

# CenterPiece

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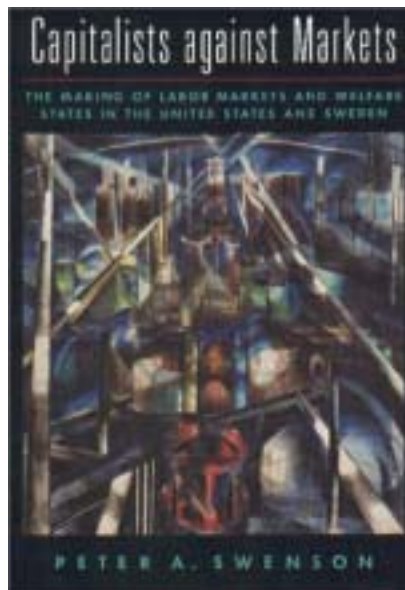
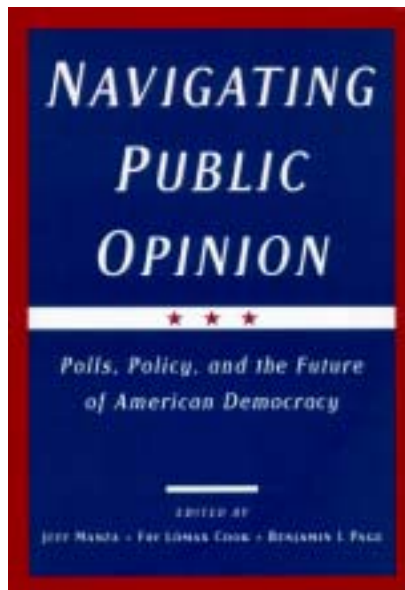
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## Cover Story

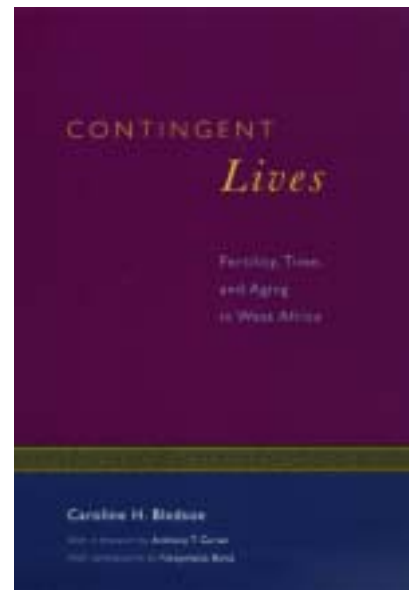
This issue's cover features recent titles from four University research center faculty. They are (clockwise from top, left):

**Manza, J., Cook, F. L., and Page, B. I.** (eds.) *Navigating Public Opinion: Polls, Policy, and the Future of American Democracy*. Oxford University Press, 2002.



**Ratner, M. and Ratner, D.** *Nanotechnology: A Gentle Introduction to the Next Big Idea*. Upper Saddle River, NJ: Prentice Hall PTR, 2002.

**Bledsoe, C. H.** *Contingent Lives: Fertility, Time, and Aging in West Africa*. The University of Chicago Press, 2002.



**Swenson, P. A.** *Capitalists against Markets: The Making of Labor Markets and Welfare States in the United States and Sweden*. Oxford University Press, 2002.

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# Life Sciences Collaborative Access Team receives funding

Two complementary research issues are emerging as structural biologists address the challenges of the “post-genomic” era. First is the significant effort directed towards the study of increasingly complex biomacromolecules and biological machines—basically, units in every living cell which have highly specialized functions and are large assemblies of proteins and nucleic acids. The ability to unravel very large biological atomic assemblies, or structures, is critical for understanding important biological processes at a molecular level. Recent stunning successes in determining the structure of the ribosome and of RNA polymerases demonstrate that scientists have tools to do this research.

The second issue emphasizes highly efficient acquisition of structural data and anticipates the enormous wealth of DNA sequence information that will fuel expression and characterization of a vast array of biomacromolecules.

Ultimately, the convergence of both research issues will result in a substantial collection of structural information that will have broad

applications in biological, pharmaceutical, and biotechnological research.

To address these issues, a consortium of academic and research institutions—Michigan State University, Northwestern University, University of Illinois at Urbana-Champaign, University of Michigan, University of Wisconsin–Madison, Van Andel Institute, and Wayne State University—developed the Life Sciences Collaborative Access Team (LS-CAT) that will be constructing research facilities at the Advanced Photon Source (APS) at Argonne National Laboratory.

