CenterPiece

A Quarterly Publication Featuring the Northwestern University Research Centers

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IN THIS ISSUE

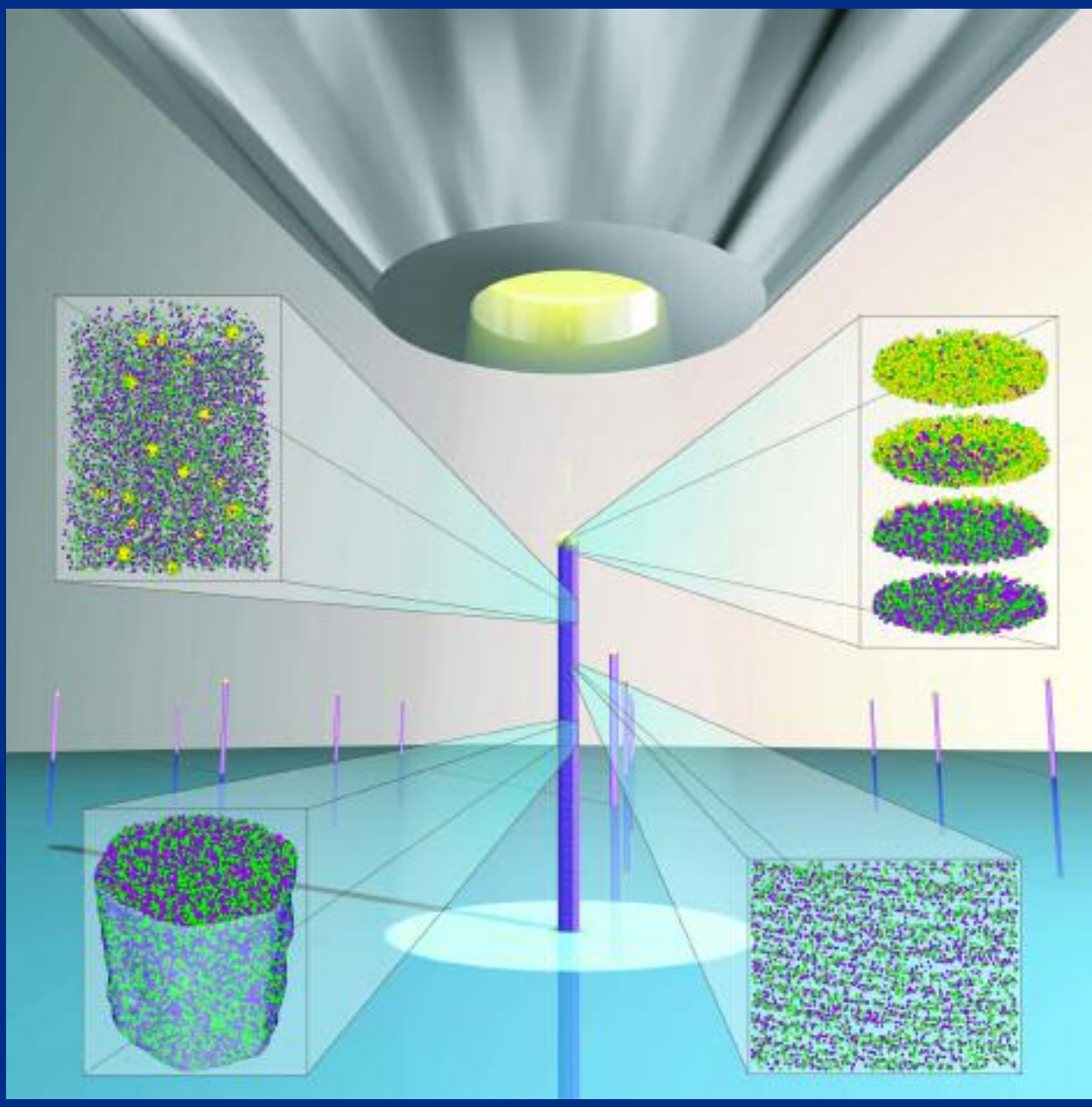


Image from "Three-dimensional nanoscale composition mapping of semiconductor nanowires using a local-electrode atom probe microscope." D.E. Perea, J.E. Allen, S.J. May, B.W. Wessels, D.N. Seidman, and L.J. Lauhon. *Nano Letters* 6:181-185 (2006). A full description of the image may be found on p. 10.

Mapping semiconductor nanowires

The central paradigm of material science is that the structure and composition of a material determine its properties. The properties of new nanoscale semiconductor materials, including quantum dots and nanowires, are fascinating and useful because the structures are small, but the precise composition of individual nanostructures can be extremely difficult to determine. As a result, the influence of nanoscale composition on properties and the connections between synthesis conditions and composition are often left to speculation. A research team led by Lincoln J. Lauhon, materials science and engineering, has shown how to fill this knowledge gap by mapping the composition of a single nanowire with single atom sensitivity and sub-nanometer resolution.

—see Mapping, continued on p. 10

Center is leader in reproductive sciences

The Center for Reproductive Research (CRR) at Northwestern University is one of 14 centers nationwide supported by the Specialized Cooperative Centers Program in Reproduction Research (SCCPRR) of the National Institute of Child Health and Human Development (NICHD). A research-based centers program designed to promote multidisciplinary interactions between basic and clinical scientists, SCCPRR seeks to improve human reproductive health through accelerated transfer of laboratory research into clinical practice. CRR has been a part of this program since 2003, when NICHD awarded the center a $5 million, five-year grant to fund three projects and an administrative core.

In its first three years, CRR has developed as a leader in reproductive science, bridging the gap between basic science and clinical applications. All three CRR-sponsored projects have made significant advances in the knowledge of reproductive hormones' structures and functions, as well as in unique applications of this knowledge to improve fertility. CRR also played a key role in establishing the Center for Families After Cancer, a new initiative specifically designed to provide more options for preserving the fertility of women diagnosed with cancer (see insert).

Project 1: Live birth of mice from follicles matured *in vitro*. Immature oocytes were matured in a three-dimensional alginate gel developed in the laboratories of Lonnie Shea and Teresa Woodruff, then used for *in vitro* fertilization. The fertilized eggs were placed into a foster mother that was of a different strain than the donor egg and sperm, resulting in babies with a different skin coat color.

