Graduate Program in Medical Physics

Summer 2018
Volume 12

Alumni News

Message *from the Director*

The past year we saw four major events that affected the program.

The school year got off to an exciting start with Hurricane Harvey, which flooded Houston over the weekend after new student orientation and before the first week of classes. While quite a few faculty and staff members had flooded houses or lost cars, fortunately only one graduate student and one resident were flooded out of their homes.

When the Medical Center got back on its feet after a week, and classes finally started, a big change from the students' perspective was the inauguration of our new curriculum. The clinical rotation courses have been replaced by a first-semester Introduction to Clinical Medical Physics course and enhanced labs in the introductory therapy, imaging and nuclear medicine physics courses. The new two-semester sequence in Anatomy, Physiology and Biology incorporates the subject matter of the former radiobiology and anatomy and oncology courses along with elements of the molecular imaging course. The molecular imaging course has been revamped and remains as an elective. The former math course has been replaced by two, one in Imaging Science and the other on Statistics for Medical Physicists. The electronics course has been pared down to reflect modern practice.

Later in the fall, the program submitted its self-study for the quinquennial re-accreditation by the Commission on the Accreditation of Medical Physics Education Programs. It had been a decade since the program had received an on-site visit by CAMPEP, so in late April, we were reviewed in person. Our students, led by Daniela Branco, took the reviewers to many of the areas where students work and gave them a students'-eye view of the program. The reviewers had a very enlightening lunch with most of the students. Many of our faculty members met with them to describe the courses in our curriculum and our students' research. Melissa Tovar, Program Manager, and Frances Quintana, Program Co-ordinator, saw to it that the reviewers' visit was logistically flawless including running an audible from the line of scrimmage when an institutional administrator's schedule suddenly changed. The review was very positive, with only a few suggestions for how we might gild the lily, as it were, and we received re-accreditation for a full five-year term.

THE UNIVERSITY OF TEXAS MD Anderson Cancer Center | UTHealth The University of Texas Health Science Center at Houston

Graduate School of Biomedical Sciences

What's Inside

Www.gsbs.uth.edu/medphys

After two years as our Program Manager, in May Melissa Tovar returned to the Department of Diagnostic Radiology in order to support the diagnostic radiology residency program with the same effort, enthusiasm and devotion that she had invested in the graduate program and in the imaging physics residency program.

We were able to recruit Anne Baronitis to replace her. Anne has a wealth of experience in educational administration, and our alumni of a certain age will remember Anne from her previous work at the Graduate School.

Several other matters are noteworthy. This year starts the third decade of the Aaron Blanchard Research Award. For some of us it seems like only yesterday that Aaron was our student or classmate, gamely pursuing his studies in the face of cancer. To others, he is known primarily through this memorial award, which recognizes the best cancer-related thesis or dissertation each year. We are grateful to Aaron's family, who created and, along with other donors, has sustained the award as an inspiration to us all.

The careful reader of this newsletter might note that no Shalek Fellowships were awarded to the incoming class of 2018. This is because the balance in the accounts had been nearly exhausted in the previous year, even with the faithful contributions of a number of our alumni and friends. Recently, we received two one-of-a-kind gifts that have restored the accounts to a more comfortable balance. However, with changes at the federal level and within the institution, the industrial support and short course proceeds that had sustained the awarding of numerous fellowships in the past are no longer sources of income to the fellowship accounts. Without the regular and generous support of a substantial number of alumni and friends, it is now difficult to support many students. In the past few years, we have been giving SMS students a half stipend (which is currently $16,000 a year compared to $32,000 a year for PhD students) plus tuition and fees (which amount to about $8000 a year). Thus, to support even one student a year at this level, we would need for 240 of us to contribute $100 a year or for 48 of us to contribute $500 a year. I am grateful to the many supporters of this ongoing effort, and I would ask that you respond generously to every fundraising appeal. Please also keep the graduate program in mind when you are making estate plans.

There are several people whom I must thank individually for helping to make this such a great year for the graduate program. Daniela Branco, our Student-Faculty Liaison, has been innovative and tireless in leading our student body in their own activities and in organizing their support of the program. She has raised the baseline for fun in medical physics. Melissa Tovar kept the program running smoothly, which is far harder than this simple statement makes it appear. Frances Quintana is a hero, often unsung, who brings her creative talents to bear on many aspects of the program and has stepped into the breach whenever she was needed. In particular, she has designed and written this alumni newsletter for the first time. Finally, George Starkschall, who apparently really means it this time about retirement, has contributed so much to the program as a teacher, an advisor to students, a mentor to faculty members, and a wise counselor in the operation of the program that mere words do not suffice to describe how badly he will be missed.

Thank you all.

Bud Wendt

Richard Wendt, Ph.D.
713-745-3250 | rwendt@mdanderson.org

2018-2019 Student Council

Cayla Wood
Student-Faculty Liaison

Tucker Netherton
Education Chair

Constance Owens
Social Representative

- **Student-Faculty Liaison** serves as the main point-of-contact between the student body and the program director
- **Education Chair** provides a formal channel for students to discuss issues related to their educational experience
- **Social Representative** organizes student social events to promote student interaction and collaborations outside of individual labs

Our New Program Manager

Anne Baronitis comes to us with over 20 years of experience in higher education administration, including student recruitment, admissions, event planning, student advocacy and academic advising. She has worked for The University of Texas Health Science Center at Houston School of Public Health and The University of Texas Graduate School of Biomedical Sciences. We are excited to be working with Anne.

Anne Baronitis, M.Ed | 713-563-2548
aibaronitis@mdanderson.org

2017-2018 Student Update

By Daniela Branco

This past year was very successful for our student body. We had a total of fifteen oral presentations, five E-posters, and three general posters accepted for the 2018 AAPM Annual Meeting happening this July. In addition to the regular sessions, **Carlos Cardenas** was invited to be a guest speaker and give a lecture on *"Machine Learning in Radiomics".* Beyond AAPM, our students were invited to present a total of 23 oral presentations, 15 posters and 3 E-posters to other national and international meetings, including ASTRO, ESTRO, ISMRM, PTCOG, and SNMMI. At this year's regional SWAAPM meeting, our students swept the podium for the oral presentations, with **Brian Anderson** placing 1st, **Rachel Ger** placing 2nd, and **Tucker** Netherton placing 3rd.

We had a total of seven posters accepted at the meeting and **Mary Peters** took 3rd place in the student competition. In the novel MedPhys Slam competition **Brian** secured 1st place and will compete for the top prize at the AAPM Meeting in Nashville. In summary, we had a total of 40 orals, 24 posters, eight E-posters and two MedPhy slam presentations accepted just in the last twelve months!

Our success on paper did not fall behind! In the past year, we had 17 first authors, and 13 co-author peer reviewed manuscripts published with eight first author manuscripts and one technical note currently under review.

The Graduate Student Council also organized some events to help disseminate important information to the student body. **Mallory Glenn** put together a PhD Candidacy presentation with general expectations and exam structure for the students taking the exam this coming fall. We also hosted a Residency Match Panel Discussion with our soon-to-be residents **Rachel McCarroll, Garrett Baltz, Angela Steinmann, Megan Jacobsen, Daniel Craft,** and **Sara Thrower.** The slides were organized by the panelists and were used to guide questions and discussions regarding the interview matching process.

9th Annual Medical Physics Student Research Retreat

The 9th Annual Medical Physics Student Retreat was a hit, focusing on the importance of cooperation and student relationships. The retreat was held on June 15th with the theme "Building Stronger Relationships". Several team building activities, including a medical physics Jeopardy game, pitted groups of students against one another in a fun environment. This year's invited speaker was **Dr. Nathan Childress,** an alumnus of our Medical Physics Program and founder of Mobius Medical Systems (now a part of Varian Medical Systems). Dr. Childress offered advice on his own journey through the medical physics field in career options outside the clinic. The retreat concluded with a trip to the Houston Zoo so students could relax and enjoy the good weather.

On behalf of the Graduate Student Council, it has been an honor to serve our student community this past academic year. We are proud to announce next year's representatives, Cayla Wood (Student-Faculty Liaison), Tucker Netherton (Education Representative), and Constance Owens (Social Chair). We wish them the best in their endeavors to continue elevating our student programs to new heights!

