Math Strengths Add Up to Big Impact

Flying aboard a 747 high above the Atlantic, the surface of a glass of wine remains perfectly flat, ostensibly proving that the plane is traveling in a straight line.

The reality, however, is that a person’s in-flight — or local — experience is far different than the global reality. The plane, of course, is not flying straight at all, but rather along an arched trajectory some 35,000 feet above the Earth’s curved surface.

Our world is a huge sphere, and from an individual’s limited vantage point the landscape seems pretty flat: think of the last time you noticed the planet’s curvature on your walk to Starbucks.

This perceived discrepancy between “local” and “global” topology is the hallmark of what’s known as a mathematical manifold — any smooth object that is continuous and locally resembles Euclidean, or flat, space. In mathematical terms, the Earth is a two-dimensional manifold situated in three-dimensional space.

This year, Northwestern’s Department of Mathematics continues to implement its multiyear plan to train students and postdoctoral fellows in the field of analysis. The efforts are part of a $2.18 million National Science Foundation Research Training Groups (RTG) grant.

Roughly, analysis is synonymous with calculus, but at a level well beyond any class by that name. The field is largely concerned with the study of differential equations, a pursuit that informs our understanding of manifolds and more. Most laws of physics are expressed through differential equations.

Researchers Race to Preserve Rare Orchid

Deep within one of America’s most inhospitable landscapes, Lynnaun Johnson finds himself staring at a “ghost.”

The *Dendrophyllax lindenii*, or ghost orchid, has a storied past. Travelers hoping to spot the most-recognizable native orchid in the United States have to traverse the alligator-infested swamps of South Florida. Still prominent in Cuba, the plant is listed as endangered in the United States, largely due to habitat destruction and over-collecting. Once prolific, the ornamental orchid’s
a differential equation, a mathematical approach to illustrate how a rate of change in one variable is related to other variables. For instance, if one wants to describe heat, waves, gravity, or elementary particles, she would use a differential equation. This makes the study of analysis central to many applications of mathematics — and most science and engineering.

**Building Careers in Math**

The RTG grant’s purpose is to encourage more students to pursue analysis and to strengthen America’s mathematics workforce. At Northwestern, the grant will support eight graduate students and several postdoctoral fellows over five years. This latest grant follows an earlier one and confirms the University’s excellence in this field.

“Our first RTG on mathematical physics in 2007 advanced the careers of a number of students who are now postdocs, faculty, and visiting scholars at top national and Midwestern research universities, such as Harvard and Kansas State,” says Ezza Getzler, a mathematical physicist and principal investigator of the analysis RTG. “The rarity of being awarded two of these grants in close succession illustrates the educational strength and research rigor within our department.”

Co-principal investigators of the RTG include mathematics faculty members Aaron Naber, Jared Wunsch, Laura DeMarco, and Ben Weinkove.

“The point of an RTG is to create a community of researchers around an already existing group of some strength; in this case, it’s our geometric analysis group,” says Department Chair Paul Goerss. “This group consists mostly of research mathematicians in the early- to early-middle stages of their careers with an upper trajectory to their work and reputations. They are well known already as rising stars, and the RTG is both a ratification of this and an indication that they are moving toward leadership roles within the international research community.”

Among activities funded by the RTG was the department’s recently concluded Summer School in Probability. The two-day workshop included lectures by scholars from Cambridge, Stanford, Georgia Tech, and other prestigious universities. The grant also helped fund the inaugural Graduate Research Opportunities for Women conference (see below).

“In recent years, students in pure mathematics have been drifting away from analysis and are over-represented in other areas of pure math, such as algebra, topology, and combinatorics,” says Weinkove, who studies differential equations on geometric spaces. “Given the centrality of analysis, and its deep connections to geometry, physics, and applications, this is an unfortunate trend and one that the RTG will help combat.”

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**More Women in Math Goal of Northwestern GROW**

For some, grappling with whether or not to attend graduate school can prove alarming: Which school is right? How much will it cost? What summer research opportunities might exist? Will they be funded?

“Rather than worry about all of these things, we want undergraduates to realize that they truly need to focus on learning the basics of mathematics and how to speak about math with passion,” says Ezza Getzler, mathematics.

To ease the transition into graduate school and to increase the number of women in the field, Bryna Kra, mathematics, spearheaded Northwestern’s Graduate Research Opportunities for Women (GROW) conference.

This year, GROW takes place October 14-16. The deadline to apply is August 31.

“The inaugural GROW conference welcomed 50 undergraduates to campus and of the six seniors who participated in 2015, all applied and were admitted to graduate school,” says Kra. “This year we anticipate 80 participants and we hope that, in the long run, the program will increase the number of women applying to and attending graduate school in mathematics.”

The conference will feature panel discussions on “Getting into Graduate School,” “Careers in Academia,” and “Research in Mathematics.” The event will also feature lectures by Nancy Rodriguez-Bunn, North Carolina State; Antonio Auffinger, Northwestern; Teena Gerhardt, Michigan State; and Dusa McDuff, Barnard. Learn more.
Research Note: Helping Investigators Navigate the Complex Regulatory Terrain

At Northwestern, we pride ourselves on our high-impact research contributions. Each day, our community of scientists and scholars makes discoveries that enhance our understanding of complex forces and leads to innovations that improve the world.

Such progress demands extraordinary thought leadership and a passion for creating new knowledge. Progress, to be sustainable, also requires an ecosystem governed by the appropriate framework. We know that our labs, classrooms, and workplaces can only deliver optimal results if the proper incentives, resources, and rules inform the research enterprise.

