

02/04/09

## Tobias Baumgart

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Department of Chemistry  
University of Pennsylvania  
231 South 34<sup>th</sup> Street  
Philadelphia, PA 19104-6323

Tel: (215) 573-7539  
Fax: (215) 898-6242  
Email: baumgart@sas.upenn.edu

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### Positions:

2005- University of Pennsylvania, Assistant Professor of Chemistry  
2004-2005 Cornell University, Research Associate  
2001-2004 Cornell University, Postdoctoral Associate

### Education:

Ph.D. in Physical Chemistry from Max Planck Institute for Polymer Research  
and Johannes Gutenberg University in Mainz, Germany (2001)  
M.A. in Physical Chemistry from the University of Clausthal, Germany (1998)

### Publications (\* indicates UPenn, bold indicates undergraduate researcher):

#### Submitted manuscripts:

28\* Tian A., Capraro B., Baumgart T., "Bending stiffness depends on curvature of ternary mixture tubular membranes", *submitted to Biophysical Journal*

27\* Baker RG, Hsu CJ, Lee D, Jordan, M.S., Maltzman J.S., Hammer D.A., Baumgart T, and Koretzky G.A. "The adapter protein SLP-76 mediates "outside-in" integrin signaling and function in T cells", *in revision*

26\* Christian D., Tian A., **Kim Y.**, Baumgart T., Discher D., "Spotted Polymersomes and Striped Worms: ligand induced lateral segregation at the meso-scale in blended block copolymer assemblies", *in revision (Nature Materials)*

25\* Levental I., Choudhourie P., Gai F, Baumgart T, Janmey P, "Cholesterol, but not sphingomyelin, determines phase behavior in cell-derived giant plasma membrane vesicles", (*submitted to Nature Chemistry*)

24\*. **Reminick J.**, Fang X., **Go M.**, **Stinson B.**, Baumgart T., "Lateral protein partitioning between and temperature dependence of fluid lipid/protein domains in giant plasma membrane vesicles", *in revision (Biochimica et Biophysica Acta)*

#### Not peer reviewed:

23\*. Hess S., Gudheti M., Mlodzianoski M., Baumgart T. "Shape analysis of giant vesicles with fluid phase coexistence by laser scanning microscopy to determine curvature, bending elasticity and line tension" (*book chapter*), *Humana press*

Peer reviewed published manuscripts:

22\* Das SL, Jenkins JT, Baumgart T. "Neck geometry and shape transitions in vesicles with co-existing fluid phases: Role of Gaussian curvature stiffness versus spontaneous curvature, *in print (European Physics Letters)*

21\* Tian A., Baumgart T., "Sorting of lipids and proteins in membrane curvature gradients", *Biophysical Journal*, **96**, 2676-2688 (2009)

20\*. Das S., Tian A., Baumgart T.: "Equilibrium and stability of aspirated giant vesicles with fluid phase coexistence", *Journal of Physical Chemistry, B*, **112**, 11625-11630 (2008)

19\* Heinrich M., Leventhal I., **Gelberg H.**, Janmey P., Baumgart T., "Critical exponents for line tension and dipolar density difference from flicker spectroscopy of lipid monolayer domain boundary fluctuations", *Journal of Physical Chemistry, B*, **112**, 8063-8068 (2008)

18\*. Esposito, C., Tian A., **Johnson C.**, **Melamed S.**, Tee SY., Baumgart T. (2007). "Flicker spectroscopy of thermal lipid bilayer domain boundary fluctuations." *Biophysical Journal* **93** (9), 3169-3181, 2007

17\*. Tian A., **Johnson C.**, **Wang W.**, Baumgart T., "Line tension at fluid membrane domain boundaries measured by micropipette aspiration" *Physical Review Letters* **98**, 2007, 208102

16. Wu M., Baumgart T., Hammond S., Holowka D., Baird B., "Differential targeting of secretory lysosomes and recycling endosomes in mast cells revealed by patterned antigen arrays." *Journal of Cell Science* **120**(17), 2007, 3147-3154.

