Coordination Chemistry in $^{19}$F Magnetic Resonance Imaging: Agents for Illuminating Biological Environments in Vitro and in Vivo

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$^{19}$F Magnetic resonance imaging (MRI) is an emerging technique for in vivo imaging, showing great promise due to the favorable NMR properties of the fluorine nucleus (high sensitivity, large ppm range) and the lack of detectable fluorine signal in biological systems. Imaging agents can be designed that exhibit either a turn-on or chemical shift response that is selective for a specific biological molecule or event. We are developing a series of metal complexes designed to report on different biological environments associated reductive stress (hypoxia), oxidative stress, changes in pH, metal ion concentration, and enzymatic activity. These sensors act via a switch from a paramagnetic to diamagnetic state upon reduction or oxidation at the metal center. Through careful tuning of the ligand scaffold, we have developed selective sensors for hypoxia and oxidative stress, showing promise for future applications for in vivo detection of these states in both cellular and animal disease models. New enhanced nanoparticle-based platforms based on metal-doped perfluorocarbons will also be discussed.

Professor Emily Que joined the faculty in the Department of Chemistry at the University of Texas, Austin, in the summer of 2014. Her research lies at the intersection of bioinorganic chemistry and chemical biology, with an emphasis on the development of chemical tools and probes to gain a deeper understanding of biological systems. Projects in metals in medicine and metals in biology are current foci of the lab.

Professor Que earned her bachelor’s degree from the University of Minnesota, and her doctorate from the University of California, Berkeley. She developed a series of Gd-based contrast agents for copper sensing applications, earning an American Chemical Society Division of Inorganic Chemistry Young Investigator Award. She was a post-doctoral researcher at Northwestern University, developing new imaging tools and methods for exploring how the mammalian egg utilizes zinc at the time of fertilization.

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