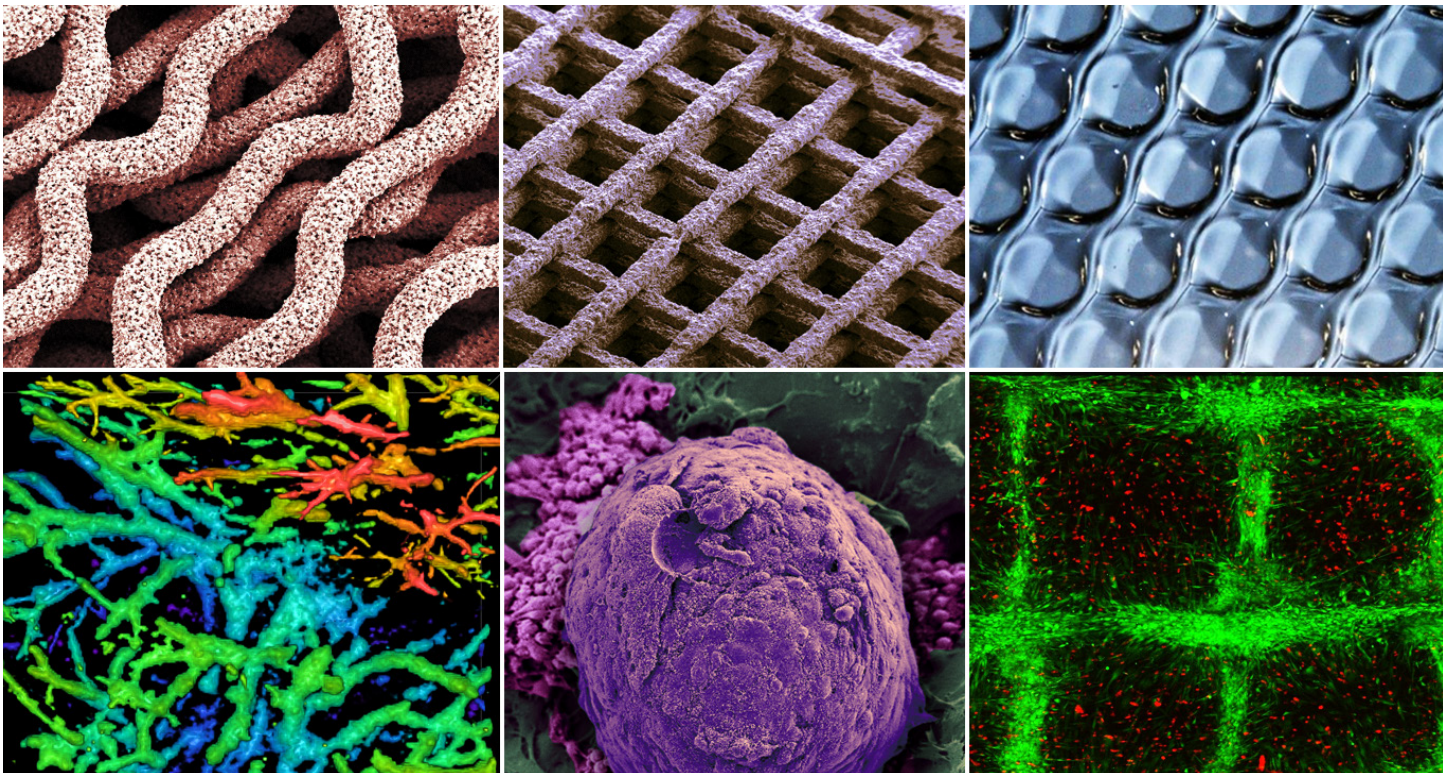
Breakthroughs

Feinberg School of Medicine Research Office

February 2016



The lab of Ramille Shah, PhD, has developed a wide array of 3-D printable biomaterials, from soft hydrogels to solid particle-based inks, all used to form structures for regenerating tissues and organs.

A Pioneer in 3-D Printable Biomaterials Field

In 2011, Ramille Shah, PhD, took a leap of faith and bought a 3-D printer for her lab. At the time, the idea that "bio-inks" could be printed layer-by-layer to regenerate human tissues and organs was still very new. But her gamble paid off.

"That piece of equipment is now the basis of my whole research portfolio, a niche my lab has built developing materials that are both 3-D printable and functional," said Shah, an assistant professor of Surgery with a joint appointment at the McCormick School of Engineering.

In the years since making the foresightful purchase, Shah's lab and collaborators across Feinberg's departments have worked together to develop a vast array of new biomaterials to build many types of tissue and organ structures: bone, muscle, skin, livers, kidneys, ovaries and even cardiac and nerve tissue. The challenge for all of these projects is developing inks suitable for 3-D printing that also safely support cells and promote desirable biological interactions once inside the human body.

"The main goal of my lab is to develop new printable material systems that can enable us to spatially organize cells, materials and appropriate signals in 3-D that will lead to constructs that better mimic the architectural and functional qualities of real organs and tissues," Shah said. "I think the sky's the limit as far as targets for this work."

In one recent study, published in *Advanced Materials*, she and

(continued on page 2)

Northwestern Medicine®

A Pioneer in 3-D Printable Biomaterials Field

(continued from cover page)

biomedical engineering graduate student Alex Rutz came up with a universal process for synthesizing a wide variety of 3-D printable hydrogels. Cells can be directly incorporated into these aqueous materials, which can be made with natural polymers such as gelatin and collagen. However, hydrogels are usually physically weak and, thus, do not easily maintain a 3-D printed form.

