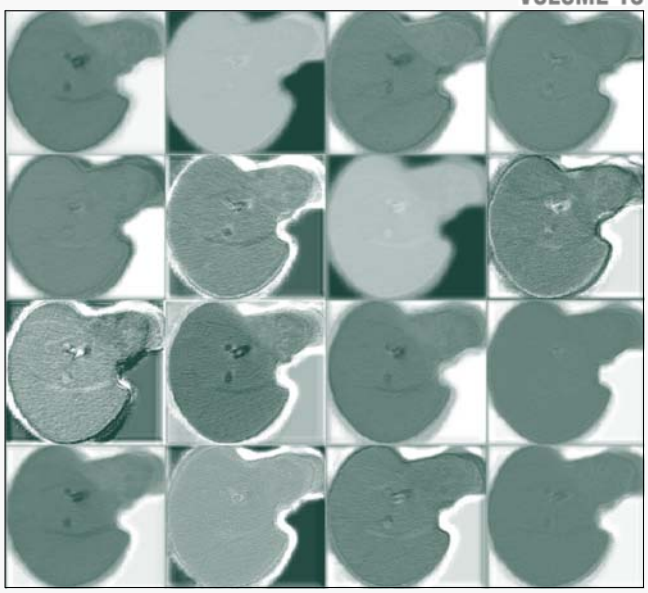
2018-2019

MEDICAL PHYSICS ALUMNI NEWSLETTER

VOLUME 13



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Graduate School of Biomedical Sciences

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Graduate School of Biomedical Sciences

Medical Physics Graduate Program

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ON THE COVER

Cover art by Brian Anderson
Ph.D. Student

"Opening the Black Box"

This figure illustrates the convolutions learned within a deep learning algorithm to distinguish liver vasculature from normal liver. Each panel is highlighting a different feature that the model has self-taught for this task. Panel 1,1 (row, col) in the top left seems to suppress contrast enhancing regions, making the vasculature appear darker against the normal liver background. Panel 2,3 appears to be a smoothing kernel. Visualizing these during the training process can help offer qualitative insight into how the deep learning model works.

Mentor, Kristy Brock, Ph.D.

REPORT BY THE PROGRAM DIRECTOR

This has been another great year for the Graduate Program in Medical Physics of The University of Texas MD Anderson Cancer Center UTHealth Graduate School of Biomedical Sciences.

Our students have excelled in their studies and research as the listing of student presentations at this year's AAPM meeting, starting on page 41, demonstrates. We fall in the top quintile of CAMPEP-accredited graduate programs for students' publications and presentations. Our students do a lot more than just study and work, though, as is reported on page 8. Their annual retreat, which was facilitated by Paul Naine of Elekta, was a noteworthy success.

Our graduating students have fared very well this year. As in past years, every one of our newest PhD alumni had obtained a residency, a post-doctoral fellowship or a faculty position by the time that they graduated. One of our two SMS graduates this year is continuing on for the PhD, and the other has joined an imaging residency. We have yet to have a PhD or SMS graduate seek a residency and fail to obtain one.

Our incoming class is as impressive as ever. We will have seven PhD students and one SMS student matriculate in August, 2019. Although the Graduate School can afford initial funding for only five first-year medical physics PhD students each year, the Departments of Radiation Physics and Imaging Physics are funding two more, for which the program is very grateful. This amounts to a $32,000 annual stipend plus fringe benefits and in-state tuition and fees of $6235 a year for each PhD student. From the 65 applicants to the PhD program, we made 14 offers, and from the 14 applicants to the SMS program, we made 1 offer, so we remain quite selective in our admission standards. Our faculty members have been very successful in obtaining external funding for their research and thus our students have all been able to find mentors who can support them after the initial funding period.

Brent Parker, Chris Baird and Anne Baronitis have launched an exciting initiative to strengthen the engagement of our alumni with the program. Their first activity was a seminar with the students that also included Steve McCullough, Rebecca Marsh and Mich Price. This was an immensely enriching experience for our students, and we thank all of the panelists. The program is facing two challenges.

Graduate students with Director Bud Wendt, left to right, Benjamin Musall and Sharbacha Edward at the 2018 Lab Coat Ceremony.

One is the initial support of students prior to their choosing an advisor, and the other is the future of the SMS program.

We typically have more faculty members who would like a PhD student from each entering class than we have funded positions for entering students. With the demise of corporate support and short course income over the years, philanthropy has become the most important facet of meeting this challenge. The Shalek Fellowships are our only means of helping first year Specialized Master of Science students with the cost of their education until they have signed on with a research mentor. They are also used for bridge funding when PhD students need a few months of support for various reasons such as taking slightly longer to finish than the duration of their advisors' grant funding. In the past, we have made a biennial appeal for contributions to the Shalek Fellowships. Henceforth, we will conduct fundraising every year so that our appeal is more predictable and the proceeds of our donors' generosity are more uniform over time. In the past two years, we have received $26,577. Of this amount, $8,000 was contributed by a PhD alumnus and $10,000 was contributed by a departing faculty member as one-time gifts. The remaining $8,577 was contributed by 7 PhD alumni, 6 SMS alumni (one of whom is also among these 7 PhD alumni), 6 faculty members, 1 former faculty member and 1 friend of the program. Their gifts ranged in magnitude from $25 to $1200. The program is grateful to all of these donors.

We would like to offer our SMS students a $16,000 annual stipend plus benefits along with in-state tuition and fees of $6,235 for the first year. As you can see, our recent donation income would not support even one SMS student a year at this level. What is more, the number of contributors is rather modest compared to the numbers of our alumni and faculty members.

I would ask each of you please to consider making at least a small contribution each year. Even nominal gifts from each of us, when magnified by our appreciable numbers, would greatly strengthen the program's ability to help future students. The information on how to pledge or to donate by check or online is at the bottom of this page.

The other challenge that is faced by the program is a proposal from members of the program faculty that the SMS degree program be terminated. This is a controversial, if not contentious, proposal, and the program is approaching the question carefully and deliberately, albeit with a desire to have decided the question in time for the recruitment of the entering class of 2020. Part of that care and deliberation is to solicit comments on the proposal from our faculty, students, alumni and friends.

If you wish to comment, please do so to Anne Baronitis, aibaronitis@mdanderson.org, our Program Manager, by 16 August 2019. Anne will anonymize your comments, unless you request otherwise, and pass them along to a subcommittee of the Program Steering Committee for coalescence into a statement of the pros and cons of the proposal.

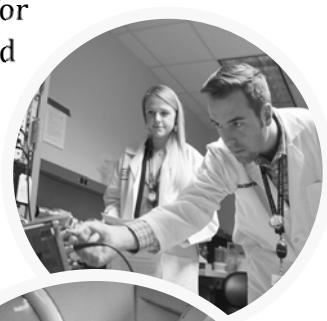
Our program is successful only because of the hard work and active support of many people to whom I am grateful. John Hazle and Mary Martel, as the chairs of the two departments, enable the faculty to teach and advise students, and they underwrite many of the other costs of running the program. The GSBS faculty is voluntary, and our program faculty members choose to teach and advise students rather than to pursue other interests. Anne Baronitis, our Program Manager, and Frances Quintana, our Program Co-ordinator, keep the program running administratively. In addition to her numerous other duties, Frances edited this newsletter, including collecting many of the articles, writing the rest, and designing and laying out the finished product. Our 2018-2019 Student-Faculty Liaison, Cayla Wood, and her student council, Constance Owens and Tucker Netherton, carried on in the tradition of their predecessors of organizing a rich and varied program of student activities throughout the year. Cayla's innovation of a student newsletter is particularly noteworthy. You, our alumni, support the program in many ways, not the least of which is by your professional accomplishments and stature, which reflect so well upon your alma mater.

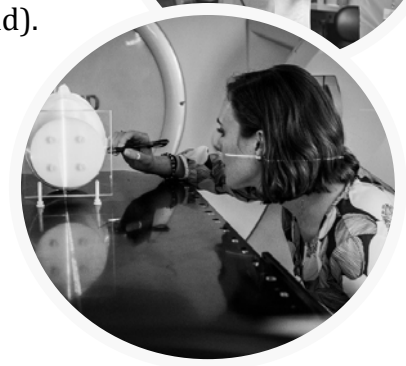
Thank you all.

Bud

Donate to the Shalek Fellowship Fund

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.





To donate online go to **gifts.mdanderson.org**. Choose a gift amount. Check the box "I'd like to choose where my donation will go", from the menu, choose other and enter Robert J. Shalek Fellowship (this annotation is essential to ensuring that your gift is directed as you intend).

To donate by check, mail donations/pledges to:
Shalek Fellowships
Department of Imaging Physics
Attn: Anne Baronitis, Program Manager
1515 Holcombe Blvd., Unit 1472
Houston, TX 77030

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

Highlights from the Program Office

2018-2019 Orientation Welcome Party

The Medical Physics Program kicked off the 2018-19 academic year with an orientation welcome party for new students. Current students and some faculty attended a Fiesta Feast at the home of Anne Baronitis, giving the newbies a chance to interact with everyone over a casual dinner. This will now become an annual tradition as we plan for a repetition with this year's orientation around the corner.

2019 Imaging Physics Super Hero

Our very own Frances Quintana, Program Coordinator, was selected as our IP Superhero during Employee Appreciation Month in May. Glowing comments from students, residents, faculty and staff flowed in to heap praise on Frances for her dedication, creativity and hard work. She was surprised with a $500 Southwest Airlines gift card purchased with the generous donations of faculty. Department Administrator, Rose Delphin, joined Dr. John Hazle in presenting the award.

Medical Physics Program Alumni Panel

Five alumni participated in our first Medical Physics Program Alumni Panel featured as a recent addition to our Summer Seminar Series. Their sharing of advice and experiences was very well received by an audience of current students and other trainees. We plan to make this an ongoing activity as alumni Chris Baird and Brent Parker lead the effort to increase alumni engagement. Chris and Brent participated in the panel live while Rebecca Marsh Milman, Steven McCullough and Mich Price contributed virtually. A special thanks goes to faculty member Julianne Pollard-Larkin for moderating the panel. We will be soliciting alumni to participate in the new Medical Physics Program Alumni Association at the upcoming Alumni Reception at AAPM. If you are interested in getting involved, you may also contact Anne Baronitis (aibaronitis@mdanderson.org) for more information.

Medical Physics

BY THE NUMBERS

ADMISSIONS

15
OFFERS

Applicants
79

Interviewed
16

8
MATRICULATING

SMS PhD

SCORES

3.69
OVERALL MEAN GPA

	Average
Undergraduate GPA	3.65
Graduate GPA	3.82
Verbal GRE	155
Quantitative GRE	159
Analytical GRE	4.00

ENTERING CLASS OF 2019

FRE'ETTA BROOKS
University of Houston

DANIEL EL BASHA
University of Florida

REBECCA DITUSA
Louisiana State University, A&M Baton Rouge

SHANNON HARTZELL
MDA UTHealth, GSBS

BARBARA MARQUEZ
Mount Holyoke College

KELLY NEALON
Vanderbilt University

BRANDON REBER
University of British Columbia

YAO ZHAO
Duke University

UNDERGRADUATE MAJORS
Physics was the most common major of this class.
Other majors: Bioengineering and Physics & Neuroscience.

