The American Association *of* Physicists in Medicine

AAPM EDUCATION & RESEARCH FUND

focus on **our future**

2018 ANNUAL REPORT

AAPM

Education & Research Fund Annual Report 2018

The AAPM Education & Research (E&R) Fund, established in 1990, supports the development of our vital medical physics profession by funding strategic education and research programs and awards. Research support includes seed grants for early-career researchers, a mentorship program, and travel grants. Education support includes matching grants for clinical residency programs, fellowships for PhD students, and travel and tuition awards. Also, the Fund is used to attract undergraduates to medical physics and to promote diversity by supporting the Summer Undergraduate Fellowship Program (SUFP) and the Diversity Recruitment through Education and Mentoring (DREAM) Program.

The Education & Research Fund receives its revenues primarily from member donations, donations from our local chapters and sister organizations, and the transfer of funds from the AAPM operations budget. As always, AAPM is extremely grateful for these generous gifts. Member donations, which are an essential component and provide the catalyst for other revenue sources, comprise both endowed and unendowed funds in the E&R Fund's portfolio of funds, many being named or memorial funds. In 2018, the AAPM E&R Fund supported more than $300,000 in programs.

One exciting project completed in 2018 was raising $50,000 ($25,000 in member gifts matched by AAPM) for the *JACMP* Annual Best Paper Awards. As part of that project, four awards were named in honor of the first four *JACMP* editors, all who have made major contributions to our profession and our organization: (1) **Michael D. Mills Editor In Chief Award of Excellence for Outstanding General Medical Physics Article,** (2) **Peter R. Almond Award of Excellence for Outstanding Radiation Measurements Article,** (3) **George Starkschall Award of Excellence for Outstanding Radiation Oncology Physics Article,** and (4) **Edwin C. McCullough Award of Excellence for Outstanding Medical Imaging Physics Article**. Look for these awards to be given at our 2019 AAPM Annual Meeting. Another exciting project that commenced in 2018 was the ASTRO-AAPM Physics Resident/Postdoctoral Fellow Seed Grant, a $25,000 grant awarded to perform radiation oncology physics research.

In this report, recipients of the following grants, fellowships, and awards funded by the E&R Fund in 2018 will be described:

- **Research Seed Grants**

  Science Council, through its Research Committee, was funded $75,000 from the AAPM operations budget to support three $25,000 research seed grants for new researchers in medical physics.

- **ASTRO-AAPM Physics Resident/ Postdoctoral Fellow Seed Grant**

  Science Council, through its Research Committee, was funded $12,500 from the AAPM operations budget to match ASTRO's contribution to support one $25,000 research seed grant for a talented resident/ postdoctoral fellow to perform radiation oncology physics research.

- **Imaging Physics Residency Program Grants**

  In 2017, the AAPM Board of Directors approved $140,000 in funding for two new imaging physics residency positions, either in diagnostic, diagnostic with a nuclear medicine option, or nuclear medicine. Two institutions with such programs, selected in 2018, will receive $35,000 per year for two years as matching support for one resident commencing July 2019.

- **Graduate Fellowships in Medical Physics**

  Earnings from the E&R Fund funded $36,000 to support the first of two years for the fellow selected for the 2018-2020 AAPM Graduate Fellowship in medical physics and the second of two years for the fellow selected for the 2017-2019 RSNA AAPM Graduate Fellowship in medical physics.

- **Summer Undergraduate and DREAM Fellowships**

  Education Council, through its Education & Training of Medical Physicists Committee (ETC), was funded $50,000 to support ten undergraduate fellowships in the Summer Undergraduate Fellowship Program (SUFP) and another $25,000 to support five undergraduate fellowships in the Diversity Recruitment Through Education and Mentoring (DREAM) Program.

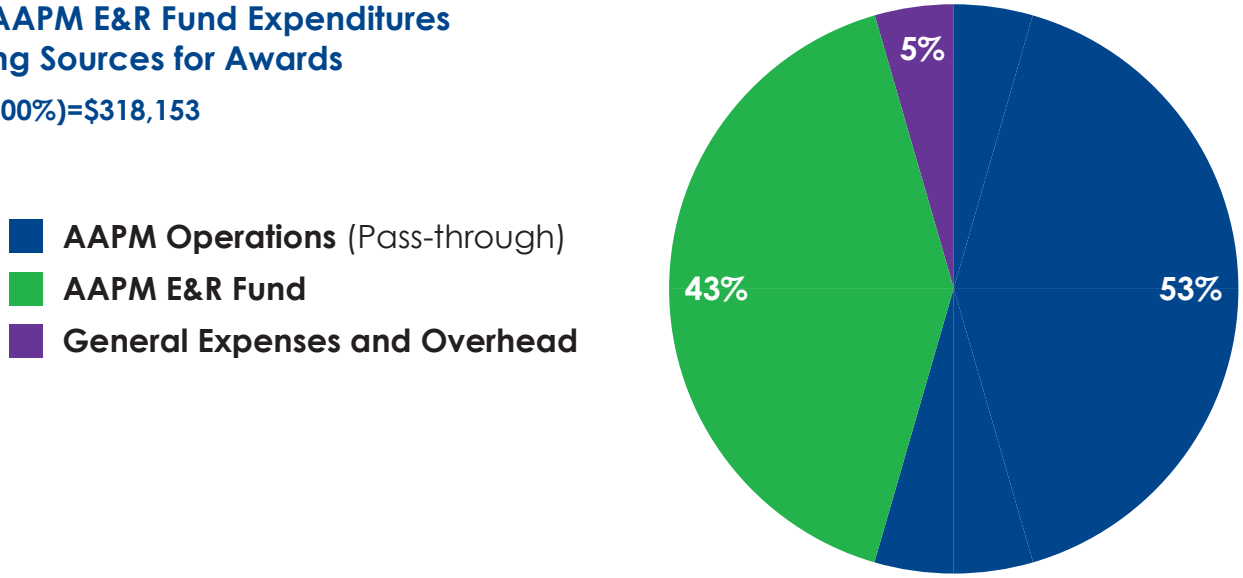
- **Other Awards**

  Other awards aimed at cultivating junior medical physics researchers and at providing medical physics education included (1) **the AAPM Science Council Associates Mentorship Program,** (2) **the AAPM Expanding Horizons Travel Grants,** (3) **the BEST/AAPM Travel Awards,** and (4) **AAPM Summer School Tuition Scholarships**.

The benevolence of our members and sister societies is greatly appreciated, without which these programs would not be possible. AAPM reports in the following pages detail these programs, 2018 award recipients, and testimonials, which demonstrate the enormous value the recipients place on this support. As you read the reports, consider how these programs impact our medical physics profession by attracting bright, young people into our profession, encouraging development of quality graduate and resident medical physics education programs, and helping develop outstanding research scientists, all starting with your contributions to our AAPM E&R Fund.

