

Brandeis University Science Initiative

Mission Statement and Organizational Plan

March 2005

The science faculty at Brandeis University hold appointments in the departments of Biochemistry, Biology, Chemistry, Computer Science, Mathematics, Physics and Psychology. Hallmarks of Brandeis's science faculty are its high overall quality and its devotion to both research and teaching. Indeed, since the inception of the institution, a close link between world-class research and inspired teaching of students at all levels has epitomized the sciences at Brandeis. Further, in addition to a remarkable record of achievement within individual scientific disciplines, our faculty has a long-standing tradition of interdisciplinary work. These interdisciplinary connections have forged a highly interactive scientific culture which takes advantage of the relatively small size of the university to achieve an impact well beyond the sum of its parts.

As evidence of our faculty's eminence, we note that Brandeis ranks number two out of 3,000 colleges and universities in the United States in the percentage of faculty who are members of the National Academy of Sciences and the American Academy of Arts and Sciences, and fellows of the American Association for the Advancement of Science. Within the sciences, individual faculty members are regularly recognized as world leaders in their respective fields, frequently garnering such prestigious national and international awards as MacArthur Fellowships ("genius" awards), Howard Hughes Medical Institute Investigatorships and Benjamin Franklin Medals.

With the solid foundation of an outstanding faculty in the core disciplines, Brandeis is well positioned for interdisciplinary efforts. Our small faculty is entrepreneurial, interactive and agile. Further, because all the sciences are located within a single science complex, our faculty and their students have many more opportunities for intellectual collisions and cross-disciplinary excursions than would be the case at a larger institution.

Whereas the value of interdisciplinary research has only recently been emphasized on the national stage, interdisciplinary approaches have long been *de rigueur* at Brandeis. The Rosenstiel Center for Basic Medical Sciences, where biologists, chemists, physicists and biochemists share space and ideas, opened in 1973, while the Volen National Center for Complex Systems, which contains members of seven different departments, just celebrated its tenth birthday. In looking to the future, the science faculty recognizes the need both to maintain a strong disciplinary base and to foster ever more innovative connections between the traditional disciplines.

The infrastructure required to support modern scientific enterprise is wide ranging and in constant need of renewal. As elsewhere, this is the case at Brandeis. Therefore, the University has embarked upon a strategic initiative that concentrates on the sciences. Its foci are the support and enhancement of research coupled with innovative improvements in science instruction at both the undergraduate and graduate levels. New state-of-the-art research and teaching space combined with new shared resources will be central to the achievement of these goals.

Mission Statement and Objectives

While maintaining the strength and vitality of our core scientific disciplines is an ongoing commitment, we recognize that it is at the interface of disciplines that the most profound advances often occur. In our rapidly evolving world society, such interdisciplinary efforts are becoming ever more essential for both the development of new fundamental knowledge and for addressing the pressing national and international problems with which we all are faced. For the coming decade, therefore, our overall mission is to establish Brandeis as the leading university for visionary interdisciplinary research within the life, physical and information sciences. In doing so, we will maintain basic research as our primary focus, as this is the foundation for all advances in the sciences. At the same time, we will foster application of insights from basic research to real-world problems. We will do a superb job in training our undergraduate and graduate students by providing them with basic knowledge coupled with practical applications. We will instill in these students the abilities to reason critically, to think “outside the box”, and to integrate different ways of thinking as practiced by different disciplines. We will promote scientific literacy, as well as an understanding of the value of science in the broader community, including all Brandeis undergraduates. Finally, we see applying basic science to real-world problems and communicating the substance and importance of science as critical to the social justice mission of the university.

This mission will be accomplished by way of the following objectives:

- Enhance our reputation as a leading research university by building on existing strengths and fostering growth in emergent areas;
- Create a physical and intellectual environment second to none for both intradisciplinary and interdisciplinary scientific research and teaching;
- Broaden the interdisciplinary model to include contributions from the Social Sciences and the Humanities;
- Build a science complex that inspires the creative process and fosters innovation in both teaching and research;
- Equip researchers and students with cutting edge technological capabilities.

