AMERICAN ASSOCIATION of PHYSICISTS IN MEDICINE

Improving Health Through Medical Physics

AAPM Newsletter — Volume 43 No. 5 — September | October 2018

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AMERICAN ASSOCIATION of PHYSICISTS IN MEDICINE

Improving Health Through Medical Physics

PRESIDENT ELECT'S REPORT

Cynthia McCollough, PhD | Madison, WI

AAPM Newsletter — Volume 43 No. 5 — September | October 2018

HOW TO VOLUNTEER — AND LEAD — IN AAPM?

Act – Learn – Build – Repeat! That was the message shared by **Paul Brown** during the 2018 Annual Meeting's President's Symposium. That is his recipe for creating the future that you want. He encouraged taking a small step (act) toward your goal and consider the outcomes (learn). Did the action take you close to where you want to go, or was it a dismal fail? In either case, modify it (build) and then act again (repeat). This is how you go from where you are to where you want to be.

Many people have asked me about leadership within AAPM, particularly how one can become a leader in our association. Dr. Brown's recipe is a great model to use to achieve this goal. So, let's start at the beginning with a new member of AAPM who wants to volunteer his/her time and talents to serve the profession of medical physics through service to AAPM. A game plan might look like this:

> **Action:** Respond to AAPM yellow pages ad for a new member in a committee, sub-committee, task group or working group.
> **Learn:** No one responds to your inquiry so you assume that you can't get on an AAPM committee, sub-committee, etc.
> **Build:** You form a negative impression of AAPM committee system and complain to others that leadership is a closed, "old-boys" club.
> **Repeat:** Not likely.
> **Outcome:** You do not get to where you want to go.

Hmmm, why didn't that work out? Well, there are a few things wrong with this approach, besides the obvious fact that it didn't work. Most critically, the cycle stopped, with no iterations to find a better way forward. Rather than passively waiting for an already too busy volunteer (with a busy day job too) to get back to you, I suggest the following tried and true technique for becoming involved in the work of AAPM: **SHOW UP!**

That's right. The first action should be to look at the vast number of committee, sub-committee, task group and working group meetings that occur during an AAPM meeting (primarily the Annual Meeting and at RSNA, although a small number of groups do meet at the Spring Clinical and ASTRO meetings) and pick one—or more—to attend.

What is your interest? Education? We have groups involved in the education of physicians and in the education of allied health personnel. Research? We have literally hundreds of scientific task groups, whose end goal is to produce a definitive report on a specific topic. We have a number of Professional and Administrative groups as well. There is definitely something for everyone. The list for the 2018 Annual Meeting appears here. Glance through and find something that you are interested in and that you'd like to work on, and then plan to attend. You can also drop an email to the Chair noting your interest and background. Ask to be added as a guest to the group. This will allow you to participate in online discussions and remote meetings. Chairs love having energetic new members who are willing to roll up their sleeves and do the work of the committee. Regular attendance, and volunteering to do some of the needed work, is the best path to membership. Now the committee may already be pretty large and the Chair may not be adding new members right away. But, if you really want to serve there, keep attending and demonstrate your willingness to contribute, and when a current member rotates off, you'll be a natural new appointee.

So, if that is how to become a member of a committee, sub-committee, task group or working group, how do you reach a leadership level? The answer, similar to show up, is **WORK HARD**. AAPM committees, sub-committees, task groups and working groups have work to get done. They are not there just to build your CV. We need our volunteers to participate regularly in meetings, to do work between meetings, to review reports in a timely fashion, and to be good citizens of the group. This latter part is essential. Meetings are meant to be inclusive and gather opinions from all present. They are also supposed to be constructive, moving toward a solution rather than turning the topic into a debate. Our time together in face-to-face meetings is precious and we want to spend it well. Raise your hand and wait for the Chair to recognize you when you want to speak, try not to interrupt others, and don't give speeches. We want to hear from you, but we want to hear from everyone else in the room too. Finally, be there to help the Chairperson. For example, if he/she is trying to gain consensus on a point and move on to other topics, help them out by not bringing up tangential discussion points.

