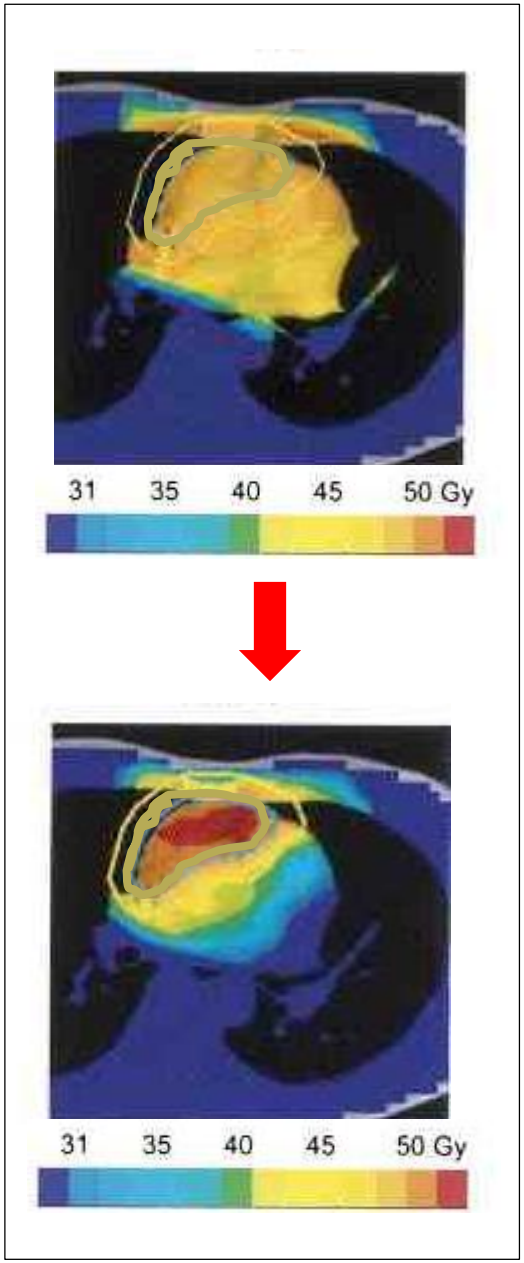
A quantitative technique for simultaneous imaging of multiple biomarkers