-Daniela Branco

Entering Class of 2018 & Admission Data

PhD Incoming Class	Undergraduate/Graduate Institution
Soleil Hernandez	Texas A&M University
Tianzhe Li	Northwestern University
Suman Shrestha	Louisiana State University
Kai Huang	Carlton College
Cenji Yu	Wake Forest University
Mary Peters	MD Anderson UTHealth GSBS

SMS Incoming Class	Undergraduate Institution
Aashish Gupta	Texas Tech University

Application Data	Ph.D.	S.M.S.
Total Applications	76	8
Interviewed	14	3
Offers	10	3
Matriculating	6	1
Average Scores of Matriculating Students		
Undergraduate GPA	3.71	
Graduate GPA	3.84	
Verbal GRE	157	
Quantitative GRE	162	
Analytical GRE	4.1	

Congratulations 2018 Graduates

Garrett Baltz
MS
Advisor: Howell

Megan Jacobsen
Ph.D.
Advisor: Cody

Angela Steinmann
Ph.D.
Advisor: Followill

Rachel McCarroll
Ph.D.
Advisor: Court

Sara Loupot
Ph.D.
Advisor: Hazle

Daniel Craft
Ph.D.
Advisor: Howell

Student Accomplishments

National Meetings	Presentations
ASTRO	1 Oral, 1 Poster
PTCOG	2 Orals
American Society of Neuroradiology	1 Oral
SNMMI	4 Orals, 1 Poster
AAPM Spring Clinical Meeting	Young Investigator's Symposium Finalist: **Garrett Baltz**
RSNA	1 Poster
St. Jude Future Fellows in Research Conference	1 Poster
SPIE	4 Orals, 1 Poster
UTH Evening of Discovery	2 Posters
CIRMS	1 Oral
Radiation Research Society	2 Orals
Society of Thermal Medicine	1 Poster
14th U.S. National Congress on Computational Mechanics	1 Oral
IEEE IUS	1 Poster
WMIC	1 Oral
American Brachytherapy Society	1 Oral, 1 E-Poster
International Meetings	
ESTRO 37	2 Orals, 1 Poster
ISMRM	3 Orals, 2 E-posters, 4 Posters
SCINT	1 Poster

Sanders Selected for Summer Deep Learning Program

Jeremiah Sanders, doctoral student in our Medical Physics Program, was selected to participate in the highly competitive summer internship with the Air Force Research Laboratory (AFRL) Maui Optical and Supercomputing Site in Maui, Hawaii. The internship is fully funded to include a research stipend, housing, travel and food for the duration of the summer (May 11 – August 5, 2018). His supervisor is Captain Justin Fletcher, Principal Investigator of the Machine Intelligence for Space Superiority (MISS) Program.

Sanders will be working on two projects this summer:

Wave-front sensor image super-resolution: Improve the resolution capabilities of the optical wavefront sensors at AMOS. The goal of this project is to develop an artificial neural network capable of doubling the spatial resolution of the optical wavefront sensors without producing high frequency aliasing in the image.

Satellite image object detection: Develop a generalized detection algorithm for satellite imagery. The goal of this project is to develop an artificial neural network to rapidly process frames of satellite imagery and detect all instances of objects from a range of 62 different classes. These classes comprise objects that vary as much as two orders of magnitude in size. This work will yield a better understanding of fine-scale object detection, large-image data processing, and high class instance per image detection for the Air Force Research Labs. The techniques developed to solve the problems inherent in this detection domain are likely applicable to medical imaging.


Kealaloloa Ridge looking at Haleakala

Throughout the summer, Sanders will develop deep neural networks and train, evaluate, and deploy them on AMOS's supercomputer, Hokule'a. After successful completion of the projects, he will maintain access to Hokule'a for use in his doctoral research at MD Anderson. Hokule'a has 32 compute nodes with 4 NVIDIA P100 GPUs per node, for a total of 128 GPUs.

Jingfei Ma, Ph.D., is Sander's medical physics mentor.


Kapalua Bay (taken underwater)
Photos taken by Jeremiah Sanders

Department of Imaging Physics and Radiation Physics

Cordially Invite You to Join Us for the

ANNUAL ALUMNI RECEPTION

During the

AMERICAN ASSOCIATION OF PHYSICISTS IN MEDICINE 2018 ANNUAL MEETING & EXHIBITION

Sunday, July 29, 2018
8:00 pm—10:30 pm

Omni Hotel Nashville

250 5th Ave S, Nashville, Tennessee 37203
Broadway Ballroom A/B

A Message from Outreach Physics:

The University of Texas MD Anderson Section of Outreach Physics will be hosting a booth at the AAPM Annual Meeting in Nashville, Tennessee. We will have representatives from Radiation Dosimetry Services (RDS), the Accredited Dosimetry Calibration Laboratory (ADCL), and the MD Anderson Dosimetry Laboratory (MDADL). This year we are at Booth number 833, so be sure to stop by. We are again handing out the MD Anderson logo ribbons to our alumni as well as current students, faculty and staff. Please hang it from your name badge. We look forward to seeing you in Nashville!

Contact Information

Richard Wendt, Ph.D., Program Director
RWendt@mdanderson.org

Anne Baronitis, M.Ed., Program Manager
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Frances Quintana, Program Co-ordinator
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Houston, Texas 77030
medicalphysicsprogram@mdanderson.org

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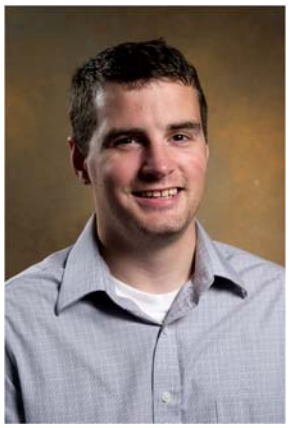
THE UNIVERSITY OF TEXAS MD Anderson Cancer Center | UTHealth The University of Texas Health Science Center at Houston

Graduate School of Biomedical Sciences

Daniel Craft, M.S.



Graduation: August 2018

Advisory Committee

Rebecca M. Howell, Ph.D. (Advisory Professor)

Stephen F. Kry, Ph.D.

Peter Balter, Ph.D.

Wendy Woodward, M.D., Ph.D.

Mohammad Salehpour, Ph.D.

Daniel Craft started his residency at the Mayo Clinic in Arizona on July 1, 2018.

Design, Fabrication and Validation of 3D Printed Patient-Specific Compensators for Postmastectomy Radiation Therapy

The purpose of this study was to use 3D printed, patient-specific tissue compensators to overcome the 3D planning limitations for postmastectomy radiation therapy (PMRT). Tissue compensators can be used to reduce dose heterogeneity, hot and cold spots at field junctions, and treatment complexity, but are currently seldom used due to the difficulty in designing, fabricating, and validating them. To produce compensators using 3D printing technology, suitable materials had to be found and characterized. Several materials were found to be promising, but previously unreported material uncertainties were also discovered that must be carefully controlled for in 3D printing studies. A new algorithm was also created to optimally design the compensator shape to conform the dose to the desired region, while maintaining acceptable geometric considerations for 3D printing. Patients' dose distributions calculated using this algorithm were superior to dose distributions calculated in those same patients using more conventional matched field plans. To validate the idealized dose distributions, a new technique was developed to 3D print patient-specific, large scale radiotherapy phantoms with dosimeters throughout that can accurately reflect patients' anatomy better than generalized phantoms. Six of these phantoms were created for a sample of patients with a range of body sizes. A sample of compensators was designed and printed for these novel phantoms, and radiation doses were measured and compared to planned dose distributions. Measured doses agreed well with planned doses. This study demonstrates that 3D printed, patient-specific compensators can be used to simplify treatments, and improve dose distributions in PMRT patients relative to their conventional 3D plans. Additionally, the algorithm could be applied to calculate compensators for different treatment sites in the future, and the phantoms developed could be used to perform pseudo in vivo dosimetry measurements for a wide range of radiotherapy experiments.

