Jayajit Das

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Battelle Center for Mathematical Medicine
Nationwide Children's Hospital and Department of Pediatrics, Ohio State University
JW3924, 700 Children's Drive
Columbus, OH 43205.

Education and Professional Experience

Battelle Center for Mathematical Medicine, Nationwide Children's Hospital and Department of Pediatrics, Biophysics Graduate Program, Ohio State University, Columbus, OH
Assistant Professor **2008-**

Massachusetts Institute of Technology, Cambridge, MA
Postdoctoral Fellow **2005-2008**
Research Advisor: Arup K. Chakraborty

- Used computer simulations and statistical mechanics to show that digital signaling and hysteresis characterize Ras activation in lymphocytes (experimental collaborators: Jeroen Roose and Arthur Weiss Lab, UCSF). These ideas were extended to provide a molecular mechanism underlying differential characteristics of positive and negative selection thresholds in the thymus.
- Demonstrated the role of stochastic fluctuations and feedback effects in determining cell decision and signal spreading using stochastic simulations and kinetic Monte Carlo simulations (collaborator: Mehran Kardar, Physics, MIT).
- Studied the effects of receptor clustering and antigen quality on activation and signaling of T lymphocytes using statistical mechanics and coarse grained in-silico analysis (experimental collaborator: Andrey Shaw Lab, Washington University, St. Louis).
- Used computer simulations to demonstrate how T cell sensitivity to antigen and antagonism emerge from a common signaling module.

University of California, Berkeley, CA
Postdoctoral Fellow **2002-2005**
Research Advisor: Arup K. Chakraborty

- Studied the single molecule conformations of a dendronized polymer chain using statistical mechanics and Monte Carlo simulations to discover that dendronized polymers are single molecule glasses. Investigated the self-assembly of dendronized chains to form microphases that may mimic ion channels (experimental collaborator: J. M. J. Fréchet's Lab, UC Berkeley).
- Studied the phase behavior of crosslinked di-block copolymers that have mechanical properties similar to actuators using self-consistent field theoretic techniques (experimental collaborator: Nitash Balsara's Lab, UC Berkeley).

Virginia Institute of Polytechnic and State University, Blacksburg, VA
Postdoctoral Fellow **2000-2002**
Research Advisor: Uwe C. Täuber

- Investigated the dynamics of flux lines in high temperature superconductors using Monte Carlo simulations to identify the type (point or extended columnar) and the spatial organization (random or ordered) of defects or pins present in the material from voltage noise and voltage-current characteristics.

Raman Research Institute, Bangalore, India, and **Institute of Mathematical Sciences**, Chennai (Madras), India.
Ph.D. in Physics (Concentration: Non-equilibrium Statistical Physics) **1996-2000**
Research Advisor: Madan Rao

Thesis: *Dynamics of Driven Dissipative Heisenberg Spins with Inertia*
Studied the interplay between dissipative and inertial dynamics and an external drive on a model of an isotropic magnet using Langevin simulations and dynamic renormalization group calculations.

Institute of Mathematical Sciences, Chennai (Madras), India.
M.Sc. in Physics (Concentration: Theoretical Physics) **1994-1996**
Research Advisor: Madan Rao

Thesis: *Scaling and spatial pattern formation in Martensites.*

Presidency College, **University of Calcutta**, Calcutta, India.
B.Sc. in Physics **1991-1994**

Other Professional Experience

- Boulder School for Condensed Matter and Materials Physics on *Nonequilibrium statistical physics, glasses, transport and friction, biological systems and turbulence*, University of Colorado, Boulder, CO, 2-27 July, 2001.
- Abdus Salam International Center for Theoretical Physics (ICTP) Summer College on *Statistical mechanics and dynamics of soft condensed matter*, Trieste, Italy, 2nd May - 6th June, 1998.

