

RADICALOMICS

The next measurement layer for living biology

Quantum Nuova reveals local response dynamics inside biological models.



Genomics

DNA



Proteomics

Proteins



Radicalomics

Local radical-response dynamics

Biology's missing context is where and when stress emerges

**Genomics describes sequence.
Proteomics describes proteins.**

Drug discovery also needs to see how the local chemical environment responds inside a living model.

A bulk endpoint can hide the timing, location and persistence of that response.

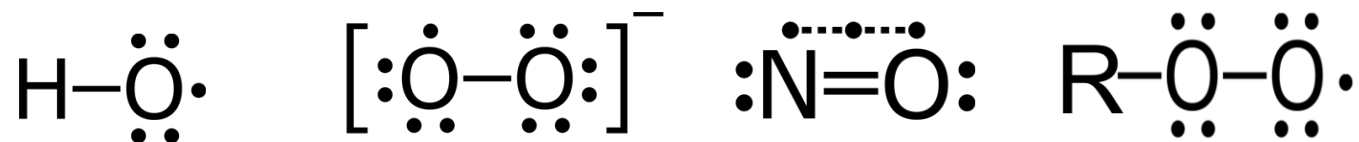
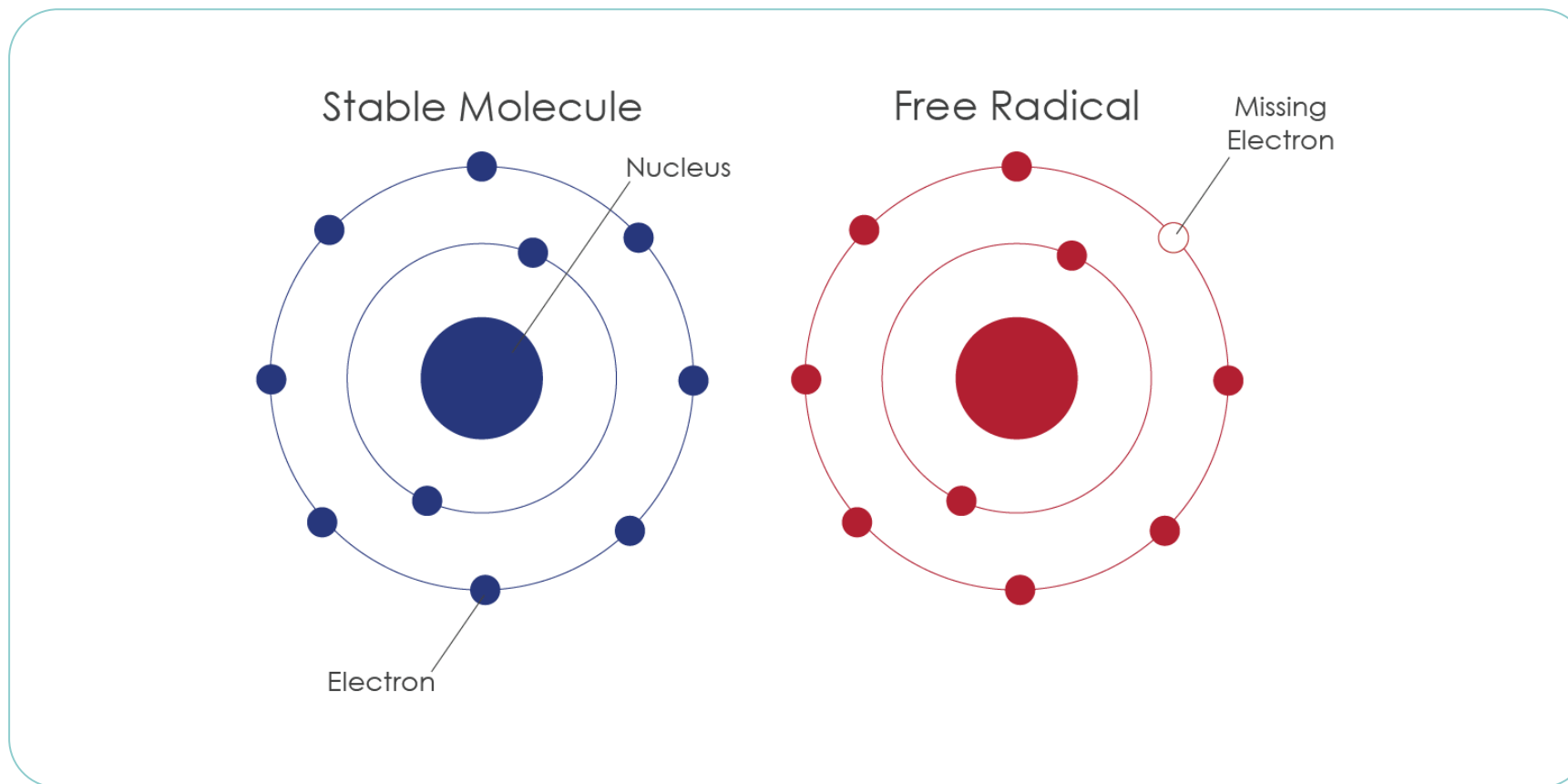
WHERE

