Vibrating magnetic particles as a tool for new therapies

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Abstract

The mechanical vibration of magnetic particles under low frequency magnetic field allows for the application of mechanical stress at the cell level. This mechanical stress induces a large variety of physiological reactions from the cells depending on their nature and on the intensity of the magneto-mechanical stimulation. It has for instance a strong influence on the cells cytoskeleton that triggers a variety of cell physiological reactions. Using U87 glioma brain cancer cells, we observed that a weak stimulation induces already a disorganization of the cell cytoskeleton resulting in a cell contraction, a loss of motility and a temporary stops of the mitosis. A stronger stimulation can induce the apoptotic cell death (1, 2), which can lead to a new approach towards cancer treatment.
Studies on cancer cells were conducted *in-vitro* as well as *in-vivo* revealing quite different results for a variety of reasons. Ongoing studies are carried out on spheroids of cells embedded in 3D gels, which represent *in-vitro* models much closer to *in-vivo* situations.

Experiments were also conducted on INS1 pancreatic cells where it has been demonstrated that the magnetically induced mechanical stimulation allows enhancing insulin release, which can also open a new route towards innovative diabetes treatment (3).

(1) S. Leulmi *et al.*, Nanoscale **7,** 15904 (2015).

(2) C. Naud *et al.*, Nanoscale Adv. **2,** 3632 (2020).
(3) S. Ponomareva *et al.*, Nanoscale **14,** 13274 (2022).

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