2018 AAPM E&R Fund Expenditures Funding Sources for Awards

Total (100%)=$318,153



Distribution of sources that funded 2018 E&R programs. Overhead costs are charged to the E&R Fund.

The Research Seed Funding Grant

Three $25,000 grants were awarded to provide funds to develop exciting investigator-initiated concepts, which will hopefully lead to successful longer term project funding from the NIH or equivalent funding sources. Funding for the 12-month grant period began July 2018. Research results are submitted for presentation at future AAPM meetings.

Sponsored by the AAPM Science Council through the AAPM Education & Research Fund
(See AAPM website for more details, including eligibility requirements.)

Xianjin Dai, PhD

Stanford University School of Medicine

Department of Radiation Oncology

"Quantitative X-ray-induced shortwave infrared luminescence computed tomography in a single snapshot"

This project is focused on tackling the challenges in X-ray-induced luminescence computed tomography when imaging speed, spatial resolution, and field of view are considered simultaneously. X-ray excitable nanophosphors emitting light in the shortwave infrared region were investigated, single-view cone beam XLCT without scanning imaging system was built, and a compressive sensing (CS) based reconstruction algorithm was developed to achieve real-time XLCT imaging with sub-millimeter spatial resolution.

The system has two immediate applications. First, the system is capable of in vivo small animal molecular imaging with high temporal and spatial resolution. Particularly, high spatial resolution is necessary to precisely quantify metastases in animal models of cancer. High temporal resolution is helpful for studies of tumor dynamics and radiation dose reduction in animals. Second, the system is suitable for dosimetric application, offering real-time monitoring of delivered dose for external beam radiation therapy. Real-time in vivo dosimetry is highly desired to precisely target tumors and their margins, largely sparing normal adjacent tissues from exposure and assessing whether or not the proper dose has been delivered exactly as planned.

This award supports my preliminary investigations of this research, which should incline other research organizations to support further improvements and applications.

Arash Darafsheh, PhD

Washington University School of Medicine

Department of Radiation Oncology

"High-resolution radioluminescent dosimeters for concurrent dose and LET measurement in proton therapy"

The objective of this proposal is to exploit unique radioluminescent (RL) properties of undoped plastic and glass materials for developing novel high-spatial resolution dosimeters for emerging radiation therapy modalities, including intensity modulated proton therapy (IMPT). Its results will support enhanced quantitative, but clinically practical dosimetry performance not achievable by currently available technologies. Our proposed dosimeters will measure dose and linear energy transfer (LET) profiles with high resolution in 2D, and measure the integral depth dose required for treatment planning system commissioning and periodic machine quality assurance of pencil beam scanning proton delivery.

Two aims are: (1) to identify an optimal combination of luminescent medium and readout technique for silica glass and plastic polymers for use as absorbed dose and LET detectors in IMPT fields and (2) to develop a practical single-element dosimetry system for IMPT dosimetry. In aim 1, radioluminescent spectra of various fiber materials will be collected and characterized. A correlation between RL of fibers and absorbed dose will be investigated. For materials with two emission bands, e.g., silica glass (460 nm and 650 nm), a correlation between ratio of the RL peaks and LET will be established. In aim 2, for the most promising RL media, a single-element fiber dosimeter will be designed, fabricated, and tested for simultaneous proton therapy dose/LET measurements.

The grant helped the researcher buy a required piece of equipment for fiber optic dosimetry and prepare and submit an R01 grant to NIH.

David A. Hormuth, II, PhD

The University of
Texas at Austin

*Institute for Computational
Engineering and Sciences,
Livestrong Cancer Institutes*

"Development and validation of a computational and experimental framework for predicting radiation therapy outcomes"

Temporal and spatial variations in a tumor's environment significantly inform its sensitivity to radiation therapy. Biophysical models that accurately characterize the tumor and its environment could potentially be used to optimize or adapt treatment plans on an individual basis. Previously, I developed an experimental and computational approach employing quantitative diffusion-weighted MRI and dynamic contrast-enhanced MRI data to provide tumor and vasculature growth forecasts on an individual basis. Using an individual's quantitative MRI data, we are able to calibrate subject specific parameters describing the growth and death of tumor cells and vasculature. The seed grant from AAPM has helped me expand our previous efforts to collect pre-clinical in vivo MRI data in clinically-relevant models of glioblastoma and expand the experimental and computational framework to model response to fractionated radiation therapy. I am hopeful that the modeling approach developed here for glioblastoma can be applied broadly to other tumor sites and locations. Additionally, the AAPM, through this seed funding, has provided the opportunity to perform preliminary experiments, which will be used towards a larger NIH application that will allow me to develop as an independent scientist in the field of computational and radiation oncology.

ASTRO-AAPM Physics Resident/Post-Doctoral Fellow Seed Grant

The ASTRO-AAPM Physics Resident/Post-Doctoral Fellow Seed Grant is a jointly funded effort to advance the field of radiation oncology in novel ways through the support of talented, early-career scientists performing physics and radiation oncology-related research. The aim of the $25,000 Physics Seed grant is to support the next generation of researchers. During the one-year grant period, the awardee will devote 75% of their professional effort toward research.

Co-sponsored by the AAPM Science Council through the AAPM Education & Research Fund and by the American Society for Radiation Oncology (ASTRO)
(See AAPM or ASTRO websites for more details, including eligibility requirements.)

Khadija Sheikh, PhD

Johns Hopkins University

*Department of
Radiation Oncology*

"Predicting Radiation Induced Toxicities using Radiation and Imaging Biomarkers of Head and Neck Cancer"

In head and neck cancer patients, radiotherapy can damage the salivary glands and lead to dry mouth and difficulty of swallowing (xerostomia and dysphagia), compromising a patient's quality of life. We hypothesize that combining salivary glands dose, patient demographics, and image patterns of salivary glands will allow us to generate a method to predict a patient's risk of developing xerostomia and dysphagia following radiotherapy.

We will collect patient characteristics, dose information, quality of life data, and images from a large database. The salivary glands will be outlined by the radiation oncologists. The extent of xerostomia and dysphagia will be determined by questionnaires that the patients will complete. The imaging features that will be determined include quantities such as shape, intensity, and texture. Some of these values can be calculated by evaluating the changes in signal intensity within the salivary glands. Collectively, this will result in several thousands of variables that will allow us to predict these complications.

The data will be split into two sets: training and test datasets. The prediction model will be built using the training dataset. The test data set will be used to verify the accuracy of the model's output. Multiple models will be built for predicting xerostomia and dysphagia. The algorithm resulting in the model with the greatest predictive accuracy will be used on the test data. This project serves as the first step to determine which patients will benefit from intervention that can be used to avoid these toxicities after receiving radiotherapy.

