

WINTER ISSUE. 2022
VOL. #04

THE READ

NEWSLETTER

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SEE THE LATEST
IN MAMMOGRAPHY
AND ARTIFICIAL
INTELLIGENCE

CHECK OUT OUR
MENTORSHIP
PROGRAM

LEARN MORE
ABOUT RESEARCH
OPPORTUNITIES
AND EDUCATION

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NORTHWESTERN

DEPARTMENT OF RADIOLOGY

A MESSAGE FROM THE CHAIR

I want to thank everyone for another great year. Despite the complex pressures that COVID brought us, our department has accomplished a number of notable achievements, some of which are outlined in this issue of *The Read*.

Thank you all for your ongoing commitment to the COVID-19 safety measures, which remain in effect at the hospital. Despite the drop in cases and hospitalizations, we must remain vigilant in keeping our patients and co-workers safe.

The imaging informatics team continues to be very busy, as illustrated by its continued success. Visage Mobile is ready to download for iOS. We continue to implement a web-based application for Android devices and integration with Haiku and Canto. I'm also excited by all the work being done by the Advanced Software Applications Workgroup (ASAW), which brings together leaders in NMIS with critical members of our clinical and research teams in Radiology. This workgroup will oversee all software applications (including AI algorithms) that are internally coded at NM/ FSM and are seeking deployment into either the research instance of Visage or the clinical (total production) instance of Visage.



Dr. James Carr, Chair

Match Day was Friday, March 18, 2022. We have seen record numbers of applicants to our residency programs again this year, and we anticipate another outstanding new class of incoming trainees. As current residents strive to complete another great year, I would like to commend everyone for their continued dedication and commitment. The first Resident Retreat happened on Friday, February 11, 2022. I want to congratulate Leah Gilligan and her team for organizing a unique and enjoyable event. And thanks to all the faculty, leadership team members, and staff who committed their time and made the retreat such a success.

The Department of Radiology Diversity, Equity, and Inclusion (DEI) Council has initiated several exciting projects this past year under the leadership of Dr. Senta Berggruen. On March 21, 2022, our department hosted Northwestern undergraduate students to introduce them to Radiology as a career option. The DEI Council also facilitated an online small-group work session titled: "How to Create an Inclusive Workplace" on March 29 at noon. Finally, on the heels of a successful Giving Tuesday fundraiser for Horizons for Youth, the DEI Council is planning a career event for high school students this spring. Horizons for Youth is a local non-profit providing educational opportunities for Chicago families in underserved communities, and we are proud to partner with them.

Last year, Dr. Eric Hart became Clinical Director of the Northwestern Medicine Lung Cancer Screening Program. This system-wide program, under his leadership, continues to expand and provide a real benefit to our patients. On a recent note, Dr. Hart says that CMS will continue to change their lung cancer screening eligibility requirements by February 22, 2022. Thank you to Dr. Hart for all your work.

With the support of the Feinberg Dean's Office, the Department of Radiology has established the Research Imaging Collaboration Office (RICO) as a new resource for the centralized and efficient coordination of industry-sponsored studies that utilize Radiology's imaging services. Run by our Research Operations team, this new service will significantly facilitate clinical research projects that use imaging. Effective January 15, 2022, all clinical studies utilizing Radiology services must contact the RICO team and operate the new dedicated study intake and review process. I want to commend Jessica Agosto, Senior Research Administrator, and Crystal Santillanes, Research Operations Manager, for creating RICO.

I also want to encourage anyone interested in research to attend the Research Operations team's Research Compliance Bootcamp Sessions. Spearheaded by Crystal Santillanes and our Regulatory Coordinator Yasmeen Khan, these one-hour sessions answer all your IRB compliance and contract questions. The last presentation took place on February 25, 2022. Contact Daniel Aviles in the Research Office for a Zoom link to future bootcamp sessions.

Congratulations are in order for Dr. Daniel Kim, who has been awarded the Knight Family Professor of Cardiac Imaging at the Feinberg School of Medicine. This prestigious designation recognizes his commitment to cardiac imaging and his stature as a notable scientific innovator in the field. I also want to acknowledge the great work of Dr. Jeesoo Lee, who was recently appointed Research Assistant Professor. Many thanks go out to Dr. Gary Dillehay, who has served as the Chief of Nuclear Medicine for the last several years. We are grateful for his leadership of this section and wish him the very best as he prepares to retire next year. Thanks also to Dr. Ryan Avery, who has stepped in as Interim Chief of Nuclear Medicine as of December 2021.

