

## Jianmin Gao

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### **Education**

Ph.D.	07/2004	Chemistry, Stanford University, Stanford, CA
B.S.	07/1999	Chemistry, University of Science and Technology of China Hefei, Anhui, P.R.China

### **Professional Experience**

07/2013-present	Associate Professor of Chemistry, with Tenure Boston College, Chestnut Hill, MA
07/2007-06/2013	Assistant Professor of Chemistry Boston College, Chestnut Hill, MA
08/2004-07/2007	Postdoctoral Researcher with Professor Jeffery W. Kelly The Scripps Research Institute, La Jolla, CA
09/1999-07/2004	Ph.D. Thesis with Professor Eric T. Kool Stanford University, Stanford, CA
01/1998-06/1999	Undergraduate Reseacher with Professor Qing-Xiang Guo University of Science and Technology of China, Hefei China

### **Honors**

- 2007, Smith Family Young Investigator  
Smith Family Foundation, the Medical Foundation, Boston, MA
- 2002-2004, Stanford graduate fellowship, General Wang Yaowu fellow  
Stanford University, Stanford, CA
- 1998, “Guo Mo-Ruo” scholarship-the best graduates of the year  
University of Science and Technology of China, Hefei, China
- 1997, Outstanding student award of first class  
University of Science and Technology of China, Hefei, China
- 1996, “Zhang Zhongzhi” scholarship-Award to outstanding chemistry majors  
University of Science and Technology of China, Hefei, China
- 1995, “GuoBao” scholarship-Outstanding freshman award  
University of Science and Technology of China, Hefei, China

**Teaching Activities**

- CHEM560, *Principles of Chemical Biology*, Fall 2007, 2008, 2009
- CHEM765, *Chemical Biology: Current Topics and Literature*, Fall 2009
- CHEM473, *Physical Chemistry for Biochemistry Majors*, Spring 2009, 2010, 2013
- CHEM582, *Advanced Topics in Biochemistry*, Fall 2010, 2012
- CHEM242, *Honors Organic Chemistry II*, Spring 2011

**Work in Progress** (undergrad coauthors underlined)

36. Hong Zheng, Fang Wang, Ryan Malonis, and **Jianmin Gao\***, “An Expanded Set of Fluorophores That Gain Selective Entry into Apoptotic Cells,” manuscript in preparation.
35. Christopher Pace and **Jianmin Gao\***, “Probing the Plasticity of the Protein Core Packing,” manuscript in preparation.

**Publications at Boston College** (undergrad coauthors underlined)

34. Fang Wang, Luoheng Qin, Patrick Wong and **Jianmin Gao\***, “Effects of Lysine Methylation on Gramicidin A Folding in Lipid Membranes,” *Biopolymers: Peptide Science* **2013**, in press.
33. Lauren K. Regula, Richard Harris, Fang Wang, Jayne F. Koellhoffer, Chelsea D. Higgins, Kartik Chandran, **Jianmin Gao**, Mark E. Girvin, and Jonathan R. Lai\*, “Conformation and Lipid-Binding Properties of Peptides Corresponding to the Ebolavirus GP2 Membrane-Proximal External Region,” *Biochemistry*, **2013**, in press.
32. **Jianmin Gao\*** and Hong Zheng, “Recent Developments of Peptide-Based Markers of Membrane Lipids,” *Future Med. Chem.* **2013**, *5*, 947-59.
31. Christopher Pace and **Jianmin Gao\***, “Exploring and Exploiting Polar- $\pi$  Interactions with Fluorinated Aromatic Amino Acids,” *Acc. Chem. Res.* **2013**, *46*, 907-15.
30. Christopher Pace, Diane Kim and **Jianmin Gao\***, “Experimental Evaluation of CH- $\pi$  Interactions in a Protein Core,” *Chem. Euro. J.* **2012**, *18*, 5832-6.
29. Yue Zhao and **Jianmin Gao\***, “Split Ligand for Lanthanide Binding: Facile Evaluation of Dimerizing Proteins,” *Chem. Comm.* **2012**, *48*, 2997-9.
28. Luoheng Qin, Christopher Sheridan and **Jianmin Gao\***, “Synthesis of Tetrafluorinated Aromatic Amino Acids with Distinct Signatures in  $^{19}\text{F}$ -NMR,” *Org. Lett.* **2012**, *14*, 528-31.
27. Fang Wang, Luoheng Qin, Christopher J. Pace, Patrick Wong, Ryan Malonis and **Jianmin Gao\***, “Solubilized Gramicidin A as Potential Systemic Antibiotics,” *ChemBioChem* **2012**, *13*, 51-5.
26. Christopher Pace, Hong Zheng, Ruben Mylvaganam, Diane Kim and **Jianmin Gao\***, “Stacked Fluoroaromatics as Supramolecular Synthons for Programming Protein Dimerization Specificity,” *Angew. Chem., Int. Ed.* **2012**, *51*, 103-7.