AAPM Imaging Physics Residency Grants

On November 29, 2017, the AAPM Board of Directors approved $140,000 in funding for two new imaging physics residency positions, in diagnostic, diagnostic with a nuclear medicine option, or nuclear medicine. With funding commencing July 2019, two institution(s) will receive $35,000 per year for two years as matching support for one resident. Selected in 2018, the two program director recipients were:

Frederic H Fahey, DSc

Boston Children's Hospital

Diagnostic and Nuclear Medical Physics Residency Program

David Lloyd Goff, PhD

Medical & Radiation Physics, Inc.

Imaging Physics Residency Program

Graduate Student Fellowships

The AAPM Graduate Fellowship and RSNA/AAPM Graduate Fellowship are awarded in alternating years. Each fellowship is awarded for the first two years of graduate study leading to a doctoral degree in Medical Physics (PhD or DMP). Both BSc and MS holders are eligible to apply. A stipend of $13,000 per year, plus tuition support not exceeding $5,000 per year, is assigned to the recipient.

Sponsored by the AAPM Education & Research General Fund
(See AAPM website for more details, including eligibility requirements.)

AAPM Graduate Fellowship (2018-2020)

Kaelyn Seeley

University of Wisconsin-Madison

I was drawn to the field of medical physics by its interdisciplinary research, incorporating many of my interests while simultaneously allowing me to see the direct, positive impact that physics can have on people's lives. Also, the Graduate Fellowship has greatly reduced the financial burden of being in graduate school and has helped me focus on my research. My goals for this first year were to get a head start on research and find an appropriate conference to present my work. This year I have submitted an abstract on the work I have done with the cyclotron group at UW-Madison, under Dr. Jonathan W. Engle to the 2019 International Conference on Nuclear Data in Beijing, China. There, I will be giving an oral presentation on my research involving measuring cross sections for producing Ce-134 from La targets, which can be used as a theranostic pair with Ac-225 to image the biodistribution of this therapeutic isotope in the body.

RSNA/AAPM Graduate Fellowship (2017-2019)

Qiyuan Hu

University of Chicago

(See AAPM Education & Research Fund Annual Report 2017 for personal statement.)

Summer Undergraduate Fellowship Program

The Summer Undergraduate Fellowship Program is a 10-week (40 hours per week) summer program designed to provide opportunities for undergraduate university students to gain experience in medical physics by performing research in a medical physics laboratory or assisting with clinical service at a clinical facility. The mentor and fellow determine the exact 10-week schedule (May-September). In this program, AAPM matches exceptional students with exceptional medical physicists, many who are faculty at leading research centers. Students participating in the program are placed into summer positions that are consistent with their interest. Selected for the program on a competitive basis, summer fellows receive a $5,000 stipend from AAPM.

Sponsored by the AAPM Education Council through the AAPM Education & Research Fund
(See AAPM website for more details, including eligibility requirements.)

Julian Bertini

Davidson College

Senior Physics Major

Mentor:
Annie Hsu, PhD

Stanford University
Cancer Center

Department of
Radiation Oncology

My time spent in the Radiation Oncology Department of the Stanford Medical Center amounted to the most impactful summer in my four years of college. I experienced and observed the realities of working as a medical physicist, learning not only about the technical and clinical workflows, but also about the necessary emotional maturity that exist in such an environment. I had the opportunity to shadow, observe, and actively work with many different clinical professionals that comprise the oncology team, including but not limited to physicians, medical physicists, medical dosimetrists, residents, radiation therapists, and nurses. I was able to observe patients close enough to not only understand, but to truly feel the importance of my work. It made me excited for the future, to realize that this kind of work is fueled from a well of greater purpose that will never run dry.

My project involved the development of a comprehensive and robust software program that automatically handles a large portion of the patient QA process. The motivation behind using this program in conjunction with human judgment is to significantly reduce treatment plan errors that might pass through the entire QA workflow unnoticed. This script runs through a treatment-specific, comprehensive list of checks that ensures key aspects of the treatment plan are according to protocol. A paper is currently being drafted utilizing results of the project.

The AAPM fellowship was extremely helpful to me, not only educationally, but also financially, since I was living in the Bay Area, one of the most expensive regions in the country.

Alexandra Gruszkiewicz

Brigham Young University

Senior Physics Major

Mentor:
J. Adam M. Cunha, PhD

University of California,
San Francisco

Department of
Radiation Oncology

This summer, I was involved in research at UC San Francisco with Dr. Adam Cunha. I worked on a new brachytherapy optimization software that takes biological effects into account during optimization. The majority of my responsibility was to explore the effects of this new optimization algorithm for several fractionation schemes. My work has contributed to a paper that I have partially written and is being completed.

As part of my summer experience, I also learned about the clinical roles of medical physicists, as well as shadow in other parts of the radiation oncology department, including dosimetry and external beam radiotherapy. Without the AAPM stipend, I would not have been able to afford to take months off from school and work to gain this important experience, so I am very grateful for the existence of this program.

Allison Haertter

West Virginia Wesleyan College

Senior Physics Major

Mentor:
Boon-Keng Kevin Teo, PhD

University of Pennsylvania

Department of Radiation Oncology

This summer I worked with Dr. Boon-Keng Kevin Teo at the University of Pennsylvania in the Department of Radiation Oncology. I was helping with his research on Dual Energy Computed Tomography for Proton External Beam Therapy. I was able to observe and partake in photon and proton radiotherapy external beam planning, complete deformable image registration and structure segmentation on computed tomography images, and received radiation safety training. This was an amazing opportunity in which I gained both experience and knowledge in the medical physics field that will help me with my future graduate education and career. The fact that we also received a stipend to support our living expenses put this program above and beyond what I was expecting.

Brianna Lepore

Bucknell University

Senior Biomedical Engineering Major

Mentor:
Andrew Maidment, PhD

University of Pennsylvania

Department of Radiology

This summer, I worked in the lab of Dr. Andrew Maidment in the Department of Radiology at the University of Pennsylvania. In our study, we investigated the image quality capabilities of two systems capable of magnification tomosynthesis. We investigated the Mozart Specimen Tomosynthesis System, designed for use following surgical removal of breast tissue, and the next generation tomosynthesis prototype, designed to investigate alternative scanning geometries for DBT, for use in breast cancer diagnosis. We performed image quality measurements to evaluate performance of both systems for contact and magnification imaging in 2D and 3D. For both systems, we calculated the modulation transfer function and the 2D noise power spectra. A wax calcification phantom was constructed to evaluate the qualitative performance for different acquisition modes on both systems. In summary, the performance of both systems has been evaluated, and the results suggest that the systems are operating within component specifications. Following the research, a report was submitted to Kubtec, the company that designed the Mozart System, and a submission was completed for the medical imaging conference SPIE. There will likely be one to two papers written in the coming months.

