SESSION 1: IMPROVING QUALITY of LIFE

PANEL 1.1B: Human health

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DE LA RECHERCHE À L'INDUSTRIE

METALLIC NANOPARTICLES:
PROMISING TOOLS TO ENHANCE EFFICACY AND DOSIMETRY IN RADIOTHERAPY

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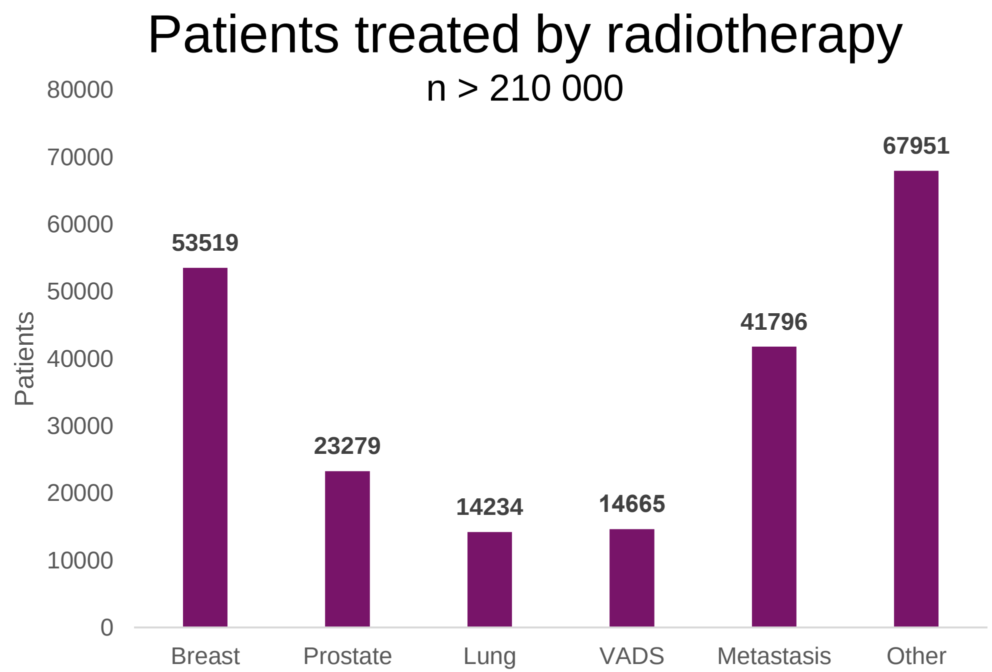
Radiotherapy



National Institute of Cancer (France) 2017

Radiotherapy a major treatment for cancer

- 50% of cancer patients received RX
- 20% of cancer are radiation-resistant

Radiotherapy road map improvements

- better target the tumor
- total dose split
- higher dose per session
- higher dose rate

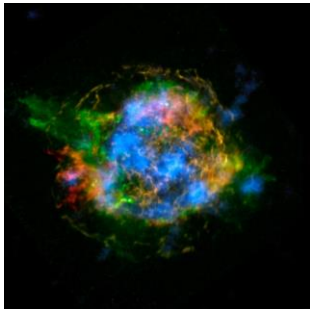
Main challenges

- increase radiation efficacy, while preserving healthy tissues
- overcome resistance and/or tumor relapse?
- intratumoral radiation dosimetry rather than calculation of the delivered radiation dose
  - is the dose currently delivered to the tumor the expected one? …
  - prevent accident during the time course of radiotherapy

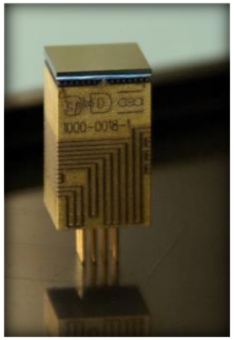
Metallic nanoparticles for radiotherapy enhancement and intratumoral radiation dosimetry

Transversal skills and technical innovations in astrophysics, biology and chemistry