STUDENT UPDATE

■ A message from the 2018-19 Student-Faculty Liaison, Cayla Wood

The 2018-2019 academic year was another incredibly successful year for our students. At the upcoming AAPM Annual Meeting, we have a total of 13 oral and 15 e-posters accepted as first-author contributions as well as 12 students who contributed as co-authors to other works. David Flint was awarded Best in Physics (Therapy) for his talk entitled *The Non-Homologous End Joining Repair Pathway Determines Cell Radiosensitivity in Helium and Carbon Ion Beams*. Additionally, Mary Gronberg was awarded first place in the SWAAPM Med Phys SLAM competition, and she will compete in the finalists' competition at the Annual Meeting in San Antonio.

We have had students traveling to present at many other conferences throughout the year, including ASTRO, ESTRO, ISMRM, IEEE IUS, and PTCOG. In total, we have had 54 abstracts accepted, 29 for oral presentation and 25 for posters. Additionally, we have published 17 first-author and 16 co-author peer-reviewed publications, and have an additional 8 first-author and 5 co-author manuscripts under review.

The Medical Physics Student Council organized a variety of events throughout the year to encourage student involvement in the program. We started the fall semester with a dinner at program manager Anne Baronitis' home during orientation week to welcome the incoming class and introduce them to other students and some of the program faculty. Our educational representative, Tucker Netherton, organized Friday afternoon help sessions for students to get help with classes or preparation for their candidacy exams. Our social chair, Constance Owens, organized many fun events, including a pool tournament, a bowling night, and our annual pool party. We also participated in the GSBS Outreach Science Night, where kids learned about Medical Physics through a Monte Carlo Plinko game and circuits made of play dough.

Our 10th Annual Medical Physics Student Retreat was a success! We focused on individualized assessment of our strengths and how we can use those strengths to guide our career decisions. We spent May 31st at TopGolf, starting the morning with each student completing the CliftonStrengths assessment to determine their top 5 strengths. Our guest speaker was Paul Naine, the Director of Global Clinical Operations at Elekta. He led us through an interactive discussion that summarized our group results, then discussed how we fit into general trends in industry, the field of Medical Physics, and hospital roles in general. Then, after lunch, we had three hours of play time on the golf bays to relax and spend some time networking with our guest speaker and team building with fellow grad students.

On behalf of the Medical Physics Student Council, it has been an honor serving our students and the program this past year. I am proud of all that we accomplished this year, and I am excited to see what the new representatives have in store for us in the year to come.

Cayla Wood

Friday Afternoon Help Sessions with Tucker Netherton. Pictured clockwise from left to right: Mark Newpower, Tianzhe Li, Cenji Yu, Soleil Hernandez, Tucker Netherton, Dong Joo Rhee, Kai Huang, and Aashish Gupta.

Mary Gronberg speaks to a group during the GSBS Outreach Career Panel

Graduate students and friends during Bowling Night and the Pool Tournament

2019 - 2020
STUDENT COUNCIL




From left to right: Emily Thompson, Student-Faculty Liaison; Constance Owens, Education Chair; Shannon Hartzell, Social Representative; and Soleil Hernandez, 1st Year Student Liaison

Thank you to our 2018-2019 Student Council Representatives for their outstanding service.



From left to right: Cayla Wood, Student-Faculty Liaison; Tucker Netherton, Education Chair; and Constance Owens, Social Representative

2019 GRADUATES

Seven graduate students completed their degree requirements in the 2018-2019 academic year.

Fahed Alsanea, Ph.D.
Advisor: Sam Beddar, Ph.D.
Therapy Residency
THE UNIVERSITY OF TEXAS MD Anderson Cancer Center
Making Cancer History®

Rachel Ger, Ph.D.
Advisor: Laurence Court, Ph.D.
Therapy Residency
MAYO CLINIC

Kelly Kisling, Ph.D.
Advisor: Laurence Court , Ph.D.
Faculty
UC San Diego School of Medicine

Sara Thrower, Ph.D.
Advisor: John D. Hazle , Ph.D.
Postdoctoral Fellow
THE UNIVERSITY OF TEXAS MD Anderson Cancer Center
Making Cancer History®

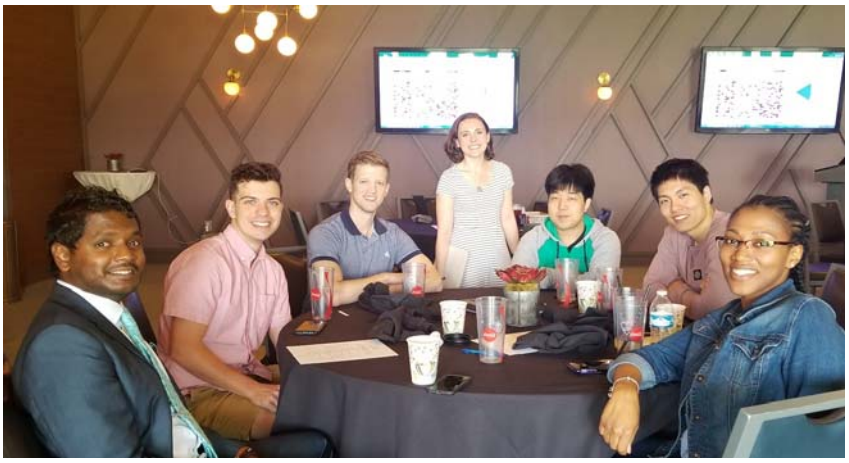
Mark Newpower, Ph.D.
Advisor: Radhe Mohan, Ph.D.
Therapy Residency
OU Health Sciences Center

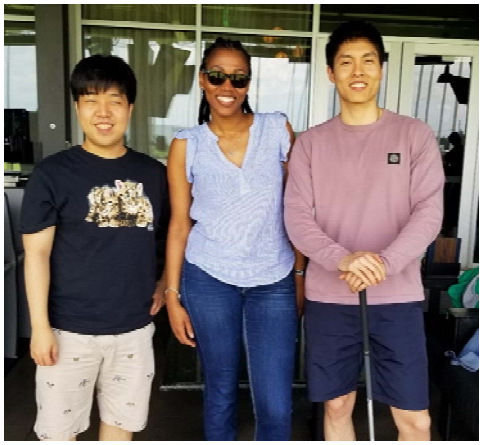
Brandon Luckett, M.S.
Advisor: Paige Taylor, M.S.
Imaging Residency
The University of Oklahoma

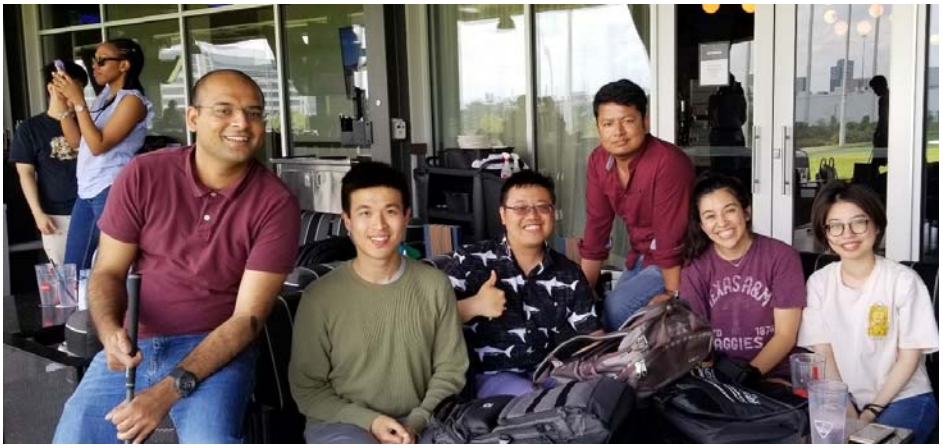
Drew Mitchell, Ph.D.
Advisor: David Fuentes, Ph.D.
Imaging Residency
THE UNIVERSITY OF TEXAS MD Anderson Cancer Center
Making Cancer History®

10th Annual
STUDENT RESEARCH RETREAT

Graduate students enjoyed their annual research retreat.







Glenn has paper published in *Physics in Medicine and Biology*

In 2018, student Mallory Glenn had her second first-authored paper published in the Journal Physics in Medicine and Biology. Her advisor is Stephen F. Kry, Ph.D.

The purpose of this study was to investigate the relationship between treatment plan complexity and treatment accuracy, with the aim of identifying which complexity metrics best predict planning and/or delivery errors and how much complexity contributes to dosimetric errors in IMRT delivery. To date, a comprehensive evaluation of a broad range of complexity metrics has not been done, particularly using a single, controlled patient geometry. This evaluation, as performed using IROC phantoms, has the potential to identify metrics related to the agreement between dose calculations and measurements. In addition, the information produced in this work may be used to better inform the treatment planning process or guide QA testing in order to mitigate potential errors.

Intensity modulated radiation therapy (IMRT), including volumetric modulated arc therapy (VMAT), is currently a standard of care technique for many disease sites. This delivery technique allows for better dose conformity than traditional 3D conformal radiation therapy while simultaneously sparing normal tissues from extraneous radiation dose. However, this technique also requires variations in multileaf collimator (MLC) motion, as well as gantry rotation speed and dose rate in some cases. Such sources of variability increase the plan 'complexity', a term describing the frequency and amplitude of fluctuations in IMRT dose distributions (Mohan et al 2000). Thus, a simple IMRT treatment consists of large beam apertures of regular shapes, and complex IMRT beams tend to have small, narrow, or irregularly shaped apertures.

> "I am very thankful for the opportunity to collaborate with brilliant physicists from around the world, even while I am still a graduate student."

Many have previously reported that the degree of complexity (i.e. beam modulation) may be associated with greater uncertainties in radiation treatments (McNiven et al 2010, Younge et al 2012, Masi et al 2013, Crowe et al 2014, Du et al 2014, Park et al 2014, Götstedt et al 2015).

This is a logical supposition as high-complexity treatment plans include more challenging dose calculations and increased sensitivity to mechanical delivery performance, especially when using very small fields. The potential for delivery errors associated with highly complex plans has ushered the need to characterize and mitigate complexity in IMRT. To do so, researchers have developed several metrics as indicators of plan complexity, consisting of both fluence map-based and aperture-based metrics (McNiven et al 2010, Younge et al 2012, Masi et al 2013, Crowe et al 2014, Du et al 2014, Park et al 2014, Götstedt et al 2015).

Fluence map-based metrics, such as the modulation index proposed by Webb, measure the variations in photon fluence between adjacent pixels in a fluence map (Webb 2003). Aperture-based approaches measure complexity by directly measuring the irregularity of the treatment field, as defined by the MLC, although some metrics also evaluate other plan parameters, such as leaf speed and variations of the dose rate and gantry speed.

