Turn-ON and cut out: Illuminating tumour margins during cancer surgery

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Inaccurate cancer surgery costs lives and money

- **55,920** new breast cancer cases each year in the UK
- **25%** of patients undergoing surgery will require a second operation
- **£14m** additional annual costs to NHS

Fluorescence guided surgery

Chemical probes can illuminate the tumour during the operation so the surgeon knows what to remove.

Hijacking proteases for Turn-ON fluorescent probes

We want a probe that only becomes fluorescent when it reaches the tumour

Proteases are proteins that chop up other proteins...

...and tumours often have high protease activity

Screening for a specific probe

How can we find a probe that will be cleaved by only the tumour proteases (and not other proteases in the body)?

Doing chemistry in parallel lets us synthesise lots of compounds at once. Here, we made a library totalling 1.3 million compounds which we screen against the tumour proteases and determine what compound those proteases will cleave.

From patient to probe (and back again)

Tumour

Extracted proteins

Compound library screen

Identify compounds cleaved only by tumour proteases

Optimal probe designed

A breast cancer fluorescent probe

Our probe shows higher fluorescence in tumour tissue than normal tissue in 9 out of 10 patients

On average our probe was 3.7 times more fluorescent in the tumour

Future work

The route to clinic

- Chemical probe optimisation
- Animal safety studies
- Clinical trials

Breast cancer makes up only **14%** of cancers

Our workflow could apply to any solid tumour

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