15. Baumgart, T., Hunt G., Farkas E., Webb W., Feigenson F., "Fluorescence probe partitioning between Lo / Ld phases in lipid membranes" *Biochimica Et Biophysica Acta-Biomembranes* **1768**(9), 2182-2194, 2007

14. Baumgart, T.; Hammond, A.; Sengupta, P.; Hess, S.; Holowka, D.; Baird, B.; Webb, W.W. "Large-Scale Fluid/Fluid Phase Separation of Proteins and Lipids in Giant Plasma Membrane Vesicles" *PNAS* **104** (9) 3165 – 3170, 2007.

13. Hammond A., Heberle, F., Baumgart T., Holowka D, Baird B, Feigenson GW: "Crosslinking a lipid raft component triggers raft-like phases in model plasma membranes": *PNAS* **102** (18) 6320 – 6325, 2005

12. Baumgart T., Das S.L., Webb W.W., Jenkins J.T.: "Membrane elasticity in giant vesicles with fluid phase coexistence": *Biophysical Journal* **89** (2), 1067 – 1080, 2005

11. Koralach J., Baumgart T., Feigenson G.W. & Webb W.W. Detection of motional heterogeneities in lipid bilayer membranes by dual probe fluorescence correlation spectroscopy. *Biochimica et Biophysica Acta* **1668**, 158 - 163 (2005).

10. Baumgart T., Hess S.T. & Webb W.W. Imaging coexisting fluid domains in biomembrane models coupling curvature and line tension. *Nature* **425**, 821 - 824 (2003).
9. Baumgart T. Kreiter M., Lauer H., Naumann R., Jung G., Jonczyk A., Offenhausser A., Knoll W., Fusion of small unilamellar vesicles onto laterally mixed self-assembled monolayers of thiolipopeptides. *Journal of Colloid and Interface Science* **258**, 298-309 (2003).
8. Baumgart, T. & Offenhausser, A. Polysaccharide-supported planar bilayer lipid model membranes. *Langmuir* **19**, 1730-1737 (2003).
7. Naumann, R.; Baumgart, T.; Graber, P.; Jonczyk, A.; Offenhausser, A.; Knoll, W. "Proton Transport Through a Peptide-Tethered Bilayer Lipid Membrane by the H<sup>+</sup>-ATP Synthase from Chloroplasts Measured by Impedance Spectroscopy" *Biosensors & Bioelectronics* **2002**, *17*, 25-34
6. Morigaki, K.; Baumgart, T.; Jonas, U.; Offenhausser, A.; Knoll, W. "Photopolymerization of Diacetylene Lipid Bilayers and its Application to the Construction of Micropatterned Biomimetic Membranes." *Langmuir* **2002**, *18*, 4082-4089
5. Bolze, J.; Takahasi, M.; Mizuki, J.; Baumgart, T.; Knoll, W. "X-ray Reflectivity and Diffraction Studies on Lipid and Lipopolymer Langmuir-Blodgett films Under Controlled Humidity" *Journal of the American Chemical Society* **2002**, *124*, 9412-9421.
4. Baumgart, T. & Offenhausser, A. Spreading of lipid monolayers on hydrophilic substrates at increased relative humidities. *Langmuir* **18**, 5899-5908 (2002).
3. Baumgart, T. & Offenhauser, A. Lateral diffusion in substrate-supported lipid monolayers as a function of ambient relative humidity. *Biophysical Journal* **83**, 1489-1500 (2002).
2. Morigaki, K., Baumgart, T., Offenhausser, A. & Knoll, W. Patterning solid-supported lipid bilayer membranes by lithographic polymerization of a diacetylene lipid. *Angewandte Chemie-International Edition* **40**, 172-174 (2001).
1. Baumgart T., Cramer S., Jahr T., Veniaminov A., Adams J., Fuhrmann J., Jeschke G., Wiesner U., Spiess H. W., Bartsch E., Sillescu H., Film-forming colloidal dispersions studied by tracer methods. *Macromolecular Symposia* **151**, 451-457 (2000).