Complexity metrics have also been suggested to be a time-efficient complement to current IMRT quality assurance (QA) methods, as they further inform the extent of beam modulation in the treatment and therefore may flag cases where modulation is higher than would normally be expected. This application is of particular interest to the Imaging and Radiation Oncology Core Houston (IROC) Quality Assurance Center.

"While the results of this work were surprising, we hope they help shed some light on how institutions can improve their IMRT practice. I am also happy to announce there's still more exciting work to come!"

IROC seeks to confirm that institutions participating in National Cancer Institute sponsored clinical trials, including those utilizing IMRT, can calculate and deliver radiation doses consistently and accurately. For IMRT, this is done through the use of end-to-end anthropomorphic phantom irradiations whereby institutions irradiate an IROC phantom containing thermoluminescent dosimeters (TLD) and radiochromic film (Molineu *et al* 2005). The measured dose distribution is then compared to the institution's calculated dose distribution. Yet, even with improvements in IMRT planning and delivery over time, and relatively lax dosimetric agreement criteria for the phantom (7%), a sizeable percentage of institutions continue to fail the phantom test; only 85%–90% of institutions have passed in recent years (Molineu *et al* 2013). Of concern, dose calculation inaccuracies have been shown to be a leading cause of treatment delivery error (Carson *et al* 2016, Kerns *et al* 2017). If complexity could be used to predict treatment accuracy, such analysis would aid in identifying the cause of phantom failures.

This study evaluated IMRT treatment plan complexity metrics with the purpose of identifying those which best predicted irradiation errors. Surprisingly, existing complexity metrics were universally not predictive of dosimetric errors in the IROC H&N phantom irradiations. That is, all metrics evaluated in this study failed to show a statistically significant relationship between phantom performance and the degree of complexity of the treatment plan, regardless of delivery technique, machine model, or TPS. This is interesting, because unlike previous experiments evaluating complexity metrics, the irradiated geometry is constant and without the heterogeneities or uncertainties found in real patient cases. These findings indicate that variations in beam complexity could not explain the disparities in phantom plan performance and that other factors affecting treatment delivery, such as beam modeling inaccuracies, dictate the accuracy of phantom treatment plans.

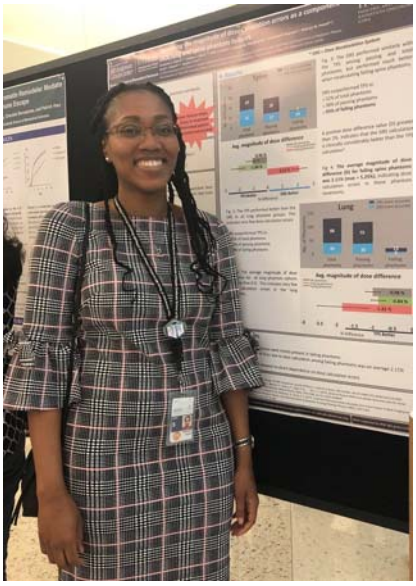
This work was supported by Public Health Service Grants CA180803 and CA214526 awarded by the National Cancer Institute, United States Department of Health and Human Services. Mallory C Glenn is a recipient of the Rosalie B Hite Fellowship in Cancer Research, awarded by the University of Texas MD Anderson Cancer Center UTHealth Graduate School of Biomedical Sciences.

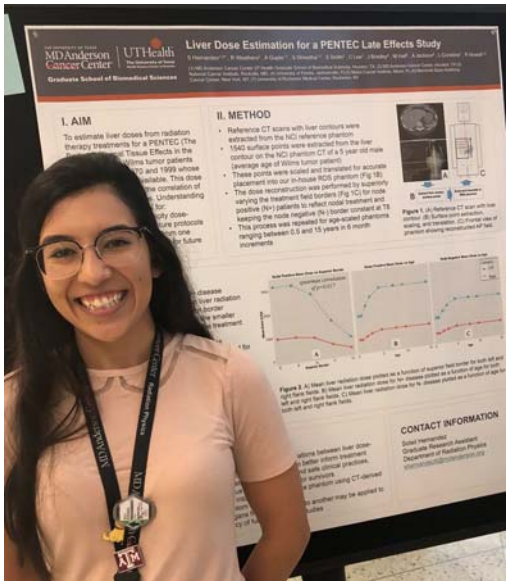
Glenn MC, Hernandez V, Saez J, Followill DS, Howell RM, Pollard-Larkin JM, Zhou S, Kry SF. Treatment plan complexity does not predict IROC Houston anthropomorphic head and neck phantom performance. Phys Med Biol. 2018;63(20):205015. doi:10.1088/1361-6560/aae29e

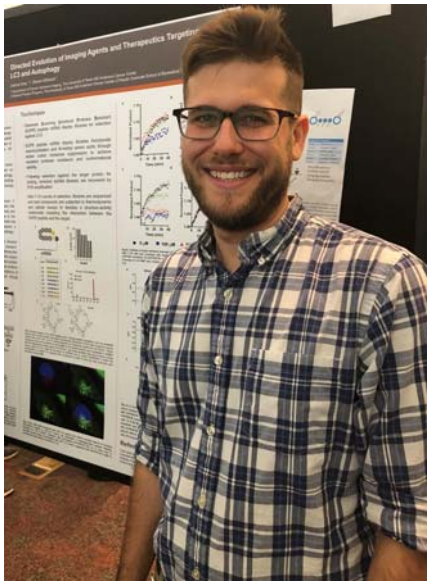
2019 GSBS Student

RESEARCH DAY

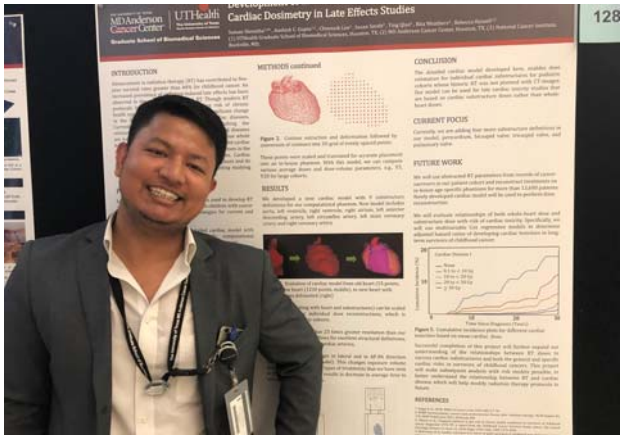
Poster Presentation

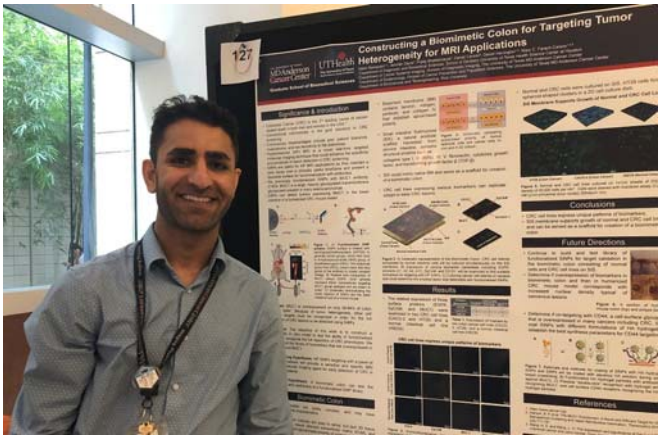




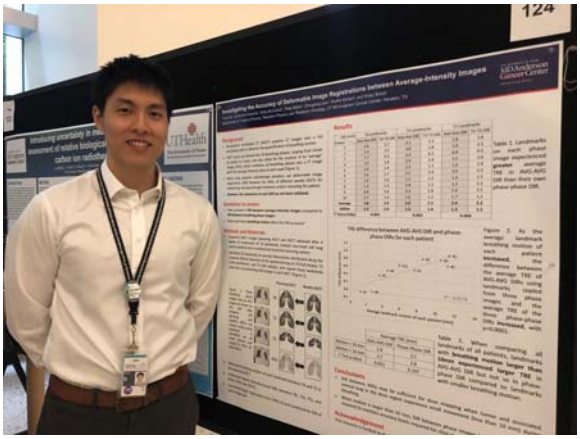


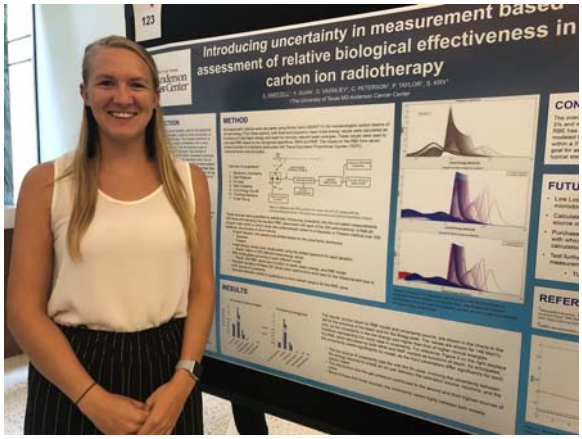
Left to right: Sharbacha Edward, Soleil Hernandez, and Joshua Gray





Left to right: Suman Shrestha and Saleh Ramezani



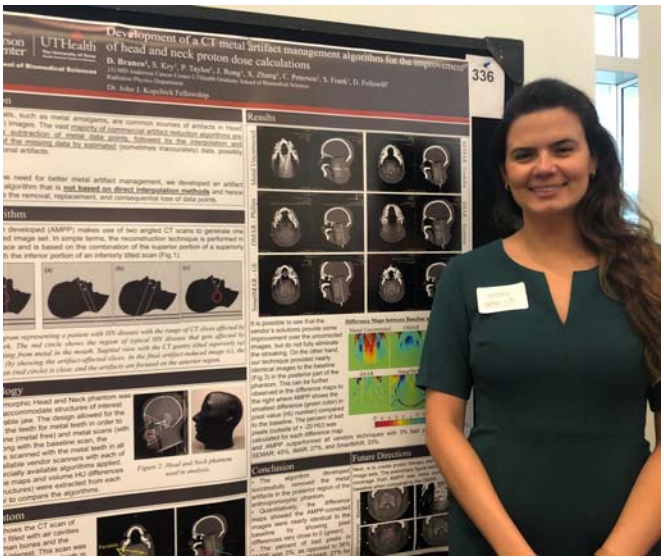


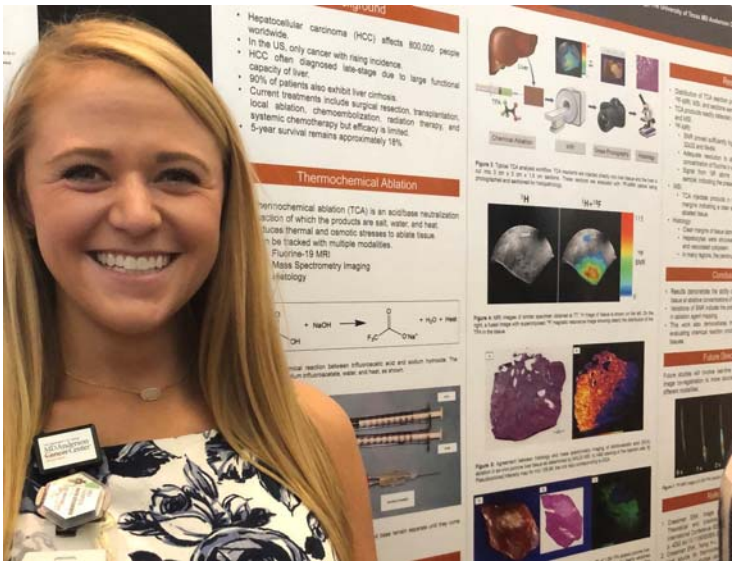
Left to right: Yulun He and Shannon Hartzell

