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Design and development of the molecular probes for application of the hyperpolarized-NMR/MRI

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Hyperpolarized-nuclear magnetic resonance and imaging (HP-NMR/MRI) is a promising technique that allows direct monitoring of metabolic reactions *in vitro* and *in vivo*. Given the 13C- or 15N-labeled molecular probes whose NMR signal is amplified by the dynamic nuclear polarization (DNP) under a cryogenic magnetic field (3.35T, 1.4K), the sample is rapidly dissolved with a superheated solvent (~458K), and then quickly reacted with enzymes or cells, or administered in animals put into the magnet. The metabolic reaction is readout onto the NMR spectra or MR image based on the >10,000-fold enhanced signals. By elucidating the extent of the metabolic reaction of the probes, early detection of disease-specific elevation of enzymatic activity, metabolic reprogramming, and alteration of their flux upon the treatment is possible.
The development of various molecular probes will be a key factor to expand the utility of this approach. In this presentation, we will concisely introduce the basics of the dis-DNP, design and application of our recent new molecular probes that allow *in vitro* and *in vivo* HP-NMR/MRI.

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Primary author: Dr TAKAKUSAGI, Yoichi (Quantum Hyperpolarized MRI Group, Institute for Quantum Life Science, QST)

Presenter: Dr TAKAKUSAGI, Yoichi (Quantum Hyperpolarized MRI Group, Institute for Quantum Life Science, QST)

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