



The INSIDE VIEW

FROM THE CHAIR



More than a year has passed since the initial outbreak of COVID-19 in the United States.

For many members of our team, this past year was a paradox. For some, it's remembered as a year filled with unbelievable teamwork and self-sacrifice; for others, it's a year filled with isolation and anxiety. Most of us have experienced a combination of these emotions. As the acute crisis winds down with widely available vaccines, we reach the latest phase: defining the new normal. Before we progress to this new phase, I wanted to take a moment to reflect on what we accomplished during the pandemic. I want to thank our frontline workers who sacrificed their own safety to provide essential imaging services. I applaud the team members who completed the difficult tasks of determining which clinical services could be delayed during the crisis, and those who were forced to ramp down their research programs and educational initiatives. And while COVID-19 has been a strenuous time, I do recognize some of the positive outcomes. I am amazed by the ease we can connect to our teammates, national, and international colleagues by video conference. We all have an increased appreciation for quality time with our family and friends, and I appreciate our reduced carbon footprint with lessened physical travel. As we move to this next phase, I know our Department is fully capable of adapting and thriving in the new normal.

- Thomas M. Grist, MD, FACP
Chair, UW SMPH Department of Radiology

RADIOLOGY REPORT: TUMOR ABLATION LAB

In 1995, Chief of Abdominal Intervention and Professor Fred Lee Jr., MD established the Tumor Ablation Laboratory at UW, one of the first of its kind in the world. The primary goal of the lab is to develop minimally or non-invasive techniques to treat cancer, destroying malignant tissue while simultaneously minimizing damage to healthy tissue. The lab has multiple inventions in clinical use, more than 20 patents, over 200 scientific publications, and created a UW-Madison spin-off company – NeuWave Medical, Inc. – to produce one of their devices. The research and technologies created in this lab have helped tens of thousands of patients to date. Learn more about how the lab got started and the incredible work they have done to improve the lives of so many.

Dr. Lee developed an interest in minimally invasive tumor ablation therapy while completing the requirements for the Radiologic Society of North America (RSNA) Scholars program in the early 1990's. At that time, only a few Italian investigators were working on tumor ablation. The Italian physicists were percutaneously placing needles in tumors and passing electrical current through them to create heat with radiofrequency (RF), an unheard-of technique for the time. It was considered highly risky, with the potential benefits to patients unknown. "Only one or two American centers had been dabbling in it and it was new, so people didn't really know how it worked or what the long-term effects would

be. I thought that the concept was fascinating, with some potentially great patient benefits, and I wanted to bring it to Wisconsin," says Dr. Lee. He used state-of-the-art equipment and human-size pigs to start testing available RF devices, which is when he found out that these devices did not always work as advertised. The ablation zones were small and irregularly shaped, making the devices hard to work with and rendering them ineffective to destroy anything except the smallest tumors.

It was at that point that the need for improvement in existing ablation devices became clear, as well as the need for a dedicated lab to test and develop the technology.

"I was fortunate that Christopher Brace, PhD – an engineering student at that time working with UW Engineering profes-

sor and my long-term collaborator Dan van der Weide, PhD – was interested in working on the technology. Assistant Professor Paul Laeseke, an MD-PhD student at the time, was also interested. They were the dynamic duo that drove much of the discovery in the early days. Today they are known as world experts, and for good reason. While Chris and Paul were driving our research lab, Professor Louis Hinshaw, MD joined the UW faculty. His clinical expertise, combined with our lab discoveries, resulted in our ascendancy to a premier clinical ablation center," says Dr. Lee.

Another key to the many discoveries and successes of the lab is WIMR (Wisconsin Institutes for Medical Research), which allows UW personnel the unique opportunity for

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RSNA 2020 Faculty Awards



Scott B Reeder, MD, PhD

Dr. Reeder received the Honored Educator Award. This award is

given to leaders invested in furthering the profession of radiology by delivering high-quality educational content in their respective field of study.

Meghan G Lubner, MD and Perry J Pickhardt, MD

Dr. Lubner and Professor Perry J Pickhardt, MD were selected as Magna Cum Laude award winners for their electronic exhibit contribution,

Mucin-Producing Cystic Hepatobiliary Neoplasms.



Meghan G Lubner, MD

Dr. Lubner also took home a Cum Laude award for her electronic exhibit for *Gastrointestinal Manifestations of Immunodeficiency.*



Meghan G Lubner, MD and Lori Mankowski Gettle, MD, MBA

RSNA awarded Drs. Lubner and Mankowski Gettle a Cum Laude award for their electronic exhibit titled *Evaluation of Pancreas Transplants.*



Steve Y Cho, MD; Nevein Ibrahim MD; Joanna Kusmirek, MD; Alan McMillan, PhD; and Elizabeth Sadowski, MD

RSNA awarded Drs. Cho, Ibrahim, Kusmirek, McMillan, and Sadowski the Cum Laude award for their NM105-ED-X education exhibit: *Pearls and Pitfalls in Assessment of Gynecological Malignancies on 18F-FDG PET/MRI.*

Mark A Kliewer, MD, MHSc

Dr. Kliewer was awarded the Cum Laude award for his exhibit, *How to Read Abdominal CT*



A VIRTUAL RSNA CONFERENCE

The annual Radiological Society of North America (RSNA) meeting is the world's largest radiology conference. Due to public health and safety concerns over COVID-19, RSNA 2020 transitioned to a virtual format. However, this did not stop an audience of 29,339 people from attending the meeting. RSNA 2020, which was live from Sunday, November 29th through Saturday, December 5th, had attendees from 134 countries, with approximately 40% of professional registrants from countries outside of North America. This year's meeting theme, "Human Insight/Visionary Medicine", focused on RSNA's commitment to diversity, equity, and inclusion in healthcare. It also highlighted the latest developments in COVID-19 research and artificial intelligence (AI) applications.