Near a selected organelle or sensor

WHEN

Before and after treatment, with repeated measurements

What are free radicals?

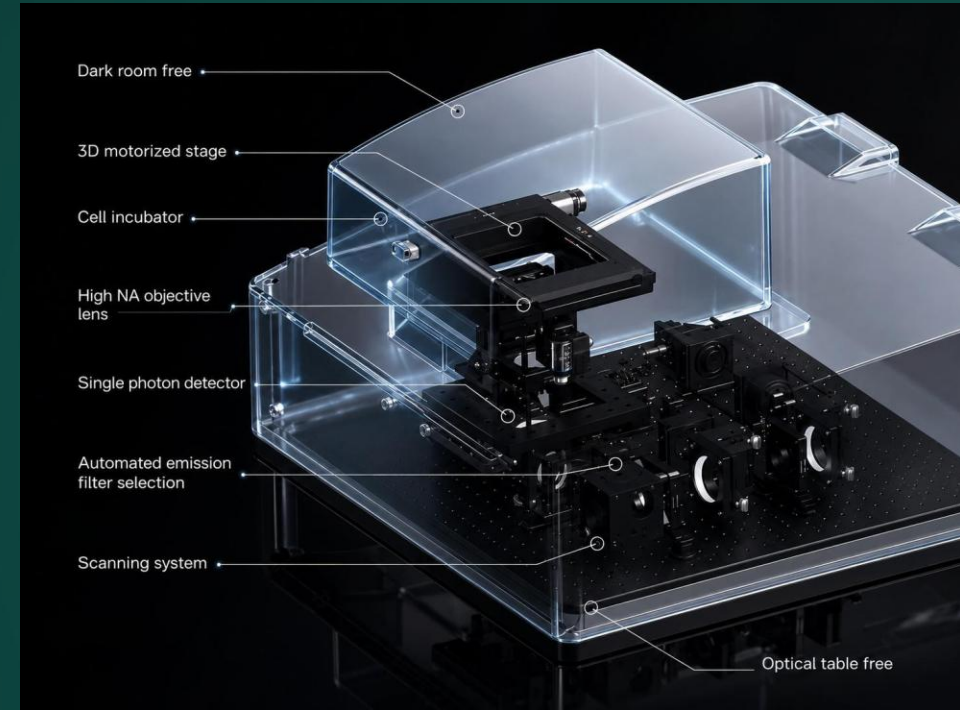


Quantum Nuova brings quantum sensing onto the biology bench

A self-contained confocal system



Optical T_1 readout with automated acquisition

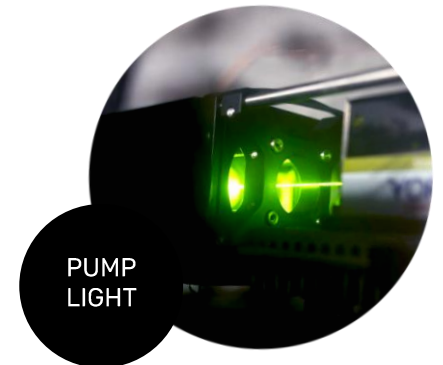
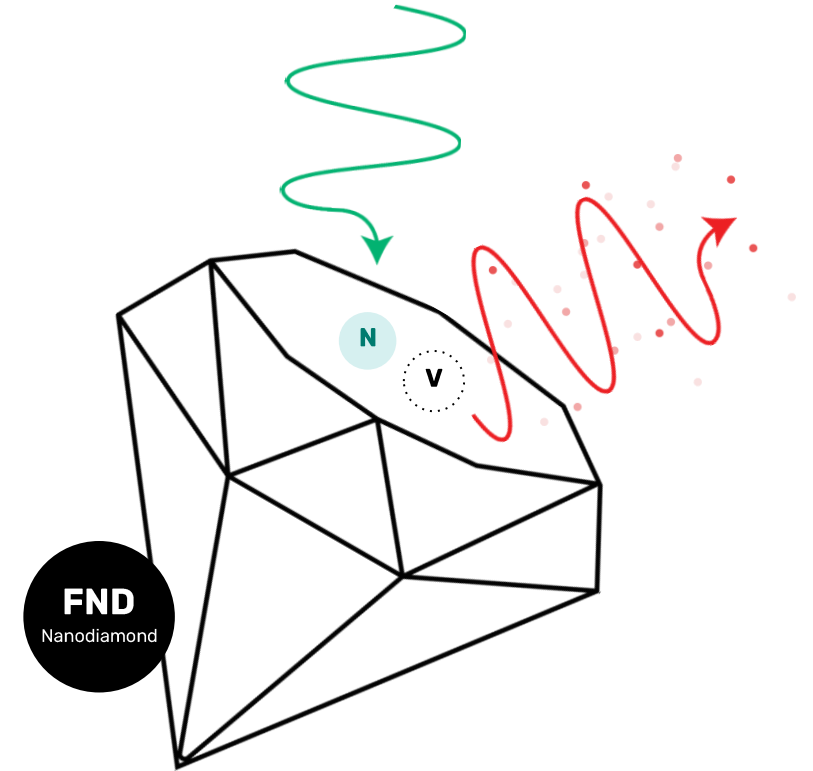


Why now: a bench instrument, external partner experiments and early commercial demand

Quantum Sensing using FND's

