

# The Read

Volume 6

**M Northwestern Medicine**<sup>®</sup>  
Feinberg School of Medicine

Department of **Radiology**

## Department of Radiology



### Letter from the Chair

James Carr, MD, Department Chair

2023 has been a year with much to celebrate here in the Department of Radiology at Northwestern University. We are proud to be part of a cutting edge clinical, educational and research institution that prioritizes care and inclusivity. Our community was thrilled to see that Feinberg School of Medicine is again one of the top medical schools in the latest *U.S. News & World Report* rankings. Northwestern Radiology's program, ranked 16th, also received recognition among specialty programs.

The Research section has had an outstanding year so far. Our department continues to climb the *The Blue Ridge Institute for Medical Research* rankings list, coming in at 18th this year. This is the highest our department has been ranked and I want to acknowledge the work that has gone into this latest milestone.

Research proposals and awarded projects have steadily increased over the past several years which would not be possible without Vice Chair of Research Dr. Michael Markl's team of faculty, trainees, and personnel. We look forward to purchasing and upgrading some of our advanced imaging research equipment with funds from a newly-awarded NIH S10 instrumentation grant. Equipment purchased will enhance pre-clinical research conducted within our imaging core.

RICO has also been operational for a full year and is already highly successful at providing a solid infrastructure for performing clinical trials at Northwestern Medicine. This summer, our researchers will begin expanding the availability of clinical trials throughout the NM enterprise, making imaging services for clinical trials more accessible to patients.

On the clinical side, our department continues to align Radiology services throughout Northwestern Medicine's enterprise. Initiatives to provide enhanced Emergency Radiology services and to standardize imaging protocols throughout the system are well under way.

This year we will also see some artificial intelligence tools becoming more closely integrated into the clinical workplace. These efforts, led by Dr. Alex Korutz and team, are highly collaborative with many internal and external partners involved. Our own research group has developed several AI tools designed to improve clinical accuracy and workflow efficiency. Dr Ulas Bagci continues to push the boundaries of AI, performing ground breaking research in the virtual reality space.

I am pleased to report that our educational programs have had a banner year. Our Diagnostic and Interventional Radiology residencies are welcoming cohorts of outstanding candidates. Applications for all of our programs increased significantly this year. More women radiologists matched to our programs than in previous years – something I am very proud to see. Gender equity in Radiology is a strategic priority for the department and we continue to make positive strides in this area. Northwestern Radiology has one of the best training environments in the country and will continue to operate at the highest level when educating students, residents and fellows to be future leaders in our speciality. The 2024 scholastic year will without doubt be a rewarding one. Thank you to Dr Senta Berggruen and all of the educational team for making Northwestern Radiology one of the top go to destinations for radiology training.

Our department continues to advance concerted efforts around sustainability. Dr. Tarek Hijaz has formed a work group mapping out areas where we can lessen our environmental impact in healthcare and Radiology. There is no future without environmental action now, and we intend to lead the way when it comes to sustainability efforts in Radiology. Dr. Hijaz's sustainability report is part of this issue and I invite you to read what his group has been able to accomplish both on the clinical and research sides.

Radiology has increased its focus on wellness and life balance within the workplace. We have introduced a flexible work environment for faculty, trainees, and staff. Dr. Jeanne Horowitz's work on wellness, mentorship and life balance in our department continues to be of immeasurable service as we continue to strive to be a top destination for Radiologists, trainees and staff to pursue their careers.

We have much to do before the end of 2023 but I am enthusiastic about our ability to provide top-class services and meaningful change for all of our trainees, employees, and patients. Please enjoy this next issue of *The Read* from the Department of Radiology.

Sincerely,

Cover image by Northwestern Radiology Cardiovascular MRI Group



# Pipeline Pathways in Diversity, Equity and Inclusion Practices in Northwestern's Department of Radiology

DEI Update | In Conversation with Senta Berggruen, MD, Vice Chair for Education and Diversity

Since establishing the Diversity, Equity and Inclusion Council in the Department of Radiology in 2020, Dr. Senta Berggruen, Vice Chair of Education and Diversity, has worked to cultivate inclusivity in a number of ways from admissions and hiring to hands-on community involvement.

This year, she was awarded the Society of Abdominal Radiology (SAR) inaugural Achievement Award for Diversity, Equity and Inclusion. SAR is the premiere society for abdominal imagers, and this award is made possible by the SAR DEI committee in order to recognize outstanding efforts as well as to “develop a diverse and inclusive Society,” according to their mission statement.

“This award belongs to our department,” Berggruen said, “because of all the support I get from my colleagues.”

Special thanks are extended to Dr. James Carr, Department Chair, who has supported these efforts from inception, as well as Dr. Syed Hussaini and Dr. Imo Uko, two former residents who were extremely active in starting department-wide conversations and planning events.

She also gave a shoutout to the department's Women in Radiology group, which continues to host quarterly events.

Dr. Berggruen has also presented at a plenary session at the SAR annual conference February 23 – March 3, 2023.

“Including this as a plenary session at the conference is exciting to me,” Berggruen said. “Everyone is in the same room, focused on pipeline pathway programming, intentional recruitment, and mentorship. These conversations place the limelight on diversity, inclusivity in abdominal imaging. This plenary session denotes a meaningful commitment to DEI.”

Beyond the focus on DEI, this session was also a chance for our department to get feedback and opinions from leaders across the country – a process of “planting and sharing seeds,” as Berggruen called it.

She also underscored the importance of having a diverse workforce in healthcare. “It's better for the community to see like-minded people caring for them.” With this in mind, Berggruen sees DEI as “an opportunity to mentor trainees and faculty to think about community engagement. This can potentially attract people into all radiology careers.”