Strategic Initiatives

To further our mission and accomplish the aforementioned objectives, the Brandeis science faculty envision the following:

New Organizational Structures:

Pursue new interdepartmental, interdisciplinary research and/or teaching initiatives, some of which will include faculty outside the traditional scientific disciplines. These will serve to:

- Increase the visibility of the sciences at Brandeis;
- Advance our established role as a leader in the opening up of new fields;
- Provide exciting opportunities for students at Brandeis in emerging frontiers of science;
- Serve as magnets for funding opportunities, particularly for extraordinary resources that will drive the pace of discovery;
- Inform future faculty hires.

Changes in Physical Spaces:

Create a renovated and fully-integrated science complex with an exquisite new research building as its centerpiece. This re-imagined and re-engineered science complex will include:

- Updated and expanded undergraduate teaching facilities;
- State-of-the-art new and renovated laboratory space for individual research groups;
- The capability to easily reconfigure research and teaching space as dictated by future needs without costly renovations;
- More optimal arrangement of laboratories so that research groups with mutual interests are adjoining where possible;
- Improved possibilities for "random collisions" through:
 - better physical connectivity of the science complex
 - creation of a shared eating/socialization space (Science Café).
 - increased use of common facilities and equipment

Enhanced Capabilities:

Add new physical and intellectual resources that will enable us to aggressively pursue our envisioned research and teaching objectives:

- New shared resources [e.g., supercomputer cluster; mass spectroscopy facility; transgenic animal facility; functional MRI (fMRI) facility; nanotechnology fabrication facility];
- Additional expertise in applied computational and mathematical sciences.

Changes in the Training of Students

Redesign and update our undergraduate and graduate curricula to better emphasize interdisciplinary work. Furtherance of this goal will be facilitated by:

- Innovative design of teaching labs that are maximally adaptable for cross-disciplinary instruction;
- Better use of computational and simulation models for the teaching of science;
- Development of a more formal method for interdepartmental assessment of teaching needs and teaching assignments;
- Improved financial support mechanisms and physical space for existing interdisciplinary teaching programs such as Genetic Counseling and Environmental Studies;
- Establishment of new interdisciplinary degree programs.

Improved Internal Funding Resources:

Empower the academic administration to fertilize, continually and proactively, the scientific enterprise at Brandeis by establishing permanent funding streams for the following ever-present needs:

- Competitive startup packages for new faculty hires;
- Matching funds for shared instrumentation grants;
- Attractive counter offers for resident faculty being courted by other institutions;
- A "target of opportunity" fund to enable Brandeis to pursue unanticipated hiring opportunities, including at the senior level;
- A "brain trust" investment fund for facilitating the development and implementation of new and innovative ideas.

New Interdisciplinary Research and Teaching Initiatives

This section contains outlines for several new research and teaching initiatives currently being explored by the Brandeis science faculty. These initiatives are already serving to organize our faculty in new ways and galvanize their thinking as to what short- and long-term future innovations in teaching and research are both desirable and feasible at Brandeis. Likely outcomes of these initiatives will be creative new research and teaching enterprises supported by joint applications for new funding opportunities. One or more of these initiatives may also result in the formation of a new interdisciplinary Center, as currently epitomized by the Rosenstiel Center for Basic Medical Sciences, the Volen National Center for Complex Systems, and the recently established National Center for Behavioral Genomics. Any such Center would likely comprise both physical and virtual components. "Physical components" might include shared research and/or teaching resources (see Organizational Plan), core office space for the Center, lounge space for students associated with the Center, and offices for some affiliated faculty members. "Virtual components" refers to affiliated faculty and facilities not directly housed within the above-mentioned physical space. The scope of the physical components of any Center will be dictated by the needs of that Center and the physical practicalities and limitations of the Science Complex as a whole.

In addition to a description of the already established **National Center for Behavioral Genomics**, the following pages include brief descriptions of the following interdisciplinary research/teaching initiatives currently being pursued:

- **Aging and Neurodegenerative Diseases;**
- **Nature's Nanomachines;**
- **Chemical and Biological Catalysis;**
- **Scientific Informatics;**
- **Nonlinear Dynamics;**
- **Physical and Applied Mathematical Sciences**

All of the above listed initiatives are based on existing strengths at Brandeis. However, in light of the pace of change in the sciences, we envision a flexible structure that will allow for the emergence of further initiatives in coming years. Indeed, one of the keys to Brandeis' success has been its ability to identify and capitalize on new opportunities as they arise both within and at the intersection of disciplines. For example, one area that we hope to cultivate more vigorously in the future is an expanded **Environmental Studies** program that takes full advantage of the unique combination of intellectual resources available across the university.

