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Engineering platelets and optical probes for applications in translational medicine

I will introduce recent work from my laboratory in two emerging areas of bioengineering. In the first part of my talk, I will discuss our approach to repurposing human platelets as living vehicles for in vivo imaging and targeted delivery of cytotoxins and immuno-therapeutics to cancer cells (1). In particular, I will elaborate on the chemistry detailed in Dai et al. (2) to repurpose human platelets as tumour-targeted vehicles that involve mild surface modification of platelet membrane proteins using Traut's reagent, and the subsequent coupling of platelets to maleimide conjugates of antibodies and other tumour targeting proteins directed against tumour biomarkers. Engineered platelets and nanoplatelets bind to tumours in the brains of mouse models of human cancer. I will also show how tumour-targeted platelets loaded with NIR-fluorophores, nanoparticles and MRI-contrast agents can generate high contrast images of early-stage tumours in the brains of living mice (Figure; ref. 2).

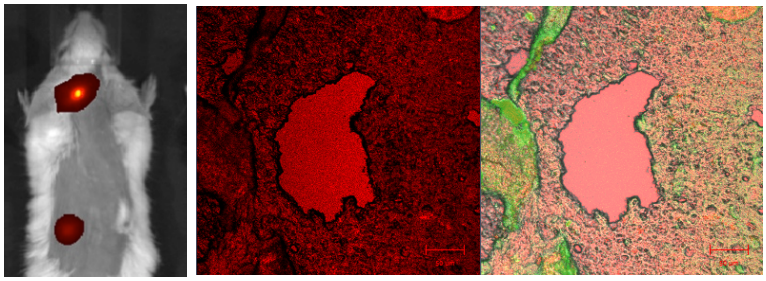

Figure: Left: in vivo NIR-fluorescence imaging of engineered platelets bound to tumour-bearing mouse within a mouse brain. Middle: Confocal imaging of engineered platelets in a tumour slice visualised by Cy5-fluorescence; Right, overlap image of Cy5 (red) and anti-transferrin (green) in the same slice

In the second part of my talk, I will introduce new classes of optical switch probes and opto-responsive biomaterials that have applications in high-contrast imaging and optical control of target proteins in the microenvironments of tumour cells (3).

References:

1), Marriott. G. (2016). Engineering platelets for tumour targeting. Aging. Vol. 8
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3), Yan, Y., Petchprayoon, C., Mao, S., & Marriott, G. (2013). Reversible optical control of cyanine fluorescence in fixed and living cells: optical lock-in detection immunofluorescence imaging microscopy. Philosophical Transactions of the Royal Society B: Biological Sciences, 368, 1611