When asked what Northwestern's Department of Radiology has prioritized in DEI efforts in recent years, Berggruen emphasizes the possibilities that DEI opens up. “If you want to recruit people, you want to keep people. Mentoring does that.”

As Vice Chair of Education, Berggruen is also invested in mentoring junior faculty and trainees. “In terms of recruitment, selection committees always have a question about candidates' understanding of DEI and how they can advance our department's mission.”

The long-term goal of the DEI Council and the Department of Radiology is to create “pipeline pathways” to careers in radiology. “Radiology is such a great field,” Berggruen said. “There are so many subspecialties. You can go into private practice or do research. And there are so many careers as technicians and sonographers, for example.”

Other efforts by the DEI Council include community engagement on a number of levels. The Council partners with the local non-profit organization Horizons for Youth sponsoring students. The department also hosts two high school career day events in May and June. Local high school students are given information about medical school and various radiology allied health professional school along with a close-up look at radiology work including cardiac imaging, ultrasound, research and hospital staff positions.

The department also funds two summer internships in radiology research mentored by Drs. Ryan Avery, Bob Lewandowski, and Michael Markl. The NM summer internship program continues to recruit up to three summer interns from underrepresented groups in medicine to shadow clinicians and complete a research project.

This year, the department has launched a pilot project hosting three college students to spend all day in the radiology department observing the work of physicians and clinical staff.

In just a couple of years, this is an astounding amount of work. To sum up this achievement, Berggruen said, “Our mission is to introduce radiology to more people, to expose people to careers in radiology, and to increase diversity and inclusivity by way of opening up opportunities.”



High school students from Horizons For Youth learn about CT Imaging in July 2023



# Yan R01 Develops MR Imaging Technology for Improved Cerebral Revascularization Surgery Outcomes

Technology and Hardware Update | Lirong Yan, PhD

Cerebrovascular disease is one of the leading causes of death and disability worldwide. Surgical revascularization has become one of the most effective therapies for management of chronic cerebrovascular diseases including moyamoya disease, complex aneurysms, and selected carotid steno-occlusive disease. Surgical therapies are known to improve cerebral hemodynamics and reduce the risk of stroke.

Dr. Lirong Yan, who started at Northwestern in April 2022, has been awarded a NINDS R01 that works to develop non-contrast, non-invasive MRI imaging to aid in pre- and post-revascularization surgery (7R01NS118019). As the need for surgery increases, so does the need for effective surgical planning. Surgeons need to know the best donor artery for bypass surgery. Imaging that quantifies blood flow significantly helps to answer the question of which artery is the best donor for at-risk territory. Currently, however, the choice of revascularization strategy highly relies on subjective interpretation of flow which is more variable, and thus patients are more at risk for post-operative complications. With this in mind, researchers like Dr. Yan are responding to the nuances of this clinical need.

“A segmented and quantitative characterization of cerebral hemodynamics pre- and post-revascularization is necessary to objectify flow requirements, standardize and improve patient care,” Yan says. “However, none of the existing clinical imaging modalities are able to provide high spatiotemporal resolution angiographic images with quantitative hemodynamic information from individual arterial segments without contrast agents.”

The technology uses arterial spin labeling (ASL) to assess both vascular territories and perfusion from individual arteries quantitatively. Non-contrasted enhanced 4D MR angiography is employed to provide better delineation of dynamic flows with good time resolution. Furthermore, the non-contrast, non-invasive component to the imaging increases patient comfort and post-operative health.

“Compared to the gold standard of digital subtraction angiography,” Dr. Yan says, “this provides a non-contrast option and is completely non-invasive.” This project also proposes an advanced image acquisition method and advanced image reconstruction algorithms to facilitate its clinical use.

## Efforts to Standardize Protocols Across NM Increases Patient Flexibility of Care

Clinical Update | Bradley Allen, MD, Chief of Cardiovascular and Thoracic Imaging

Over the past six months, a dedicated group has worked to standardize MR and CT protocols across Northwestern Medicine. As NM continues to grow and integrate with other hospitals, standardizing protocols is a critical next step to offering our patients the best care and to creating more efficient workflows for our care teams. We know that patients want to receive the best possible care close to where they live and work. In parallel, they also want to retain the ability to move across our system when needed and experience a consistent standard of excellence at each NM site.

To promote organizational alignment, improve access for our patients, and deliver highly coordinated care with system experts, this workgroup began to analyze the current state of NM protocols. Smaller groups were formed specifically to focus on Neuro, Body, Musculoskeletal, and Chest/Cardio protocols. Each group, over the course of several months, collaborated with radiologists and technical leads from across the system to understand the essential sequences of a foundational set of imaging studies. They gathered feedback about what each site’s scanners are capable of and worked to address concerns.

Next, the team will work to implement the changes that each group has recommended. Moving forward, we will need to iterate upon this approach multiple times to address a substantial number of imaging orders. In addition to those efforts, the workgroup will evaluate the options that exist for a central repository to house these protocols and begin to consider what a committee might look like in the future for approval of changes to protocols.

None of this challenging work could be accomplished without the time and help of so many of our radiologists, technical leads, and administrative team members. Thank you to all involved!