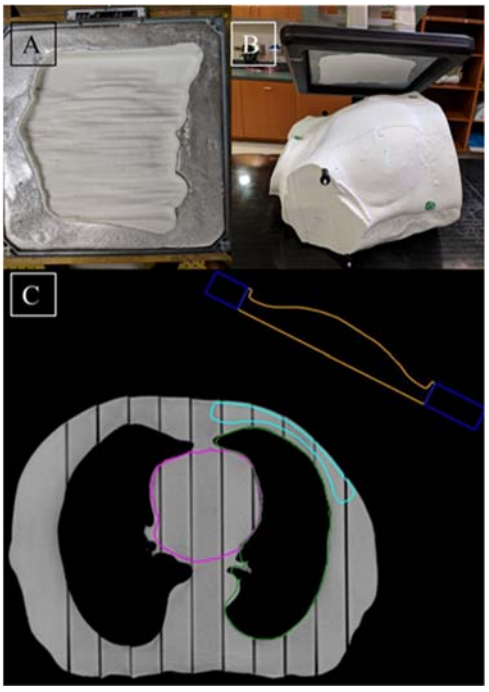


Figure 5.3: Compensator plan delivery to a phantom.

A) Photograph of the compensator in the cerrobend tray.
B) B) Photograph of the compensator and phantom in treatment position, and
C) Slice of the TPS view of the plan.

In (C) the compensator is contoured in orange, the cerrobend in dark blue, the CTV in light blue, and the heart in pink.

Megan C. Jacobsen, Ph.D.

Graduation: August 2018

Advisory Committee

Diana Cody, Ph.D.
(Advisory Professor)

Dawid Schellingerhout, M.D.
(Secondary Mentor)

Ken-Pin Hwang, Ph.D.

Lucia LeRoux, Ph.D.

Xinming Liu, Ph.D.

Veera Baladandayuthapani, Ph.D.

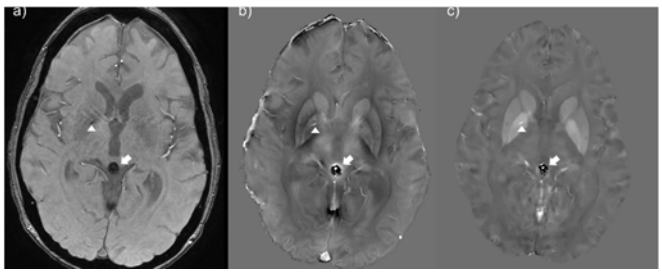
Megan Jacobsen will be a Medical Physics Fellow in the Department of Imaging Physics at MD Anderson Cancer Center, where she is continuing her research under Rick Layman, Ph.D. and receiving clinical training in diagnostic radiological and nuclear medicine physics. Her research involves developing new quantitative dual-energy CT applications, particularly for real time monitoring of chemo-ablative oncologic therapy.

Identification of Intracranial Lesions with Dual-Energy Computed Tomography and Magnetic Resonance Phase Imaging

On conventional Single-Energy Computed Tomography (SECT), lesions with an attenuation greater than 100 Hounsfield Units (HU) can be definitively diagnosed as calcification. However, low-density calcifications and hemorrhage may have overlapping attenuation ranges between 40 and 100 HU and, therefore, cannot be differentiated with SECT alone. On T2*-weighted Gradient Recalled Echo (GRE) MRI, these lesions appear as "foci of susceptibility" in which their signal is hypointense due to the magnetic susceptibility of the lesions differing from that of the background tissue.

Dual-Energy Computed Tomography (DECT) and Phase-Sensitive Magnetic Resonance Imaging (PS-MRI) represent two new imaging paradigms which both have the potential to more accurately identify intracranial calcification and hemorrhage. In DECT, x-ray tomography is acquired at two tube voltages; because x-ray attenuation is energy- and material-dependent, the data can be used to differentiate between materials that may have the same signal level on SECT. PS-MRI utilizes the phase data from T2*-weighted MRI acquisitions to determine how the local magnetic field varies across the image. By applying post-processing algorithms such as Quantitative Susceptibility Mapping (QSM), the phase can be used to calculate the magnetic susceptibility of a lesion. Since calcifications are diamagnetic and hemorrhage paramagnetic, we can make inferences about a lesion's composition from these algorithms.

The objective of this dissertation work was to characterize brain lesions, discovered with traditional imaging methods, as either hemorrhagic or calcific by using Dual-Energy Computed Tomography (DECT) and Phase-Sensitive Magnetic Resonance Imaging (PS-MRI). To this end, MRI-compatible phantoms featuring models of both calcific and hemorrhagic lesions were developed and validated. This resulted in two phantoms with biologically similar lesion models that were then used to test the feasibility of differentiating calcific and hemorrhagic lesions with PS-MRI post-processing methods, in which QSM was able to accurately differentiate calcific and hemorrhagic lesion models. Finally, we undertook a patient trial testing the feasibility of identifying calcification and chronic hemorrhage in humans using both DECT and QSM in which the two modalities had accuracies of 99.7% (327/328) and 99.4% (326/328), respectively. The two modalities were concordant for 99.3% (148/149) lesions with SECT ttenuation under 100 HU.



(Above) A multi-echo gradient recalled echo sequence (magnitude image a) is used to generate a background subtracted phase image (b) and a Quantitative Susceptibility Map (c). Note the pineal calcification (arrow) and a punctate paramagnetic lesion in the globus pallidus (arrowhead) that both appear hypointense in the magnitude image and can be differentiated in the QSM.

Rachel E. McCarroll, Ph.D.

Graduation: June 2018

Advisory Committee

Laurence Court, Ph.D. (Advisory Professor)

Peter A. Balter, Ph.D.

Beth M. Beadle, MD, Ph.D.

David S. Followill, Ph.D.

Christopher L. Nelson, Ph.D.

Christine B. Peterson, Ph.D.

***Rachel McCarroll** will continue her training as a medical physics therapy resident at the University of Maryland Medical Center.*

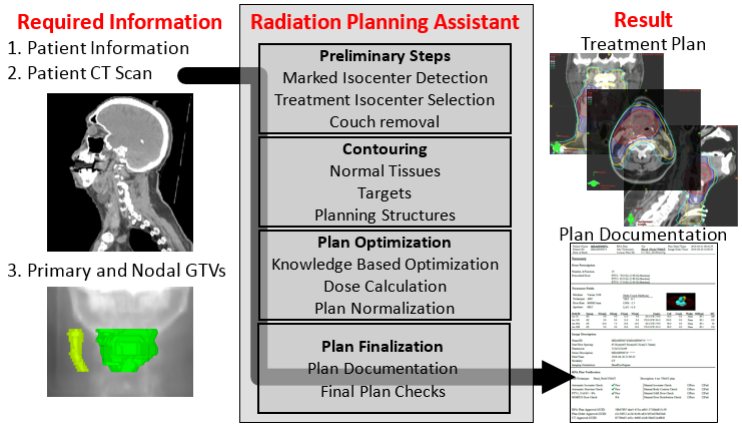
Her work at MD Anderson under the advisement of Dr. Laurence Court towards the role of radiation therapy in global health remains a primary career interest.

Equipment to Address Infrastructure and Human Resource Challenges for Radiotherapy in Low-Resource Settings

Millions of people in low- and middle- income countries (LMICs) are without access to radiation therapy and as the rate of population growth in these regions increase and lifestyle factors which are indicative of cancer increase; the cancer burden will only rise. There is a multitude of reasons for lack of access but two themes among them are the lack of access to affordable and reliable teletherapy units and insufficient properly trained staff to deliver high quality care. The purpose of this work was to investigate wo proposed efforts to improve access to radiotherapy in low-resource areas; an upright radiotherapy chair (to facilitate low-cost treatment devices) and a fully automated treatment planning strategy.

A fixed-beam patient treatment device would allow for reduced upfront and ongoing cost of teletherapy machines. The enabling technology for such a device is the immobilization chair. A rotating seated patient not only allows for a low-cost fixed treatment machine but also has dosimetric and comfort advantages. We examined the inter- and intra- fraction setup reproducibility, and showed they are less than 3mm, similar to reports for the supine position.

The head-and-neck treatment site, one of the most challenging in treatment planning, greatly benefits from the use of advanced treatment planning strategies. These strategies, however, require time consuming normal tissue and target contouring and complex plan optimization strategies. An automated treatment planning approach could reduce the additional number of medical physicists (the primary treatment planners) in LMICs by up to half. We used in-house algorithms including mutli-atlas contouring and quality assurance checks, combined with tools in the Eclipse Treatment Planning System®, to automate every step of the treatment planning process for head-and-neck cancers. Requiring only the patient CT scan, patient details including dose and fractionation, and contours of the gross tumor volume, high quality treatment plans can be created in less than 40 minutes.