At the end of the day, the “boundaries” we set actually help us achieve success. These rules ensure that our research is conducted ethically and in compliance with regulatory requirements and societal norms. The Office for Research Integrity (ORI) at Northwestern plays a key role in ensuring that our research meets the highest ethical standards and minimizing the potential for problems that could hinder the University’s ability to produce transformative knowledge.

It is said that the various administrative units within the Office for Research function a little like air traffic control at a busy airport, or a lighthouse along rocky shores. We help our investigators navigate difficult regulatory terrain so that they can focus on their work. ORI is one office focused on helping the research community understand the increasing regulatory demands.

ORI’s mission is to promote research integrity and help researchers traverse the complex research compliance and administrative arenas. ORI conducts outreach within our academic community to increase awareness of research integrity issues, policies, and channels for reporting research concerns or potential research misconduct. ORI also functions as a confidential source for reporting research-related concerns, including potential falsification, fabrication, or plagiarism. The office manages investigations of alleged research misconduct to ensure that Northwestern’s research is conducted and reported with the highest level of integrity. ORI also coordinates quarterly research administration training and tracks compliance with the National Science Foundation’s responsible conduct of research (RCR) training requirements.

Exemplary research at Northwestern happens by design, not by chance. Everyone plays a part — from the frontline PIs to administrative support staff to department chairs, deans, and the vice president for research. Clarity about each role, and how they work together, helps the University operate with transparency and integrity. (Learn more on our Research Roles and Responsibilities website.)

The way I see it, Northwestern’s a place where we produce game-changing research while adhering to the rules.

Vice President for Research

Faculty Appointed to Named Professorships

The Northwestern University Board of Trustees has honored 62 faculty members by appointing them to named professorships. These endowed positions represent the highest honor a university can bestow upon its faculty and recognize exceptional academic achievement. View the list.
Origins: Exploring the Journey of Discovery
A passion for using data to solve challenges led Florian Zettelmeyer, marketing, to create a high-impact analytics program that harnesses University-wide expertise

At the start of the commercial Internet boom in 1996, Florian Zettelmeyer, marketing, then an MIT doctoral student, wrote a dissertation about how the Internet would likely change the competitive landscape for businesses.

Students wanted to learn everything they could about this new technology, and so early in his academic career Zettelmeyer taught a popular course about online marketing. By 2003, though, the Internet had gone mainstream, and Zettelmeyer no longer believed that a dedicated class on the subject was necessary. However, the Internet had clearly exerted a secondary effect: It allowed firms unprecedented insight into consumer behavior, a development that created additional competitive complexity — and opportunities.

So Zettelmeyer challenged himself to design a very technical, hands-on customer analytics course that would appeal to many students. It would focus on key problems — such as customer retention — and show how to use models to achieve success. “It worked very well,” he says. The course was highly rated by students while also being regarded as challenging and time intensive.

In 2008, the Kellogg School of Management recruited Zettelmeyer to join Northwestern, where he collaborated with other faculty also interested in teaching highly quantitative techniques with broad student appeal. Kellogg was well positioned to offer the latest insights about “Big Data,” when that term became popular in businesses worldwide. In fact, in 2011 Zettelmeyer approached Kellogg dean Sally Blount with a proposal to harness the strengths of the school’s portfolio of analytical offerings, streamlining and positioning them to meet student needs.

Since the coursework crossed many departments, one challenge was coordinating the curriculum to resolve any conflicts. Dean Blount, whose vision included creating

inter-departmental initiatives, charged Zettelmeyer with that effort. The result established the Program on Data Analytics at Kellogg, which helps prepare faculty to teach analytics. At the same time, Zettelmeyer helped found a data science initiative at Northwestern with colleagues throughout the University.

Research News spoke with Zettelmeyer to learn what encouraged him to become an applied economist and data scientist.

What was your earliest scientific project?
When I was 13, my dad, an agricultural economist who worked for the German government and United Nations, was part of an experimental farm trying to make Portugal’s agriculture more competitive with Spain’s. One of his jobs was to build out instrumentation for greenhouses, using HP workstations.

At that time — the mid-’80s — data recorded from instruments ended up in a legendary device: the HP 41C calculator. My father asked me to program the code to retrieve, store, process, and archive the data from the greenhouses. I wrote more than 1000 lines of code on the HP’s one-line display.

That began my love affair with programming. It was problem-solving that gave me the freedom to do things. With statistics, what happens a lot is that, even if you have all the right instincts, you fail in the last mile without a way to manipulate and transform data. If you’ve done some coding, you have an idea about what an interface looks like, which helps you analyze the data. You can take the problem, figure out how it works, and get it done. Today a lot of people are afraid of coding, but my early experience eliminated this fear and made coding fun.

Curiosity is central to scientific exploration. What sparks your curiosity?
I have a high need for storytelling — how to sequence an argument. As a child, I had a total fascination with fairy tales. I grew up in a household where argumentation was seen as a good thing, and the argument “this is how I feel about it and so you should accept that”
was insufficient. You needed to have reasons to support your views and you had to justify your reasons. For me, that’s how storytelling and debate coincide.

As a researcher, I always have in mind the idea that I’ll need to stand up and convince others why my conclusions are likely to be correct. So I need to have a story, an exposition of the results, to make a convincing case.