# Research Imaging Collaboration Office: Year in Review

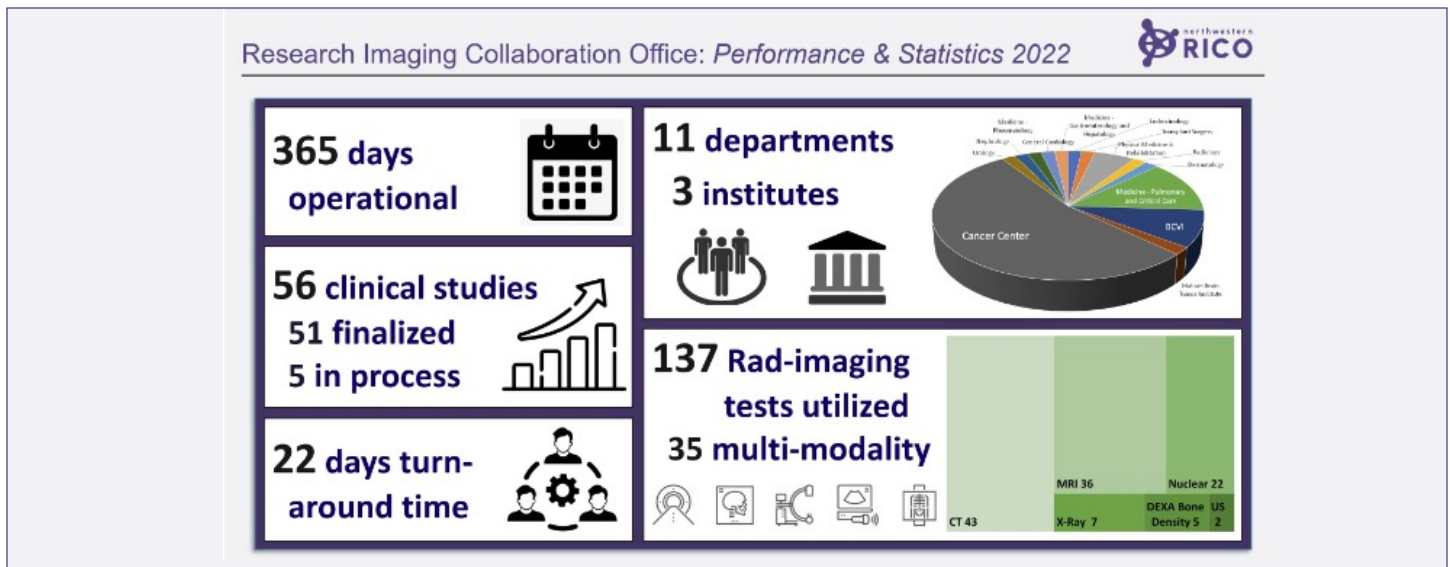
RICO Update | Caitlin Lair, Program Assistant for QUICL and RICO

The Research Imaging Collaboration Office (RICO) was established to review and manage industry-sponsored studies requiring radiology imaging services at Northwestern Memorial Hospital.

RICO commemorated their one-year anniversary on January 11th, 2023. This has been a very successful performance year, allowing the department to achieve its goal of increasing funded research studies with radiologists, technologists, collaborating departments, and sponsors. Since its establishment in 2022, RICO has continued

to grow and expand in the number of accepted proposals, committee members, and involved participants that make research all the more feasible for the department.

A year-one summary of RICO performance and statistics can be found below:



## Call for RICO Radiologist Reviewers

### Responsibilities as a reviewer:

- Assess studies for imaging feasibility at NMH
- Provide recommendations or alternative imaging procedures to collaborating departments in ways that enhance the effectiveness of the study
- Complete a short questionnaire (rapid review form) pertaining to the study and imaging requirements

### Key notes:

- Time commitment
  - 2-3 studies per month
  - 10-15 mins for standard review
- Training provided

### Why join RICO?

- Provides avenue for increased research involvement
- Expanded opportunities for department committee involvement
- Increased familiarity with departmental and collaborative research
- CV-worthy participation

*For more information on how you can work with RICO to optimize your study, contact [Caitlin Lair](#), Program Assistant for QUICL and RICO in the Department of Radiology.*

# AI for Pancreatic Diseases at Northwestern: A Look at the Machine and Hybrid Intelligence Lab

AI Update | Elif Keles, Deputy Director of Augmented Imaging for CISAM and Ulas Bagci, PhD | bagcilab.com

The Machine and Hybrid Intelligence Lab was founded at Northwestern in early 2021 when Dr. Ulas Bagci moved to Northwestern Radiology. His lab creates innovative Artificial Intelligence (AI) solutions for healthcare problems spanning from pancreatic cancer to lung cancer, prostate cancer, liver cirrhosis, infectious and inflammatory lung diseases, and others.

Bagci and his team go beyond conventional AI algorithms and try to build a trustworthy bridge between the engineering world and clinical sciences. In this article, we focus on one of the groundbreaking studies that Dr. Bagci, and his senior clinical research associate Dr. Elif Keles are leading titled “AI for Pancreatic Diseases”.

Pancreatic cancer is a type of cancer that is often aggressive and difficult to treat. There is currently no widely recommended screening test for pancreatic cancer that has been shown to reduce the mortality rate from this disease effectively. This is because pancreatic cancer often does not produce symptoms until it has progressed to an advanced stage, at which point the cancer may have already spread beyond the pancreas.

Some tests may include imaging tests or endoscopic procedures. However, their effectiveness in detecting early-stage pancreatic cancer is not apparent. Early detection and treatment may improve the chances of a better outcome. The team at the Machine and Hybrid Intelligence Lab are working on the early detection of pancreatic cancer from pancreatic cysts.

Efforts towards the team’s larger goal have been funded by a NIH R01 titled “Cyst-X: Interpretable Deep Learning Based Risk Stratification of Pancreatic Cystic Tumors” (5R01CA246704-03). This grant, awarded to Northwestern University, is a multi-center study at the national and international level, with collaborations from NYU Langone, Mayo Clinic (Florida, Rochester, Arizona), Erasmus Medical Center- Rotterdam, and Allegheny Health Network. The overall goal of this project is to create a new diagnostic tool called Cyst-X to detect pancreatic cysts from radiologic (MRI) images first, then characterize them to predict their likelihood of being aggressive in the future.