The UW Department of Radiology was heavily involved in this year's meeting, with faculty members participating in poster presentations, giving lectures, and winning awards. Many of the electronic exhibits that faculty presented were collaborative with faculty from other institutions around the country. These collaborations created quality presentations, many of which won awards.

In addition to the numerous honors bestowed upon Department of Radiology members, faculty from 10 different sections of the Department spoke at the meeting. Highlighting the lectures given by UW faculty was the plenary session featuring Professor and Radiology Department Chair Thomas M Grist, MD, FACR, and Professor Charles Mistretta, PhD. Their lecture, "Together We Can Make a Difference: Radiology/Physics Collaboration in the Development of New



Dr. Grist



Dr. Mistretta

Imaging Techniques" focused on X-ray, MRI and CT techniques for diagnostic and interventional angiographic applications, as well as the history that led to these developments.

These faculty presentations covered a wide array of topics, ranging from clinical applications of research, to becoming a better educator and leader within the profession, to the relevance of AI in radiology education.

See RSNA Awards in side panels

ALAN MCMILLAN AND MULTIDISCIPLINARY TEAM AWARDED R01 GRANT



Dr. McMillan

Professors Alan McMillan, PhD, Associate Professor in the UWSMH Department of Radiology, Po-Ling Loh, PhD, Associate Professor in UW's Department of Statistics, and Varun Jog, PhD, Assistant

Professor in the UW College of Engineering were awarded an R01 from the National Library of Medicine. The title of their project is "Can Machines Be Trusted? Robustification of Deep Learning for Medical Imaging." The goal of their research is to study ways to strengthen deep learning networks by looking at the ways in which they fail in both intentional and real-world situations. This research will be funded from the National Library of Medicine FOA [PAR18-896] - NLM Research Grants in Biomedical Informatics and Data Science.

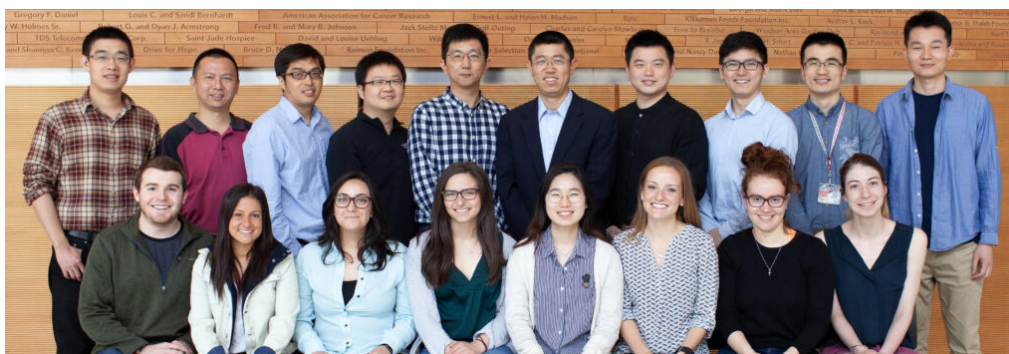
Professor McMillan met Professors Loh and

Jog through UW's Machine Learning for Medical Imaging (ML4MI). ML4MI is an interdisciplinary initiative that encourages collaboration between machine learning experts and medical imaging researchers at UW. The initiative aims to create machine learning solutions for challenging imaging problems. In 2018 Professors McMillan and Jog received a pilot grant from ML4MI that helped spark their research idea on the development of robust deep learning AI.

Their research studies the ways deep learning networks fail, as understanding the failures will help determine the best ways to improve the technology. "We have always been able to engineer good solutions with AI for any problem... however, it is not known how the methods will respond in respect to unanticipated inputs," says Professor McMillan. AI is very specific to the data and application that was used to train

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CAI RESEARCH GROUP BRINGS HOME AWARDS



Picture: Cai Research Group

The Cai Research Group has been selected for over a dozen honors and awards from the Society of Nuclear Medicine and Molecular Imaging (SNMMI) over the past two years. SNMMI is a nonprofit scientific and professional organization that promotes the science, technology, and practical application of nuclear medicine and molecular imaging. The society strives to optimize imaging to improve health outcomes.

Among the recipients of these honors was Professor Weibo Cai, who was elected Fellow of SNMMI at their 2019 Annual Meeting. “I am truly humbled and deeply honored to be elected as a SNMMI Fellow. It is the most prestigious honor that I have received to date. It is a recognition to long-time SNMMI members and symbolizes distinguished service to SNMMI, as well as exceptional achievement in the field of nuclear medicine and molecular imaging,” says Cai, Vilas Distinguished Achievement Professor in the Departments of Radiology and Medical Physics, with affiliation in Biomedical Engineering, Materials Science and Engineering, and Pharmaceutical Sciences.

