Two polarization techniques, dynamic nuclear polarization (DNP) and parahydrogen-induced polarization (PHIP), have been used to produce magnetic resonance spectroscopic and imaging agents containing polarized $^{13}$C and $^{15}$N nuclei. While operating by different mechanisms of polarization, DNP and PHIP both have succeeded in producing substrates with high levels of signal enhancement.

**DNP**

Hyperpolarization using dynamic nuclear polarization (DNP) has emerged as a versatile method to dramatically improve the MR signal of low-sensitivity nuclei. DNP facilitates the study of real-time metabolism in vivo using $^{13}$C-enriched substrates and has been applied to numerous models of human disease. Within this field, pyruvic acid has been the most heavily and successfully studied substrate due to its long T$_1$, ease of use and metabolic relevance. Research into the development of additional substrates has also shown the potential of other compounds.

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Custom Hyperpolarization Products

Parahydrogen-induced Polarization

Parahydrogen-induced polarization (PHIP) is accomplished by performing a para-H₂ hydrogenation of an unsaturated substrate followed by polarization transfer to a ¹³C label. PHIP is usually accomplished in a home-made polarizer at room temperature in a matter of seconds to minutes. Several substrates have been polarized using PHIP and have subsequently been used in MR experiments to study brain tumors and cellular glucose uptake.

Custom Synthesized Substrates

Due to the application specific nature of PHIP substrates, these products are usually made available through a custom request. This can often be the case for DNP substrates as well. As this field progresses, the identification of substrates that will produce sufficiently long T₁ relaxation times while providing information about the metabolic cycle or disease being studied is important.

Isotec Stable Isotopes specializes in the custom synthesis of labeled compounds. Isotec employs a highly trained group of stable isotope scientists led by industry expert, Dr. C.T. Tan. This group is comprised of varied chemistry expertise, ensuring the synthesis of any compound. Our facilities give us the capability to perform syntheses ranging from milligram to kilogram quantities. In addition, we offer a variety of product grades including S&P tested to full GMP.

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