In vitro *environment for maturing eggs*

The only option currently available to women at risk for infertility is freezing a mature, fertilized egg. This process takes up to six weeks, a delay of treatment that is not ideal for many women. CRR's first project, led by Lonnie D. Shea, chemical and biological engineering, and Teresa K. Woodruff, neurobiology and physiology, seeks to create an *in vitro* environment in which to mature follicles, or oocytes.

Shea and Woodruff have developed novel tools to grow immature eggs *in vitro* until they are fully mature and can be used for conventional *in vitro* fertilization. The immature oocytes are placed in a three dimensional bead of alginate where they can receive the necessary hormones and signaling for development and maintenance of their normal architecture. Working with Ralph Kazer and John X. Zhang, obstetrics and gynecology, CRR has established a clinical protocol that enables women to freeze an ovary and, potentially, participate in this experimental fertility treatment.

Technique successful with mice

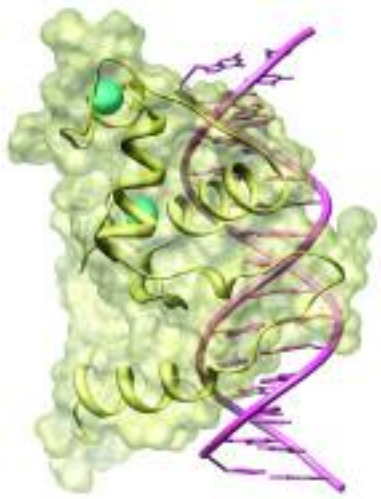
The latest development in this project is the birth of mice using the alginate technique. Postdoctoral embryologist Min Xu and his colleagues matured mouse oocytes with this technique, then proceeded with *in vitro* fertilization. The fertilized eggs were implanted into a different strain of mouse (a foster mother), creating babies that had a different phenotype than the mother and proving that the births were the result of the *in vitro* fertilization (see image, Project 1). Undergraduate Carrie Nieman is developing cryopreservation methods that are important for the application of this work to women.

Future research plans include working with the Oregon Primate Center to attempt this technique with a primate. Within the next few years, CRR hopes to enable women to bank eggs just as men bank sperm.

Specific transcription factors

Kelly E. Mayo and Ishwar Radhakrishnan, biochemistry, molecular biology, and cell biology, lead CRR's second project, which seeks to understand the interactions of specific transcription factors and to learn how their regulatory proteins mediate hormone-dependent gene expression in reproductive tissue. In one of this project's most recent developments, the Structural Biology Nuclear Magnetic Resonance Facility in the Weinberg College of Arts and Sciences was used to find the three-dimensional structure of steroidogenic factor 1 (SF1) bound to the promoter of inhibin-α (see image, Project 2).

Inhibin-α plays a key role in the maturation of follicles, while SF1, a member of the NR5A sub-family of nuclear hormone receptors, is considered a master regulator of reproduction because it controls a number of genes encoding reproductive hormones and enzymes involved in steroid hormone biosynthesis. Demonstrating SF1's interaction with inhibin-α is a major step toward understanding the workings of reproductive hormones and finding where faulty structures could cause problems with reproductive development.



Project 2: Three-dimensional structure of the DNA binding domain of steroidogenic factor 1 (SF1) bound to a physiologically relevant DNA sequence in the inhibin-α promoter.

Roles of hormones

The third project, led by Theodore S. Jardetzky, biochemistry, molecular biology, and cell biology, and Woodruff, examines the roles of the hormones activin, inhibin, and FSH (follicle stimulating hormone) in ovarian follicle maturation. Through a better comprehension of the structures, ligands, and properties of these hormones, potential defects caused by mutations can be understood.

Activin and inhibin are members of the transforming growth factor β (TGF-β) superfamily of peptide hormones/growth factors that regulate many cellular growth and differentiation processes. Activin and inhibin play a central role in the reproductive systems of animals through the endocrine regulation of FSH levels and paracrine actions in both the testis and the ovary. TGF-β ligands control diverse physiological processes important to organismal development, reproduction, and health.

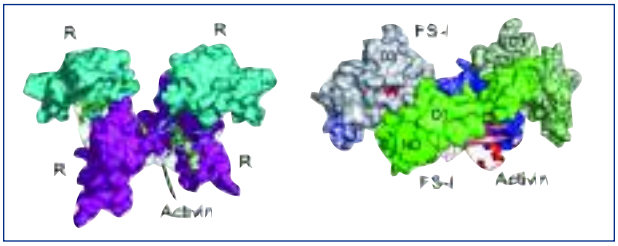
X-ray crystallographic studies

In order to provide a structural basis for understanding the specificity and function of TGF-β ligands and their interactions with receptors and antagonists, the Jardetzky and Woodruff laboratories have undertaken X-ray crystallographic studies of activin A complexes. They previously determined the crystal structure of activin A bound to the high affinity type II receptor, ActRIIB, revealing unusual flexibility in the ligand at its putative type I receptor binding interface.

In an important new development, Jardetzky and Woodruff have determined the crystal structure of activin A bound to the extracellular antagonist follistatin (see image, Project 3). In the complex, two follistatin molecules encircle activin, neutralizing the ligand by burying one third of its residues and its receptor binding sites. Previous studies had suggested that type I receptor binding would not be blocked by follistatin, but the crystal structure revealed that the follistatin N-terminal domain has an unexpected fold that mimics a universal type I receptor motif and occupies this receptor binding site. The mode of ligand binding by follistatin has important implications for its ability to neutralize ligands of this growth factor family.

Center research advances field

CRR continues to make great strides in the field of reproductive science, particularly in understanding the hormonal signaling and structures within the ovary and in finding new ways to maintain female fertility and eliminate infertility. For more detailed information about the center and its research, see www.northwestern.edu/crr/.



Project 3: Three-dimensional structure of activin A.

Center for Families After Cancer

The Center for Reproductive Research, in collaboration with the Robert H. Lurie Comprehensive Cancer Center and the Center for Reproductive Science, established the Center for Families After Cancer (CFAC), an all-encompassing center focused on helping cancer survivors maintain their fertility. In addition to creating the first follicle bank at Northwestern University, CFAC supports research on new fertility preservation techniques and addresses also the social, psychological, and ethical issues that cancer patients face in regard to their fertility.

CFAC goals

CFAC's four primary objectives are:

1) to encourage research that can protect or preserve fertility options for survivors of cancer;
2) to apply the research findings to clinical practice;
3) to understand better the decision-making process leading to patient acquisition of fertility options; and
4) to serve as an educational resource for cancer-caused, fertility-related questions by the community.