In 2019, research group members Carolina Ferreira, Tuanwei Sun, and Emily Ehlerding received travel awards to attend the SNMMI Annual Meeting (a total of only seven Travel Awards were given out). Dawei Jiang, then a postdoc in the Cai Group, was the sole recipient of the Michael J. Welch Postdoctoral Travel Grant. At the Annual Meeting, members from the Cai Research Group swept the Center for Molecular Imaging Innovation and Translation (CMIIT) Young Investigator Award (YIA) symposium, which is the first time a single research group has garnered the top three spots. Lei Kang, Emily Ehlerding and Dalong Ni placed first, second, and third, respectively. Carolina

Ferreira took second in the SNMMI’s Radiopharmaceutical Sciences Council (RPSC) YIA Symposium. In addition to wins in the symposiums, abstracts by Dalong Ni and Zachary Rosenkrans were two of 10 abstracts chosen for Press Release.

In 2020, Zachary Rosenkrans received the SNMMI Bradley-Alavi Student Fellowship. In addition, he had two abstracts selected to compete in the 2020 SNMMI Annual Meeting CMIIT YIA symposium, where only seven total abstracts are chosen to compete. Former Cai Lab member Carolina Ferreira, now a postdoctoral scholar at Harvard Medical School/Massachusetts General Hospital, won first place in the symposium.

Six former Cai Research Group members were selected as “Ones to Watch” by SNMMI, which recognizes early career professionals with the potential to shape the future of precision medicine. In 2019 Dawei Jiang, Emily Ehlerding, and Feng Chen were among the 30 selected. Jiang currently works as a Professor in Huazhong University of Science and Technology in China, Ehlerding works at the Society for Immunotherapy of Cancer, and Chen works at Elucida Oncology, Inc. In 2020 Dalong Ni, Sixiang Shi, and Reinier Hernandez were among the 30 selected. All three are faculty, with Ni as Professor at Shanghai Jiao Tong University, Shi as Assistant Professor at Hong Kong Polytechnic University, and Hernandez as Assistant Professor at UW-Madison. Professor Cai is thrilled that his lab members are getting recognized for their hard work. “I am certainly extremely proud of the achievements of all my former and present group members. Together they have received more than 100 awards to date, and more than a dozen of my trainees have started independent research groups at world-class universities,” says Cai.

RSNA 2020 Certificates of Merit



Michael C
Brunner,
MD, FACR,
FSIR



Kirkland W
Davis, MD,
FACR



Jeffrey P
Kanne, MD



David Kim,
MD, FACR,
FSAR



Kenneth S
Lee, MD



Meghan
G Lubner,
MD



Lori
Mankowski
Gettle, MD,
MBA



Scott
Sheehan,
MD



Lindsay
Stratchko, DO

RSNA Resident & Fellow Awards

Ece Meram, MD

Dr. Meram was awarded the Philips/RSNA Research Resident Grant for *A Quantitative Angiographic Technique for Characterizing Flow Through Normal and Stenotic Iliofemoral Arteries*.



Thomas Reher, MD

RSNA awarded Dr. Reher the Ralph Schlaeger Charitable Foundation Research Fellow Grant for *Multi-compartment Diffusion Weighted Imaging Across the Lifespan in Healthy Aging and Alzheimer’s Disease*.

Edward Lawrence, MD, PhD

Dr. Lawrence received the Roentgen Resident/Fellow Research Award.



EXCITING DEVELOPMENTS IN THE NUCLEAR MEDICINE AND MOLECULAR IMAGING SECTION

There are many exciting developments transpiring in the Nuclear Medicine and Molecular Imaging Section. The Section's is working with an investigational new drug (IND) tracer to identify abnormal parathyroid tissue. The tracer, fluoro-choline, is only being used in a few places across the country. The UW Radio-pharmaceutical Production Facility recent-



Dr. Perlman

ly had success purifying a form of this drug for use. Abnormal parathyroid tissue is difficult to image, but the fluoro-choline tracer will help improve PET/CT and MR imaging. Section Chief and Professor Scott Perlman, MD is leading the charge with the help of other section personnel. There is a lot of paperwork and approval processes to go through, but Dr. Perlman hopes that clinical work with the tracer can begin in late spring of 2021.

Clinical Director of PET/MR and Assistant Professor Ali Pirasteh, MD is leading the expansion of the PET/MRI program. The program is a clinical and research collaboration between the Nuclear Medicine and other Department of Radiology sections. The simultaneous PET and MR imaging delivers the optimal diagnostic information, empowering physicians to make the best treatment decisions for patients. "The program is evolving to improve patient satisfaction by reducing scan times as it has the advantage of acquiring two image sets simultaneously. Furthermore, novel PET and MR imaging techniques are constantly in development, which will make a tangible impact on the future of hybrid molecular and morphologic imaging," says Dr. Pirasteh.

Professors within the Nuclear Medicine and Molecular Imaging Section have collaborated with AIQ Solutions, a Madison-based start-up, to develop a software to help with tumor response assessment. The aim is to develop a software that can assess tumors on an individual level to determine whether each tumor is responding to treatment. This software

would help physicians read scans and determine the best course of treatment. While current prototypes are in the early stages of development, the preliminary software is very impressive, notes Dr. Perlman.