Ricketts K, Guazzoni C, Castoldi A, La Rosa V, Gibson A, Loizidou M, Royle G

University College London

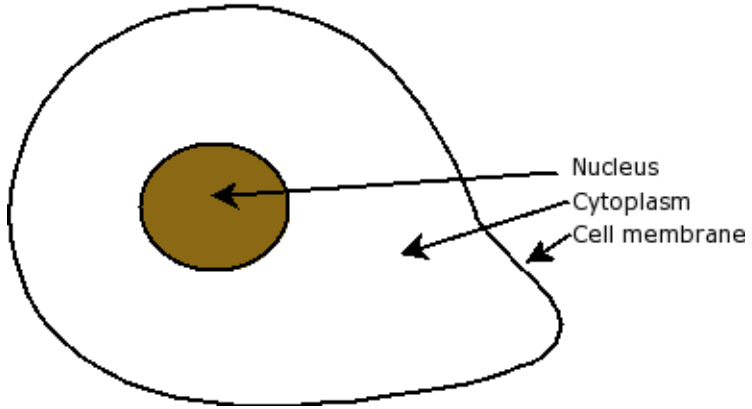
k.ricketts@ucl.ac.uk

Current

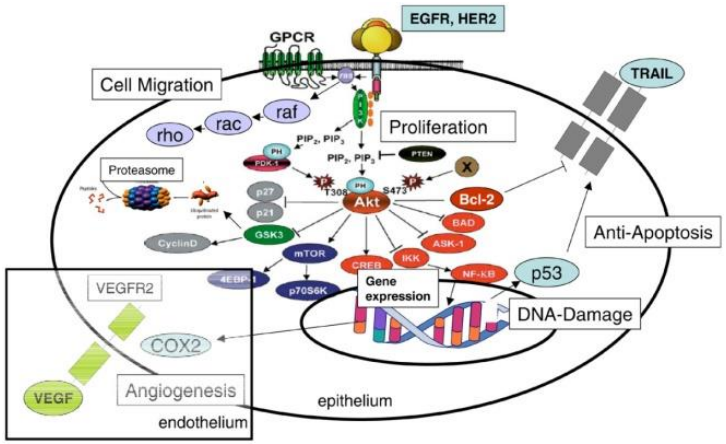


Potential

Current



Potential



Radiotherapy moving from

DOSIMETRY → BIOMETRY

Consider

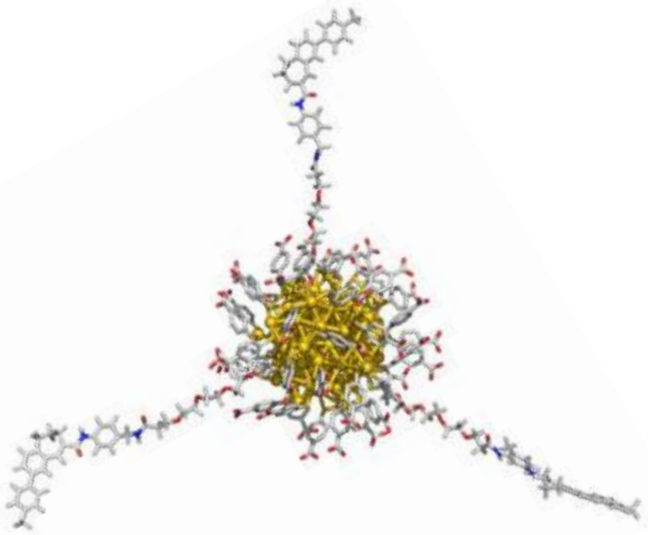
- **Hypoxia** **instead of mass**
- **Cell density**
- **Proliferation**
- **And effect of chemo, lasers etc.**

NANOPARTICLES for TARGETING

Diagnostics

Boost imaging signal - sensitivity

Targeted imaging - specificity



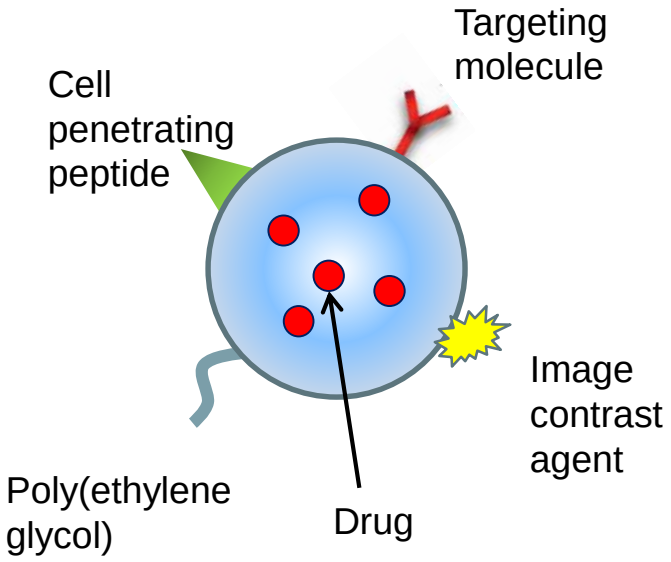
Dose enhancement

Target cancer cell / nucleus

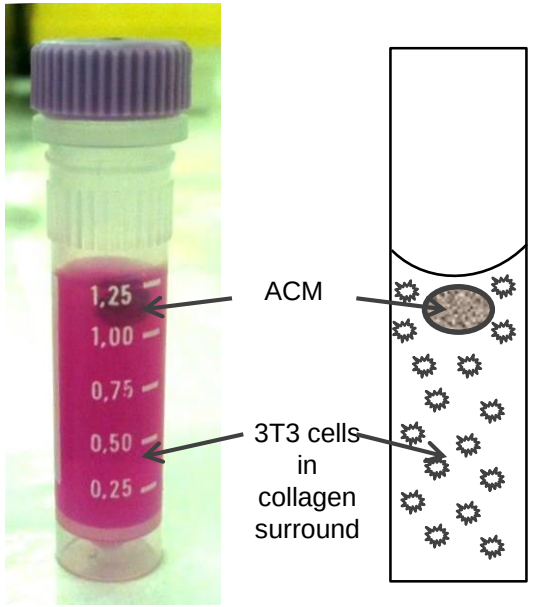
Drug delivery

NANOPARTICLES as BIOMARKERS

- **Bioconjugation**
  - Paramount for medical use
  - Functionalising capability
  - Reduce surface reactivity and toxicity
  - Improve stability