A really great way to gain leadership experience is to serve at the chapter level. Chapters are almost entirely volunteer led and there is much work to be done. Active participation in a chapter can even result in serving as a chapter representative to the Board, which is a great "short-cut" to board service compared to waiting to win a board-member-at-large seat. We need active grassroots programs and opportunities at the Chapter level, so get involved there. I guarantee that you will be warmly welcomed.

Another typical question is "How are Chairs selected?" The Chair, Vice-Chair, and members of a group are appointed by their parent group. The parent group's Chairperson, however, typically speaks with the current Chair of a group to gather suggestions. If you have been a regularly attending committee member and demonstrated initiative, your name is likely to be mentioned. While you wait for this

opportunity, observe how the Chairs of groups that you are on, or that you visit, handle conflict, lack of follow-through, inclusiveness, and report preparation. You'll see many styles of leadership. Note those that seem effective and use that knowledge when you rotate into a leadership role.

Are you interested in senior leadership? It's worthwhile to navigate through the committee tree on AAPM website to see how our organization is structured. Senior leaders are those that have volunteered – a lot – typically in multiple branches of the organization. If you look at the service history of senior leaders, you will see years of active service and multiple experiences as a Chair. As you consider this level of service, you will want to attend council meetings (as a guest – almost all AAPM committee meetings are open to guests). You'll want to attend the Annual Business Meeting and even the Board Meeting. This will help prepare you to serve at this level, both by familiarizing yourself with current issues and topics of discussion, and by watching the more formal operation of the councils and board.

I hope that this primer to volunteerism and leadership within AAPM prompts you to become an active volunteer. I have found my 30+ years of membership in AAPM so rewarding because of the opportunities that it has provided to serve our profession and our patients through service to AAPM. If you have further questions, reach out to your chapter leaders, council leaders, members of the Board or the Executive Committee of the Board (EXCOM). We are here to help engage and train the next generation of AAPM leadership!

AMERICAN ASSOCIATION of PHYSICISTS IN MEDICINE

Improving Health Through Medical Physics

EXECUTIVE DIRECTOR'S REPORT

Angela R. Keyser | Alexandria, VA

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AAPM WEBSITE

Thanks for your patience through this transition to the new AAPM database. If you find a page or section of the website that is not working as it should, please send an email to helpdesk@aapm.org which will put things into the Information Services Team queue. Someone will then respond to let you know when it has been resolved.

AAPM TRANSPARENCY

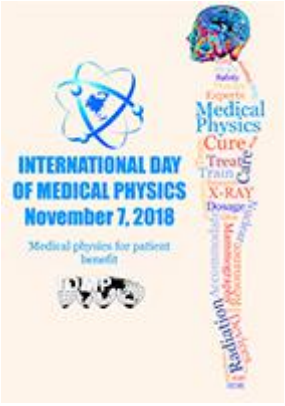
Ever want to know more about the operations and governance of AAPM? AAPM's volunteer leadership continues to provide a wealth of information about the management of the organization to Members via the web. I applaud current and past leaders for seeking to provide a high level of transparency. Won't you take a few moments to review the information?

Members will find:

- ✔ Links to AAPM's governance documents;
- ✔ Audited financial reports dating back to 1992;
- ✔ AAPM's current budget;
- ✔ Minutes from AAPM Board meetings and background;
- ✔ Minutes from past Annual Business Meetings; and,
- ✔ Reports from all the Headquarters Site Visit Committees, a group of volunteers that reviews HQ operations every three years.

Should you ever have any questions, please do not hesitate to contact me.