Funding of \$9.3 million for construction of the initial crystallography x-ray beamline and \$2.7 million to support operations for five years will be provided by a grant from the Michigan Life Sciences Corridor (MLSC), a funding program administered by the State of Michigan Economic Development Corporation.

Design and operation of LS-CAT has been contracted to Northwestern University’s Synchrotron Research Center. This center, established in 1999 as a University research center, recognized Northwestern’s leadership in the DuPont–Northwestern–Dow Collaborative Access Team (DND-CAT), the first non-Argonne based CAT to begin construction and commissioning operations on the APS experimental floor. Center personnel have significant expertise in beamline construction and operations with a large variety of experiments, as well as academic and industrial user bases.

## Scientific objectives

LS-CAT scientists will lead research programs in cutting-edge structural biology that depend critically on the use of synchrotron x-ray sources, with special emphasis in four major areas:

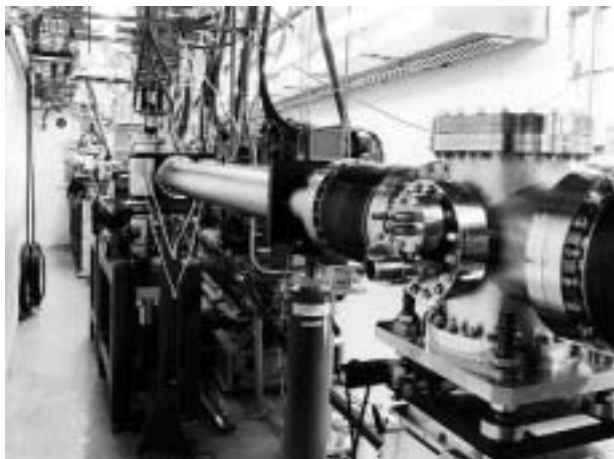
- membrane proteins;
- structures of enzymes and their biological function;
- multicomponent systems in cellular signaling and protein transport; and
- protein/nucleic acid complexes involved in genome replication, regulation, and expression.

Many of the researchers associated with LS-CAT have already reached the technical barriers of small crystal size (maximum dimensions of 20-80 microns) or large asymmetric units (300-500 kDa), which makes access to a dedicated synchrotron source essential to their scientific progress.

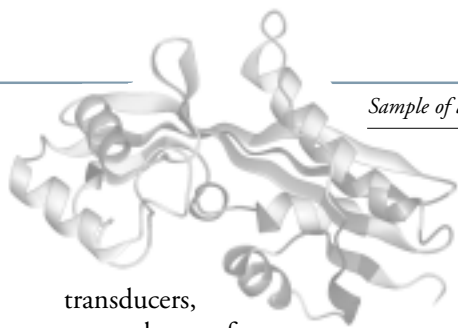
## Membrane proteins

Research conducted by LS-CAT scientists will place strong emphasis on structure-function analyses of intrinsic membrane proteins and membrane-associated macromolecular complexes. These entities present a number of technical challenges to structural biologists, but the challenges can be overcome with persistence and access to new and evolving technologies.

A major goal is to expand the relatively meager database of information about the folds, functions, and interactions of intrinsic membrane proteins or membrane-attached proteins that serve as pores, pumps, energy transducers, signal



Front end of a bending magnet. Photograph courtesy of Advanced Photon Source at Argonne National Laboratory.



transducers, or regulators of transmembrane traffic. For many of these proteins, disruption of native function can have important consequences that are often lethal to the organism. In mammals, dysfunction may lead to a specific disease state; for pathogenic bacteria, the ability to infect a host and reproduce can be seriously compromised. Hence, knowledge of the structural biology that underlies the function of biological membranes will eventually improve human health.

### Structures of enzymes and biological function

Enzyme structures, their biological function, and the relationships between the structures continue to provide fundamental data for studies of catalysis and for the design of new or simpler catalysts. Three-dimensional structures are uniquely able to define the conformational states and structural rearrangements that are often keys to enzyme activity



An insertion device beamline on the Advanced Photon Source (APS) experiment hall floor. Photograph courtesy APS at Argonne National Laboratory.

and its control by natural agonists and antagonists. This research has direct implications for drug discovery, from antitumor agents to novel antibiotics. Structural enzymology groups in LS-CAT examine multi-protein or multicomponent systems and reveal the structural changes that are the basis of regulation and control. Because enzymes are involved in essentially all biological processes, such research has the potential for making significant contributions to biomedical sciences and biotechnology.