Schematic of the proposed automatic treatment planning strategy. Presented in this work are the development and validation of automatic contouring of both normal tissues and targets and the knowledge-based plan optimization technique and associated quality assurance checks.

Laura C. Bennett, M.S.

Graduation: August 2018

Advisory Committee

Oleg Vassiliev, Ph.D., (Advisory Professor)

Stephen F. Kry, Ph.D.

Dershan Luo, Ph.D.

Shouhao Zhou, Ph.D.

Mary McAleer, M.D., Ph.D.

Laura Bennett will be starting as a PhD student in Biomedical Engineering at the University of Iowa.

Her project will involve algorithm development and optimization of a dynamic collimation system for proton therapy.

Stereotactic Radiotherapy for Spinal Metastases Using Flattening Filter Free Beams

Of the patients that are diagnosed with metastatic disease, up to 40% will develop spinal cord metastases. These metastases tend to be located in close proximity to the spine itself, making it difficult to achieve the recommended minimum dose of 14 Gy for single-fraction SBRT or 21 Gy for three fraction SBRT while maintaining acceptable doses to the cord and cauda equina. This has the potential to compromise the efficacy of the plan in favor of reducing normal tissue dose, causing plan failure and local recurrence at follow-up. Flattening Filter Free (FFF) photon beams have been shown to have lower out-of-field dose and sharper dose gradients when compared with conventionally flattened (FF) photon beams of similar energy; this reduction could potential prove beneficial in cases where greater precision is required, such as for high-dose hypofractionated spinal cord treatments. The purpose of this project was to compare the physical properties (penumbral width and penumbral and out-of-field dose) of FFF and FF photon beams as well as determine the clinical effects of these beams on spinal cord tumors. It was hypothesized that FFF beams would show a definitive improvement in target coverage while maintaining acceptable normal tissue doses when compared with FF beams. To test this hypothesis, penumbral width and dose were measured for FF and FFF beam profiles at various depths and field sizes using the Varian Standard Beam Data; additionally, treatment plans were developed for twelve patients with spinal cord metastases using both FF and FFF beams. There was a statistically significant reduction in penumbral width for FFF plans when compared to FF plans; however, this difference was in effect quite small and may not translate to better treatment plans. There was no demonstrable difference between treatment plans developed using FF or FFF beams in terms of minimum dose to the GTV.

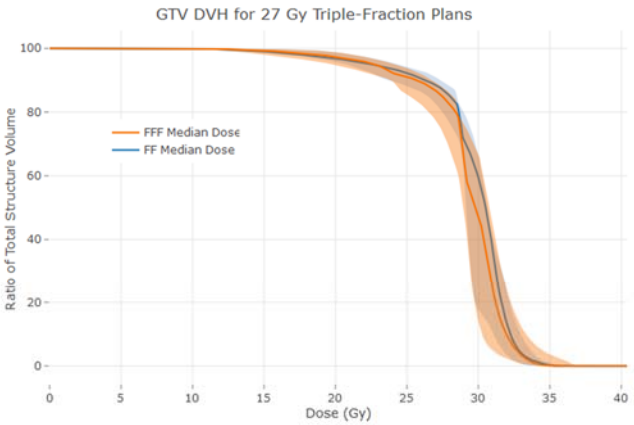


Figure 1: Median DVH with interquartile spread of GTV for patients undergoing single-fraction course

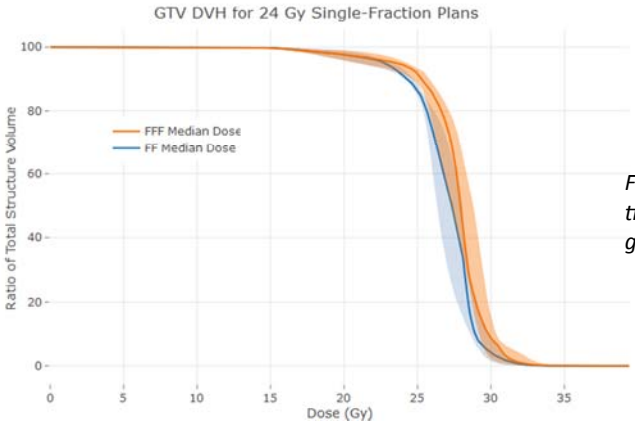


Figure 2: Median DVH with interquartile spread of GTV for patients undergoing triple-fraction course

Mary Peters, M.S.

Graduation: August 2018

Advisory Committee

Rebecca Howell, Ph.D. (Advisor & Committee Chair)

David Followill, Ph.D.

Sunil Krishnan, M.D.

Stephen Kry, Ph.D.

Mohammad Salehpour, Ph.D.

Ramesh Tailor, Ph.D.

Mary Peters has been accepted as a Ph.D. student in our Medical Physics Graduate Program. She is participating in research tutorials to help her select a dissertation project that complements her research passion and career goals.

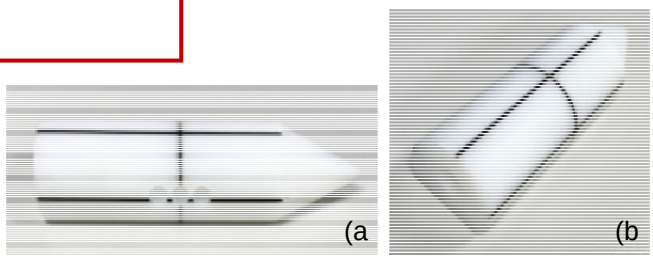
Development and Commissioning of an Independent Peer Review System for a Small Animal Irradiator

Dosimetry for small animal irradiators lacks the standardization of clinical radiotherapy practice, yet plays a central translational role in human trial design. The purpose of this work was to improve the dosimetric accuracy and consistency of animal studies by developing an independent peer review system to verify dose delivery from animal irradiators. This study focused on the development of a mouse phantom and characterization of the thermoluminescent dosimetry system for a commonly used small animal irradiator.

First, a mouse model and irradiation stand were designed with the purpose of being used in a mailable audit. Two mouse phantoms were machined from high impact polystyrene; one accommodated three thermoluminescent dosimeters (TLD) and the other an Exradin A1SL 0.053 cc ion chamber (Standard Imaging, Middleton, WI) for cross-comparison with the TLD. An acrylic irradiation stand was constructed to allow users to align the mouse phantom to the irradiator's isocenter. Second, the mouse system was commissioned in a small animal irradiator using a 225 kVp beam. A pseudo tissue-air ratio was determined using the ion chamber mouse phantom. The dose rate was determined using the TG-61 "in-air" method, along with the measured half-value layer of the beam. The response of the TLD in the mouse phantom was characterized under identical irradiation conditions. Lastly, the commissioned mouse system was mailed to two institutions to verify feasibility of the service.

We designed a robust, user-friendly mouse phantom and foldable irradiation stand, ideal for a mail audit service. The system was commissioned at 225 kVp in a small animal irradiator. The energy correction factor for TLD in the mouse phantom was 0.792 (SD=0.006) relative to 60Co. This factor can be applied to validate dose delivered in this model of animal irradiator. The feasibility of the independent peer review system was demonstrated by verifying beam output and small animal dosimetry for two institutions.

We established and commissioned a methodology for independent peer review of mouse dosimetry for a commonly used animal irradiator. This methodology can be used to characterize other commercially available orthovoltage irradiators.



High impact polystyrene thermoluminescent dosimeter (a) and ion chamber (b) mouse phantoms

Precision X-Ray's X-RAD 225Cx orthovoltage small animal irradiator (reproduced with permission from Paul DeJean)

Carlos E. Cardenas, Ph.D.

Graduation: August 2018

Advisory Committee

Laurence E. Court, Ph.D. (Advisory Professor)

Michalis Aristophanous, Ph.D.

Jinzhong Yang, Ph.D.

Clifton D. Fuller, Ph.D.

Arvind Rao, Ph.D.

Carlos Cardenas accepted a faculty position in the Department of Radiation Physics at MD Anderson Cancer Center.