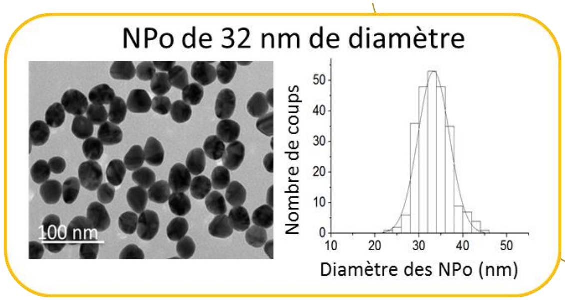
Astrophysics



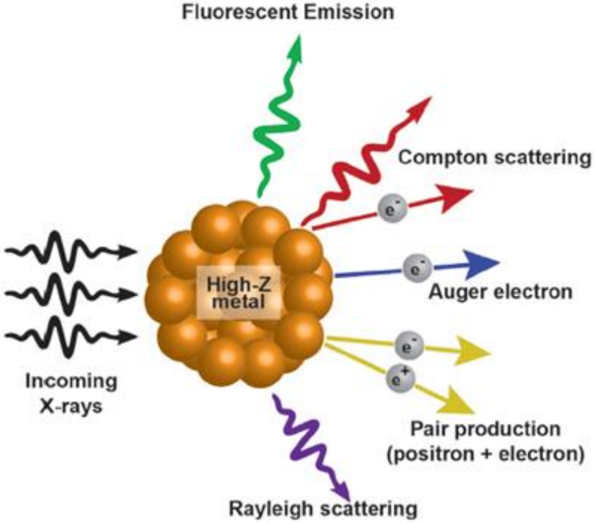
Detector X-ray



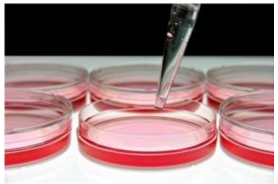
Chemistry Gold NPs