We use nitrogen vacancy (NV) centers in diamonds to convert magnetic noise from free radicals into optical signal.

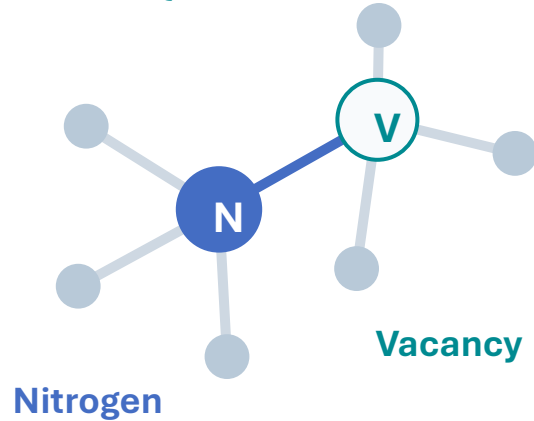
Detect and measure free radicals in living cells without affecting its natural state



T₁ relaxometry

Prepare the spin with light. Let it relax in the dark. Read its remaining polarisation.

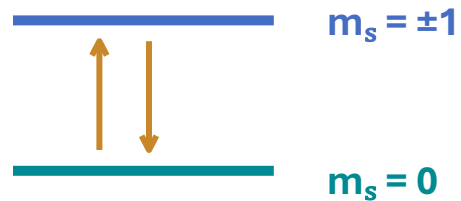
01 THE QUANTUM SENSOR



NV⁻: nitrogen beside a missing carbon
The defect hosts an electron spin ($S = 1$).

