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Molecule has potential to stop cancer at the source

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A molecule has been developed with the potential to detect cancer-causing cells before they have the chance to divide.

Researchers from Flinders University in South Australia have developed the highly-specific molecule that can identify and trap proteins containing the biomarker sulfenic acid, which could lead to new testing methods and treatments.

Lead researcher Justin Chalker said the molecule could demonstrate how sulfenic acid was related to diseases associated with oxidative stress, such as cancer.

"Oxidative stress leads to the formation of a cysteine sulfenic acid on a protein that in turn provokes cell division. This leads to tumours," he said.

"Therefore, if our probe can trap the sulfenic acid before it signals for a cell to reproduce, perhaps it could be a tool for cancer biology or even a drug.

"We have invented a new type of molecule that reacts very fast and very rapidly with sulfenic acid. Existing tools are inadequate and we have something that can deal with those deficiencies."

Oxidative stress occurs when reactive oxygen species such as hydrogen peroxide are produced in the cell at high levels. It is associated with

many diseases including cancer, diabetes, heart disease, atherosclerosis, and Parkinson's disease.

During oxidation, amino acid residues found on proteins called cysteines begin to oxidise and are converted into sulfenic acids.

The new molecule will be used to identify which specific cysteines in particular proteins oxidise. This is currently unknown.

Contemporary methods use molecules that are sulfenic acid specific and cell permeable. They are injected into live cells using a small probe.

The molecules are fitted with a fluorescent substance that glows when they trap a sulfenic acid in a protein.

Dr Chalker said the new molecule worked in the same way but had an altered structure that allowed it to react much faster in trapping a sulfenic acid, which reduced the chance of missing it.

"The problem is we don't know very much at all about the biomarker. What we are doing is designing a reagent that can go into live cells and react with sulfenic acid and nothing else," he said.

"The molecules will show us first what proteins have this biomarker and then we can identify levels of that biomarker and how they are related to specific diseases.

"Within six months we will submit a paper on the structure of our new probe and how it reacts with model sulfenic acids. This will allow other researchers to use this tool for their own experiments.

"After that we will engage in a long-term project to identify all proteins that contain cysteine sulfenic acid."

According to the World Health Organisation (WHO) cancers kill about 8.2 million people every year, which is an estimated 13 per cent of all deaths worldwide.

There are more than 100 different cancers and the WHO predicts a 70 per cent increase in new cancer cases over the next two decades.

Dr Chalker was last month awarded a South Australia Young Tall Poppy Science Award for his work in the field of organic chemistry, in particular detecting diseases using new diagnostic tools and creating biodegradable wound dressings for burns victims.

Provided by Flinders University