To achieve these goals, CFAC brings together leaders in fields ranging from oncology, assisted reproductive technologies, and medical ethics to communication and social policy. CFAC has also developed key interactions with faculty members in Cells to Society (C2S): The Center on Social Disparities and Health. Founded by P. Lindsay Chase-Lansdale, education and social policy and Institute for Policy Research, C2S brings together the social, life, and biomedical sciences in order to understand the origins and consequences of, as well as the policy solutions for, contemporary health inequalities in the United States.

Focus groups

To learn about the fertility decision-making process of women under the age of 21 who are diagnosed with cancer, CFAC has teamed up with the Survivors Taking Action and Responsibility (STAR) program at Children's Memorial Hospital and the Northwestern Medical Faculty Foundation. Focus groups of women (who were diagnosed before the age of 21) and their parents were used to determine what the patients and their parents remember learning about the risks of infertility at the time of treatment, what options they remember having been available to preserve fertility, and how this knowledge affected their decisions about treatment.

CFAC is also designing several projects with the national Childhood Cancer Survivor Study (CCSS) group, including a longitudinal study of ovarian reserve in childhood cancer survivors.

The Center will continue to expand, bridging clinical, laboratory, and social research to improve the reproductive outlook of cancer survivors. For more information, see www.cancer.northwestern.edu/CFAC/index.cfm.

Northwestern receives funding for premier cancer nanotechnology center

Northwestern University has been awarded an $18.5 million five-year grant from the National Cancer Institute (NCI) at the National Institutes of Health (NIH) to establish one of the country's first Centers for Cancer Nanotechnology Excellence (CCNE). The Center – the only CCNE in the Midwest – will develop innovative nanotechnology approaches and devices to combat cancer. Chad A. Mirkin, chemistry, medicine, materials science and engineering, and director of the International Institute for Nanotechnology, is the Center director. "This is a truly exciting opportunity," said Mirkin. "It is possible that nanotechnology will become one of the fundamental drivers in oncology and cancer research, and we are extremely excited about focusing our research in this direction."

Capitalizing on the existing partnership between the University's International Institute for Nanotechnology (IIN) and the Robert H. Lurie Comprehensive Cancer Center, CCNE will support highly multidisciplinary teams of nanoscientists, cancer biologists, engineers, and clinicians working collaboratively to develop nanomaterials and nanodevices for cancer therapeutics, drug delivery, imaging, diagnostics, and monitoring. The new Center will both draw and build upon previous research advancements and discoveries.

Steven T. Rosen, medicine and director of the Robert H. Lurie Comprehensive Cancer Center, is a member of the executive committee. "This new effort will build a bridge between scientists, engineers, and clinicians – all focused on advancing the application of nanotechnology for the diagnosis, early detection, and treatment of human cancer," observed Rosen. "I am confident that this effort will lead to new discoveries that will enhance the care of patients and lead to approaches that prolong life."

Technology and academic partners

Eighteen companies have expressed formal interest in partnering with CCNE to help transition new technologies into the private sector. Academic collaborators include The University of Chicago, University of Illinois at Urbana-Champaign, and Yonsei University, South Korea.

Equipment and facilities

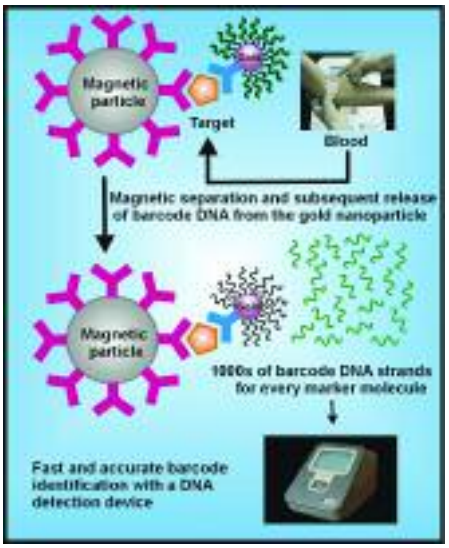
The Center will benefit from existing infrastructure, as well as from an extensive array of equipment, facilities, and laboratories. On the Evanston campus, Center researchers are housed in the four-story, 44,000-square-foot, state-of-the-art Center for Nanofabrication and Molecular Self-Assembly, which opened in 2002; the Hogan Biological Sciences Building; the Technological Institute; and the Pancoe-Evanston Northwestern Healthcare Life Sciences Pavilion.

On the Chicago campus, Center researchers will be housed in the Ward Building and the 240,000-square-foot Robert H. Lurie Medical Research Center, which opened in 2005.

Additionally, Center researchers will be able to utilize a wealth of instrumentation at 16 existing shared facilities, including the newly established Nanoscale Imaging, Fabrication, Testing, and Instrumentation (NIFTI) Facility on the Evanston campus and the Bioinformatics Core Facility and Biostatistics Core Facility on the Chicago campus.

Educational outreach

The Center will provide an array of educational and training programs to a diverse constituency. Speakers at seminars and symposia will disseminate research progress and results to the clinical oncology community and build effective bridges of communications between practitioners and researchers. A research program in the ethical and social implications of nanotechnology in translational research will be launched, engaging Center researchers with philosophers, social scientists, public policy makers, and the public. Graduate students and postdoctoral fellows will be involved in Center research at all levels, and curriculum enhancements are expected to reflect this new initiative.



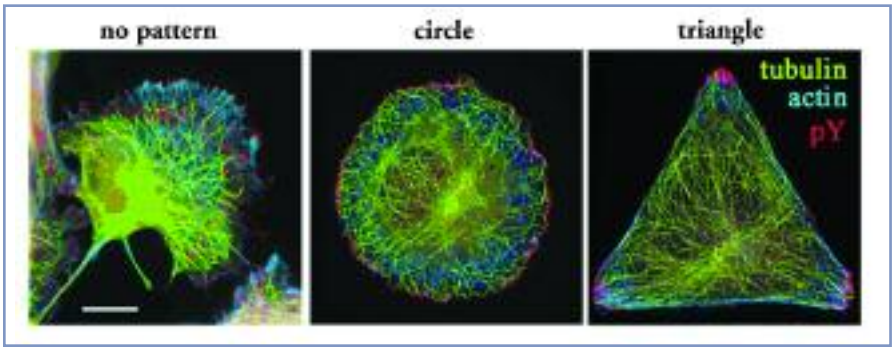
This image shows the bio-barcode process, which will be applied in Project 1 to the development of superior diagnostic tools for ovarian and, ultimately, other cancers. Image courtesy of the Mirkin laboratory.

