

Dear Dr. Swanson,

My name is Cameron Harvey. I am currently a Ph.D candidate in biophysics working with Dr. Mark Alber in the Department of Applied and Computational Mathematics and Statistics at the University of Notre Dame. Upon completion of my Ph.D. dissertation in May 2013, I am hoping to find a research position in computational biology. I would very much like the opportunity to interview for the post-doctoral position with you at the Feinberg School of Medicine.

Though I am in the Physics department, my Ph.D. project is multi-disciplinary and bridges Applied Mathematics, Physics, Computer Science, and Microbiology. While completing the requirements for a Physics Ph.D., I have worked very closely with members in other departments for several years gaining the skills needed to develop mathematical models for biology and also to perform laboratory research in microbiology. My research focuses on using cell movement patterns obtained from video microscopy in order to develop and test mathematical models and run simulations of bacteria movement. One broad goal of the predictive simulations was to understand how the physical properties of cells influence the collective movement of a larger population of bacteria.

In order to carry out my research, I have developed necessary programming skills in the C/C++ and Cuda (Graphical Processing Unit (GPU) programming) for the simulation program as well as scripting in python and other languages to automate the processing of simulation results and data analysis. I regularly use Matlab for statistical analysis of simulation results as well as analyzing data from the experiments we perform. In addition to computational work, I have spent significant time in the lab growing and imaging bacteria in order to have experimental data that informs and tests our models. Finally, I have worked closely with experts in computer vision in order to develop image analysis programs in Matlab to identify and track bacteria cells from the microscopy videos.

Not only can I quickly find and learn new information, but have experience researching at the interface of mathematics, physics, and biology and working with experts in both the biology and computational fields. The bacteria I have been studying are fascinating, but I am very interested in moving closer to disease related research. I think your research in mathematical modeling of brain tumors is an excellent opportunity to expand on my imaging and modeling background. I am excited about a post-doc that combines individual patient data with computational modeling and simulation.

Sincerely,

Cameron Harvey

Cameron W. Harvey

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Education:

2013 – Ph.D. in Physics, University of Notre Dame, Notre Dame, IN. (expected May)
2012 – M.S. in Physics. University of Notre Dame, Notre Dame, IN.
2008 - B.S. in Physics; Second Major: Mathematical Sciences. University of Memphis, Memphis, TN.
2008 - B. A. with Honors in History; Double Major: Philosophy. University of Memphis, Memphis, TN. Honors Thesis in History: Platonism and the Science of Sixteenth- Century Europe: The Influence of the Platonic Tradition on Copernicus, Paracelsus, and Dee

Research Interests

Computational Biophysics; Multi-scale Mathematical and Computational Modeling in Biophysics, Bacterial Swarming, Emergent Behaviors in Complex systems; Image Recognition and Cell Tracking

Research Experience

Graduate Research, University of Notre Dame

May 2009 – present

Modeling and Experiments with bacteria swarming. Advisors: Dr. Mark Alber, Dr. Dale Kaiser, and Dr. Joshua Shrouf

- Use cell-based stochastic model to investigate properties of swarming for wildtype and mutant *Myxococcus xanthus*
- Developed novel 3D Subcellular Element Model to study dynamic clustering of bacteria.
- Performed bacteria motility assays and microscopy.

June – Aug. 2011

Summer Research Program (SRP) Award at Argonne National Lab. Supervisor: Dr. Igor Aronson.

- Computer Modeling, Image Analysis, and further development of techniques from previous summer.

June – Aug. 2010

Summer Research Program (SRP) Award at Argonne National Lab. Supervisor: Dr. Igor Aronson.

- Bacteria Imaging with Optical Microscope using chambers of bacterial swarming and Optical Coherent Tomography experiments on fruiting bodies formation.

Aug. 2008 – June 2009

Modeling Microtubules. Advisors: Dr. Holly Goodson, Dr. Mark Alber

Cameron W Harvey

- Used stochastic model of Microtubule growth and depolymerization to study dynamic instability.

Undergraduate Research, University of Memphis

May 2007 – May 2008

Computational physics of soft matter. Advisor: Dr. Mohamed Laradji.

- Molecular Dynamic simulation of lipid membranes with cytoskeleton
- Research the effects of the cytoskeleton on lipid membrane's elastic properties

Aug 2006 – Sept 2007

Applications of fractional calculus in physics. Advisors: Dr. John Hanneken and Dr. Nahari Achar.

- Research properties of derivatives of Mittag-Leffler function with respect to parameters