**What do you hope will be a positive outcome of your research?**

Many business institutions operate with little evidence-based decision-making. A particular weakness is that managers often fail to understand whether some piece of analytics supports a causal interpretation. One example of this occurs in the advertising measurement industry.

Despite a massive explosion of data in that field, it’s not clear that there has been a commensurate increase of insight. Some of my research examines how to improve industry measurement. If we succeed, we could potentially change industry practices to increase efficiency.

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**Gallio Honored for Innovative Brain Research**

The Pew Charitable Trusts have named Marco Gallio, neurobiology, as a Pew Scholar in the Biomedical Sciences. The neuroscientist is one of 22 Pew Scholars named this year nationwide.

Gallio uses the fruit fly as a model in which to study how the brain controls behavior, helping scientists better understand how sensory circuits work in human brains.

The 2016 class of Pew biomedical scholars is drawn from prestigious institutions across the country, with each early-career scientist receiving four years of flexible funding to pursue foundational, innovative research.

“I am humbled by this award — a lot of the scientists I look up to as role models have been recipients of this award in years past,” says Gallio. “This is fantastic encouragement for a junior principal investigator and pushes us to dare attacking more and more challenging scientific questions.”

Gallio’s goal is to understand how the world is represented within the brain during decision-making and how this representation translates into behaviors, such as attraction and rejection.

Read more.
Machine and Electronic Shops to Get Retooled as Construction Begins

Expansion and modernization of machine and electronics shops located in the Technological Institute will start in August with completion scheduled for August 2017. These improvements are the result of a faculty-driven task force that recommended better coordination, integration, and capabilities of shops on the Evanston campus to support research innovation and to provide a better training environment for students and postdocs.

These changes will impact the professional Instrument Shop (NG40), Physics Student Shop (NG36), Ford Design Shop, and Rapid Prototyping Shop. During construction, the professional Instrument Shop and Physics Student Shop will remain open, although there will be brief closures due to movement of instruments and walls. The Ford Shops will not be affected by construction.

The new Research Shop — managed by the Office for Research — will combine the professional Instrument Shop and Physics Student Shop by incorporating adjacent space currently occupied by the Masters in Biotechnology Program (NG29), which is moving to another location in Tech. The Research Shop will add personnel and equipment that will provide new capabilities, oversight of operations, CAD design, consulting service, and machining support to meet the research needs of faculty, staff, and students.

The new Electronics Shop — managed by the Chemistry Department — will incorporate the Electronics and Laser Systems Core facility, which will be relocated to space currently occupied by the Physics Student Shop. It will include safety enhancements and additional staff and equipment to assist faculty, staff, and students in the design and fabrication of electronic devices for research projects.

The Ford Shops will expand their services by including training for graduate students and postdocs. This revamped mission will allow these shops to develop training modules for researchers, coordinate training with the Research Shop, and enable access to specialty instruments such as the water jet and 3D printers.

“This shop expansion and integration is something our faculty were clamoring for, and it comes at a time when workspaces are becoming more popular with students,” says Phil Hockberger, assistant vice president for research. “Modernization of space and capabilities will enable our researchers to accelerate the process of moving ideas from design to implementation.”

ISEN-Exelon Partnership Will Accelerate Green Innovations

The Institute for Sustainability and Energy at Northwestern (ISEN) and Exelon Corporation are embarking on a five-year strategic research partnership to advance clean energy innovation.

“Scaling basic discovery energy science for systems-level innovation is a tremendous bottleneck for academia and industry alike,” says Michael R. Wasielewski, ISEN’s executive director. “Leading energy companies at the cutting-edge of our electric power grid, like Exelon, are ideal partners for Northwestern and its entire research enterprise.”

The Northwestern-Exelon Master Research Agreement will provide for an initial five-year research period focused on a robust project portfolio, including grid management and resilience, energy storage, and renewable technologies.

The partnership will streamline the process for evaluating, testing, and scaling scientific discoveries made in Northwestern labs for commercial use. Such progress could have an immediate, tangible impact on how energy is produced, transmitted, and consumed in the United States.

“Future sustainability and energy solutions lay at the intersection of science, policy, and economics,” says Jay Walsh, vice president for research. “ISEN is ideally positioned to lead Northwestern’s interdisciplinary commitment to these global challenges. This innovation-focused partnership with Exelon allows both organizations to capitalize on the tremendous scope of opportunity that exists as we transition to a 21st-century grid.”

Learn more.
Scientists Bridge Disciplines, Campuses at Biomedical Data Science Day

More than 150 people attended the Center for Data Science and Informatics's (CDSI) first Biomedical Data Science Day in early June.

The event included presentations on data science activities at the Feinberg School of Medicine. A networking lunch, breakout sessions, and a keynote lecture provided an opportunity for research collaboration and engagement among faculty, staff, and students from Northwestern, Northwestern Memorial Healthcare, Ann and Robert H. Lurie Children’s Hospital of Chicago, and the Rehabilitation Institute of Chicago.

“The day is really about building awareness and excitement about what is possible in biomedical informatics and data science,” says Justin Starren, chief of the Division of Health and Biomedical Informatics and director of the CSID in the Northwestern University of Clinical and Translational Sciences Institute. “We encouraged attendees to reach out to each other to learn about and take new approaches to their research.”

The daylong program presented various topics for discussion, including genomics, proteomics, natural language processing and text mining, statistics and social data, networks, and health.

“The presentations were fantastic and gave us a better understanding of what’s happening across Feinberg,” says Joseph Paris, associate director for research computing at Northwestern University Information Technology. “It was a great way to learn what people are doing.”

