

Development of Nanomaterials for Imaging Guided Therapy of Cancer

Yongfeng Zhao

Department of Chemistry and Biochemistry, Jackson State University

Nanomaterials have been intensively studied for diagnosis and therapy of diseases. After forming a formula in nanoscale, the pharmacokinetics property of the drug will be significantly different. For example, nanomaterials usually show longer blood circulation due to evasion of renal clearance from blood system. Because of comparable small size with biomolecules (e.g. DNA, antibody), nanomaterials have chance to interact with biomolecules on the surface and/or inside of the cells. On the other side, the size of nanoparticles is bigger than that of small molecules, so nanoparticles can be integrated simultaneously with components such as imaging and therapeutics. Most interestingly, nanomaterials can be engineered to favor the targeted cells by attaching a homing group or changing shape and surface charges. As result, nanoparticles hold promises as platform for “magic bullet”, killing targeted cells and leaving other cells unaffected.

Yongfeng Zhao

Assistant Professor
Department of Chemistry and Biochemistry
Jackson State University
Jackson, MS 39217

Tel: 601-979-3490, E-mail: yongfeng.zhao@jsums.edu



EDUCATION

- Ph.D.** in Chemistry, Peking University, Beijing, China 2005
Advisor: Professor Qifeng Zhou
- B.S.** in Chemistry, Lanzhou University, Lanzhou, China 1999

RESEARCH EXPERIENCE

- *Assistant Professor, Department of Chemistry and Biochemistry, Jackson State University* 2015-present
- *Staff Scientist, School of Medicine, Washington University in St Louis,* 2012-2015
- *Postdoctoral Research Fellow, Department of Bioengineering, University of California, Riverside,* 2006-2011
- *Research Assistant, College of Chemistry and Molecular Engineering, Peking University,* 2000-2005

RESEARCH INTERESTS

- 1) Design, synthesis and characterization of multifunctional small molecules and polymers for surface functionalization.
- 2) Development of organic, inorganic and organic-inorganic hybrid nanomaterials with controlled sizes and functions by green chemistry.
- 3) Application of bioconjugation / nanomaterials as chemical tools for imaging, diagnostics and therapy of human diseases like cancer.

GRANT REVIEWER

Panelist, National Science Foundation (NSF) 2017, 2018, 2019

REPRESENTATIVE PUBLICATIONS

1. Heo, G.; **Zhao, Y.F.**; Sultan, D.; Zhang, X.; Detering, L.; Luehmann, H.; Zhang, X.; Li, R.; Choksi, A.; Sharp, S.; Levingston, S.; Reichert, D.; Sun, G.; Razani, B.; Li, S.; Weilbaecher, K.; Dehdashti, F.; Wooley, K.; Liu, Y. "Assessment of Copper Nanoclusters for Accurate In Vivo Tumor Imaging and Potential for Translation" *ACS Applied Materials & Interfaces*, **2019**, accepted (Co-first authors)
2. **Zhao, Y. F.**; Pang, B.; Detering, L.; Luehmann, H.; Yang, M.; Black, K.; Sultan, D.; Xia, Y.; Liu, Y.; "Melanocortin 1 receptor targeted imaging of melanoma with gold nanocages and positron emission tomography", *Molecular Imaging*, **2018**, in press
3. Liu, Y.; Gunsten, S.; Sultan, D.; Luehmann H.; **Zhao, Y. F.**; Blackwell, T.; Bollermann-Nowlis, Z.; Pan, J.-H.; Byers, D.; Atkinson, J.; Kreisel, D. Holtzman, M.; Gropler, R.; et al. "PET-based Imaging of Chemokine Receptor 2 in Experimental and Disease-related Lung Inflammation", *Radiology*, **2017**, 283, P. 162409
4. Liu, Y.; Li, W.; Luehmann H.; **Zhao, Y. F.**; Detering, L.; Sultan, D. E.; Hsiao, H. M.; Krupnick, A. S.; Gelman, A. E.; Combadiere, C.; Gropler, R. J.; Brody, S. L.; Kreisel, D. "Noninvasive Imaging of CCR2⁺ Cells in Ischemia Reperfusion Injury after Lung Transplantation" *American Journal of Transplantation*, **2016**, 16, 3016-3023
5. **Zhao, Y. F.**; Detering, L.; Sultan, D.; Cooper M. L.; You, M.; Cho, S.; Meier, S. L.; Luehmann, H.; Sun, G.; Rettig, M.; Dehdashti, F.; Wooley, K. L.; Dipersio, J. F.; Liu, Y. "Gold Nanoclusters Doped with ⁶⁴Cu for CXCR4 Positron Emission Tomography Imaging of Breast Cancer and Metastasis", *ACS Nano*, **2016**, 10, 5959–5970
6. Pang, B[§]; **Zhao, Y. F.**[§]; Luehmann, H.; Yang, X.; Detering, L.; You, M.; Zhang, C.; Zhang, L.; Li, Z.; Ren Q.; Liu, Y.; Xia, Y. "⁶⁴Cu-Doped PdCu@Au Tripods: A Multifunctional Nanomaterial for Positron Emission Tomography and Image-Guided Photothermal Cancer Treatment", *ACS Nano*, **2016**, 10, 3121-3131 ([§] Co-first authors)
7. **Zhao, Y. F.**; Pang, B.; Luehmann, H.; Detering, L.; Yang, X.; Sultan, D.; Harpstrite, S.; Sharma, V.; Cullter, C.; Xia, Y.; Liu, Y. "Gold Nanoparticles Doped with ¹⁹⁹Au Atoms and Their Use for Targeted Cancer Imaging by SPECT", *Advanced Health Materials*, **2016**, 5, 928-935
8. Black, K.; Wang, Y.; Luehmann, H.; Cai, X.; Xing, W.; Pang, B.; **Zhao, Y. F.**; Cutler, C.; Wang, L.; Liu, Y.; Xia, Y. "Radioactive ¹⁹⁸Au-Doped Nanostructures with Different Shapes for in vivo Analyses of Their Biodistribution, Tumor Uptake, and Intratumoral Distribution", *ACS Nano*, **2014**, 8, 4385-4394
9. **Zhao, Y. F.**; Sultan, D.; Detering, L.; Cho, S.; Sun, G.; Pierce, R.; Wooley, K.; Liu, Y. "Copper-64-alloyed gold nanoparticles for cancer imaging: improved radiolabel stability and diagnostic accuracy", *Angewandte Chemie International Edition*, **2014**, 53, 156-159.