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Heat generation and nanoscale thermal transport in thermo-magnetic genetic cellular stimulation RAHUL MUNSHI, IDOIA CASTELLANOS-RUBIO, ARND PRALLE, State Univ of NY - Buffalo — Magnetic nanoparticles act as heat sources, when exposed to alternating magnetic fields, creating steep temperature gradients around them. We studied the capabilities of various geometrical distribution of such particles to be efficient transducers for stimulating cellular signaling, upon magnetic field application. We tagged synthesized core-shell nanoparticles with fluorescent dye molecules and attached them via membrane proteins, effectively creating a sheet of particles, wrapped around the cellular membrane. Exploiting the thermo-sensitivity of fluorescent proteins, we systematically studied temporal evolution of temperature gradients with magnetic fields, by monitoring fluorescence intensity changes on the particles confined to particular geometrical arrangements, on cells as well as in fabricated polymer matrices. We also studied the impact of magnetic dipolar interactions on heat generation in tightly packed self-assemblies, like particle chains in magnetotactic bacteria. Lastly, we show how nanoparticles can be targeted with specificity to deep brain neurons to evoke remotely stimulated behavioral changes in awake mice.

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