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Supplementary Information

Nanobrick toxicity to bEnd.3 cells



Figure S1 MTT assay of different concentration of nanobricks to bEnd.3 cells. Values represent the mean \pm standard error of the mean of three samples per treatment group.





Figure S2 Temperature dependent uptake of nanobricks in bEnd.3 monolayers. Cells were exposed to various concentrations of the iron-oxide nanobricks at either 4° or 37° C in the presence or absence of external magnetic field. After 1.5 hour exposure, cells were washed and iron content measured as described in text. Values represent the mean \pm SEM of 3 monolayers per treatment group. **** p < 0.001 compared to 4° C or the absence of an external magnetic field.



Figure S3 MTT assay of chlorpromazine (7 μ g/mL), methyl-beta-cyclodextrin (10 mM), genistein (200 μ M), monensin (25 μ M), or cytochalasin D (5 μ g/mL) to bEnd.3 cells. Values represent the mean \pm standard error of the mean of three samples per treatment group.

Simulation of the field profile for spheres and parallelepipeds

In order to understand more completely the significant differences in cellular internalization of the nanoparticle samples, the magnetic field profiles of a simple sphere and parallelepiped were simulated using a finite element magnetics method [1]. The results of this simulation are shown in Figure S3. The magnetization of the sphere is effectively uniform over the entire volume, whereas there exists a gradient in the field of the parallelepiped. These results are a consequence of the different symmetries that a sphere and parallelepiped posses, which can be described in terms of the magnetocrystalline anisotropy. Both the sphere and parallelepiped can be most simply described by a uniaxial crystalline anisotropy, defining a single easy axis of magnetization. As spheres possess both azimuthal and polar symmetries, there is no preferred direction of the easy axis (all directions are effectively identical). Parallelepipeds do not possess these symmetries and thus the easy axis lies preferentially along one direction, most probably along the dimension with



Fig S4 Magnetic field profiles for (a) a sphere and (b) a parallelepiped calculated using a finite element magnetics method [1].

the most magnetic material. Thus, under the influence of an external magnetic field, the

nanobrick sample will preferentially orientate such that the largest dimension lies along the magnetic field. With a magnetic field applied from below the cell culture plates, the shorter dimension of the nanobricks will be interacting with the cell surface. This could act to enhance cellular internalization by having both a smaller interaction area and multiple points of contact with the cell surface (corners of the parallelepiped).

[1] D. C. Meeker, Finite Element Method Magnetics, Version 4.0.1 (03Dec2006 Build), http://www.femm.info