INTERNATIONAL DAY OF MEDICAL PHYSICS ON NOVEMBER 7



IOMP is once again promoting activities to raise awareness about the role of medical physicists through the International Day of Medical Physics (IDMP). The 2018 IDMP is scheduled for November 7, the birthdate in 1867 of Marie Sklodowska-Curie. The theme of IDMP 2018 is "Medical Physics for Patient Benefit." This is an excellent opportunity to promote the role of medical physicists. Visit the IOMP website for more information and promotional resources.

Find us on

@IntDayofMedPhys

RSNA 2018 — TOMORROW'S RADIOLOGY TODAY

Register now for the RSNA 104th Scientific Assembly and Annual Meeting, November 25 – 30. AAPM Members must register by October 26 to receive complimentary registration. Reminder – AAPM's Headquarters Hotel is the Hyatt Regency Chicago located at 151 E. Wacker Drive. The AAPM Reception will be held on Tuesday, November 27 from 6:00 PM – 8:00 PM at the Hyatt.

2018 DUES RENEWALS

Dues renewal notices for the 2019 year will be sent out in early October. I encourage you to pay your dues via the AAPM website. Remember, many of the regional chapters are partnering with HQ on the dues process, so make sure to check the invoice to see if you can pay your national and chapter dues with one transaction. Be mindful, though, that some chapters have a membership application process. Please only remit dues for chapters of which you are an official member.

INTERESTED IN EMERITUS MEMBERSHIP?

If you have fully retired from the field after being a Full or Associate member of AAPM for 10+ total years (the last two consecutive) and are over the age of 55, you are eligible for Emeritus Membership.

To request a change to Emeritus, email jennifer@aapm.org with your request and our HQ team will do the rest!

MARK YOUR CALENDARS!

The 2019 AAPM Spring Clinical Meeting will be held March 30 – April 2 in Kissimmee, Florida.

The 2019 Summer School on Practical Medical Image Analysis will be held June 3 – 7 at the University of Vermont in Burlington, VT.

AAPM's 2019 Annual Meeting will be held July 14 – 18 in San Antonio, TX.

SHOP AMAZON SMILE = DONATION MADE TO AAPM'S EDUCATION & RESEARCH FUND

Contribute to the AAPM's Education & Research Fund while you shop on Amazon. With a simple action and at no cost to you, AmazonSmile will donate to AAPM's Education & Research Fund.

What is AmazonSmile? When first visiting AmazonSmile, customers are prompted to select a charitable organization from almost one million eligible organizations. For eligible purchases at AmazonSmile, The AmazonSmile Foundation will donate 0.5% of the purchase price to the customer's selected charitable organization.

How to Get Started

To select **AAPM's Education & Research Fund** as your charity:

1. Go to this link - https://smile.amazon.com/ch/23-7057224
2. Log in using your Amazon account. Your shopping cart, Wish List, wedding or baby registry, and other account settings are also the same

3. Now every eligible purchase you make at https://smile.amazon.com/ will result in a donation to AAPM's Education & Research Fund.

For more information about the AmazonSmile program, go to smile.amazon.com/about

The 2017 Education and Research Fund Annual Report was recently released and is available online.

AAPM'S HQ TEAM . . . AT YOUR SERVICE!

Who does what on the AAPM HQ Team? See a list with contact information and brief descriptions of responsibilities online. An Organization Chart is also provided.

AMERICAN ASSOCIATION of PHYSICISTS IN MEDICINE

Improving Health Through Medical Physics

TREASURER'S REPORT

Mahadevappa Mahesh, PhD | Baltimore, MD

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I am writing this column after attending the AAPM Annual Meeting in Nashville, TN. I want to share in this column the financial report I gave at the Annual Business Meeting. Fiscally, AAPM continues to perform well and ended the year with a slight deficit.