### Cellular signaling and protein transport

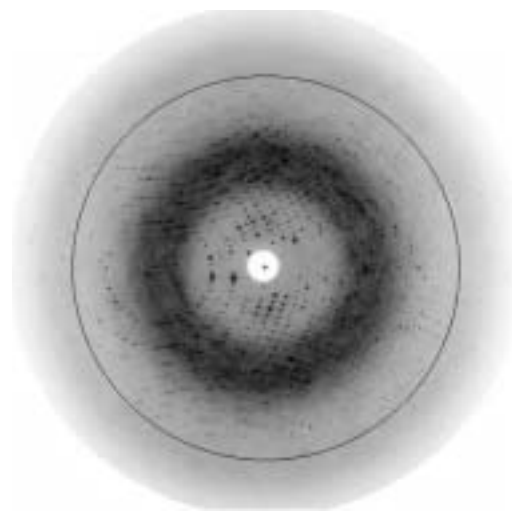
This research area overlaps with the other major scientific objectives. Cellular signaling—mechanisms for the transmission of signals within or between cells—generally involves the formation of large multicomponent structures. The cell surface receptors that play an important role in regulating the responses of a cell to its environment are membrane proteins, and the components of signal transmission pathways are often enzymes. Proper transport, targeting, and assembly of proteins are essential to get them correctly located. The proteins can then carry out their biological roles, and this requires multicomponent biological machines. Structural studies provide unique insight into how the parts of these machines are assembled and how they carry out their biological functions.

### Protein/nucleic acid complexes

Interaction of proteins with nucleic acids and formation of multiprotein-nucleic acid complexes are essential to the core biological activities of replication, transcription, translation, repair, and recombination. Determining structures of the components that function in these processes, and

the multicomponent assemblies they form, expands the understanding of these essential processes and leads to further discovery.

Protein-nucleic acid interactions are not made by simple lock and key design. There are differences and adaptations in both structures which optimize specificity and affinity. These conformational adjustments



Diffraction pattern obtained from a crystal of the *E. coli* DNA polymerase II at DND-CAT. A complete data set may contain hundreds of these images. The relative darkness of every spot is used in determining the three dimensional structure of the protein. Image courtesy of Wayne Anderson.

are very important in the formation of complexes and in enzyme activity. Therefore, ongoing structural studies are required for many different conformational states and complexes, which necessitates continuing, regular access to synchrotron radiation.

### New beamline construction

The primary x-ray beamline constructed in Phase 1 of the project will provide the most intense x-ray beam and the greatest flexibility for carrying out experiments.

To increase the capacity, additional experimental stations utilizing x-rays from the second undulator will be constructed in Phase 2. One

—see *LS-CAT*, continued on page 6

# New census research data center opens doors

After two years of planning, the Chicago Research Data Center (CRDC), housed at the Federal Reserve Bank of Chicago in the Loop, is up and running. The new research center, sponsored in part by the Institute for Policy Research (IPR), is offering qualified Chicago-area researchers access to a rich, relatively untapped source of Census Bureau economic microdata.

Following a stringent review process, researchers with approved projects will be allowed access to longitudinal data sets that cover business establishments and firms, as well as households and individuals. "The center paves the way for new explorations of countless subjects, from the effects of neighborhoods on family well-being to the relationship between medical expenditures and health," said IPR director Fay Lomax Cook. "For the first time, researchers will be able to delve into key data that just haven't been available in the Chicago area."

A research consortium that includes Argonne National Laboratory, the Federal Reserve Bank, Northwestern University,

The University of Chicago, and the University of Illinois at Chicago will provide funding of \$1 million to cover the operation of the Center and fees of approved researchers from their institutions over the next three years. In addition to IPR, Northwestern sponsors include the Center for the Study of Industrial Organizations, Kellogg School of Management, and Office of the Vice President for Research. IPR also received an award of \$300,000 from the National Science Foundation (NSF) to help support CRDC through 2005. After this initial three-year period, the planners expect the center to become self-sustaining.

