy

Medical researchers know that a compound called Glycerrhetinic Acid (GA) can break through the cell wall and mitochondria wall, then once inside the mitochondria another compound called Doxorubicin (DOX) can cause a cascade of reactions that trigger the cancer cell to die (activating the auto-destruct switch).

The problem is that when using the compounds separately, very high dosage levels have to be used. This causes damage to the brain, liver and kidney. These toxic effects prevent the drugs from being used in practise.

If the two drugs can be combined somehow then the dosage can be reduced to safe levels. This is where graphene oxide comes in.

Graphene Oxide drug delivery system

Graphene Oxide is an ideal nanoscale drug delivery system.

First, it is a two dimensional material. This means it has a high surface area with plenty of room to attach things. Graphene Oxide nanoplates are very small so they can be injected into the body.

Second, graphene oxide contains alcohol, epoxy and carboxylic acid groups that are familiar to our bodies, making it both biocompatible and providing plenty of sites on which to anchor the drugs.

A research team from the China Pharmaceutical University in Nanjing have done the clever chemistry to attach both the GA and DOX drugs to the same graphene oxide nanoplates. They made a

nano-carrier for the drugs.

More than that, the Chinese team have tested this system in the laboratory. The early trials have found that the graphene oxide nano-carrier system can target cancer cells and successfully cause them to self-destruct. The dosage levels are so small that the team believe it is perfectly safe. In short, it works!

There are many hurdles before a new anti-cancer treatment is used in real people to cure the disease. However if it passes the safety testing and regulatory requirements, we could find this nanoscale graphene oxide Swiss Army knife curing cancer in hospitals of the future.