Overall, I learned immensely from the research experience, gaining skills in data analysis, problem solving, writing scientific reports, and giving formal presentations. I was fortunate to be able to join in the activities of the Summer Undergraduate Program for Educating Radiation Scientists (SUPERS) at the University of Pennsylvania. These activities included a morning lecture series three times a week focused on radiation oncology, a chalk talk presentation mid-way through, and a final presentation at the end of the summer. I found the AAPM stipend extremely helpful in covering costs of transportation and food throughout the summer.

Zachary B. Metzler

Loyola University Maryland

Junior Physics and Mathematics Major

Mentor:
Gabriel Sawakuchi, PhD

University of Texas M D Anderson Cancer Center

Department of Radiation Physics

My research project consisted of analyzing data to predict the potential effectiveness of intensity modulated proton therapy (IMPT) in the treatment of locally advanced pancreatic cancer (LAPC). A poster presentation, as well as a talk, will result from this research.

In addition to the research, I was able to observe the clinical duties of a medical physicist, such as patient and machine quality assurance. The AAPM Stipend was extremely helpful, and I definitely would not have been able to participate in the program without it.

Louise M. Naumann

Westmont College

Senior Physics Major

Mentor:
Piotr Zygmanski, PhD

Brigham and Women's Hospital

Department of Radiation Oncology

This summer, I had the privilege of working at the Department of Radiation Oncology, BWH / DFCI in Boston. This was the perfect research experience for me, working on designing and 3D printing of prototype sensor arrays. This project had a tangible scope and application, which made it fun and easy to be immersed. I enjoyed learning about the physics behind what we were doing and then applying it to design and fabrication. A large part of the project was learning about the different materials that can be used with a 3D printer and discovering the capability of the printer with respect to these different materials. I experimented with the two most popular filaments for 3D printing, ABS (Acrylonitrile Butadiene Styrene) and PLA (Polylactic Acid). In my prototypes, I used both conductive and non-conductive materials, which added another layer of difficulty to the design and fabrication. I not only learned about this specific work, but also about the general process of conducting research. I was able to work on a report and presentation. Research in this project was explorative and will be continued, as there remains work to be done collecting data and exploring other designs to make prototype sensor arrays suitable for clinical application.

Thanks to the AAPM stipend, I was able to enjoy this invaluable research experience whilst in the culturally diverse and historically rich city of Boston. Overall, this summer was an incredible experience and helped me gain insight into the field of medical physics. I am excited to apply to graduate programs being confident that I want a career in this field. Thank you so much for making this summer possible.

Thomas J. Rhines

University of Chicago

Senior Physics and Molecular Engineering Major

Mentor:
Maryellen L. Giger, PhD

University of Chicago

Department of Radiology/ Medical Physics

This summer, I explored and implemented several deep-learning techniques used for the identification and localization of pneumothorax in patient chest radiographs. As a result, I am listed as secondary author to several papers related to the use of deep learning in chest radiographs, as well as having an abstract, "Multi-institutional deep network for high performance sorting of over 3000 AP and PA chest radiographs," accepted for a presentation at the 2018 RSNA meeting. The AAPM fellowship enabled me to continue my work with Dr. Maryellen Giger, as well as provide me with an opportunity to delve deeper into the research process and computer programming than would be allowed during the academic year.

Jacqueline Elizabeth Van Slycke

Siena College

Senior Physics Major

Mentor:
Atchar Sudhyadhom, PhD

University of California, San Francisco

Department of Radiation Oncology

What a great opportunity I was afforded this summer to work with Dr. Atchar Sudhyadhom at the University of California, San Francisco on a new project to use magnetic resonance imaging to more accurately understand tissue composition for increased precision of proton therapy. I gained experience in the basics of MRI science, both from the chemical and coding perspectives. I learned what it was like to work in a lab environment and the structure and processes involved in running a group project. I look forward to seeing progress of this project and the strides made by using MRI for proton therapy in the years to come.

I've seen so much in this short summer, from lab work to 3D printing initiatives, arduino sensors, and unpacking MRI images. Thank you to Dr. Atchar Sudhyadhom and all of AAPM for opening my eyes to medical physics.

Benjamin C. Wollant

Saint Olaf College

Senior Physics and Mathematics Major

Mentor:
Kenneth Bader, PhD

University of Chicago

Department of Radiology/ Medical Physics

This summer, I had the phenomenal opportunity to conduct medical physics research with Dr. Kenneth Bader at the University of Chicago. My project focused on how acoustic cavitation, the generation of bubble clouds through high intensity focused ultrasound, aids therapeutic drug penetration into tissue at blood-tissue interfaces. In my work I developed tissue models for the study and the experimental protocols for collecting data from the experiments. I presented my findings in a Skype call with Dr. Bader's collaborators, and although no paper or report resulted directly from my research this summer, my project will likely feed into a section of one of Dr. Bader's PhD student's thesis.

The AAPM fellowship was extremely helpful in my career as a scientist. As a direct result of my experiences in this summer's program, I intend to pursue graduate work in medical physics or biomedical engineering.

Teresa M. Yuhas

Saint Vincent College

Senior Physics Major

Mentor:
Nima Kasraie, PhD

Children's Mercy Hospital and Clinics, Kansas City

Department of Radiology

My summer in Kansas City, Missouri at Children's Mercy Hospital was a fantastic experience! It was the first time I lived in a city and experienced so much culture and diversity. Everyone at Children's Mercy was so welcoming and pleasant! Prior to coming to Kansas City, I had no exposure to the daily duties of a Diagnostic Imaging Medical Physicist. My mentor, Dr. Nima Kasraie, was extremely helpful. He gave me much advice about the field of medical physics and educated me on many of the physics concepts involved in diagnostic imaging. My project for the summer was to perform various physics tests on medical imaging equipment including x-ray, fluoroscopy, and ultrasound machines. I wrote my report on QA ultrasound testing and will present it as my senior research for my undergraduate degree.

The AAPM fellowship's stipend greatly helped with travel expenses and for everyday living necessities. Overall, my experience at Children's Mercy Hospital taught me how important it is to love and to be loved. Seeing so many sick children enduring illness and families suffering gave me insight on how love conquers fear and gives purpose to our lives. By spreading, sharing, and cherishing love, we can make the world a better place. Love is our hope and reason to celebrate our gift of life!

Diversity Recruitment Through Education and Mentoring Program (DREAM)

The Diversity Recruitment Through Education and Mentoring Program (DREAM) is a 10-week (40-hours per week) summer program designed to increase the number of underrepresented groups in medical physics by creating new opportunities, outreach, and mentoring geared towards diversity recruitment of undergraduate students in the field of medical physics. Students participating in the program are placed into summer positions that are consistent with their interest. Selected for the program on a competitive basis, DREAM fellows receive a $5,000 stipend from AAPM.

