BIOGRAPHICAL SKETCH

Provide the following information for the key personnel and other significant contributors in the order listed on Form Page 2. Follow this format for each person. **DO NOT EXCEED FOUR PAGES.**

NAME	
RAO, JIANGHONG	
eRA COMMONS USER NAME	POSITION TITLE
	Assistant Professor

EDUCATION/TRAINING (Begin with baccalaureate or other initial professional education, such as nursing, and include postdoctoral training.)

INSTITUTION AND LOCATION	DEGREE (if applicable)	YEAR(s)	FIELD OF STUDY
Peking University, China	B.S.	1991	Chemistry
Rutgers, the State University of New Jerseys	M.S.	1994	Chemistry
Harvard University	Ph.D.	1999	Organic Chemistry
University of California, San Diego	Postdoc	2001	Chemical Biology

A. Positions and Honors.

Positions and Employment

- 2002-2003 Assistant Professor, Department of Molecular and Medical Pharmacology, University of California, Los Angeles
- 2004- Assistant Professor, Department of Radiology, Biophysics, Bio-X, Cancer Biology, and Molecular Imaging Programs, Stanford University School of Medicine
- 2009- Assistant Professor, Department of Chemistry (by courtesy), Stanford University

Other Experience and Professional Memberships

- 2006-2009 Editorial Board, Experimental Biology and Medicine
- 2006 Co-founder and technical advisory board, Zymera Inc.

Awards and Honors

- 1996-1997 Eli Lilly Predoctoral Fellowship
- 1997-1998 Roche Fellowship in Organic Chemistry
- 1998-1999 Glaxo Fellowship in Organic Chemistry
- 1999-2001 Damon Runyon Cancer Research Fund, Merck Fellow
- 2002-2003 UCLA Frontiers of Sciences Faculty Development Award
- 2002-2007 Burroughs Wellcome Career Award at the Scientific Interfaces
- 2007-2010 Human Frontier Science Program Young Investigator Award

B. Selected peer-reviewed publications (in chronological order).

- Rao J, Colton IJ, Whitesides GM. Using capillary electrophoresis to study the electrostatic interactions involved in the association of D-Ala-D-Ala with vancomycin. *Journal of American Chemical Society* 1997; 119:9336-9340.
- 2. **Rao J**, Whitesides GM. Tight binding of a dimeric derivative of vancomycin with dimeric L-Lys-D-Ala-D-Ala. *Journal of American Chemical Society* 1997; 119:10286-10290.
- 3. Colton IJ, Carbeck JD, **Rao J**, Whitesides, GM. Affinity capillary electrophoresis: a physical-organic tool for studying interactions in biomolecular recognition. *Electrophoresis* 1998; 19:367-382.
- 4. **Rao J**, Lahiri J, Isaacs L, Weis RW, Whitesides GM. A trivalent system from vancomycin•D-Ala-D-Ala with higher affinity than biotin•avidin. *Science* 1998; 280:708-711.
- 5. **Rao J**, Yan L, Xu B, Whitesides GM. Using surface plasmon resonance to study the binding of vancomycin and its dimer to self-assembled monolayers presenting D-Ala-D-Ala. *Journal of American Chemical Society* 1999; 121:2629-2630.
- Rao J, Yan L, Lahiri J, Whitesides GM, Warren HS, Weis RM. Binding of a dimeric derivative of vancomycin with L-Lys-D-Ala-D-Lactate in solution and at a surface: insights into its enhanced activity against vancomycin-resistant bacteria. *Chemistry & Biology* 1999; 6:353-359.