Northwestern Radiology continues to lead the way in our specialty, and this is primarily due to the contributions of so many in our department.

Sincerely,

James Carr

THE MENTORSHIP PROGRAM AT NORTHWESTERN RADIOLOGY

As individuals progress through medical training, one of the most significant steps comes between medical school and residency. Residents exist in a special middle ground of medicine – already doctors but not yet experienced enough to practice independently. After the acceptance into residency, new questions emerge. What subspecialty should I choose? Should I pursue a career in research? Is private practice suitable for me? Even these questions come with added stressors. This is where a mentoring program can be of great use.

Mentoring allows early physicians an opportunity to peek behind the curtain of attending life to help determine what they might want out of their careers. Studies have shown that mentoring programs increase the research output (manuscripts, grants) and open career opportunities. Add to that reduced rates of burnout and improved rates of overall career satisfaction, and the case for mentorship becomes even more robust.

While some radiology faculty have taken on residents as mentees in the past, until recently, the residency program had no formal faculty-resident mentorship program. The faculty-resident mentorship program was proposed and designed by a current resident, Francisco Maldonado (PGY-4), with the guidance of Drs. Mike Magnetta, Ankur Garg, and Jeanne Horowitz.

Maldonado credits an organized mentorship program that he participated in while in medical school as a key to his previous success. This was the impetus for him to establish a similar program here at Northwestern for radiology residents.

The mentorship program got off the ground in 2021 to start the academic year. Faculty meet with mentees in groups of 4-5 a few times a year. So far, the mentorship groups have been a big success. The regularity of the meetings varies, with some groups meeting monthly while others meet bi-monthly or quarterly.

One of the program's biggest benefits up front has been for residents of all levels to interact. Normally, they may not get the chance to sit down with one another. The mentorship program offers them the opportunity to know one another better professionally. Additionally, as work became more remote due to the pandemic, attendings from different sections also had the chance to meet regularly.

If you are not part of the mentorship program but would like to join next year, please reach out to the organizers for more information. You can also look out for a future sign-up opportunity before the beginning of the new academic year.

- *Rishi Agrawal, MD*





MAMMOGRAPHY AND AI: A BETTER TOMORROW

Breast cancer is the most common non-skin cancer among women and the second most deadly. With this significant human toll comes tragedy and cost, estimated at \$180 billion in health care expenses and lost productivity per year.

Researchers at Google have developed a mammogram screening tool that uses AI technology, adding to the ability to reduce costs, increase accuracy, and save lives.

When it came time to choose clinical partners, Google looked to Northwestern.

"Northwestern is an ideal partner for Google because we are one of the largest breast imaging centers in the country," explains Dr. Sarah Friedewald, Northwestern's Vice Chair of Women's Imaging and primary investigator for the Google-Northwestern collaboration.

"We also serve a very diverse population, pulling in women from all across Chicago," Friedewald says.

"The AI technology uses existing mammogram data to 'learn' suspicious patterns within the mammograms. The program can then 'read' new mammograms by looking for similar patterns: the more data, the more accurate the predictions."

Friedewald adds, "The AI pre-reads the screening mammograms. A radiologist is immediately notified of any suspicious findings, and then subsequent workup – more imaging or a biopsy – can be performed before the patient leaves the office. This is smarter, faster, and avoids recalls."

Recalls result in excess anxiety and delays in treatment.

At Northwestern, approximately 12% of mammograms result in recalls.

Recruitment for the study is currently ongoing, but the publication of results could come as early as next year.

"So far," Friedewald notes, "most women have been excited to take part. They know how important screening is, and this trial offers a chance to help women everywhere."

While this project focuses on breast cancer, Dr. Friedewald believes similar projects will soon become common throughout radiology: "Mammograms, CTs, MRIs – all of them are data. AI uses data, and in the future, we will use AI to transform patient care. This is just the beginning."