Meanwhile, the lab continues collecting multi-modal data from pancreas MRIs and CT scans, pathology, cytology results, and demographic data from our collaborating centers. Already, they have developed a cutting-edge AI algorithm for pancreas MRI analysis and have trained over 500 MRI scans. All pancreas images were classified by the deep learning normal, low-grade, and high-grade cyst cases. Current segmentation and classification results were analyzed to create new evaluation metrics and radiomics in daily clinical routines. Next, the team will further enhance the initially developed AI-based risk stratification model with newly collected data and information to characterize pancreatic cysts better.

The Machine and Hybrid Intelligence Lab will act as the AI Core Lab for the IMMINENT and DREAM studies. They are primarily working on making new machine learning algorithms for MRI analysis of the pancreas in both health and disease. As an AI Core Lab, they will create systems that use AI to make predictions for

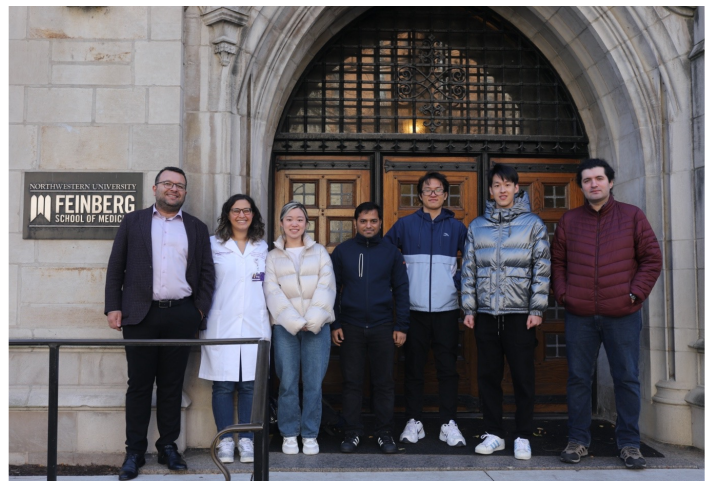
MRI analysis of the pancreas. Specifically, these algorithms will be able to be explained in the decision space and understood in the model construction space.

DREAM (Design and Rationale for the Use of Magnetic Resonance Imaging Biomarkers to Predict Diabetes after Acute Pancreatitis in the Diabetes Related to Acute Pancreatitis and Its Mechanisms) is another part of the project.

In collaboration with the University of Illinois at Chicago and the other PIs of the IMMINENT ((Imaging Morphology of Pancreas in Diabetic Patients following Acute Pancreatitis) study, the team at Northwestern will coordinate the technical and clinical parts of the project. More specifically, they will connect clinical sciences and artificial intelligence for the IMMINENT study's imaging and image analysis.

IMMINENT is under the T1DAPC - The Type 1 Diabetes in Acute Pancreatitis Consortium. T1DAPC was granted in 2020 by the National Institute of Diabetes and Digestive and Kidney Diseases (19093//3U01DK127384-02S1). It consists of ten clinical centers and one data coordination center. It aims to investigate Type 1 diabetes and other kinds of diabetes manifesting during or after one or more episodes of acute pancreatitis. To achieve this, T1DAPC's primary research will follow up with patients recently diagnosed with acute pancreatitis to see how many patients develop diabetes.

Most recently, the Lab also began work as an AI Center under the CPDPC (Chronic Pancreatitis, Diabetes, and Pancreatic Cancer) Consortium due to their AI efforts for pancreatic diseases,. They will develop new Trustable AI Based Risk Assessment for Patients with Chronic Pancreatitis PROspective Evaluation of Chronic Pancreatitis for EpidEmiologic and Translational StuDies (PROCEED): Rationale and Study Design From the Consortium for the Study of Chronic Pancreatitis, Diabetes, and Pancreatic Cancer.



# NU Radiology-Founded AI-Enhanced Medical Imaging Company Clearvoya Receives NHLBI STTR Grant

## AI Update

In the 1980s, the medical imaging technique digital subtraction angiography (DSA) was developed to visualize blood vessels. As the need for minimally-invasive endovascular interventions increased, DSA emerged as one of the more common technologies applied in the treatment of stroke, myocardial infarction, and peripheral vascular disease, pathology that more adversely affects underserved and minority patient populations.

The MPIs of the STTR grant focused on DSA technology and artificial intelligence, Dr. Sameer Ansari, Professor of Radiology, Neurology, and Neurological Surgery, and Dr. Donald Cantrell, Assistant Professor of Radiology and Neurology, met at Northwestern while Cantrell completed his residency in the Department of Radiology and both Diagnostic/Interventional Neuroradiology fellowships. “Just prior to COVID and toward the end of [Cantrell’s] fellowship, we had been discussing neurointerventional applications that could leverage rapidly developing machine learning technology and his expertise in this field,” Ansari says.

These discussions were the beginning of a medical start-up called Clearvoya. Ansari recalls, “As we filed our first patent, we realized that this work and a pipeline of neurointerventional applications could be commercialized over time and we began to consider forming a company.”

Leon Cho - co-founder of Clearvoya, MPI of the grant and Ansari’s longtime friend since high school in Baton Rouge, LA - had moved to Chicago where the two reconnected. “Since I knew he had a computer science background working in Silicon Valley for some time and also had completed an MBA from the University of Chicago, I asked him to assist us in developing our vision and, hence, Clearvoya came into existence!”

Research from Cantrell and Ansari has led to improvements in DSA imaging. “Catheter angiography is performed by inserting a small catheter into an artery and recording a series of X-Ray images as the contrast traverses the patient’s blood vessels,” Cantrell says of the technique. “However, superimposed X-Ray densities from bones and soft tissues obscure the imaging details of the blood vessels.”