Graduate Advisor:

Prof. Wolfgang Knoll, Max-Planck-Institute for Polymer Research, Mainz, Germany

Postdoctoral Advisor:

Prof. Watt Webb, Cornell University

Honors and Awards:

Alfred P. Sloan Fellowship (2008)  
 Postdoctoral Fellowship from the Keck foundation (2001 - 2004)  
 Procter & Gamble award for diploma in Chemistry (1998)  
 Fellowship from a Graduiertenkolleg of the  
 German research foundation, DFG, 1998 – 2001  
 Fritz ter Meer fellowship, Bayer Company (1997 - 1998)

ERASMUS fellowship (1996 - 1997)

Recent and future invited talks

- 40) Feb 2010: Invited workshop talk, annual meeting of the Biophysical Society
- 39) 09/21/09: University of Saarbruecken, Physics Department, invited colloquium talk
- 38) 09/14-18/09: International Conference: "Dynamics in Systems Biology 2009", Aberdeen, UK, invited talk
- 37) 07/27-31/09: Workshop on: "Biological Membranes and Membrane Proteins: Challenges for Theory and Experiment", Telluride
- 36) 08/2-7/09: Gordon research conference on "Chemistry and Physics of Liquids", invited talk
- 35) 06/28-07/03/09: Gordon research conference on "Chemistry of Supramolecules & Assemblies", invited talk
- 34) 04/29/2009: Invited talk at the Philadelphia Microscopy Society, Horsham, USA
- 33) 04/08/2009: Invited seminar talk, Carnegie Mellon University, Department of Physics
- 32) 03/22-26/09: Invited talk at the ACS National Meeting in Salt Lake City
- 31) 12/12/08: Rutgers University Newark, invited seminar talk
- 30) 11/10/08: Penn Muscle Institute, invited seminar talk
- 29) 10/08: Max Planck Institute for the physics of complex systems, Dresden, Germany, invited symposium talk
- 28) 10/08: CNRS/Institut Curie, Physical Chemistry Curie, Paris, France, invited seminar talk
- 27) 9/17/08: Harvard Medical School, Department of Genetics, invited seminar talk
- 26) 9/3/08: Cornell University, Department of Applied and Engineering Physics / Biophysics Colloquium, invited seminar talk
- 25) 08/18/08: Invited talk at the ACS National Meeting in Philadelphia
- 24) 05/21/08: Invited talk at the AIMS (American Institute of Mathematical Sciences) annual meeting, Symposium on Modeling and Analysis of Multi-Phase Lipid Bilayer Membranes
- 23) 05/19/08: Invited talk at the Meeting of the International Society for the Study of Fatty Acids and Lipids, Kansas City
- 22) 05/14/08: Drexel University, Chemistry Department, invited seminar talk
- 21) 05/01/08: George Washington University, Department of Mathematics, invited seminar talk
- 20) 04/29/08: Pennsylvania State University, Chemistry Department, invited seminar talk
- 19) 04/06-04/10 08: Invited talk at the ACS National Meeting in New Orleans, Symposium on "Structure, Property, and Function of Membranes and Membrane Related Biomolecules"
- 18) 03/20-21 08: "Signal protein partitioning, phase behavior and mechanics of lipid membranes" Symposium on "Biomembrane Frontiers: Nanostructures, Models & Design of Life", UC Davis
- 17) 01/12-17 08: "Phase Separation of Proteins and Lipids in Giant Plasma Membrane Vesicles" Keystone Symposium on the molecular basis for biological membrane organization, Big Sky Resort, Montana
- 16) 11/08/07: "Of domains and boundaries: fluid phases in biological membrane models", Swarthmore College
- 15) 10/01/07: "Of domains and boundaries: phase behavior and mechanics of lipid membranes", International Soft Matter Conference, Aachen, Germany

