

# Nano-discs destroy cancer cells

ArgonneNationalLab

A new technique, designed with the potential to treat brain cancers, is under study at Argonne National Laboratory and the University of Chicago Medical Center. The micron-sized magnetic materials, with vortex-like arrangements of spins, were successfully interfaced with Glioblastoma multiforme (GBM) cancer cells. The microdisks are gold-coated and biofunctionalized with a cancer-targeting antibody. The antibody recognizes unique receptors on the cancer cells and attaches to them (and them alone), leaving surrounding healthy cells unaffected during treatment. Under application of an alternative magnetic field, the magnetic vortices shift, leading to oscillatory motion of the disks and causing the magneto-mechanic stimulus to be transmitted directly to the cancer cell. Probably because of the damage to the cancer cell membrane, this results in cellular signal transduction and amplification, causing initiation of apoptosis (programmed cell death or "cell suicide"). Manifestation of apoptosis is of clinical significance because the malignant cells are known to be almost "immortal" (due to suppressed apoptosis), and, consequently, highly resistant to conventional (chemo- and radio-) therapies. Due to unique properties of the vortex microdisks, an extremely high spin-vortex-induced cytotoxicity effect can be caused by application of unprecedentedly weak magnetic fields. An alternative magnetic field as slow as about 10s Hertz (for comparison, 60 Hertz in a electrical outlet) and as small as less than 90 Oersteds (which is actually less than the field produced by a magnetized razor blade) applied only for 10 minutes was sufficient to cause ~90% cancer cell destruction in vitro. The study has only been conducted in cells in a laboratory; animal trials are being planned. Watch a news clip of the story from ABC-7 News:

<http://abclocal.go.com/wls/story?section=news/health&id=7245605> More details on this study can be found in the original research paper: Biofunctionalized magnetic-vortex microdiscs for targeted cancer-cell destruction, by Dong-Hyun Kim, Elena A. Rozhkova, Ilya V. Ulasov, Samuel D. Bader, Tijana Rajh, Maciej S. Lesniak & Valentyn Novosad. Nature Materials (cover story), vol. 9, pp. 165 171, February 2010. <http://www.nature.com/nmat/journal/v9/n2/index.html>

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