Images can also be degraded by voluntary, respiratory, or cardiac motion during the exam, which are common to routine clinical practice. “In situations where patients are unable to remain still, which may be due to difficulty breathing or the distress of an acute stroke, the poor quality of motion-degraded DSA imaging increases the risk of complex procedures such as stroke clot removal (thrombectomy) or cardiac (coronary) stenting.”

In response to this need for better imaging and procedures, Cantrell and Ansari developed a deep learning algorithm to use DSA even with motion. Using Vision-Transformer-based network architecture, images identify blood vessels and separate them from other X-ray densities such as bone and soft tissue. A novel data augmentation mechanism trains the neural network to outperform the imaging techniques during patient motion.

The STTR project (R41HL164298) titled “Motion-Resistant Background Subtraction Angiography with Deep Learning: Real-Time, Edge Hardware Implementation and Product Development” will utilize this algorithm for real-time application in minimally-invasive procedures with the overall aim to integrate this technology into angiography machines in the future.



**Leon Cho**

- *Co-founder of Clearvoya*



**Donald Cantrell, MD**

- *Assistant Professor of Radiology and Neurology*



**Sameer Ansari, MD**

- *Professor of Radiology, Neurology, and Neurological Surgery*



# Radiology Mentorship Program

Wellness & Professional Development Update | Jeanne Horowitz, MD, Vice Chair of Education & Faculty Affairs

Since its launch in 2020, the Radiology Mentoring Program (NU RaMP) has offered many opportunities for career growth, professional development, and employee wellness within our department. This program was initiated by Dr. Jeanne Horowitz with the goal of creating supported space for residents and faculty members to work on leadership development, research, and promotions within the context of the mentee's goals.

Horowitz notes that there is a wellness aspect to these efforts. "Mentoring is important for career satisfaction and development. Good mentors can also help with recognition as well as provide support with work overload or tips with workflow and processes."

Nu RaMP has two mentorship tracks: paired mentorship and resident mentorship. Paired mentorship is offered to faculty who wish to work with an associate or full-time professor. Mentorship is highly encouraged for faculty within five years of starting their appointment. With the help of PGY-4 Dr. Francisco Maldonado and PGY-2 Dr. Logan Jackson, the resident mentorship program is fully operational. This group consists of a group of two faculty with 6-8 residents who meet a few times a year.

Informational workshops geared toward mentors and mentees are regularly available. Materials from these workshops are offered on the department website. A mentoring lunch occurred in May 2023, as well.

Mentorship is very effective in getting promotions. Survey results after the first year of the resident program and year-end evaluations of the mentoring pairs have both shown positive results overall.

Horowitz has a keen interest in mentoring and says she got her start through NUCATS. By studying research and literature in radiology articles as well as business publications in the lay press, she was able to come up with effective strategies for mentoring in the Department of Radiology.

She is also part of the Alliance of Leaders in Academic Affairs in Radiology (ALAAR) group through AUR. Currently, she is part of the mentorship committee. "What I appreciate about this group is that leaders can learn from each other about what other groups are doing," she says.

The Department of Radiology has benefitted from having top-down support as well. "One thing I've noticed networking with these radiologists is that they need leadership support," Horowitz continues. "Dr. Carr's support has helped to structure these programs to be successful."

NU RaMP always welcomes new mentors and mentees. All are welcome to reach out to Dr. Horowitz for more information.

## Wellness in the Department of Radiology

Recent studies have shown that clinician burnout is an increasingly important issue to address on a national level. Burnout is closely associated with both job satisfaction and clinician retention. The Department of Radiology's Wellness Council, headed by Drs. Jeanne Horowitz and Senta Berggruen, works to improve physician wellness in a number of ways.

"There are six main factors that lead to burnout at work: work overload, lack of control, lack of fairness, insufficient rewards or recognition, lack of community, mismatch in values," Horowitz says. Understanding the sources of problems directly translates into solutions on the department level.

"The Wellness Council focuses on trying to improve things that are in our circle of control at work. This can be at the section, group, or department level," Horowitz adds. The larger the group, the more difficult it becomes to find specific ways of addressing wellness.

In 2022, Dr. Horowitz and a team from the department published "Team Approach to Improving Radiologist Wellness: A Case-Based Methodology" in Issue 5 of Current Problems in Diagnostic Radiology which helped to launch current wellness efforts in the department. This paper shows how the DMAIC methodology (define, measure, analyze, improve, control) helps to make lasting

changes in wellness. This is one of many methodologies that can be employed to achieve results in improvement projects.

Special events include a summer welcome party, an RSNA alumni reception, a trainee holiday party, and resident/ fellow graduation. Getting together increases a feeling of community, which is important in a workplace.

"Radiologists and staff can do small or big things to improve wellness at work," Horowitz points out. This year the group is working on rewards and recognition including awards to faculty and encouraging a practice of giving kudos to trainees, staff and to radiologists. Kudos, it has been found, increase both personal and group satisfaction with contagious energy.

If you are looking to get involved in departmental wellness events please contact Drs. Horowitz and Berggruen. If you would like to introduce a wellness program in your area mentors are also available to help make those improvements.



# Kim and Lee Receive AHA Funding for Innovations Into Cardiac COVID-19 Research

Research Update | Daniel Kim, PhD, Associate Vice Chair of Research

When it comes to COVID-19, a lot is still unknown. The pandemic is ongoing, and many people suffer from long-term symptoms caused by this virus. One very common symptom is chest pain, which is the basis of co-PIs Dr. Daniel Kim and Dr. Daniel Lee's latest research project funded by the American Heart Association titled "Rapid Cardiovascular MRI for Quantifying Coronary Microvascular Dysfunction in COVID-19 Survivors."

