# NANO HIGHLIGHT
# MicroCT Imaging Based Theoretical Simulation and Protocol Design in Magnetic Nanoparticle Hyperthermia

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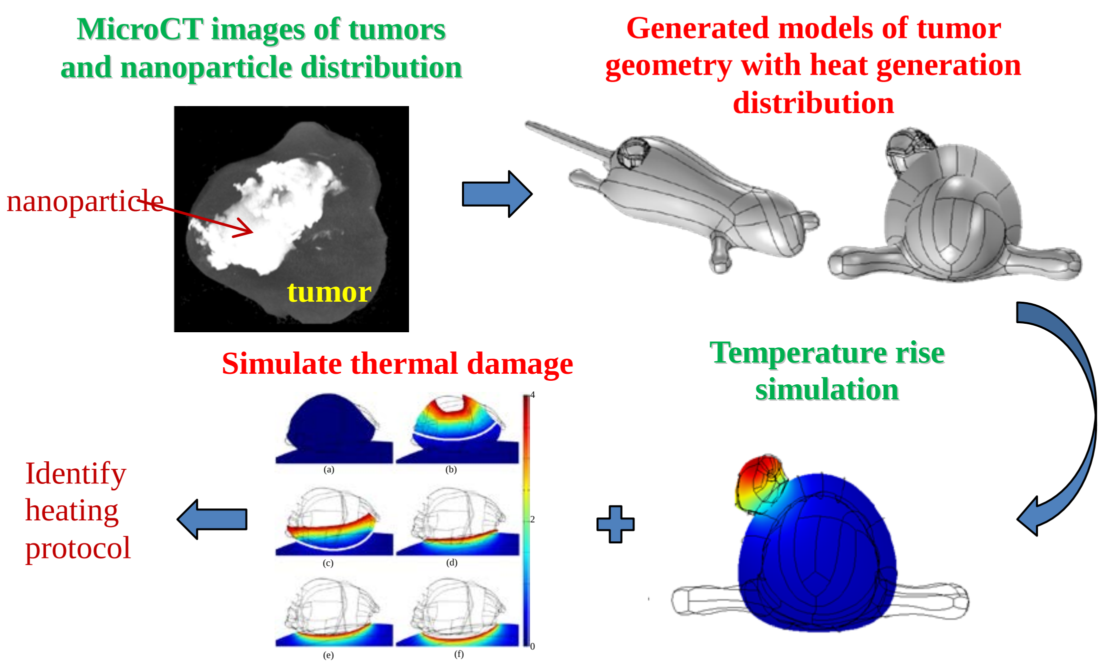
Magnetic nanoparticles subject to an alternating magnetic field can generate heat. It holds a high cell-killing potential in cancer treatment because it can deliver confined thermal energy to tumors. Unfortunately, particle spreading in tumors is difficult to model due to tumor heterogeneous structures and complex processes such as particle deposition, agglomeration, and intake. In this project, we have utilized a microCT system to obtain tumor geometry and nanoparticle distribution in prostate tumors implanted in mice. Controllable nanoparticle deposition patterns unique to individual tumor groups are visualized and quantified. Individual tumor geometry and particle distribution obtained from the microCT scan are then generated and exported for heat transfer simulation. Thermal damage regions are simulated to determine optimal treatment protocols. Finally, the heating protocols are implemented into human prostatic tumors implanted in mice during *in vivo* magnetic nanoparticle hyperthermia. The success of the designed protocols are verified via measured tumor temperature elevations, histological analyses of thermal damage, and observed tumor shrinkage following the heating treatment. These results, obtained by testing the imaging based theoretical simulation in animal models, suggest new approaches for individualized heating treatment designs for cancer patients.




**References**
[1] For further information about this project link to **bioheat.umbc.edu** or email **zliang@umbc.edu**
[2] LeBrun, A., Joglekar, T., Bieberich, C., Ma, R. and Zhu, L.. *International J. Hyperthermia*, 32(2):132-143, 2016.
[3] LeBrun, A., Ma, R. and Zhu, L.. *Journal of Thermal Biology*, in press, eprinting, available online, July 2016.
[4] LeBrun, A., Joglekar, T., Bieberich, C., Ma, R. and Zhu, L.. ASME *Journal of Heat Transfer*, in press, 2016.