Auto-Delineation of OroPharyngeal Clinical Target Volumes Using Deep Learning Techniques

Head and neck intensity modulate radiation therapy allows for the delivery of high-precision radiotherapy by conforming radiation dose to the defined treatment targets achieving more accurate target dose distribution and better sparing of normal tissues. However, producing very precise treatment plans may be ineffective if the target volumes are not defined accurately. Furthermore, there are several reports of significant inter-observer variability when delineating these target volumes for head and neck cancers making this variability one of the largest sources of uncertainty in head and neck radiation therapy.

The purpose of this study was to develop algorithms to automate target delineation for oropharyngeal cancer patients. Automating this delineation process could aid in reducing inter-observer variability and provide a venue for head and neck target delineation standardization in radiation therapy. These algorithms would be especially valuable for head and neck cancers where the observed variability is highest amongst radiation oncologists.

An assessment of our head and neck section's inter-observer clinical target volume delineation variability was conducted to quantify the variability in our algorithm's inputs. We then developed two novel deep learning algorithms to auto-delineate high-risk and low-risk clinical target volumes. The predicted delineations for high-risk and low-risk clinical target volumes performed well in comparison to their respective ground-truth delineations. The quantitative analysis showed that the predicted volumes provided, on average, improved delineations when compared to the assessed inter-observer variability. Lastly, we investigated dosimetric differences on target coverage and normal tissues based on the physician delineated and deep learning auto-delineated low-risk target volumes. The percent volume receiving 95% of the prescribed dose on the original physician PTVs was found acceptable, per RTOG 1016 guidelines, on over 70% of auto-delineated plans. In addition, we found no significant difference in normal tissue doses between the physician and auto-delineated target plans.

This study resulted in strong evidence that auto-delineated clinical target volumes could aid in the standardization of target delineation in radiation therapy. The target volume auto-delineation algorithms showed an improvement in overlap and dosimetric agreement with respect to the reported variability in the literature. Future studies may validate the clinical use of these algorithms.

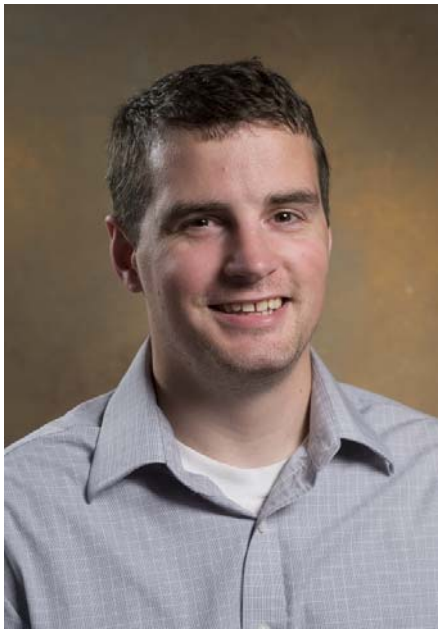
Mark Newpower Selected to Participate in the 2018 St. Jude Future Fellow Research Conferences

From over 1,500 students invited to apply for the 2018 St. Jude Symposia, Newpower is one of 21 students selected by a faculty review committee to attend.

Newpower's project, "An algorithm using microdosimetry to predict the RBE of a proton beam based on the proton energy spectrum", aims to understand and predict the high relative biological effectiveness (RBE) of proton irradiation experiments using microdosimetry. Newpower is also exploring whether his work can be translated into heavier ions such as carbon and helium.

Radhe Mohan, Ph.D., Professor of Radiation Physics is Newpower's advisor.

Daniel Craft Selected as recipient of JACMP Editor-in-Chief Award



Craft was selected by the AAPM as a recipient of the JACMP Editor-in-Chief Award for the calendar year for an outstanding General Medical Physics Article published in 2017 for his paper, "Preparation and Fabrication of a Full-Scale, Sagittal-Sliced, 3D-Printed, Patient-Specific RadioTherapy Phantom," Journal of Applied Clinical Medical Physics 18 (5), 285-292 (2017).

The award will be presented to Craft and his co-authors at the Awards Ceremony during the upcoming AAPM Meeting in Nashville, Tennessee.

The Awards Ceremony is scheduled for Monday, July 30 at 6:30 PM at the Omni Hotel followed by a reception.

Craft's mentor is Dr. Rebecca M. Howell, PhD.

Sara Thrower Awarded GSBS Scholarship

Congratulations to Medical Physics Ph.D. student, Sara Thrower, for receiving the Ellen Taylor Goldin Legacy Scholarship for the 2017-2018 academic year.

Recipients of this award are selected by the GSBS Student Scholarship Committee and the Deans. It is given to recognize exceptional graduate students with a preference for those who are interested in radiation sciences.

Thrower's project, "A Sparse Reconstruction Algorithm for Superparamagnetic Relaxometry", aims to improve the early detection of cancer by developing an algorithm to recover the location of cancer-bound nanoparticles from measurements of their unique magnetic properties.

Thrower's medical physics advisor is John Hazle, Ph.D.

2018 GSBS Evening of Discovery

The University of Texas MD Anderson Cancer Center UTHealth Graduate School of Biomedical Sciences hosted its 9th annual Evening of Discovery on Wednesday, January 31, at the Houston Country Club. The event is a unique opportunity for the UTHealth community of supporters to learn about the incredible research happening at the Graduate School. Ten GSBS student shared their recent biomedical breakthroughs with the group. Those students were: **Kristine Ferrone,** Kiefer Forseth, Ayesha Khan, Leandra Mangieri, Sara Martin, **Travis Salzillo**, Deborah Silverman, Smruthy Sivakumar, Sarah Wu and Ndidi Uzor.

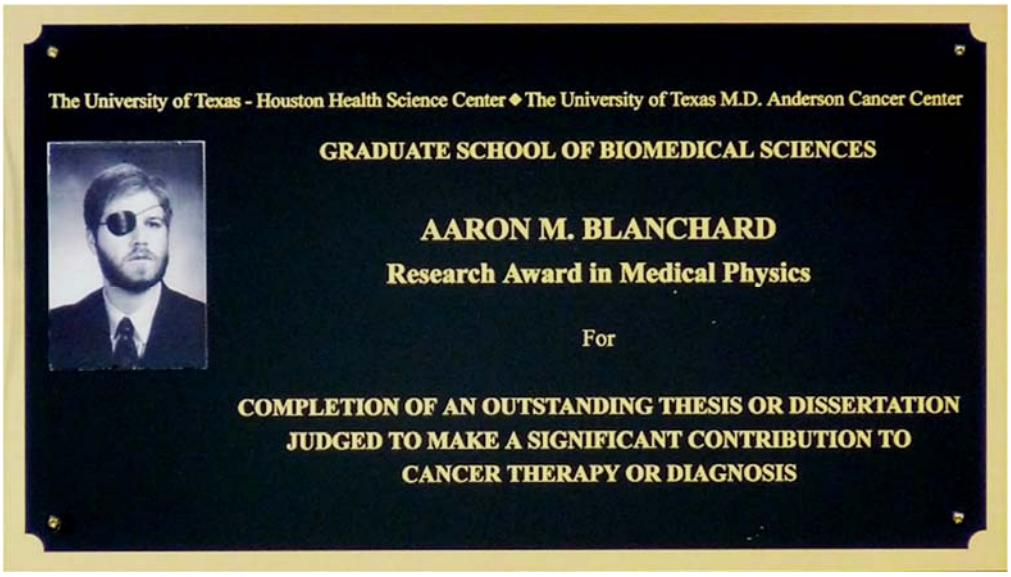
Student **Kristine Ferrone** (above) with her faculty advisors, Stephen F. Kry, Ph.D., left, and Charles E. Willis, Ph.D. Kristine is a third-year graduate student in the Medical Physics Program and her research focuses on space radiation, a major risk for long-duration human space flight.

Student **Travis Salzillo** (left) with his faculty advisor, Pratip Bhattacharya, M.D. Salzillo is a third-year graduate student in the Medical Physics Program and his research focuses on analyzing tumor metabolism for the diagnosis of glioblastoma as well as for monitoring the effects of therapy.

The Aaron Blanchard Research Award

The Aaron Blanchard Research Award was established as a memorial to Aaron Blanchard, a graduate student in the Medical Physics Program, who succumbed to cancer before earning his degree.