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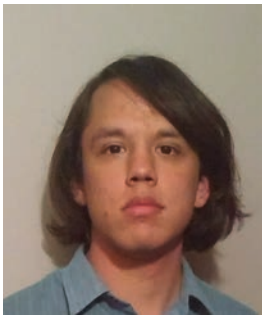


Marco Antonio Carmona

University of Michigan

Nuclear Engineering & Radiological Sciences Major

Mentor:
Arvind Rao, PhD

University of Michigan

Department of Computational Medicine & Bioinformatic/ Radiation Oncology

In this project, I worked on using Matlab to create patches from SVS file to be used in a Discriminative Feature-oriented Dictionary Learning (DFDL) program. SVS files are very large, so a method was needed in order to obtain smaller patches of the image in order to use them in the DFDL. However, only satisfactory patches could be used, so a wide variety of methods was used to search through the various SVS files in order to obtain a large number of satisfactory patches. This is especially useful because a Cancer Genome Atlas available online has a wide variety of cancer types, and they all use SVS files. For this project, we focused on types involving BAP1 and IDH1. Wild and mutant types can be compared in this DFDL in order to teach the DFDL what each type looks like so it can look at new images and determine which type they are, hopefully with high accuracy. We also worked on the DFDL in order to understand what it is outputting to make improvements.

I also worked on a project involving degenerative eye diseases. By using the various layers in the eye, we can compare different patients and identify if they have an eye disease based on the features of the various layers of the eye. Eyes that have a lesion tend to have distorted layers when compared to a normal eye, so this could be useful in identifying potential eye problems during an eye scan.

We are making further progress on these projects, and namely, we are preparing a manuscript for the work on DFDL. We are also discussing the potential for its future use in other research projects and papers.

Vijay Chockalingam

University of Michigan

Neuroscience Major

Mentor:
MingDe Lin, PhD

Philips Research North America at Yale University

Radiology and Biomedical Imaging

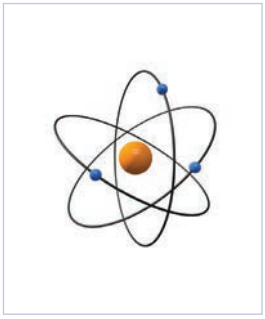
Having the opportunity to work in Yale's Radiology Research Lab was an extremely rewarding experience. I could not have imagined a better way to spend my summer. Throughout my time in the lab, I had exposure to pre-clinical and clinical research, while also having the opportunity to take charge of my own study. Guided by great mentorship from my principal investigator, Dr. MingDe Lin, and other faculty, I was able to experience what it takes to meaningfully contribute to science, as well as make the most of this unique opportunity.

The level of science was way above my head, considering everyone I would be working with is at least a graduate/medical student, but I managed to not look too lost. I immediately got involved in helping with the scanning of an embolization procedure for pre-clinical studies in which my lab was working. I learned how to operate the cone-beam CT and fluoro machines to help the physicians take scans during the procedure, which was used to direct the embolization of the tumor that was grown in the animal. This embolization is done by accessing a feeding artery to the tumor and using lipiodol as a drug delivery system to bring the chemotherapy drugs to the site of the tumor. These pre-clinical trials aim to improve the assessment of the tumor microenvironment, which will ultimately help improve the transarterial

chemoembolization (TACE) procedure.

My own clinical project aimed at figuring out how to quantify lipiodol deposition seen in cone-beam CT and compare it against the lipiodol deposition seen in post-treatment CT to determine if cone-beam CT can be used to help physicians modify their embolization target in "real time." With this project, there was a lot of freedom in terms of how I could approach problem solving. I was given guidance from Dr. Lin and other mentors to help push me in the right direction, but having a sense of control over the direction of the project was both exciting and nerve-wracking. The support I received from Dr. Lin and others in the lab helped to ease my nerves and propelled me to make consistent progress with the project. By the end of the summer, after shuffling between Yale's imaging software, BioImage Suite, and MATLAB, I was able to quantify the 3D overlap of lipiodol deposition. Now all that needs to be done is to increase the patient sample size and hopefully a manuscript of the results can be published.

Aside from all of the science and technical skills I learned during my time at Yale, I definitely have come to appreciate the importance of collaboration and hope to carry this virtue with me in my future endeavors.



Tracy Simone Edwards

Hampton University

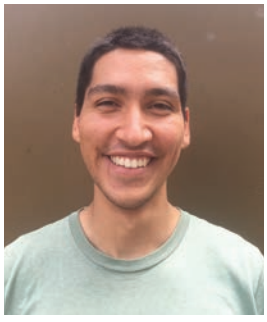
Physics Major

Mentor:

Justin B. Solomon, PhD

Duke University

Department of Radiology



Daniel Meza Keane

Amherst College

Physics Major

Mentor:

Arash Darafsheh, PhD

Washington University School of Medicine

Department of Radiation Oncology

My first six weeks were spent reading medical physics and optics research papers, learning and discussing concepts related to medical physics and the lab's research, attending lab group meetings to discuss the research, and working in the lab doing research. I learned how to use spectroscopy software (Enlighten) and image analysis software (ImageJ), and I learned the principles of radiochromic film dosimetry. On two occasions, I assisted in irradiating films with a clinical linear accelerator.

During the last four weeks, I worked on a feasibility test of an iPhone camera for film dosimetry. This involved experimenting with different lighting setups to obtain photos of particular brightness levels, image processing, and use of Excel and Origin software for data analysis. At the end of the summer I gave a brief oral presentation on this project. It is possible that after further experiments are conducted by a future summer student or another member of the lab group, the work that I did during the last four weeks of the fellowship would be suitable material for a technical note or a presentation at the AAPM Annual Meeting.

Claudia R. Miller

Wayne State University

Biomedical Engineering Major

Mentor:
Carri Glide-Hurst, PhD

Henry Ford Health System

Department of Radiation Oncology

Overall, I had a great experience as a DREAM fellow. The fellowship's stipend was very helpful in supporting my continued education and convenient transportation to and from my work location.

During the 10-week program, I conducted research that focused on how CT image reconstruction affects radiotherapy treatment planning tasks, such as automatic segmentation of organs in the targeted treatment region. The model based iterative reconstruction (MBIR) can help to improve image quality and reduce radiation dose. Nine different levels of the reconstruction filter were tested and compared to a "gold standard" reconstruction algorithm called filtered back projection (FBP). It was found that MBIR had the largest impact on soft tissue structure automatic segmentation. I presented an e-poster on this data at the AAPM conference, and I am also working toward submitting a paper on the same topic.

