

Nanoplatfoms for Imaging, Targeting, and Image-Guided Drug Delivery



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The Molecular Imaging and Nanotechnology Laboratory at the University of Wisconsin - Madison (<http://mi.wisc.edu/>) is mainly focused on three areas: 1) development of multimodality molecular imaging agents; 2) nanotechnology and its biomedical applications; and 3) molecular therapy of cancer.

In this talk, I will present our recent work on molecular imaging and image-guided drug delivery of cancer and some cardiovascular diseases with peptides, proteins, and a variety of nanomaterials. The primary imaging techniques used in these studies are positron emission tomography (PET), photoacoustic tomography (PAT), optical imaging, and magnetic resonance imaging (MRI). Three of the major molecular targets that we are investigating are CD105 (i.e. endoglin), VEGFR, and integrin $\alpha_v\beta_3$. The nanomaterials that will be discussed in this presentation include nano-graphene oxide, zinc oxide nanomaterials, micelles, silica-based nanoparticles, magnetic nanoparticles, among many others. A few representative side projects will also be presented, such as the facile synthesis of PET/MRI and PET/PAT dual-modality agents.

CURRICULUM VITAE

Dr. Weibo Cai is an Associate Professor of Radiology and Medical Physics (with Tenure) at the University of Wisconsin - Madison. He received his Ph.D. degree in Chemistry from the University of California, San Diego in 2004, and did his postdoctoral research at the Molecular Imaging Program at Stanford University. In February 2008, Dr. Cai joined the University of Wisconsin - Madison as a Biomedical Engineering Cluster Hire, and his research there has focused on molecular imaging and nanotechnology (<http://mi.wisc.edu/>).

Dr. Cai has authored > 160 peer-reviewed articles, > 20 book chapters, and > 180 conference abstracts. In addition, he has edited 2 books (1 more in the process) and given >120 talks. Dr. Cai has received many prestigious awards, including the Society of Nuclear Medicine Young Professionals Committee Best Basic Science Award (2007), the European Association of Nuclear Medicine Springer Prize (2011 & 2013), European Association of Nuclear Medicine Eckert & Ziegler Abstract Award (2012), American Cancer Society Research Scholar (2013-2017), NIH R01, among many others. But what he is most proud of is that his trainees at UW-Madison have received >30 awards (e.g. 2012 Berson-Yalow Award from the Society of Nuclear Medicine and Molecular Imaging).

Dr. Cai has served on the editorial boards of many scientific journals, performed peer review for >120 journals, participated in many grant review panels, served on various committees of scientific societies (e.g. SNMMI), and chaired sessions at multiple international conferences. Prof. Cai is currently the Editor-in-Chief of the American Journal of Nuclear Medicine and Molecular Imaging (<http://www.ajnmml.us>), which was launched in 2011 and is currently fully indexed in PubMed

EDUCATION:

Universities Attended:

Nanjing University, P.R. China B.S. Chemistry 1995

University of California - San Diego M.S. Chemistry 2000

University of California - San Diego Ph.D. Chemistry 2004

Mentor: **Professor Murray Goodman**

Scholarships:

Teaching Assistant 1998-1999

Research Assistant 1999-2004

Post-Doctoral Training:

Molecular Imaging Program at Stanford (MIPS), Stanford University 2005-2008

Mentor: **Professor Xiaoyuan (Shawn) Chen**

EMPLOYMENT HISTORY:

University of Wisconsin - Madison

Associate Professor of Radiology (80%) and Medical Physics (20%) 07/2014-

Associate Professor of Biomedical Engineering (0%) 07/2014-

Assistant Professor of Radiology (80%) and Medical Physics (20%) 02/2008-06/2014

Assistant Professor of Biomedical Engineering (0%) 02/2008-06/2014

Most relevant publications:

1: Liu T, Shi S, Liang C, Shen S, Cheng L, Wang C, Song X, Goel S, Barnhart TE, Cai W, Liu Z. Iron Oxide Decorated MoS₂ Nanosheets with Double PEGylation for Chelator-Free Radiolabeling and Multimodal Imaging Guided Photothermal Therapy. *ACS Nano*. 2015 Jan 6. [Epub ahead of print] PubMed PMID: 25562533.