The award was created by Blanchard's family and is sustained by their generosity and by other donations to the GSBS. It recognizes a medical physics graduate (M.S. or Ph.D.) for completion of an outstanding thesis or dissertation, that is judged to make a significant contribution to cancer therapy or diagnosis. The recipient of the award is selected by a subcommittee reporting to the Medical Physics Graduate Program's Steering Committee. The award consists of a certificate and cash. Additionally, the graduate's name is engraved on the Aaron Blanchard Research Award in Medical Physics plaque that is on display in the classroom, and a book plate is placed on the front page of the graduate's thesis in recognition of the award.



2017 Justin Mikell, Ph.D.
2016 Daniel Robertson, Ph.D.
2015 John Eley, Ph.D.
2015 Luke Hunter, M.S.
2013 Kevin Casey, M.S.
2012 Richard Castillo, Ph.D.
2011 Brian Taylor, Ph.D.
2010 Malcolm Heard, Ph.D.
2009 Jonas Fontenot, Ph.D.
2008 Stephen Kry, Ph.D.
2007 Jennifer O'Daniel, Ph.D.
2006 Jason Shoales, M.S.
2005 Kent Gifford, Ph.D.
2004 Stephen Kry, M.S.
2003 Jennifer O'Daniel, M.S.
2002 R. Jason Stafford, Ph.D.
2001 Brent Parker, M.S.
2000 Steven McCullough, Ph.D.
1999 Teresa Fischer, M.S.

In addition to the awards listed below, throughout this newsletter other special student honors and recognitions are noted or highlighted. Dissertation and thesis abstracts are also included for students who defended May 2018 – July 2018.

Brian Anderson
Mentor: Jingfei Ma, Ph.D.
- Placed 1st in the MedPhys Slam Talks at SW-AAPM
- Placed 1st in oral presentation at SW-AAPM

Fahed Alsanea
Mentor: Sam Beddar, Ph.D.
- Recipient of the American Legion Auxiliary Fellowship in Cancer Research from GSBS

Daniel Craft
Mentor: Rebecca M. Howell, Ph.D.
- Awarded JACMP Editor-in-Chief Award

Rachel Ger
Mentor: Laurence E. Court, Ph.D.
- Recipient of the Rosalie B. Hite Fellowship
- GSBS Travel Award
- Placed 2nd in oral presentation at SW-AAPM

Mallory Glenn
Mentor: Stephen F. Kry, Ph.D.
- Recipient of the Rosalie B. Hite Fellowship

Jeremiah Sanders
Mentor: Jingfei Ma, Ph.D.
- Recipient of the Pauline Altman-Goldstein Foundation Discovery Fellowship

Daniela Branco
Mentor: David Followill, Ph.D.
- Elected as Vice President, GSA Officers

Carlos Cardenas
Mentor: Laurence E. Court, Ph.D.
- Cancer Answers Award

David Flint
Mentor: Gabriel Sawakuchi, Ph.D.
- GSBS Travel Award

Evan Gates
Mentor: David T. Fuentes, Ph.D.
- GSBS Travel Award

Kelly Kisling
Mentor: Laurence E. Court, Ph.D.
- GSBS Travel Award

Benjamin Lopez
Mentor: S. Cheenu Kappadath, Ph.D.
- Placed 1st in poster competition at SNMMI

Rachel McCarroll
Mentor: Laurence E. Court, Ph.D.
- GSBS Travel Award

Keith Michel
Mentor:
- GSBS Travel Award

Tucker Netherton
Mentor: Laurence E. Court, Ph.D.
- Placed 3rd in oral presentation at SW-AAPM
- GSBS Travel Award

Mark Newpower
Mentor: Radhe Mohan, Ph.D.
- GSBS Travel Award

Mary Peters
Mentor: Rebecca Howell, Ph.D.
- Placed 3rd in posters at SW-AAPM
- GSBS Travel Award

Travis Salzillo
Mentor: Pratip Bhattacharya, Ph.D.
- GSBS Travel Award

Announcing the 1st Annual TShirt Design Contest

The medical physics student body participated in its 1st Annual T-Shirt Design Competition. Medical Physics students submitted a number of entries for the theme "Medical Physics," impressing the judges with their artistic creativity and design.

Congratulations to **David Flint,** with his entry of "The Hadron" design for becoming the first student to win first place in this contest! Mr. Flint was awarded a $100 gift card. His design was added to T-shirts, hoodies and long sleeve shirts. The back of the shirts showcased a list of current Medical Physics Program students. Over 65 shirts were purchased between students and faculty.

T-Shirt Contest Winner, David Flint with "The Hadron" Design (right).

The Robert J. Shalek Fellowship Fund is used specifically for the support of the Medical Physics Educational Programs. Donations to the fund also support the long-term goal of providing continuous funding for the fellowships.

Robert J. Shalek Fellowship Fund

2016
- Mary Peters

2015
- Brian Anderson
- Laura Bennett
- Benjamin Musall

2014
- Daniela Branco
- Harlee Harrison
- Joseph Weygand

2013
- Mattie McInnis
- Olivia Popnoe

2012
- Ming Jung Hsieh
- Jennifer Sierra Irwin
- Dana Lewis
- Justin Mikell

2011
- Shuaiping Ge
- Annelise Giebeler
- Olivia Huang
- Elizabeth McKenzie
- James Neihart
- Matthew Wait

2010
- Jennelle Bergene
- Kevin Casey
- Jared Ohrt
- Kevin Vredevoogd

2009
- Sarah Joy
- Emily Neubauer
- Paige Summers
- Jackie Tonigan Faught

2008
- Joseph Dick
- James Kerns
- Kelly Kisling
- David Zamora

2007
- Triston Dougall
- Georgi Georgiev
- Ryan Grant Lafratta
- Malcolm Heard
- Katie West

2006
- Maria Bellon
- Jimmy Jones
- Nathan Pung
- Yevgeney Vinogradskiy

2005
- Renee Dickinson
- Susannah Lazar
- Alanna McDermott
- Paige Nitsch

2004
- Michael Bligh
- Ryan Hecox
- Hilary Voss

2003
- Blake Cannon
- Scott Davidson

2002
- Earl Gates
- Kenneth Homann
- Hilary Voss
- Claire Nerbun

2001
- Melinda Chi
- Gary Fisher
- Jackeline Santiago

2000
- Michael Beach

1999
- Laura Butler
- Amanda Davis
- Nicholas Koch
- Jennifer O'Daniel
- Nicholas Zacharopoulos

1998
- Shannon Bragg-Sitton
- Christopher Cherry
- Dee-Ann Radford

1997
- Christopher Baird
- Aaron Blanchard
- Michael Lemacks
- Luke McLemore

1996
- Michael Bieda
- Tamara Duckworth
- Gwendolyn Myron

1995
- Jonathan Dugan
- Teresa Fischer
- Russell Tarver

1994
- Victor Howard
- Usman Qazi
- Donna Reeve
- Steve Thompson
- Matthew Vossler

1993
- Kyle Antes
- Sarah Danielson
- Dena McCowan
- Donna Reeve
- Matthew Vossler

1992
- Peter Balter
- Kay Jones

1991
- John Bayouth
- Robert Praeder
- Twyla Willoughby

1990
- Maria Graves
- John Wallace

1989
- Mike Gazda
- Scott Jones

From 1987 to 2017, 96 Shalek Fellowships have been awarded. In recent years, an average of two Ph.D. students a year have received short-term bridge funding.

The selection of Shalek Fellows is the responsibility of the Medical Physics Program Steering Committee.

Robert J. Shalek Fellowship Fund

In the period between 1950 and 1984, Robert J. Shalek, for whom this fellowship is named, worked at The University of Texas MD Anderson Cancer Center. During that time the institution grew from small beginnings in temporary buildings to a leading cancer center with a large physical plant and over 6,000 employees.

During the same period medical physics, which had started in the United States around 1915, but had languished as a profession, took guidance from the well-developed British example and grew into a confident and respected profession. Dr. Shalek was shaped by and contributed to these events.

Following Drs. Leonard Grimmett and Warren Sinclair, both very experienced medical physicists from England, he served as head, or chairman, of the Physics Department from 1960 to 1984. Under his direction, the department became recognized as a major research and teaching center in medical physics.

Dr. Shalek earned his undergraduate degree in physics from The University of Illinois and his Ph.D. from the Rice Institute (now Rice University). He spent a postdoctoral year at the Royal Cancer Hospital in London, England. He has published about 100 scientific papers, served in various editorial capacities, and served as President of the American Association of Physicists in Medicine.