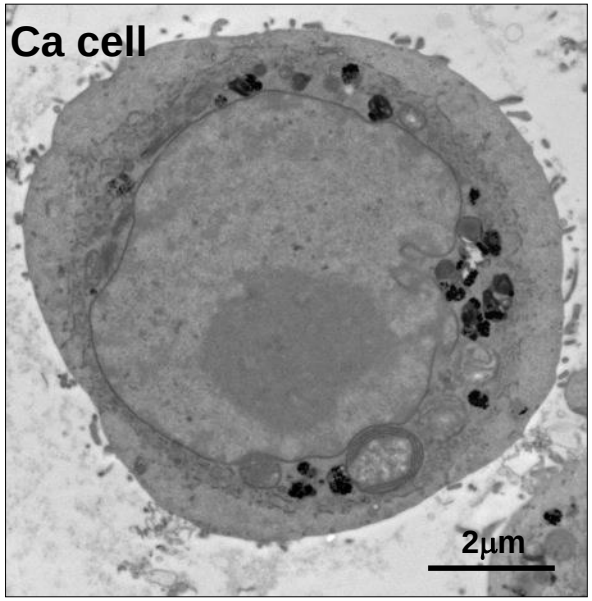
3D Biomimetic *in vitro* tumouroid

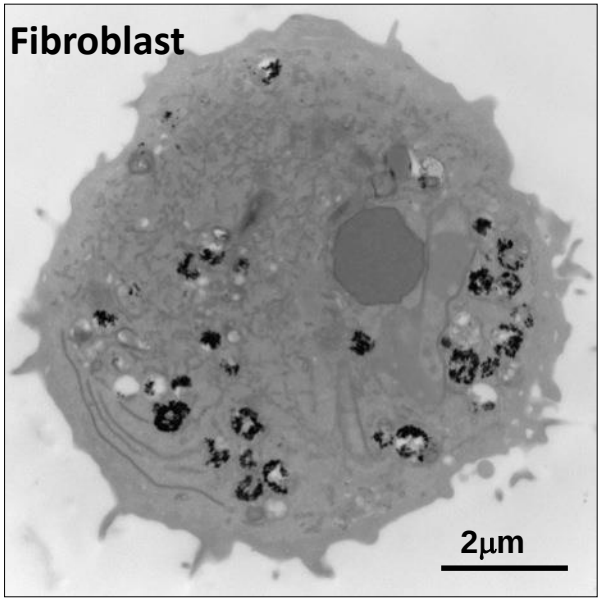


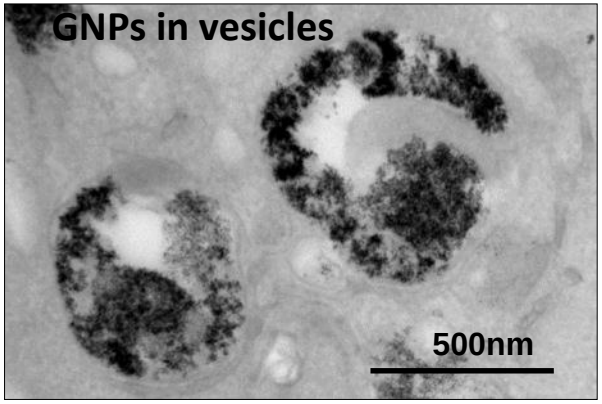
- Failure of 2D tissue culture
- Controllable alternative to small animal models
  - Cell density, type
  - Collagen type
  - Microenvironment
  - Spatial distribution

Correlate to signal

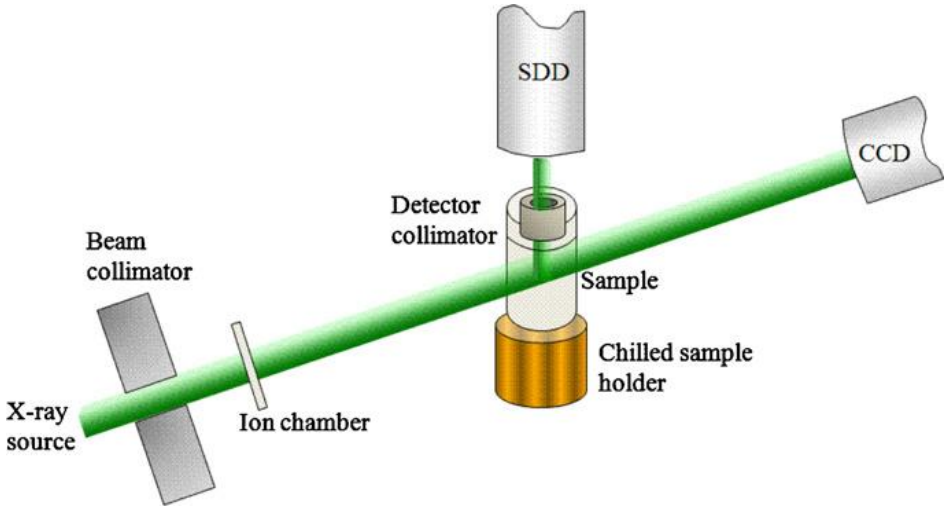
Purpose: Create realistic cancer model to test imaging and therapy

