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Chemically Resolved Nuclear Spin Relaxation

In Nuclear Magnetic Resonance (NMR) Spectroscopy, the excitation of nuclear spins is used to generate spectra of radiofrequency resonance signals. The signal frequencies are typically used to determine the structure of chemical compounds, while the relaxation of the spins to thermodynamic equilibrium provides useful information about the molecular vicinity of a material. When a chemical compound occurs in different molecular environments, a single resonance signal can have multiple relaxation times. To quantify how much material is in how many different environments, a multi-exponential analysis was developed resolving resonance signals and relaxation times in two-dimensional contour plots. Samples of known resonance signals and relaxation times were used to test the implementation of the new technique. For a new type of polymer hydrogels, the contour plots provide information about how much of the gel-forming water is freely moving as bulk solvent and how much is restricted in motion as molecularly bound water.

Megan is currently finishing her sophomore year at Missouri S&T as a chemistry student. This is her first year doing undergraduate research on NMR spectroscopy. She plans on graduating in May of 2023 with her B.S. in Chemistry with no solidified plan for after graduation.