Publications

- Arup K. Chakraborty and **Jayajit Das**, "Computational Studies Marry In-vitro and In-vivo Experiments: A Power Couple For Studying T cell Signaling" *Nature Reviews Immunology, in review* (2009).
- **Jayajit Das**, Mehran Kardar and Arup K. Chakraborty, "Positive Feedback Regulation Results in Spatial Clustering and Fast Spreading of Active Signaling Molecules on a Cell Membrane" *Journal of Chemical Physics, in review (2009)*.
- **Jayajit Das,** Mary Ho, Julie Zikherman, Christopher Govern, Yang Ming, Arthur Weiss, Arup K. Chakraborty and Jeroen Roose, "Digital Signaling and Hystersis characterize characterize Ras Activation in Lymphocytes" *Cell* **136**, 337 (2009).
- Ashok Prasad, Julie Zikherman, **Jayajit Das**, Jeroen Roose, Arthur Weiss, Arup K. Chakraborty, "Origin of the Sharp Boundary that Discriminates Positive and Negative Selection of Thymocytes" *PNAS* **106**, 528 (2009).
- S. Cemerski, **Jayajit Das**, Emanuele Giurisato, Mary A. Markiewicz, Paul M. Allen, Arup K. Chakraborty and Andrey S. Shaw, "Evidence for Signaling from the Center of the Immune Synapse",*Immunity* **29**, 414 (2008)*.

(*)This paper is in the Editors Choice of Science Signaling (Issue 23rd Sept. 2008). Also see a preview of this paper by S. Valitutti in the same issue of *Immunity*.

- T. J. Bullard, **Jayajit Das**, G. L. Daquila, and U. C. Uwe C. Täuber, "Vortex Washboard Voltage Noise in Type II Superconductors", *European Physical Journal B* **65**, 464 (2008).
- Maxim Artyomov, **Jayajit Das**, Mehran Kardar and Arup K. Chakraborty. "Purely Stochastic Binary Decision in Cell Signaling Models without Underlying Deterministic Bistabilities", *Proceedings of National Academy of Sciences USA* **104**, 18958 (2007)*.

(*) Special mention in Physics Today 61, 28 (2008).

- Dennis Wylie, **Jayajit Das** and Arup K. Chakraborty. "Sensitivity of T Cells to Antigen and Antagonism Emerges from Differential Regulation of the Same Signaling Module", *Proceedings of National Academy of Sciences USA* **104**, 5533 (2007).*

  (*)This paper is selected in the faculty of 1000 Biology papers

- S. Cemerski*, **Jayajit Das***, Jason Locasale, Pheobe Arnold, Emanuele Giurisato, Mary A. Markiewicz, Daved Fremont, Paul M. Allen, Arup K. Chakraborty and Andrey S. Shaw, "The Stimulatory Potency of T cell Antigens is Influenced by the Formation of the Immunological Synapse", *Immunity* **26**, 345 (2007).

  (*) These authors have equal contribution

- Enrique D. Gomez, **Jayajit Das**, Arup K. Chakraborty, John A. Pople and Nitash P. Balsara, "Effect of Crosslinking on the Structure and Thermodynamics of Lamellar Block Copolymers", *Macromolecule*s **39**, 4848 (2006).

- **Jayajit Das,** Masaru Yoshida, Zachary Fresco, Tae-Lim Choi, J. M. J. Fréchet and A. K. Chakraborty, "A Dendronized Polymer is a Single Molecule Glass" *Journal of Physical Chemistry B* **109**, 6535 (2005).

- Hyeok Hahn, Arup K. Chakraborty, **Jayajit Das,** John Pople and Nitash P. Balsara, "Order-Disorder Transitions in Cross-linked Block Copolymer Solids", *Macromolecules* **38**, 1277 (2005).

- Thomas J. Bullard, **Jayajit Das** and Uwe C. Täuber, "Dynamics of Magnetic Flux lines in the Presence of Correlated Disorder" in *Trends in Superconductivity Research*, 67-76, Nova Science Publishers, Inc., NY, (2004).

- **Jayajit Das,** Thomas J. Bullard and Uwe C. Täuber, "Vortex Transport and Voltage Noise in Disordered Superconductors", *Physica A* **318**, 48(2003).

- **Jayajit Das,** Madan Rao and Sriram Ramaswamy, "Nonequilibrium Criticality, Spatiotemporal Chaos and Control", *Europhysics Letters* **60**, 418(2002).

- **Jayajit Das** and Madan Rao, "Ordering Dynamics of Heisenberg Spins with Torque: Crossover, spin waves and defects", *Physical Review E* **62**, 1601(2000).

- **Jayajit Das** and Madan Rao, "Dynamics of Ordering of Isotropic Magnets", *Physica A* **270**,253(1999).

- **Jayajit Das** and Madan Rao, "Dynamics of Ordering of Heisenberg Spins with Torque – Nonconserved Case", *Physical Review E* **57**, 5069(1998).