2019 GSBS Student

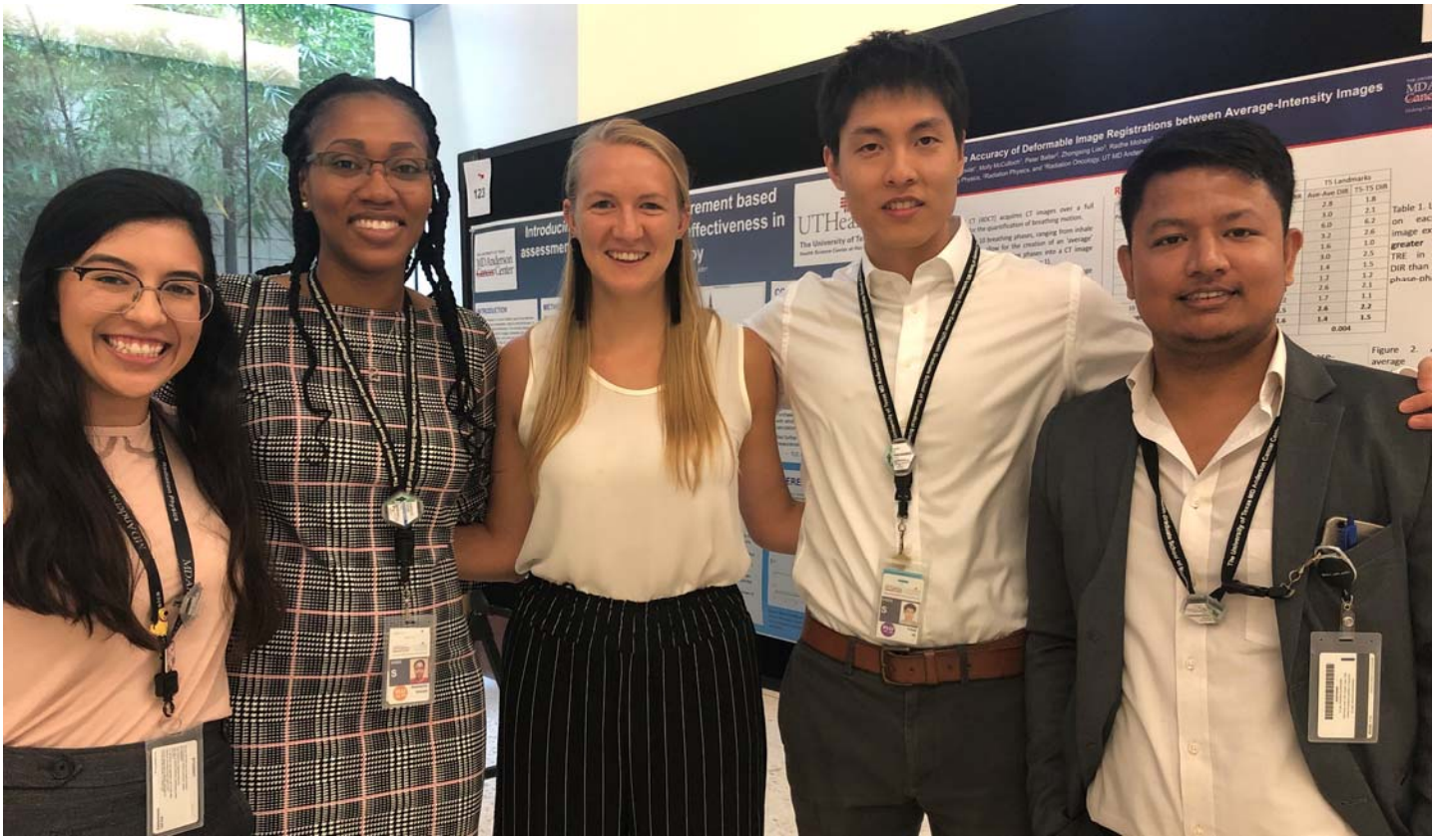
RESEARCH DAY

Poster Presentation





Left to right: Daniela Branco and Emily Thompson



Left to right: Soleil Hernandez, Sharbacha Edward, Yulun He, and Suman Shrestha

GSBS OUTREACH

SCIENCE NIGHT

Science Night is an evening event hosted by GSBS annually. It is organized by GSBS programs and largely run by students. During Science Night, the children come and interact with each program's station. These stations offer a FUN and educational experience where the kids learn about a particular area of science related to each GSBS program. Most stations are creative carnival-like games. This year we had 4 students and one faculty member participate in the medical physics booth.

Scenes from GSBS Outreach Science Night

STUDENT AWARDS

Medical Physics students fared well with 10 scholarships and fellowships received during the past academic year.

AMERICAN LEGION AUXILIARY FELLOWSHIPS
Mallory Glenn
Advisor: Stephen F. Kry, Ph.D.
Evan Gates
Advisor: David Fuentes, Ph.D.
Mary Gronberg
Advisor: Richard Wendt, Ph.D.

CPRIT-UTHEALTH FELLOWSHIP
Saleh Ramezani
Advisor: Cindy Farach-Carson, Ph.D.

JOHN J. KOPCHICK FELLOWSHIP
Daniela Branco
Advisor: David Followill, Ph.D.

MARILYN AND FREDERICK R. LUMMIS, JR., M.D., FELLOWSHIP
Suman Shrestha
Advisor: Rebecca M. Howell, Ph.D.

MAUI OPTICAL AND SUPERCOMPUTING RESEARCH INTERNSHIP
Jeremiah Sanders
Advisor: Jingfei Ma, Ph.D.

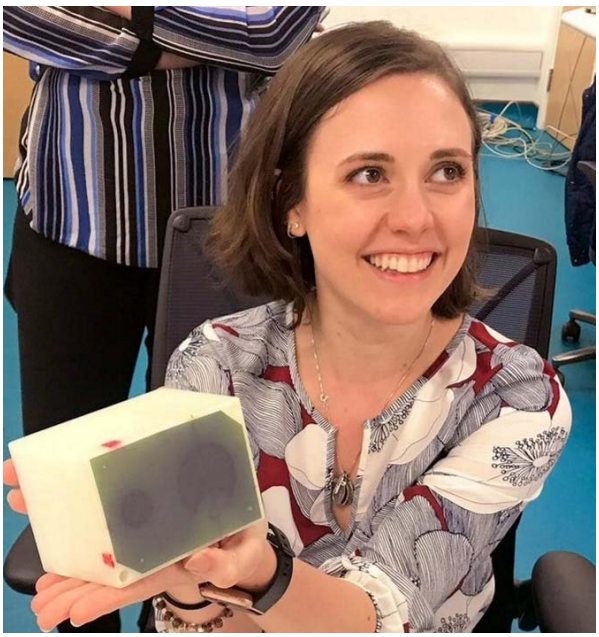
NLM TRAINING PROGRAM IN BIOMEDICAL INFORMATICS AND DATA SCIENCE
Evan Gates
Advisor: David Fuentes, Ph.D.

ROSALIE B. HITE FELLOWSHIP
Mallory Glenn
Advisor: Stephen F. Kry, Ph.D.

THE FADINE JACKSON ROQUEMORE SCHOLARSHIP
Brigid McDonald
Advisor: Clifton Fuller, M.D., Ph.D.

ESTRO 38, MILAN, ITALY

Ph.D. graduate students, Daniela Branco, Sharbacha Edward, and Mallory Glenn attended the European SocieTy of Radiotherapy and Oncology (ESTRO 38) in Milan, Italy from April 26-30, 2019. Edward and Glenn each had an oral presentation and a poster to share. Edward's poster was also selected to compete in the poster competition.



DI Trainee Research Symposium

Congratulations to Evan Gates, graduate research assistant-GSBS, Imaging Physics; Joshua Gray, graduate research assistant-GSBS, Cancer Systems Imaging; Yulun He, graduate research assistant-GSBS, Imaging Physics; and Travis Salzillo, graduate research assistant-GSBS, Cancer Systems Imaging.

The goal of this event is to provide an opportunity for our trainees to practice their poster presentation skills and help prepare them for larger conferences, while also providing a chance to secure a prize that could help send them to a future conference. Due to the mixture of clinical and research trainees, as well as a diverse group of imaging faculty in attendance, the event provided a great opportunity for conversation among groups that might not otherwise connect.

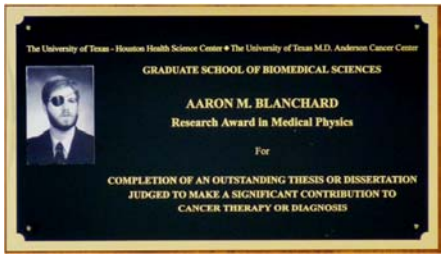
Evan Gates
An Imaging Based Algorithm For Grading Glioma
Mentor: David Fuentes, Ph.D.

Joshua Gray
Directed Evolution of Imaging Agents and Therapeutics Targeting LC3 and Autophagy
Mentor: Steven Millward, Ph.D.

Yulun He
Investigating the Accuracy of DIR Between Average-Intensity Images
Mentor(s): Kristy Brock, Ph.D. and Radhe Mohan, Ph.D.

Travis Salzillo
The Metabolic Evolution of Glioblastoma During Tumor Development and Following Radiotherapy Treatment
Mentor: Pratip Bhattacharya, Ph.D.

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 displayed in the classroom, and a book plate is placed on the front page of the graduate's thesis in recognition of the award.

2018 RECIPIENT
XENIA FAVE, PH.D.

Fave received this award in recognition of her Ph.D. dissertation, "Detecting and Evaluating Therapy induced Changes in Radiomics Features Measured from Non-Small Cell Lung Cancer to Predict Patient Outcomes".

Her research with Laurence E. Court, Ph.D., focused on if radiomics features measured from weekly 4-dimensional computed tomography (4DCT) images of non-small cell lung cancers (NSCLC) change during treatment, and whether those changes are prognostic for patient outcomes or are dependent on treatment modality.

PAST BLANCHARD AWARD RECIPIENTS

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

RECOGNITION & ACHIEVEMENTS

In addition to the recognitions and achievements listed below, throughout this newsletter other special student honors and recognitions are noted or highlighted.