U.S. law requires that the census microdata be kept confidential, restricting use of the data to secure Research Data Center (RDC) sites. Approved research projects must demonstrate scientific merit, satisfy stringent confidentiality requirements, and provide valuable feedback to the Census Bureau in order to improve its data programs. RDC operating procedures, strict security, and strong legal safeguards are designed to

protect the confidentiality of these data. Researchers must obtain special sworn status and become officers of the Census Bureau.

A governing board chaired by

Argonne National Laboratory economist Gale Boyd will review proposed projects for scientific merit, potential breaches of confidentiality, and other concerns.



Gale Boyd, CRDC chair.

"The CRDC will enable area scientists to conduct more powerful social research, while protecting the confidentiality of data," said statistics professor Bruce Spencer, IPR faculty fellow and principal investigator on the NSF grant.

Spencer points to a vast array of potential research topics that can benefit from use of the CRDC. Among them are energy, the environment, and economic activity; changes in structure of the U.S. and Chicago economies; technological and organizational change; information dissemination; jobs, unemployment, and work retraining; crime; health and child care; and immigration.

Several RDCs have been established since the Census Bureau's Center for Economic Studies was created in 1982 to handle access to microdata on businesses; CRDC is the first in the Chicago area. Other RDCs are located at the University of California, Berkeley; University of California, Los Angeles; Carnegie Mellon University; Duke University;

—see CRDC, continued on page 6



Left to right: Fay Lomax Cook, director of the Institute for Policy Research (IPR); Bruce Spencer, faculty fellow at IPR; Bhash Mazumder, executive director of the Chicago Research Data Center (CRDC); Daniel Sullivan, vice president and senior economist for the Federal Reserve Bank of Chicago; and Gale Boyd, economist at Argonne National Laboratory and CRDC chair.

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# Acting vice president for research appointed

Peter Dallos, John Evans Professor of Neuroscience, is serving as acting vice president for research. His appointment, announced in November 2002 by President Henry S. Bienen and Provost Lawrence B. Dumas, became effective January 1, 2003.

In making the announcement, Bienen noted that, "The breadth and depth of Peter Dallos' research and experience will serve him well in his new appointment, and we look forward to a smooth transition of leadership in an area that is critical to the University's future."

The importance of interdisciplinary research is well understood by Dallos, who holds appointments in the School of Communication, Feinberg School of Medicine, Robert R. McCormick School of Engineering and Applied Science, and Judd A. and Marjorie Weinberg College of Arts and Sciences. He is also a faculty

member in the Institute for Neuroscience.

Dallos, recognized for his work on the biophysics and neurobiology of the cochlea, is the author or editor of three books and more than 170 papers.

In an unusual collaboration of hearing science and molecular biology experts, he and other researchers recently cloned the gene *Prestin* (named after the musical notation *presto*) that is critical to the functioning of the outer hair cell, a sensory receptor cell unique to the inner ear of mammals and responsible for the ear's extraordinary sensitivity. Published in *Nature* in May 2000, the study significantly advances the understanding of the fundamental operation of the ear.

Dallos came to Northwestern as a graduate student shortly after leaving his native Hungary. He received his PhD in electrical (biomedical)



*Peter Dallos, Acting Vice President for Research*

© 2003 Photograph by Jim Ziv.

engineering from the University in 1962 and joined the Northwestern faculty.

He is a fellow of the American Academy of Arts and Sciences, Acoustical Society of America, American Association for the

—see *Dallos*, continued on page 6

## CenterPiece

Acting vice president for research  
Peter Dallos

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## University research centers

### Program of African Studies

[www.northwestern.edu/african-studies](http://www.northwestern.edu/african-studies)

### Center for Applied Psychological and Family Studies

E-mail: [family-institute@northwestern.edu](mailto:family-institute@northwestern.edu)

### Institute for Bioengineering and Nanoscience in Advanced Medicine

[www.ibnam.northwestern.edu](http://www.ibnam.northwestern.edu)

### Center for Catalysis and Surface Science

[www.northwestern.edu/catalysis](http://www.northwestern.edu/catalysis)

### Center for Functional Genomics

[www.genome.northwestern.edu](http://www.genome.northwestern.edu)

### Materials Research Center

[www.mrcemis.ms.northwestern.edu](http://www.mrcemis.ms.northwestern.edu)

### Materials Research Institute

[www.mrcemis.ms.northwestern.edu](http://www.mrcemis.ms.northwestern.edu)