In the past, scientists have increased the polymer concentration of hydrogels or cross-linked polymer chains to thicken or strengthen the material. But these methods can prevent cells from migrating and proliferating.

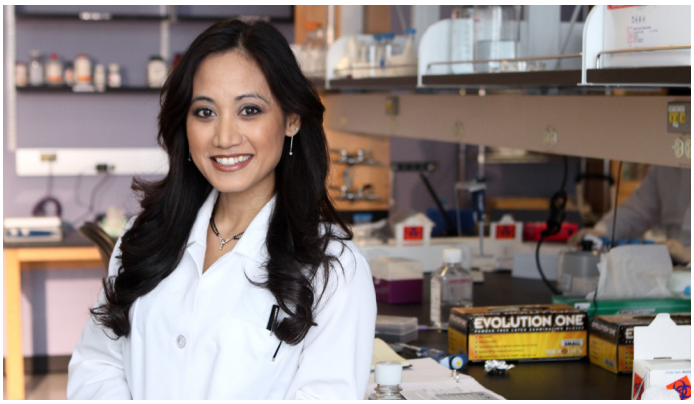
In the study, Shah's group used a commercially available compound called polyethylene glycol (PEG) designed to lightly cross-link both natural and synthetic hydrogels. In this way, the materials can be 3-D printed into multilayered, well-defined and self-supporting scaffolds with polymer concentrations much lower than ever before to better support cell survival and growth. The method can be tailored – the lab demonstrated 35 different formulations – to accommodate the printing of multiple materials at once, with or without cells, as well as different structural and biological properties. This work was the first demonstration of a single bioink method that is compatible with a diverse array of materials and allows for ink customization without compromising "printability."

"We're trying to create a ubiquitous method so that multiple types of biomaterials – for example, ones for vascularization or ones for liver regeneration – can be 3-D printed together to create more complex organs and tissue structures," Shah said.

While soft, water-rich hydrogels are ideal for printing materials containing live cells for tissue engineering, solid particle-based inks can be used to create structural scaffolds that cells are placed onto after printing. In a paper published in *ACS Nano,* Shah's group developed a particularly promising biomaterial using graphene.

CONTENTS

Faculty profile: Jennifer Kearney	3
Call for abstracts	4
Staff profile: Roger Knight	5
Student profile: Osefame Ewaleifoh	6
In the news and NUCATS corner	7
Sponsored research	8
Funding and new faculty	9
Galter Library connection	10
High-impact research	11
Events and NIH news	12



Shah is an assistant professor of Surgery with a joint appointment in Materials Science and Engineering at the McCormick School of Engineering.

Composed of nano-thin sheets of carbon atoms, graphene is an appealing resource for biomedical applications because it's electrically conductive – a property that can influence cell behavior. In the study, Shah and colleagues printed 3-D structures that were 60 to 70 percent graphene by volume – previously, only about 20 percent graphene had been possible, not enough to preserve the material's unique properties.

"This is the first time anyone has demonstrated the ability to 3-D print majority-graphene structures at larger scales – multiple centimeters in size – while still maintaining structural integrity and functional properties," Shah said. "We're interested in using them as electrically conductive scaffolds to grow cells that respond to electrical signaling, like those in cardiac or nerve tissue."

In another particle-based ink formulation, hydroxyapatite (HA), the main mineral component of natural bone, was incorporated into the inks instead of graphene. Although comprised of majority HA (a brittle ceramic), the resulting 3-D printed structures are highly elastic and inherently promote stem cell differentiation into bone cells. Shah believes her hyperelastic "bone" material will likely be the first to translate to patients.

"I envision that a hospital could have its own 3-D printer that is compatible with our inks," she said. "Then, for example, a craniofacial surgeon who needs an implant to regenerate bone can input in a file that prints out exactly the size and shape needed for the specific patient. Because of their unique properties, 3-D printed constructs derived from our particle-based inks can also be manipulated *in situ* – cut or trimmed to fit during surgery."

Clinical applications for Shah's work are broad: Graphene scaffolds could provide signaling to help cardiac muscle contract after a heart attack or help guide neural cells to regenerate nerve tissue. Hyperelastic "bone" can be used for a wide variety of orthopaedic, craniofacial or dental defects. And with hydrogels, multiple cell types can be 3-D printed together, self-organizing to form complex structures like those found in a liver with blood vessels and bile ducts.

(continued on page 5)

Studying the Genetic Basis of Epilepsy

Jennifer Kearney, PhD, associate professor of Pharmacology

Jennifer Kearney, PhD, associate professor of Pharmacology, focuses her research on studying the genetic modifiers that influence the clinical severity of epilepsy.

Since joining Feinberg in 2014, she described a new mutation linked to severe childhood epilepsy in a paper published in the October 2014 issue of *Annals of Neurology*. Her team found an anomaly in a potassium channel gene that causes neurons to misfire, which can lead to seizures and disrupted development.

She completed her graduate degree in neuroscience and postdoctoral fellowship in genetics at the University of Michigan. Before joining Feinberg, Kearney worked at Vanderbilt University.

The ultimate goal of her research is to translate our genetic knowledge toward precision medicine in epilepsy and improve patient outcomes.

Q&A

What are your research interests?

My research program is focused on studying the genetic basis of epilepsy and epileptic encephalopathies. Isolation of epilepsy genes will help us understand the underlying pathophysiology and suggest novel therapeutic strategies for improved treatment of patients. We use classical genetic approaches to identify modifier genes in mouse models and then investigate whether the same genes contribute to epilepsy risk in human patients. One of our current projects is focused on identifying genetic modifiers of Dravet syndrome, a severe epileptic encephalopathy in which patients have intractable epilepsy accompanied by intellectual disability and autistic features.