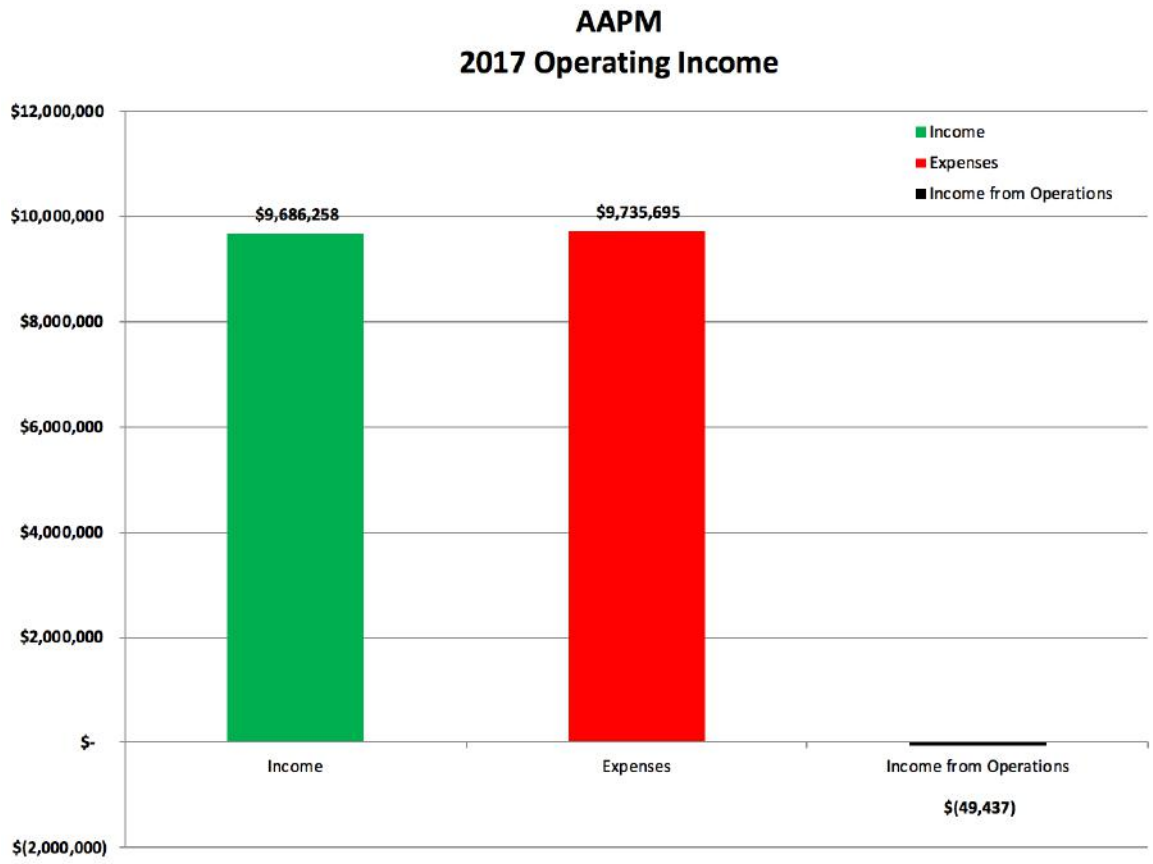

Figure 1: AAPM Income and Expenses for year 2017

The Association realized a deficit from operations of approximately $49,000 in 2017 (Figure 1). For the year 2017, AAPM had budgeted for a deficit of approximately ($1.2M), therefore this led to a favorable variance of $1.15M for 2017. The largest single driver contributing to this favorable variance came as the result of net under-spending and favorable revenue performance versus budget in Councils and

Committees contributed $836,000 to the favorable variance. Overhead costs were lower than budget by approximately $139,000. Additionally, costs associated with the Annual Meeting held in Denver, CO were lower than budget creating a favorable variance of nearly $138,000. Despite the modest deficit from operations, AAPM was still in compliance with the Debt Service Coverage (DSC) ratio of 1.2 to 1 covenant requirement as a part of AAPM's building financing with TD Bank. For the year ending December 31, 2017 AAPM's DSC ratio was 1.79 to 1.