Project highlights

Research in the Center is organized into six projects. Each team includes faculty with expertise spanning nanomaterial fabrication and characterization, cancer and cell biology, translational and clinical diagnostics, and detection and therapeutics.

Project 1: Development of barcode assays for the detection of ovarian cancer

Chad Mirkin is principal investigator. Co-investigators involved in the project are Teresa K. Woodruff, neurobiology and physiology; Julian Schink, obstetrics and gynecology; Annelise E. Barron, chemical and biological engineering; Gustavo Rodriguez, obstetrics and gynecology, Evanston Northwestern Healthcare Research Institute;



From Project 2: "Designer" cells on micro-patterned substrata. Focal adhesions (red) of melanoma cells self-organize at perimeter or vertices of circular or triangular patterns, respectively; scale bar, 10 mm. Image courtesy of the Borisy laboratory.

Diljeet Singh, obstetrics and gynecology; and Richard Van Duyne, chemistry.

In the U.S., ovarian cancer is the leading cause of death among all gynecologic cancers and is the fourth leading cause of female cancer deaths. If diagnosed early, the patient survival rate is 75-95%; the survival rate if diagnosed when advanced is only 31%. Unfortunately, 75% of women with ovarian cancer are diagnosed with advanced disease. Despite progress in the treatment of early ovarian cancer, there is no reliable tool for early diagnosis. The challenge undertaken by this research group is to develop a range of diagnostic tools to identify women with curable ovarian cancer.

These tools will rely on recent advances in ovarian cancer biomarkers and nanotechnology, as well as the application of nanoparticle-based, bio-barcode assay technology. The research team has access to the largest patient database of cancer patient samples for women at high risk for ovarian cancer available through the Northwestern University Ovarian Early Detection Program.

Project 2: Deconstructing directional cell motility in metastasis through nanopatterning

Gary G. Borisy, cell and molecular biology, is principal investigator. Co-investigators involved in the project are Bartosz Grzybowski, chemical and biological engineering; Chad Mirkin; M. Sharon Stack, cell and molecular biology; Steven Rosen; and Milan Mrksich, chemistry, The University of Chicago.

The major cause of death in cancer is from metastasis, which depends on the ability of cells to crawl. There is currently no approved therapeutic to target this fundamental process. The goal of this project is to develop anti-metastasis therapeutics using a novel approach that combines nanotechnology with molecular and cell biology. The rationale is to deconstruct the directional cell motility mechanisms that underlie invasiveness by controlling cell geometry. The premise of the approach is that control of cell geometry will allow researchers to elicit stereotypical structural and functional cell phenotypes characteristic of defined phases of the motility cycle. Arrays of essentially identical "designer cells" will provide a unique platform for probing complex directional motility mechanisms and for establishing high-content, translational screening procedures. This research has the potential to discover a new class of cancer drugs that will inhibit or reduce metastasis.

Project 3: Bioactivated nanoprobes for molecular imaging of cancer

Thomas J. Meade, chemistry; biochemistry, molecular biology, and cell biology; neurobiology and physiology; and radiology, is principal investigator. Co-investigators involved in the project are Jinwoo Cheon, chemistry, Yonsei University, South Korea; M. Sharon Stack; Steven Rosen; Vinayak Dravid, materials science and engineering and director of the Northwestern University Atomic and Nanoscale Characterization Experimental (NU*ANCE*) Center; and Alice Wyrwicz, Evanston Northwestern Healthcare Research Institute.

Molecular imaging is becoming an important tool in biological sciences and clinical arenas. In order to maximize the impact of these techniques, functional and far more sensitive contrast agents must be investigated and developed. The goal of this research group is to develop contrast agents for early staging of cancer that will be 10 to 100 times more sensitive than currently available, while simultaneously reporting on the physiological properties of lesions and tumors. The principle barriers to the development of new classes of contrast agents for noninvasive imaging of cancer can be summarized as: (1) amplification of the signal; (2) *in vivo* delivery; and (3) development of biochemical reporters. Recent advances in nanotechnology have demonstrated that the solutions to these problems may be at hand. By coupling the unique properties of nanomaterials that function as a platform-diagnostic with new types of biochemically activated probes, entirely new generations of contrast agents can be developed that are capable of detecting cancer at the cellular level in whole organisms.

From Project 3: A magnetic resonance imaging agent that is activated enzymatically. In the image on the left, the probe is "off" and in the image on the right, the probe is "on." The enzyme reporters can detect biochemical processes by molecular imaging. Image courtesy of the Meade laboratory.

Project 4: Nanoscale encasement and targeted delivery of multifunctional therapeutic agents for hematological cancer and solid tumors

Thomas V. O'Halloran, chemistry; biochemistry, molecular biology, and cell biology; and director of the Chemistry of Life Processes Institute, is principal investigator. Co-investigators involved in the project are Martin Tallman, medicine; William Bloomer, radiology; Seema Singhai, medicine; SonBinh Ngyyen, chemistry; Steven Rosen; Teresa Woodruff; Robert C. MacDonald, biochemistry, molecular biology, and cell biology; Warren A. Kibbe, Robert H. Lurie Comprehensive Cancer Center; Alfred W. Rademaker, preventive medicine; and George C. Schatz, chemistry.

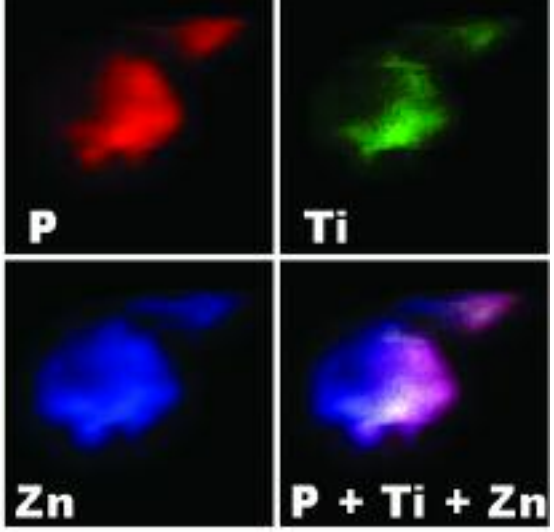
This team of investigators will develop novel multifunctional therapeutic and diagnostic agents encased in nanoscale delivery devices. The central goal of this project is to engineer and evaluate a variety of "smart" nanoscale cargo bins that can target cancer cells, bind to them, and subsequently unload more than 500,000 molecules of a cytotoxic or radiopharmaceutical agent. Agents will be evaluated in cell culture models for leukemia and multiple myeloma, as well as solid tumor models. The group is working to develop nanoscale cargo bin systems with the capacity to house biological agents, peptides, enzymes, and growth-inhibiting factors that impact a tumor and/or its immediate environment. Thus, these new materials have the potential to provide sustained therapy.