02 SPIN-LATTICE RELAXATION

Ground-state spin levels



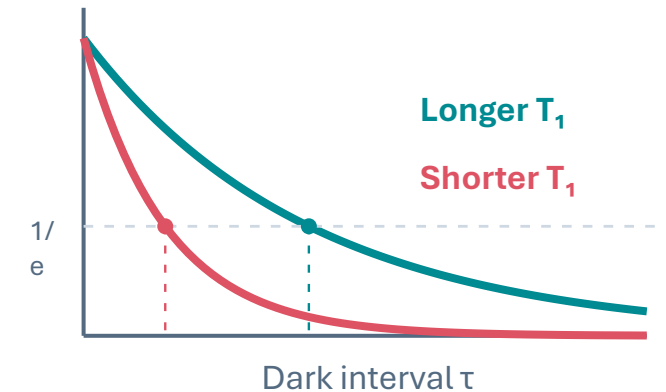
~2.87 GHz
at zero field

Energy exchange

Lattice vibrations (phonons)
and nearby fluctuating spins
redistribute spin populations.

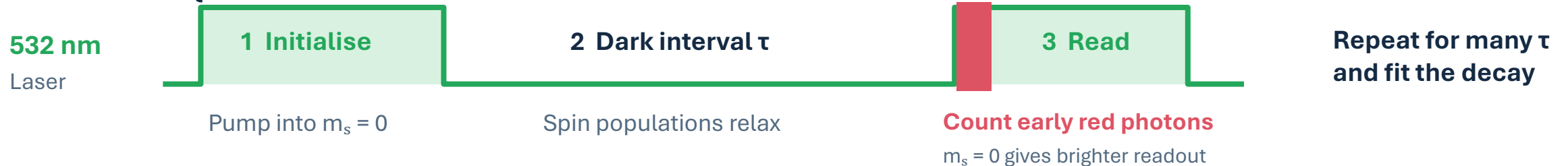
03 THE T₁ MEASUREMENT

Fluorescence contrast



**More resonant magnetic noise
accelerates relaxation.**

LASER PULSE SEQUENCE



T₁ = the timescale for loss of spin polarisation

Schematic single-exponential model: $C(\tau) = C_0 \exp(-\tau/T_1)$

PROCESS IN STEPS

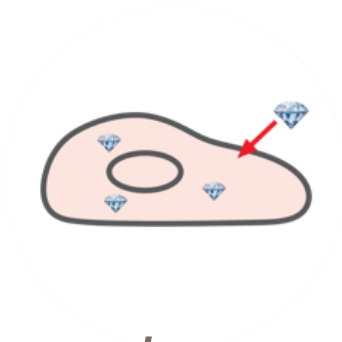
Fit to biology work flow

1 Nanodiamonds placed in sample



Multiple cells in a petri dish or well plate.

2 Nanodiamond uptake by cells



Fluorescent nanodiamonds (FNDs) are internalised by the cells.

3 Placed in Quantum Nuova



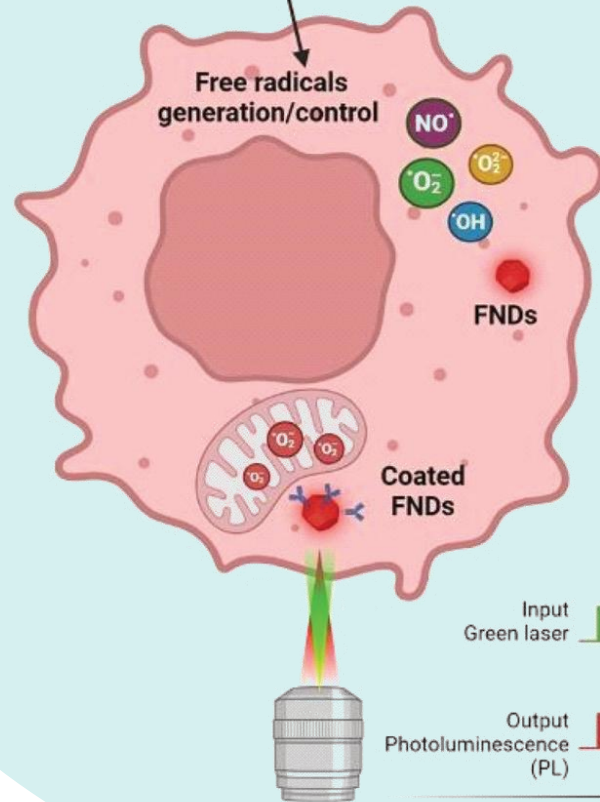
Establish baseline T_1 relaxation on the instrument.