Read more.

Multi-factor Authentication Expands

Northwestern changed how our community logs in to several campus-wide systems to help protect University data and your personal information.

On July 11, Northwestern added Multi-factor Authentication (MFA), powered by Duo Security, to several University systems. These include NUFinancials, InfoEd, Business Intelligence System (Cognos), NUPortal, and CATracks. FASIS Self Service and NUPlans already use MFA. The Student Enterprise System (CAESAR) is planned to adopt MFA in October.

Multi-factor Authentication helps keep the University protected by adding a security step to confirm your identity before allowing access. You may have experienced this type of login security without realizing it, such as when accessing your bank account or Gmail account and receiving an email or text message with an access code to verify whether it is really you attempting to access your account.

“Email scams and attempts to ‘phish’ passwords have been increasing in frequency and becoming more sophisticated,” says Roger Safian, acting director of information and systems security/compliance at Northwestern Information Technology. “Multi-factor Authentication is one more addition to Northwestern’s arsenal of information security measures used to help keep online criminals from gaining access to University data and personal information — even if someone learns your NetID password.”

To prepare for this change, you’ll first need to register your phone with MFA. If you already registered with MFA to access FASIS Self-Service, you do not need to re-register. Check your registration status. Visit the Multi-factor Authentication at Northwestern page for additional information about the service, a quick guide, and answers to frequently asked questions. Northwestern IT has also created a series of registration how-to videos.

NRM Focuses on the Unseen

In the Spring + Summer edition of Northwestern Research Magazine we highlight some of the ways that our faculty explore the unseen. They do so from many perspectives: biological, cultural, literary, institutional, and aesthetic. For example, we show how Northwestern researchers are improving the world by revealing life’s building blocks and solving the mystery of cosmic forces; how researchers in a broad range of fields — sociology, philosophy, marketing, economics, medicine, and government — explore trust; and how ultramodern imaging can reveal the hidden story of artifacts. Read more.
SOFI Managing Director Delivers Keynote at United Nations Forum

Speaking June 6 at the United Nations Forum on Science, Technology, and Innovation in New York, Dick Co, chemistry, implored member states to create a global ecosystem where scientific breakthroughs can more easily result in scalable technologies.

The US Department of State invited Co, managing director of Northwestern’s Solar Fuels Institute (SOFI), to share his expertise in renewable energy. He joined other scientists, entrepreneurs, and executives to address the global challenges identified by the 2030 UN Sustainable Development Goals.

Co highlighted Northwestern’s research efforts to develop a cost-competitive, carbon-neutral solar fuel from sunlight, water, and air. SOFI is a one of four research centers within the Institute for Sustainability and Energy at Northwestern (ISEN).

“Answering the United Nations’ call for solutions will require that nations leverage existing infrastructures to turn scientific breakthroughs into scalable technologies and implement effective policies toward the Sustainable Development Goals,” says Co.

Co challenged UN member states to support and build on the innovations developed in their countries. Achieving the Sustainable Development Goals by 2030 “will require a paradigm shift in how science interfaces with technology and how it enables innovators from around the world,” he says.

Co proposed creating a classification system for innovation that links basic research output — measurements and data — to the Sustainable Development Goals. As one example, he cited the SOFI Knowledge Map, a unique database created at Northwestern to accelerate knowledge development and to catalyze innovation within any academic field, starting with solar fuels.

The SOFI Knowledge Map contains 60,000 entries from 100 countries and nearly 3,000 journals, providing researchers with intuitive access to a coherent, searchable knowledge database. The goal of the project is to capture 90 percent of all solar fuels research papers by 2018.

“Collectively, member states of the United Nations invest hundreds of billions of dollars a year in basic research at universities and government labs,” says Co. “With modern tools now available to us, we can create a better platform where science meets technology.”

Read more.

Schiltz, Chetkovitch to Create New Antidepressants

Collaborators from the Center for Molecular Innovation and Drug Discovery (CMIDD) and Feinberg School of Medicine have received a $1.15 million grant from the National Institute of Mental Health to develop novel antidepressant therapies.

Gary Schiltz, CMIDD director of chemistry, and Dane Chetkovich, neurology and physiology, have designed a screening approach to study a brain channel that could be targeted directly.

Major depressive disorder is one of the most common psychiatric diseases worldwide, yet up to half of all sufferers do not see symptom improvements with existing treatments.

Read more.

SA VE THE DATE
for the inaugural
State of LGBT Health Symposium
August 18, 2016
1–4 p.m.
From left: International Institute for Nanotechnology (IIN) Director Chad Mirkin and IIN Associate Director Teri Odom welcomed Director General Francis Gurry from the United Nation’s World Intellectual Property Organization (WIPO) to campus on June 16. Gurry was invited to visit Northwestern by alumnus and Board of Trustee member David Weinberg. WIPO is a global forum for intellectual property services, policy, information, and cooperation, and views nanotechnology as an innovation engine for the future.

**New Director Matz to Bolster University Facilities**

Northwestern has named Steven Matz director of facilities and planning, a newly created position within the Office for Research (OR).

Matz brings a wealth of knowledge and experience from both academic and industrial environments with special expertise in scientific lab renovations. For the past seven years, he worked as a project manager in the Office of Facilities Management.

“We are excited to welcome Steve to the OR leadership team,” says Philip Hockberger, assistant vice president for research. “Steve will be instrumental in providing guidance and counsel to OR leadership, deans, associate deans, department chairs, program directors, administrators, faculty, and staff as we continue to grow our research enterprise.”