Assistant Professor Joanna Kusmirek, MD, is collaborating on numerous research studies, mostly focused on cardiology. She collaborates with Professor Elizabeth Sadowski, MD, on PET and MR projects focused on pulmonary



Dr. Kusmirek



Dr. Ibrahim



Dr. Cho

nodules and gynecologic malignancies. Clinical Assistant Professor Nevein Ibrahim, MD, assists with the pulmonary nodule research, and Assistant Professor Steve Cho works with the gynecologic malignancy research. Dr. Kusmirek helps evaluate pulmonary hypertension patients with V/Q scans for research in the Pulmonary Hypertension Clinic. She also recently started working with Assistant Professor Sofia Masri, MD on cardiac sarcoidosis evaluation by helping with PET, CT, and cardiac MRI. The Therapy Service is continuing to expand to provide care for patients with neuroendocrine tumors. In January 2018 a new drug, Lutathera, was approved for use with neuroendocrine tumors. UW was the first hospital in Wisconsin to start administering the drug to patients. Since the hospital was approved to provide the treatment, Drs. Perlman and Cho have continued to treat patients. Dr. Perlman commented on the collaborative, interprofessional nature of this treatment, as he works with personnel in oncology, radiation safety, nuclear medicine, radiopharmacy, and more, to safely administer the treatment to patients.

This service is just one of the ways that the Nuclear Medicine Section is endeavor-

ing to use more theranostics treatments. Theranostics, a combination of therapeutics and diagnostics, is a treatment where one radioactive isotope is used to identify the tumor and a second radioactive isotope is used to deliver therapy to the tumors. In theranostic cancer treatment, imaging-based dosimetry guides therapy dosing. Physicians can quantify tumor uptake for each patient and use that to deliver an individualized radiation dose of the therapeutic agent. "Our goal is to develop and expand theranostics because that is the future for cancer treatment," says Dr. Perlman.

Related to theranostic treatments is the new SPECT/CT scanner that was installed in the UW Small Animal Imaging and Radiotherapy Facility (SAIRF) this summer, the first and only preclinical SPECT/CT in the state. This scanner has the potential to be a key player in theranostic cancer treatment, particularly during the preclinical research stages that test the effectiveness of different isotopes.

Professor Jamey Weichert discusses how theranostics is proving to be effective in mice. "We are now using our targeted radionuclide therapy agent, NM600, to enhance systemic immune detection and response to a variety of solid metastatic cancers in mice...when combined with immunotherapy, the results are striking with typically over 70% of mice experiencing complete tumor responses while developing T-cell immune memory which kills tumor cells injected months later," says Dr. Weichert.



Dr. Weichert

This and other studies on theranostics lend hope for the future. "This scanner is key for the development of a clinical theranostic center of excellence which will hopefully establish UW as a leading destination theranostic cancer treatment facility capable of conducting paradigm-changing clinical cancer treatment trials," says Dr. Weichert. "One goal is to develop and expand theranostics because that is the future for cancer treatment," says Dr. Perlman.

JASON STEPHENSON, TABBY KENNEDY, AND KATIE YANG RECEIVE GRANT TO TRANSFORM COURSE INTO SYNCHRONOUS DISCUSSION SERIES

Director of Medical Student Education and Associate Professor Jason Stephenson, MD, Neuroradiology Section Chief and Associate Professor Tabby Kennedy, MD, and Medial Education Research and Outreach Services Coordinator Katie Yang, MSC, received a \$5,000 Instructional Continuity Grant from UW to transform their course's discussion board assignment into a synchronous discussion series. Instructional Continuity Grants from UW aim to enhance student-to-instructor interaction and student-to-student interaction and learning for the spring of 2021.

Drs. Stephenson and Kennedy are co-instructors for the medical student Diagnostic Radiology Elective, which is being held virtually due to COVID-19. Concerned by the lack of opportunities for students to connect and work with one

another while on the rotation, they teamed up with Yang, who has advanced training in facilitating classroom discussion, to convert the previous discussion board assignment into synchronous discussion sessions where students can collaborate with their peers. Yang is facilitating the discussions each week.

The Diagnostic Radiology Elective has 11 two-week rotations during spring 2021. The discussion board assignment has four prompts, and each prompt is now offered as a 40-minute discussion session, with two sessions available each week. Students can either participate in the synchronous discussion session or respond to the online written version of the prompt. This flexibility is key, as it accommodates students who have difficulty attending the synchronous sessions at their set times.

FACULTY SPOTLIGHT: BRIAN MULLAN, MD



Thoracic Imaging Professor Brian Mullan, MD started in the Department of Radiology in the fall of 2020.

Why did you choose

Radiology?

Three reasons. First, I really like the problem-solving aspect of it. That's the core of what we do. Second, I enjoy the collegial, collaborative spirit of radiology. Providers from all over the hospital come together around the imaging aspects of patient care like nowhere else in medicine. Third, I like the technology. When I gave a talk at Disney World, signs were all around about "The Disney Magic". But then I gave a talk on quantifying calcium in the coronary artery walls while the heart was beating, and the patient didn't even have to untie their shoelaces – now that's magic!

What are your career interests and goals?

