

# Diamond Endoscopy - towards clinical application of the nanodiamond magnetometry

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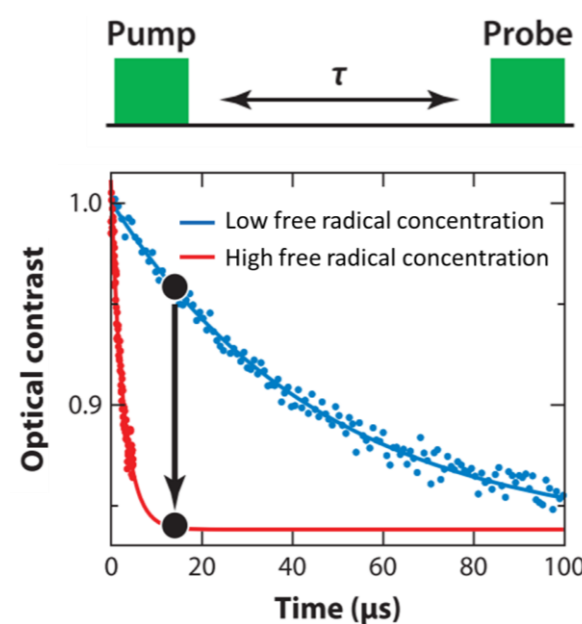
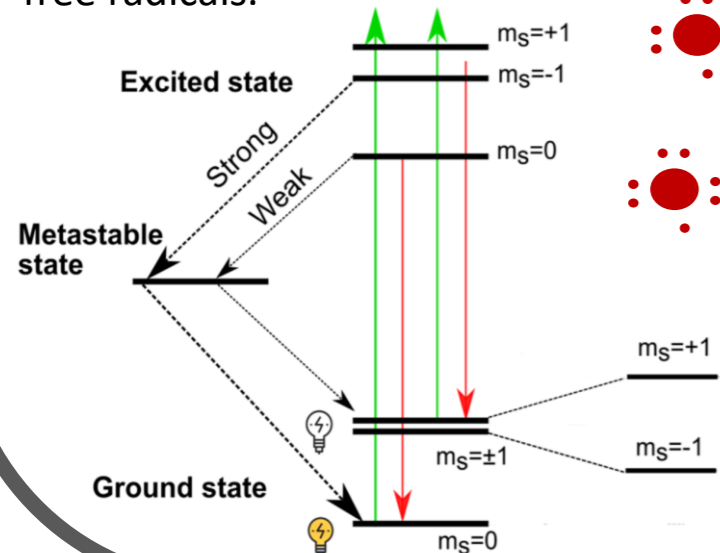
## What is nanodiamond magnetometry?

It is a quantum sensing technique that enables real time detection of free radical generation.

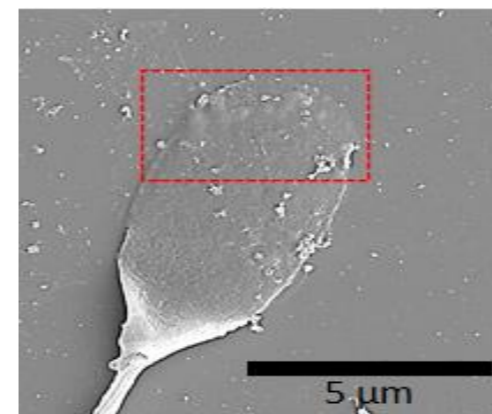
**Free radicals (FRs):** short-lived reactive chemical species with unbound electrons. Their imbalance is linked with aging and pathological changes in human body.

**Probes:** fluorescence nanodiamonds (FNDs) with NV centers that emit red photons upon green laser light illumination. FNDs have magnetic states (marked with  $m_s = +1$  and  $-1$ ) that enable nanoscale MRI.

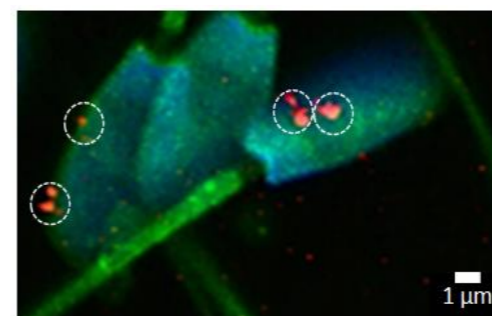
**T1 relaxation time:** shorter for a NV center in the presence of higher concentration of the free radicals.



