ANDREW T. KRUEGER

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EDUCATION

Postdoctoral Fellow: Massachusetts Institute of Technology, Cambridge, MA (2009-2013)

- Advisor: Prof. Barbara Imperiali

Ph.D., Organic Chemistry: Stanford University, Stanford, CA (2009)

- Thesis: Part I: Fluorescence of Size-expanded DNA Bases: Reporting on DNA Sequence and Structure with an Unnatural Genetic Set. Part II: Toward Replication of xDNA, a Size-Expanded, Unnatural Genetic System.
- Advisor: Prof. Eric T. Kool [GPA: 3.7/4.0]

Honors B.S. Chemistry (Highest Distinction): University of Wisconsin, Madison, WI (2003)

- Advisor: Prof. Howard E. Zimmerman [GPA: 3.9/4.0]

RESEARCH EXPERIENCE

2013-present – **Investigator II** - Novartis Institute for Biomedical Research

2009-2013 – **MIT-Merck Postdoctoral Fellow** - Massachusetts Institute of Technology, Advisor: Prof. Barbara Imperiali

- Employed enzymatic ligations and click chemistries in semisynthetic hybrid design and execution of functionalized divalent protein ligands for biasing epidermal growth factor (EGFR) receptor interactions.
- Utilized site-selective unnatural amino acid incorporation in *E. coli* and click chemistries to develop fluorogenic protein ligand probes for monitoring EGFR binding events.
- Executed syntheses of solvatochromatic fluorophores and functionalized peptides for selective bioconjugation to recombinantly-expressed proteins.

2003-2009 – **Graduate Research Assistant** - Stanford University, Advisor: Prof. Eric T. Kool

- Synthesized multistep size-expanded DNA (xDNA) base analogues for conjugation to oligonucleotides and evaluated their fluorescence and biophysical properties.
- Designed and synthesized oligonucleotide probe scaffolds containing fluorescent xDNA base analogues for selective detection of DNA sequence and structure.
- Cloned xDNA-containing oligonucleotides into *E. coli* plasmid DNA, demonstrating the first example of a biological system faithfully reading all components of an unnatural genetic set.

2002 – **R&D Chemistry Intern** - Dow Chemical Specialty Amines, Advisors: Dr. Steve King, Ron Cook.

- Developed several piperazine/divinyl sulfone-based polymers as potential wood preservatives.
- Initiated evaluation of using specialty amines in organic light-emitting diodes (OLEDs).

2001-2003 – **Undergraduate Research Assistant** - University of Wisconsin, Madison, Advisor: Prof. Howard E. Zimmerman

- Planned and executed syntheses for a 5,5-diphenyltetrahydroazepinone and several 6-substituted 4,4-diphenylcyclohexenones and evaluated their photochemistry in crystalline and solution states.
- Honors Thesis: A New Heterocyclic Guest for Host-Guest Complexation: Synthesis and Photochemistry of a 5,5-diphenyltetrahydro-2H-azepin-2-one.

TEACHING AND WORK EXPERIENCE

2007-2011 – **Mentorship of Undergraduates** - Stanford University and Massachusetts Institute of Technology

- Designed an independent research project and trained an undergraduate in the Kool laboratories.
- Managed and instructed an undergraduate in the Imperiali laboratories.

Fall 2004, 2005 – **Head Teaching Assistant** - Stanford University

- Managed over 20 teaching assistants for instruction and application of advanced organic lab techniques.
- Assisted in course design and organization.

2002-2004 – **Teaching Assistant** - Stanford University, University of Wisconsin-Madison

- Instructed over 200 undergraduates in discussion sections for advanced organic and general chemistry.
- Instructed and supervised over 200 students for organic chemistry lab courses.