2018 REVIEW
Presentation & Publication Awards

Each of the following, a competitive, prestigious award or lecture, which is connected to the AAPM Annual Meeting, is supported by a named, and in most cases, endowed E&R Fund:

Farrington Daniels Award

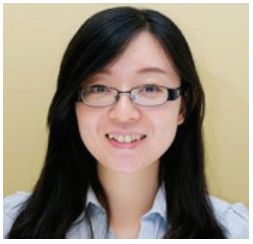
This award is for an outstanding paper on radiation therapy dosimetry, planning, or delivery published in *Medical Physics* in 2017. Presented in 2018, the awardees were **Huan-Hsin Tseng**, **Issam M El Naga**, **Jen-Tzung Chien**, **Randall K. Ten Haken**, **Sunan Cui and Yi Luo** for their paper entitled "Deep Reinforcement Learning for Automated Radiation Adaption in Lung Cancer," *Medical Physics* 44 (12), 6690-6705 (2017).

(Funded by the endowed Farrington Daniels Fund)

Moses and Sylvia Greenfield Award

This award is for an outstanding paper on imaging, published in *Medical Physics* in 2017. Presented in 2018, the awardees were **Alexander Grant**, **Brian J. Lee**, **Chen-Ming Chang and Craig S. Levin** for their paper entitled "Simultaneous PET/MR imaging with a radio frequency-penetrable PET insert, *Medical Physics* 44 (1), 112-120 (2017).

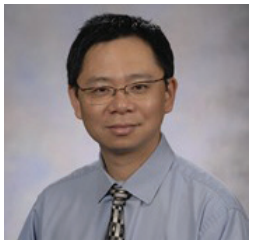
(Funded by the endowed Moses and Sylvia Greenfield Fund)



Jack Fowler Junior Investigator Award

This award was established in honor of Jack Fowler, PhD, Emeritus Professor of Human Oncology and Medical Physics, University of Wisconsin. The award was presented to **Grace Jianan Gang, PhD**, Department of Biomedical Engineering, Johns Hopkins University, for the top scoring abstract submitted by Junior Investigators who entered the competition, entitled "Dynamic Fluence Field Modulation with Multiple Aperture Devices: Design, Implementation and Assessment."

(Funded by the Jack Fowler Award Fund)



Jack Krohmer Junior Investigator Award

This award was established in honor of Jack Krohmer, PhD, a pioneer in the medical physics community. The award was presented to **Jian Wu, PhD**, Department of Radiation Oncology, University of Florida, Gainesville for the best abstract submitted to the Scientific Program of the AAPM Annual Meeting, judged according to criteria of significance, innovation, and the potential for major scientific impact in an area of cutting-edge interest in medical physics. The abstract was entitled "Selecting Predictive Genomic Biomarkers for Oropharyngeal Cancer Treatment Prediction by Use of Advanced Machine Learning Method."

(Sponsored by the AAPM Science Council through the AAPM Education & Research Fund)

Award for Innovation in Medical Physics Education

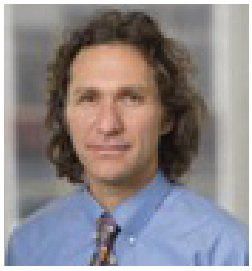
This award is given for the best presentation at an Education Council session concerning innovative programs in medical physics education of physicists, physicians, ancillary personnel, and the public. Presentations can be concerned with scientific research, novel teaching strategies (team teaching or adult learning efforts), or novel educational materials (lectures, websites, or other innovations). This year's award went to **Wilfred F. Ngwa, PhD**, Department of Radiation Oncology, Harvard Medical School, for a presentation entitled, "Emerging Models in Global Health for Medical Physicists and experiences in parts unknown."

(Funded by the Harold Marcus Fund)

Anne and Donald Herbert Distinguished Lectureship in Modern Statistical Modeling

(Funded by the endowed Anne and Donald Herbert Fund)

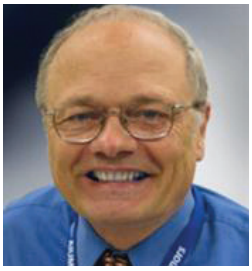
On Tuesday, July 31 at the AAPM 2018 Annual Meeting, invited lecturer, **Joseph Deasy, PhD**, Director of Medical Physics at Memorial Sloan Kettering Cancer Center, delivered his lecture, "Predictive Modeling in Radiation Oncology: A Quick Status Report."



Co-presenter, **Andrew Vickers, PhD**, Department of Epidemiology and Biostatistics, Memorial Sloan Kettering Cancer Center, presented his lecture, "Everything you always wanted to know about prediction modeling (but everyone was too afraid to ask)."

Carson/Zagzebski Distinguished Lecture On Medical Ultrasound

(Funded by the endowed Carson/Zagzebski Fund)



On Sunday, April 8 at the AAPM 2018 Spring Clinical Meeting, invited lecturer **James Zagzebski, PhD**, University of Wisconsin, delivered his lecture, "Ultrasound Instrumentation: An Important Focus for the Medical Physicist."

Co-presenter, **Glen McLaughlin, PhD**, Chief Product Officer for Shenzhen Mindray Bio-Medical Electronics Co., LTD, presented his lecture, "Synthetic Aperture Imaging Methods: Technologies and Trade-offs."

John R. Cameron Young Investigator Awards

(Funded by the endowed John Cameron Fund)

The Young Investigator's Symposium is a competition in honor of University of Wisconsin Professor Emeritus John R. Cameron, PhD. The 10 highest scored abstracts submitted for the Symposium are selected for presentation, from which the top three presentations receive awards. 2018 winners were:

1st place: Avilash Cramer

Massachusetts Institute of Technology/Harvard Medical School

PhD Student in Medical Engineering/ Medical Physics

"A Stationary Computed Tomography Module Using Photocathode-Driven X-Ray Sources"

2nd place: Adrian F. Howansky

Stony Brook University

PhD Student in Biomedical Engineering and Medical Physics

"Guiding Novel Flat Panel Detector Designs with Direct Measurements of Depth-Dependent Scintillator Gain and Blur"

3rd place: Irwin I. Tendler

Dartmouth College

PhD Student in Medical Physics

"Scintillator Target Imaging Provides Accurate Remote Multi-Site Surface Dosimetry"

AAPM Science Council Associates Mentorship Program

The program has been established to recognize and cultivate outstanding researchers at an early stage in their careers with the goal of promoting a long-term commitment to science within AAPM. The program uses the process of "shadowing" to integrate the Associates into the scientific activities of the organization. Science Council Associates participate in the program for one year and are funded up to $4,000 per Associate (to cover travel costs including flight, hotel, and meeting registration) to attend two consecutive AAPM Annual Meetings, including the pre-meeting activities associated with each Committee.

Sponsored by the AAPM Science Council through the AAPM Education & Research Fund
(See AAPM website for more details, including eligibility requirements.)