2: Goel S, Chen F, Ehlerding EB, Cai W. Intrinsically radiolabeled nanoparticles: an emerging paradigm. *Small*. 2014 Oct 15;10(19):3825-30. doi: 10.1002/sml.201401048. Epub 2014 Jun 30. PubMed PMID: 24978934; PubMed Central PMCID: PMC4191998.

3: Hong H, Chen F, Zhang Y, Cai W. New radiotracers for imaging of vascular targets in angiogenesis-related diseases. *Adv Drug Deliv Rev*. 2014 Sep 30;76:2-20. doi: 10.1016/j.addr.2014.07.011. Epub 2014 Jul 30. PubMed PMID: 25086372; PubMed Central PMCID: PMC4169744.

4: Chakravarty R, Valdovinos HF, Chen F, Lewis CM, Ellison PA, Luo H, Meyerand ME, Nickles RJ, Cai W. Intrinsically germanium-69-labeled iron oxide nanoparticles: synthesis and in-vivo dual-modality PET/MR imaging. *Adv Mater*. 2014 Aug 13;26(30):5119-23. doi: 10.1002/adma.201401372. Epub 2014 Jun 18. PubMed PMID: 24944166; PubMed Central PMCID: PMC4127144.

5: Zhang Y, Jeon M, Rich LJ, Hong H, Geng J, Zhang Y, Shi S, Barnhart TE, Alexandridis P, Huizinga JD, Seshadri M, Cai W, Kim C, Lovell JF. Non-invasive multimodal functional imaging of the intestine with frozen micellar naphthalocyanines. *Nat Nanotechnol*. 2014 Aug;9(8):631-8. doi: 10.1038/nnano.2014.130. Epub 2014 Jul 6. PubMed PMID: 24997526; PubMed Central PMCID: PMC4130353.

6: Chen F, Hong H, Shi S, Goel S, Valdovinos HF, Hernandez R, Theuer CP, Barnhart TE, Cai W. Engineering of hollow mesoporous silica nanoparticles for remarkably enhanced tumor active targeting efficacy. *Sci Rep*. 2014 May 30;4:5080. doi: 10.1038/srep05080. PubMed PMID: 24875656; PubMed Central PMCID: PMC4038837.

7: Chen F, Cai W. Tumor vasculature targeting: a generally applicable approach for functionalized nanomaterials. *Small*. 2014 May 28;10(10):1887-93. doi: 10.1002/sml.201303627. Epub 2014 Mar 3. PubMed PMID: 24591109; PubMed Central PMCID: PMC4126500.

8: Chen F, Ellison PA, Lewis CM, Hong H, Zhang Y, Shi S, Hernandez R, Meyerand ME, Barnhart TE, Cai W. Chelator-free synthesis of a dual-modality PET/MRI agent. *Angew Chem Int Ed Engl*. 2013 Dec 9;52(50):13319-23. doi: 10.1002/anie.201306306. Epub 2013 Oct 24. PubMed PMID: 24166933; PubMed Central PMCID: PMC3855680.

9: Chen F, Hong H, Zhang Y, Valdovinos HF, Shi S, Kwon GS, Theuer CP, Barnhart TE, Cai W. In vivo tumor targeting and image-guided drug delivery with antibody-conjugated, radiolabeled mesoporous silica nanoparticles. *ACS Nano*. 2013 Oct 22;7(10):9027-39. doi: 10.1021/nn403617j. Epub 2013 Oct 1. PubMed PMID: 24083623; PubMed Central PMCID: PMC3834886.
<https://mail.google.com/mail/u/0/?ui=2&ik=564e3f1f2f&view=pt&search=inbox&msg=14b27c84df05d834&siml=14b27c84df05d8342015-01-27 09:23>

10: Hong H, Yang K, Zhang Y, Engle JW, Feng L, Yang Y, Nayak TR, Goel S, Bean J, Theuer CP, Barnhart TE, Liu Z, Cai W. In vivo targeting and imaging of tumor vasculature with radiolabeled, antibody-conjugated nanographene. *ACS Nano*. 2012 Mar 27;6(3):2361-70. doi: 10.1021/nn204625e. Epub 2012 Feb 16. PubMed PMID: 22339280; PubMed Central PMCID: PMC3314116.