25. Hong Zheng, Fang Wang, Qin Wang and **Jianmin Gao\***, “Cofactor-Free Detection of Phosphatidylserine with Cyclic Peptides Mimicking Lactadherin,” *J. Am. Chem. Soc.* **2011**, *133*, 15280-3.
24. Christopher Pace, Qiongying Huang, Fang Wang, Kanwal S. Palla, Amelia A. Fuller and **Jianmin Gao\***, “A FLAsH-tetracysteine Assay for Quantifying the Association and Orientation of Transmembrane  $\alpha$ -Helices,” *ChemBioChem* **2011**, *12*, 1018-22.
23. Fang Wang, Luoheng Qin, Patrick Wong and **Jianmin Gao\***, “Facile Synthesis of Tetrafluorotyrosine and Its Application in pH Triggered Membrane Lysis,” *Org. Lett.* **2011**, *13*, 236-9. This paper is highlighted in the recent ACS virtual issue on Peptide Chemistry.
22. Hong Zheng and **Jianmin Gao\***, “Highly Specific Heterodimerization Mediated by Quadrupole Interactions,” *Angew. Chem., Int. Ed.* **2010**, *49*, 8635-9. This article was rated as a Very Important Paper. See highlight by Kros et al. “Introducing Quadrupole Interactions into the Peptide Design Toolkit,” *Angew. Chem., Int. Ed.* 2010, 49, 8570-2.
21. Luoheng Qin, Julian Vastl and **Jianmin Gao\***, “Highly Sensitive Amyloid Detection Enabled by Thioflavin T Dimers,” *Mol. Biosyst.* **2010**, *6*, 1791-5.
20. Hong Zheng, Kristofer Comeforo and **Jianmin Gao\***, “Expanding the Fluorous Arsenal: Tetrafluorinated Phenylalanines for Protein Design,” *J. Am. Chem. Soc.* **2009**, *131*, 18-9.

