Electron paramagnetic resonance (EPR): a versatile and little-known tool in life sciences and related applications.

Paola Fattibene, Donatella Pietraforte, Emanuela Bortolin, Mattea Chirico, Cinzia De Angelis, Sara Della Monaca, Egidio Iorio, Maria Elena Pisanu, Maria Cristina Quattrini

Core Facilities, Istituto Superiore di Sanità, Viale Regina Elena 299, Rome – Italy.

Electron Paramagnetic Resonance (EPR) is the less-known, although elder, sister of NMR. Although, for several reasons, it has been developed less than the more famous nuclear magnetic resonance, EPR is a versatile tool for the study of materials and biological systems, especially if associated with other spectroscopic techniques, including its companion NMR. What makes EPR unique is its ability to detect directly, to identify, and to quantify paramagnetic species, i.e. materials or compounds that have one or more unpaired electrons in the outer orbitals of their atoms or molecules. A surprisingly large number of materials have unpaired electrons, including free radicals, transition metal ions, and localized defects in materials. EPR is applied, *in vitro/ex vivo*, to the study of stable paramagnetic systems (stable radicals, antioxidants, metals, radicals derived by radiation- and photo-induced damage), of unstable paramagnetic systems (reactive oxidizing species and target-centred radicals) as well as of non-paramagnetic systems charged with paramagnetic probes (protein structures and membranes), with applications in health, medicine, pharmaceutical and food science industries, material science. By presenting a panorama of these applications, in some cases in combination with NMR, this presentation aims at providing suggestions and inspirations for the use of this powerful and versatile technique.