DAVID FLINT
Mentor: Gabriel Sawakuchi, Ph.D.
- Best in Physics in Therapy AAPM 2019

SHANNON HARTZELL
Mentor: Stephen F. Kry, Ph.D.
- 2019 Student Council: Social Chair

YULUN HE
Mentor: Kristy Brock, Ph.D., and
Radhe Mohan, Ph.D.
- DI Trainee Research Symposium Scholarship

SOLEIL HERNANDEZ
Mentor: Laurence Court, Ph.D.
- 2019 Student Council: First-Year Liaison
- Travel Award

KAI HUANG
Mentor: Richard Wendt, Ph.D.
- Travel Award

KELLY KISLING
Mentor: Laurence Court, Ph.D.
- AAPM Spring Clinical Young Investigator's Symposium—Oral Presentation

TREVOR MITCHAM
Mentor: Richard Bouchard, Ph.D.
- Travel Award

BRIGID MCDONALD
Mentor: Clifton Fuller, M.D., Ph.D.
- GSBS Student Research Day—Oral Presentation, People's Choice Award
- Travel Award

CONSTANCE OWENS
Mentor: Jinzhong Yang, Ph.D.
- 2019 Student Council:
- Educational Representative

MARY PETERS
Mentor: Rebecca Howell, Ph.D.
- SW-AAPM Chapter SLAM Winner

JEREMIAH SANDERS
Mentor: Jingfei Ma, Ph.D.
- Travel Award
- Cash Award
- Poster Presentation

SUMAN SHRESTHA
Mentor: Rebecca Howell, Ph.D.
- Travel Award

EMILY THOMPSON
Mentor: Erik Cressman, M.D.
- 2019 Secretary of the Association of Student Communication
- 2019 Student Council: Student-Faculty Liaison

The following pages highlight dissertation and thesis abstracts for students who graduated since the last newsletter.

SARA L. THROWER, PH.D.

A Compressed Sensing Approach to Detect Immobilized Nanoparticles using Superparamagnetic Relaxometry

Superparamagnetic relaxometry (SPMR) is an emerging technology that leverages the unique properties of biologically targeted superparamagnetic iron oxide nanoparticles to detect cancer. The use of ultra-sensitive sensors enables SPMR to detect tumors ten times smaller than current imaging methods. Reconstructing the distribution of cancer-bound nanoparticles from SPMR measurements is challenging because the inverse problem is ill posed. Current methods of source reconstruction rely on prior knowledge of the number of clusters of bound nanoparticles and their approximate locations, which is not known in clinical applications. In this work, we present a novel reconstruction algorithm based on compressed sensing methods that relies on only clinically feasible information. This approach is based on the hypothesis that the true distribution of cancer-bound nanoparticles consists of only a few highly-focal clusters around tumors and metastases, and is therefore the sparsest of all possible distributions with a similar SPMR signal. We tested this hypothesis through three specific aims. First, we calibrated the sensor locations used in the forward model to measured data, and found a 5% agreement between the forward model and the data. Next, we determined the optimal choice of the data fidelity parameter and investigated the effect of experimental factors on the reconstruction. Finally, we compared the compressed sensing-based algorithm with the current reconstruction method on SPMR measurements of phantoms. We found that when a multiple sources were reconstructed simultaneously, the compressed sensing approach was more frequently able to detect the second source. In a blinded user analysis, our compressed sensing-based reconstruction algorithm was able to correctly classify 80% of the test cases, whereas the current reconstruction method had an accuracy of 43%. Therefore, our algorithm has the potential to detect early stage tumors with higher accuracy, advancing the translation of SPMR as a clinical tool for early detection of cancer.

Supervisory Committee Members, John D. Hazle, Ph.D., Advisory Professor, Jim Bankson, Ph.D., Robert Bast, M.D., David Fuentes, Ph.D., Konstantin Sokolov, Ph.D.

Thrower graduated in December 2018 and is currently working as a postdoctoral fellow in the Department of Imaging Physics at MD Anderson Cancer Center.

FAHED ALSANEA, PH.D.

3D Scintillator Detector Quenching Characterization for Scanning Proton Beams

Proton pencil beam scanning is becoming the standard treatment delivery technique for proton therapy centers. Scanned proton pencil beams provide a highly conformal dose distribution. The complex dose distribution poses challenges for quality assurance measurements leading to sophisticated detector setups and time consuming measurements. Fast 3D measurements are therefore desirable to verify the complex dose distribution and to enable the utilization of the full potential of proton therapy. The overall objective of this project is to improve volumetric scintillators detectors to provide 3D measurements for applications for beam commissioning, quality assurance program, and patient-specific treatment delivery verification.

Detectors based on volumetric scintillators are gaining interest for use in proton therapy because they promise fast and high-resolution proton beam measurements. However, the scintillators' response depends on the ionization density of the incident radiation, termed ionization quenching. For protons and other heavy charged particles, the ionization density, which is quantified as the linear energy transfer (LET), varies as a function of depth. Therefore, quenching introduces a non-linear response to the absorbed dose of proton beams. To fully utilize volumetric scintillator detectors for dose verification, ionization quenching correction factors are needed.

Previous studies have shown the feasibility of using multiple cameras to image volumetric scintillators for obtaining real-time measurements, and 3D information. Furthermore, ionization quenching correction models based on the widely used Birks' equation was shown to have lower dose accuracy at the Bragg peak for low-energy beams. The purpose of this study is to accurately determine the ionization quenching correction factors and to characterize a novel 3D scintillator detector for scanned proton beams.

The 3D scintillator detector consisted of a liquid scintillator filled tank imaged by three identical sCMOS cameras. The system exhibited a high spatial (0.20 mm) and temporal resolution (10 ms). It was capable of capturing and verifying the range of all the 94 beam energies delivered by the synchrotron with sub-millimeter accuracy. The use of multiple orthogonally positioned cameras allows for detecting the precise locations of delivered beams in 3D. The beam images captured by the detector were synchronized with synchrotron beam delivery trigger signals. The developed image acquisition technique demonstrates the capability of the detector to capture single spots with a reproducible accuracy of 2%. Ionization quenching correction factors were used to correct the response of scintillators for dose linearity. The EDSE scintillation model was explored which relates the scintillation light emission to the energy deposition by secondary electrons.

This project explored key improvements necessary for volumetric scintillator-based detector and demonstrated the capabilities of a novel 3D scintillator detector as a potential comprehensive quality assurance tool and for patient treatment verification detector for spot scanning proton therapy.

Supervisory Committee Members, Sam Beddar, Ph.D., Advisory Professor, Narayan Sahoo, Ph.D., Gabriel Sawakuchi, Ph.D., Dragan Mirkovic, Ph.D., Rajat Kudchadker, Ph.D., Clifton Fuller, M.D., Ph.D.

Alsanea graduated in December 2018 and will be starting his residency in the Department of Radiation Physics at MD Anderson Cancer Center in September.

RACHEL GER, PH.D.

Quantitative Imaging for Precision Medicine in Head and Neck Cancer Patients

The purpose of this work was to determine if prediction models using quantitative imaging measures in head and neck squamous cell carcinoma (HNSCC) patients could be improved when noise due to imaging was reduced. This was investigated separately for salivary gland function using dynamic contrast enhanced magnetic resonance imaging (DCE-MRI), overall survival using computed tomography (CT)-based radiomics, and overall survival using positron emission tomography (PET)-based radiomics. From DCE-MRI, where T1-weighted images are serially acquired after injection of contrast, quantitative measures of diffusion can be obtained from the series of images. Radiomics is the study of the relationship of voxels to one another providing measures of texture from the area of interest. Quantitative information obtained from imaging could help in radiation treatment planning by providing quantifiable spatial information with computational models for assigning dose to regions to improve patient outcome, both survival and quality of life. By reducing the noise within the quantitative data, the prediction accuracy could improve to move this type of work closer to clinical practice.

For each imaging modality sources of noise that could impact the patient analysis were identified, quantified, and if possible minimized during the patient analysis. In MRI, a large potential source of uncertainty was the image registration. To evaluate this, both physical and synthetic phantoms were used, which showed that registration of MR images was high, with all root mean square errors below 3 mm. Then, 15 HNSCC patients with pre-, mid-, and post-treatment DCE-MRI scans were evaluated. However, differences in algorithm output were found to be a large source of noise as different algorithms could not consistently rank patients as above or below the median for quantitative metrics from DCE-MRI. Therefore, further analysis using this modality was not pursued.

Supervisory Committee Members, Laurence E. Court, Ph.D. (Advisory Professor, Clifton D. Fuller, MD, Ph.D., Rebecca M. Howell, Ph.D., Rick R. Layman, Ph.D., Heng Li, Ph.D., R. Jason Stafford, Ph.D., Shouhao Zhou, Ph.D.

Ger graduated in May 2019, and is starting a therapy residency program at The Mayo Clinic in Arizona.

KELLY KISLING, PH.D.

Development of Automated Radiotherapy Treatment Planning for Cervical and Breast Cancer for Resource–Constrained Clinics

Globally, cancer rates are on the rise, especially in low - and middle-income countries (LMICs). However, many of these countries lack access to radiotherapy, which is due in part to a substantial shortage of the staff necessary to deliver safe and effective radiotherapy. This staff shortage could be mitigated by the automation of the radiation treatment planning process. To this end, we developed automated planning for cervical and postmastectomy breast cancer radiotherapy, the two most common types of cancer in women in many LMICs.

For radiotherapy of cervical cancer in resource-constrained clinics, the recommended treatment technique is a four-field box. We created algorithms to plan four-field box treatments with homogenous dose distributions by automatically determining the beam apertures and relative beam weights. Using our techniques we automatically planned 150 four-field-box treatments and 89% were scored acceptable by radiation oncologists. The dose distributions were more homogenous (p
For radiotherapy of node-positive, postmastectomy breast cancer, it is recommended to treat the chest wall and ipsilateral nodes, while reducing the dose to normal tissues, such as the heart and lungs. We created algorithms to plan three-field treatments (mono-isocentric tangential and supraclavicular fields) on free-breathing patient CTs. The dose distribution was automatically optimized by using mixed energy photon beams and field-in-field dose modulation. Using these algorithms, we automatically planned radiotherapy treatments for 10 left-sided, postmastectomy patients. The plans were evaluated quantitatively based on their dose distributions, and 90% of the plans met constraints for lung dose, heart dose and target coverage. Physicians accepted all plans either as-is (50%) or with only minor changes (50%). Automatic QA of the plans flagged 92% of the changes requested by physicians.
To assess the risk of failure in our automated treatment planning workflow, we performed Failure Modes and Effects Analysis (FMEA). FMEA showed that a specially-designed automated QA program reduced the risk of automated treatment planning. Additionally, we found that human error is still a prominent cause of potential failures and that manual plan reviews of automatically generated plans are still vital for safe delivery of radiotherapy.

In conclusion, automated treatment planning and QA for radiotherapy of cervical and breast cancers were clinically viable for a majority of patients tested. Our algorithms will be implemented clinically at our partner hospitals in South Africa in the next year.