### **Publications from Scripps**

19. **Jianmin Gao**, Daryl A. Bosco, Evan T. Powers, and Jeffery W. Kelly\*, “Localized Thermodynamic Coupling between Hydrogen Bonding and Microenvironment Polarity Significantly Stabilizes Proteins,” *Nat. Struct. Mol. Biol.* **2009**, *16*, 684-90.
18. Michelle R. Bunagan, **Jianmin Gao**, Jeffery W. Kelly\*, and Feng Gai\* “Probing the Folding Transition State Structure of the Villin Headpiece Subdomain via Sidechain and Backbone Mutagenesis,” *J. Am. Chem. Soc.* **2009**, *131*, 7470-6.
17. Marcus Jager, Songpon Deechongkit, Edward K. Koepf, Houbi Nguyen, **Jianmin Gao**, Evan T. Powers, Martin Gruebele, and Jeffery W. Kelly\*, “Understanding the Mechanism of  $\beta$ -sheet Folding from a Chemical and Biological Perspective,” *Biopolymers* **2008**, *90*, 751-8.
16. **Jianmin Gao** and Jeffery W. Kelly\*, “Towards Quantification of Protein Backbone-Backbone Hydrogen Bonding Energies: An Energetic Analysis of an Amide-to-Ester Mutation in an  $\alpha$ -Helix within a Protein,” *Protein Sci.* **2008**, 1096-101.
15. Yanwen Fu, **Jianmin Gao**, Jan Bieschke, Maria, A. Dendle, and Jeffery W. Kelly\*, “Amide-to-*E*-Olefin versus Amide-to-Ester Backbone H-Bond Perturbations: Evaluating the Repulsive Lone Pair-Lone Pair interaction for Extracting H-Bond Energies,” *J. Am. Chem. Soc.* **2006**, *128*, 15948-9.
14. Yan Zhang, Youngjun Kim, Nicolas Genoud, **Jianmin Gao**, Jeffery W. Kelly, Samuel L. Pfaff, Gordon N. Gill, Jack E. Dixon, and Joseph P. Noel\* “Determinants for Dephosphorylation of the RNA Polymerase II C-terminal Domain by Scp1,” *Mol. Cell.* **2006**, *24*, 759-70.

### **Publications from Stanford**

13. Sarah K. Jarchow-Choy, Andrew T. Krueger, Haibo Liu, **Jianmin Gao** and Eric T. Kool\*, "Fluorescent xDNA Nucleotides as Efficient Substrates for a Template-independent Polymerase," *Nucleic Acids Res.* **2011**, *39*, 1586-94.
12. Haige Lu, Andrew T. Kruger, **Jianmin Gao**, Haibo Liu and Eric T. Kool\*, "Toward a Designed Genetic System with Biochemical Function: Polymerase Synthesis of Single and Multiple Size-Expanded DNA Base Pairs," *Org. Biomol. Chem.* **2010**, *8*, 2704-10.
11. James C. Delaney, **Jianmin Gao**, Haibo Liu, Nidhi Shrivastav, John M. Essigmann\* and Eric T. Kool\*, "Efficient Replication Bypass of Size-expanded DNA Base Pairs in Bacterial Cells," *Angew. Chem., Int. Ed.* **2009**, *48*, 4254-7.
10. James N. Wilson, **Jianmin Gao**, and Eric T. Kool\*, "Oligodeoxyfluorosides: Strong Sequence Dependence of Fluorescence Emission," *Tetrahedron* **2007**, *63*, 3427-33.
9. Stephen R. Lynch, Haibo Liu, **Jianmin Gao**, and Eric T. Kool\*, "Toward a Designed, Functioning Genetic System With Expanded-size Base Pairs: Solution Structure of the 8-Base xDNA Double Helix," *J. Am. Chem. Soc.* **2006**, *128*, 14704-11 (This work is featured in a Research Highlight in *Nature*, **2006**, *444*, 5 and highlighted in the News and Views in *Nature*, **2006**, *444*, 554-5).
8. **Jianmin Gao**<sup>†</sup>, Haibo Liu<sup>†</sup>, and Eric T. Kool\*, "Assembly of the Complete Eight-Base Artificial Genetic Helix, xDNA, and Its Interaction with the Natural Genetic System," *Angew. Chem., Int. Ed.* **2005**, *44*, 3118-22. (†co first author. This paper is featured in *Chemical and Engineering News*, **2005**, *83*, 23.)
7. Haibo Liu, **Jianmin Gao**, and Eric T. Kool\*, "Helix-forming Properties of Size-expanded DNA (xDNA), an Alternative Four-base Genetic Form," *J. Am. Chem. Soc.* **2005**, *127*, 1396-402.
6. Haibo Liu, **Jianmin Gao**, and Eric T. Kool\*, "Size-expanded Analogues of dG and dC. Synthesis and Pairing Properties in DNA," *J. Org. Chem.* **2005**, *70*, 639-47.
5. **Jianmin Gao**, Soichiro Watanabe, and Eric T. Kool\*, "Modified DNA Analogues That Sense Light Exposure with Color Changes," *J. Am. Chem. Soc.* **2004**, *126*, 12748-9. (This work is featured in a Research Highlight in *Nature Methods* **2004**, *1*, 100-1.)
4. **Jianmin Gao**, Haibo Liu, and Eric T. Kool\*, "Expanded-Size Bases in Naturally Sized DNA: Evaluation of Steric Effects in Watson-Crick Pairing," *J. Am. Chem. Soc.* **2004**, *126*, 12748-9.
3. Haibo Liu, **Jianmin Gao**, Y.David Saito, Lystranne Maynard, Eric T. Kool\*, "Toward a New Genetic System with Expanded Dimensions: Size-expanded Analogues of Deoxyadenosine and Thymidine," *J. Am. Chem. Soc.* **2004**, *126*, 1102-9.
2. Haibo Liu, **Jianmin Gao**, Stephen Lynch, Y.David Saito, Lystranne Maynard, Eric T. Kool\*, "A Four-base-pair Genetic Helix with Expanded Size," *Science* **2003**, *302*, 868-71. (This paper is reported in *Chemical and Engineering News* **2003**, *81*, 3, highlighted in *Angew. Chem., Int. Ed.* **2004**, *43*, 1625-6, and featured in *ChemBioChem* **2004**, *5*, 765-7.)
1. **Jianmin Gao**, Christoph Strassler, Deborah Tahmassebi, and Eric T. Kool\*, "Libraries of Composite Polyfluors Built from Fluorescent Deoxyribosides," *J. Am. Chem. Soc.*, **2002**, *124*, 11590-1.