- 14) 09/28/07: "Spotting membranes: domains, boundaries, and protein partitioning", University of Salerno, Salerno, Italy
- 13) 09/24/07: "Spotting membranes: domains, boundaries, and protein partitioning", Imperial College, London, UK
- 12) 09/21/07: "Of domains and boundaries: phase behavior and partitioning in biological and model membranes", TETHMEM 2007, International workshop of the MPI for Polymer Research, Germany
- 11) 09/18/07: "Of domains and boundaries: fluid phases in biological membrane models", Chemistry Department, University of Wisconsin
- 10) 07/22-27 2007: "Signal protein partitioning, phase behavior and mechanics of lipid membranes", Gordon Research Conference on Biomolecules in the Gas Phase, Bates College, USA
- 9) 06/11/07: "Of domains and boundaries: phase behavior and mechanics of lipid membranes", Workshop Meeting entitled "Biological Membranes and Membrane Proteins: Challenges for Theory and Experiment", Utah
- 8) 05/04/07, "Of domains and boundaries: phase behavior and mechanics of lipid membranes", Mathematics Department, Penn State University
- 7) 11/03/06, "Physicochemical and mechanical aspects of fluid phase coexistence in model and biological membranes, Physics Department, Harvard University
- 6) 06/27/06, "Heterogeneities in biological membranes assessed by fluorescence imaging", Bio-Systems Conference, Berlin, Germany.
- 5) 05/01/06, "Coupling of membrane geometry and composition in model and biological membranes", Applied mathematics seminar, University of California, Irvine
- 4) 03/22/06, "Fluorescence microscopy imaging of biomembrane fluid phases and membrane mechanics", Chemical and Biomolecular Engineering Department, University of Pennsylvania
- 3) 03/13/06, "Imaging of protein partitioning in plasma membranes with coexisting fluid phases", 2006 APS March meeting, Baltimore, USA
- 2) 03/02/06, "Imaging biomembrane structure: compositional and shape heterogeneities in lipid membranes", Frontiers in Biomembranes Workshop, IMB, Jackson labs and University of Maine
- 1) 01/10/06, "Coupling of curvature and phase behavior in model and biological membranes" James Franck-Institute, University of Chicago

### Department Service

Physical Chemistry Division Faculty Search Committee, academic year 2008/09  
 Member, Graduate committee and recruiter for physical chemistry, since 2005  
 Physical Chemistry Division, First year student adviser, since 2007  
 Member, General chemistry laboratory committee (2007 – 2008)  
 Physical Chemistry seminar coordinator and speaker host, since 2007  
 Cumulative exam coordinator, physical chemistry, since 2005  
 Member, planning committee for SAS Imaging workshop, 2007  
 Freshmen adviser for 7 members of class 2011, 2007-2009

### Synergistic and Educational Activities

- Development and co-direction of a workshop for high school teachers addressing common misconceptions in thermochemistry and thermodynamics and introducing novel teaching tools: August 8/9 2008, to be repeated in August 2009

- Development and teaching of a new undergraduate course “Honors General Chemistry II” (Chem 16) with an emphasis on exposing students to current research topics
- Teaching of three graduate courses, including Statistical Mechanics (Chem 521), a special topics course on Biomolecular Imaging Methods (Chem 700), and development and teaching of a Biomembrane seminar course (BMB 571)
- Lecturing to high school students and high school teachers in NSF MRSEC program
- Involvement of high school teachers, high school students (ACS SEED), and undergraduate research assistants in laboratory research
- Co-organization of symposia: 5-day ACS fall meeting symposium (2006) on biomembrane research, co-organized with Erin Sheets (Penn State University), SAS Imaging symposium (2007): a multi-departmental workshop allowing inter-disciplinary exchange among researchers in the broad field of imaging: From Molecules, over Brain, to Universe, co-organized with Ivan Dmochowski (UPenn)

#### Thesis supervision

Currently supervising 6 graduate students, and supervising two master thesis projects of undergraduate students.

#### Current Funding:

- NSF grant MCB-0718569 (PI: T. Baumgart): "Curvature and Composition Regulation in Tubular Lipid Membranes" (2007 – 2009, continuing grant)
- NIH grant 1R21AI073409 (PI: T. Baumgart) “Biophysics of fluid lipid/protein membrane domains and immune cell signaling” (2008 – 2009)
- University of Pennsylvania, Institute for Medicine and Engineering seed grant-
- University of Pennsylvania NSF MRSEC seed grant
- University of Pennsylvania research foundation seed grant
- Alfred Sloan Foundation Research Fellowship