We developed a mouse model of Dravet syndrome that exhibits variable phenotype severity depending on the genetic background. Identifying genetic modifiers and understanding how they contribute to disease development and progression may suggest novel, genome-guided therapies.

What types of collaborations are you engaged in across campus (and beyond)?

We have a long-standing and productive collaboration with Al George, MD, Magerstadt Professor and chair of Pharmacology. His laboratory is expert in defining the functional consequences of ion channel mutations using electrophysiological recordings. Bringing together genetic mutations that we identify in patients and functional consequences advances our understanding of the underlying disease mechanisms. In addition to characterizing human ion channel mutations, Dr. George's group also performs recordings of neurons from our mouse models, enabling comparison of neurons' protective and susceptible backgrounds. Our laboratories are located directly adjacent to one another in an open-design lab, allowing constant exchange of ideas between the groups and enriching the experience of my trainees.

Who makes up your research team?

Our research team is currently made up of two postdoctoral fellows, a graduate student and a technician. Nicole Hawkins, PhD, is studying transcriptome dynamics and novel therapies in a mouse model of Dravet syndrome. Jeffrey Calhoun, PhD, is studying genetic modifiers of focal epilepsy in a mouse model with an Scn2a mutation. Erin Baker, a second-year Driskill Graduate Program in Life Sciences student, is studying novel pharmacological treatments in mouse models with Scn2a and Scn8a mutations. Our technician, Nicole Zachwieja, MS, is performing fine mapping of Dravet syndrome genetic modifiers.

How is your research funded?

Our research has been funded mainly by the National Institutes of Health, with additional support from epilepsy-focused foundations and pharmaceutical companies.

Who inspires you?

I am inspired by the families of patients with epileptic encephalopathies. These devastating neurodevelopmental disorders are debilitating, life-long conditions that severely impact quality of life for patients and their families. Despite the endless demands of caring for children with a chronic, complex medical condition, parents work tirelessly to raise awareness and research funds. Their staunch advocacy on behalf of their children is inspiring and motivates our work.

12TH ANNUAL LEWIS LANDSBERG RESEARCH DAY

Call for Abstracts

Submission Deadline
Tuesday, March 1 at 5 p.m.

Research Day is Thursday, April 7, from 1 to 5 p.m. on the Chicago campus.

This event features a poster competition open to researchers in the following categories:

- Faculty
- Graduate students
- MD-PhD students
- Medical students
- Postdoctoral researchers and fellows
- Clinical residents and fellows
- Research staff

Those interested in participating in the 2016 event must submit an abstract online no later than 5 p.m. Tuesday, March 1 at feinberg.northwestern.edu/research/abstract2016

Space is limited and will be assigned on a first-come, first-serve basis.

For more information, please contact the Feinberg Research Office, 312-503-1499 or researchday@northwestern.edu

Using Digital Media to Enhance Research

Roger Knight, MS, Marketing Communications Specialist, IPHAM

Where are you originally from?
I am from Panama City, Panama, and growing up I spent most weekends at the beach. I came to the U.S. in 2002 to attend the University of Notre Dame.

What is your educational background?
I have a master's in health communication from Boston University and a bachelor's degree in sociology from the University of Notre Dame.

Please tell us about your professional background.
My relationship with Northwestern University started with the National Children's Study (NCS) under the direction of Jane Holl, MD, MPH, director of the Center for Healthcare Studies at the Institute for Public Health and Medicine (IPHAM). Initially, I was part of the community outreach team based at University of Illinois at Chicago, where I built relationships with community organizations and participated in local events to raise awareness of the NCS in Cook County. I pioneered using social media to interact and engage with potential study participants and I created a behind-the-scenes blog about the study. I moved to Northwestern when we were selected to manage 10 study locations across seven states in the southern region of the United States. I spent two years testing and evaluating methods such as digital communication and in-person engagement to keep a large cohort of participants engaged and retained in the study. Prior to my work with the NCS, I worked in the Institute for Latino Studies at the University of Notre Dame where I managed the Census Information Center program.

How do you help scientists and/ or research students at the medical school?
As a part of IPHAM, I help scientists publicize the results of their research through various communication channels, including social media. I have become an evangelist for utilizing social media for research dissemination and I have provided training and consultations for faculty across IPHAM and beyond. In addition, I lead several digital marketing efforts to recruit patients for clinical trials and research studies working with the Center for Behavioral Intervention Technologies.

What is your favorite part of the job?
I enjoy meeting researchers across Feinberg, learning about diverse areas of research and discussing how digital communications can impact their projects. Just in the past year, I had brainstorming sessions about using social media to reach out to older patients with osteoarthritis, diabetic patients curious about the artificial pancreas, millennials interested in mental health apps and many more. I try to learn as much as I can about the research study audience and put myself in their shoes. When I worked for the NCS, I learned to think like a parent, even though I don't have any children. I use this same approach when discussing communications plans for new research at Northwestern.

What exciting projects are you working on?
In 2016, I will continue working on patient recruitment projects and research dissemination efforts. One area I want to focus on is provider outreach. I am excited about finding others at our institution who are using digital tools for research and perhaps forming a community of practice around these shared interests. Connect with Roger on LinkedIn

---

A Pioneer in 3-D Printable Biomaterials Field

(continued from page 2)

Shah's many Feinberg collaborations include a project with Teresa Woodruff, PhD, chief of Fertility Preservation in the Department of Obstetrics and Gynecology, to create an ovarian bioprosthesis for women with cancer.