- **Joshua Niedzielski, PhD**
  Postdoctoral Fellow
  Departments of Radiation Physics and Imaging Physics
  University of Texas M D Anderson Cancer Center
  Houston, TX
  Mentor: Paul Keall, PhD, Professor
  University of Sydney
- **Sarah Quirk, PhD**
  Medical Physics Resident
  Tom Baker Cancer Center
  Calgary, Alberta, Canada
  Mentor: Stephen Kry, PhD, Associate Professor
  University of Texas M D Anderson Cancer Center
- **Matthew Scarpelli, PhD**
  Postdoctoral Fellow
  Barrow Neuro Imaging Innovation Center
  Phoenix, AZ
  Mentor: Keyvan Farahani, PhD, Program Director
  National Cancer Institute
- **Emil Schueler, PhD**
  Radiation Oncology Physics Resident
  Stanford University School of Medicine
  Stanford, CA
  Mentor: Robert Jeraj, PhD, Professor
  University of Wisconsin
- **Chunhao Wang, PhD**
  Medical Physicist
  Department of Radiation Oncology
  Duke University Medical Center
  Durham, NC
  Mentor: Carri Glide-Hurst, PhD, Program Director
  Henry Ford Cancer Institute
- **You Zhang, PhD**
  Assistant Professor
  Department of Radiation Oncology
  University of Texas Southwestern Medical Center
  Dallas, TX
  Mentor: George Ding, PhD, Professor
  Vanderbilt University

AAPM Expanding Horizons Travel Grant

Up to ten AAPM Expanding Horizons Travel Grants are awarded per year, each up to $1,000, for the purpose of providing additional support for student and trainee travel to conferences that are not specifically geared toward medical physics. The travel grant is designed to provide an opportunity to broaden the scope of scientific meetings attended in order to introduce students and trainees to new topics which may be of relevance to medical physics research and which may subsequently be incorporated into future research in order to progress the field in new directions. The grants are awarded twice annually.

Sponsored by the AAPM Science Council through the AAPM Education & Research Fund
(See AAPM website for more details, including eligibility requirements.)

Round 1 Awardees

- **Elham Abouei, MS**
  Graduate Student
  University of British Columbia
- **Elizabeth Boehnke, MS**
  Graduate Student
  University of California - Los Angeles
- **Justin Brown, MS**
  Graduate Student
  University of Florida
- **Samuel Einstein, PhD**
  Fellow
  University of Texas M D Anderson Cancer Center
- **Eric Morris, BS**
  Graduate Student
  Wayne State University

Round 2 Awardees

- **Jennie Crosby**
  Graduate Student
  University of Chicago
- **Nastaran Emaminejad**
  Graduate Student
  University of California - Los Angeles
- **Daniel Huff**
  Graduate Student
  University of Wisconsin-Madison
- **Daniel Mulrow**
  Graduate Student
  Washington University in St. Louis

Team BEST/AAPM Award

Team BEST provides funding for five fellowships in the amount of $1,000 each, to be used for travel, food and lodging expenses to attend the Annual Meeting. AAPM provides complimentary Annual Meeting registration for each recipient, including social functions. Team BEST also provides a plaque for each of the five fellowship recipients.

Sponsored by Team BEST through the AAPM Education & Research Fund

- **Yu Gao**
  University of California - Los Angeles, Radiology
- **Angelia Landers, PhD**
  University of California - Los Angeles, Radiology
- **Christopher MacLellan**
  University of Texas M D Anderson Cancer Center, Imaging Physics
- **James Renaud, PhD**
  McGill University, Medical Physics Unit
- **Irwin Tendler, PhD**
  Dartmouth College, Medical Physics & Biomedical Engineering

Summer School Tuition Scholarships

Summer School Tuition Scholarships were in the form of a full waiver of tuition fees for the entire AAPM 2018 Summer School. This award is available to applicants who are in the first five years of their careers in medical physics.

Sponsored by the AAPM Administrative Council through the AAPM Education & Research Fund
(See AAPM website for more details, including eligibility requirements)

- **Nrusingh Biswal, PhD**
  University of Maryland, School of Medicine
  Department of Radiation Oncology

- **Daniel Christ, DMP**
  Ohio State University, Wexner Medical Center
  Department of Radiation Oncology

- **Samuel French, MS**
  Piedmont Healthcare
  Radiation Oncology

- **Sarah Geneser, PhD**
  University of Washington, School of Medicine
  Department of Radiation Oncology

- **Donna Murrell, PhD**
  Medical Physics Resident
  London Regional Cancer Program

- **Albert Pinder-Arabpour, PhD**
  Colorado University, School of Medicine
  Department of Radiation Oncology

The AAPM Development Committee hopes that this report conveys the worthwhile activities supported by our Education & Research Fund and the value of your contributions, encouraging future member support of the AAPM Education & Research Fund. Although the success of these programs depends on the diversity of current funding, AAPM aims to increase its dependence on earnings from the E&R Fund. See the attached bar graphs for the E&R Fund balances at the end of 2018, revenues for 2018, and member contributions for 2018.

We ask each member to participate in contributing, for which there are many options. In 2019, we expect to facilitate our Planned Giving program with a new, comprehensive web presence, which offers multiple options to give, however is best suited to your financial position. Presently, AAPM offers incentives for legacy gifts. Also, it provides 1:1 matching funds for gifts no less than $500 per year to our Five-Year Pledge Program, which was initiated in January 2016 by the AAPM Board of Directors *(https://www.aapm.org/education/edfundintro.asp)*.

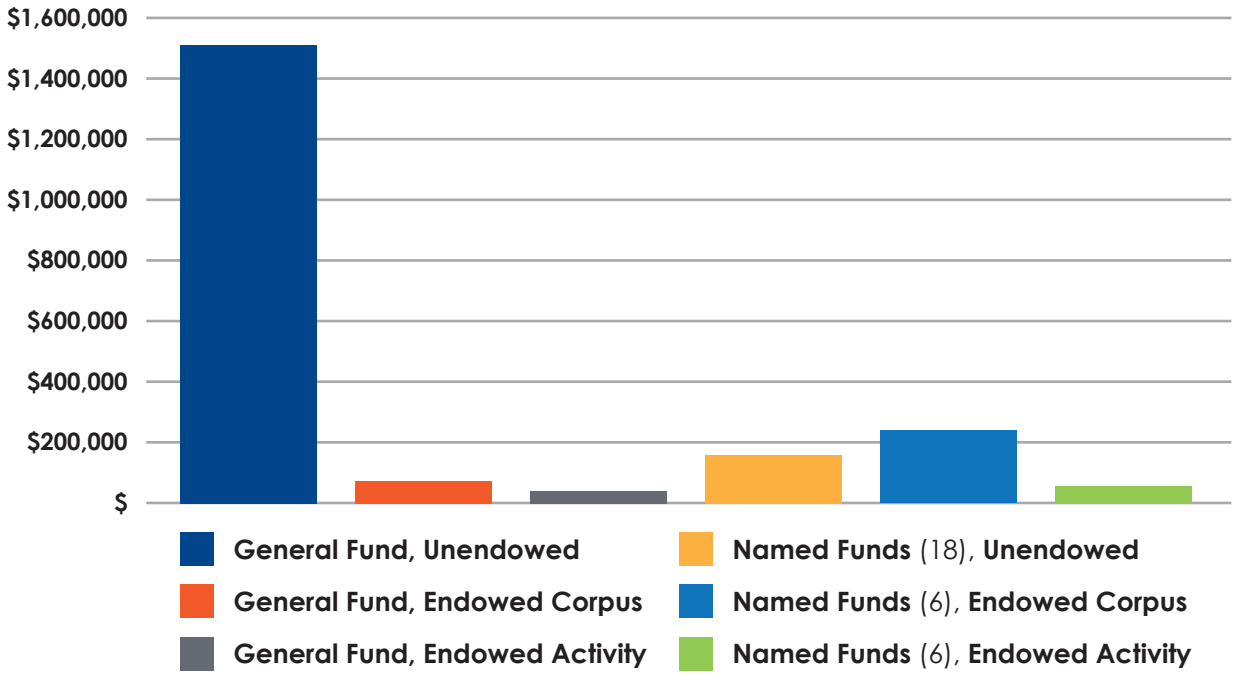
Your Development Committee continues to work on other ways to encourage gifts through memorial gifts and named funds.