"One of the pathways of chest pain in COVID happens in coronary microvascular dysfunction," Kim says. Small blood vessels in downstream levels can get clogged. When this happens, these vessels supplying blood to the heart will cause chest pain. COVID-19 causes inflammation in these vessels. However, cardiac MRI can detect these abnormalities.

MRI offers a very comprehensive test when examining the long-term effects of the virus. It offers many different types of images, which help to determine unintended or unidentified pathways. Medical professionals need to know all the pathways this virus causes abnormalities.

The outcome of the project seek to show whether small vessel clogging is worse in long-term COVID-19 patients as opposed to controls. This team of investigators, including Drs. Brad Allen, Michael Markl, Ravi Kalhan, and Jacob Schauer, will test to see if blood flow to the heart is different for patients with normal and abnormal exercise capacity. This project also seeks to understand whether measurement of blood flow to the heart indicates exercise intolerance. Answering this question will help to shed light on the best methods for measuring blood flow when using MRI mechanisms.

The PIs note, "COVID-19 is a novel virus and it is not going away. Right now, we're at the learning phase. There is a need to treat people but you can't treat them if you don't know how it works."



## Northwestern Faculty Presentation Addresses LGBTQIA+ Imaging and Health Needs

Faculty Update | Nicole Beaubien, Communications Intern

Dr. Anugayathri Jawahar, an abdominal imaging radiologist at Northwestern University, has successfully developed a lecture series with Dr. Anne Darrow designed to educate Chicagoland medical students and residents about transgender imaging and LGBTQIA health equity. The awareness program and the educational series was the outcome of a grant approved by the American College of Radiology for the state chapter of Chicago Radiological Society. The first lecture series took place for the aspiring medical students and residents of UIC and Cook County hospitals on June 13<sup>th</sup>, 2023 with Dr. Anne Darrow, Dr. Anugayathri Jawahar, and Dr. Morlie Wang.

According to Jawahar, there is lack of knowledge about what terminologies are acceptable to use for transgender patients, which commonly creates instances of insensitivity and patient dissatisfaction. In fact, 50% of trans patients have reported having to educate their healthcare provider on such topics. Jawahar, alongside Darrow, Kulkarni and Wang, strives to address this gap in knowledge and educate about the recommendation for screening protocol in this transgender patient population.

"We want them to be aware that there are certain recommendations and guidelines for the healthcare of this community," Jawahar noted, "How am I supposed to guide them [her patients] if I don't have the knowledge?"

Jawahar aims to enlighten aspiring physicians by "empowering" them with this information "so that they might help others." For instance, she emphasized that patients should know what to watch for after they undergo surgeries and that radiologists should be aware of the potential complications that occur in these patients related to how specific gender-reassignment surgeries appear in imaging.

Jawahar also spoke of the emotional turmoil that comes with discrimination, which is exemplified when added to medical stress in these patient groups. She aspires to create an environment where transgender patients feel safe and comfortable under the care of their medical providers while simultaneously receiving high-quality treatment. Another statistic presented at Jawahar's lecture stated that 23% of trans patients do not seek healthcare due to fear of mistreatment. This issue is very important to Jawahar and her team, as she stated: "The knowledge gap has to be filled so that we achieve equity and inclusion in patient care."

As she conducts more classes in the future, Jawahar hopes to both create a safe space for transgender patients in imaging and to encourage LGBTQ+ medical students to pursue a career in radiology. Addressing health equity in radiology – and across every medical specialty – paves the way for a safer and more welcoming future of medicine.

# Northwestern Radiology Welcomes ASNR 2023 to Chicago

Faculty Update | Virginia Hill, MD

Northwestern neuroradiologists played important roles in welcoming the 61st Annual Meeting of the American Society of Neuroradiology to Chicago. The meeting, entitled "Transforming the Future of Neuroradiology", was held at the Sheraton Grand in Chicago from April 29 - May 3, 2023.

The first plenary session, "Unpacking the Stars: Luminaries Share Their Cases and Analyses," was co-moderated by Chief of Neuroradiology at Northwestern, Alexander J. Nemeth, MD. The session began with highlights from an oral history project "Stories of Neuroradiology," comprising more than 100 hours of interviews with 65 pioneers in the neuroradiology field, including our own Chair Emeritus neuroradiologist Eric Russell.

Dr. Nemeth then kicked off the educational portion of the session by introducing his former Neuroradiology Fellowship Program Director and mentor from Massachusetts General Hospital, Pamela W. Schaefer, who gave a scintillating case-based talk entitled "Train the Brain."

Later in the day, Ali Shaibani, Chief of Neurointerventional Radiology, moderated the informative session "From Embryology to a Contemporary Understanding of Functional Neurovascular Anatomy," reminding us of the importance of the embryology of the arteries and veins of the head and neck.

Marinos Kontzialis co-moderated the session "Essentials of Brain Imaging 1." This session included talks on imaging aneurysms, primary brain tumors in the adult, intracranial infection, and head trauma.

Virginia Hill had fun introducing Eshan Damle to his first ASNR meeting. Eshan is a Tulane undergraduate who participated in the Northwestern Medicine Pre-Med Internship Program in 2022. Eshan had a poster accepted to ASNR23 on the imaging of a cauda equina paraganglioma.

The Foundation of the ASNR's 2023 four grant recipients also were recently announced. Virginia B. Hill, MD received a grant for the project "Augmented Intelligence Analysis of Meningioma MRIs According to DNA Methylation Subgroups, Molecular Markers, and Copy Number Variants." This project will run from July 2023 through June 2024.