Supervisory Committee Members, Laurence Court, Ph.D., Advisory Professor, Peter A. Balter, Ph.D., Rebecca M. Howell, Ph.D., Anuja Jhingran, M.D., Kathleen Schmeler, M.D.

Kisling graduated in May 2019, and has started an Assistant Professorship at the University of California, San Diego.

BRANDON LUCKETT, M.S.

Commissioning of Micro-Cube Thermoluminescent Dosimeters for Small Field Dosimetry Quality Assurance in Radiotherapy

Small field dosimetry presents complications and uncertainties that could be circumvented by using detectors which are smaller than the radiation field. This study evaluates the reproducibility and accuracy of TLD micro-cubes for use in stereotactic radiosurgery (SRS) remote auditing quality assurance (QA) for treatment centers participating in clinical trials. This study tested the hypothesis that TLD micro-cubes could be commissioned to evaluate small field dosimetry, and provide reproducibility within ±3%, as well as assure agreement between measured dose and calculated doses to within ±5%.

The aims of this thesis were to characterize and commission TLD micro-cubes as well as to develop guidelines for handling micro-cubes. Additionally the micro-cubes were commissioned to evaluate standard single field output dosimetry. Further aims were to adapt IROC Houston SRS head phantoms to use TLD micro-cubes for anthropomorphic phantom quality assurance and to test this design on linac, Gamma Knife, and CyberKnife treatment delivery machines. The final aim was to use TLD micro-cubes to evaluate photon fields which are smaller than 1.25 cm in diameter.

This study was designed by first defining the handling process, including: selection of micro-cubes, annealing parameters, and readout techniques. The micro-cubes were then characterized based on correction factors for element sensitivity, signal fading, dose response, and energy response.

To test the reproducibility and accuracy of the dosimeters, they were first evaluated under a single small field beam in a simple geometric configuration, then in anthropomorphic SRS head phantoms. Agreement between calculated dose and measured dose was evaluated. Following satisfactory results of these experiments, the micro-cubes were used to evaluate single small fields down to 5 mm fields on the same basis as single field output checks.

TLD micro-cubes showed good accuracy and agreement when compared to beam output, treatment planning system (TPS) dose, and measurements made with TLD powder. For all experiments conducted in this study, measured dose was within 4.1%. For SRS experiments, the average difference in measured and expected dose was within 3.4% with an average difference of 1.0% and an average coefficient of variation of 0.9%. For single field experiments, all measurements were within 4.1% with an average of 2.1% and an average coefficient of variation of 0.6%. These results give us confidence in our ability to accurately measure dose in radiation fields as small as 5 mm in diameter, as well as obtain excellent reproducibility.

Supervisory Committee Members, Paige A. Taylor, M.S., Advisory Professor, David S. Followill, Ph.D., Stephen F. Kry, Ph.D., Dershan Luo, Ph.D., Christine B. Peterson, Ph.D.

Luckett graduated in May 2019 and will start in the imaging residency program at the University of Oklahoma Health Science Center in Oklahoma City, OK.

MARK NEWPOWER, PH.D.

Modeling Proton Relative Biological Effectiveness using Monte Carlo Simulations of Microdosimetry

Proton therapy is a radiotherapy modality that can offer a better physical dose distribution when compared to photon radiotherapy by taking advantage of the Bragg peak, a narrow region of rapid energy loss. Proton therapy is also known to offer an enhanced relative biological effectiveness (RBE) compared to photons. In the current clinical standard, RBE is fixed at 1.1 at all points along the proton beam, meaning protons are assumed to require 10% less dose than photons to achieve target coverage and organ at risk (OAR) sparing. However, there is mounting clinical evidence, and a significant number of in vitro experiments, that show RBE varies, typically as a function of dose averaged linear energy transfer (LETD).
There are two goals of this work. The first is to develop a novel method to model proton RBE by using the microdosimetric kinetic model (MKM). The MKM requires a quantity called dose mean lineal energy (ybar), which is analogous to LETD, to model RBE. In this work, a novel method to calculate ybar is proposed, based on the proton energy spectrum at a location, and Monte Carlo simulations of microdosimetry. The second goal of this work is to implement MKM into a treatment planning system to assess the theoretical clinical impact of including variable RBE during treatment plan optimization.
This work presents a method to calculate ybar and model the RBE of several proton RBE experiments. The variable RBE of these experiments was modeled more accurately by MKM than previously proposed phenomenological models. However, a clear superiority over an LETD-based model was not shown. In a treatment planning exercise, including variable RBE modeling into the optimization algorithm led to increased target coverage while maintaining the dose sparing of OARs. Based on the parameters chosen for the MKM, this led to an increase in physical dose delivered to the brainstem, and when reanalyzed assuming an RBE = 1.1, led to doses beyond tolerance. In conclusion, this work presents a novel method to compute ybar for input into the MK model, and demonstrates slight potential benefits of considering a variable RBE in treatment plan optimization.

Supervisory Committee Members, Radhe Mohan, Ph.D., Advisory Professor, Uwe Titt, Ph.D.
Fada Guan, Ph.D., Narayan Sahoo, Ph.D., Oleg Vassiliev, Ph.D., David Grosshans, M.D., Ph.D., and Suyu Liu, Ph.D.

Newpower Graduated in June of 2019, and will start in the therapy residency program at the University of Oklahoma Health Sciences Center.

DREW P. MITCHELL, PH.D.

An Information Theory Model for Optimizing Quantitative MRI Acquisitions

Quantitative magnetic resonance imaging (qMRI) is a powerful group of imaging techniques with a growing number of clinical applications, including synthetic image generation in post-processing, automatic segmentation, and diagnosis of disease from quantitative parameter values. Currently, acquisition parameter selection is performed empirically for quantitative MRI. Tuning parameters for different scan times, tissues, and resolutions requires some measure of trial and error. There is an opportunity to quantitatively optimize these acquisition parameters in order to maximize image quality and the reliability of the previously mentioned methods which follow image acquisition.

The objective of this work is to introduce and evaluate a quantitative method for selecting parameters that minimize image variability. An information theory framework was developed for this purpose and applied to a 3D-quanti_cation using an interleaved Look-Locker acquisition sequence with T2 preparation pulse (3D-QALAS) signal model for synthetic MRI. In this framework, mutual information is used to measure the information gained by a measurement as a function of acquisition parameters, quantifying the information content of the acquisition parameters and allowing informed parameter selection.

The information theory framework was tested on synthetic data generated from a representative mathematical phantom, measurements acquired on a qMRI multiparametric imaging standard phantom, and in vivo measurements in a human brain. The application of this information theory framework resulted in successful parameter optimization with respect to mutual information. Both the phantom and in vivo measurements showed that higher mutual information calculated by the model correlated with smaller standard deviation in the reconstructed parametric maps.

With this framework, optimal acquisition parameters can be selected to improve image quality, image repeatability, or scan time. This method could reduce the time and labor necessary to achieve images of the desired quality. Making an informed acquisition parameter selection reduces uncertainty in the imaging output and optimizes information gain within the bounds of clinical constraints.

Advisory Committee Members, David Fuentes, Ph.D., Advisory Professor, Ken-Pin Hwang, Ph.D., James Bankson, Ph.D., Erik Cressman, M.D., Ph.D., James Long, Ph.D.

Mitchell graduated in June of 2019. He starts his residency in July with the Department of Imaging Physics at MD Anderson Cancer Center.

AWARDS & RECOGNITIONS

International Society of Magnetic Resonance in Medicine (ISMRM) 20th Annual Meeting

An Imaging Physics Fellow and a Medical Physics Graduate Student received the ISMRM Magna Cum Laude Merit Award at its 20th anniversary meeting.

EVALUATION OF TRIFLUOROACETIC ACID AS A THERANOSTIC FLUORINE -19 MRI AGENT FOR CHEMICAL ABLATION OF SOLID TISSUE

Samuel A. Einstein, Ph.D.
Imaging Physics Fellow
Mentor: James Bankson, Ph.D.

SYNTHESIZING RCBV MAPS FROM DCEMRI OF BRAIN TUMORS USING CONDITIONAL ADVERSARIAL NETWORKS

Jeremiah Sanders, M.S.
Medical Physics Graduate Student
Mentors: Anthony Liu, Ph.D. and Jingfei Ma, Ph.D.

2019-2020 Cancer Prevention Research Institute of Texas (CPRIT) Graduate Scholar Award

Travis Salzillo was awarded a CPRIT Graduate Scholar Award. This award provides tuition, stipend, fringe benefits and a modest travel allowance to recipients. CPRIT Graduate Scholars also receive additional training and support. Recipients are selected based on their outstanding cancer research in a variety of areas ranging from genomics to immunology. CPRIT's goal is to expedite innovation in cancer research and product development and to enhance access to evidence-based prevention programs throughout the state of Texas.

Society of Nuclear Medicine and Molecular Imaging Poster Competition

Benjamin Lopez, graduate research assistant-GSBS, Imaging Physics - Research, won the Physics, Instrumentation and Data Science Poster Competition at the Society of Nuclear Medicine and Molecular Imaging Conference. His poster entitled "Evaluation of Errors in Common Lung Mass Estimation Methods used for Lung Mean Dose Calculation in 90Y-Microsphere Therapy Planning" and was presented with co-authors Anjali Balagopal, Armeen Mahvash, M.D. and S. Cheenu Kappadath, Ph.D.

AWARDS & RECOGNITIONS

American Legion Auxiliary Fellowship in Cancer Research 2019-2020

Evan Gates has been awarded the American Legion Auxiliary Fellowship in Cancer Research. Awarded by the Student Scholarship Committee and GSBS Deans, this achievement recognizes a student's accomplishments and promise as a cancer research scientist. The award is renewable, on a competitive basis, for up to three years. The American Legion Auxiliary is composed of women who served in the U.S. armed forces or who are the wives, mothers, sisters, and daughters of members of the American Legion. The fellowship program for GSBS graduate students was established over 40 years ago to encourage the development of young scientists and to advance cancer research. Since then, this group has carried out countless bake sales, fun runs, and other grass root efforts to raise money in support of over 100 GSBS students. Evan will formally receive his award at the American Legion Auxiliary Luncheon in October.

Society of Interventional Radiology (SIR) Foundation Allied Scientist Grant

Brian Anderson received the SIR Allied Scientist Grant for his work, "Improving Treatments of Local Liver Disease with Biomechanical Modeling and Deep Learning." The mission of this grant mechanism is to fund research that will lead to the ongoing collaboration between basic or translational science laboratories and interventional radiology by funding graduate-level trainees. Specifically, the SIR seeks to promote highly innovative, groundbreaking research; high-impact research with near-term clinical relevance; multidisciplinary, synergistic research; translational studies to support the fluid transfer of knowledge from bench to bedside; the next generation of interventional radiology investigators through mentored research. Funding decisions are based on the overall impact/priority score, which reflects an assessment of the likelihood that the project will exert a sustained, collaborative influence on the field of interventional radiology through basic science or translational research.