From Project 4: Concentrations of cytotoxic agents delivered. The liposome cargo bins are capable of containing large amounts of anticancer agents that should be enough to kill tumor cells, even if only a single liposome cargo bin enters a tumor cell. The project will further develop these nanoscale drug delivery devices to include a variety of therapeutic and diagnostic agents. Image courtesy of the O'Halloran laboratory.

Project 5: TiO_2 nanocomposites for targeted treatment and imaging of prostate cancer

Gayle E. Woloschak, radiology, and cell and molecular biology, is principal investigator. Co-investigators involved in the project are Zhou Wang and Chung Lee, urology; Thomas Meade; Tatjana Paunesku, radiology; Alice Wyrwicz; and Mark Ratner, chemistry.

This research group is working on development of new approaches to prostate cancer therapy to create nanocomposites that can be used for treatment of advanced prostate cancer and for imaging of disseminated prostate cancer cells. The investigators are working with titanium dioxide based nanocomposites (TiNCs) that belong to the category of bionanocomposites – nanometer-sized particles created by the conjugation of inorganic and "traditionally" biological molecules. The research focuses on the development of TiNCs to cleave specific DNA targets involved in prostate cancer cell growth and, when coupled with gadolinium (Gd) compounds, to image disseminated prostate cancer cells in mice using magnetic resonance imaging. The ultimate goal is to combine the imaging and treatment capabilities into a single nanocomposite.

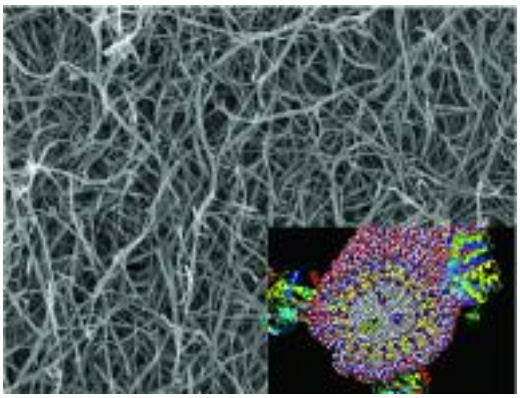


This photograph from Project 5 shows a nucleus from a cell that has been treated with TiO_2-DNA nanoparticles. The P signal shows the presence of phosphorus in the nucleus; the Zn signal shows zinc; and the Ti signal shows the TiO_2-DNA nanoparticles. The composite photograph is shown in the lower left image. Image courtesy of the Woloschak laboratory.

Project 6: Multifunctional nanostructures for therapeutic targeting of breast cancer

Samuel I. Stupp, materials science and engineering, chemistry, medicine, and director of the Institute for BioNanotechnology in Medicine, is principal investigator. Co-investigators involved in the project are Hamid Band, Evanston Northwestern Healthcare Research Institute; SonBinh Nguyen; Karl Scheidt, chemistry; William Gradishar, medicine; Elizabeth Wiley, pathology; Alfred Rademaker; Alice Wyrwicz; Warren Kibbe; and James F. Hulvat, materials science and engineering.

The mainstays of current breast cancer treatment are chemotherapeutic agents with substantial toxicity to normal tissues. Specifically targeting tumor cells would allow concentration of cytotoxic drugs in the tumor while reducing side effects. The goal of this research group is to generate ErbB2 receptor-targeted nanostructures to carry cytotoxic drugs and to test their efficacy as selective drug delivery vehicles against breast cancer cells *in vitro* and in an *in vivo* animal model. Three platforms will be designed: cylindrical supra-molecular nanofibers, copolymer spherical micelles, and nanostructure-loaded liposomes. While this project focuses on breast cancer, the strategy would apply broadly to other cancer therapies.



From Project 6: Supramolecular nanofibers observed by electron microscopy. Inset cartoon illustrates the nanofiber's molecular structure, showing small drug molecules encapsulated in the interior and targeting proteins bound to the surface. Image courtesy of the Stupp laboratory.

Joyce Foundation grant expands policy briefing series

Throughout its 38-year history, the Institute for Policy Research (IPR) has hewn closely to its core mission of producing policy-relevant research and disseminating its research results as widely as possible. A two-year grant from the Joyce Foundation is allowing expansion and enhancement of the Institute's policy briefing series, one of its key dissemination vehicles.

The grant has enabled IPR to organize three policy briefings per year. Two sessions are held in Chicago and a third in Washington, D.C. The 90-minute briefings take place over lunch and are open to the public. Additionally, the briefings have been rebroadcast online on the Illinois Channel, a public affairs station. Video and Powerpoint slides from the presentations may be viewed at www.northwestern.edu/ipr/events.

"Much of the policy-relevant research and data generated by universities never reaches those most in need of it, namely federal, state, and local policymakers," said Larry Hansen, vice president of the Foundation. "As a result, many important decisions are often driven more by anecdotes or ideological considerations than empirically based evidence. IPR's policy briefings represent a promising effort to address this all-too-common shortcoming."

"The briefings allow researchers and the public the opportunity to engage in two-way, mutually beneficial dialogue," said Therese J. McGuire, management and strategy. McGuire directs the policy briefing series. "It gives the experts on-the-ground insights that allow them to refine their research – and it gives policymakers, advocates, journalists, students, and other attendees the chance to hear and talk about the implications of the latest research and thinking on a particular topic."

IPR selects topics that reflect its faculty expertise and areas of policy concern. So far, four have taken place under the auspices of the Joyce Foundation grant.

Therese McGuire directs the Institute for Policy Research policy briefing series. Photography by Jim Ziv.

"Shaping Our Children's Future: How Policies in Child Welfare, Education, and Health Are Affecting At-Risk Children" took place in November 2004 and tackled three specific issues. Dorothy E. Roberts, law, spoke about insistent systematic biases in child welfare systems that are disadvantageous to children of color. P. Lindsay Chase-Lansdale, human development and social policy, discussed how a fully integrated pre-kindergarten to third grade in schools could improve educational outcomes. Kristin Butcher, a senior economist with the Federal Reserve Bank of Chicago, linked the rise in maternal employment and increase in the availability of junk foods in public schools to growing rates of childhood obesity.