Matz will lead an immediate assessment of existing space and needs of University Research Centers, core facilities, and OR administrative units. He will also oversee the strategic utilization of OR’s physical resources, encompassing 350,000 square feet of space in more than 20 buildings.

In his new role, Matz will participate in long-range OR space/facilities planning and programming; the formulation and implementation of space guidelines for OR; and coordination of renovations and moves. He will manage OR physical infrastructure projects in collaboration with schools, departments, programs, centers, and institutes as well as with the Office of Facilities Management, the Office of Risk Management, and others.

**Graslie to Deliver Keynote Talk at ComSciCon**

The public is invited to attend a free keynote address by the Field Museum’s Emily Graslie at this year’s ComSciCon-Chicago workshop.

Graslie’s YouTube channel, The Brain Scoop, delves into the intricacies of natural history collections. She will present “Communicating Science of Museums through YouTube” at 3:30 p.m. on August 6 at the Robert H. Lurie Medical Research Center on the Chicago campus.

ComSciCon-Chicago, organized by students from Northwestern and the University of Chicago, is a two-day workshop designed to empower graduate students to communicate the complex concepts arising in science, engineering, and other technical fields to diverse audiences.

Science in Society’s Rebecca Daugherty and Sara Grady will be taking part in workshops along with Dan Moser, communication studies, and Steve Franconeri, psychology. Michelle Paulsen, senior program administrator at the Center for Interdisciplinary Exploration and Research in Astrophysics will be a featured panelist.

Register to attend Graslie’s keynote presentation.
ISEN Awards Graduate Fellowships in Energy, Sustainability

The Institute for Sustainability and Energy (ISEN) has announced five winners of its 2016-17 Cluster Fellowship Awards. The institute has administered the fellowships since 2010 under the auspices of The Graduate School’s Interdisciplinary Cluster Initiative, which was launched to foster connections with students and faculty in other programs with whom a student might have natural intellectual affinities.

In addition to receiving a stipend, ISEN Cluster Fellows also support ISEN’s educational mandate as teaching assistants and receive automatic placement into ISEN’s graduate courses. This year’s winners are:

**Quentin Sherman.** This fourth-year PhD student in materials science and engineering is focusing his research on developing computational models to predict how metals and alloys will corrode in various environments.

**Phillip Goodman.** A third-year JD/MBA student, Goodman is studying legal structures and advanced project finance topics to develop innovative methods for advancing utility-scale renewable energy projects.

**Ding-Wen Chung.** As a second-year PhD student in materials science and engineering, Chung’s research aims to improve the operational temperature and corrosion resistance of cobalt-based super-alloys to increase efficiency in power generators and jet engines.

**Alex Grant.** The second-year PhD student in chemical and biological engineering is seeking new catalysts for synthesizing methanol from carbon dioxide. The effort may help incentivize industry to repurpose carbon dioxide emissions.

**Lingqiao Li.** A second-year PhD student in materials science and engineering, Li is developing synthetic concepts and methods to overcome challenges associated with making polymer network materials (such as rubber tires) sustainable, doing so by recycling them into highly valued products.

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Chemist Tobin Marks Lauded for High-Impact Research

Northwestern chemist Tobin J. Marks recently received several international honors: the President’s International Award for Distinguished Scientists from the Chinese Academy of Sciences; an honorary doctorate from the Technical University of Munich (TUM); and the American Chemical Society (ACS) 2017 Priestley Medal winner, the organization’s most prestigious prize.

Marks, the Vladimir N. Ipatieff Professor of Chemistry, professor of materials science and engineering, and professor of applied physics, has made major contributions in the field of materials chemical science — specifically catalysts and catalytic processes, opto-electronic materials, and organometallic chemistry. He has created new plastics, catalysts for environmentally benign chemical transformations and efficient plastic solar cells, as well as printable transistors and organic light-emitting diodes that are faster, more energy efficient, and more versatile.

Marks’ landmark research is documented in 1,200 peer-reviewed publications and 234 U.S. patents. He has mentored and trained many graduate students, and he has tirelessly served the ACS and international science societies. Marks partnered with Dow Chemical to develop world-scale multi-billion-dollar olefin polymerization processes and co-founded the startup Polymera Corp. to produce printed electronics.

Read more.
Illinois Precision Medicine Consortium to Receive More Than $51 Million as Part of Landmark Study

Northwestern will play a leading role in one of the most ambitious scientific endeavors in our nation’s history.

In collaboration with four local institutions, the University will receive $4.3 million this fiscal year to help launch the Cohort Program of President Obama’s Precision Medicine Initiative (PMI). A grant from the National Institutes of Health’s Illinois Precision Medicine Consortium is funding the effort, which is expected to receive more than $51 million in total over the next five years.

The PMI Cohort Program is a landmark longitudinal research effort that aims to engage 1 million or more Americans to improve disease prevention and treatment measures based on individual differences in lifestyle, environment, and genetics. The Northwestern collaboration’s goal is to enroll 150,000 Illinois participants in the study.

“The big excitement here is the opportunity to improve the way we predict, prevent, and eventually treat disease,” says Philip Greenland, the Harry W. Dingman Professor of Cardiology and a principal investigator of the new award. “Just the scope of it — 1 million people — is beyond anything that anybody in the US has ever done. This could be a game changer.”