Fundamentally, regardless of the arena, my core goal is to help people heal. For me, healing doesn't mean anything is broken. It's just combining someone's innate, perhaps untapped or unrecognized poten-

tial, with my experiences and guidance to help them move forward to whatever goal is right for them. Whether teaching to help a student learn something, researching to work with a peer to discover new ideas, doing a deep dive into a patient's chart to gain that insight that changes our understanding of what's going on with them – these are all expressions of that. Key to all this, my goal is to work with them to creatively solve significant problems with the solutions leaving the world at least a little bit better off.

Why did you choose and what excites you about UW?

As I was starting the third phase of my career, I wanted to look for new adventures and opportunities. I spent the 1st phase learning to be a radiologist and educator, the 2nd doing those and a lot of administration. Now, I'm looking to administer less and explore more. UW is an exciting place to do so due to the variety, energy, and expertise of the people here. At this point, I'm not exactly sure where my path will lead, but I know that with the extraordinary people and resources here, the only limitation will be my imagination. That's exciting!

NEWS BRIEFS



Fred Lee, Jr., MD, was recently appointed as the Robert A. Turrell Professor in Imaging. In his reappointment letter

from John Karl Scholz, Provost and Vice Chancellor for Academic Affairs, Dr. Scholz references the high honor of this position, as a confirmation of the high esteem Dr. Lee is held by his colleagues. In this renewable professorship, Dr. Lee will serve through 2025, and will continue to receive annual funding from the endowment fund to support the advancement of his scholarly activities.

Tim Szczykutowicz, PhD, DABR

has been appointed to two prestigious positions. He will be serving as a Consultant Editor in Physics for the Journal of Thoracic Imaging. Additionally, he was named the Radiologic Physicist Member on the State of Wisconsin Department of Safety and Professional Services (DPS) Radiography Examining Board.



David Bluemke, MD, PhD, and Vivek Prabhakaran, MD, PhD, were two of 39 researchers who received 2020



Distinguished Investigator Awards recently from the Academy for Radiology & Biomedical Imaging Research.

This award, established in 2012, recognizes the nation's top imaging researchers, as outstanding contributors to the field of medical imaging, and also those who have achieved scientific excellence while also being involved in clinical care.

Weibo Cai, PhD, FRSC

has been admitted as a Fellow of the Royal Society of Chemistry (RSC). The RSC is a learned society based in the United Kingdom. The organization aims to accelerate the growth, dissemination, appli-



NEWS BRIEFS (FROM P. 5)

cation and impact of chemical science knowledge around the world.



Tabby Kennedy, MD was awarded the Women in Neuroradiology Leadership Award. This joint award is from the Foundation of the American Society of Neuroradiology (ASNR), the American College of Radiology (ACR), and the American Association for Women Radiologists (AAWR) that recognizes women that have demonstrated leadership in neuroradiology. Dr. Kennedy believes she made her greatest impact through the websites she created. These websites allow her to reach a broader audience and break down complex topics to help others gain a better understanding of the material.

Amy Fowler, MD, PhD

has had her latest research published in the Radiological Society of North America's journal *Radiology: Imaging Cancer*. She co-authored the publication with Radiology Department faculty Scott Perlman, MD, MS, Alan McMillan, PhD, and Roberta Strigel, MD, MS, and other colleagues from SMPH, the Carbone Cancer Center, and the Medical Physics Department.



Kenneth Lee, MD was awarded ISS President's Medal for his research focused on sports medicine. His multidisciplinary musculoskeletal ultra-

sound research team is studying tendon elasticity and how it can predict injury and monitor healing. He also acts as the Principal Investigator on numerous randomized control trials studying treatment outcomes of platelet-rich plasma therapy in patients with plantar fasciitis and Achilles tendinitis. Dr. Lee has presented his research globally, including recently receiving an invitation to lecture at the US Olympic Training Center.

UW/GE CT PROTOCOL PARTNERSHIP UPDATE

For those unfamiliar, the UW Departments of Radiology and Medical Physics have been working with CT Technologists to improve CT imaging protocols. The goals of improving protocols are to provide clearer images, reduce the number of repeat scans, and provide a better experience for patients. UW partnered with GE Healthcare to get better insight into and better understanding of the capabilities of the GE CT scanners. As part of the partnership, UW provides their CT protocols to current and future GE CT users, which helps these users save time and resources. Read below to learn about the newest developments from the partnership.

In August 2020, a new member was added to the CT Protocol Optimization Team: Rachel Bladorn, BS RT(R)(CT). In her role, Rachel will help write protocols and instructional documents, load protocols, program CT scanners, and pull data from various sources for analysis and protocol validation.

The UW CT Protocol Optimization Team continues to bring high quality CT protocols to the rest of the world. Through September of 2020, nearly 3,000 GE scanners with UW CT protocols have shipped worldwide. This shipment of scanners includes 1,374 scanners in the US, 34 in Canada, 32 in Mexico, and 1,353 internationally in 98 countries.

In December 2020, UW delivered Version 6.0 of the CT protocols to GE for distribution. UW protocols currently support 11 GE scanner platforms. Updates in Version 6.0 included, but were not limited to, the following:

- 15 new protocols were added
- The CT Brain Perfusion Guidance was updated
- Several protocols that enable the use of Auto Prescription and kV Assist features were introduced on the Revolution CT
- Protocols that combine a Routine Chest/Abdomen/Pelvis with a Routine Neck were added that include decreased contrast volumes and scan delay adjustments
- Cardiovascular Protocols were revised to reflect a weight-based contrast model
- All Pediatric protocols were updated to scan faster, which is ideal in the pediatric population to decrease motion



Picture: Medical Advisory Board meeting in 2019.