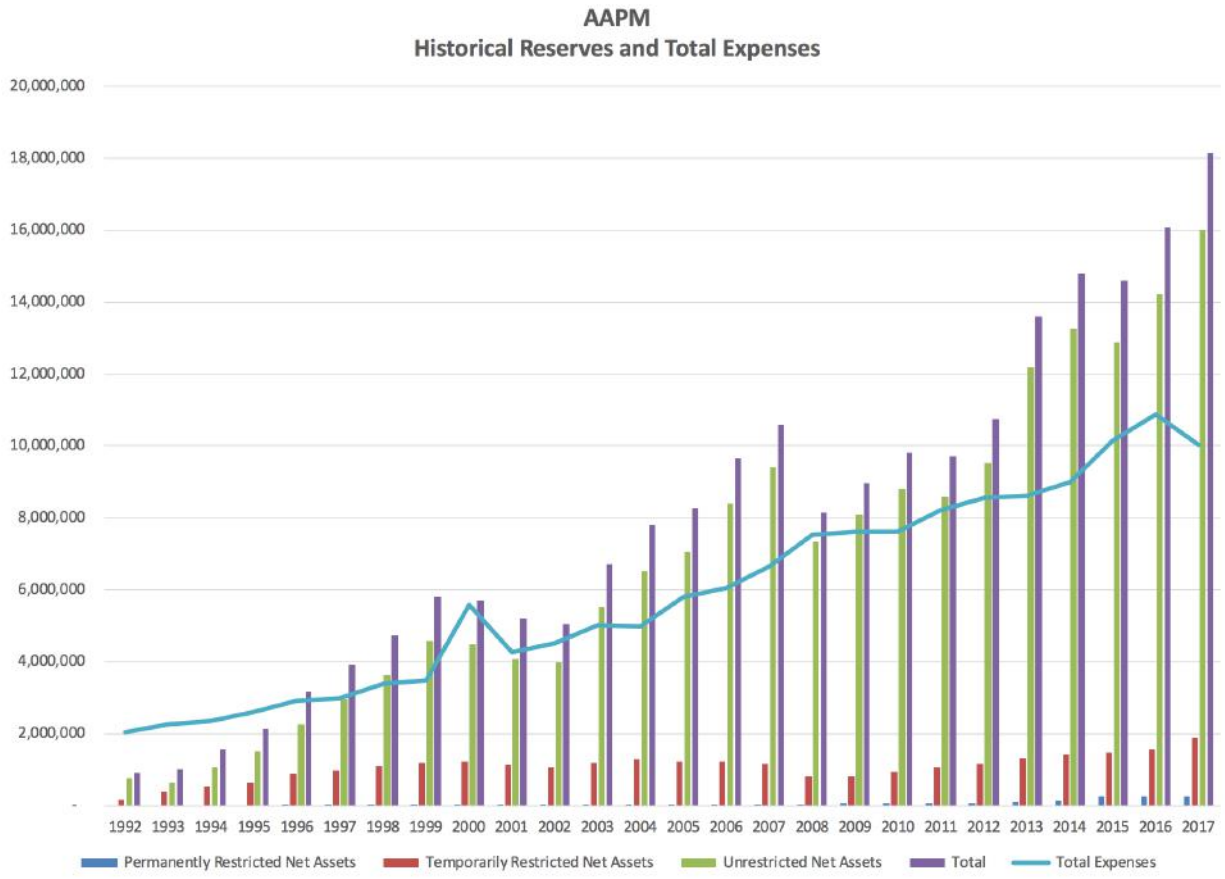

Figure 2: AAPM Historical Reserves (Restricted & Unrestricted funds)

AAPM's balance sheet is strong as of the end of the year 2017, with total assets exceeding $25.6M. This represents an increase of approximately $1.8M over the prior year (2016). AAPM's investments performed very well in 2017; for the year we had unrealized gains of approximately $1.6M. At year-end reserve balances stood at nearly $14.1M (Figure 2).