National Center for Behavioral Genomics

The Brandeis National Center for Behavioral Genomics is an outstanding example of an initiative that has evolved into a center. As such, it serves as a model for how some of the initiatives described below might develop. It started as an area of emphasis among faculty in biology and psychology who were interested in the genetic basis of sleep, aggression, learning and memory and other aspects of what is generally referred to as behavior. As it grew into a network of collaborative interactions it became able to attract independent funding at the highest levels. As a National Center, it has now been in existence for more than five years. Its strategy is to apply the information from the human genome project and other genetic advances and link these genomic tools to molecular, cellular, and systems analyses of brain functions. The goal is to understand and identify treatments for complex behaviors, dysfunctions, and diseases.

The Center aims to train a new generation of researchers in the cutting-edge technologies necessary to understand the genesis of human behaviors. Through this interdisciplinary research and training Center, Brandeis is integrating its internationally recognized strengths in genetics and molecular biology, biological rhythms, structural biology, behavioral neuroscience, neural networks, psychology and cognitive science. Practical applications of the Center include an understanding of specific behaviors: the mechanisms of learning and memory, the molecular basis of cognition, mental diseases and the identification of new, psychoactive pharmacological agents. There is also a specific, dedicated focus to advancing our understanding of sleep, its regulation and its function(s).

Although many of these areas of interest address pathological conditions or disabling disorders, there are aspects of the Center programs that have an impact on an even larger fraction of the human population. Stress management and the relationship between stress and performance are of interest to many different segments of society. Violence is poorly understood and has a remarkable impact on human society throughout history. There is practical as well as academic interest in distinguishing and characterizing different forms of learning and memory.

Our enhanced understanding of the biochemical basis of behavior is already having tremendous consequences. We know, for example, that many mental illnesses have a chemical etiology and that there is a genetic predisposition for many neurological and psychiatric diseases. There are many different kinds of school learning; some may suit certain individuals better than others. For example, rote learning is virtually unexplored from a neurobiological perspective. What impact does it have on brain function and other forms of learning and memory?

The practical applications of the research carried out in the Center include enhanced understanding and better ways of treating a number of specific behavioral problems. These include major depression, autism, hyperactivity, schizophrenia, personality disorders, learning disabilities, aggression, dyslexia, sleep disorders, circadian rhythms and jet lag, sleep impairment in aging, and a host of other specific traits and disorders. Understanding the genetic and biochemical basis of such behaviors will have a very positive impact on the preservation of mental health and on enhancing education of young as well as adult workers – both here and abroad. All of these applications are also relevant to many national security and defense issues.

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The Center aims to contribute to the development of new diagnostic and therapeutic strategies for a wide variety of neurological and psychiatric disorders and dysfunctions. With the realization that there is often a more gradual, heterogeneous distribution between “healthy” and “ill”, these new diagnostic and therapeutic tools should be able not only to reduce morbidity but also to improve quality of life for a large fraction of the human population.

Current core faculty:

Michael Rosbash	(BIOL)
Susan Birren	(BIOL)
Leslie Griffith	(BIOL)
Don Katz	(PSYC)
Sacha Nelson	(BIOL)
GinaTurrigiano	(BIOL)

Other possible participants:

Jeffrey Agar	(CHEM)
Jeffrey Hall	(BIOL)
John Lisman	(BIOL)
Eve Marder	(BIOL)
Piali Sengupta	(BIOL)
Kalpana White	(BIOL)

Aging and Neurodegenerative Disease

The Aging and Neurodegenerative Disease initiative is composed of Brandeis faculty and their research teams who are investigating the process and consequences of aging. This initiative will serve both as a focus for work currently being conducted on campus and a means of attracting support from a wide variety of sources. Additionally, it will strengthen interdisciplinary interaction among existing Brandeis faculty in the life and social sciences whose work focuses on or includes aging.