Publications

1. **Cameron W Harvey**, Huijing Du, Zhiliang Xu, Dale Kaiser, Igor Aranson, Mark Alber. Interconnected Cavernous Structure of Bacterial Fruiting Bodies. *PLoS Comput Biol* 8(12): e1002850 (2012).
2. Xiaomin Liu, **Cameron W. Harvey**, Haitao Wang, Mark S. Alber, Danny Chen "Detecting and Tracking Motion of *Myxococcus xanthus* Bacteria in Swarms," Medical Image Computing and Computer-Assisted Intervention – MICCAI 2012 Lecture Notes in Computer Science, Volume 7510, pp 373-380 (2012).
3. Zhiliang Xu, Scott Christley, Joshua Lioi, **Cameron Harvey**, Wenzhao Sun, Elliot Rosen and Mark Alber [2012], Multiscale Modeling of Fibrin Accumulation on Thrombus Surface and Platelet Dynamics. *Methods Cell Biol.* 110 367-88. (2012)
4. **Cameron W Harvey**, Faruck Morcos, Chistopher R Sweet, Dale Kaiser Santanu Chatterjee, Xiaomin Liu, Danny Z Chen, Mark Alber. Study of elastic collisions of *Myxococcus xanthus* in swarms. *Physical biology*, 8(2), p.026016. (2011).
5. Eric J. Spangler, **Cameron W. Harvey**, Joel D. Revalee, P. B. Sunil Kumar, and Mohamed Laradji. Computer simulation of cytoskeleton-induced blebbing in lipid membranes. *Phys. Rev. E* 84, 051906 (2011).
6. **Cameron Harvey**, Mark Alber, Lev Tsimring, Igor Aronson, Continuum modeling of clustering of myxobacteria, *New Journal of Physics* (resubmitted).
7. **Cameron Harvey**, Amy Buchmann, Scott Christley, Joshua Shrou, Dale Kaiser, Igor Aronson, Mark Alber, *Myxococcus xanthus* Cluster Formation (in preparation).

Presentations

Oral Presentation

July 2012

"Internal Structure of the *Myxococcus xanthus* Fruiting Bodies". Myxo 2012 annual conference. Chicago, IL.

July 2012

"Cluster Dynamics in *Myxococcus xanthus*". Society for Mathematical Biology(SMB) Annual Meeting. Knoxville, TN.

June 2012

"Internal Structure of the *Myxococcus xanthus* Fruiting Bodies". Physics of Bacteria Workshop, Chicago, IL.

May 2012

"Modeling Bacteria Gliding on GPU cards". Midwest Conference on Numerical Analysis and Scientific Computing, Notre Dame, IN.

Cameron W Harvey

March 2012 “Role of cell bending and slime navigation in swarms of *M. xanthus*”. American Physical Society March Meeting, Boston, MA. (Abstract: <http://meetings.aps.org/Meeting/MAR12/Event/167803>)

Poster Presentations

March 2010 “Multiscale Modeling of Bacteria Motility”. MBI Current Topic Workshop on Biofilms in Infectious Disease: Biology to Mathematical Models and Back Again. The Ohio State University, Columbus, OH.

October 2009 “Model of Myxobacteria Motility Mutants”. Workshop on Agent-Based Complex Systems at Institute for Pure and Applied Mathematics (IPAM). University of California, Los Angeles, CA.

April 2009 “Computational Modeling of Microtubule Dynamics”. Center for Research Computing Workshop on Scientific Computing. University of Notre Dame, Notre Dame, IN.

Nov 2007 “Large Scale Computer Simulation of Erythrocyte Membranes”. 74th Annual Meeting of the Southeast section of APS, Nashville, TN. (Abstract: <http://meetings.aps.org/Meeting/SES07/Event/73640>)

Mar 2007 “Derivatives of Mittag-Leffler Functions with Respect to their Parameters”. American Physical Society (APS) March Meeting, Denver, CO. (Abstract: <http://meetings.aps.org/Meeting/MAR07/Event/59334>)

Skills, Proficiencies

- Programming and Development Experience:
 - FORTRAN, C/C++, LabView, Android, CUDA C, Latex
 - Unix/Linux Administration, Scripting in Bash and Python
- Software Experience:
 - Microsoft Word, Power Point and Excel, ImageJ, VMD
 - Mathematica, Maple, Matlab, Inkscape
- Laboratory Experience:
 - Bright Field and Laser Scanning Confocal Microscopy for time-lapse imaging of bacteria movement.
 - Maintaining Bacteria strains: buffer preparation, standard microbiology lab techniques: pouring and inoculating plates, pipetting, centrifuge
 - Optical Coherent Tomography and 3D image reconstruction

Honors, Awards, Affiliations

June 2011 2nd Prize in University of Notre Dame’s Wireless Institute Mobile Application Development Contest: Awarded to our team that developed a mobile app for the android operating system that provides users with the live location of public transportation buses.

Aug 2008 – Aug 2009 Zahm Fellowship, University of Notre Dame : Awarded to Outstanding Incoming Graduate Students

April 2008 College of Arts and Sciences Dean’s Award for Outstanding Undergraduate Student

April 2008 Department of Physics Outstanding Student Award

Cameron W Harvey

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| April 2008 | Department of History's Major L. Wilson Undergraduate Paper Award |
| May 2007 - present | Chi Beta Phi, National Science Honorary |
| March 2007 – present | American Physical Society, Student Membership |
| Sept 2006 - May 2007 | Bob Baker Memorial Scholarship in History |
| April 2005 | Department of Philosophy Outstanding Student Award |
| April 2004 – present | Phi Kappa Phi, National Honor Society |

References

Mark Alber, Ph.D. Advisor, University of Notre Dame
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Joshua Shrout, Ph.D committee and research mentor, University of Notre Dame
jshrout@nd.edu, office phone: (574)631-1726

Dale Kaiser, Research Mentor, Stanford University
adkaiser@stanford.edu, Office Phone: (650) 725-5127

Igor Aronson, Research Supervisor, Argonne National Laboratory
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