### Center for Mathematical Studies in Economics and Management Science

[www.kellogg.northwestern.edu/research/math](http://www.kellogg.northwestern.edu/research/math)

### Institute for Nanotechnology

[www.nanotechnology.northwestern.edu](http://www.nanotechnology.northwestern.edu)

### Institute for Neuroscience

[www.northwestern.edu/nuin](http://www.northwestern.edu/nuin)

### Northwestern University Atomic and Nanoscale Characterization Experimental (NUANCE) User Facility

[www.nuance.northwestern.edu](http://www.nuance.northwestern.edu)

### Institute for Policy Research

[www.northwestern.edu/ipr](http://www.northwestern.edu/ipr)

### Center for Public Safety

[www.northwestern.edu/nucps](http://www.northwestern.edu/nucps)

### Center for Reproductive Science

[www.northwestern.edu/center-for-reproductive-science](http://www.northwestern.edu/center-for-reproductive-science)

### Center for Sleep and Circadian Biology

[www.northwestern.edu/ccbm](http://www.northwestern.edu/ccbm)

### Synchrotron Research Center

[www.dnd.aps.anl.gov](http://www.dnd.aps.anl.gov)

### Center for Technology Innovation Management

E-mail: [m-radnor@kellogg.northwestern.edu](mailto:m-radnor@kellogg.northwestern.edu)

### Transportation Center

[www.nutc.northwestern.edu](http://www.nutc.northwestern.edu)

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—*LS-CAT*, continued from page 3

line will be tunable in a restricted range and the others will be at fixed wavelengths.

A less intense, though fully tuneable, bending magnet beamline and experimental station is proposed for Phase 3.

All of the experimental stations will have the equipment necessary for state-of-the-art macromolecular crystallography experiments, including devices for accurate positioning of the very small crystals and for cooling the crystals to  $-270^{\circ}$  F. The diffracted x-rays will be recorded with high performance area detectors similar to those utilized in digital cameras.

## Operation and administration

A management board comprised of scientists and senior administrative officials selected by the LS-CAT members will have ultimate responsibility for overall operation of the CAT, including development and maintenance of its facilities. Northwestern University faculty members Michael Bedzyk, professor of materials science and engineering and physics and astronomy, and Theodore Jardezyk, associate professor of biochemistry, molecular biology, and cell biology, serve on this board.

Wayne Anderson, Northwestern University professor of molecular pharmacology and biological chemistry, is the scientific director of the facility. One of the principal tasks

of the director will be long-range planning and fundraising for development and maintenance of the new sector.

John Quintana, Northwestern University research scientist and associate professor, is the key onsite person and CAT manager, reporting to the scientific director and the management board. The scientific director and the manager will also rely on an external scientific advisory committee, comprised of knowledgeable experts in the field, and on a safety committee.

For further information contact John Quintana at [jq@northwestern.edu](mailto:jq@northwestern.edu) or Wayne Anderson at [wf-anderson@northwestern.edu](mailto:wf-anderson@northwestern.edu). □

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—*CRDC*, continued from page 4

and the National Bureau of Economic Research. Earlier this fall, an RDC was opened at the University of Michigan.

CRDC executive director Bhash Mazumder describes the new facility as “a win-win situation for researchers and the bureau.” The center will develop new data products and documentation for the bureau, while providing researchers with access to previously unavailable microdata.

Mazumder has used the census microdata in his own research to create a large intergenerational sample with earnings histories for fathers and their children for a project on intergenerational mobility. Another researcher used block-level data on characteristics of households—including income, education, and language proficiency—to explain observed racial segregation in a West Coast city.

New projects starting shortly in the Chicago RDC will tackle health

insurance and immigrant assimilation in the U.S. labor market.

The CRDC has three review cycles a year: January 15, May 15, and September 15. CRDC administrator Lynn Riggs is the liaison between researchers and the Census Bureau and will help with proposals. Contact her at [tlriggs@frbchi.org](mailto:tlriggs@frbchi.org) or by telephone at 312-423-4692.

Mazumder may be contacted at [bmazumde@frbchi.org](mailto:bmazumde@frbchi.org) or by telephone at 312-322-8166. □

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—*Dallos*, continued from page 5

Advancement of Science, and Institute of Electrical and Electronic Engineers.