SKILLS AND QUALIFICATIONS

- **Bioconjugation:** Expertise in employing tag specific enzyme labeling, click chemistries, and electrophilic labeling reagents for selective conjugation of peptides and small molecules to proteins.
- **Molecular biology/protein expression:** Designed and constructed plasmids for incorporating unnatural amino acids or selective tags for bioconjugation. Expert in *E. coli* recombinant protein expression, purification and characterization.
- **Peptide and DNA synthesis:** Completed several modified oligonucleotide and peptide syntheses. Extensive experience with merging these scaffolds with recombinantly-expressed proteins in probe design.
- **Small molecule synthesis:** Executed several small molecule multistep syntheses. Comfortable working from milligram to multi-gram scales.
- **Instrumentation & characterization:** use of Varian NMR (1D and 2D), MALDI, ESI; use and maintenance of UV/Vis and fluorescence spectrometers, ABI peptide and DNA synthesizers, analytical and preparatory HPLC and FPLC purification systems.
- **Teamwork:** Worked directly with chemists, biologists, and biological engineers on collaborative projects.
- **Leadership:** Routinely led chemists through important tasks: teaching sessions, supplies acquisitions.

AWARDS AND HONORS

- MIT-Merck Postdoctoral Fellowship (2009-2012)
- Poster Award, 35th International Symposium on Nucleic Acids Chemistry, Kyoto Japan (2008)
- William S. Johnson Fellowship, Stanford University (2007)
- UW-Madison Department of Chemistry Undergraduate Research Scholarship (2002)
- Margaret McLean Bender Scholarship for Undergraduate Research (2002)
- Phi Beta Kappa (2001/2002)

PUBLICATIONS

Andrew T. Krueger; Carsten Kroll; Edgar Sanchez; Linda Griffith; Barbara Imperiali "Tailoring of Chimeric Ligands for Studying and Biasing ErbB Receptor Family Interactions" *Angew. Chem. Int. Ed.* **2014,** *53,* 2662-2666.

Andrew T. Krueger; Barbara Imperiali "Fluorescent Amino Acids: Modular Building Blocks for the Assembly of New Tools for Chemical Biology" *ChemBioChem* **2013, 14,** 788-799.

Andrew T. Krueger; Larryn W. Peterson; Jijumon Chelliserry; Daniel J. Kleinbaum; Eric T. Kool "Encoding Phenotype in Bacteria with a Size-expanded DNA Architecture" *J. Am. Chem. Soc.* **2011,** *143,* 18447-18551.

Sarah K. Jarchow-Choy; **Andrew T. Krueger**; Haibo Liu; Jianmin Gao; Eric T. Kool "Fluorescent xDNA Nucleotides as Efficient Substrates for a Template-Independent Polymerase" *Nucleic Acids Res.* **2010,** *39,* 1586-1594.

Haige Lu; **Andrew T. Krueger**; Jianmin Gao; Haibo Liu; Eric T. Kool; "Toward a Designed Genetic System with Biochemical Function: Polymerase Processing of Size-expanded DNA Base Pairs" *Org. Biol. Chem.* **2010,** *8,* 2704-2710.

Andrew T. Krueger; Eric T. Kool "Redesigning the Architecture of the Base Pair: Toward Biochemical and Biological Function of New Genetic Sets" *Cell Chem. Biol.* **2009,** *16,* 242-248.

Andrew T. Krueger; Eric T. Kool "Fluorescence of Size-Expanded DNA Bases: Reporting on Sequence and Structure with an Unnatural Genetic Set" *J. Am. Chem. Soc.* **2008,** *130,* 3989-3999.

Andrew T. Krueger; Haige Lu; Torben Højland; Haibo Liu; Jianmin Gao; Eric T. Kool "Towards the Replication of xDNA, a Size-expanded Unnatural Genetic System. *Nucleic acids symposium series* **2008,** *52,* 455-6.

Andrew T. Krueger; Eric T. Kool; "xDNA (size-expanded DNA)" In *Nucleic Acids from A to Z*; Muller, S. Ed; Wiley-VCH: Weinheim, Germany, **2008**; 331-332.

Andrew T. Krueger; Haige Lu; Alex H. F. Lee; Eric T. Kool "Synthesis and Properties of Size-Expanded DNAs: Toward Designed, Functional Genetic Systems" *Acc. Chem. Res.* **2007,** *40,* 141-150.

