

Biosensors using laser-polarized ^{129}Xe NMR

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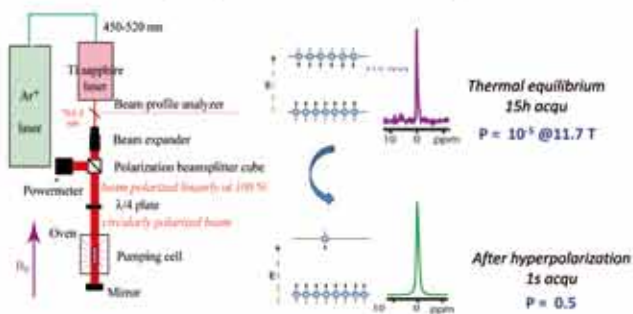
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Context

When hyperpolarized, xenon can become a sensitive NMR probe of biological events. It can be used as a free diffusive tracer¹¹ or it can be encapsulated in host systems in which it takes a specific resonance frequency, opening access to molecular imaging.¹⁻¹⁰

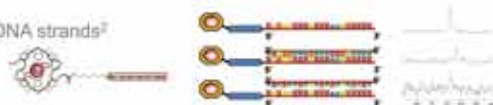
^{129}Xe Hyperpolarization

Due to spin-exchange optical pumping, high polarization level of xenon is obtained; the sensitivity gain is 45000 at 11.7 T which enables detection of 10^{13} spins (micro- to nano-molar range).



Examples of biosensors

• Detection of DNA strands⁷



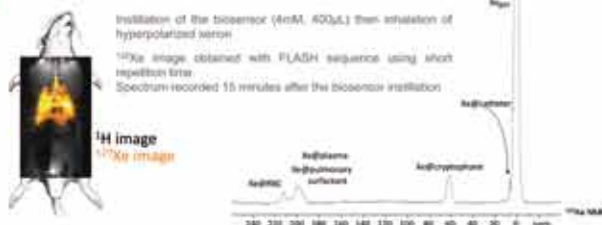
• Probe for pH⁸



• Targeting of transferrin receptors¹¹



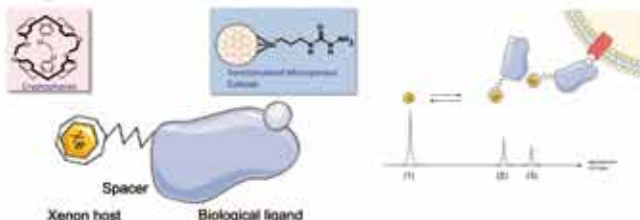
In vivo proof of concept



Conception of the biosensors

Suitable properties:

- High affinity for xenon or large quantities transported
 - Functionalizable (ligand for biological recognition)
 - Specific frequency for encapsulated xenon
 - Xenon in-out exchange : slow at the chemical shift timescale but fast enough to enable replenishment of the host in hyperpolarization
- cage-molecules or microporous particles⁶



Related publications

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