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Engineering Imaging Probes and Molecular Machines for Nanomedicine

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Abstract: The integration of biomolecular engineering, nanotechnology and biology is expected to produce major breakthroughs in medical diagnostics and therapeutics. Due to the size-compatibility of nano-scale structures with proteins and nucleic acids, the design, synthesis and application of nanoprobes, nanocarriers and nanomachines provide unprecedented opportunities for achieving a better control of biological processes, and drastic improvements in disease detection, therapy, and prevention. Recent advances include the development of functional nanoparticles, activitable molecular probes, nano-structured materials and devices, and engineered nanomachines for biological and biomedical applications.

In this talk I will present the development of molecular imaging probes and engineered nucleases in my lab, including molecular beacons and magnetic nanoparticle probes for molecular imaging and biomolecule detection, and the design and validation of Zinc Finger Nucleases (ZFNs), Tal Effector Nucleases (TALENs) and CRISPR/Cas9 systems for treating single-gene disorders. Examples will be given to illustrate the potential application of nanotechnology to disease studies, including cardiovascular disease and sickle cell disease.

Biography: Dr. Gang Bao is Robert A. Milton Chair of Biomedical Engineering and a College of Engineering Distinguished Professor in the Department of Biomedical Engineering, Georgia Institute of Technology and Emory University. He is Director of Center for Translational Cardiovascular Nanomedicine, a NIH/NHLBI Program of Excellence in Nanotechnology (PEN) at Georgia Tech and Emory University, Director of Nanomedicine Center for Nucleoprotein Machines, a NIH Nanomedicine Development Center (NDC) at Georgia Tech, and Director of the Center for Pediatric Nanomedicine at Children's Healthcare of Atlanta and Georgia Tech. Dr. Bao received his undergraduate and Master's degrees from Shandong University in China, and his PhD from Lehigh University in the US. Dr. Bao is a Fellow of the American Association of Advancement in Science (AAAS), a Fellow of the American Society of Mechanical Engineers (ASME), a Fellow of the American Physical Society (APS), and a Fellow of the American Institute for Medical and Biological Engineering (AIMBE).

Dr. Bao's current research is focused on the development of nanotechnology and biomolecular engineering tools for biological and disease studies, including molecular beacons, magnetic nanoparticle probes, quantum dot bioconjugates, protein tagging/targeting methods, and engineered nucleases. These approaches have been applied to the diagnosis and treatment of cardiovascular disease and cancer, and the development of gene correction approaches for treating single-gene disorders.