The 2018 budget has an approved deficit of approximately $955,000. This budget was prepared utilizing statistical model, using historical budgets and operating results as a guide. As previously mentioned for 2017 the Association budgeted for a deficit of $1.2M based on the model and achieved a deficit of $49k and met the covenants — evidence that the model is working. The model assumes that AAPM will finish the year in compliance with the DSC covenant requirements of TD Bank. Currently, the Association is working on the budget for 2019. All councils and committees are invited to prepare their respective budgets and will submit them by the end of August. FINCOM will meet on October 17, 2018 to review and approve the 2019 budget.

Chart 1					
5 Year Trend Statement of Activities					
	2013	2014	2015	2016	2017
Operating Revenue	9,512,294	9,196,319	9,657,220	11,002,721	9,686,258
Operating Expenses	8,344,316	8,755,320	9,917,356	10,580,445	9,735,695
Net Income (Loss) from Operations	1,167,978	440,999	(260,136)	422,276	(49,437)
Investment Income	206,382	236,912	229,227	225,067	219,347
Unrealized Gains (Losses)	1,306,200	389,953	(335,871)	703,017	1,603,959
Education and Research Fund, Net	190,166	113,698	179,082	111,602	317,107
Net Income (Loss)	2,870,726	1,181,562	(187,698)	1,461,962	2,090,976

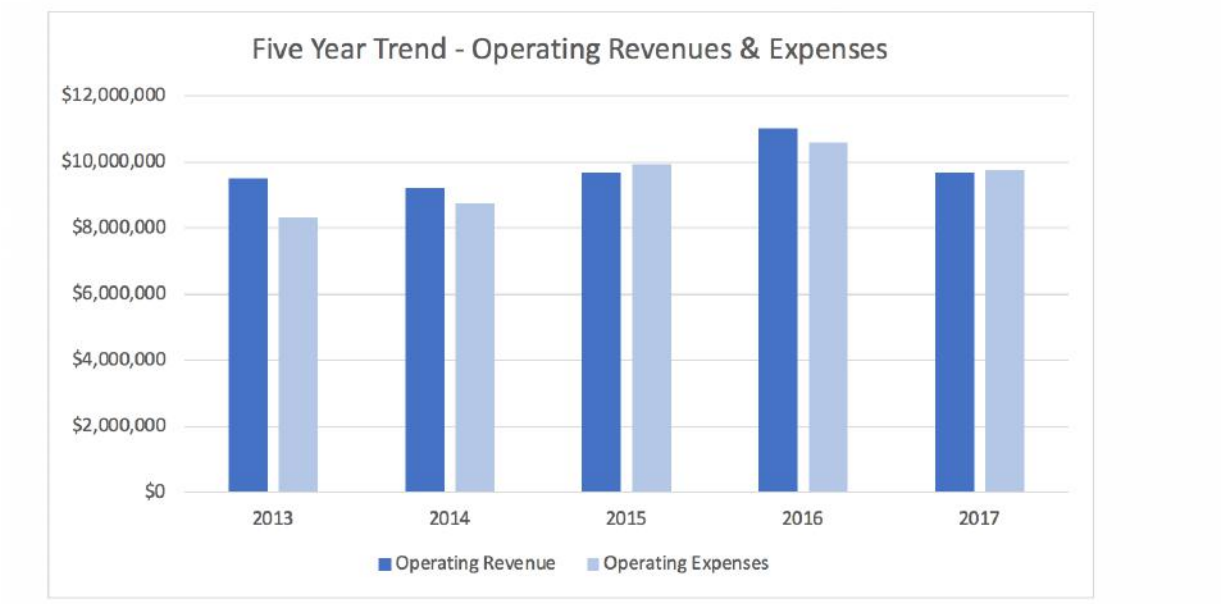

Figure 3: Five Year Trend Operating Revenues and Expenses

I have also included for informational purposes a five-year trend of Operating Revenues and Expenses (Figure 3). In addition to operating activity, investment income and Education and Research Fund (net) activity is shown as well to provide total AAPM activity over the past five years. As shown in the attached data, the Association is in a very healthy financial status with operating reserves exceeding the annual budget.