Southwest Regional Chapter Meeting SLAM Winner

Mary Peters Gronberg won the MedPhys Slam competition at the recent Southwest Regional Chapter Meeting of the AAPM. MedPhys Slam is an elevator pitch competition where students describe their research to a lay audience in 3 minutes using 3 slides. Mary impressed the judges with her talk, explaining how she is working to reduce the amount of time that patients wait to receive radiation treatment by using artificial intelligence techniques to automate radiation treatment planning. Mary is pursuing her PhD research under the supervision of Dr. Mohammad Salehpour. The Southwest Regional Chapter is sponsoring Mary to compete in the MedPhys Slam competition at the 2019 AAPM Annual Meeting in San Antonio.

2019 COMMENCEMENT

On May 18, 2019, GSBS held its annual commencement ceremony at Rice University in the Alice Pratt Brown Hall. More than 50 students participated in the event featuring Commencement Speaker, Peter W.T. Pisters, M.D., MHCM, President of MD Anderson Cancer Center.

ALUMNI NEWS

AAPM Awards Ceremony and Reception
Monday, July 15 — 6:30 PM - 8:00 PM
Lone Star Ballroom, 2nd floor, Grand Hyatt Hotel, followed by a reception, Texas Ballroom, 4th floor, 8:00 - 9:00 PM

James C. H. Chu, Ph.D.

Medical Physics Graduate Program Alumnus

The Edith E. Quimby Lifetime Achievement Award

2019 CLASS OF THE FELLOWS OF THE AAPM

Nine present or former members of the program faculty are members of the 2019 class of Fellows of the AAPM.


William D. Erwin, M.S.


William R. Geiser, M.S.


A. Kyle Jones, Ph.D.


S. Cheenu Kappadath, Ph.D.


Jessica Lowenstein, M.S.


Brent C. Parker, Ph.D.

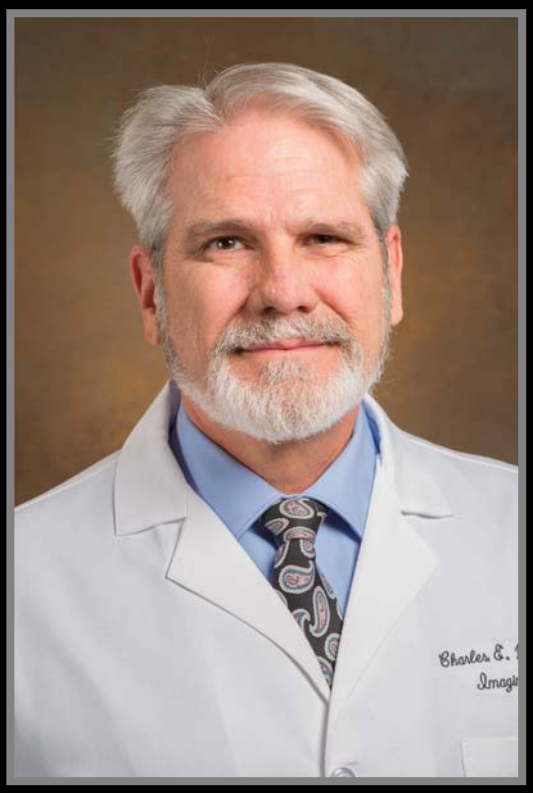

Donna M. Reeve, M.S.


Richard E. Wendt, Ph.D.


Donna M. Stevens, M.S.

Farewell and Thank-You to Retiring Faculty Members

Two members of the Program Faculty announced their retirement at the end of the 2018-2019 academic year. We thank each of them for their years of service to both the institution and the Program.



Charles E. Willis, Ph.D.
Associate Professor

Donna M. Reeve, M.S.
Senior Medical Physicist

COURT NAMED 2019 DARLINGTON AWARD WINNER

The University of Texas MD Anderson Cancer Center UTHealth Graduate School of Biomedical Sciences faculty member Laurence E. Court, Ph.D., is the recipient of the 2018 Paul E. Darlington Mentor Award for GSBS Faculty.

Court is an associate professor in the Department of Radiation Physics at the University of Texas MD Anderson Cancer Center and is affiliated with the GSBS Program in Medical Physics. He has been a GSBS faculty member since 2010.

His research group works on two research topics: the development of automated treatment planning tools, with the goal of improving access to radiotherapy across the world, and the extraction of information from medical images to improve clinical decision making.

During his time at the Graduate School, he has advised 18 students including 14 Ph.D.'s.

He is a member of the American Association of Physicists in Medicine (AAPM) and the American Society for Radiation Oncology (ASTRO).

The Darlington Award provides an honorarium of $2,000 and recognizes a current faculty member who has made an exceptional impact, as a mentor, on both students and faculty. It was created to honor Paul Darlington, Ph.D., former GSBS Associate Dean.

The award was presented to Court at the 2018 Lab Coat Ceremony on Friday, September 21, 2018.

"I am honored to receive this award — and am very grateful to the many students and colleagues who have willingly survived my evolving attempts of mentorship." -Laurence Court

Article by Tracey Barnett

MARTEL NAMED CHAIR OF RADIATION PHYSICS

Mary Martel, Ph.D., professor of Radiation Physics, has been selected chair of Radiation Physics.

Martel has served as department chair ad interim since March 2017, and her appointment as chair was effective June 1st. Her selection followed a comprehensive national search to find the right strategic leader with academic and technical skills, emotional intelligence, coachability and drive.

Martel earned her doctoral degree in Nuclear Chemistry from Clark University in Worcester, Massachusetts, and completed a postdoctoral fellowship at Memorial Sloan Kettering Cancer Center in New York City. Upon completion of her training, she joined the faculty of Columbia University in New York City. Subsequently she served on the faculties at the University of Michigan, Ann Arbor, and the University of Chicago.

Dr. Martel joined our faculty in 2007 as a professor in Radiation Physics and deputy clinical chief of clinical services for Radiation Physics.

Her major research interest is outcomes analyses, focused primarily on normal tissue toxicity modeling. She is a leader in national studies that have resulted in publications that serve as benchmarks to guide clinical radiation treatment around the world. Recent work has concentrated on the study and incorporation of clinical, genetic, technological and spatial effects into dose-volume models to better predict toxicity rates.

Since she joined the institution, Martel has been a full faculty member in the MD Anderson UTHealth Graduate School. In addition to teaching, she has directly supervised and mentored students and trainees and served on many student advisory committees. More recently, she joined the school's Executive Committee and has served since 2016 as chair of its Membership Committee.

Beyond MD Anderson, Martel serves in leadership roles within her profession, including president and chair of the Board for the American Association of Physicists in Medicine (AAPM), and chair of the Science Council for the American Society for Radiation Oncology (ASTRO). She is a Fellow of the AAPM and of ASTRO, and both organizations have honored her with their Distinguished Service Award.

IMAGING PHYSICS
RESIDENCY PROGRAM

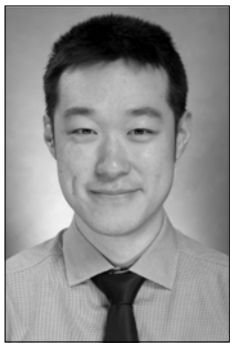
INCOMING FELLOWS

The Residency Program welcomes its newest fellows, M. Allan Thomas and Drew Mitchell. Thomas and Mitchell will begin their residencies in July. We look forward to having them join the program.

M. Allan Thomas, Ph.D.
University of Arkansas,
Little Rock

Drew Mitchell, Ph.D.
UT MD Anderson Cancer Center,
GSBS

CURRENT FELLOWS



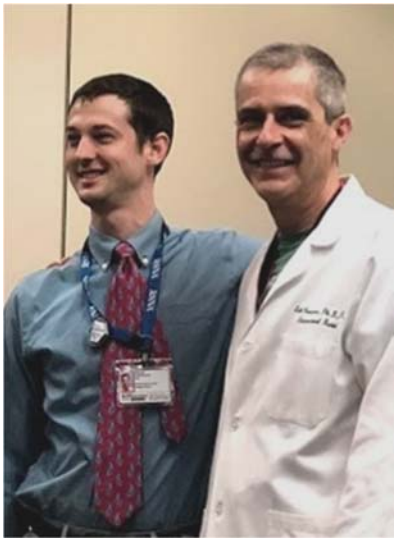
Jorge Jimenez, Ph.D., Megan Jacobsen, Ph.D., Henry Chen, Ph.D., Christopher Walker, Ph.D., and Samuel Einstein, Ph.D.

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

IMAGING PHYSICS
RESIDENCY PROGRAM
RECENT GRADUATES

The Residency Program bade farewell to **Christopher MacLellan, Ph.D.** and **Samuel Fahrenholtz, Ph.D.** as they completed the Program. MacLellan is now at Duke University Health System in Raleigh-Durham, North Carolina where he is working as a Radiation Physicist. Fahrenholtz is at Mayo Clinic in Phoenix, Arizona where he is working as an Associate Consultant.

Farewell reception for Christopher MacLellan, December 20, 2018.



Farewell reception for Samuel Fahrenholtz, April 15, 2019.

RADIATION PHYSICS
RESIDENCY PROGRAM

INCOMING RESIDENTS

Three residents will start the program on September 1, 2019

Fahed Alsanea, Ph.D.
MD Anderson UT Health
Graduate School

Yvonne Gonzalez, Ph.D.
University of Houston

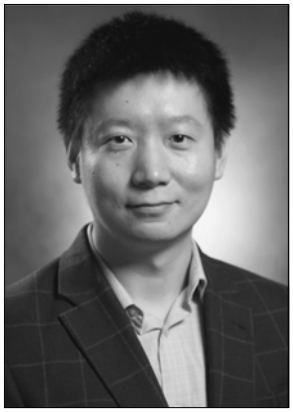
Joshua Niedzielski, Ph.D.
MD Anderson UT Health
Graduate School

Mohammad Salehpour, Ph.D., Program Director

RADIATION PHYSICS RESIDENCY PROGRAM

GRADUATING RESIDENTS

Three residents will complete the program on August 31, 2019



Rachael Martin, Ph.D. (MD Anderson UT Health Graduate School) will be joining the MDA Department of Radiation Physics as an Assistant Professor. **Jordan Slagowski, Ph.D.** (University of Wisconsin-Madison) will be joining the University of Chicago as an Assistant Professor. **Wenjun Yang, Ph.D.** (University of Wisconsin-Madison) is currently interviewing.