Andrew T. Krueger; Eric T. Kool "Model Systems for Understanding DNA Base Pairing" *Curr. Op. Chem. Biol.* **2007,** *11,* 588-594.

PRESENTATIONS AND POSTERS

Andrew T. Krueger "A Semisynthetic Approach to Divalent Ligands to understand and regulate ErbB Receptor Family Disregulation in Cancer" *Boston Symposium on Organic and Bioorganic Chemistry,* Boston, MA, Sept. 27-28, **2012. (Lecture)**

Andrew T. Krueger "A Semisynthetic Approach to Divalent Ligands for Biasing ErbB Receptor Signaling" *MIT Integrative Cancer Biology Program Retreat,* Danversport, MA, July 26, **2012**. **(Lecture)**

Andrew T. Krueger "New Chemical Biology Tools for detecting and controlling protein-protein interactions in extracellular communication networks." *243rd ACS National Meeting & Exposition*, San Diego, CA, March 25-29, **2012**. **(Lecture)**

Andrew T. Krueger, Linda G. Griffith and Barbara Imperiali "New Chemical Biology Tools for detecting and controlling protein-protein interactions in extracellular communication networks." *MIT Integrative Cancer Biology Program Retreat,* Danversport, MA, July 21, **2011**. **(Poster)**

Andrew T. Krueger "Chemical Strategies for Monitoring Protein-Protein Interactions in Extracellular Signaling" Invited seminar, Metals in Synthesis Seminar Series, Massachusetts Institute of Technology, MA, April 15, **2011**. **(Lecture)**

Andrew T. Krueger, Galen S. Loving, Linda G. Griffith and Barbara Imperiali "New Chemical Biology Tools for detecting protein-protein interactions and parsing extracellular communication networks." *MIT Integrative Cancer Biology Program Retreat,* Dedham, MA, July 22, **2010**. **(Poster)**

Andrew T. Krueger, Galen S. Loving, Linda G. Griffith and Barbara Imperiali "New Chemical Biology Tools for Detecting Protein-Protein Interactions and Parsing Extracellular Communication Networks." *MIT-Merck Computational & Systems Biology Symposium,* Boston, MA, April 5, **2010**. **(Poster)**

Andrew T. Krueger, Haige Lu, Torben Højland, Haibo Liu, Jianmin Gao and Eric T. Kool "Towards the Replication of xDNA, a Size-expanded Unnatural Genetic System" *23rd Annual William S. Johnson Symposium*, Stanford, CA, October 3-4, **2008**. **(Poster)** and *Joint Symposium of the 18th International Roundtable on Nucleosides, Nucleotides, and Nucleic Acids and the 35th International Symposium on Nucleic Acids Chemistry*, Kyoto, Japan, September 8-12, **2008**. **(Poster)**

Andrew T. Krueger "Self-Reporting of DNA structure and sequence by size-expanded DNA (xDNA), a fluorescent, unnatural genetic set" *236th ACS National Meeting & Exposition*, Philadelphia, PA, August 17-21, **2008**. **(Lecture)**

Andrew T. Krueger and Eric T. Kool "Fluorescence of Size-expanded DNA Bases: Reporting on Sequence and Structure with an Unnatural Genetic Set" *Bio-X Interdisciplinary Initiatives Symposium*, Stanford, CA, February 20, **2008**. **(Poster)**

Andrew T. Krueger "Conjugated Polymers: Enhanced Fluorescence Quenching in Chemical Sensors" Presentation at Stanford University, Stanford, CA, October 29, **2004**. **(Lecture)**

H. E. Zimmerman and **Andrew T. Krueger** "Toward New Inclusion Compounds and Photochemistry: A New Heterocyclic Guest" *University of Wisconsin-Madison Undergraduate Research Symposium,* Madison, WI, April 25, **2002. (Poster)**

H. E. Zimmerman and **Andrew T. Krueger** "Toward New Inclusion Compounds Held Together By Hydrogen Bonds" *University of Wisconsin-Madison Undergraduate Research Symposium,* Madison, WI, April 24, **2001. (Poster)**

REFERENCES

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