He received many prestigious honors, including:

- The William D. Coolidge Award of the American Association of Physicists in Medicine
- The Marvin M. D. Williams Professional Achievement Award of the American College of Medical Physics
- The Gold Medal Award of the American Society for Therapeutic Radiology and Oncology.

His career encompassed both basic research and the application of physics to clinical problems. His basic research included studies of oxygen reactions following radiation interactions and the proportion of direct and indirect radiation action in living cells. His clinically-related work included the dosimetry of external treatment beams, brachytherapy dosimetry, and quality assurance in radiotherapy physics.

The Radiological Physics Center was an outgrowth of his interest in quality assurance. This program, after more than four decades, continues to make important contributions to the reliability of radiation dose statement in interinstitutional clinical trials and to contribute to the implementation of standards in the broader radiological community. Many people have participated in the program and many more have been affected by it.

The contributions that Dr. Shalek made to the Radiological Physics Center have been his most enduring work. Anticipating the end of his institutional career, he studied law at night school, lectured regularly on legal questions in medical physics and regularly gave professional legal advice to physicists. He also participated in medical malpractice suits, usually as an expert witness.

Teaching and dissemination of knowledge and skills to the community had been an important activity of the physicists at The University of Texas MD Anderson Cancer Center. As a member of the faculty of The University of Texas Graduate School of Biomedical Sciences, Dr. Shalek lectured to and supervised a large number of graduate students.

He provided the necessary leadership as Director of the M.S. in Medical Physics program for 25 years and had always demonstrated a sincere sense of responsibility for our students, derived particular satisfaction in observing former students perform to high scientific and professional standards.

In 1987, shortly following the retirement of Dr. Robert J. Shalek as Chairman of the Department of Radiation Physics at The University of Texas MD Anderson Cancer Center and Director of the M.S. in Medical Physics program in The University of Texas Graduate School of Biomedical Sciences, the Department of Radiation Physics established graduate fellowships in Medical Physics in honor of Dr. Shalek.

The selection of Shalek Fellows is the responsibility of the Medical Physics Program Steering Committee. From 1987 to 2012, the Shalek Fellowships have supported over 80 pre-masters and 12 pre-doctoral students.

All gifts to the Robert J. Shalek Fellowship Fund will be used specifically for the support of the medical physics educational programs, and will be used in conjunction with other funds to support current fellowships. Gifts will also support the long-term goal of providing continuous funding for the fellowships.

To Make a Donation:

Go to:
Www.gifts.mdanderson.org

Choose a gift amount:

If you would like to make your gift a monthly donation, check the box next to **Make my gift a monthly donation** once you choose your gift amount.

Complete Your Information:

To ensure that your donation goes towards **Shalek Fellowships**, check the box next to **I'd like to choose where my donation will go.** Select **Other** from the drop box, and type in **Robert J. Shalek Fellowship**

Complete Payment Information:

Submit payment by clicking on the orange **Give Now** button.

By Check
Print and complete the
Donation Card

Mail to:
Shalek Fellowships
Department of Imaging Physics, Education, Unit 1472
The University of Texas MD Anderson Cancer Center
1400 Pressler Street
Houston, TX 77030

Imaging Physics Residency Program

Ho-Ling Anthony Liu, Ph.D., Program Director

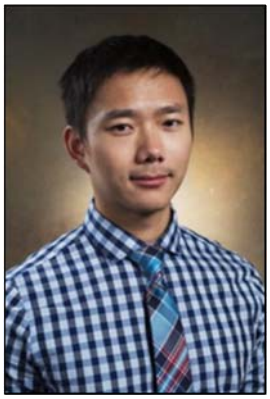
Incoming Fellows


Two fellows will start the Program in August 2018.

Megan Jacobsen, Ph.D., (MD Anderson UTHealth Graduate School of Biomedical Scicences)

Jorge Jimenez, Ph.D., (University of Wisconsin-Madison)

Recent Graduates

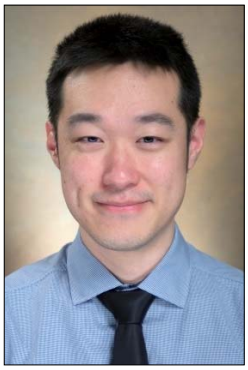



Asher Ai, Ph.D., (MD Anderson UTHealth Graduate School of Biomedical Sciences) completed his residency in August 2018.

Benton Pahlka, Ph.D., (University of Texas - Austin) completed his residency in August 2017 and passed the ABR oral exam this year. He is now a medical physicist at Texas Children's Hospital.

As of August 2017, 26 residents have completed the program and all have obtained board certifications.

Current Residents & Fellows


Chris MacLellan, Ph.D., (MD Anderson UTHealth Graduate School of Biomedical Sciences) is in his last year of residency and will complete the program in December 2018.

Henry Chen, Ph.D., (University of British Columbia) started the fellowship program this spring.

Samuel Einstein, Ph.D., (University of Minnesota) just started the second year of his fellowship and is working with James Bankson, Ph.D., on his research in fluorine-19 MR imaging and spectroscopy.


Samuel Fahrenholtz, Ph.D., (MD Anderson UTHealth Graduate School of Biomedical Sciences) is in the second year of his fellowship and is working with Erik Cressman, M.D., Ph.D., for his research on thermochemical ablation and embolization.

Chris Walker, Ph.D., (MD Anderson UTHealth Graduate School of Biomedical Sciences) is in his first year of his fellowship. Walker is working with James Bankson, Ph.D. for his research on hyperpolarized MRI.

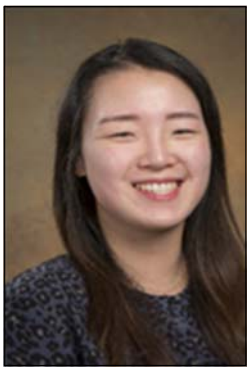
Radiation Physics Residency Program

Mohammad Salehpour, Ph.D., Program Director

Incoming Residents

Four residents will start the program on September 1, 2018.

Manik Aima, M.S. (University of Wisconsin-Madison)
Garrett Baltz, M.S. (MD Anderson UTHealth Graduate School of Biomedical Sciences)
Parmeswaran Diagardjane, Ph.D. (MD Anderson UTHealth Graduate School of Biomedical Sciences)
Christopher Peeler, Ph.D. (MD Anderson Postdoctoral Fellowship Program – Department of Radiation Physics)



Graduating Residents

Four residents will complete the program on August 31, 2018.

Mikhail Chetvertkov, Ph.D., (Wayne State University) will be joining Allegheny Health Network as a Medical Physicist and Drexel University as an Assistant Professor.

Gye Won "Diane" Choi, M.S., (MD Anderson UTHealth Graduate School of Biomedical Sciences) will be joining MDA - Cooper as a Staff Physicist.

Shane Krafft, Ph.D., (MD Anderson UTHealth Graduate School of Biomedical Sciences) will be joining MDA - Department of Radiation Physics as an Assistant Professor.

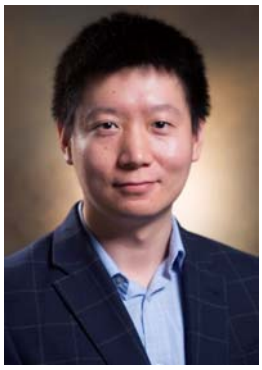
Yilin Liu, Ph.D., (Duke University) will be joining Memorial Sloan Ketering Cancer Center as an Assistant Attending Physicist.

Current Residents

Rachael Martin, Ph.D., (MD Anderson UTHealth Graduate School of Biomedical Sciences)

Jordan Slagowski, Ph.D., (University of Wisconsin-Madison)

Wenjun Yang, Ph.D., (University of Wisconsin-Madison)



There are currently three first-year residents in the program. They will complete the program on August 31, 2019.