WEIBO CAI RECEIVES MULTIPLE GRANTS TO ADVANCE RESEARCH

Professor Weibo Cai, PhD has received three grants within the past month to help fund his research initiatives. These three grants total to over \$400,000 and will facilitate various research projects for the Cai Research Group, which focuses on molecular imaging and nanotechnology.

The first grant is from the UW-Madison Graduate School Fall Competition, and starts on July 1st, 2021. The proposal, titled "DNA Nanostructures for Treatment of Acute Kidney Injury", will be used to gather more data for R01 submission to the NIH. Dr. Cai received his second grant from Focus-X Therapeutics, Inc, which starts on January 1st, 2021. This industry-sponsored research agreement focuses on developing novel anti-cancer radiopharmaceuticals for imaging and therapy, with the goal of starting Phase

I and II clinical trials in the near future. The third grant was provided by the UW-Madison Office of the Vice Chancellor for Research and Graduate Education, with funding from the Wisconsin Alumni Research Foundation. This grant, which also starts on January 1st, is flexible funding that will be used on different molecular imaging and nanotechnology projects.

Dr. Cai is excited about these grants and how they will support research projects in his lab. "We are delighted to receive three grants over the last month, which cover a broad scope of molecular imaging, nanobiotechnology, and translational research, with a clear goal of moving the best radiopharmaceuticals into clinical trials so we can benefit cancer patients in the near future," says Dr. Cai

RADIOLOGY REPORT: TUMOR ABLATION LAB (FROM P. 1)

intervention on large animals. “We need to continue to leverage our ability to do large animal research and imaging, because it is so unique and is a critical step prior to applying our discoveries in humans. Facilities like WIMR don’t exist in most radiology departments. The combination of the facility and the innovative research in the Department of Radiology have and will continue to provide us with many opportunities to contribute to our field,” Dr. Lee comments.

He describes his time in the lab as covering four distinct research phases. The first of these phases was focused on cryoablation, a method of destroying cancer cells by freezing them. When the lab was first created, cryoablation was only feasible using large probes, too large to be used percutaneously. With the development of new, smaller probes, the idea of percutaneous cryoablation of the liver and kidney was born. Percutaneous cryoablation was first explored systematically in the Tumor Ablation Lab, led by Dr. Lee and Dr. Peter Littrup (Wayne State University), and later with Dr. Hinshaw. Drs. Lee and Littrup found they could use CT and ultrasound to visualize the cryoablation ice balls, allowing for minimally invasive percutaneous procedures in addition to the intraoperative ones.

The second phase of the lab focused on RF ablation. RF ablation uses electric current to cause tissue heating to a temperature which causes cell death. The technology of the time consisted primarily of single-probe RF systems that produced small and irregularly-shaped ablation zones. One of the first technologies developed in the lab was a multiple-probe RF ablation system, which created larger and faster ablation zones. The invention was licensed to Medtronic through WARF (Wisconsin Alumni Research Foundation), and has been used worldwide to help thousands of patients since the late 1990’s.

The third phase of the lab’s research concentrated on microwave ablation. Similar to RF ablation, microwave ablation uses heat to destroy cells. However, microwave ablation has a larger zone of active heating with consistently higher temperatures, which increases confidence that the tumor

is destroyed. The lab started researching and testing microwave ablation in the preliminary stages, and pioneered research that has altered how these tools are used today.

The basic research and subsequent patents led to the creation of a medical device company in 2008, called NeuWave Medical. Through this spin-off company, members of the lab invented and produced a microwave ablation system, the Certus140™. The device was first used in patients in 2010. In 2016, NeuWave was sold to Johnson and Johnson, although the lab still contributes to research and testing. The Certus140™ is now the leading microwave ablation device in the United States and has treated over 50,000 people to date.

“I’m most proud of our developments in microwave ablation. These have had the greatest impact clinically as we’ve helped the technology go from relatively unknown to commonplace over the last 15 years,” says Dr. Brace. The lab continues to study microwave ablation to improve understanding of how it impacts different organ systems. There is continual testing to evaluate the effectiveness of treatment on patients, and to learn about and mitigate side effects that may occur.

The fourth and current phase of the lab is focused on Histotripsy. Histotripsy is the process of using sound energy to mechanically destroy targeted tissue at a sub-cellular level. The lab is collaborating with HistoSonics, Inc. and the University of Michigan on this endeavor. Histotripsy, originally invented at the University of Michigan, uses ultrasound sound waves from outside the body to destroy cells. The device is completely non-invasive. UW is working with the inventors to improve the device so it will be more conducive to treating human patients. “This is a remarkable idea with the potential to significantly reduce recovery time and side effects for patients. I think this is truly the future of tumor ablation,” says Dr. Lee.