"One of the most important frontiers in modern biology is creating soft organ prosthetics. The work we are doing with the Shah lab has crossed an important threshold," Woodruff said.

The thought is that follicles can be removed before radiation or chemotherapy, placed into the artificial structures and implanted back into the patient after treatment to restore normal hormone production and fertility.

Shah and her biomaterials team, which includes postdoctoral fellow Adam Jakus, PhD, and biomedical engineering PhD students Alex Rutz, Phillip Lewis and Jimmy Su, recognize that the field of tissue engineering and 3-D printing is still in its early days. But the possibility that their work will someday lead to personalized treatments for patients with tissues or organs damaged by trauma or disease is real.

Shah says her 3-D printed biomaterials are surgically friendly, scalable and cost-effective – all qualities that can accelerate their implementation in the current health care environment.

"We're just at the beginning," Shah said. "We have expanded the biomaterial toolbox for 3-D printing, but now we need to test these materials with different cell types and for different tissue targets. It's very exciting to be pioneers in this area."

Using Science to Help Developing Countries

Osefame Ewaleifoh, Driskill Graduate Program

Osefame Ewaleifoh, a dual Masters in Public Health and fourth-year PhD student in Northwestern University's Driskill Graduate Program, studies both basic science research in virology and neuroscience as well as public health and how they can be used to help strengthen developing countries. He is also the co-founder and editor-in-chief of the Northwestern Public Health Review, as well as the co-organizer of the Northwestern University Global Health Interdisciplinary Seminar.

Ewaleifoh earned a bachelor's degree in genetics from Texas A&M University and a master's in biotechnology with a neuroscience focus from Johns Hopkins University. Ewaleifoh knew early on that he wanted to pursue a PhD, to learn how to effectively ask and answer the right questions and ultimately become a competent scientist.

Q&A

Where is your hometown?
I am from Uromi, a very small rural village in West Africa, right of the tip of southwestern Nigeria.

What are your research interests?
My research interests range from a basic science research question such as understanding the innate immune function of the central nervous system, to broader health policy questions such as understanding health policy innovations and frameworks that have succeeded in the West and how they can be reapplied in developing economies.

What exciting projects are you working on?
I am working on several really exciting projects in the lab right now. The central focus of my current research is to understand how and why neurons in the central nervous system are able to protect themselves from herpes viral infection. We know that herpes infection is fairly common, however the herpes viral infection very rarely moves beyond the peripheral nervous system neurons to the central nervous system, where it can become lethal, causing encephalitis. However a seminal study by our collaborator, Jean-Laurent Casanova, MD, PhD, and his colleagues at Rockefeller University, recently showed that mutations in the protein Toll Like Receptor 3 (TLR3) might make human central nervous system neurons more susceptible to infection.

Our research is beginning to provide mechanistic insight into precisely how TLR3 functions to restrict viral infection from the central nervous system. This work is particularly exciting because it is among the earliest attempts to understand herpes viral infection infection in the human central nervous system neurons on a molecular level by using human neurons derived from reprogrammed induced pluripotent stem cells that are derived from patient skin cells.

What attracted you to the PhD program?
Before coming to Northwestern I worked and studied at Johns Hopkins for several years. During this time, I realized that to do meaningful work in science, I needed more focused and specialized training in the fields I was interested in. I also realized that I needed more rigorous training in both scientific thinking and writing. The graduate training program at Northwestern offer an incredibly supportive faculty whom I met when I visited on interview weekend were a wonderful plus.

How would you describe the faculty at Feinberg?
One of the best parts about being here is how supportive and collaborative the faculty here has been. I can stop by the offices of most of my instructors and share my crazy scientific or non-scientific ideas and never be shunned. I have also been very fortunate to work with excellent advisors, specifically my PI, Greg Smith, PhD, associate professor of Microbiology – Immunology; Jack Kessler, MD, professor of Neurology and Pharmacology; and Steve Anderson, PhD, assistant professor of Microbiology-Immunology. They all have been absolutely wonderful mentors.

What do you do in your free time?
I love writing, wandering around antique stores, playing chess and taking long walks.

What are your plans for after graduation?
I am still incubating post-graduation plans, but a lovely long-term goal is to set up an advisory think tank and research institute focused on providing health, scientific and public health counsel to small and emerging economies around the world.

Connect with Osefame on LinkedIn

Research in the News

***Crain's Chicago Business*, Jan. 5**
Durbin hails another $50 million for Chicago biotech
Senator Dick Durbin was quoted at news conference at Northwestern University Feinberg School of Medicine.

***The Today Show*, Jan. 6**
Women are more likely to have sleep problems than men
Kelly Glazer Baron was quoted.

***NPR*, Jan. 7**
Spanish Website Features Telenovelas to Inform Latinos About Kidney Donation
Juan Caicedo was quoted.

***The Washington Post*, Jan. 15**
Implanted coils help some lung disease patients, study says
Ravi Kalhan's research was quoted.

***NPR*, Jan. 15**
Average Age Of First-Time Moms Keeps Climbing In The U.S.
Priya Rajan was quoted.

***TIME Magazine*, Jan. 19**
Why Obama Wants to Be America's Dad
Sheehan Fisher was quoted.

***DNA Info*, Jan. 20**
Dream Team Assembled to Fight Pediatric Brain Tumors
Ali Shilatifard's research featured.

***Huffington Post*, Jan. 21**
Northwestern University Professor Creates Startup to Help Primary Care Practices Thrive Using Data Science
Nicholas Soulakis was quoted.