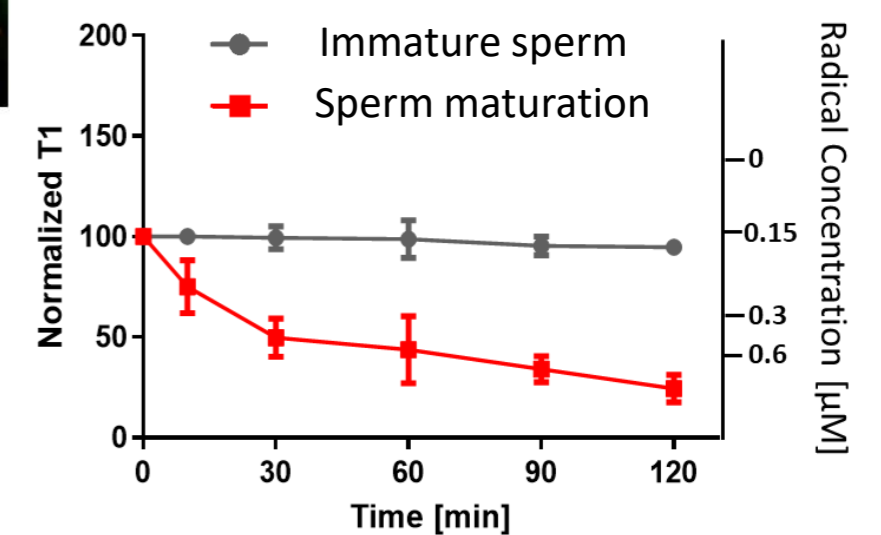
## To improve quality of life



Male factor of subfertility is correlated with an imbalance of FRs which impact sperm cell behavior, maturation and fertilization capability.

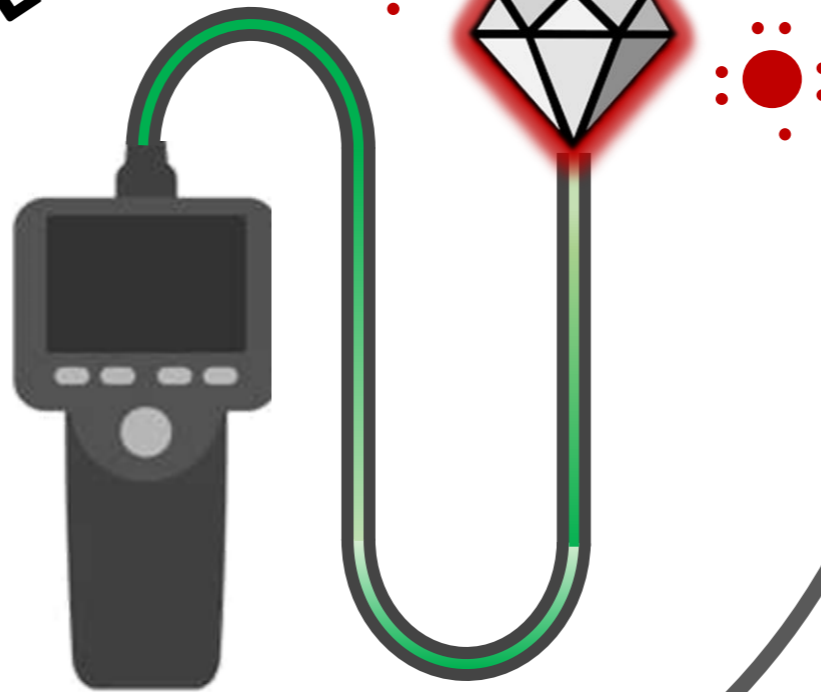


In single sperm cells and in semen plasma, real-time diamond magnetometry can reveal the relation between the lifestyle, infertility and cancerogenesis.