4 Add treatment stimuli

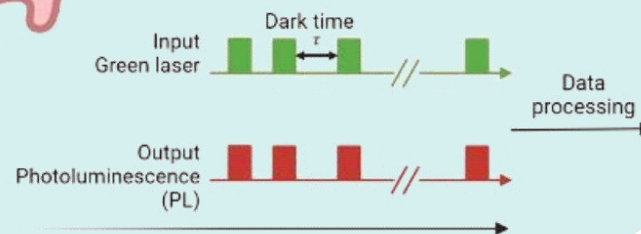


Deduce free radicals; re-measure T_1 and compare.

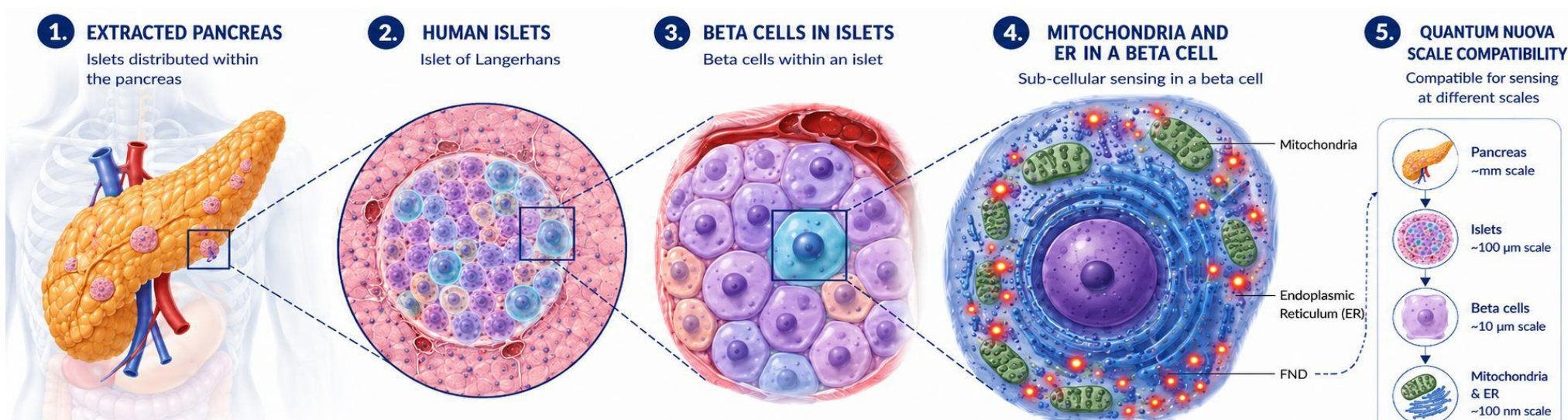
- Stress Inducer
- Treatment
- Drug



Sensing at Cellular and Subcellular Level (Mitochondria, Cytoplasm and Nucleus)