***ABC News* (National), Jan. 22**
Cold Weather Myths: What You Need to Know During a Snowstorm
Clyde Yancy was quoted.

***Chicago Tribune*, Jan. 26**
Northwestern team competes for $1M prize to slow aging
Douglas Vaughan was quoted.

***The Wall Street Journal*, Jan. 26**
Broader Understanding of Heart Disease Risk
Namratha Kandula was quoted.

More media coverage available online.

Northwestern University NUCATS Clinical and Translational Sciences Institute

NUCATS Corner

Help Your Research Make an Impact

A key part of enhancing research impact is making that research more discoverable. There are a number of strategies for making sure your research can be found, including choosing a journal for publication that is right for your audience that is indexed by PubMed, and publishing in Open Access journals, which are often associated with higher citation counts and enable authors greater options for reuse.

Depositing your research into Galter Library's DigitalHub repository is another way to give your research more visabilty. The DigitalHub repository preserves intellectual works, enhances the visibility of Northwestern Medicine scholarship and promotes its authors by enabling discovery and accessibility of these works by the international scientific community.

Consider submitting both traditional works, such as research papers and non-traditional outputs, such as white papers, case reports, technical reports, survey instruments and educational materials. Every object deposited in DigitalHub is assigned a Digital Object Identifier (DOI). These identifiers allow the deposited object to be unambiguously identified, enabling better association of metadata with the object and a way of citing (and getting credit) for these non-traditional outputs that might otherwise sit on your hard drive or server.

Check out the DigitalHub:
https://digitalhub.northwestern.edu

How to upload a file to DigitalHub: Getting Started

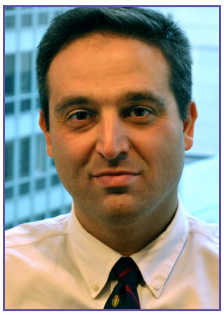
How to create a collection in DigitalHub: Collections

How-To Videos: Uploading Files and Creating Collections

For assistance with DigitalHub, email DigitalHub@northwestern.edu.

For more information about research impact, contact The NUCATS Evaluation Program or the Galter Library Metrics and Impact Core and be sure to read this month's Galter Library Connection on page 10 for more tips.

Sponsored Research



PI: Hossein Ardehali, MD,PhD professor of Medicine in the Division of Cardiology and professor of Pharmacology

Sponsor: National Heart, Lung, and Blood Institute

Title: "Role of SNRK in cardiac metabolism and development of heart failure"

Heart cells alter their metabolism in response to changes in their environment, especially in the setting of heart failure and heart attack. In this proposal, Ardehali's team will determine whether a novel protein called sucrose non-fermenting-1 related kinase (SNRK) plays a role in regulating heart metabolism and its progression to heart failure in response to injury. They will study whether this protein makes the heart more metabolically efficient and will determine the mechanism for this process.

The central hypothesis of this proposal is that SNRK affects cardiac metabolism by reducing substrate utilization and increasing mitochondrial coupling, and that SNRK over-expression protects against the development of heart failure and ischemic injury. Ardehali's team will assess whether deletion of SNRK will result in the opposite phenotype of its overexpression, i.e., increased glucose and fatty acid metabolism with similar cardiac force.

His team has generated global SNRK+/- mice and cardiac-specific SNRK knockout mice and will measure cardiac metabolic parameters in these animals. They will also assess the role of Trib3, UCP3 and PPARα in this process. In aim two of the proposal, the team will test if the reduced glucose and fatty acid metabolism still occurs in the hearts of SNRK TG mice mediated through Tribbles homolog 3 (Trib3).

They have generated SNRK TG/Trib3 knockout mice and will measure glucose and fatty acid metabolism in their hearts. They also plan to investigate the mechanism of Trib3 regulation by SNRK, and PPARα regulation by Trib3. In aim three, they will determine whether SNRK is protective against the development of heart failure and ischemic damage and will study the mechanism for this protective effect.

Their studies showing that SNRK reduces fatty acid and glucose metabolism and improves mitochondrial coupling promise to advance the knowledge of the role of cardiac metabolism in heart failure and may lead to the development of novel therapies for this disorder.

PI: David Victorson, PhD associate professor of Medical Social Sciences

Sponsor: National Cancer Institute

Title: "Reducing the Effects of Active Surveillance Stress, Uncertainty and Rumination thru Engagement in Mindfulness Education (REASSURE ME)"

Every year, thousands of men are diagnosed with prostate cancer, many of whom have very low-risk disease that doesn't require invasive surgery or radiation. Instead, these men are placed onto "active surveillance," which is the ongoing tracking and monitoring of their tumor status by their urologist.

At the first sign of tumor progression, if it should progress, more conventional treatments are deployed. A benefit of this approach is that it prevents a growing trend of the over-treatment of prostate cancer, as well as the associated urinary, bowel, sexual and emotional side effects that can persist from having the prostate removed or radiated. A challenge has been that upwards of 25 to 50 percent of men on active surveillance will eventually drop out to receive more invasive treatments when it isn't always medically warranted.

Victorson plans to use training in mindfulness meditation to for men diagnosed with prostate cancer on active surveillance and their spouses. His team wants study if mindfulness training can help men and their partners be better able to "sit with" and tolerate some of the uncertainties and stressors that this diagnosis and treatment approach can bring. He hopes this can result in fewer men dropping out of active surveillance prematurely to receive surgery in order to get greater "peace of mind."

Victorson and his team are partnering with other academic medical institutions to conduct a five-year multi-site randomized controlled trial where men and their spouses will either be randomized to eight-weeks of intensive mindfulness meditation training or an eight-week control group that teaches important health promotion skills.