In February 2005, three educational researchers explored "Inside the Black Box of Schools: Classrooms, Teachers, and School Leaders." James P. Spillane, education and social policy, pointed out that while the effects of school leadership are small, they can account for up to 25% of all school-level variation and tend to be stronger for the nation's most troubled schools. Spyros Konstantopoulos, education and social policy, discussed strong evidence indicating that small class sizes are more conducive to student achievement. Kim Rueben, a fellow at the Urban Institute, talked about indicators of teacher quality, the most important of which seems to be experience.

"The briefings allow researchers and the public the opportunity to engage in two-way, mutually beneficial dialogue."

"The Prison Effect: Consequences of Mass Incarceration for the U.S." took place in Washington, D.C., in May 2005. Jeff Manza, sociology and IPR's acting director in 2004/2005, discussed his recent research on how felon disenfranchisement relegates ex-offenders to second-class citizenship and makes it more difficult for them to reintegrate. John L. Hagan, sociology, discussed his finding that children with parents behind bars are at greater risk for becoming "institutionally disconnected" and that girls whose biological fathers are in jail are more likely to be homeless and sexually abused. In her research, Devah Pager, sociology, Princeton University, found evidence of employment discrimination; her study showed that black job applicants were only half as likely to receive a call-back from employers as equally qualified white applicants and had roughly the same chances as white applicants just out of prison.

In December 2005, IPR brought together three experts to discuss "The Evolution of the Social Safety Net – Change for the Better?" Rebecca M. Blank is dean of the Gerald R. Ford School of Public Policy and Henry Carter Adams Collegiate Professor of Public Policy at the University of

—see IPR, continued on p. 10

From Center initiatives and activities to global impact

The Center for International and Comparative Studies (CICS) is a dynamic institution at Northwestern that provides a broad platform for research and teaching on international affairs. Established in 1994, CICS became a University research center in September 2004. The director of the Center is Andrew Wachtel, Slavic languages and literatures and dean of The Graduate School.

Working to prepare global citizens

The world of the 21st century requires that universities take a broad global view of their activities: faculty and students must be knowledgeable and informed global citizens, and universities' expertise must be shared with the world at large. CICS encourages, supports, and coordinates research, academic programs, and other activities at Northwestern that relate to international affairs. Working with a variety of organizations and communities, CICS thereby makes an important contribution to preparing exemplary global citizens.

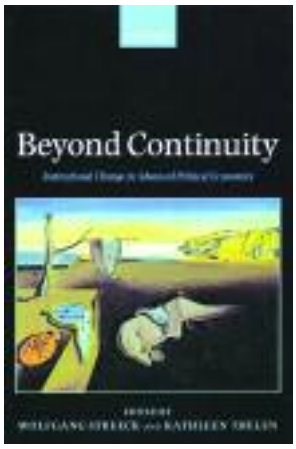
The Center sponsors and facilitates collaborative interdisciplinary scholarship on crucial problems facing the world today. Its activities promote dialogue on past, current, and future international affairs thereby enriching educational programming at Northwestern.

Forging a link with the Max Planck Institute

As part of its commitment to strengthen and expand scholarly dialogue with other prestigious academic and research institutions from around the world, CICS is undertaking initiatives to build and develop relationships with the Max Planck Institute for the Study of Societies (Max-Planck-Institut für Gesellschaftsforschung, or MPIfG). The premier social science institute within the prestigious Max Planck Society, MPIfG is located in Cologne, Germany, and is directed by Wolfgang Streeck and Jens Beckert. Emeriti directors include Fritz Scharpf and Renate Mayntz, both still active at the institute. MPIfG employs over 20 postdoctoral researchers and hosts numerous visiting scholars and doctoral students. The Institute's research program focuses on institutional analysis, comparative political economy, and public policymaking, with special strength in the political economy of advanced industrial societies and economic sociology. The Institute is recognized internationally in these fields and is considered by some to be the most important such institution of its size in Europe.

A number of Northwestern faculty and CICS associates have longstanding relationships with the Max Planck Institute and its directors, either through research visits or scholarly contacts. CICS faculty affiliate Kathleen Thelen, political science, enjoys a particularly strong link to the Institute.

In 2003, Thelen was honored with a Max Planck Research Award. The Award provides generous funding for joint projects with the Cologne Institute and other social science institutions in Germany. The first result of this collaboration was a book that Thelen co-edited with the MPIfG's director, Wolfgang Streeck. A collection of essays, *Beyond Continuity: Institutional Change in Advanced Political Economies* (Oxford University Press, 2005) was written by a distinguished set of authors from different disciplines to examine current theories of institutional change and their application to contemporary developments in advanced industrial countries.



In 2005, Thelen was appointed by the president of the Max Planck Society as one of the Institute's two permanent external scientific members.

In addition, Thelen is currently co-director of a working group at MPIfG on Institutional Complementarities and Institutional Change. The group is composed of seven postdoctoral researchers working on related questions of contemporary tensions and developments in several associated institutional arenas, including industrial relations, corporate governance, vocational education and training, and social welfare.

In spring quarter 2006, CICS will host Britta Rehder, one of the members of the working group and a researcher at MPIfG who studies comparative industrial relations, institutional change, and law and politics. She will conduct research at Northwestern on the impact of law and the courts on the evolution of German collective bargaining institutions. In this context, CICS will be hosting a workshop on the topic of "Institutional Change and the Law" to be held on April 7, 2006. In addition to Rehder, Thelen, and other CICS affiliates and Northwestern

Kathleen Thelen received a Max Planck Research Award. The Award was presented in Berlin by Rüdiger Wolfrum, vice president of the Max Planck Society.

professors from political science, sociology, and law, confirmed participants include Francesca Bignami (Duke University School of Law), Jack Knight (political science, Washington University), Howard Gillman and John Barnes (political science, University of California, San Diego), and Ryken Grattet (director of the Office of Research, California Department of Corrections and Rehabilitation).

In an exciting development, agreement was reached between the Northwestern sociology and political science departments and the Max Planck Institute to allow for an exchange of graduate students on a long-term basis. As part of founding a new International Max Planck Research School to train doctoral students, MPIfG invited three institutions (Sciences Po Paris, Harvard University, and Northwestern) to serve as partner institutions in such an exchange. Beginning next year, Northwestern and MPIfG have agreed to host one or two of each other's doctoral students for six-month stays in which the doctoral students may take classes and generally participate in the life of the host institution.