- 7. **Rao J**, Lahiri J, Weis RW, Whitesides GM. Design, syntheses, and characterization of a high-affinity trivalent system derived from vancomycin and L-Lys-D-Ala-D-Ala. *Journal of American Chemical Society* 2000; 122:2698-2710.
- 8. Gao W, Xing B, Tsien RY, **Rao J**. Novel fluorogenic substrates for imaging ß-lactamase expression. *Journal of American Chemical Society* 2003; 125:11146-11147.
- 9. Hasegawa S, Jackson WC, Tsien RY, **Rao J**. Imaging Tetrahymena ribozyme splicing activity in single live mammalian cells. *Proceedings of National Academy of Science USA* 2003; 100:14892-14896.
- 10. Hasegawa S, Choi JW, **Rao J**. Single-cell detection of trans-splicing ribozyme in vivo activity. *Journal of American Chemical Society* 2004; 126:7158-7159.
- 11. Xing B, Khanamiryan A, **Rao J**. Cell-permeable near-infrared fluorogenic substrates for imaging ßlactamase activity. *Journal of American Chemical Society* 2005; 127:4158-4159.
- 12. Hasegawa S, **Rao J**. Modulating the splicing activity of Tetrahymena ribozyme via RNA self-assembly. *FEBS Letters* 2006; 580:1592-1596.
- 13. So M-K, Xu C, Loening AM, Gambhir SS, **Rao J.** Self-illuminating quantum dot conjugates for in vivo imaging. *Nature Biotechnology* 2006; 24:339-343.
- 14. Xu Č, Xing B, **Rao J**. A self-assembled quantum dot probe for detecting ß-lactamase activity. *Biochemical & Biophysical Research Communications* 2006; 344:931-935.
- 15. Hasegawa S, Gowrishankar G, **Rao J**. Detection of mRNA in mammalian cells with a split ribozyme reporter. *ChemBioChem* 2006; 7:925-928. (Cover picture)
- Zhang Y, So M-K, Loening AM, Yao H, Gambhir SS, Rao J. HaloTag protein-mediated site-specific conjugation of bioluminescent proteins to quantum dots. *Angewandte Chemie International Edition* 2006; 45:4936-4940.
- 17. So M-K, Loening AM, Gambhir SS, **Rao, J**. Creating self-illuminating quantum dot conjugates. *Nature Protocols* 2006; 1:1160-1164 (Invited).
- 18. Zhang Y, So M-K, **Rao J.** Protease-modulated cellular uptake of quantum dots. *Nano Letters* 2006; 6: 1988-1992.
- 19. Cai W, **Rao J**, Gambhir SS, Chen X. Molecular imaging of tumor angiogenesis in drug development. *Molecular Cancer Therapeutics* 2006; 5:2624-2633 (Invited).
- 20. Gowrishankar G, Rao J. Visualizing RNA splicing in vivo. Molecular Biosystems 2007; 3:301-307 (Invited).
- 21. **Rao J**, Dragulescu-Andrasi A, Yao H. Fluorescence imaging *in vivo*: recent advances. *Current Opinion in Biotechnology* 2007; 18:17-25 (Invited).
- 22. Yao H, Zhang Y, Xiao F, Xia Z, **Rao J**. QD-BRET based highly sensitive detection of proteases. Angewandte Chemie International Edition 2007; 46:4346-4349 (selected as "hot paper").
- 23. Dragulescu-Andrasi A, **Rao J**. Chemical labeling of proteins in living cells. *ChemBioChem* 2007; 8:1099-1101 (Invited).
- 24. Schipper ML, Cheng Z, Lee S-W, Keren S, Bentolila LA, Sundaresan G, Iyer G, Gheysens O, Ebenstein Y, Li J, **Rao J**, Chen X, Wu AM, Weiss SS, Gambhir SS. MicroPET-based biodistribution of quantum dots in living mice. *Journal of Nuclear Medicine* 2007; 48:1511-1518.
- 25. Yao H, So M-K, **Rao J**. A bioluminogenic substrate for *in vivo* imaging of ß-lactamase activity. *Angewandte Chemie International Edition* 2007; 46:7031-7034.
- 26. Lin S, Xie X, Yang Y, Li Z, Cao F, Patel MR, Gheysens O, Zhang Y, Gambhir SS, **Rao J**, Wu J. Quantum dots imaging for embryonic stem cells. *BMC Biotechnology* 2007; 7:67.
- 27. Xing B, **Rao J**., Liu R. Novel beta-lactam antibiotic derivatives: their new applications as gene reporters, antitumor prodrugs, and enzyme inhibitors. *Mini-Reviews in Medicinal Chemistry* 2008; 8:455-471.
- 28. Xing Y, So M-K, Koh AL, Sinclair R, **Rao J**. Improved QD-BRET conjugates for detection and imaging. *Biochemical & Biophysical Research Communications* 2008; 372:388-394.
- 29. Xing Y, **Rao J**. Quantum dot bioconjugates for *in vitro* diagnostics and *in vivo* imaging. *Cancer Biomarkers* 2008; 4:307-319 (Invited).
- 30. So M-K, Gowrishankar G, Hasegawa S, Chung J-K, **Rao J**. Imaging target mRNA and siRNA-mediated gene silencing *in vivo* with ribozyme-based reporters. *ChemBioChem* 2008; 9:2682-2691.
- 31. So M-K, Yao H, **Rao J**. HaloTag protein-mediated specific labeling of living cells with quantum dots. *Biochemical & Biophysical Research Communications* 2008; 374:419-423.
- 32. Xia Z, Xing Y, So M-K, Koh AL, Sinclair R, **Rao J**. Multiplex detection of protease activity with nanosensors prepared by intein-mediated specific bioconjugation. *Analytical Chemistry* 2008; 80:8649-8655.