- Slaton Case, 4th-year medical student



SAVAS, CANKURTARAN RECEIVE NORTHWESTERN FUNDING TO RESEARCH RADIOTRACER TREATMENT

From left: Dr. Hatice Savas and Dr. Ceylan Cankurtaran

In Fall 2021, co-PIs Drs. Hatice Savas and Ceylan Cankurtaran received notification of award for a project researching new radiotracers for PET cancer screenings. The project, titled “Multimodality Imaging with advanced multiparametric MRI and molecular imaging to improve treatment planning and evaluate early response assessment in neurooncology : A pilot study for multidisciplinary initiative,” is a collaborative project seeking to improve detection and treatment of Glioblastoma multiforme (GBM) – one of the most common and aggressive types of primary brain tumors – using PETMR.

PET-MRI is technology only available in select institutions in the United States. “The technology is capable of performing advanced MRI as well as PET imaging with a variety of radiotracers simultaneously; therefore, it has a unique feature of fused imaging,” Savas and Cankurtaran say.

“To our knowledge,” according to the PIs, “there is no study conducted to date that assesses early treatment response, including the effects of a potentially more precise radiation field planning glioblastoma treatment response, by utilizing multimodality neuroimaging with F-FLT-PET simultaneously acquired with advanced multiparametric MR using the novel PETMR technology.”



Northwestern staff and faculty Tim Houston, Gary Dillehay, Lyndsi Hay, Hatice Savas, Ryan Avery, and Logan Linscheid are part of the team that helped to implement the new PET agent.



Drs. Ryan Avery, Gary Dillehay, and Hatice Savas, review results of a prostate cancer test using the new PYLARIFY® radiopharmaceutical PET agent.

“Funding for this project was provided by the Women’s Board of Northwestern Memorial Hospital through The Eleanor Wood-Prince Grant Initiative. The grant was awarded close to NM’s adoption of PYLARIFY PET agent for prostate cancer screening, which was covered by NM’s Physician Forum.

“The new agents detect tiny metastases, which totally changes the clinical decision,” Savas points out. “There are new exciting developments coming soon.”

- Hatice Savas, MD and Abby Hagler



DIVERSITY, EQUITY AND INCLUSION HOSTS EVENTS

On March 21, 2022, the department's Diversity, Equity, and Inclusion Council hosted 15 Northwestern undergraduate students along with the Northwestern University Docs Program. The purpose of this event was to introduce students to radiology as a career option.

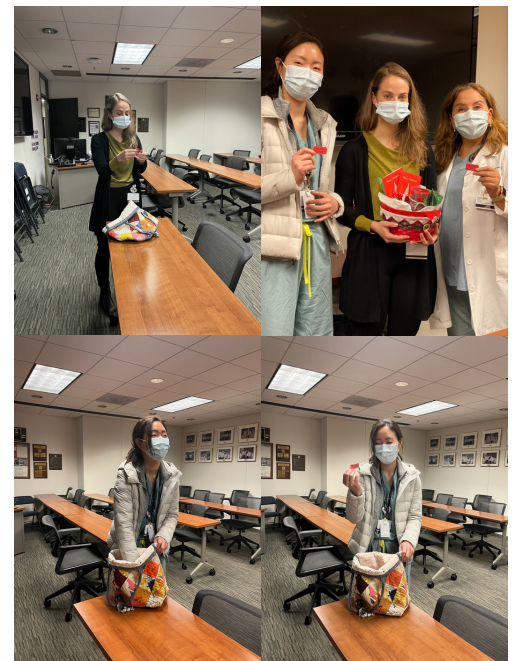
The Council also facilitated another small group discussion event on March 29, 2022. This discussion panel was called: "How to Create an Inclusive Workplace."



The Council's Director, Dr. Senta Berggruen, said, "We are also in the process of organizing a career event for Horizons for Youth high school students in the spring, as well as two events for Chicagoland high school students through the Lurie Cancer Youth Lab Exploration Program."

The mission of Horizons for youth is "to transform children's lives by providing targeted resources rooted in education in a trusting partnership with their families and communities." For more information about Horizons got the Youth, visit their website.

Additionally, the Northwestern Women in Radiology Group raised over two thousand dollars this past winter for Sarah's Circle, a local not-for-profit organization that helps women in need.



Photos courtesy of the Women in Radiology Group during the raffle for Sarah's Circle.

RESEARCH OFFICE LAUNCHES NEW IMAGING COLLABORATION SERVICE

RICO, short for the Research Imaging Collaboration Office, is a new resource for the centralized and efficient coordination of industry-sponsored studies utilizing radiology imaging services. RICO'S team works within the Department of Radiology to facilitate research projects by meeting project-specific imaging needs.