Prior to this study, Victorson was principal investigator of a smaller pilot study of the same intervention with men on active surveillance, which showed that those randomized to the mindfulness arm endorsed significantly greater self-reported resilience over time compared to controls.

NIH Funding Increases in 2016

Sen. Dick Durbin visits Feinberg to highlight importance of medical research and a $2 billion increase in federal funding from Congress this year.

U.S. Sen. Dick Durbin (D-Ill.) held a press conference Jan. 4 at Northwestern University Feinberg School of Medicine alongside Feinberg scientists to highlight how a $2 billion increase in NIH funding from Congress this year will benefit University research, ranging from cancer to Alzheimer's disease. Of the $710 million of Illinois' NIH funding last year, Northwestern University received $293 million.

Emily Rogalski, research associate professor in the Cognitive Neurology and Alzheimer's Disease Center and Milan Mrksich, associate director of the Robert H. Lurie Comprehensive Cancer Center of Northwestern University, spoke about their research at the event.

Watch video highlights from the press conference.

Welcome New Faculty

Irina Balyasnikova, PhD, joins as associate professor in the department of Neurological Surgery. She earned her PhD from the National Cardiology Research Center, Moscow.

Balyasnikova then completed two post-doctoral fellowships, one at the University of Pennsylvania and the second at the University of Illinois, Chicago. She comes to Feinberg from the University of Chicago. Her research focuses on the engineering of antibodies directed against tumor-associated antigens and the development of cell-based therapeutic approaches for treatment of glioblastoma and other brain malignancies. Her research is currently supported by a RO1 and R21 grants from the National Institutes of Health.

Funding

Use of 3-D Printing for Creation of Implantable Devices

More information

Sponsor: National Institutes of Health and Eunice Kennedy Shriver National Institute of Child Health and Human Development

Submission deadline: March 17

Upper Amount: $1.75 million

Synopsis: This Funding Opportunity Announcement encourages applications to utilize 3-D printing technologies to develop implantable devices and biodegradable scaffolds for long-term use that will adapt to the needs of growing children.

High-End Instrumentation Grant Program

More information

Sponsor: Department of Health and Human Services National Institutes of Health

Submission deadline: May 16

Upper Amount: $2 million

Synopsis: The High-End Instrumentation Grant Program encourages applications from groups of NIH-supported investigators to purchase or upgrade a single item of expensive, specialized, commercially available instruments or integrated systems that cost at least $600,000. The maximum award is $2,000,000. Types of instruments supported include, but are not limited to: X-ray diffraction systems, nuclear magnetic resonance and mass spectrometers, DNA and protein sequencers, biosensors, electron and confocal microscopes, cell-sorters and biomedical imagers.

Expanding the Encyclopedia of DNA Elements (ENCODE) in the Human and Mouse (UM1)

More information

Sponsor: National Institutes of Health and the National Human Genome Research Institute

Submission deadline: May 16

Upper Amount: $15.5 to $20M in FY 2017 to fund six to eight awards.

Synopsis: The purpose of this FOA is to solicit applications for research projects to apply state-of-the-art, high-throughput and cost-effective data generation pipelines to develop an expanded catalog of candidate functional elements in the human and mouse genomes.

View more funding opportunities

Galter Library Connection

Optimizing Your Article for Discovery

We all want our published work easily discoverable online and often scientists choose journals based on their audience and coverage for that reason. Beyond your choice of journal, there are proactive steps to ensure your article is discoverable once it's been published. Regardless of how your article is made available online, it will need to be indexed by a search engine in order to be discoverable. There are many search engines to consider, such as those behind Google Scholar, PubMed, Web of Science and Scopus. Below are some tips on optimization that can help search engines better understand the contents of your article. Keep in mind this isn't a comprehensive or exact list because search engines look at fields (i.e. title, abstract, author keywords, body of the text, tables and figures, etc.) differently depending on their specific algorithm.

Choose Your Words Carefully

Some search engines don't index the full body of your text, leaving the basis for discoverability solely on the title, abstract and keywords. Remember, the terms you use should reflect pathways in which searchers might come across your article. Additionally, these words can impact where your article appears in search results. Generally, the more frequently a search term is used in your article (though hopefully not frequently enough to annoy your readers), the more relevant the article is considered in the search results. Consider using words from controlled vocabularies such as PubMed's Medical Subject Headings (MeSH), CINAHL's Subject Headings or Embase's Emtree. These lists contain the main terms used when indexing biomedical literature. Also consider using Google Trends to learn how people have recently queried a specific topic in Google's search engine.

Use Synonyms

If possible, use synonymous words or phrases in the abstract and body of your text based on your chosen key terms. Most search engines are unable to recognize and translate synonymous phrases, unless the database has a sophisticated controlled vocabulary. For example, a search for "inborn genetic disease" in many databases won't also search for "single-gene defect" though the two phrases could be considered synonymous.

Clear and Descriptive Titles

Well-constructed titles are those that clearly describe the topic of your work. They reiterate important phrases or words from the abstract. They are neither short (i.e. one or two words), nor are they very long (i.e. run-on sentence length). Generally, if a search term is found in an article's title (rather than the abstract, keywords or body of the text), the article is considered more relevant in the search results.

Figures and Tables as machine readable

Generally, the text contained in figures and tables is only indexed if it is considered "real text" or found within a vector graphic (such as a *.svg, *.ai, *.eps, *.pdf file formats). The text in raster graphics (such as *.bmp, *.png, *.jpg, *.tif, *.gif files formats) is not indexed because it is considered part of the image. If your publisher requires the raster file format, consider seeking permission to submit figures and tables to Figshare, which provides metadata tags so they can be indexed by Google Scholar and Thomson Reuter's Data Citation Index.