When asked about his favorite accomplishments from the lab, Dr. Lee reflected on the drive lab members had (and still have) to continue moving forward. “Many

times people have said to me ‘Why are you bothering to work on a particular device, when existing technology works perfectly well?’ My answer is that nothing is ever perfect. The history of the world is full of examples of prominent people defending the status quo, and they have been proven wrong every time. Change is inevitable; the only question in my mind is what will the change be and when will it happen? We can always make things better for patients, no matter how good we think it already is. I am proud that we have never fallen victim to complacency, and that the lab has always looked for ways to innovate and improve,” says Dr. Lee.

Dr. Brace agrees about the forward-thinking nature of the lab. “Ablation technologies have only begun to make their fullest impact on cancer care. We will see the tools become less invasive, more precise, and ablation treatments being used for new clinical indications. Our lab will continue to foster the development of devices, provide the scientific evidence of their efficacy and safety, and train the engineers and physicians that will lead future efforts,” he says.

While Dr. Lee was the one who started the Tumor Ablation Lab, he is quick to give credit to the other members that have helped make it successful. “I am so proud of the people in the laboratory. I want to make this clear: this isn’t something that is driven just by me. I am the oldest and have been around the longest, so I often get more credit than I deserve, but there are others that are making a huge impact in our work. Paul Laeseke, Louis Hinshaw, Meg Lubner, Tim Ziemlewicz, Ken Lee, Keegan Markhardt, Erica Knavel (who will soon be joining our faculty), Johnny Swietlik, Amanda Smolock, Kaite Longo, Mircea Cristescu, Scott Mauch, and Allison Couillard are just some of the people I can name that have made invaluable contributions to our lab. The last several years have seen Emily Knott and Annie Zlevor drive our projects forward. Working with these talented people has left me with no doubt that the next generation will continue to push the lab towards the forefront of medicine,” says Dr. Lee.

FACULTY SPOTLIGHT: ERICA KNAVEL KOEPEL

Interventional Radiology Assistant Professor Erica Knavel Koepsel, MD joined the Department in spring



2021. She attended the UW SMPH for medical school, residency, and fellowship before going to the Mayo Clinic in Rochester, MN. She is now back at UW as an Interventional Radiologist. Learn more about her below.

Why did you choose Radiology?

I chose radiology because I have always been fascinated by imaging and anatomy. I also was drawn to the specialty as it is a vital part of modern medical care. We have such a giant impact on patient care and guiding patient management. Vascular and interventional radiology combined my love of imaging with my interest in procedures/surgery.

What are your career interests and goals?

Procedurally, I am interested in complex IVC filter retrievals, MR Guided interventions, tumor ablation, uterine artery embolization, venous recanalization, and MR and fluoroscopic lymphangiography. I hope to grow our MR interventions by adding MR guided prostate and vascular malformation ablation to the list of services we can provide here at UW.

Why did you choose and what are you excited about at UW?

I really enjoy the collegiality of the Department of Radiology and the hospital as a whole. I am always impressed by the accomplishments of my talented colleagues and the robust research and innovation that has come out of UW.

UW CONTRIBUTES TO COVID-19 AI MODEL



Photo by Bryce Richter / UW-Madison

The UW –Madison School of Medicine and Public Health helped create an Artificial Intelligence (AI) model for predicting supplemental Oxygen need for COVID-19 patients. The model was devised by researchers at NVIDIA and Massachusetts General Brigham Hospital to help physicians determine the best course of treatment for patients reporting to the ER with COVID-19 symptoms. After establishing the model, the researchers began a federated learning initiative with 20 hospitals in eight different countries, including UW. Each institution provided data from chest X-rays, vitals, and lab results to construct the model's algorithm. UW was chosen because it has the infrastructure to provide the curated datasets needed for this model. Out of the 20 sites, UW provided the second most data, helping to rapidly improve the tool so that it could be used during the current pandemic. Department of Radiology Assistant Professor John Garrett was the Principal Investigator at UW and helped facilitate the school's involvement in this project. In addition to success in creating the AI model, Garrett believes UW's participation was significant

because it provided a valuable opportunity to participate in a federated learning project, allowed UW to network with other institutions, and set the groundwork for future trials with AI models. "I see this type of work as a significant step towards more broad acceptance of clinical AI tools. It can be challenging to build and then trust a tool like this with a single site's data to validate, but traditional ways of performing multi-center studies require years of work. Federated learning lowers the barrier to this type of collaboration without sacrificing security or HIPAA compliance. I think it represents a way for researchers to much more rapidly iterate and develop new tools," says Garrett. The recent surge of COVID-19 cases in Wisconsin has highlighted how valuable AI models are in the current world. "The major implication of the current surge has placed an emphasis on the value of these tools which are now validated and ready to test clinically. Although we will need to work with the IRB and other compliance groups before rolling this out in clinical practice, there is clearly a need for tools like this to help us utilize our resources

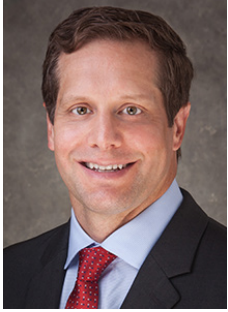
ALAN MCMILLAN AND MULTIDISCIPLINARY TEAM AWARDED R01 GRANT (FROM P. 2)

the model, which can cause problems when sharing algorithms globally. "This is really important to consider as AI algorithms are shared across the world. What works well here at UW may not work well at another institution for a variety of reasons," Professor McMillan comments.