Research within this interest group will span all levels, from the molecular, cellular and systems-level functioning of the brain and nervous system, to the levels of individual and societal impact and social policy. As such, the group will span numerous departments in the Schools of Science and Social Science. Currently envisioned participants are:

Dorothee Kern	(BCHM)	Biochemistry of Alzheimer's Disease
Tom Pochapsky	(CHEM)	Biochemistry of Alzheimer's Disease
Dagmar Ringe	(BCHM/CHEM)	Neurobiology of Alzheimer's Disease
Kalpana White	(BIOL)	Neurobiology of Alzheimer's Disease
Greg Petsko	(BCHM/CHEM)	Neurobiology of Parkinson's Disease
Jeff Agar	(CHEM)	Mechanism of Lou Gehrig's Disease/ALS
Sacha Nelson	(BIOL)	Mechanisms of Neurodegeneration
Dan Oprian	(BCHM)	Retinal and Macular Degeneration
Liz Hedstrom	(BCHM)	Retinal and Macular Degeneration
Robert Sekuler	(PSYC)	Aging and Vision
Arthur Wingfield	(PSYC)	Aging and Memory
James Lackner	(PSYC)	Problems of Balance
Paul Dizio	(PSYC)	Problems of Balance
Margie Lachman	(PSYC)	Aging and Personality
Derek Isaacowitz	(PSYC)	Aging and Emotional Change
Aurora Sherman	(PSYC)	Health and Aging
Sarah Lamb	(ANTH)	Aging Across Cultures
Walter Leutz	(Heller)	Long Term Care Service Delivery

Nature's Nanomachines

For the ultimate in nanotechnology, one need look no further than the cell. Biological nanomachines are composed of protein, RNA and DNA molecules. They perform functions essential for cellular life, such as information storage and processing, intracellular cargo transport, and energy production. Thinking of these units as "machines" is a way of emphasizing that mechanical movement and force play central roles in the functioning of these biological devices. A particularly effective strategy for research in this field therefore involves cross-disciplinary collaborations between physicists, chemists and biologists. The Nature's Nanomachines initiative will promote these collaborations at Brandeis, serve as an effective tool for recruiting new science faculty, and provide an important element for attracting outside funding. It will also be a source of new ideas for interdisciplinary science courses at all levels.

Currently envisioned faculty organized around specific research interests are:

Michael Welte (BIOL), Bruce Goode (BIOL):

Assembly and dynamics of cytoskeletal machinery for organelle transport and cell locomotion.

Jeff Gelles (BCHM), Jane' Kondev (PHYS):

Assembly and dynamics of transcription regulatory complexes.

Melissa Moore (BCHM), Michael Rosbash (BIOL), Nikolaus Grigoriev (BCHM):

Assembly and dynamics of RNA splicing complexes.

James Haber (BIOL), Jane' Kondev (PHYS):

Chromosome and chromatin movement and reorganization.

Liz Hedstrom (BCHM), Dorothee Kern (BCHM), Anne Gershenson (CHEM), Tom Pochapky (BCHM/CHEM), Greg Petsko (BCHM/CHEM), Dagmar Ringe (BCHM/CHEM):

Macromolecular movement and dynamics in enzyme function.

Seth Fraden (PHYS), Jane' Kondev (PHYS):

Statistical mechanics of macromolecular complexes in solution.

Dan Oprian (BCHM), Ulrich Genick (BCHM):

Assembly and dynamics of sensory and signal transduction complexes.

Jeff Gelles (BCHM), David DeRosier (BIOL), Carolyn Cohen (BIOL):

Force generation and movement by motor enzymes.

Chris Miller (BCHM), Nikolaus Grigorieff (BCHM), Peter Jordan (CHEM), Judith Herzfeld (CHEM): Gating and regulation of ion channels.

Chemical and Biological Catalysis

Catalysts, molecules that speed up chemical reactions by hundreds or even millions of times, play essential roles in nearly all processes of biological and industrial importance. For decades, Brandeis scientists have been at the forefront of efforts to develop new chemical catalysts and to understand the mechanisms of biological catalysts (enzymes). Continuing progress in catalysis requires that disciplinary barriers in standard chemistry curricula be surmounted to meet the challenges of science in the 21st century. These barriers include the traditional divisions between organic, inorganic, physical, biochemical and analytical chemistry and the almost unconscious bias for solution chemistry over solid phase reactions. The great advances in chemistry are now at the interfaces between these subdisciplines, where scientists apply the lessons of enzyme catalysis to organic reactions, use organic ligands to modulate inorganic reactions and exploit the organization of crystals to direct reactivity. The principles and practice of catalysis can unify these usually segregated fields. By focusing specifically on catalysis, we hope to foster cross-disciplinary interactions and midwife the next generation of advances in chemistry.