Northwestern is one of four regional healthcare provider organizations to receive an award from the NIH for this study. The other institutions in the collaboration include subgrantees Ann and Robert H. Lurie Children’s Hospital of Chicago, University of Chicago, University of Illinois at Chicago, and Alliance of Chicago Community Health Services LLC.

In addition to the funding for participation enrollment, NIH will also support a data and research support center, of which Northwestern is a subawardee, and a participant technologies center to help build the PMI Cohort Program.

With these awards, NIH is on course to begin initial enrollment into the PMI Cohort Program later this year, with the aim of meeting its enrollment goal by 2020.

Jay Walsh, Northwestern’s vice president for research, expressed his enthusiasm for the pathbreaking initiative. He also emphasized the importance of the “foundational groundwork” that the University has put in place over the years to make this kind of grant possible.

“I’m thrilled that Northwestern will be a leader in the PMI Cohort Program,” says Walsh. “Our many research strengths obviously make us highly competitive for this award. Perhaps less obvious, though, is all the sustained effort we have put forward over the last decade and more to position Northwestern as a preeminent global research institution. Had we not invested in that groundwork — the infrastructure, the thought leadership, the trust and collaborative partnerships within and outside the University — we would not have developed the world-class research ecosystem that has enabled Northwestern to thrive and contribute at the highest national and international levels.”

Among those foundational investments are the University’s Center for Genetic Medicine (CGM), which has facilitated the development of new genetic knowledge and its application to medicine for more than 15 years. CGM’s NUgene project — launched in 2002 — has become a large-scale biorepository of DNA samples and healthcare information for Northwestern researchers. The effort laid the foundation for Northwestern’s participation in the nation’s first Electronic Medical Records and Genomics Network. The multimillion-dollar grants funding these initiatives have transformed biomedical research at the Feinberg School of Medicine, as researchers propel important discoveries in rare and common diseases and begin to translate those findings into new treatments and individualized patient care at an accelerated pace.

Much of the research is possible because of the oceanic depth of clinical data housed in Northwestern Medicine’s Enterprise Data Warehouse (see page 12), one of the leading and most mature depositories in the country with 8.4 million unique patient records. That includes 95 million inpatient admissions and outpatient visits and more than 101 billion data elements (a patient lab test, for example) — a number updated by 14 million new data elements every night.
Access to Robust Data Warehouse Transforming Research

Matthew Feinstein, a third-year fellow at the Feinberg School of Medicine, knew the questions he wanted to ask, but lacked the data to pursue the answers.

With just one-third of one percent of Americans infected with HIV, it seemed unlikely that a repository of those individuals would readily exist. But thanks to the Northwestern Medicine Enterprise Data Warehouse (NMEDW), Feinstein not only had access to 8.4 million patients, but he also could work with data analysts to create a unique cohort of individuals: those diagnosed with HIV who have had heart-related testing performed.

“Studies in large cohorts have found that people living with HIV have elevated risks for various forms of heart disease, but many of these large cohorts have lacked the clinical detail needed to better understand why these risks exist,” says Feinstein. “This is where the NMEDW has offered the opportunity to create a data set with richly detailed clinical data from a large group of HIV-infected and uninfected patients — the very type of data set needed to begin to understand potential mechanisms underlying associations between HIV and heart disease.”

Feinstein and collaborators — who include Dan Schneider, Anna Pawlowski, and Prasanth Nannapaneni, all members of the Northwestern University Clinical and Translational Sciences Institute — recently found that HIV-infected patients have significantly more extensive scarring and dysfunction of their heart muscle after heart attacks compared with uninfected patients.

An American Heart Association Fellow-to-Faculty Grant as well as a Center for AIDS Research Pilot Grant is funding Feinstein’s research.

A joint project between Feinberg and Northwestern Memorial HealthCare, the NMEDW supports analytics for both clinical research and healthcare operations. This shared platform allows research findings to be converted quickly into healthcare operations, increasing the potential for new discoveries to impact patient care sooner.

Learn more.
Spotlight: Research in the News

A groundbreaking tool for early cancer detection developed by Vadim Backman, biomedical engineering, has been identified as one of “six new medical technologies worth watching,” according to Wall Street Journal. Through a specialized microscope that uses light to measure cell changes, Backman’s lab has developed a noninvasive diagnostic test that holds promise for systematizing an inexpensive and accurate method for early detection of certain cancers within primary care settings.

Today’s fathers want to be more involved in parenting than any prior generation — and there is science to back up the benefits. Craig Garfield, pediatrics, and coauthors observed a cultural shift in perceptions of fatherhood among new dads over the past decade and discovered numerous health benefits afforded their children as a result of their involvement. The research findings were reported in USA Today and Chicago Tribune.

A research team led by Seema Jayachandran, economics, discovered that deforestation in Uganda can be effectively mitigated by paying land owners not to cut down their trees for either agricultural purposes or timber sales. The study, featured in the Washington Post, suggests that encouraging forest preservation in developing countries, where forests are often relied on for livelihoods, turns out to be more cost effective than the same strategy in wealthier nations.

For a second time, the LIGO international team – which includes astrophysicists Vicky Kalogera and Shane Larson, and Selim Shahriar, electrical engineering and computer science – has directly detected distortions in the fabric of spacetime. These ripples, known as gravitational waves, are caused by the collision of two black holes approximately 1.4 billion light-years from Earth. The secondary detection further substantiates the phenomenon, although scientists are trying to understand what led to the cosmic quakes. This discovery appeared on Fox News, Science News and Daily Mail, among other publications.

