DIAMOND NANOMRI FOR DRUG DISCOVERY AND PRECISION MEDICINE

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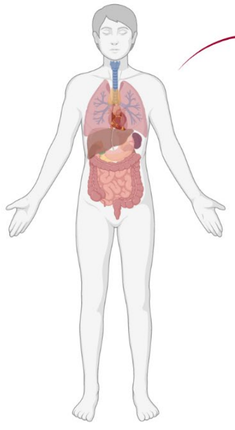
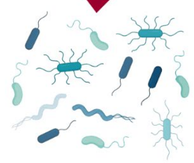
BACKGROUND

- 8 out of 10 top causes of death worldwide are associated with oxidative stress and free radicals (27M deaths in 2019)
- Free radicals in live systems are elusive
- Diamond nanoMRI is an all-optical quantum-based technique for free radical detection with diamond nanoparticles

Human body: **2 m**



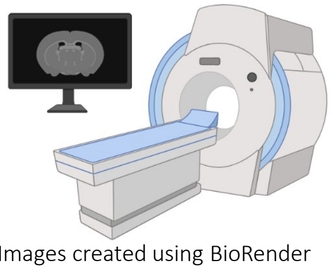
Antonie van Leeuwenhoek's **optical microscope**: bridging **6 orders of magnitude** In spatial resolution

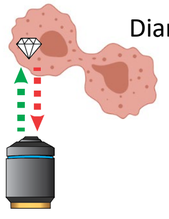


Bacterial cell: **2 µm**

Diamond nanoMRI reduces the voxel size by **15 orders of magnitude**

MRI voxel size: **1x1x1 mm**

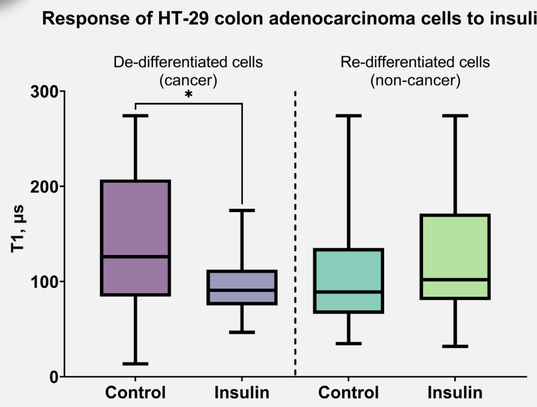




Diamond nanoMRI voxel size: **10x10x10 nm**

Images created using BioRender (https://biorender.com/)

APPLICATION EXAMPLES



Sample size: 170 tests

Material costs: €0.67

Assay time: ~4 hours

For a commercial assay:

Material costs: €250

Assay time: 1.5 hours + processing time

Insulin increases free radical load (shortens T1) in cancer, but not in re-differentiated HT-29 cells

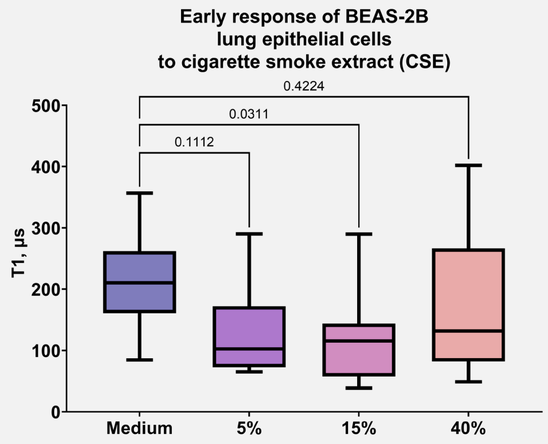
- Diamond nanoMRI detects changes in free radical load in live cells
- It can both reveal trends in cell populations and highlight single-cell differences
- It has higher sensitivity than commercial assays

Sample size: 40 tests

Material costs: €6.80

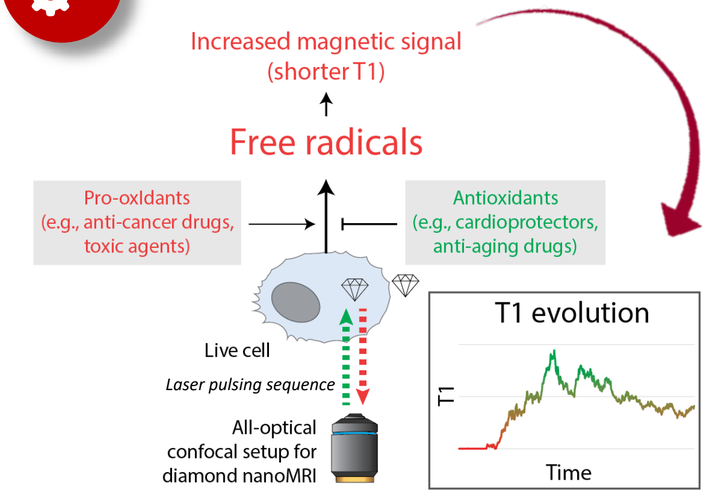
Assay time: ~6.5 hours

Commercial fluorescent assay was not sensitive enough to reveal this effect.



Cigarette smoke extract increases free radical load in lung epithelial cells at non-lethal concentrations after a very short exposure

METHOD



TAKE-AWAY

- To better understand diseases and treat patients, we need **high-precision methods**
- Diamond nanoMRI is a fast, cheap and incredibly sensitive technique for free radical detection
- With **higher throughput**, it can become a powerful tool in (pre-)clinical research

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Find out more at bioanalysisgroup.com

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