Brandeis scientists rank at the forefront of biological catalysis, with internationally recognized research in enzyme structure/function, protein dynamics and redesign. A new generation of chemists now establishes Brandeis as a leader in chemical catalysis. Moreover, remarkable synergies exist between the biological and chemical catalysis programs. Organocatalysis has obvious parallels to enzyme catalysis. Though often unappreciated, the same is true for solid-state reactions, often thought of as the province of inorganic chemists. Organic chemists, inorganic chemists and biochemists at Brandeis investigate a common set of research themes in catalysis and utilize many of the same approaches: NMR spectroscopy, x-ray crystallography, mutagenesis and single molecule techniques. The Catalysis initiative will build on these natural synergies and propel this cross-disciplinary science to the next level.

Currently envisioned faculty:

Lizabeth Hedstrom	(BCHM)	mechanisms of enzyme catalysis
Li Deng	(CHEM)	development of new organocatalysts
Oleg Ozerov	(CHEM)	development of new organometallic catalysts
Jin-Quan Yu	(CHEM)	mechanisms of new organometallic catalysts
Bruce Foxman	(CHEM)	solid-state reactions and polymer catalysis
Seth Fraden	(PHYS)	catalysis of protein aggregation/crystallization
Jeff Gelles	(BCHM)	single-molecule investigations of biological motors
Ulrich Genick	(BCHM)	ultra-high resolution time resolved crystallography
Anne Gershenson	(CHEM)	single-molecule investigations of enzyme dynamics
Bruce Goode	(BIOL)	catalysis of biological polymer assembly
Dorothee Kern	(BCHM)	dynamics of enzyme catalysis
Melissa Moore	(BCHM)	mechanisms of RNA and enzyme catalysis
Gregory Petsko,	(BCHM/CHEM)	structure and mechanism of enzyme catalysis
Tom Pochapsky	(BCHM/CHEM)	structure of metalloenzymes
Dagmar Ringe	(BCHM/CHEM)	structure and mechanism of enzyme catalysis
Barry Snider	(CHEM)	development of radical catalysts

Scientific Informatics

Computation has moved into a critical core position in many sciences, in at least three different ways. First, computational modeling is used for developing theories about natural systems that are too complex to describe using pencil and paper equations. Second, embedded computing is at the heart of all new scientific instruments, from PET scanners to NMR. Third, given the reams of data from many new scientific enterprises, computing is the source of tools necessary for visualizing and analyzing the data. Many of the breakthroughs of the late 20th century, from space travel, to the genomics projects, to brain scanning technologies were built on Scientific Informatics.

The Scientific Informatics initiative will provide a new research and teaching hub within the re-engineered Science Complex. It will help focus numerous efforts at Brandeis using computation and informatics across all science departments and other interdisciplinary centers. It will manage a new supercomputer cluster. Associated faculty will teach both undergraduates and graduate students across the sciences about the latest tools in analysis, visualization, and modeling.

Faculty currently working in computational science, complex systems modeling and scientific informatics who might constitute the core of the Scientific Informatics initiative include:

Timothy Hickey, Computer Science
Jacques Cohen, Computer Science
James Pustejovsky, Computer Science
Jordan Pollack, Computer Science
Jim Storer, Computer Science
Richard Alterman, Computer Science
Xiao-Jing Wang, Physics
Eve Marder, Biology
Bioinformatics Hire
Nikolaus Grigorieff, Biochemistry
Dagmar Ringe, Biochemistry
Blake Lebaron, Economics
Ruth Charney, Mathematics
Irv Epstein, Chemistry

Nonlinear Dynamics

Nonlinear dynamics involves the study of how complex behavior, from ordered spatial patterns to temporal chaos, can emerge from the interaction of simple units. Remarkably, as revealed by the work of the last decades of the 20th century, many of the features of seemingly disparate systems are “universal”: the fractal structure that describes the coastline of a continent also characterizes the detailed organization of the human lung; the chaotic sequence of times between drops from a leaky faucet mimics the motion of the moons of the giant planets; the spiral structures that develop in an inorganic chemical reaction are identical to those seen in calcium waves in a developing frog egg or waves of electrical activity in a fibrillating heart. For this reason, nonlinear dynamics is ideally suited to the kind of interdisciplinary approach that characterizes science at Brandeis. Researchers who study complex physical, biological and social problems are developing and drawing on a powerful set of mathematical and computational tools from nonlinear dynamics, and Brandeis faculty are among the leaders in this conceptual revolution.