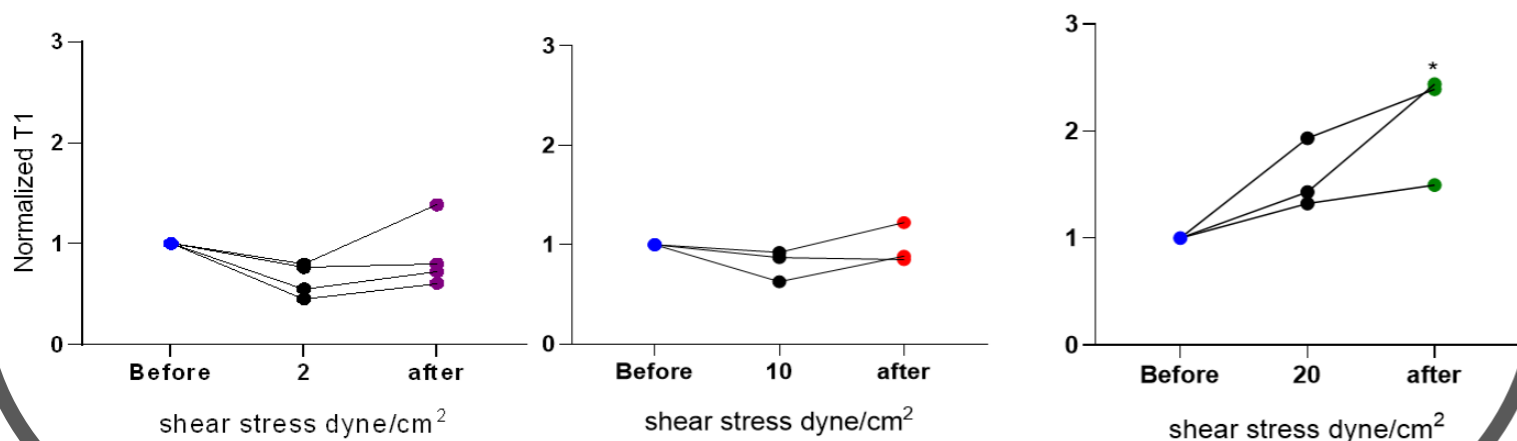
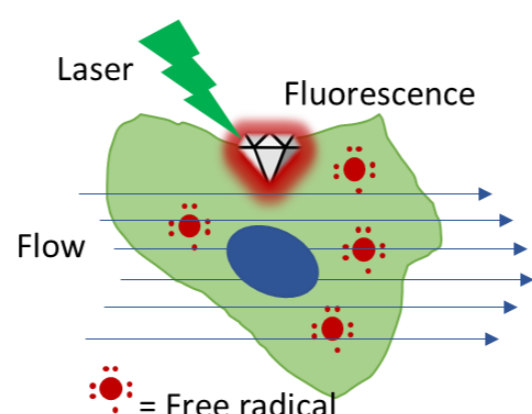
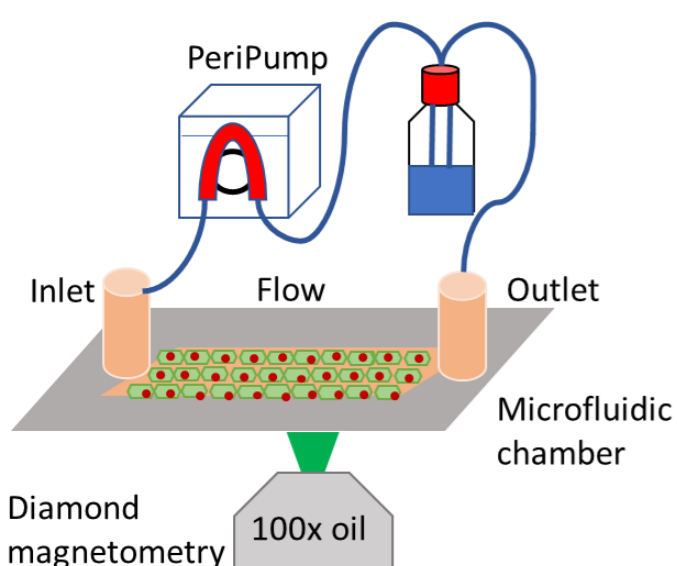
Increased T1 value  
Increased free radical

## Diamond Endoscopy



## To extend life time

Human umbilical vein endothelial cells produce FRs under shear stress to maintain functions such as non-thrombogenicity. Early detection of changes in FRs generation may indicate cardiovascular disease.



## Summary

Diamond magnetometry is unique among techniques for FRs detection in cells and human tissues:

- probes are biocompatible
- no bleaching of the diamond
- cheaper than NMR/MRI and ESR

Implementation of diamond magnetometry into endoscopy enables:

- localized MRI
- real time overview of the tissue status
- diagnosis of disease at early stage

## Acknowledgements



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