Awards and Honors

- Invited talk at the Immunology Seminar Program, Ohio State University, Columbus, 20th January, 2009.
- Invited talk at Mathematical Biosciences Institute, Ohio State University, Columbus, 25th November, 2008.
- Invited talk at Biophysics Graduate Program, Ohio State University, Columbus, 8th October, 2008.
- Invited talk at **Engineering Cell Biology – Cell in Context conference**, Cambridge, 5-8 August, 2007.
- Travel grant and fellowship by UNESCO and Govt. of India for a summer college and conference at ICTP, Trieste, Italy, 1998.
- Senior Research Fellowship, Dept. of Atomic Energy, Govt. of India, 1996-2000.
- Junior Research Fellowship, Dept. of Atomic Energy, Govt. of India, 1994-1996.

- National Scholarship, Govt. of India, 1991.

Teaching Experience

Instructor: Physics121, Raman Research Institute, Bangalore, India. **Summer, 1999**

Undergraduate level summer course on Statistical mechanics

Teaching Assistant: Physics 418, Institute of Mathematical Sciences, Madras, India. **Fall, 1997**

Graduate level course on Statistical Mechanics. Led recitations and extra discussion sessions.

Conference and Seminars

- **FASEB Summer Research Conference**, New Haven 3-8 August, 2008.
  "Rasgrp dependent feedback of SOS contributes to digital Erk responses and efficient lymphocyte activation" (poster presentation).
- **AIChE Annual Meeting**, Salt Lake City 4-9 November, 2007.
  "Rasgrp dependent feedback of SOS contributes to digital Erk responses and efficient lymphocyte activation" (oral presentation).
- **Invited talk** at **Engineering Cell Biology – Cell in Context conference**, Cambridge, 5-8 August, 2007.
  "The Immunological Synapse Modulates Antigen Quality During T cell Activation."
- **EMBO conference** series on "Signaling in the immune system", Siena, 24-28 May, 2007.
  "*Rasgrp dependent feedback of SOS contributes to digital Erk responses and efficient lymphocyte activation"* (poster presentation).
- **Invited talk** at **National Center for Biological Sciences**, Bangalore,13 October, 2006.
  "Early and Late time Signaling Events During T cell Activation."
- **AIChE Annual Meeting**, San Francisco 12-17 November, 2006.
  "Antigen quality regulates signaling and degradation in the immunological synapse" (oral presentation).
- **APS Annual Meeting**, Los Angeles, CA, 21-25 March, 2005; AIChE Annual Meeting, Austin, TX, 7-12 November, 2004.
  "A dendronized polymer is a single molecule glass" (oral presentation).
- **Stat. Mech. Meeting**, Berkeley, CA, 9-11 January, 2004.
  "Single chain configurations and self-assembly of dendronized polymer" (poster presentation).
- **AIChE Annual Meeting**, San Francisco, 16-21 November, 2003; APS March Meeting, Austin, TX, 3-7 March, 2003; Stat. Mech. Meeting, Berkeley, CA, 11-13 January, 2003.
  "Phase behavior of crosslinked di-block copolymers" (oral presentation).
- **APS March Meeting**, Indianapolis, IN, 18-22 March, 2002; **Third Annual Greater Boston Area Statistical Mechanics Meeting**, Brandeis University, Boston, MA, 20 October, 2001; **Boulder School for Condensed Matter and Materials Physics**, University of Colorado, Boulder, CO, 2-28 July, 2001.
  "Voltage transport and voltage noise in disordered superconductors" (oral presentation).
- **APS March Meeting**, Seattle, WA, 12-16 March, 2001.
  "Driven magnets, spatio-temporal chaos and chiral steady states" (oral presentation).
- **Stat-Phys - Calcutta - III** (**an international satellite meeting of STATPHYS**), S. N. Bose Center of Basic Sciences, Calcutta, India, 4-9 January, 1999; International conference on *Structure and Dynamics of materials in the Mesoscopic Domain* organized by the Royal

Society, London and Unilever National Chemical Laboratory, Pune, India, 8-12 December, 1997.
"Dynamics of ordering in isotropic magnets" (poster presentation).

Reviewer

Journal of Immunology, Biophysical Journal, Journal of Chemical Physics, Nano Letters

Professional Memberships

- American Institute for Chemical Engineers (AIChE)
- American Physical Society (APS)