In addition, each year, a summer institute will bring together faculty and graduate students from all four participating institutions to discuss ongoing work. The summer institute will take place at each of the four campuses on a rotating basis.

Raising awareness about human rights

Co-sponsoring the Conference on Human Rights is an important CICS activity. Now in its third year, the conference arose from the commitment of a group of Northwestern undergraduate students to heighten public awareness about crucial human rights issues. The organizers have aimed to bring together various communities – not only from different geographic areas, but also from diverse backgrounds – that do not usually come into contact with one another. By virtue of the students' self-motivation and energy, a constructive dialogue

among distinguished academics, policy makers, activists, and the wider public, has begun to materialize.

The first conference examined U.S. policy during several major international human rights crises, including the 1994 Rwandan genocide and the ethnic cleansing campaigns in the Balkans during the 1990s. General Romeo Dallaire, former commander of the United Nations forces in Rwanda, and U.S. Ambassador Richard Holbrooke were among the presenters.

Last year's conference focused on U.S. policy regarding AIDS in the Developing World. The impressive panel of speakers included Bernard Kouchner, co-founder of the Nobel Peace Prize-winning organization Doctors Without Borders; Stephen Lewis, U.N. Special Envoy for HIV/AIDS in Africa; and Mark Dybul, Assistant U.S. Global AIDS Coordinator. Over 70 undergraduate delegates from 37 universities and colleges across the country attended and exchanged views with leading experts and policy makers.

Organizers have since expanded the conference to include an association of more than 500 students from 50 universities. This year's conference, to be held April 6-9, 2006, is entitled "Conference on Human Trafficking." It will focus on the modern slave trade in all its implications and complexities. The primary goal will be to raise awareness about the impact that students can have through the discourse of rights and advocacy in the service of social change. Organizers hope to broaden the dialogue on the tragic slave trade that pervades so many communities.

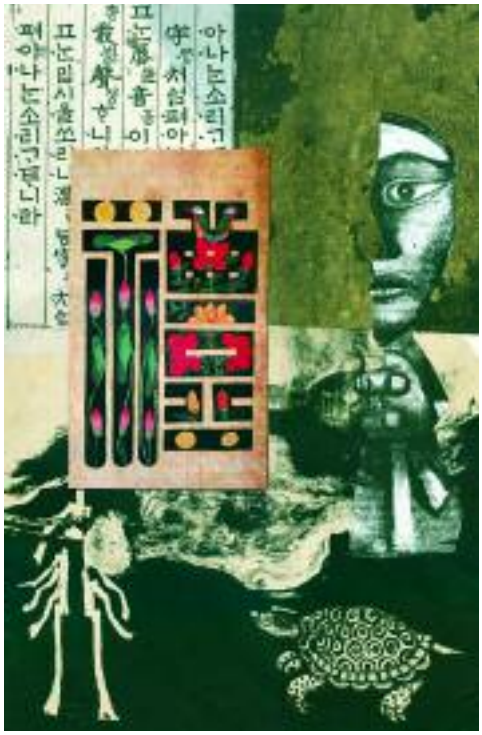
Additional related programming will expand the influence of the conference. This winter quarter, organizers put together a film series to attract interest and raise awareness prior to the conference. Complementing the film series, organizers will also mount an art exhibition at a local museum and offer a seminar for Northwestern students to expand and deepen their knowledge. After the conference, student delegates will be offered an extraordinary opportunity to turn their local experience into global action by participating in a two-week summer project with a non-governmental organization that specializes in combating human trafficking. For more information about the conference, contact Michael Chanin at m-chanin@northwestern.edu.

Contemporary exhibit recalls past injustice

Art exhibits can be powerful tools in educating and raising awareness of global problems. CICS supported and helped bring to Northwestern "Remembrance and Reconciliation: The Art of Tomiyama Taeko." The exhibit, held in January and February 2006 was curated by Laura E. Hein, historian and director of the Asian and Middle East Studies Program. It was also supported by Dittmar Memorial Gallery, Weinberg College of Arts and Sciences, and Northwestern's Department of History.

Born in Kobe in 1921, Tomiyama Taeko was raised in Japanese-controlled Manchuria. Her work deals with the

—see CICS, continued on p. 11



The Shaman's Prayer: Epilogue, mixed media, 2004, by Tomiyama Taeko.

—*Mapping, continued from p. 1*

To do so, they used a new local-electrode atom probe (LEAP) microscope housed in the Northwestern University Center for Atom-Probe Tomography (NUCAPT). David N. Seidman, materials science and engineering and director of NUCAPT, collaborated on the work.

A schematic of the LEAP microscope is shown in Figure 1. When a high voltage is applied to the conductive substrate, a very large electric field

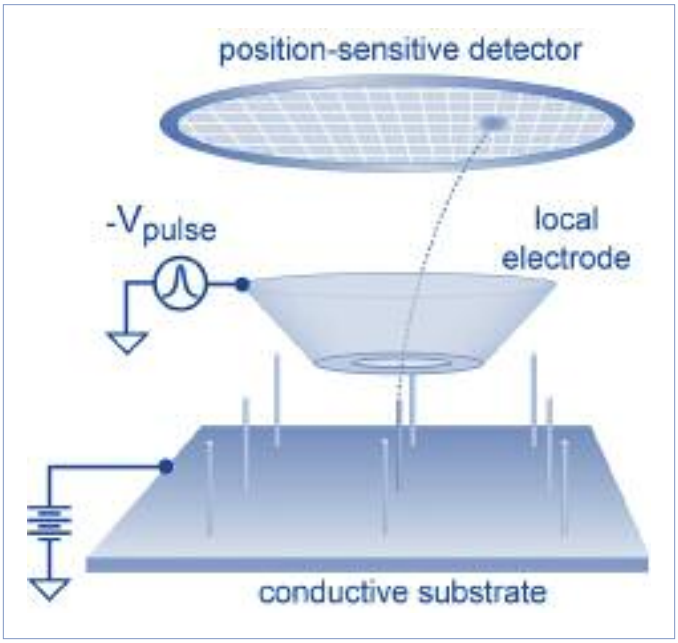


Figure 1

develops at the tip of the nanowires, and the local electrode enhances the field at the nanowire directly beneath it. This local electric field reduces the potential energy barrier that bonds an atom to the surface.

To dissect the nanowire precisely, atom by atom, sub-nanosecond voltage pulses are applied to the local electrode hundreds of thousands of times per second, leading to sequential field evaporation of single ions at the pulsing frequency. The chemical identity of each ion is determined by measuring how long it takes to fly to the position-sensitive detector; heavy ions take longer to make the trip.