## Presentations

- Invited speaker, the 23rd American Peptide Symposium, June 2013
- Department of Chemistry, University of Rhode Island, Mar. 2013
- Department of Biochemistry, Albert Einstein College of Medicine, Jan. 2013
- Special Chemistry Seminar, Department of Chemistry, Boston College, Oct. 2012
- Chemistry Seminar Series, University of Colorado, Boulder, Oct. 2012
- The Six International Peptide Engineering Meeting (PEM6), Emory University, Oct. 2012
- Chemistry Seminar Series, Colorado State University, Oct. 2012
- Chemistry Seminar Series, The Scripps Research Institute, Sept. 2012
- Biology Seminar Series, Department of Biology, Boston College, Sept. 2012
- American Chemical Society National Meeting, *Breakthroughs in Biological Chemistry*, Aug. 2012, Philadelphia, PA
- Bioorganic Chemistry Gordon Conference, Jun. 2012, Proctor Academy, NH
- Chemistry Seminar Series, Stanford University, May 2012
- Chemistry Seminar Series, University of California - Davis, May 2012
- Chemistry Seminar Series, Santa Clara University, May 2012
- Chemistry Seminar Series, University of Rochester, May 2012
- Chemistry Seminar Series, New York University, May 2012
- Chemistry Seminar Series, Florida State University, Apr. 2012
- Chemistry Seminar Series, University of Florida, Apr. 2012
- Chemistry Seminar Series, Tufts University, Apr. 2012
- Chemistry Seminar Series, Texas A&M University, Mar. 2012
- Mesilla Chemistry Workshop organized by Ken Houk, Marcey Waters and Bill Hase, Mar. 2011.
- ACS Fall National Meeting, Boston, Aug. 2010

## Patents

- **Jianmin Gao** and Hong Zheng, “*Cyclic lactadherin peptide mimetics and their uses*” International Application No. PCT/US12/39255, Filed on May 24, 2012
- **Jianmin Gao** and Hong Zheng, “*Novel cell-penetrating markers of apoptosis*” Provisional Patent Application U.S. Serial No. 61/642,678, filed on May 4, 2012
- **Jianmin Gao** and Fang Wang, “*Gramicidin A mutants that function as antibiotics with improved solubility and reduced toxicity*”, Provisional Patent Application, U.S. Serial No. 61/557,990, filed on Nov. 10, 2011
- Eric T. Kool and **Jianmin Gao**, “*Fluorescent glycosides and methods for their use*”, PCT Int. Appl. (2004), WO2004019002, 2004.