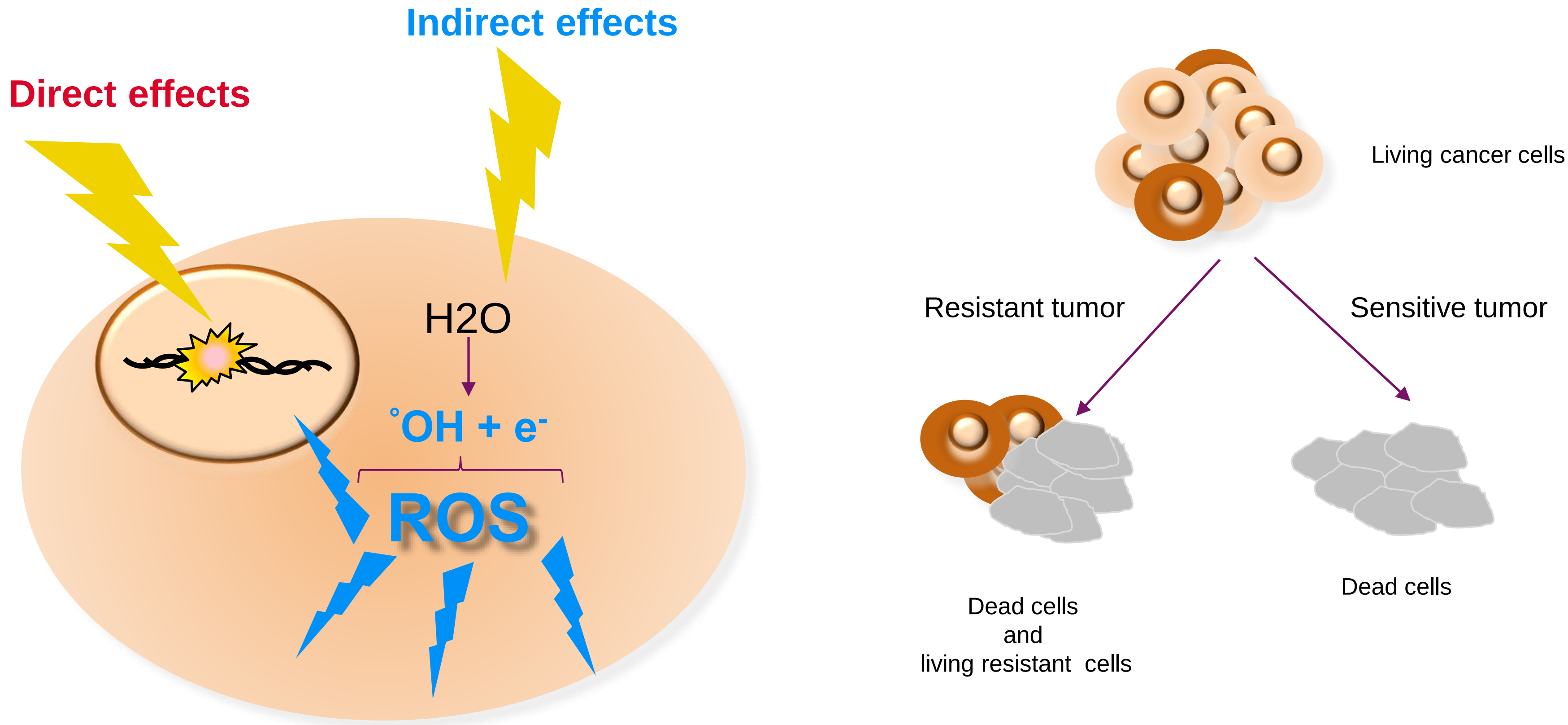
Dosimetry



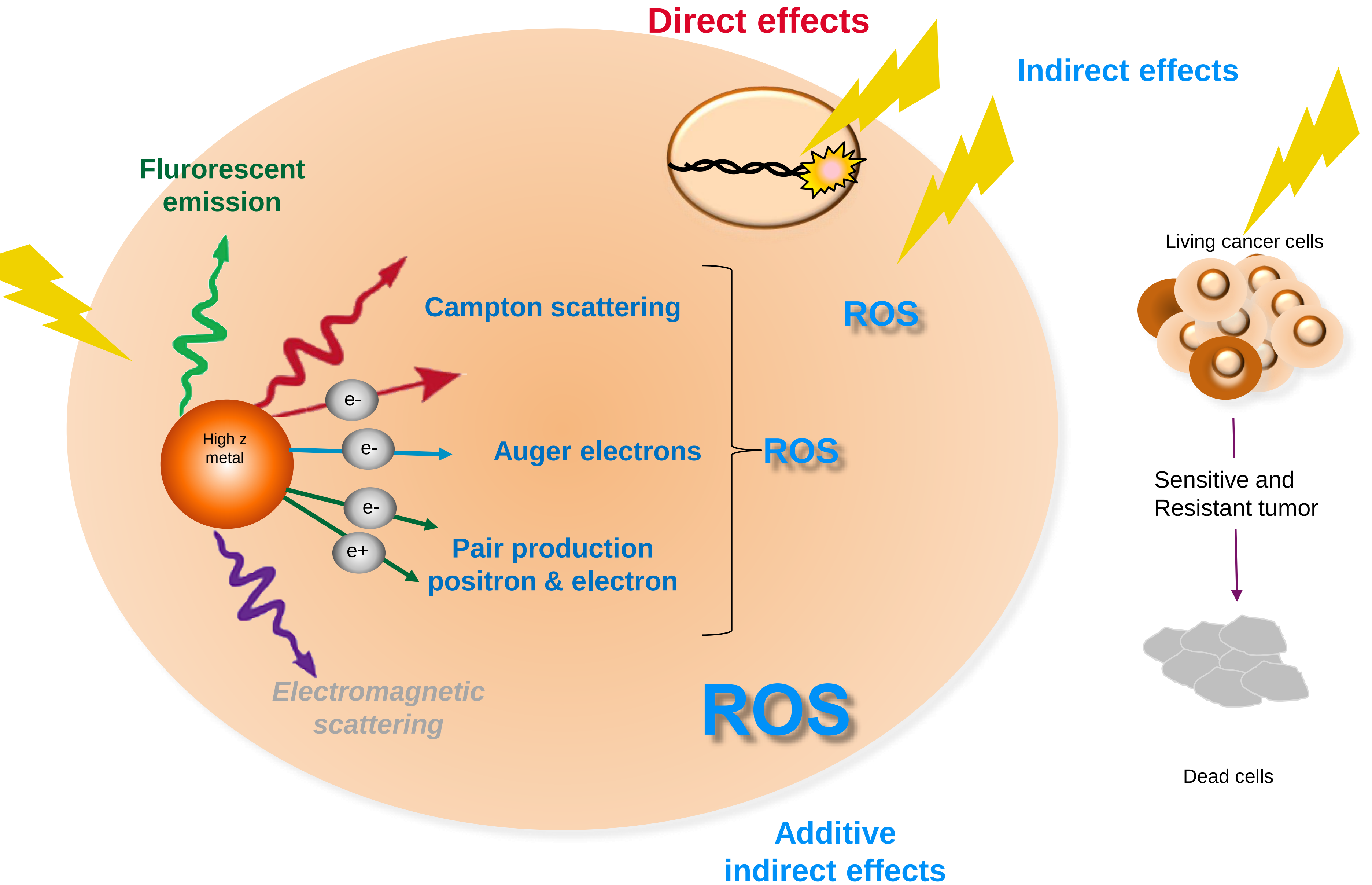
Biology
Cancer response



Principle effects of radiotherapy on cancer cells