Metabolic disease model for screening incretins



Disease question

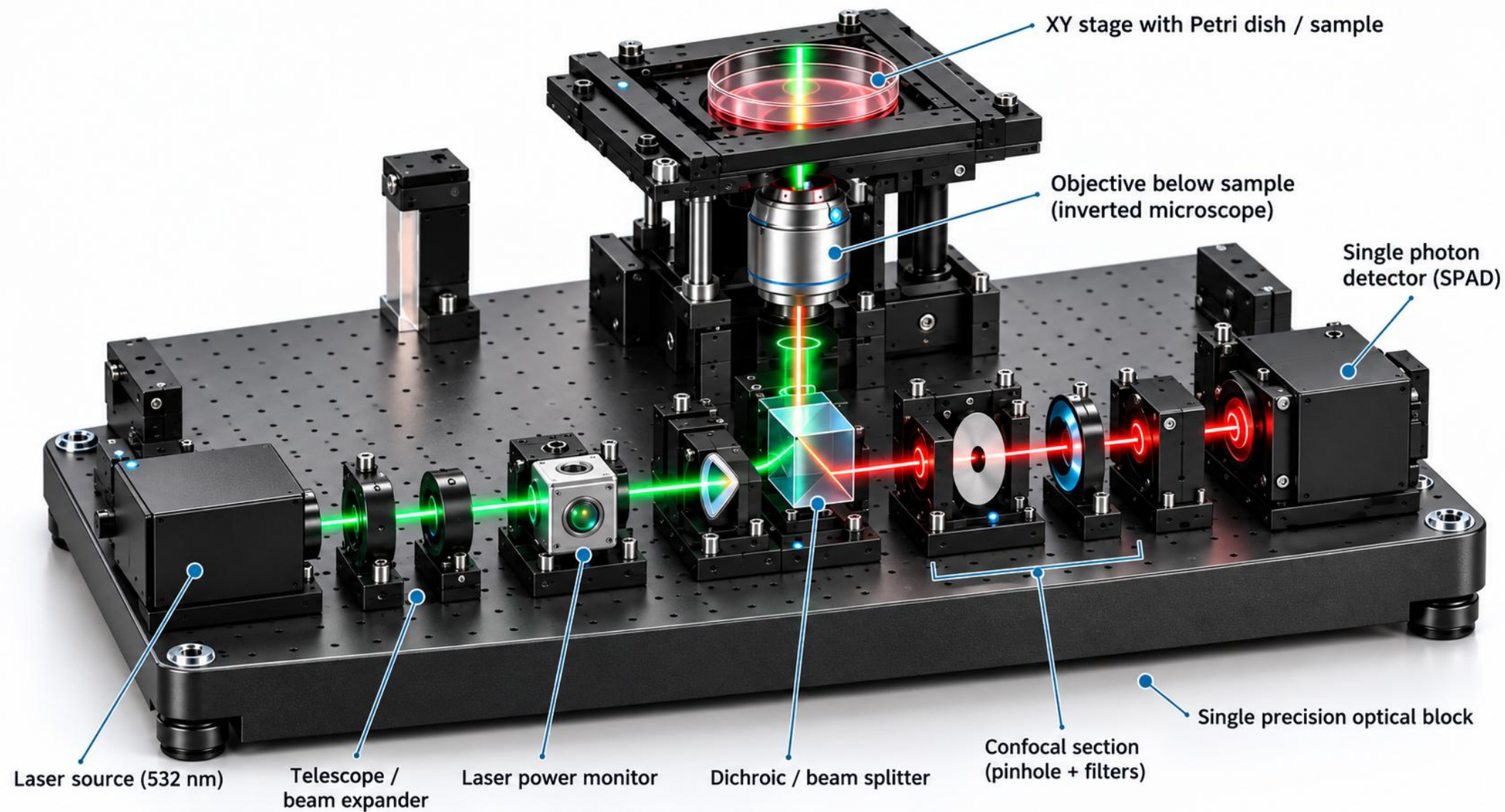
How does local oxidative stress relate to β -cell dysfunction?

Proposed QN study

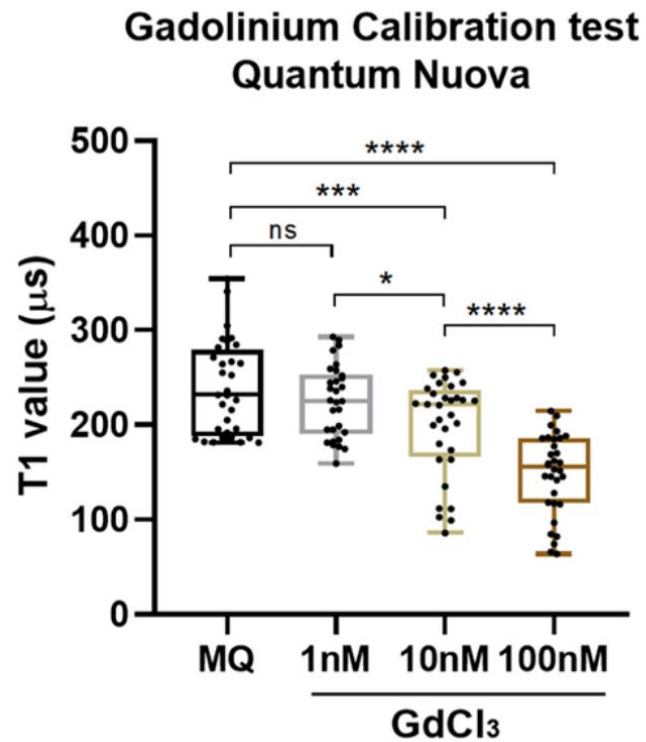
Profile human-islet responses across incretin-class compounds.