The Nonlinear Dynamics initiative will bring together Brandeis faculty from several departments and schools to exploit the methods and approaches of nonlinear dynamics. By coordinating efforts in apparently disparate fields, the initiative will provide a catalyst for the growth of new, synergetic collaborations, a vehicle for attracting new faculty and resources to Brandeis, and a means of organizing teaching efforts in this area.

Faculty who have expressed interest:

Bulbul Chakraborty, Physics
Milos Dolnik, Chemistry
Irving Epstein, Chemistry
Jané Kondev, Physics
Blake LeBaron, Economics
Eve Marder, Biology
Robert Meyer, Physics
Jordan Pollack, Computer Science
Robert Sekuler, Psychology
Anatol Zhabotinsky, Chemistry

Other potential faculty:

Rick Alterman, Computer Science
Seth Fraden, Physics
Bruce Goode, Biology
Don Katz, Psychology
John Lisman, Biology
Xiao-Jing Wang, Physics

Physical and Applied Mathematics

Mathematics is the common language for the natural sciences and quantitative social sciences. It unifies many disciplines that share common mathematical structures. The study of fiber bundles in algebraic topology is central to theories of elementary particles, and provides a useful description of bacterial motility. Nonlinear dynamics brings together mathematics, physics, biology, neuroscience, and economics. Furthermore, the problems, concepts, and viewpoints that arise from disciplines outside of mathematics feed back into mathematics itself; developments in string theory and gauge theory have led to significant progress in topology, algebra, geometry, and number theory. It is crucial that mathematical scientists in related disciplines can communicate both current results and the fundamental questions in each field.

The Mathematical Sciences initiative will bring together two broad areas of interdisciplinary mathematical science: (1) physical mathematics, and (2) applied mathematics. The physical mathematics component will examine the deep connections between theoretical physics and pure mathematics that arise in studies of the fundamental building blocks of the Universe. The applied mathematics component will foster interactions between faculty who apply mathematical models to problems ranging from cell biology to the financial markets. This interest group will provide a unique forum for faculty and students in the mathematical sciences to educate each other and to share ideas and results. It will be a wellspring of ideas for new interdisciplinary course offerings in the mathematical sciences.

Current faculty likely to be involved in the initiative, listed with research areas that are of interdisciplinary interest:

1. Physical Mathematics:

- Mark Adler (MATH): integrable systems and random matrices.
- Stanley Deser (PHYS): supersymmetry, classical and quantum gravity.
- Kyoshi Igusa (MATH): intersection theory on moduli spaces.
- Dmitri Kleinbock (MATH): dynamics, geometry, and number theory.
- Jane' Kondev (PHYS): conformal field theory.
- Albion Lawrence (PHYS): string theory and quantum field theory, mirror symmetry, mathematics of string compactifications.
- Bong Lian (MATH): mirror symmetry, vertex operator algebras.
- Alan Mayer (MATH): algebraic geometry, conformal field theory.
- Daniel Ruberman (MATH): geometry of four-manifolds.
- Howard Schnitzer (PHYS): string theory and quantum field theory, integrable models, conformal field theory.
- Harry Tamvakis (MATH): quantum cohomology.
- Ed Taylor (MATH): special holonomy manifolds and calibrated submanifolds.
- Pierre van Moerbeke (MATH): integrable systems and random matrices.

2. Applied mathematics:

- Bulbul Chakraborty (PHYS): granular matter, non-equilibrium physics.
- Irving Epstein (CHEM): pattern formation, oscillating chemical reactions.
- Ira Gessel (MATH): Discrete mathematics, theoretical computer science.
- Peter Jordan (CHEM): computational models of ion channel proteins.

- Jane' Kondev (PHYS): continuum mechanics of macromolecules and macromolecular assemblies.
- Albion Lawrence (PHYS): singularities in gravitational dynamics.
- Blake LeBaron (ECON): chaos theory, models of financial markets.
- Jordan Pollack (COSI): artificial life.
- Xiao-Jing Wang (PHYS): computational neuroscience.