For investigators, the new intake process comprehensively evaluates a research project for radiology protocol nuances, needs, and specifications. Once collect all necessary information is collected from the protocol, this team of trained radiologists, technicians, and research administrators will provide a detailed letter of support including a study budget for radiology imaging services (based on CPT codes) and departmental services and associated fees.

If you have a new industry-sponsored research project needing radiology services, please complete the intake survey application on the Department of Radiology website. A department team member will contact you within two business days for any outstanding information.

- Crystal Santillanes

RESEARCH COMPLIANCE SESSIONS PRESENTED BY THE RESEARCH OFFICE COMPLIANCE TEAM

Yasmeen Khan and Crystal Santillanes in the Research Office at Radiology (ROAR) have begun hosting monthly bootcamp sessions covering data use, transfer topics, PI oversight, and overall best compliance practices.

These sessions are an excellent way for new and experienced investigators to understand how to conduct compliant research projects within the Northwestern community. Seasoned investigators, staff, students, and trainees can also benefit by asking questions concerning their research. The hosts always allow plenty of time for questions.

The last bootcamp session was February 25, 2022 via Zoom. If you want to sign up for the next session or learn more about any research-related topic, please check out the Research Office at Radiology (ROAR) section of the Department of Radiology's website.

- Yasmeen Khan



Fact: Did you know you need permission to enter the Medical Record for research purposes, regardless of you already have access to the Medical Record? Come to ROAR's bootcamp sessions to discover more!

PRESENTATIONS ON AUGMENTED INTELLIGENCE (AI) NEURO-ONCOLOGY APPLICATIONS

Virginia Hill, Todd Parrish, and Aggelos Katsaggelos were honored to give presentations on augmented intelligence (AI) neuro-oncology applications at the September 24 and January 24 Lou and Jean Malnati Brain Tumor Institute research retreats.

In September, Hill, Parrish, and Katsaggelos prioritized their research presentation on AI models of recurrence and textural MRI titled “Unlocking the Potential of AI.” They reviewed different AI techniques such as deep learning, texture analysis, and random forest models and demonstrated how they could be applied clinically.

The future of MR acquisitions was illuminated by quantitative techniques, including synthetic MRI that can detect treatment-induced microscopic changes before clinical imaging.

Shortcomings of current AI studies in neuro-oncology and ways to overcome these limitations by integrating gene set enrichment analysis, convolutional neural networks, and radiomics were discussed, along with Northwestern’s unique large brain tumor data sets, innovative treatments, and cutting edge neuropathology techniques. Our site is one of few that performs complete next-generation sequencing and now DNA methylation profiling on all brain tumors.

In January, Hill, Parrish, and Katsaggelos, along with Robbie Cantrell, Eric Russell, Adam Sonabend, Craig Horbinski, Amy Heimberger, Rimas Lukas, Sean Sachdev, and Lee Cooper, built upon this framework by presenting two pitches for funding to the group: “Using AI to Predict Glioma Molecular Markers and Subcategories of Glioblastomas, Analyze the Tumor Microenvironment and Predict Survival” and “True Progression vs. Pseudoprogression in Treated Brain Tumors with an Emphasis on Blood-Brain Barrier Disruptive Therapies Such as the SonoCloud and Immunotherapy.”

The first pitch detailed how to use AI to noninvasively gather information needed to prevent sequela of surgery, allow personalized precision treatment planning, and analyze the entirety of the tumor habitat (instead of the small portion that can be examined with biopsy or resection).