While this project is in progress, there are some common causes of AI failures that the group has already picked up on. For example, AI is only good at giving answers

to types of data that it has seen before. "If there are unanticipated variations in the input data, the results may not be all that robust. This could be due to patient effects like motion, operator error of the scanner, or other image artifacts due to system issues. All of these could cause an AI algorithm to give an unpredictable result. Therefore, it is really important to understand the idea of making robust AI methods," says Professor McMillan.

GREG AVEY AWARDED GRANT FOR FINANCIAL WELLNESS EDUCATION



Dr. Avey

Congratulations to the Director of Head and Neck Imaging and Associate Professor Greg Avey, MD for receiving the Financial Education Research Grant from the AccessLex Center for Education and Financial Capa-

bility®. The grant, which is for \$94,749, will fund Dr. Avey's research on the impact that financial wellness courses have on the wellbeing of young physicians. The research is starting right here at UW, where Dr. Avey implemented a financial wellness elective course for fourth-year medical students in the spring of 2020.

For many years, Dr. Avey has been providing seminars on personal finance for radiology residents and fellows to promote their financial and personal wellness, both in training and as they transition into their careers. He was approached by UWSMPH medical student Chris Sweeney, who was searching for a financial literacy course at the medical school and had heard about the work Dr. Avey did with residents. The culmination of their collaborative efforts was an elective created to help fourth-year medical students gain more in-depth knowledge about student loans, investing, insurance, and planning for their financial future. His work on this elective course led to Dr. Avey's nomination for the White Coat Investor Financial Educator of the Year award in 2020, where he was one of eleven finalists.

Given the diverse topics, the elective course relies on a team of content experts in each individual area. "We have a core team that helped us get this course running and ensured that we have enough experience and a broad exposure to topics. Specifically, I want to thank Chris Sweeney; Emma Crawford, Manager of SMPH Financial Aid and Financial Wellness; Associate Professor Cliff Robb, PhD, in the Consumer Science Department at the UW School of Human Ecology (SOHE); and Brianne Camacho, Financial Aid and Financial Wellness Advisor, for the hard work they have put in to help set-up this course," says Dr. Avey.

For example, the team brings in experts – financial planners, insurance experts, student loan experts, and more – to provide up-to-date teachings within their respective fields. Despite this use of financial experts, the course is not focused on speculating which stocks will rise or listing the best investments on the market. "The class is designed to give students the opportunity to consider what is important to them and their career arc. When people look at their priorities for the future, there are natural financial and wellness decisions that flow from that knowledge," says Dr. Avey. With this focus, the course helps students create individualized plans based on their priorities and goals with support from a variety of financial experts.

The course content is tailored towards medical students on the verge of graduation, and high student loan debt is a key concern among these students. The current median debt among medical school graduates is \$241,600 (Hanson, 2020), but new physicians graduating from residency with \$350,000 to \$500,000 in debt is not uncommon. The course aims to provide students with the knowledge and financial tools to manage their loans and make well-informed decisions about their future. In addition to loans, the course compares the pros and cons of renting or buying housing during residency. It also addresses saving for retirement, budgeting, investing, insurance, and more.

One of the most important aspects of the course is the physician lens through which it is taught. "What makes this course different from other financial courses is the emphasis on the physician point of view on finances. Physicians are in a unique position because they start with so much debt and yet have the high potential for income. Presenting information from a physician's perspective is necessary, as it allows instructors to empathize with the students and understand both their opportunities and challenges," says Dr. Avey.

Now in only its second year, the elective has already become a popular course. When it was first offered in spring 2020, about one-fourth of the medical class enrolled in the course. Now the course is at capacity, with about half of the current

graduating class enrolled. "We are excited about the response we are getting from medical students. They are ecstatic about the course, giving it glowing reviews and stating how applicable the content is to their lives," Dr. Avey mentions.

With the initial positive feedback on the course, Dr. Avey's team is excited for the grant and the approval to start their financial wellness education research. "We were very pleased. Not many medical schools have a program similar to this. We were glad to get this support because it is a novel program, and we hope to better understand its impact on students," he says. In the course, students take pre- and post- surveys to determine how much their views on financial topics have changed, and to see if the course is having a positive impact on their knowledge of and feelings on financial wellness. The grant Dr. Avey received will help as he continues to study the short and long-term effects of financial wellness education and how the course impacts physicians throughout their careers.

In terms of future plans, the vision for this course and the related research is to take the teachings to a broader audience. "We want to help students become highly effective physicians that achieve success in every area of their lives, and we believe reducing financial stress can help our students attain this goal," says Dr. Avey. He hopes to help create similar courses for other medical schools and find ways to disseminate knowledge further using publications and other resources.

While the plans for this project are ambitious, the course's initial success and the potential to improve the lives of physicians make it an exciting prospect. "We have been excited about the positive feedback we've gotten so far. It is gratifying to do this in the first place, because I think we will have a significant impact on a huge class of physicians as they move forward. We are hoping that they will have less stress and lower rates of burnout as they embark on their careers," says Dr. Avey.



Department of Radiology

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Thanks to the hard work and ingenuity of our residency program team, we held virtual interviews for our Diagnostic and Interventional Radiology Residency Programs and matched with an incredible group of incoming residents!

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For news and information about the UWSMPH Department of Radiology, please visit www.radiology.wisc.edu