Citations count

Search engines such as Google Scholar consider citation count very heavily in their relevance rankings. This emphasizes how important it is for authors to cite articles that have influenced their work. To keep things in perspective, while many search engines take citation counts into consideration, they also employ other more balanced measures. PubMed, for example, weights factors such as how many times and in what fields search terms are found, and how recently an article was published.

Optimizing after publishing

If you've already published with a less-than-optimal title, abstract, or keyword list, there are options for mending the issue. The library offers DigitalHub a repository for Northwestern Medicine's scholarly outputs. After checking your publisher's copyright policies, consider uploading your article to DigitalHub. You can enhance your article by adding a well-optimized description and new keywords. DigitalHub is crawled by Google, so your scholarly outputs will be more discoverable and better accessible for searchers. In the end, search engines make optimization a moving target as algorithms change and factors are weighted differently. Even though there is no perfect formula for optimization in all search engines, the options listed here will help search engines better understand your article.

Want to learn more?

For more tips and tricks, join us for Enhancing the Impact of Your Research, a one-hour introductory class by Galter Health Sciences Library. Participants will learn practical strategies on establishing an online presence, enhancing the discovery and dissemination of scholarly outputs, and communicating the impact of their research.

High Impact Factor Research

December 2015

Amiram M, Haimovich AD, Fan C, Wang YS, Aerni HR, Ntai I, Moonan DW, Ma NJ, Rovner AJ, **Hong SH, Kelleher NL**, Goodman AL, Jewett MC, Soll D, Rinehart J, Isaacs FJ. Evolution of translation machinery in recoded bacteria enables multi-site incorporation of nonstandard amino acids. *Nature Biotechnology*. 2015 Dec;33(12):1272-1279.

Bonow RO, Nishimura RA, Thompson PD, Udelson JE, Amer Heart A, Amer Coll C. Eligibility and Disqualification Recommendations for Competitive Athletes With Cardiovascular Abnormalities: Task Force 5: Valvular Heart Disease A Scientific Statement From the American Heart Association and American College of Cardiology. *Circulation*. 2015 Dec;132(22):E292-E297.

Curry MP, O'Leary JG, Bzowej N, Muir AJ, Korenblat KM, Fenkel JM, Reddy KR, Lawitz E, **Flamm S**L, Schiano T, Teperman L, Fontana R, Schiff E, Fried M, Doehle B, An D, McNally J, Osinusi A, Brainard DM, McHutchison JG, Brown RS, Jr., Charlton M. Sofosbuvir and Velpatasvir for HCV in Patients with Decompensated Cirrhosis. *New England Journal of Medicine*. 2015 Dec 31;373(27):2618-2628.

Gaulton KJ, Ferreira T, Lee Y, Raimondo A, **Njolstad I**, et al. Meta-A DIGR. Genetic fine mapping and genomic annotation defines causal mechanisms at type 2 diabetes susceptibility loci. *Nature Genetics*. 2015 Dec;47(12):1415.

Gheorghiade M, Greene SJ, Butler J, Filippatos G, Lam CSP, Maggioni AP, Ponikowski P, **Shah SJ**, Solomon SD, Kraigher-Krainer E, Samano ET, Muller K, Roessig L, Pieske B, Coo S-RI. Effect of Vericiguat, a Soluble Guanylate Cyclase Stimulator, on Natriuretic Peptide Levels in Patients With Worsening Chronic Heart Failure and Reduced Ejection Fraction The SOCRATES-REDUCED Randomized Trial. *Jama-Journal of the American Medical Association.* 2015 Dec;314(21):2251-2262.

Grabner A, Amaral AP, Schramm K, Singh S, Sloan A, Yanucil C, Li JH, Shehadeh LA, Hare JM, **David V, Martin A**, Fomoni A, Di Marco GS, Kentrup D, Reuter S, Mayer AB, Pavenstadt H, Stypmann J, Kuhn C, Hille S, Frey N, Leifheit-Nestler M, Richter B, Haffner D, Abraham R, Bange J, Sperl B, Ullrich A, Brand M, Wolf M, Faul C. Activation of Cardiac Fibroblast Growth Factor Receptor 4 Causes Left Ventricular Hypertrophy.*Cell Metabolism*. 2015 Dec;22(6):1020-1032.

Kim S, Ogawa K, Lv J, Schweighofer N, Imamizu H. Neural Substrates Related to Motor Memory with Multiple Timescales in Sensorimotor Adaptation. *PLoS Biology*. 2015 Dec;13(12):e1002312.

Kong RR, Yi FS, Wen PS, Liu JH, **Chen XP,** Ren JQ, Li XF, Shang YL, Nie YZ, Wu KC, Fan DM, Zhu L, Feng W, **Wu JY.** Myo9b is a key player in SLIT/ROBO-mediated lung tumor suppression. *Journal of Clinical Investigation*. 2015 Dec;125(12):4407-4420

Mannix AJ, Zhou XF, Kiraly B, Wood JD, Alducin D, Myers BD, Liu XL, Fisher BL, Santiago U, Guest JR, Yacaman MJ, Ponce A, Oganov AR,**Hersam MC**, Guisinger NP. Synthesis of borophenes: Anisotropic, two-dimensional boron polymorphs. *Science*. 2015 Dec;350(6267):1513-1516.