Dallos' honors also include the Guggenheim Fellowship; Beltone Award; Amplifon International Prize; Jacob Javits Award; election to Collegium Oto-Rhino-Laryngologicum Amicitiae sacrum; Award of Merit from the Association for Research in

Otolaryngology; Honors of the Association from the American Speech, Language and Hearing Association; von Békésy Medal of the Acoustical Society of America; Sigma Xi Distinguished National Lectureship; Acta Otolaryngologica International Prize; McKnight Senior Fellowship; and Mirmelstein-Kresge Prize.

His service includes presidency of the Association for Research in

Otolaryngology and memberships on the National Institutes of Health (NIH) Study Sections and on the Council of the NIH Neurology Institute. He was founding editor-in-chief of *Auditory Neuroscience*; associate editor of *Trends in Neuroscience*, *Journal of Neuroscience*, and *Hearing Research*; and a member of several editorial boards. □



*Donor Rosemary Schnell.*

On October 14, 2002, donors, industrial partners, and University personnel gathered to celebrate the opening of the new Center for Nanofabrication and Molecular Self-Assembly (NAMSA), one of the first federally and privately funded nanotechnology facilities of its kind in the country. Over 200 guests attended the event, which was sponsored by the Institute for Nanotechnology, Judd A. and Marjorie Weinberg College of Arts and Sciences (WCAS), WCAS

development, and the chemistry department. The celebration included recognition of building donors Leonard and Mary Ginger, Rosemary Schnell, and Charles Shaw.

Following the short program, guests enjoyed a reception, attended an informational nanotechnology lecture—"Nano 101"—presented by NAMSA co-director Mark Ratner, and were given guided tours of the new building. □

## Opening celebration



*Donor Charles Shaw. Each of the framed recognitions was inscribed with the donor's name using dip pen nanolithography.*



*Donors Leonard and Mary Ginger (foreground) receive their commemorative plaque. They are pictured with (from left to right, back row) Lawrence Dumas, provost of Northwestern University, Chad Mirkin, director of Center for Nanofabrication and Molecular Self-Assembly (NAMSA) and Mark Ratner, co-director of NAMSA.*

# NUIN student receives major award

Northwestern University Institute for Neuroscience (NUIN) graduate Sharon Low-Zeddies was the 2002 recipient of the Lindsley Prize, awarded for the most outstanding PhD thesis in the general area of behavioral neuroscience submitted and approved during the previous calendar year. The winner of the prize was announced prior to The Grass Foundation Lecture held at the Society for Neuroscience annual meeting. An article based on Low-Zeddies' thesis appeared as a cover article in *Cell*, April 6, 2001.



Photograph courtesy of Sharon Low-Zeddies.

Sharon Low-Zeddies pictured with Lindsley Prize plaque.

In her thesis work, Low-Zeddies and her advisor, Joseph Takahashi, director of Center for Functional Genomics, found chimeric mice useful to study the effects of the *Clock* mutation on circadian rhythms. Chimeric mice are produced by combining two different embryos at an early developmental stage, thereby allowing researchers to study a mouse that contains a combination of both mutant/transgenic and normal (wild-type) cells in all of its tissues. Low-Zeddies and Takahashi were able to use *Clock* chimeric mice to learn about the mechanism by which circadian rhythms are generated by cells in the suprachiasmatic nucleus (SCN), which is the clock in the brain of mammals.

After receiving her PhD in 2001, Low-Zeddies was named a postdoctoral fellow in the Center for Functional Genomics. In 2002 she founded MusWorks, Inc., a company created to provide chimeric mouse-making services to biomedical researchers.

MusWorks received a Phase I Small Business Innovation Research (SBIR) Grant from the National Institutes for Health in 2001 to conduct preliminary research to show the feasibility of a chimeric mouse-making service company. Low-Zeddies, currently a visiting scholar at Northwestern, intends to submit a



"Chimera analysis of the effects of the *Clock* mutation on circadian behavior in mice," based on Sharon Low-Zeddies' thesis, appeared as a cover article in the April 6, 2001, issue of *Cell*. Reprinted from *Cell* 105, 25-42, ©2001 with permission from Elsevier.

Phase II SBIR this year, which she hopes will provide a mouse laboratory facility of her own.

Low-Zeddies' business venture was recently featured on *I-Street*, a technology business news Web site (see [www.i-street.com/featured/person/dzeddies.asp](http://www.i-street.com/featured/person/dzeddies.asp)). Contact her at [low-zeddies@earthlink.net](mailto:low-zeddies@earthlink.net). □

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