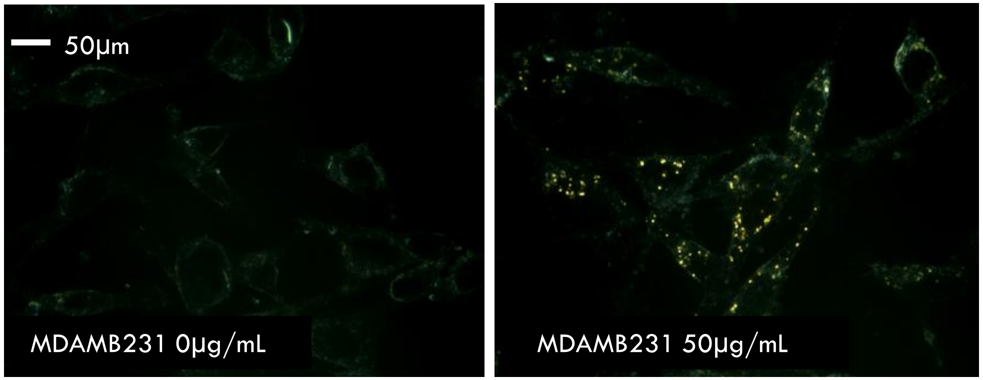
Nanoparticles : enhancement of radiotherapy



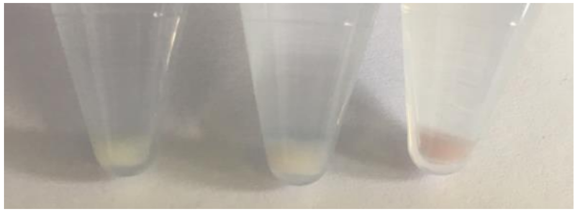
Nanoparticles enhancement of radiotherapy