- 33. Rao J. Shedding light on tumors using nanoparticles. ACS Nano 2008; 2:1984-1986 (Invited).
- 34. Jiang T, Xing B, Rao J. Recent developments of biological reporter technology for detecting gene expression. Biotechnology and Genetic Engineering Reviews 2008: 25:41-76 (Invited).
- 35. Schipper ML, Iver G, Koh AL, Cheng Z, Ebenstein Y, Aharoni A, Keren S, Bentolila LA, Li J, Rao J, Chen X, Banin U, Wu AM, Sinclair R, Weiss SS, Gambhir SS. Particle size, surface coating, and PEGylation influence the biodistribution of quantum dots in living mice. Small 2009; 5:126-134.
- 36. Thorne SH, Barak Y, Liang W, Bachman M, Rao J, Contag CH, Matin AC. CNOB/ChrR6, a new prodrug enzyme cancer chemotherapy. Molecular Cancer Therapeutics 2009; In press.
- 37. Xing Y, Xia Z, Rao J. Semiconductor quantum dots for biosensing and in vivo imaging. IEEE Transactions on NanoBioscience 2009; In press (Invited).
- 38. Xia Z, Rao J. Biosensing and imaging based on bioluminescence resonance energy transfer. Current Opinion in Biotechnology 2009; Accepted (Invited).

C. Research Support.

Ongoing Research Support 1R01CA 135294-01 Rao (PI)

NIH/NCI

QD-BRET nanosensors for protease detection and imaging

This grant focuses on the development of quantum dot based nanosensors to image matrix metalloproteinase activity in vivo and to probe their functional roles in the tumor growth and progression. Role: PI

1R01GM 086196-01 Moerner/Rao/Shapiro (PI) NIH/NIGMS

Actively controlled and targeted single-molecule probes for cellular imaging This project aims to develop novel high-resolution single-molecule probes that can be activated and targeted for live-cell imaging.

Role: one of the three PIs

RGY0073/2007-C Rao (PI) 08/01/2007 to 07/31/2010

09/15/2008 to 07/31/2013

09/30/2008 to 07/31/2012

Human Frontier Science Program

Combining chemical and imaging approaches to understand functional roles of mRNA in neuronal plasticity The objective of this project is to develop novel RNA imaging probes and apply them to understand RNA functions in the formation of neuronal plasticity. Role: PI

1003056.02 Rao (PI) 06/01/2004 to 5/31/2009 **Burroughs Wellcome Fund** Imaging protein phosphorylation in living organisms This study is to develop new imaging methods to protein kinase A function in living organisms. Role: PI

BC050909	Rao (PI)	03/01/2006 to 03/31/2009
Department of E	Defense Breast Cancer Res	earch Program
Ribozyme-medi	ated imaging of oncogene e	expression in breast tumor cells
The objective of	f this project is to develop a	a novel imaging strategy based on <i>Tetrahymena</i> ribozyme to detect
breast cancer of	ncogen	
e expression in	vivo.	
Role: PI		

BC085092 Rao (PI) 02/01/2009 to 02/29/2012 Department of Defense Breast Cancer Research Program Enzyme-triggered polymerization in tumor cells: a new template for breast cancer imaging The objective of this project is to develop a novel imaging strategy based on tumor-specific enzyme that triggers the polymerization of the probes to image breast cancer. Role: PI

1U54CA119367-01 Gambhir (PI) NIH/NCI Centers of Cancer Nanotechnology Excellence Development of nanoparticle-based imaging probes for in vivo tumor imaging. Role: Project Co-Investigator

RFP GH-TB-06 Cirillo (PI)

Bill & Melinda Gates Foundation

Real-time optical imaging solutions for tuberculosis infections The goal of this research is to develop optical imaging method to image tuberculosis infections. Role: Co-PI

1R01 CA125074-02 Matin (PI)

NIH/NCI Use of new bacterial enzymes to improve nitro-prodrug cancer therapy The goal of this project is to combine genetic engineering and imaging to improve nitro-prodrugs for effective cancer therapy.

Role: Co-investigator

Completed Research Support

BC052538 Rao (PI) 09/01/2006 to 03/01/2008

07/01/2004 to 06/30/2006

Department of Defense Breast Cancer Research Program

Development of bioluminescent nanosensors for multiplex imaging of MMPs

The objective of this project is to develop a novel multiplexed assay based on quantum dots to detect matrix metalloprotease activity.

Role: PI

P50 CA114747-01 Gambhir (PI) 09/01/2005 to 08/31/2007 NIH/NCI In Vivo Cellular and Molecular Imaging Center @ Stanford Engineering *Tetrahymena* ribozymes to target and image endogenous RNA molecules. Role: Project PI

1 R21 EB003803-01 Rao (PI) NIH/NIBIB

Burroughs Wellcome Fund

A unified reporter gene for multi-modality imaging

The objective of this project is to develop a reporter gene that can work in both single living cells and whole living animals.

Role: PI

1003056.01

Rao (PI) 01/01/2002 to 5/30/2004 Imaging gene expression in living organisms

This study is to develop a new imaging reporter to image gene expression in living organisms. Role: PI

05/01/2006 to 04/30/2011

01/01/2008 to 01/31/2010

01/07/2008 to 12/31/2010