**Supplementary**

**Supplementary 1:** Bare MNPs, before the conjugation to NGF, present a hydrodynamic diameter of 45 ± 17, as determined by dynamic light scattering.

![Dynamic light scattering measurement of bare MNPs hydrodynamic diameter.](image)

**Figure S1.** Dynamic light scattering measurement of bare MNPs hydrodynamic diameter.

**Supplementary 2:** Using COMSOL software, we simulated the magnet field gradient above the device with 6 magnet rods in a form of a circle with a single rod in the center in the opposite direction.

![Simulation of magnetic field gradient](image)

**Figure S2.** Simulation of magnetic field gradient (a) 0.1mm from top (b) 0.5mm from top (c) 1mm from top (d) 2mm from top.

**Supplementary 3:** In order to manipulate MNPs, a magnetic field gradient is required to exert a force at a distance. The force on a magnetic nanoparticle with magnetic moment $m_p$ is governed by the equation:

$$F_m = (m_p \cdot \nabla)B$$  

(1)

where $m_p$ is the magnetic moment of the particle and $B$ is the magnetic field flux density. Due to the superparamagnetic properties of the particles, the magnetic moment is proportional to the external field

$$m_p \propto B$$  

(2)
\[ m_p = \frac{V_m \Delta \chi B}{\mu_0} \]

where \( V_m \) is the volume of the particle and \( \chi \) is the magnetic susceptibility of the particle.

Hence, equation (1) becomes

\[ F_m = \frac{V_m \Delta \chi}{\mu_0} (B \cdot \nabla)B \quad \text{(3)} \]

To maximize the force, the magnet system should, on the one hand, generate field \( B^* \) that is sufficiently strong at the location of the magnetic nanoparticle to maximize the induced magnetization \( m_p \). On the other hand, the magnet system should generate strong field gradients at the nanoparticle's location.