RAMAN AND FLUORESCENCE EMISSION OF GOLD NANORODS IN LIVE BREAST CANCER CELLS

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1. GOLD NANORODS FOR CANCER DIAGNOSTICS

Gold nanorods (GNR) are rapidly emerging for use in biomedical applications due to their biocompatibility and their favourable optical properties. Conventional tumour imaging suffers from low contrast with respect to the surrounding tissue, but by administering GNR to the tumour site, high contrast non-invasive cancer imaging can be achieved, which is essential for diagnostics and treatment of early stage carcinomas.

2. RAMAN AND FLUORESCENCE DETECTION

We used single-cell confocal Raman imaging with low laser doses to establish chemical fingerprints of live SK-BR-3 cells. Comparison of the Raman spectra and images of "GNR-activated" cells with those of unperturbed cells enabled the study of the interaction of GNR with live SK-BR-3 cells.
The Raman signals of non-aggregated GNR in solution are dominated by broadband emission. The nature of the emission was attributed to fluorescence emission processes and is in agreement with observations by others.

3. GOLD NANOROD-CELL INTERACTION

Raman spectra of GNR-areas on and inside cells revealed both broadband and narrowband features, which are spatially related to the GNR distribution. The GNR fluorescence emission dominates the fingerprint region (500-1800 cm^{-1}) with a variety of shapes, implying a change of optical properties of the GNR upon entering the cells. Both passive and active uptake of GNR appears to take place, resulting in the accumulation of GNR in intracellular vacuoles.

In Raman difference spectra of the cells, subtle differences were addressed, consistent with the GNR fluorescence and its effects on SK-BR-3 cell behaviour. GNR appear to induce a shift of the lipid-protein ratio in SK-BR-3 cells towards lipids. An increase in lipid expression can be due to the formation of lipid vesicles (endosomes, lysosomes), that encapsulate the PEGGNR inside the SK-BR-3 cells after uptake. This process possibly accounts for clustering or deformation of PEGGNR inside the cells, which in turn leads to changes in the fluorescence emission.