In Vivo Spin Trapping: Opportunities and Challenges as Viewed in 2002

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The emergence of the ability to carry out ESR in vivo raises exciting new opportunities for the use of spin trapping. The requirements for successful in vivo spin trapping include considerations of the stability of the spin traps, stability of the spin adducts, localization of the spin traps, spectroscopic features of the spin adducts, and toxicity of the spin traps/spin adducts. The detection of nitric oxide in vivo presents another set of opportunities and challenges.

The stability of the spin traps in vivo generally has not been a limiting factor. The stability of the spin adducts has been the key limitation, especially for oxygen centered radicals. The development of new traps, such as DEPMPO, therefore has been a major step forward, making it possible to trap the hydroxyl radical in vivo. More spin traps with stable spin adducts clearly are needed and are becoming available from several laboratories.

Another important factor is the localization of the spin traps in vivo; less attention has been paid to this aspect. Ideally there should be spin traps that localize selectively in various compartments of interest, such as the vascular system, or within cells and in specific intracellular regions such as the mitochondria.

Some progress has been made in optimizing spectroscopic features of the spin adducts. The stability of the spin adducts is a major factor for building up sufficient intensity. Isotopic substitution also can be very useful.

The toxicity of the spin traps/spin adducts, so far, has not been a major limitation. The evaluations need to include effects on cell signaling, functions such as respiration, and cell viability.

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