MATHBIO4: SCALE Symposium

At the H. F. DeLuca Forum in the Wisconsin Institutes for Discovery
330 North Orchard Street - Madison, Wisconsin

ORGANIZED BY THE LABORATORY FOR OPTICAL AND COMPUTATIONAL INSTRUMENTATION (LOCI), MORGRIDGE INSTITUTE FOR RESEARCH, WISCONSIN INSTITUTE FOR DISCOVERY, AND UNIVERSITY OF WISCONSIN-MADISON (UW)

DAY 1: Thursday, October 18, 2012	
Time	**Presentations and Speakers**
8:15—8:45 a.m.	**Registration Table Open**
8:45 – 9:00 a.m.	**Day 1 Welcome Remarks: Why MathBio?** ***SEAN FAIN***, Assoc. Professor, Medical Physics, School of Medicine and Public Health, UW
9:00—9:15 a.m.	**Welcome by GE Global Research, MathBio Partner and Platinum Sponsor** Overview of collaborative efforts and opportunities in scale relevant research between GE Global Research and the UW.
9:15 – 10:15 a.m.	**Overview of Scale in Mathematics and Life Sciences** This introductory session presents both mathematical and bioscience perspectives on scale, and how issues of scale both challenge and advance scientific knowledge. ***Speaker: DAVID KRAKAUER***, Director, Wisconsin Institute for Discovery, UW; Professor of Genetics, UW; and External Professor at the Santa Fe Institute
10:15—10:30 a.m.	**Break**
10:30—11:45 a.m.	**Short Talks 1: Complexities of Scale** A series of short presentations by UW faculty members will highlight complexities of scale across a spectrum of current research endeavors in math and science. ***Moderator***: ***LAURENCE LOEWE***, Asst. Professor, Laboratory of Genetics, School of Medicine and Public Health, UW ***Speakers and Topics***: ***C. DAVID PAGE JR.***, Professor, Biostatistics and Medical Informatics, School of Medicine and Public Health, UW, *"Machine Learning from Clinical and Genomic Data"* ***CHRISTIAN CAPITINI, MD***, Asst. Professor, Pediatric Hematology, Oncology & BMT, School of Medicine and Public Health, UW, *"Tracking 19F-Labeled Natural Killer Cells by MRI"* ***CHRISTOS MARAVELIAS***, Assoc. Professor, Chemical and Biological Engineering, College of Engineering, UW, *"Pharmaceutical R&D Planning"* ***KALIN VETSIGIAN***, Asst. Professor, Bacteriology, College of Agricultural & Life Sciences, UW, *"Microbial Interaction Networks in Soil"*

11:45 a.m. – 1:15 p.m.	**Lunch Break** (attendees are on their own – lunch not provided by MathBio)
1:15—2:15 p.m.	**Keynote Presentation 1: *"Model Reduction: Exploiting Structure in Large-Scale Complex Systems"*** ***Speaker:* *Karen Willcox,*** Professor and Assoc. Department Head, Aeronautics & Astronautics; and Co-Director, Center for Computational Engineering, Massachusetts Institute of Technology ***Moderator*: *Michael Ferris*,** Professor, Department of Computer Sciences, UW and the Wisconsin Institute for Discovery
2:15 – 3:15 p.m.	**Panel 1 (Tetrad): Storing, Retrieving, and Managing Large-Scale Databases** UW-Madison and Medical College of Wisconsin faculty members discuss approaches to overcoming the challenges of scale and complexity in working with large research databases. **Moderator: *Jeffrey F. Naughton,*** John P. Morgridge Professor and Chair, Computer Sciences Department, UW ***Panelists:*** ***Christopher Re,*** Asst. Professor, Computer Sciences, College of Letters and Science, UW ***Jignesh Patel,*** Professor, Computer Sciences, College of Letters and Science, UW ***Daniel A. Beard,*** Professor of Physiology, Director of Center for Computational Medicine, Medical College of Wisconsin ***Umberto Tachinardi,*** Assoc. Dean, School of Medicine and Public Health, UW
3:15-3:30 p.m.	**Break**
3:30 – 4:45 p.m.	**Short Talks 2: Scales of Structure and Organization** Short presentations by campus faculty will highlight issues related to scales of structure and organization in current research efforts. ***Moderator: Jessica Flack***, Co-Director of the Center for Complexity and Collective Computation (C4), Wisconsin Institute for Discovery, UW ***Panelists:*** ***Eftychios Sifakis,*** Asst. Professor, Computer Sciences, College of Letters and Science, UW, *"Computer-aided Functional Simulation of Human Anatomy: Multi-resolution Traits, Algorithmic Challenges and Emerging Applications"* ***Darryl Thelen,*** Professor, Mechanical Engineering and Biomedical Engineering, College of Engineering, UW, *"Dynamic Simulation and Imaging of In Vivo Knee Mechanics"* ***Sebastien Roch,*** Asst. Professor, Mathematics, College of Letters and Science, UW, *"Large-Scale Phylogenetic Reconstruction from Genomic Data"* ***Timothy Rogers,*** Assoc. Professor, Psychology, College of Letters and Science, UW, "*Finding Distributed Needles in Neural Haystacks"*