**Affiliations**

- American Chemical Society
- American Peptide Society
- Chinese-American Chemistry & Chemical Biology Professors Association (CAPA)

**Collaborators**

- Prof. Mary Roberts, Boston College, Chemistry
- Prof. Eranthie Weerapana, Boston College, Chemistry
- Prof. Dan Kirschner, Boston College, Biology
- Prof. Gary Gilbert, Boston VA hospital and Harvard Medical School
- Prof. Wenshe Liu, Texas A&M University
- Prof. Jiangyun Wang, Institute of Biophysics, Beijing China
- Prof. Jonathan Lai, Albert Einstein College of Medicine

**Current Group Members**

- |                      |                  |                        |
|----------------------|------------------|------------------------|
| • Dr. Bandyopadhyay  | post-doc         | IISER-Pune             |
| • Dr. Xiuling Chi    | post-doc         | University of Kentucky |
| • Yue Zhao           | graduate student | Peking University      |
| • Azade Hosseini     | graduate student | University of Buffalo  |
| • Breanna Zerfas     | graduate student | UMass Amherst          |
| • Lauren Blair       | graduate student | Emmanuel College       |
| • Adam Esposito      | Undergraduate    | Boston College         |
| • Yechaan (Eric) Joo | Undergraduate    | Boston College         |
| • Hak Kim            | Undergraduate    | Boston College         |

**Former Group Members and Current Positions**

- |                      |             |   |
|----------------------|-------------|---|
| • Dr. Tao Ye         | Post-doc    | Massachusetts College of Pharmacy and Health Science              |
| *****                |             |   |
| • Dr. Hong Zheng     | Ph.D., 2012 | Ra Pharmaceuticals, Cambridge, MA                                 |
| • Dr. Luoheng Qin    | Ph.D., 2012 | Eli Lilly R&D, Shanghai, China                                    |
| • Dr. Fang Wang      | Ph.D., 2012 | Amgen   |
| • Dr. Chris Pace     | Ph.D., 2013 | Globaldata  |
| • Kristen Demick     | M.S., 2009  | High School Teacher, Melrose, MA                                  |
| • Nanjiu Liu         | M.S., 2011  | Nextcea, Inc.   |
| *****                |             |   |
| • Kevin Lebo         | B.S., 2008  | John Hopkins, Biophysics Ph.D. Program                            |
| • Cassandra Abel     | B.S., 2008  | Pharmaceutical industry   |
| • Kristofer Comeforo | B.S., 2009  | Teach for America   |
| • Julian Vastl       | B.S., 2010  | Yale, Chemistry Ph.D. Program,<br><i>Beckman Scholar</i>          |
| • Nicole Ciccolo     | B.S., 2010  | Clinical Research Assistant at MGH<br><i>BC Sophomore Scholar</i> |
| • Ruben Mylvaganam   | B.S., 2011  | Medical School, NYU   |

- Adrian Ong                    B.S., 2011                    Medical School, SUNY Buffalo
- Christopher Sheridan B.S., 2012                    Boston College  
*Presidential Scholar*  
*Goldwater Fellowship*
- Patrick Wong                    B.S., 2012                    Post-Bac program in NIH  
*Kozarich Fellowship*  
*Scholar of College*  
*McCarthy Prize in Natural Sciences*
- Diane Kim                    B.S., 2012                    Masters in Medical Sciences, BU
- Ryan Malonis                    B.S., 2013                    Research Assistant, NYU Medical School
- Chris Vaudo                    Undergraduate                    Boston College
- Jeremy Kaswer                    Undergraduate                    Boston College