Our members and awardees truly appreciate and thank you for your support! On the following pages is a listing of the many who have given their support to our E&R Fund.

Kenneth R. Hogstrom, PhD
Chair, AAPM Development Committee

2018 AAPM E&R Fund Account Balances

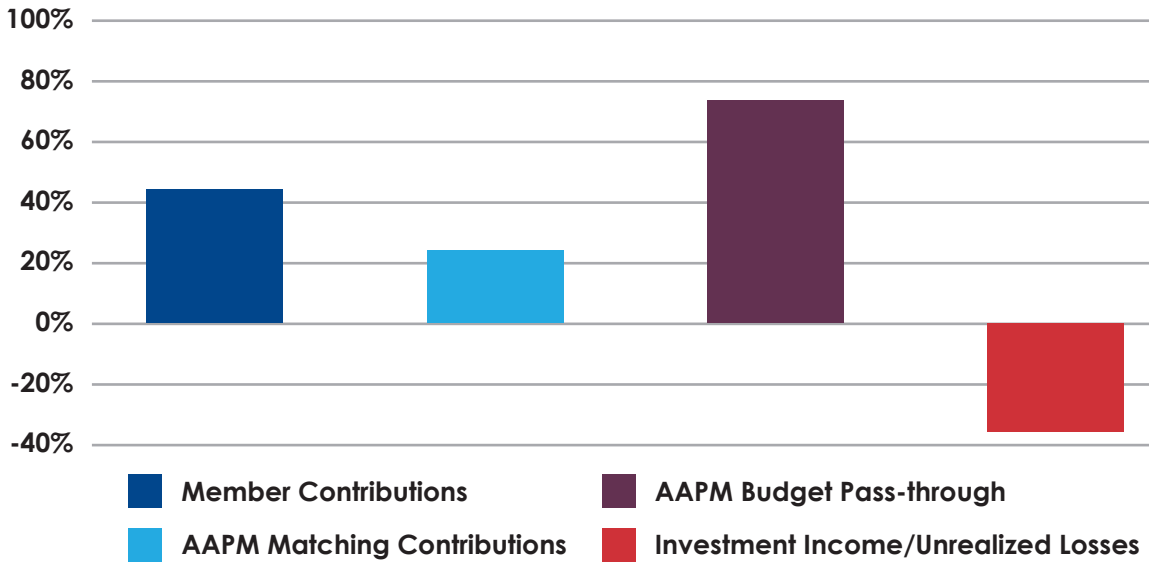
Total=$2,063,958



Distribution of AAPM E&R Fund account balances between endowed and non-endowed accounts at end of 2018. Numbers in parentheses indicate number of accounts in each Fund type.

2018 AAPM E&R Fund Revenues

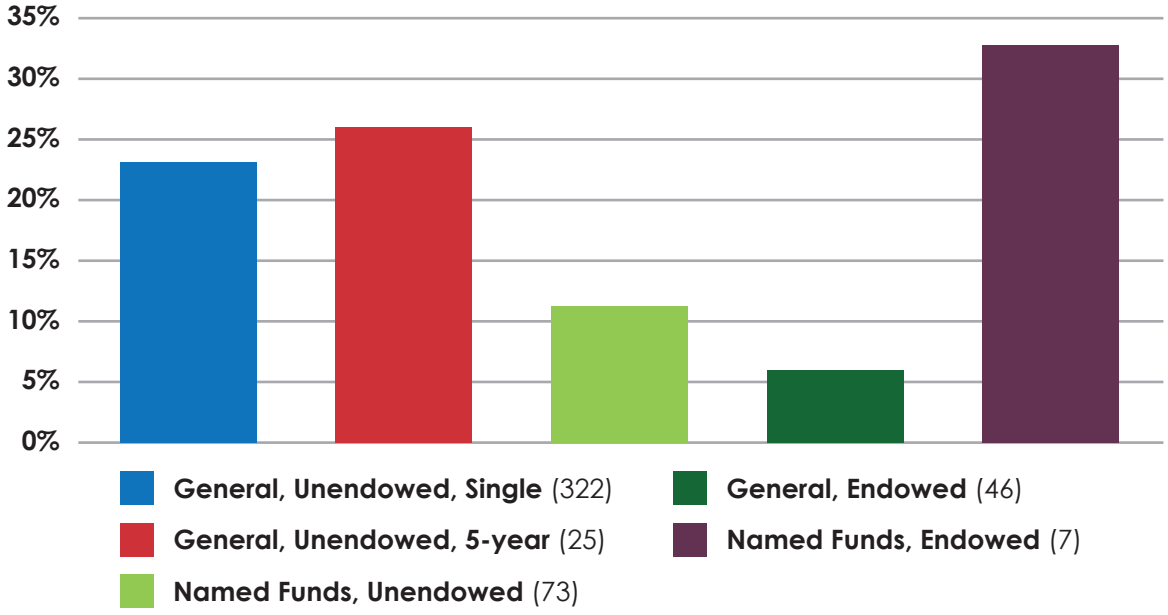
Total (100%)=$229,485



Origin of E&R Fund revenues used to fund 2018 awards. Revenues were down from 2017 due to investment earnings being negative and no matching funds from other professional societies.

2018 AAPM E&R Member Contributions

Total(100%)=$154,261



Distribution of member contributions to different types of accounts of the AAPM E&R Fund in 2018. Numbers in parentheses represent the number of gifts. The General, Unendowed 5-year amount reflects the total of first-time pledges in 2018.

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