4:45 – 5:00 p.m.	**Poster Session Highlights** A series of one-minute presentations will preview select posters in the Poster Session that follows. ***Moderator***: ***Jill C. Wildonger***, Asst. Professor, Biochemistry, College of Agricultural & Life Sciences, UW
5:00—6:30 p.m.	**Poster Session and Sponsor Tables** in the WID first-floor Atrium
5:00 – 6:45 p.m.	**Networking Reception** in the WID first-floor Atrium
	Dinner (on your own)
7:00 – 7:30 p.m.	**Video Screening** ***"Powers of Ten"*** and ***"Scale of the Universe"*** shown in the H.F. Deluca Forum and open to the public and MathBio attendees. Co-organized by the WID Town Center and MathBio4. ***Moderator:*** ***Rock Mackie***, Director Medical Devices, Morgridge Institute for Research
7:30– 8:30 p.m.	**Special Public Presentation** ***"The Arrow of Time and the Evolution of the Universe"*** Co-organized by WID Town Center and MathBio4 ***Speaker:*** ***Sean M. Carroll***, Physicist, California Institute of Technology ***Moderated by:*** ***Patty Loew***, Professor, Life Sciences Communication, College of Agricultural & Life Sciences, UW This talk, open to the public and MathBio4 attendees, is geared to captivate a broad audience. It will provide an intriguing perspective on the scale and evolution of the universe in terms those outside the field of physics will grasp and appreciate. The arrow of time is a central aspect of the physical world, from physics to biology. Dr. Carroll will discuss how it arises from the notion of entropy, how entropy is connected to cosmology and the Big Bang, and how the evolution of complexity relates to the evolution of entropy. A skilled moderator will guide questions after the talk to facilitate interactive dialogue with Dr. Carroll. Sean Carroll's research focuses on theoretical physics and cosmology, especially the origin and constituents of the universe. He has contributed to models of interactions between dark matter, dark energy, and ordinary matter; alternative theories of gravity; and violations of fundamental symmetries. Carroll is the author of *"From Eternity to Here: The Quest for the Ultimate Theory of Time," "Spacetime and Geometry: An Introduction to General Relativity,"* and the forthcoming *"The Particle at the End of the Universe."* He has been awarded fellowships by the Sloan Foundation, Packard Foundation, and the American Physical Society. His blog Cosmic Variance is hosted by Discover magazine.

DAY 2: Friday, October 19, 2012	
Time	**Presentations and Speakers**
8:30 – 8:40 a.m.	**Day 2 Welcome Remarks** ***Kevin Eliceiri,*** Director, Laboratory for Optical and Computational Instrumentation (LOCI), UW
8:40 – 9:40 a.m.	**Keynote Presentation 2** ***"Scaling Plant Growth and Shape: An Allometric Perspective"*** ***Speaker: Karl J. Niklas,*** Liberty Hyde Bailey Professor, Dept. of Plant Biology, Cornell University ***Moderator: Marisa Otegui,*** Assoc. Professor, Botany, College of Letters and Science, UW
9:40—10:50 a.m.	**Short Talks 3: Evolution and the Dimensions of Scale** UW faculty members make short presentations on groundbreaking life science and medical research related to evolution and scale. ***Moderator*: *David Baum,*** Professor, Botany, College of Letters and Science, UW ***Speakers and Topics:*** ***Colin Dewey,*** Assoc. Professor, Biostatistics and Medical Informatics, School of Medicine and Public Health, UW, "*Issues of Scale in Whole Genome Sequence Alignment and Visualization"* ***John Pool,*** Asst. Professor, Genetics, College of Agriculture & Life Sciences, UW, "The *Scale of Natural Selection's Influence on Genome-Wide Genetic Variation"* ***Nicole Perna,*** Assoc. Professor, Genetics, College of Agricultural & Life Sciences, UW, *"Assembling the Tree of Life: Genome-scale Phylogenetic Reconstruction of the Twisted and Tangled Enterobacteria Branch"* ***Audrey Gasch,*** Assoc. Professor, Genetics, School of Medicine and Public Health, UW, *"Network Inference of Yeast Signal Transduction upon Environmental Stress"*
10:50—11:00 a.m.	**Break**
11:00 a.m. – noon	**Panel 2 (Triad): Imaging and Epidemiology – a Case Study** A multidisciplinary UW medical research project is discussed, where problems in scale were addressed and overcome. ***Moderator: Oliver Wieben,*** Asst. Professor, Medical Physics & Radiology, School of Medicine and Public Health, UW ***Panelists:*** ***Sean Fain,*** Assoc. Professor, Medical Physics, School of Medicine and Public Health, UW ***Daniel Jackson,*** Asst. Professor, Pediatrics, Allergy Immunology & Rheumatology, School of Medicine and Public Health, UW ***Ronald Sorkness,*** Professor of Pharmacy, Medicine, and Pediatrics , UW

noon – 12:45 p.m.	**Lunch Break** (attendees are on their own for lunch)
12:45 – 1:45 p.m.	**Keynote Speaker 3:** ***"Characterization of Presence, Distribution, and Etiology of Pulmonary Pathophysiology via Quantitative CT"*** ***Speaker:*** ***Eric Hoffman,*** MD, Professor of Radiology, Medicine, and Biomedical Engineering, University of Iowa. ***Moderator:*** ***Scott Nagle,*** MD, Asst. Professor, Radiology, School of Medicine and Public Health, UW
1:45 – 2:00 p.m.	**Wrap of Sessions: Lessons Learned** ***Sushmita Roy,*** Asst. Professor, Biostatistics and Medical Informatics, School of Medicine and Public Health, UW; and Asst. Professor, Systems Biology, Wisconsin Institute for Discovery, UW