Maron BJ, Udelson JE, **Bonow RO**, Nishimura RA, Ackerman MJ, Estes NAM, Cooper LT, Link MS, Maron MS, Council Clinical C, Council Cardiovasc Dis Y, Council C, Stroke N, Council Functional G, Tran, Amer Coll C. Eligibility and Disqualification Recommendations for Competitive Athletes With Cardiovascular Abnormalities: Task Force 3: Hypertrophic Cardiomyopathy, Arrhythmogenic Right Ventricular Cardiomyopathy and Other Cardiomyopathies, and Myocarditis A Scientific Statement From the American Heart Association and American College of Cardiology. *Circulation*. 2015 Dec;132(22):E273-E280.

Pianko S, **Flamm SL**, Shiffman ML, Kumar S, Strasser SI, Dore GJ, McNally J, Brainard DM, Han LL, Doehle B, Mogalian E, McHutchison JG, Rabinovitz M, Towner WJ, Gane EJ, Stedman CAM, Reddy KR, Roberts SK. Sofosbuvir Plus Velpatasvir Combination Therapy for Treatment-Experienced Patients With Genotype 1 or 3 Hepatitis C Virus Infection A Randomized Trial. *Annals of Internal Medicine*. 2015 Dec;163(11):11.

Redfield MM, Anstrom KJ, Levine JA, Koepp GA, Borlaug BA, Chen HH, LeWinter MM, Joseph SM, **Shah SJ**, Semigran MJ, Felker GM, Cole RT, Reeves GR, Tedford RJ, Tang WHW, McNulty SE, Velazquez EJ, Shah MR, Braunwald E, Res NHFC. Isosorbide Mononitrate in Heart Failure with Preserved Ejection Fraction. *New England Journal of Medicine*. 2015 Dec;373(24):2314-2324.

Sun SY, Shi GJ, Sha HB, Ji YW, Han XM, Shu X, Ma HM, Inoue T, **Gao BX**, Kim H, Bu PC, Guber RD, Shen XL, Lee AH, Iwawaki T, Paton AW, Paton JC, **Fang DY**, Tsai B, Yates JR, Wu HQ, Kersten S, Long QM, Duhamel GE, Simpson KW, Qi L. IRE1 alpha is an endogenous substrate of endoplasmic-reticulum-associated degradation. *Nature Cell Biology*. 2015 Dec;17(12):1546-1555.

Wen QJ, Yang Q, Goldenson B, Malinge S, Lasho T, Schneider RK, Breyfogle LJ, Schultz R, Gilles L, Koppikar P, Abdel-Wahab O, Pardanani A, **Stein B**, Gurbuxani S, Mullally A, Levine RL, Tefferi A, Crispino JD. Targeting megakaryocytic-induced fibrosis in myeloproliferative neoplasms by AURKA inhibition. *Nature Medicine*. 2015 Dec;21(12):1473.

Wilcox DR, Muller WJ, Longnecker R. HSV targeting of the host phosphatase PP1 alpha is required for disseminated disease in the neonate and contributes to pathogenesis in the brain. *Proceedings of the National Academy of Sciences of the United States of America.* 2015 Dec;112(50):E6937-E6944.

Calendar

Monday, February 15
"Stem Cells and Ischemic Tissue Repair"

Feinberg Cardiovascular Research Institute Didactic Course to be presented by Gangjian Qin, MD.

Time: 8:30 a.m. to 10:00 a.m.
Location: Robert H Lurie Medical Research Center
Baldwin Auditorium
303 E. Superior
Contact: dlr635@northwestern.edu
More information

Tuesday, February 16
TIME Lecture: Overcoming the Global Surgical, Medical Education Gap - Are We Up for the Task?

Fizan Abdullah, MD, PhD will talks about innovative solutions to overcome surgical education deficits.

Time: 4:00 p.m. to 5:00 p.m.

Location: Robert H Lurie Medical Research Center
Baldwin Auditorium
303 E. Superior
Contact: fame@northwestern.edu
More information

Monday, February 22
DigitalHub: Preserving and Sharing Your Work Using NM's Repository

This class provides an overview of DigitalHub, Northwestern Medicine's open access repository, and provides hands-on instructions to individuals interested in curating their scientific and scholarly work.

Time: Noon to 1 p.m.
Location: Ward Building, Galter Library
LRC
303 E. Chicago Avenue
Contact: ghsl-ref@northwestern.edu
More information

More Events
Event organizers are encouraged to submit calendar items on Plan-It Purple for consideration. Please contact the Research Office with further questions.

NIH News

A Look Back on 2015
The journal *Science*'s annual top ten list of advances in all of scientific research worldwide included four developments that directly benefited from NIH support, including *Science*'s "Breakthrough of the Year," the CRISPR/Cas9 gene-editing technique. Read more about the big breakthroughs of 2015:

- CRISPR Makes the Cut
- A Vaccine against Ebola
- Yeast Engineered to Brew Opioids
- The Brain's Well-Hidden Secret

Registration Open for the Spring and Fall 2016 Seminars
NIH will hold two NIH Regional Seminars on program funding and grants administration in 2016.

- Wed. to Friday, May 11 to 13 Baltimore, MD
- Wed. to Friday, Oct. 26 to 28 Chicago, IL

The seminar is an opportunity for researchers and research administrators to connect with NIH and HHS staff individually through 1:1 meetings and through presentations on topics ranging from peer review and grant writing, finding the right funding opportunity, animals and human subjects in research, pre- and post- award management, special programs and more.

The Open Science Prize
Do you have ideas to advance open science? The Open Science Prize is a partnership between the Wellcome Trust, the National Institutes of Health and the Howard Hughes Medical Institute to unleash the power of open content and data to advance biomedical research and its application for health benefit. International teams can win $80k for prototype development. Deadline for phase one of the prize is Feb. 29.

More information

Follow Feinberg Social Media