Men are much more likely to suffer sudden cardiac death than women, according to Northwestern Medicine research featured in Wall Street Journal and Daily Mail. The study led by Donald Lloyd-Jones, preventive medicine, analyzed more than 5,200 men and women between the ages of 28 and 62, concluding that about one in nine men will suffer a cardiac arrest before the age of 70, compared to about one in 30 women.

Northwestern researchers have unveiled the third gene linked to Parkinson’s disease, the second-most common neurodegenerative disease in the United States. The study results, revealed on Fox News, suggest that genetic mutation TMEM230 produces a protein involved in the dopamine packaging in neurons, a significant finding since Parkinson’s is marked by the breakdown of dopamine-producing neurons. The research team, including Teepu Siddique and Han-Xiang Deng, both neurology, are hopeful this discovery will inform future treatments.

A Kellogg School of Management research project, led by Ned Smith, management and organization, revealed that media attention about the appointment of a female CEO negatively impacted the company’s stock, whereas the opposite was true with the appointment of a male CEO. The findings were published in the Washington Post.

More active participation in an online weight-loss community correlates to a great loss of weight, according to a study conducted by Bonnie Spring, preventive medicine. Although the most-connected users lost the most weight, the findings – featured in the New York Times – revealed that even less active users of the platform lost weight.

You are less likely to experience difficulty with daily activities in old age if you exhibit few or no heart disease risk factors in your 40s, according to new research led by Thanh Huyen Vu, preventive medicine. The study, featured in Reuters, found that eating a healthy diet and getting regular exercise helped mitigate risk factors for disease while also preventing disability later on in life.

New research suggests that for the first time in more than a century, the life expectancy of millions of Americans is declining. Diane Whittemore Schanzenbach, School of Education and Social Policy, coauthored the study which was highlighted on CBS News. While the reasons for the life expectancy decline are complex, the study suggests that despair related to stagnant low income is a principle cause of diminishing longevity.

Nearly 10 percent of all US sunscreen sales occur on Amazon, but as many as 40 percent of those products sold do not meet the standards of the American Academy of Dermatology, according to new research led by Steve Xu, dermatology. The widely-published findings (including Los Angeles Times, Washington Post, Reuters and CNN) revealed that even a 3.000 percent price differential does not represent a safer, better-quality sun protection product.
Discoveries

Daniel Dombeck, neurobiology, and postdoctoral fellow Mark Howe have identified the neurochemical signal likely missing in Parkinson’s disease by being the first to discover two distinctly different kinds of neurons that deliver dopamine to an important brain region responsible for both movement and learning/reward behavior. Learn more.

While late-term births are often associated with physical disabilities for children, new Northwestern research reveals that higher academic achievement is also associated with babies born beyond 40 weeks. The pioneering study, led by David Figlio, the Orrington Lunt Professor of Education and Social Policy, is the first to document the cognitive benefits afforded to post-term babies. Learn more.

A study conducted by David Figlio and Krzysztof Karbownik, both Institute for Policy Research, found that students who used vouchers to attend private schools in Ohio performed significantly worse on state tests than their peers who remained in public schools, despite having higher academic performance than eligible students who opted out of the voucher program. Learn more.

Although postpartum depression is serious, Northwestern Medicine research has shown that pre-pregnancy and prenatal depression is associated with increased severity and chronicity. Through the study, Sheehan Fisher, psychiatry and behavior sciences, and coauthors found that more than one-third of women were depressed while pregnant, highlighting the need for further research in this area. Learn more.

Using cognitive science theories, Ken Forbus, electrical engineering and computer science, and collaborators have developed a model that could enable computers to reason more like humans and even make moral decisions. Called the structure-mapping engine, the new model is capable of analogical problem-solving, including capturing the way humans spontaneously use analogies between situations to solve moral dilemmas. Learn more.

A new psoriasis treatment drug called ixekizumab has been cleared through Northwestern clinical trials led by Kenneth Gordon, dermatology. Nearly 80 percent of patients with moderate to severe psoriasis saw their disease completely or almost completely cleared by ixekizumab, results that were unfathomable a decade ago, according to Gordon. Learn more.

Results from a recent Northwestern Medicine study suggest that coils implanted into the lungs of patients with severe emphysema may improve exercise tolerance. While more research is needed to fully understand the potential treatment benefits, the study revealed that coil placement was also linked to improved quality of life and lung function, according to coauthor Ravi Kalhan, medicine: pulmonary and critical care. Learn more.

A team of prominent Northwestern scientists including, Chad Mirkin, chemistry, Mark Hersam and Vinayak Dravid, both materials science and engineering, has devised a very controlled way to make combinatorial libraries of nanoparticles – or a collection of systematically varied structures encoded at specific sites on a surface. Using this discovery, the scientists are developing a tool to rapidly and simultaneously test millions, if not billions, of different nanoparticles to allow researchers to pinpoint the best particles for particular applications. Learn more.

Findings from an investigation led by Northwestern journalists at Medill School of Journalism, Media, Integrated Marketing Communications have revealed that the US government allowed gaping holes in its early-warning system designed to respond to infectious disease outbreaks. Among the shortcomings discovered, the government failed to construct nearly half of its proposed Global Disease Detection sites, which could have helped mitigate the Ebola epidemic in West Africa that took 11,300 lives. Learn more.

A study led by investigator Sumeet Mitter, cardiology, revealed that long-term exposure to household air pollution from burning kerosene and diesel fuel indoors is linked to an increased risk of heart disease fatality. In particular, the findings have important implications for residents of low- and middle-income countries where high-pollution fuels are still commonly used for lighting, cooking, and heating. Learn more.