Nanoparticles internalisation

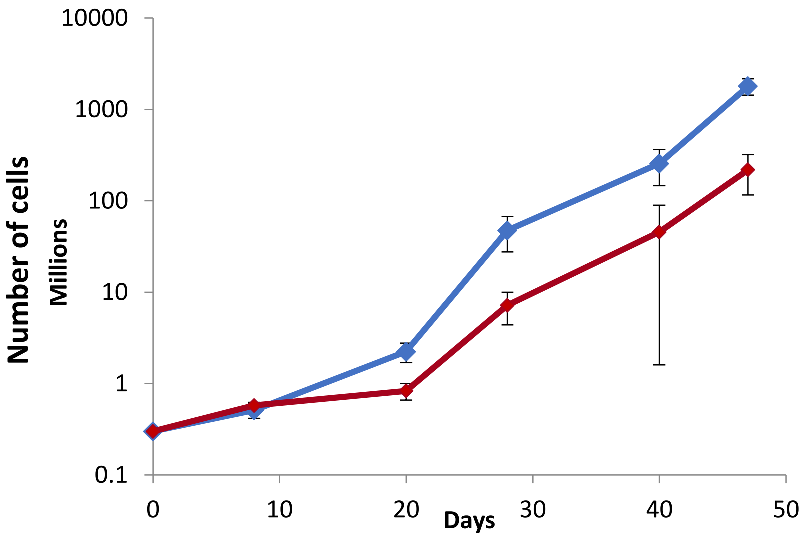
DarkField microscopy

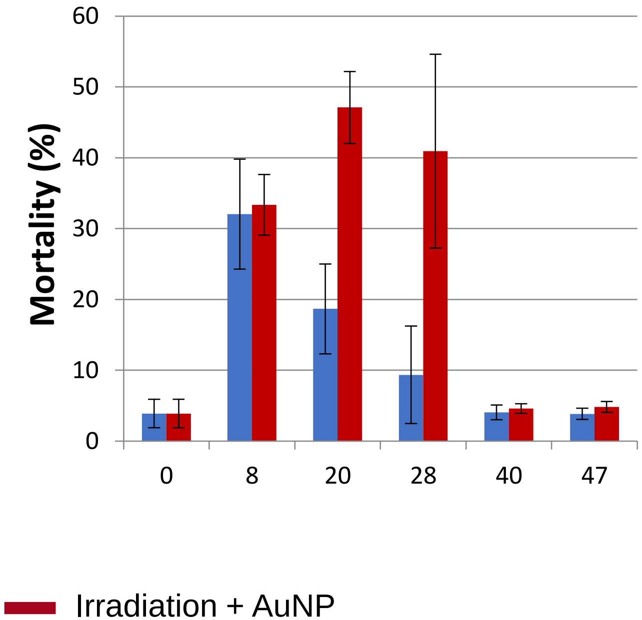


Cancer cells



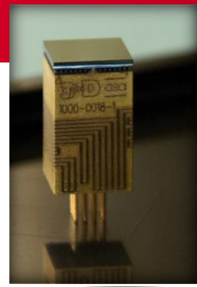
Control *10µg/mL* *50µg/mL*



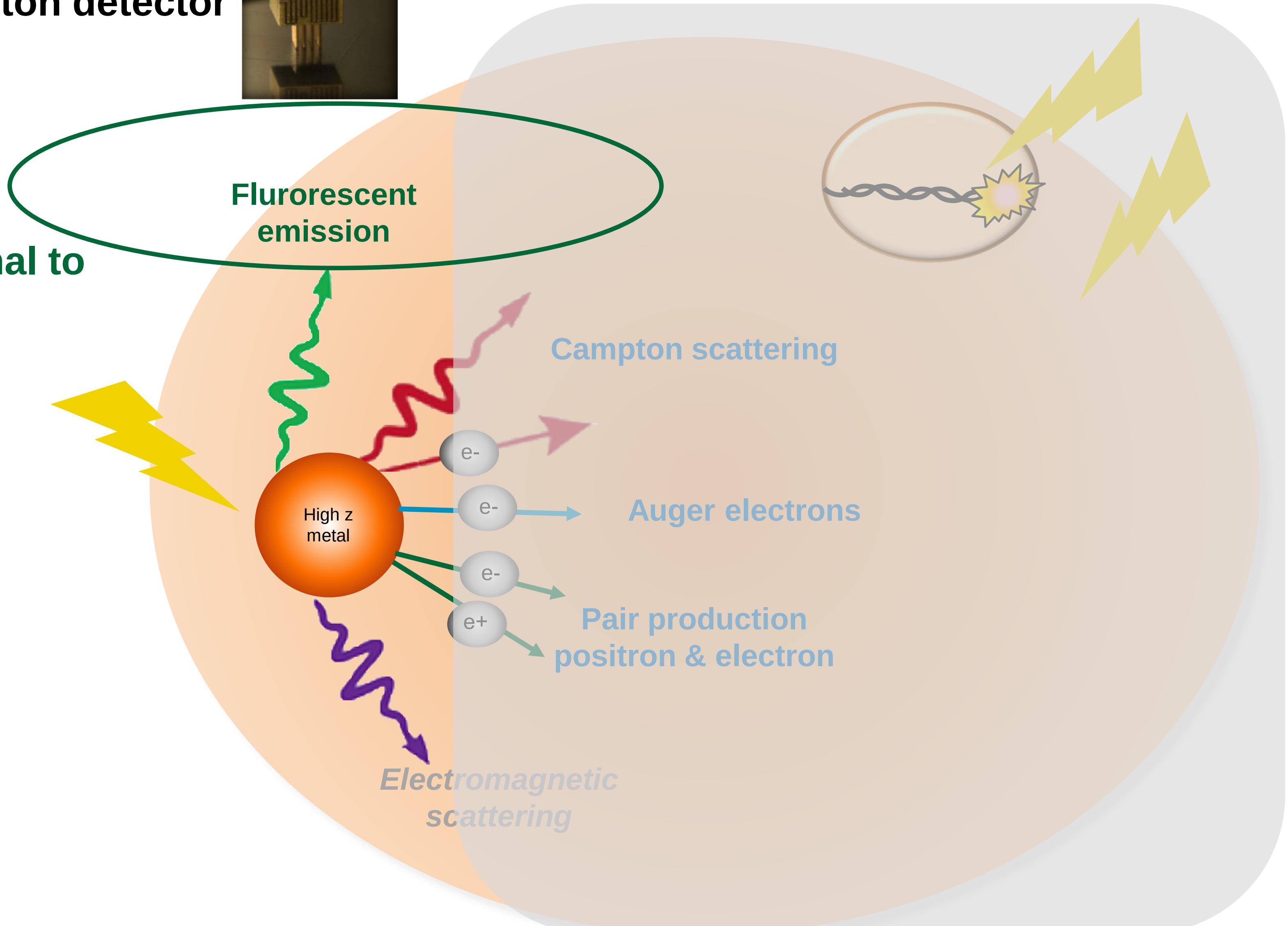


Nanoparticles : intratumoral radiation dosimetry

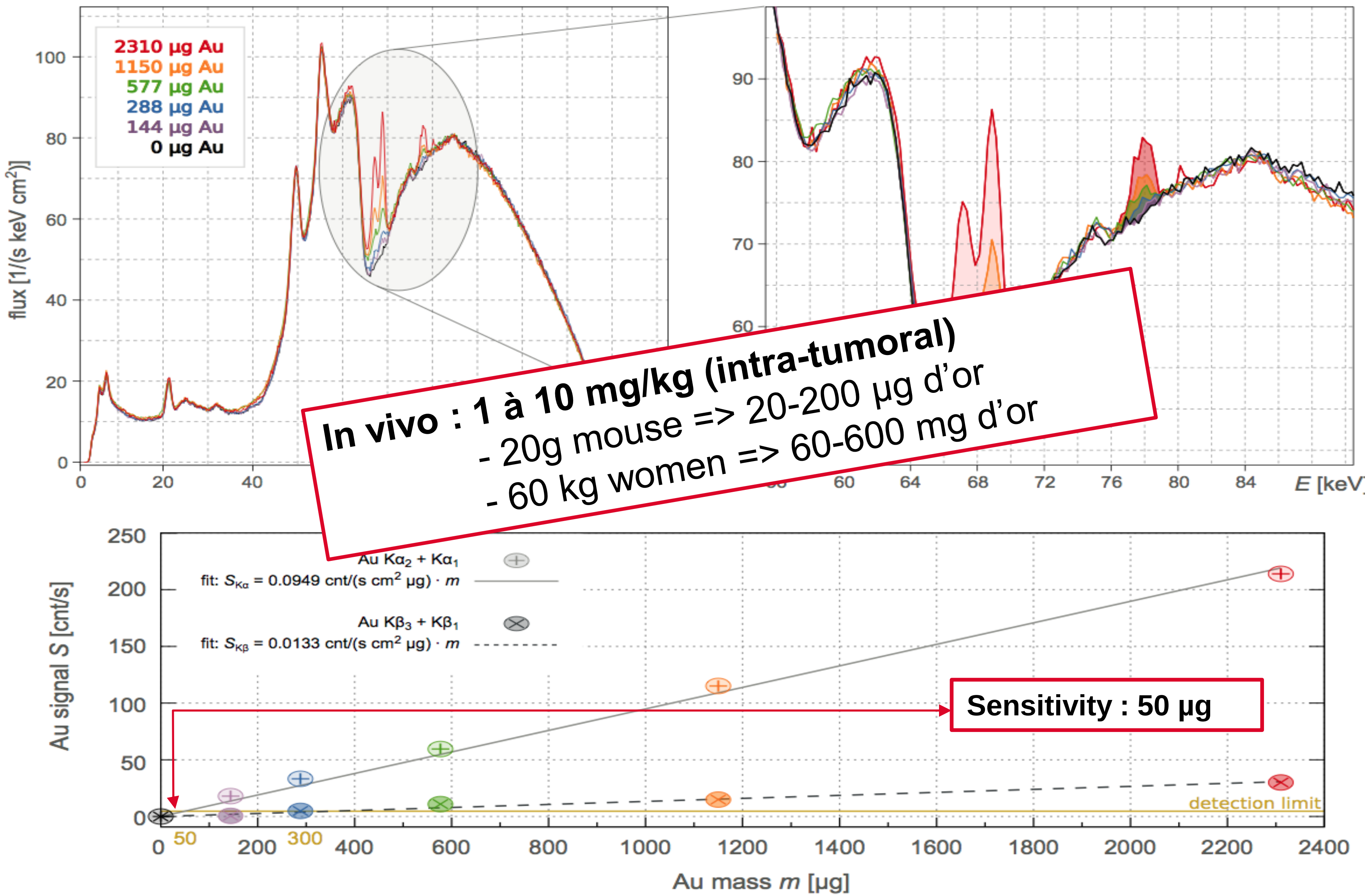
Photon detector



Strictly proportional to the dose



