Translational R&D in Healthcare Biomagnetics

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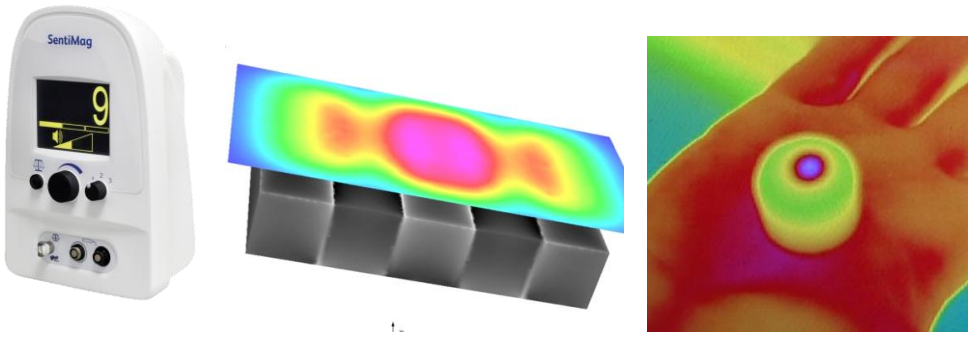
'Healthcare Biomagnetics' – the sensing, moving and heating of magnetic nanoparticles in vitro or in the human body – is a rapidly changing field that is attracting a great deal of interest worldwide.[1] It offers the potential to develop safe and convenient alternatives for a diverse range of therapeutic and diagnostic healthcare applications, using injectable materials of proven safety and reliability. In doing so, it makes use of the three fundamental 'action-at-a-distance' properties of magnetic materials – their ability to act as remote sensors,[2] mechanical actuators,[3] and heat sources.[4]



Representative images related to (from left to right): magnetic sensing, actuation and hyperthermia.

The versatility of the field is leading to the emergence of multi-modal applications, combining two or more of the sensing-moving-heating properties in the same product. Similarly, certain applications are now entering or are close to beginning Phase I/II clinical trials, or in the case of in vitro products, are already entering the marketplace. Pertinent examples of work in the fields of targeted delivery of drugs and other therapeutic agents, and others, will be presented and discussed.

References

[1] Q.A. Pankhurst et al.: J. Phys. D, 36, R167, (2003); Q.A. Pankhurst et al.: J. Phys. D, 42, 224001 (2009). [2] U.A. Gunasekera et al.: Targeted Oncology, 4, 169 (2009); M.R. Loebinger et al.: Cancer Research, 69, 8862 (2009); K.L. Vigor et al.: Biomaterials, 31, 1307 (2010). [3] E. Stride et al.: Ultrasound Med. Biol., 35, 861 (2009); J. Riegler et al.: Biomaterials, 31, 5366 (2010); J. Riegler et al.: J. Phys. D, 44, 055001 (2011). [4] M. Kallumadil et al.: J. Magn. Magn. Mater., 321, 3650 (2009); L.A. Thomas et al.: J. Mat. Chem., 19, 6529 (2009); K. Parcell et al.: Thorax, 65, A41 (2010).