# NMR Spin Trapping of Free Radicals: limitations, advantages and future directions

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Recently we proposed an NMR Spin Trapping approach for detection of free radical reactions. The approach is based on application of phosphorus-containing [1] or fluorine-containing [2] spin traps and $^{31}$P- and $^{19}$F-NMR spectroscopy, respectively. The advantage of this technique is that it allows for detection of comparatively stable diamagnetic products of spin adduct degradation and, thus, allowing these products to accumulate up to a concentration detectable by NMR. The absence of NMR signals of phosphorus- and fluorine-containing compounds at the same region of the spectra in living organisms provides a background for *in vivo* applications. We have demonstrated the possibility of detection of series of O-, C- and S-centered radicals using this method. However, one important limitation involves the assessment of O-centered radicals. Therefore, the development of new spin traps, specifically oriented for NMR application appears to be a necessary next step. Recently, we have detected the formation of the adducts of nitrone spin traps with sulfite, both in the presence of oxidants (in a model of sulfite trioxide anion radical generation) and in their absence [3]. The data provide new insights into the chemistry of sulfite toxicity. Another new direction is the application of NMR spin trapping for detection of nitric oxide using fluorinated nitronyl nytroxyl radicals (NNR). Interestingly, the application of EPR spectroscopy for NO detection using NNR is strongly limited by its fast reduction in biological systems while NMR Spin Trapping overcomes this limitation by measuring the diamagnetic products. Here we discuss the first data demonstrating the effectiveness of NO detection by NMR Spin Trapping using newly synthesized fluorinated NNR in various NO-generating systems [4].

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[1] Khramtsov, V.V. L.J.Berliner, and T.L.Clanton, 1999, *Magn. Reson. Med.* 42, 228-234.
[2]. Khramtsov et al. 2001, *Free Rad.Biol.Med*. 30 (10): 1099-1107.
[3]. Potapenko et al. 2002 (abstract, this conference).
[4]. Bobko et al. 2002 (abstract, this conference).