### **Departmental Services**

- Organizer, Chemical Biology seminar program 2007-
- Organizer, Novartis Symposium in Chemical Biology, Boston College, 2011-
- Organizer, The University Lecture Series by Prof. Dennis Dougherty, 2013
- Organizer, The University Lecture Series by Prof. Jay Keasling, 2009
- Faculty Organizer, Graduate Student Symposium 2010
- Co-chair of the Faculty Search Committee, 2009-10
- Member, Graduate Admissions Committee, 2007-2010
- Member, Ph.D. thesis defense committee of 20 students: Dr. Allen Horhota, Dr. Yanling Wang, Dr. Carl Christianson, Dr. Wei Chen, Dr. Paul Widboom, Dr. Jay West, Dr. Heather Cooke, Dr. Elisa Shielding, Dr. Tim Montavon, Dr. Ye Liu, Dr. Joe Arico, Dr. Mingming Pu, Dr. Xiaomeng Shi, Dr. Kerry Salandria, Dr. Su Guo, Dr. Qin Wang, Dr. Wenyue Guo, Dr. Ayan Pal, Dr. Chris Thiele, Dr. Becca Goldstein, Dr. Jingfei Cai, Dr. Yang Wei
- Member, M.S. thesis defense committee of 4 students: Ms. Jessica Chow, Ms. Ming Chan, Ms. Jessica Martinez, Ms. Alena Carlson

### **External Services**

- **Member**, Scientific Committee of the 23<sup>rd</sup> American Peptide Society Meeting
- **Manuscript Reviewer**  
*Proceedings of National Academy of Sciences, Journal of the American Chemical Society, Organic Letters, Biochemistry, ACS Chemical Biology, ACS Neuroscience, Biomacromolecules, Journal of Physical Chemistry, ChemBioChem, Molecular Biosystems, Protein Sciences, Bioorganic and Medical Chemistry Letters, Journal of Immunological Methods, Assays and Drug Development Technologies, Amino Acids, Science China*
- **Grant Reviewer**  
*National Science Foundation, Divisions of Chemistry (CHE)*  
*National Science Foundation, Divisions of Molecular Cell Biology (MCB)*  
*ACS Petroleum Research Fund*  
*Research Corporation, Cottrell College Science Award*

**Active Research Funding**

- 09/2012-08/2017 National Institute of Health, RO1 GM102735, Role: PI  
Approved for funding for five years, approved amount: \$1,283,300

***Title: "Small Molecule Receptors for Membrane Lipids"***

This project seeks to develop small cyclic peptides that functionally mimic natural lipid binding proteins. The research will uncover the physiochemical principles for specific lipid recognition. We will initially focus on phosphatidylserine (PS) and phosphatidylglycerol (PG) due to their significance in cancer imaging and antibiotics development.

- 09/2011-08/2014 National Science Foundation CHE-1112188, Role: PI  
\$330,000

***Title: "Develop Conditionally Charged Residues for the Design of Peptide Channels"***

This project focuses on the synthesis of unnatural amino acids and their application to probe the channel formation of gramicidin A (gA). The goal is to make gA to acquire bacterium selectivity so that it could ultimately function as a systemic antibiotic.

- 07/2011-06/2014 Aging Research Incentive Award, Role: co-PI  
University Institute of Aging, Boston College  
\$70,000, PI: Prof. Dan Kirschner (BC Biology)

***Title: "Advancing Therapeutics for Alzheimer Disease"***

This collaborative project seeks to elucidate the binding mode of small molecules to A $\beta$  amyloid. It combines the expertise of the Gao group in synthesis and the Kirschner group in amyloid analysis with X-ray powder diffraction.

**Past Research Funding**

- 12/2007-06/2010 Smith Family Young Investigator Award, Role: PI  
The Smith Family Foundation, Medical Foundation, Boston  
\$200,000

***Title: "Understanding Beta Sheet Formation in Membrane Bilayers"***

This project focused on synthesis of fluorinated amino acids and their incorporation into beta-barrel membrane proteins.

- 07/2012-06/2013 Research Incentive Grant, Boston College, Role: PI  
\$15,000

***Title: "Novel Strategies for Targeting Bacterial Lipids"***

This is a seed grant aiming to develop covalent strategies for lipid targeting.