# “Explain It Like I’m Five”: Graduate student-led elevator pitches paving the future of radiology

Graduate Student Update | Nicole Beaubien, Communications Intern

The annual International Society for Magnetic Resonance in Medicine (ISMRM) meeting and exhibition presents the latest research, innovations, and applications in magnetic resonance imaging as they relate to science. This year in Toronto, a secret session at the ISMRM meeting led by four Northwestern PhD students mentored by Department of Radiology faculty strove to make research findings more accessible for the newest generation of aspiring scientists: secondary students. In this session, “Explain it Like I’m Five,” various radiologists and scientists practiced summarizing their information for a lay audience by presenting elevator pitches to the students in a fun-spirited competition.



Jasmine Vu, Kristina Zvolanek, Kim Hemmerling, and Divya Joshi are all currently completing their PhDs and have received training via the Training Program in MRI, a NIBIB T32 program within BME and the Department of Radiology. This program, led by Dr. Michael Markl, inspired these students to do an outreach activity to get connected with the MRI community at an international level. According to Zvolanek, her pediatric research also sparked an interest in doing this event with kids. The group highlighted the importance of firsthand experience for students. More personal involvement with professionals in the MRI field helps motivate kids to consider career paths within radiology. This particular cohort of students are part of a science club at their secondary school in Toronto, so it was especially important to them to learn from the experience of conferences and get a glimpse into the life of a PhD. Despite the youth of the students, Joshi added, it is valuable to “plant the seed in their minds” and have them considering career possibilities early on.



As a part of Northwestern’s PhD program, these four students are already working towards revolutionizing the field of magnetic resonance imaging. Vu, Hemmerling, and Zvolanek are all researching alongside radiology faculty mentors. Vu, a biomedical engineering major, works in Dr. Laleh Golestani Rad’s lab improving MRI safety with active brain implants. Hemmerling, also a BME major, works with Dr. Molly Bright studying spinal cord function MRI in relation to physiological noise suppression with bipolar gradients. Zvolanek, also a BME major, was also mentored by Dr. Bright researching cerebrovascular MRI among pediatric patients. Meanwhile, Joshi, a BME major with a background in robotics, was mentored by Dr. Jules Dewald and Dr. Carson Ingo in Physical Therapy and Human Movement Sciences. Her research hones in on using diffusion MRI in human movement science, particularly that of arm muscles in patients of hemiparetic stroke.

The group hopes that this secret session will continue in ISMRM conferences to come, though their impending graduation dates mean that next exhibition might be the last where all four students will be together. Thankfully, they are optimistic about the future of the panel, and will pass it on to a new cohort of T32 trainees.



# Contrast Recycling and Energy Saving Programs Implemented in Radiology

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Sustainability Update | Tarek Hijaz, MD

The Department of Radiology's recently created Sustainability Task Force is already making steady progress in its efforts to address environmental issues. Recent areas of focus include initiation of a fully-operational iodinated contrast recycling program, plans to reduce MRI energy consumption, and attention to reducing greenhouse gas emissions related to meetings and interviews.

Dr. Tarek Hijaz, head of the task force, has reported that Feinberg CT has collaborated with GE Healthcare to participate in their iodine recycling program. This program is expanding throughout Europe and the Americas according to GE, and it is fully operational at Northwestern Medicine. Iodine is a nonrenewable mineral extracted from soil at great cost both operationally as well as environmentally. It is commonly used as contrast for both CT and X-ray imaging. As global demand for contrast media increases, statistics from the World Iodine Association show that only 18% of the current global demand is reused.

The process of recycling is simple. Hospitals are provided with 3-liter containers into which unused or uncontaminated iodinated contrast media can be deposited via the injector syringe or by the bottle. Filled containers are returned to GE's processing facility in Norway where iodine is extracted and recycled into new contrast media.

Since the implementation of these practices in 2006, GE reports, "On average, 5% of the contrast customers have purchased goes unused." Contrast recycling also prompts hospitals and radiology staff to track contrast usage and waste.

Having this program up and running is a fantastic achievement. Dr. Hijaz has acknowledged the crucial contributions of Ms. Sarah Fopma and Mr. Ray Diano of CT, as well as of Dr. Amir Borhani, Director of CT, in collaborating with GE to get this project off the ground in rapid fashion.

## Match Day 2023

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Resident Program | Holly Harper, Education Manager

The National Resident Matching Program's main residency match for radiology residents was held on Friday, March 17th. There was a high level of competition in Radiology this year. In the area of Integrated Interventional Radiology, we were able to match two candidates, and in the area of Diagnostic Radiology, we were able to match ten candidates.

This year, a record-breaking number of applications was received amounting to 25% more. Our department also saw a 50% increase in the number of women who matched in both Interventional and Diagnostic tracks.

It is expected the incoming cohort will begin their Northwestern residency programs in July 2024.

Partnering with Siemens, Northwestern Radiology is also at work on more sustainable operation of MRI scanners. Faculty leading this project include Dr. Hijaz, as well as Dr. Markl, Vice Chair of Research, and Dr. Korutz, Vice Chair of Informatics. Lower energy consumption is the goal, but maintaining operations and high image quality are challenges.

New workflows and low-energy pulse sequences have been developed to address energy efficiency. These methods help to assess MRI energy consumption during data acquisition in real-time or near real-time. New methodologies for software-derived estimation of power consumption during routine operation of the MRI system are the expected outcome of these efforts.

To address power consumption, the task force has also moved forward with plans to install a smart power meter on CTI scanners. Dr. Hijaz notes, "Routine clinical operation of MRI results in substantial energy consumption associated with high costs and contributions to climate change."