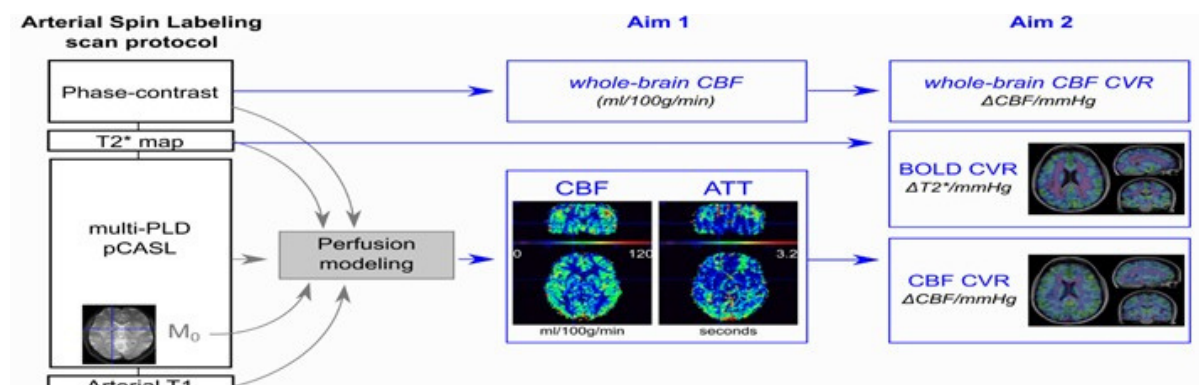
The second pitch emphasized how AI tools can be used to overcome the shortcomings of MR perfusion in differentiating actual progression from pseudoprogression.

- Virginia Hill, MD

EVALUATING NEW INTERVENTIONS TO IMPROVE HUMAN CEREBROVASCULAR FUNCTION

Dr. Molly Bright's lab has just started an NIH-funded two-year clinical trial to test the potential of a novel intervention to improve the brain's blood supply, thereby mitigating the vascular contributions to neurodegeneration and functional impairment.

Acute Intermittent Hypoxia (AIH) is emerging as a powerful therapy to improve overall cardiovascular health and facilitate neural plasticity; however, its impact on human cerebrovascular function is unclear. Hypoxia is known to influence angiogenesis and blood flow generally, and exposures to brief hypoxic stimuli can "precondition" the vasculature of other organs to be more resilient to severe hypoxic threats. This sham-controlled crossover study tests whether a 3-week daily AIH intervention will drive beneficial vascular plasticity in the human brain.



An advanced ASL protocol is used to quantify cerebral blood flow (CBF) throughout the brain at three physiological conditions: during a person's baseline physiology, during hypoxia, and during hypercapnia. Phase-contrast scans are used to get a single whole-brain CBF measure. A multi Post Label Delay pseudo-continuous ASL sequence is combined with Arterial Blood T1 and Phase-contrast information to accurately model CBF in the different physiological states. Aim 1 tests whether the intervention increased resting CBF, and Aim 2 tests whether the responsiveness of CBF to vasodilatory stressors (e.g., hypoxia or hypercapnia) is enhanced.

Dr. Bright employs an innovative MRI protocol to assess the beneficial effects of AIH on regional human cerebrovascular physiology, using advanced arterial spin labeling perfusion imaging and prospectively-targeted hypoxic and hypercapnic gas challenges to evoke vasodilatory responses.

If this proof-of-concept study is successful, AIH will become an exciting new intervention for facilitating cerebrovascular plasticity and opening up new therapeutic treatment opportunities in the numerous neurological disorders where vascular dysfunction is implicated, including Multiple Sclerosis, Parkinson's Disease, and several forms of dementia.

- Laleh Rad, PhD

NEW GRANTS

CONGRATULATIONS TO THE FOLLOWING INVESTIGATORS ON RECEIVING NEW GRANT FUNDING

Bradley Allen, MD, American Roentgen Ray Society, 2022 ARRS Scholar Award

Donald (Robbie) Cantrell, MD, AHA Career Development Award, "*Motion-Resistant Artificial Subtraction Angiography with Deep Learning*"

Lexiaozi Fan (PhD student, Daniel Kim lab), AHA Predoctoral Fellowship, "*Rapid automatic inline reconstruction and analysis for quantitative perfusion CMR*"

Laleh Golestani Rad, PhD, Northwestern University's COVID-19 Research Recovery Grant, "Developing novel MRI technology for safe imaging of children and infants with cardiac devices"

Suvai Gunasekaren, PhD, NIH/ NIBIB K99/ R00, "*Non-contrast 3D T1p Mapping for Myocardial Fibrosis Quantification of Pediatric Cardiomyopathy Patients*"

Daniel Kim, PhD, & Daniel C. Lee, MD, AHA's Mechanisms Underlying Cardiovascular Consequences Associated with COVID-19 and Long COVID Award, "*Rapid Cardiovascular MRI for Screening Microvascular Angina in COVID-19 Survivors*"