AAPM 2018 Presentations by Students in Medical Physics

***Authors** whose work was done as a graduate student (including some recently graduated alumni)*

Productive Research Collaborations with Global Partners to Address Challenges in Low-Resource Clinics, Medical Physicists and the Global Health Challenge, **Kisling K,** Court L

A Novel SPECT/CT-Based Lung Dose Estimation for Treatment Planning in Y90 Microsphere Radioembolization Therapy, **B Lopez*,** A Mahvash, S Kappadath

Optimization of a Spectroscopic Photoacoustic Imaging Technique to Noninvasively Assess Oxygen Saturation in Murine Femoral Bone Marrow, **C Wood***, K Harutyunyan, J De La Cerda, C Kaffes, M Konopleva, R Bouchard

The Impact and Detectability of MLC Positioning Error in the VMAT Plan Delivered on Varian Halcyon, S Gay*, **T Netherton,** C Cardenas, P Balter, L Court

Does Diffusion Kurtosis Imaging Add Value for Early Prediction of the Response to Neoadjuvant Chemoradiation in Esophageal Cancer? **B Musall***, S Lin, P Fang, B Carter, J Son, B Fellman, J Ma

Effects of Non-Ideal Spectral-Spatial Excitation Slice Profile on Quantitative Analysis of Metabolism Using Hyperpolarized Pyruvate, C Walker*, J Bankson

An Extensive Search for Optimal Collimator Angle and Field Size Settings for Knowledge-Based Automated Head-And-Neck VMAT Plans, **Y He***, L Zhang, **R McCarroll**, **K Kisling**, J Yang, C Mayo, B Beadle, L Court

Improving Colorectal Liver Metastases Treatment: Neural Networks and Biomechanical Models, **B Anderson*,** E Lin, G Cazoulat, S Gupta, E Koay, B Odisio, K Brock

Radiomics Feature Robustness as Measured from an MRI Radiomics Phantom J Lee*, **A Steinmann**, Y Ding, H Lee, J Wang, D Followill, L Court

Shifting to Free Breathing CT For Attenuation Correction of Q-Freeze PET/CT Elastic Respiratory Motion Correction, O Mawlawi, **J Meier**

Chemoablation Agent Imaging with Background-Free 19F-MRI, **E Thompson***, S Einstein, J Bankson, E Cressman

Automated Detection of Vertebral Body Metastases for Fully-Automated Palliative Radiotherapy Using Transfer Learning, **T Netherton*, C Cardenas**, A Klopp, P Balter, C Chung, C Peterson, R Howell, L Court

A Comparison of Two Deep Learning Architectures to Automatically Define Patient-Specific Beam Apertures, **C Cardenas***, **B Anderson,** L Zhang, A Jhingran, H Simonds, J Yang, K Brock, A Klopp, B Beadle, L Court, **K Kisling**

Quantitative Accuracy of Virtual Non-Contrast Imaging in Various Dual-Energy CT Scanners, M Ahmad*, **M Jacobsen**, D Cody, V Surabhi

Applying a Saturation Correction to the Microdosimetric Kinetic Model Prediction for the Relative Biological Effectiveness of a Carbon Ion Beam, **M Newpower*,** D Patel, L Bronk, F Guan, D Grosshans, U Titt, R Mohan

Homogeneous and Heterogeneous 3D Dosimeters for IMRT End-to-End Testing in a Pre-Clinical MR-Linac, **B McDonald*,** H Lee, Y Roed, Muhammad Akram, G Ibbott

Broadening the Graduate School Experience: Paper-in-a-Day, **K Kisling***, **R Ger, C Cardenas,** A Rubinstein, **T Netherton,** W Ingram, X Fave, **C Owens**, **B Anderson,** J Lee, S Gay, J Yang, **R McCarroll**, D Mackin, Y Li, **D Rhee**, **S Edward**, **Y He**, S David, P Nitsch, P Balter, L Court

Improve IVIM & DCE Map Using Convex Optimization with Higher-Order Total-Variation Regularizations, R He, Y Ding, A Mohamed, H Elhalawani, **R Ger**, B Elgohari, J Wang, K Brock, C Chung, K Hutcheson, S Frank, S Lai, C Fuller

Acceptance and Verification of Halcyon Linear Accelerators without the Need for 3D Water Scanning System, S Gao*, P Balter, **T Netherton**, J Shi, M Rose, W Simon

A Pilot Study of IROC's Proton Head & Neck Phantom, P Taylor*, **D Branco**, N Hernandez, D Followill

Hyperpolarized Magnetic Resonance Imaging Reveals Transformations in Pyruvate Metabolism Prior to Anatomic Changes in Patient-Derived Glioblastoma Models, **T Salzillo***, J Gumin, J Lee, I Hassan, N Zacharias, R Colen, F Lang, P Bhattacharya

AAPM 2018 Presentations by Students in Medical Physics

***Authors** whose work was done as a graduate student (including some recently graduated alumni)*

Comparison of Two Reconstruction Methods for Bound-Nanoparticle Detection Using Superparamagnetic Relaxometry, **S Thrower*,** S Kandala, D Fuentes, K Mathieu, W Stefan, A Kulp, J Hazle

Quantitative Prediction of Cellular Proliferation Marker Ki67 Using MR Imaging in Glioma, **E Gates***, J Lin, J Weinberg, J Hamilton, S Prabhu, J Hazle, G Fuller, V Baladandayuthapani, D Fuentes, D Schellingerhout

Design and Implementation of a Head and Neck Anthropomorphic Phantom Used in MRI Guided Radiotherapy Systems, **A Steinmann***, P Alvarez, H Lee, Z Wen, G Sawakuchi, L Court, R Stafford, C Fuller, D Followill

Detecting Iodine Enhancement with Dual-Energy Computed Tomography: How Low Can We Go? **M Jacobsen*,** E Cressman, X Duan, D Cody, D Schellingerhout, R Layman

Harmonized CT Protocols for High Quality Radiomics Studies, **R Ger***, D Mackin, S Zhou, P Chi, H Lee, R Layman, A Jones, D Goff, C Fuller, R Howell, H Li, R Stafford

Characterization and Validation of TLD and EBT3 Film in MR/CT Visible Phantoms under the Presence of 0T, 0.35T and 1.5T, **A Steinmann***, D O'Brien, K Mittauer, J Bayouth, G Sawakuchi, Z Wen, L Court, R Stafford, C Fuller, D Followill

A Comparison between Dosimetric Reporting Quantities for APBI Brachytherapy: MBDCA and Monte Carlo, G Fonseca, F Verhaegen, **S Thrower,** K Gifford*

Convolutional Neural Networks for Fully Automatic Segmentation of Lung Tumors in CT Images, **C Owens***, C Peterson, C Tang, E Koay, W Yu, J Li, M Salehpour, D Fuentes, L Court, J Yang

Linking Single-Site DNA Damage Response to Individual Charged Particle Type in C-Ion Radiotherapy Beams, C Mc Fadden*, S Rahmanian, **D Flint**, S Bright, D O'Brien, A Aroumougame, A Abdollahi, S Greilich, G Sawakuchi

The Importance of DNA Double Strand Break Repair Defects to Cell Radiosensitivity in Helium and Carbon Ion Beams, **D Flint**, C Mcfadden, S Bright, D Yoon, S Kodaira, T Konishi, G Sawakuchi*

Role of Double Strand Break DNA Repair Deficiency on the Sensitivity of Cells to Therapeutic Proton Beams, S Bright, **D Flint,** C McFadden, D Yoon, A Aroumougame, G Sawakuchi

Homogenizing Reconstruction Kernels for CT Radiomics, D Mackin*, **R Ger**, L Zhang, J Yang, P Chi, S Bache, C Dodge, A Jones, L Court

A Novel Tool for Remote, Independent Audits of Linac Beam Properties, C Nguyen*, **T Netherton,** P Alvarez, P Balter, S Gao, D Followill, L Court

Challenges of Attenuation Correction in Conventional Respiratory Motion Corrected PET/CT O Mawlawi, **J Meier**

Removing Noise Bias in Photoacoustic-Based SO2 Estimates: A Simple Empirical SNR-Adaptive Thresholding Approach, D Sampaio*, M Naser, **T Mitcham, C Wood,** J Pavoni, T Pavan, R Bouchard

Ultrasound Activatable Nanodroplets Targeted to EGFR for Molecular Imaging with High-Frequency Ultrasound, **T Mitcham*,** D Nevozhay, S Lai, K Sokolov, R Bouchard

Design and Validation of 3D Printed Patient Specific Tissue Compensators for Post Mastectomy Radiation Therapy, **D Craft***, S Kry, P Balter, W Woodward, M Salehpour, **G Baltz**, **M Peters,** R Howell

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