CURRENT RESIDENTS

Manik Aima, Ph.D. (University of Wisconsin-Madison), **Garrett Baltz, M.S.** (MD Anderson UT Health Graduate School), **Parmeswaran Diagaradjane**, Ph.D. (Anna University), **Christopher Peeler, Ph.D.** (MD Anderson UT Health Graduate School)

AAPM 2019

PRESENTATIONS BY STUDENTS IN THE MEDICAL PHYSICS PROGRAM

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

Deep Learning for Rapid Deformable Image Registration of Liver CT Scans, B Anderson*, G Cazoulat, E Lin, B Odisio, K Brock

Examining the Magnitude of Dose Calculation Errors as a Component of IROC Lung and Spine Phantom Failures, M Glenn, P Balter, J Pollard-Larkin, C Peterson, R Howell, S Kry

Differences in Patterns of Failure Between the Imaging and Radiation Oncology Core (IROC) Lung and Spine Phantom Irradiations, S Edward*, P Alvarez, P Taylor, A Molineu, D Followill, S Kry

BEST IN PHYSICS (THERAPY): The Non-Homologous End Joining Repair Pathway Determines Cell Radiosensitivity in Helium and Carbon Ion Beams, D Flint*, S Bright, C McFadden, S Chakraborty, D Yoon, S Shaitelman, S Kodaira, T Konishi, G Sawakuchi

Effects of CT Image Acquisition and Reconstruction Parameters on Automatic Contouring Algorithms, K Huang*, D Rhee , R Ger , R Layman , J Yang , C Cardenas , L Court

Harmonizing Imaging Protocols: Impact on Radiomics Survival Prediction in Large Patient Cohorts, R Ger*, S Zhou, D Mackin, H Elhalawani, B Elgohari, J Meier, C Fuller, R Howell, R Layman, H Li, O Mawlawi, R Stafford, L Court

Dosimetric Impact and Detectability of Multi-Leaf Collimator Positioning Errors on Varian Halcyon, S Gay*, T Netherton, C Cardenas, R Ger, P Balter, L Dong, D Mihailidis, L Court

Sensitivity Analysis of Common Beam Modeling Parameters in the Eclipse Treatment Planning System on IROC Head and Neck Phantom Results, M Glenn*, D Followill, R Howell, J Pollard-Larkin, C Peterson, S Kry

Examining the Magnitude of Dose Calculation Errors as a Component of IROC Lung and Spine Phantom Failures, S Edward*, M Glenn, P Balter, J Pollard-Larkin, C Peterson, R Howell, S Kry

Implementation of 3D Computational Human Phantoms in RayStation for Retrospective Studies in Late Effects, A Gupta*, Y Qiao, C Lee, C Ditty, S Smith, R Weathers, S Shrestha, S Hernandez, R Howell

Development of an Enhanced Heart Model with Substructures for Cardiac Dosimetry in Late Effect Studies, S Shrestha*, A Gupta, C Lee, S Smith, Y Qiao, R Weathers, R Howell

Introducing Uncertainty to Measurement Based RBE Assessment in Carbon Ion Radiotherapy, S Hartzell*, F Guan, O Vassiliev, C Peterson, P Taylor, S Kry

Consistency of RBE Assessment in Carbon Ion Radiotherapy, S Hartzell*, F Guan, O Vassiliev, P Taylor, C Peterson, S Kry

AAPM 2019

PRESENTATIONS BY STUDENTS IN THE MEDICAL PHYSICS PROGRAM

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

Investigation of the Accuracy of Deformable Image Registrations between Average-Intensity Images, Y He*, G Cazoulat, M McCulloch, P Balter, Z Liao, R Mohan, K Brock

Dose Estimation for a PENTEC Late Effects Study, S Hernandez*, R Weathers, A Gupta, S Shrestha, S Smith, C Lee, J Bradley, M Hall, A Jackson, L Constine, R Howell

Implementation of 3D Computational Human Phantoms in RayStation for Retrospective Studies in Late Effects, A Gupta*, Y Qiao, C Lee, C Ditty, S Smith, R Weathers, S Shrestha, S Hernandez, R Howell

Effects of CT Image Acquisition and Reconstruction Parameters on Automatic Contouring Algorithms, K Huang*, D Rhee, R Ger, R Layman, J Yang, C Cardenas, L Court

Y-90 PET/CT with Long Axial Field-of-View Digital Detectors, C Beijst*, B Lopez, H de Jong, S Kappadath

Commissioning of TLD Micro-Cubes for a Remote SRS Audit Program, B Luckett*, P Alvarez, P Taylor, S Kry, C Peterson, D Luo, D Followill

Independent Validation of Deformable Image Registration for MR-Guided Adaptive Radiotherapy for Head and Neck Cancers, B McDonald*, A Ohrt, S Vedam, B Elgohari, J Yang, J Wang, C Fuller, K Brock

Harmonizing Imaging Protocols: Impact on Radiomics Survival Prediction in Large Patient Cohorts, R Ger*, S Zhou, D Mackin, H Elhalawani, B Elgohari, J Meier, C Fuller, R Howell, R Layman, H Li, O Mawlawi, R Stafford, L Court

Optimization of Spatial and Spectral Encoding for Hyperpolarized [1-13C] Pyruvate MRI, K Michel*, C Walker, M Merritt, J Bankson

Nonlinear Ultrasound Imaging of Phase-Change Perfluorocarbon Nanodroplets Activated by High-Frequency Ultrasound in a Tissue-Mimicking Environment, T Mitcham*, D Nevozhay, S Lai, K Sokolov, R Bouchard,

Calibration of Synthetic MRI Acquisition Parameters through Information Theory Modeling, D Mitchell*, K Hwang, R Stafford, J Bankson, D Fuentes

TG263-Net: A Deep Learning Model for Organs-At-Risk Nomenclature Standardization, D Rhee*, C Nguyen, T Netherton, C Owens, L Court, C Cardenas

Dosimetric Impact and Detectability of Multi-Leaf Collimator Positioning Errors on Varian Halcyon, S Gay*, T Netherton, C Cardenas, R Ger, P Balter, L Dong, D Mihailidis, L Court

Automated Detection and Segmentation of Lung Tumors using Deep Learning, C Owens*, D Rhee, D Fuentes, C Peterson, J Li, M Salehpour, L Court, J Yang

AAPM 2019

PRESENTATIONS BY STUDENTS IN THE MEDICAL PHYSICS PROGRAM

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

Effects of CT Image Acquisition and Reconstruction Parameters on Automatic Contouring Algorithms, K Huang*, D Rhee, R Ger, R Layman, J Yang, C Cardenas, L Court

The Metabolic Evolution of Glioblastoma during Tumor Growth and following Radiotherapy Treatment using Hyperpolarized MRI, T Salzillo*, J Gumin, J Lee, I Hassan, N Zacharias, R Colen, F Lang, P Bhattacharya

A 2-Hydroxyglutarate (2HG) MRS Phantom for Periodic Quality Control Testing, P Hou*, H Liu, T Salzillo, J Johnson, C Choi, R Stafford

Parallel Imaging Compressed Sensing in Fully Balanced SSFP for Prostate Brachytherapy MRI: Pulse Sequence Development and Validation in a Phantom Study, J Sanders*, S Frank, J Ma

Dose Estimation for a PENTEC Late Effects Study, S Hernandez*, R Weathers, A Gupta, S Shrestha, S Smith, C Lee, J Bradley, M Hall, A Jackson, L Constine, R Howell

Development of an Enhanced Heart Model with Substructures for Cardiac Dosimetry in Late Effect Studies, S Shrestha*, A Gupta, C Lee, S Smith, Y Qiao, R Weathers, R Howell

Linearity of R1 with Temperature in Trifluoroacetate: Development of Fluorine-19 MRI Thermometry for Thermochemical Ablation, E Thompson*, S Einstein, J Bankson, E Cressman

Quantitative Photoacoustic Imaging for the Assessment of Targeted Lipo-JICG in a Preclinical Model, C Wood*, C Kim, S Han, Y Wen, M Naser, C Kaffes, J Cook, A Sood, K Sokolov, R Bouchard,

Evaluation of Brain Normalization Methods and Their Effect on the Construction of Functional Connectomics in Patients with Gliomas, H Chen*, V Kumar, J Johnson, K Noll, S Prabhu, D Schomer, H Liu

Verification of Dose Calibrator Consistency for Tc-99m XSPECT System Calibration in a Large Clinical Nuclear Medicine Department, M Jacobsen*, W Erwin

Automated High Contrast Resolution Test Analysis for MRI Daily QC, J Jimenez*, W Stefan, J Yung, D Reeve, R Stafford, J Hazle

Verification and Normalization of Clinical T1 Contrast using a System Phantom, K Hwang*, C Walker, R Stafford

Metal Artifact Reduction for MRI of a Magnetic Fiducial, C Walker*, R Stafford, K Hwang

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 San Antonio, Texas. 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 #1316** so be sure to stop by. We look forward to seeing you in San Antonio!

AAPM RESIDENCY FAIR
Sunday, July 14, 1-3 pm
Stars at Night Ballroom Foyer
Convention Center

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713-563-2548

Feedback from alumni is always welcomed by the Program.
Please send your suggestions or comments to medicalphysicsprogram@mdanderson.org

ROBERT J. SHALEK
FELLOWSHIP FUND

The Robert J. Shalek Fellowship 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 fellowships.

2019
Rebecca DiTusa

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Shannon Hartzell
Brandon Luckett

2016
Mary Peters Gronberg

2015
Brian Anderson
Laura Bennett
Benjamin Musall

2014
Daniela Branco
Harlee Harrison
Joseph Weygand

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Matte McInnis
Olivia Popnoe

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Ming Jung Hsieh
Jennifer Sierra Irwin
Dana Lewis
Justin Mikell

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

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Jennelle Bergene
Kevin Casey
Jared Ohrt
Kevin Vredevoogd

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Sarah Joy
Emily Neubauer
Paige Summers
Jackie Tonigan Faught

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Joseph Dick
James Kerns
Kelly Kisling
David Zamora

2007
Triston Dougall
Georgi Georgiev
Ryan G. Lafratta
Malcom Heard
Katie West

2006
Maria Bellon
Jimmy Jones
Nathan Pung
Yevgeney Vinogradskiy

2005
Renee Dickinson
Susannah Lazar
Alanna McDermott
Paige Nitsch

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Michael Bligh
Ryan Hecox
Hilary Voss

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Blake Cannon
Scott Davidson

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Earl Gates
Kenneth Homann
Hilary Voss
Claire Nerbun

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Melinda Chi
Gary Fisher
Jackeline Santiago

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Michael Beach

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Laura Butler
Amanda Davis
Nicholas Koch
Jennifer O' Daniel
Nicholas Zacharopoulos
Matthew Vossler

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Shannon Bragg-Sitton
Christopher Cherry
Dee-Ann Radford

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Christopher Baird
Aaron Blanchard
Michael Lemacks
Luke McLemore

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Michael Bieda
Tamara Duckworth
Gwendolyn Myron

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Jonathan Dugan
Teresa Fischer
Russell Tarver

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Victor Howard
Usman Qazi
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Steve Thompson
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Please send an Email message or forward a copy of your Email donation receipt to Anne Baronitis at aibaronitis@mdanderson.org to inform the Program of your gift so that we can thank you as promptly as possible.

Medical Physics Graduate Program

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The online version of the 2018-2019 Medical Physics Graduate Program Newsletter is available at gsbs.uth.edu/medphys

Editor
Frances Quintana

Thanks to our alumni, students, faculty, and staff for another successful year for the Medical Physics Program!