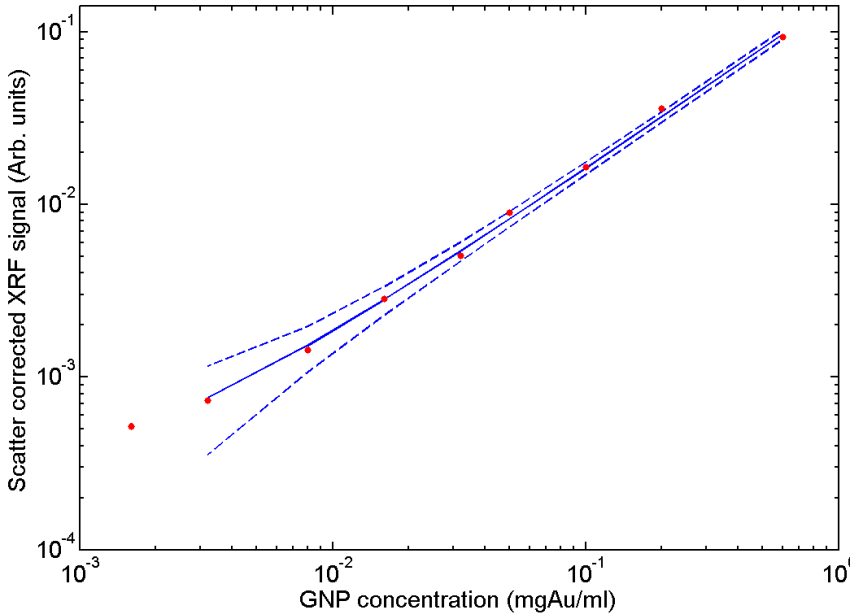

Ca cell
2μm


Fibroblast
2μm


GNPs in vesicles
500nm

X-ray fluorescence Imaging



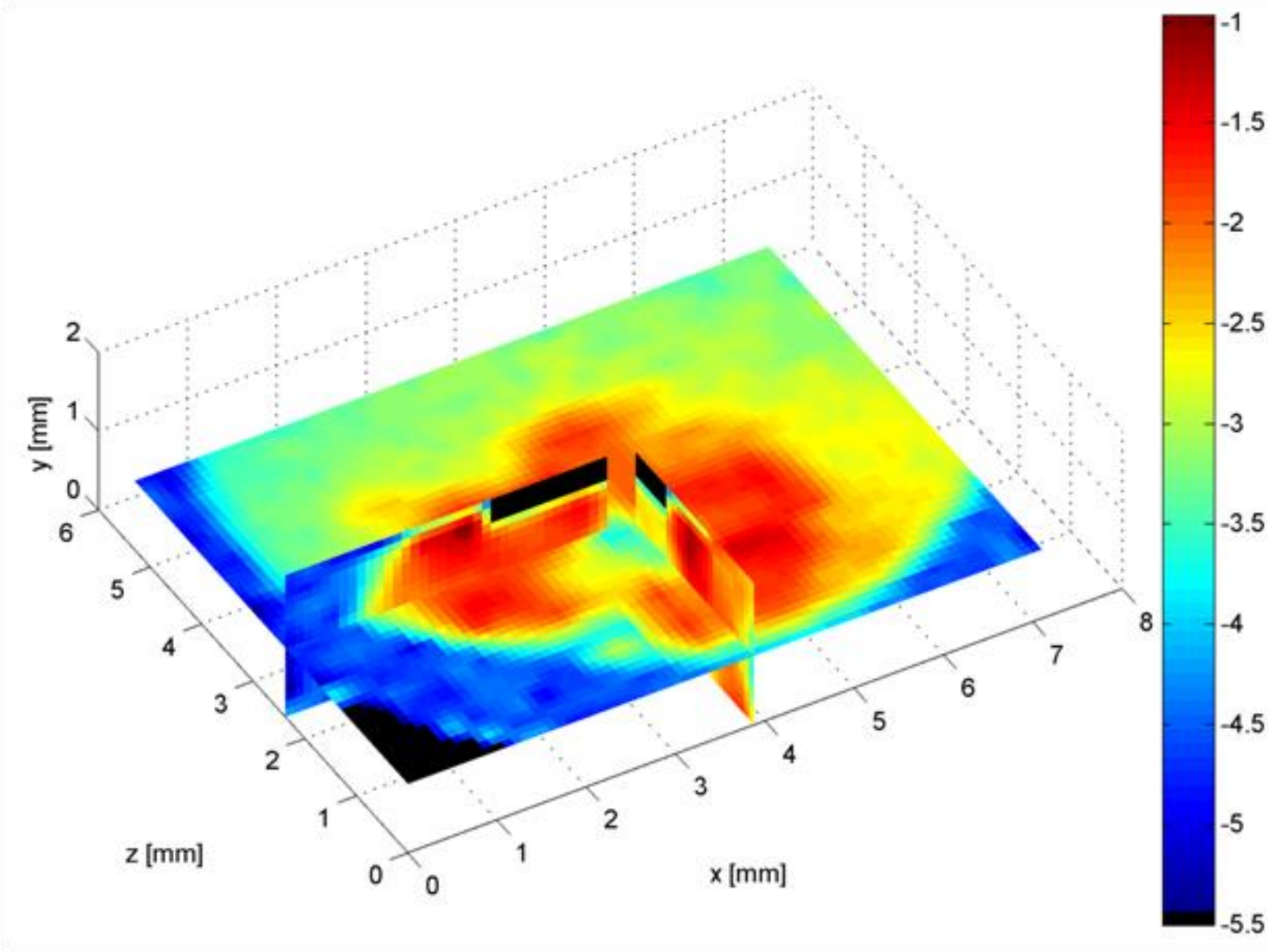


- NP concentration — XRF magnitude
- NP type
- Cell type
- Cell bio properties — XRF energy

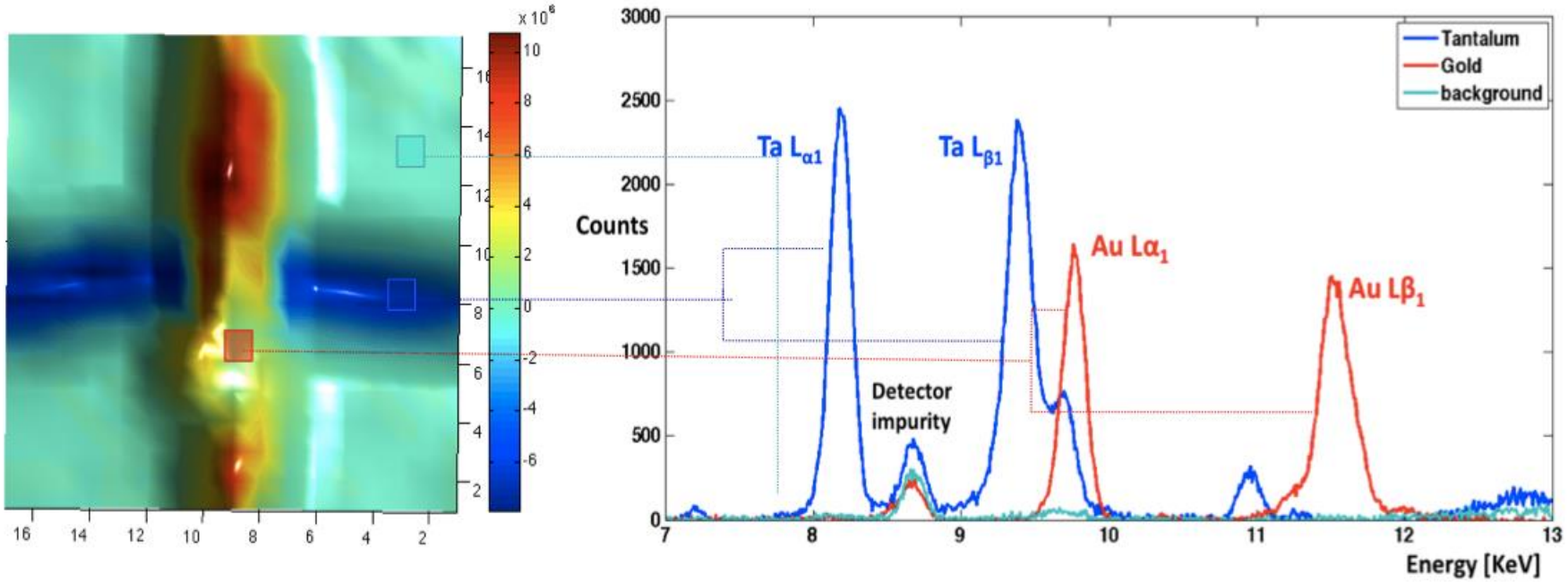
(detection limit 1 ppm)

*Ricketts et al (2012) A quantitative x-ray detection system for gold nanoparticle tumour biomarkers *Phys. Med. Biol.* ***57*** *5543-5555*.

X-ray fluorescence imaging of cancer model



Multi-parametric technique



Thank you

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