The environmental impact of travel for radiology meetings and conferences is another area being explored. Dr. Hijaz and his fellow co-members of the Association of University Radiologists (AUR) Sustainability Committee have begun looking into the potential for decreasing greenhouse gas emissions related to radiology conferences and meetings. As expected, initial investigations point to the fact that in-person conference attendance generates significantly higher greenhouse gas emissions than virtual attendance. The majority of these emissions are related to air travel, according to sustainable event management agency MeetGreen, with whom members of the AUR's committee met recently. In light of this information regarding the impact of air travel, the Department of Radiology is looking into maintaining and possibly increasing its use of virtual interviews where possible.

Our sincere thanks go out to all the faculty and staff who contributed to the success of our recruitment campaign. We are confident that these new residents will have a positive impact on our training program and will benefit from the outstanding educational opportunities offered here. We look forward to welcoming them on board and working with them in the upcoming year.

# Radiology Research Day 2023

The Department of Radiology hosted another successful Radiology Research Day on May 17, 2023. Many thanks go out to PG-Y2 residents Drs. David Polito and Derek Hesse for their work organizing this year's event!

Special congratulations go out to Dr. Daniel Kim, PhD, Associate Vice Chair of Research, who was selected as this year's Department of Radiology **Mentor of the Year!**

Awards were given out for the Medical Trainee Publication Award and Best Trainee Presentation Award. Each award-winning project exemplifies innovation and commitment to advancing radiology research.

The exceptional quality of all 2023 Research Day presentations impressed our judges, making the selection process highly competitive. We extend our gratitude to all Research Day participants for their invaluable contributions.

And the winners are:

## Medical Trainee Publication Awards

### Nicholas Xiao, MD (3 publications)

“Gender Disparities in Academic Radiology Authorship: A 13-Year Review”

“Inferior Vena Cava Thrombosis Risk in 1582 Patients with Inferior Vena Cava Filters”

“Median Arcuate Ligament Compression Associated with Flow-related Visceral Aneurysms”

### Jonathan Levine, MD (1 publication)

“Resident Perspective of the Virtual Diagnostic Radiology Residency Interview Process: A National Survey From the Association of Program Directors in Radiology”

## Best Trainee Presentation Award

### 1st-Place: Thara Nallamothu

Title: “Post-ablation 4D flow restoration in atrial fibrillation patients with high CHA<sub>2</sub>DS<sub>2</sub>-VASc score quantified by novel 4D Hemodynamic Signature Index”

### 2nd-Place: Neha Reddy

Title: “Denoising task-correlated head motion from motor-task fMRI data with multi-echo ICA”

### 3rd-Place: Elizabeth Weiss

Title: “Respiratory-Resolved Flow in Congenital Heart Disease: A 5D Flow MRI Study”



*Derek Hesse and David Polito at Radiology Research Day 2023 with Medical Trainee Publication Award winner Nicholas Xiao*

# Second Annual Radiology Residency Retreat

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Resident Update | Alison Esteve, MD and Jonathan Levine, MD, Chief Residents

The second annual Radiology Residency Retreat held on February 10, 2023 at WhirlyBall was an enormous success! The retreat featured an inspiring presentation by guest speaker Dr. Richard Gunderman, who discussed leadership and compassion in the field of radiology.

Wellness was an engaging topic for the group. Together they completed an important activity entitled "Where do I stand?" During this time, residents contemplated assorted topics in leadership ranging from conflict resolution to the energizing benefits of coffee and naps. Everyone participating was invited to form their own stances to carry forward in the program.

In addition to the guest speaker and group work, residents got to have some fun including the creation of a spaghetti tower, bowling, and playing WhirlyBall.

The event was capped off with time for reflection and an inspiring collective message from radiology faculty.

The residents would like to thank the faculty and department leadership for supporting the residency wellness retreat, and we look forward to continuing this tradition in the coming years.

## New Grants

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Grant Funding Update | Research Office at Radiology (ROAR)

Ulas Bagci, PhD, NCI Uo1, "Hybrid Intelligence for Trustable Diagnosis and Patient Management of Prostate Cancer (HIT-PIRADS)"

Donald Cantrell, PhD, and Sameer Ansari, MD, NHLBI R41, "Motion-Resistant Background Subtraction Angiography with Deep learning: Real-Time, Edge Hardware Implementation and Product Development"

Laleh Golestani Rad, PhD, NIBIB R01, "Discovery and Applied Research for Technological Innovations to Improve Human Health"

Virginia B. Hill, MD, ASNR 2023 Foundation Grant, "Augmented Intelligence Analysis of Meningioma MRIs According to DNA Methylation Subgroups, Molecular Markers, and Copy Number Variants"

Daniel Kim, PhD, and Daniel C. Lee, MD, NHLBI R01, "Quantitative Detection of Coronary Microvascular Dysfunction in Long COVID Patients using a Comprehensive, Rapid, Free-Breathing Cardiovascular MRI"

Daniel Kim, PhD, and Daniel C. Lee, MD, RSNA Emerging Issues Grant – Long-Term COVID Effects Award, "Discovery of Racial Disparities in Coronary Microvascular Dysfunction in Long COVID Patients using Rapid Quantitative Cardiovascular MRI"

Dong-Hyun Kim, PhD, NCI R01, "Local Tumoral Delivered Immune Checkpoint Blockades Immunotherapy and Radioembolization Combination Therapy"

Jeesoo Lee, PhD, NHLBI R21, "Mitral Regurgitation Quantification Using Dual-venic 4D flow MRI and Deep learning"

Michael Markl, PhD, NIH S10, "State-of-the-art High Field 7T MRI System Upgrade to Accelerate Translational Sciences"

Elizabeth Weiss, NHLBI F30, "Dual-Venic 5D Flow for Assessment of Congenital Heart Disease in Pediatrics"