Fluorescence detection of irradiated nanoparticles intratumoral radiotherapy dosimetry



In vivo : 1 à 10 mg/kg (intra-tumoral)

- 20g mouse => 20-200 µg d'or
- 60 kg women => 60-600 mg d'or

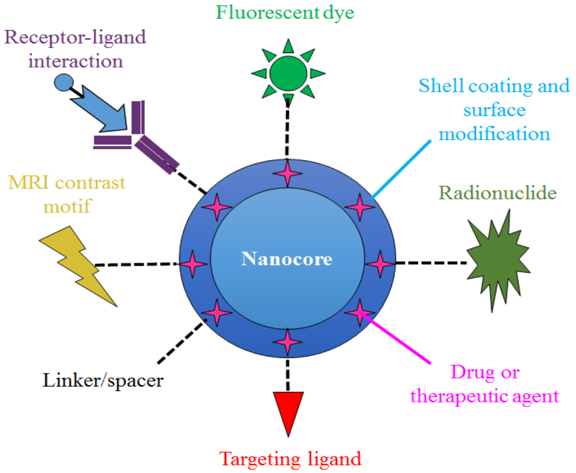
Sensitivity : 50 µg

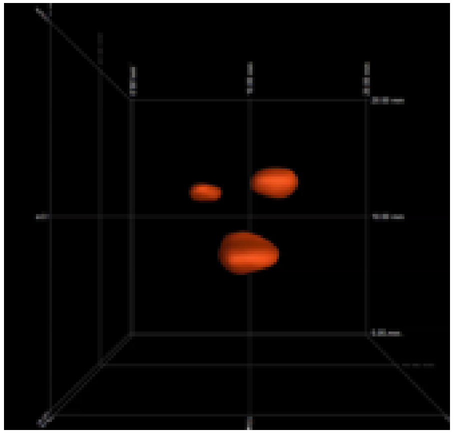
Conclusions

Main results

- Improve efficacy of radiotherapy by killing resistant cancer cells – **Better cure**
- Real time measurement of radiation dose delivered into the tumor – **Better cure and increased safety**

First attempts of XRF tomographic reconstruction for adjustment of NP exposure





Combine transversal skills ans knowledge
Disruptive technologies are only possible through multidisciplinary approaches

Still a lot of work to get to the patient, but all proofs of concept are there

Thank you for your attention

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