Subsequently, the initial position of an atom on the nanowire tip is determined by reconstructing the flight path between the detector and the tip. In this manner, a three-dimensional reconstruction of the nanowire composition may be generated atom by atom with sub-nanometer resolution.

Cover image

In collaboration with Bruce W. Wessels, materials science and engineering and electrical engineering and computer science, Indium arsenide (InAs) nanowires were synthesized using chemical vapor deposition and gold catalyst nanoparticles.

In the image on the cover, representations of the three-dimensional data from various regions of an InAs nanowire are shown in the foreground panels.

In the upper right panel, tomographic slices through the catalyst-nanowire interface are shown with the In atoms green, As atoms purple, and Au atoms yellow.

In the upper left panel, one can see residual gold atoms left in the middle of the nanowire. The gold atoms are enlarged for clarity.

At the lower left, hexagonal faceting of the nanowire is observed, and the atomic resolution of LEAP microscopy is seen in the lower right panel with the appearance of atomic planes perpendicular to the vertical growth axis.

This work, which was supported in part by seed funding from the Materials Research Center, is featured on the cover of *Nano Letters*, February 2006.

—*IPR, continued from p. 7*

Michigan, Ann Arbor. She highlighted substantial behavioral changes brought about by welfare reform and the creation of Temporary Assistance for Needy Families (TANF); but the exact effects still remain unknown, and public assistance remains a work in progress. Leemore S. Dafny, management and strategy, reviewed the increase in Medicare enrollment and spending over the years and discussed how managing long-term care costs will be a key component to controlling its future growth. Melissa S. Kearney, a fellow at the Brookings Institution, spoke about helping to lift children out of poverty; the number of poor children receiving Supplemental Security Income has tripled since 1990 (while those receiving aid through Aid to Families with Dependent Children and TANF fell dramatically).

For more information about the policy briefings, or to join the IPR mailing list, access the web site at www.northwestern.edu/ipr/events.

CenterPiece

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This publication is available online at www.northwestern.edu/research/publications/centerpiece/.

Fox Story: Sending a Soldier Off to War, mixed media, 2004, by Tomiyama Taeko.

—CICS, continued from p. 9

themes of war and imperialism in the 20th century, reflecting in a compelling and extraordinarily sensitive way her life experience over the past 85 years. Through her art, she asks viewers to remember the suffering of those whose lives were destroyed and whose stories were silenced by history, particularly wartime forced laborers.

As an artist, Tomiyama draws on multiple histories and artistic traditions, mostly Asian but also Scytho-Siberian. A noted painter and printmaker, she has also collaborated with musician and composer Takahashi Yuji to create multimedia slide presentations. The exhibit presented some of her most recent work, constructed around the theme of remembrance and reconciliation. It included two of her collaborative projects with Takahashi: *Voices of the Sea*, which focuses on gender and forced sexual labor, and *Harbin: Requiem for the Twentieth Century*, a meditation on the attitudes that protect perpetrators from recognizing their own cruelty.

By highlighting forgotten people and cultures, Tomiyama hopes that remembrance of the world's multiple histories will lead toward cooperation for a more just, peaceful future and reconciliation after the cruelties of the past. For more information on the artist, see http://womeninjapan.com/tomiyama.htm.

For information on current activities and events at CICS, see www.cics.northwestern.edu.

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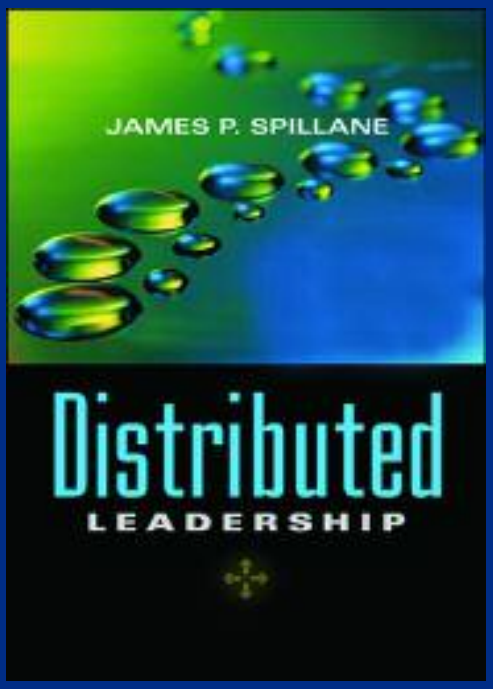
New books from Institute for Policy Research faculty fellows

Distributed Leadership explores how leadership practice takes shape in the interactions between leaders and followers in unique situations. A distributed perspective provides a lens for generating insights into how leadership is practiced, and helps practitioners think about and approach their work in new ways.

James P. Spillane, human development and social policy and learning science, is the leading expert on distributed leadership. He shows how leadership happens in everyday school practices, through formal routines, and informal interactions. He examines the distribution of leadership among administrators, specialists, teachers, and others, such as parents, in the school community. Spillane explains the ways in which leadership practice is stretched over leaders and followers through communications, routines, and tools such as memoranda, scheduling procedures, and evaluation protocols.

The book provides an overview of what it means to take a distributed perspective on leadership and offers an examination of various uses of the term, a summary of current research, illustrative examples, and helpful guidelines.

Spillane is principal investigator of the Distributed Leadership Project, a longitudinal study of urban school leadership funded by the National Science Foundation and the Spencer Foundation.



Much like doctors, economists have long sought to learn the effect of a "treatment" on some outcome of interest. A central practical objective of research on treatment response is to provide decision makers with information useful in choosing treatments. Often the decision maker is a social planner who must choose treatments for a heterogeneous population – for example, a physician choosing medical treatments for diverse patients or a judge choosing sentences for convicted offenders. But research on treatment response rarely provides all the information that planners would like to have. How then should planners use the available evidence to choose treatments?

This book addresses key aspects of this broad question, exploring and partially resolving pervasive problems of identification and statistical inference that arise when studying treatment response and making treatment choices. Charles Manski, economics, addresses the treatment-choice problem directly, using Abraham Wald's statistical decision theory taking into account the ambiguity that arises from identification problems under weak but justifiable assumptions. The book unifies and further develops the influential line of research Manski began in the late 1990s. It will be a valuable resource to researchers and upper-level graduate students in economics, as well as other social sciences, statistics, epidemiology, and related areas of public health and operations research.

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