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Nanoparticle Interactions with Low-Frequency Electromagnetic Fields for Ablation Therapy SCOTT JENSEN, TIMOTHY DOYLE — The *in vivo* ablation of malignant tumors can be significantly enhanced with nanoparticles (NPs) that absorb energy from electromagnetic (EM) waves and subsequently heat targeted regions in the body. Low-frequency EM fields can penetrate much deeper than near-infrared and visible light. Ohmic heating has primarily been the sole mechanism considered for the coupling of the EM fields to the NPs, but few quantitative analyses have been published to predict NP heating rates. To address this issue, this study identified and modeled four excitation mechanisms for the remote heating of NPs by low-frequency EM waves. These mechanisms included (1) ohmic heating of conductive NPs, (2) translational vibrations of charged NPs, (3) rotational vibrations of piezoelectric NPs, and (4) acoustic wave generation by piezoelectric NPs. Preliminary results showed that for a constant NP volume, the heating rate is independent of NP size for ohmic heating. Additionally, ohmic heating produced the lowest heating rates of the four mechanisms. These results point to possible new NP technologies to optimize heating rates and tumor ablation in patients.

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