The latest government guidelines doctors follow to determine if patients should be screened for diabetes missed 55 percent of high-risk individuals with prediabetes or diabetes, according to a new study led by Matthew O’Brien, medicine: general internal medicine and geriatrics. Learn more.

Moderate-to-vigorous physical activity is related to improved subjective memory in breast cancer survivors, who often complain about memory problems, reports a new Northwestern Medicine study led by Siobhan Phillips, preventive medicine. It appears the physical activity alleviates stress and benefits women psychologically, which in turn aids their memory. Learn more.
Honors

P. Lindsay Chase-Lansdale, associate provost for faculty and Frances Willard Professor of Human Development and Social Policy, has been elected to the Harvard Board of Overseers. The board’s election of Chase-Lansdale is based on her “strong track record in building diverse and inclusive academic communities,” which includes her efforts at Northwestern.

Chuyang Cheng, a postdoctoral fellow in chemistry, was awarded the prestigious 2016 Distinguished Student Award from the Foresight Institute, a leading think tank and public interest organization focused on molecular nanotechnology. Cheng is the third Northwestern graduate student in four years to receive the award.

Two student startups tied for top prize at Northwestern’s Venture Challenge. The winners, The Graide Network, an online platform that connects teachers with remote, on-demand teaching assistants to grade and offer feedback on student work, and SurgiNet, a medical device company that produces bioabsorbable scaffolds for use in surgery, each received $20,000.

Michael Kennedy, neurobiology and Science in Society director, has been appointed to the National Academies Teacher Advisory Council, a 12-member council that serves as an expert resource in K-12 education for the National Academies of Sciences, Engineering, and Medicine. Kennedy was selected for his background in non-traditional STEM education and represents the first nominated council member who is not a classroom teacher.

The American Society for Engineering Education presented Bruce Lindvall, assistant dean of graduate studies at McCormick, with the 2016 DuPont Minorities in Engineering Award for his commitment to increasing student diversity in science, engineering, and technology.

The Simons Foundation has named Madhav Mani, engineering sciences and applied mathematics, as a Simons Investigator in the Mathematical Modeling of Living Systems (MMLS) program. The prestigious award provides long-term financial support for young theoretical scientists in mathematics, physics, computer science, and MMLS.

Sarah Maza, history, has been named the 11th recipient of the Dorothy Ann and Clarence L. Ver Steeg Distinguished Research Fellowship Award for the four monographs she produced on French history and social identity. The Ver Steeg Fellowship supports research and scholarship by a tenured Northwestern professor whose work enhances the national and international reputation of the University.

Milan Mrksich, biomedical engineering, has been selected to receive the 2016 iCON Innovator Award for his leadership in biotechnology education and research that is anticipated to enhance economic development in Illinois.

Robert Murphy, medicine: infectious diseases, has received a National Institutes of Health Fogarty International Center award to advance the study of HIV and mycobacterial infections, such as tuberculosis, in Mali. The Fogarty funding was part of $13 million effort to support 15 new US training programs.

Teri Odom, chemistry and materials science and engineering, was named Chemistry Finalist for the 2016 Blavatnik National Awards for Young Scientists. The Blavatnik Awards celebrate exceptional young researchers who “drive the next generation of scientific innovation by answering the most complex scientific questions of today.”

Jian Cao, mechanical engineering, received the 2016 Frederick W. Taylor Research Medal from SME – the first woman to receive the award in the international professional society’s nearly 60-year history. The Taylor Medal is the highest honor given by SME to a researcher in the broad manufacturing field. From left: Dean Bartles, SME president; Cao; Sandra Bouckley, SME president-elect; and Jeffrey Krause, SME executive director and CEO.

World-renowned nanoscale expert Chad Mirkin, chemistry, has been awarded the international 2016 Dan David Prize in the Future Time Dimension. From left: Joseph Klafter, president of Tel Aviv University and chairman of the Dan David Prize Board of Directors; Mirkin; and Northwestern President Morton Schapiro. The distinguished award recognizes outstanding achievements in time dimensions – this year focusing on innovative and interdisciplinary nanotechnology research.
Proposal and Award Report: Through May 2016

Northwestern has received a total of $348.3 million in award funding this fiscal year, through May. This figure reflects a 4 percent increase ($14.8 million) compared with May 2015. The number of awards to date (1,836) is slightly less than this time last year.

The dollar volume of awards from federal agencies increased 8 percent ($19.4 million). Awards from industrial sponsors declined about 14 percent ($8.4 million). Foundation funding is down 41 percent ($8.7 million), while voluntary health organization funding decreased 20 percent ($2 million).

The dollar volume of proposals submitted through May is $1.9 billion, an increase of 1 percent compared to last year. The number of proposals submitted (2,555) is slightly lower.

The dollar volume of proposals submitted to federal agencies increased 2 percent ($39.6 million), while proposals to industrial sponsors was up 1 percent ($1 million). Proposal activity to voluntary health organizations is down 5 percent ($3 million) and foundation proposals declined by 12 percent ($6 million).

Click here to access the full report.

Nearly 250 students, staff, faculty, and postdocs took part in the sixth annual Chemistry of Life Processes Institute Core Crawl on July 14. Attendees learned about core-supported projects and how the facilities play a vital research role. Pictured: Jessica Hornick discusses Northwestern’s Biological Imaging Facility.