Translation potential

Connect local response to insulin secretion and functional rescue.



Gadolinium as a golden reference test



10 nM

Lowest tested level significantly different from water control

10 nM vs control: $p = 0.0007$

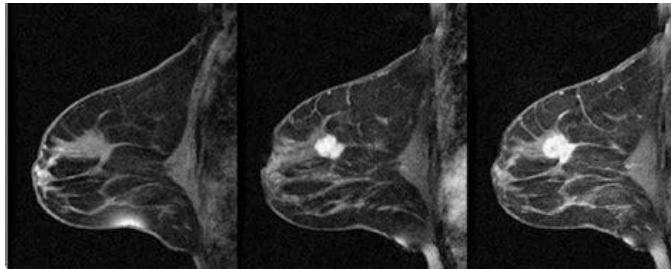
Tested series: water control, 1, 10 and 100 nM GdCl₃.
Repeated reads across dishes

REPEATED-MEASUREMENT DESIGN

100+ FND Sensors
5+ Quantum Nuova

10 nM reference sensitivity in GdCl₃; intracellular calibration remains assay-specific

MRI Tumor Imaging: Disease model for Contrast Agents



Patent filed: P105773NL (July 2026)

€7B

**Global contrast media
2026 market estimate**

CT / X-ray, MRI and ultrasound

Active manufacturers

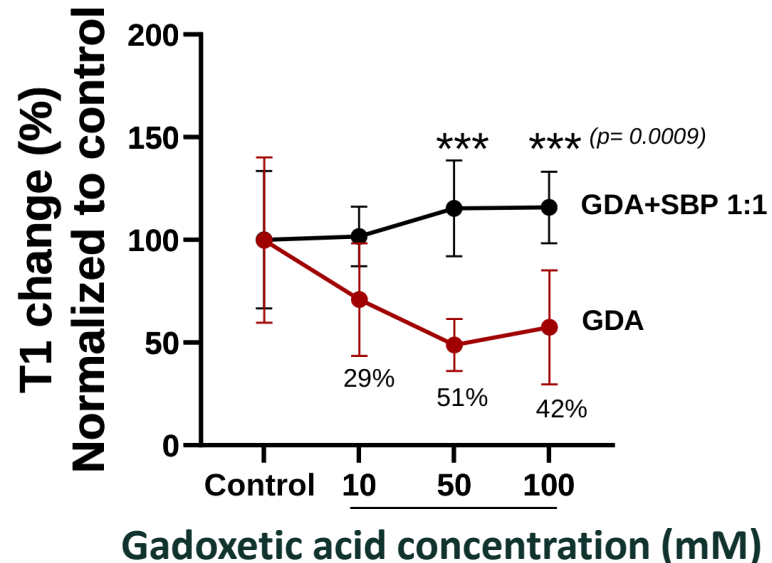
Bayer
Bracco Imaging
Guerbet
GE HealthCare

A disease model for screening

NHS collaboration using MDA-MB-231 tumor cells to screen intracellular contrast uptake.

Transporter-associated uptake

GDA lowers T_1 at 10–100 mM. SBP attenuates the response, supporting transporter involvement.



Gadoxetic acid is non-fluorescent and cannot be directly tracked using conventional fluorescence imaging. LC-MS/MS provides only endpoint measurements, while preclinical MRI is expensive and resource-intensive.

Performance and biological capabilities

10 nM

Reference sensitivity

GdCl₃

Demonstrated reference test

100 nM

Drug-response sensitivity

Assay response, not analytical LOD

300 nm

Spatial resolution

Confocal resolution

Reference target validated

Sub-second

Temporal performance

Free radical kinetics in min

End-to-end T₁ time qualified

SENSORS & TARGETING

70 & 120 nm FNDs

VDAC2 mitochondrial targeting

Application-specific protocols demonstrated

SAMPLE FORMAT

Live cells & tissue

Dish workflows

96-well format: ideation

AUTOMATION

Autofocus & navigation

Mosaic / galvo scanning

User experience

Radicalomics

A new measurement layer
for biology

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