Nanotechnology and Precision Medicine: New Opportunities in Image-Guided Cancer Diagnostics and Surgery

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Abstract. Nanotechnology is an area of considerable current interest in biomedical engineering because of its broad applications in biomedical imaging, in-vitro diagnostics, and targeted therapy. The basic rationale is that nanometer-sized particles such as quantum dots, colloidal gold, and polymeric nanomicelles have functional and structural properties that are not available from either discrete molecules or bulk materials. When conjugated with targeting ligands such as monoclonal antibodies, peptides or small molecules, these nanoparticles can be used to target malignant tumor cells and the tumor microenvironment (such as tumor stroma and tumor vasculatures) with high specificity and affinity. In the "mesoscopic" size range of 10-100 nm, nanoparticles also have large surface areas for conjugating to multiple diagnostic and therapeutic agents, opening new possibilities in imaging, therapy, and surgery. At the present, however, there are several fundamental problems and technical barriers that must be understood and overcome. In this talk, I will discuss the major challenges and opportunities in the development of nanomedicine for intraoperative cancer detection, molecular diagnostics, and image-guided surgery. This work was supported by grants from the US National Institutes of Health (U54 CA119338, RC2 CA148265, and R01CA163256).

Biography: Dr. Nie is the Wallace H. Coulter Distinguished Chair Professor in Biomedical Engineering at Emory University and the Georgia Institute of Technology, Director of the Emory-Georgia Tech Cancer Nanotechnology Program, and Founding Dean of the College of Engineering and Applied Sciences of Nanjing University (China). His academic research is in the areas of molecular engineering and nanotechnology, with a focus on bioconjugated nanoparticles for cancer molecular imaging, molecular profiling, and targeted therapy. His major academic achievements include the discovery of colloidal metal nanoparticles that are able to amplify the efficiencies of surface-enhanced Raman scattering (SERS) by 14-15 orders of magnitude, his pioneering work on water-soluble semiconductor quantum dots for biomedical applications, and his breakthrough work in developing multifunctional smart nanoparticles for integrated biomedical imaging and therapy, including image-guided cancer surgery. Professor

Nie has published over 300 papers, patents, and book chapters, have delivered more than 400 invited lectures around the world, and have trained over 30 doctoral students and postdoctoral fellows who are now making an impact at top academic institutions and biotech companies. His scholarly work has been cited 48,000 times with an h-index of 79 (Google Scholar). Professor Nie received his BS degree from Nankai University (Tianjin, China) in 1983, earned his MS and PhD degrees from Northwestern University (Evanston, Illinois, 1984-1990), and did postdoctoral research at the Georgia Institute of Technology and Stanford University (1990-1994).