I would like to thank **Robert A. McKoy**, AAPM Director of Finance, for his subject matter contribution to this report. Please feel free to reach out to me at mmahesh@jhmi.edu, @mmahesh1, or call me at 410-955-5115, if you have any questions concerning this report.

AMERICAN ASSOCIATION of PHYSICISTS IN MEDICINE

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GOVERNMENT & LEGISLATIVE AFFAIRS REPORT

Richard Martin, JD | Alexandria, VA

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JUDICIAL DECISIONS IMPACT PATIENT SAFETY WORK PRODUCT PROTECTIONS

Two recent judicial decisions address Patient Safety Work Product (PSWP) protections under the Patient Safety and Quality Improvement Act of 2005 (PSQIA). The PSQIA spurred development of the AAPM/ASTRO Radiation Oncology Incident Learning System (RO-ILS) and other incident learning systems to facilitate safer and higher quality care. Interpretation of the PSWP protections under the act continue to evolve on a state-by-state basis through judicial decisions.

In Daley v. Ingalls Memorial Hospital, the Illinois Appellate Court, First District, Fourth Division, reversed the trial court's ruling against the hospital that claimed privilege under the PSQIA. The plaintiff argued that the documents were discoverable under "Illinois broad discovery rules." In rejecting the plaintiff's argument and upholding the hospital's claim of privilege protection under the PSQIA, the appellate court stated that the documents at issue "are an amalgamation of data, reports, discussions, and reflections, the very type of information that is by definition patient safety work product."

In Tampa General Hospital v. Azar, the U.S. District Court, Middle District of Florida, Tampa Division, denied the Secretary of the U.S. Department of Health and Human Services' motion to dismiss a suit brought by a hospital seeking declaratory judgment on privilege protection for information reported to its patient safety organization (PSO). The district court's ruling allows the hospital's declaratory judgment action to proceed and provides an opportunity for the court to interpret the PSQIA and its interplay with existing Florida law, including Amendment 7 of the Florida Constitution — "Patient's Right to Know" law — as well as the Florida Supreme Court's prior decisions on this issue.

We will keep you updated on further developments impacting PSWP. If you have any questions or would like additional information on this issue, please contact **Richard Martin**, JD, AAPM Government Relations Program Manager.

AMERICAN ASSOCIATION of PHYSICISTS IN MEDICINE

Improving Health Through Medical Physics

ABR NEWS

Jerry D. Allison, PhD | Augusta, GA & Aaron Gudenkauf, Director of Exam Services, ABR | Tucson, AZ

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LIFE CYCLE OF ABR MEDICAL PHYSICS EXAM ITEMS

The ABR administers five different medical physics (MP) exams per year. These exams are taken by candidates seeking to establish their expertise in one of the fields of medical physics by gaining board certification, and by ABR diplomates seeking to demonstrate continuing mastery in a field of medical physics. Comprising approximately 1179 items (questions), ABR MP exams are written by volunteer committees of diplomates that are content experts. Currently, 108 ABR volunteers are involved in developing, assembling, and critiquing the content of MP exams. They contribute more than 7560 work hours per year, amounting to 3.6 FTE MP professionals working together for our mutual benefit. Volunteer contributions to ABR MP exam preparation are estimated at approximately $622K annually.

ABR MP exam development is a very detailed endeavor overseen by professional psychometricians. In general, 60 percent of each exam is composed of new items. The remaining 40 percent of exam items have been previously used. These used items facilitate statistical evaluation of exam difficulty, which is used to equate exams over time. All exam items have an associated record that identifies their knowledge domain, the number of times used, statistical evaluations of each usage, editorial evolutions, and other references.

Occasionally, candidates or diplomates contact the ABR with concerns about a specific MP test item. Inquiries are handled by the associate executive director for medical physics (Don Frey), trustees (Jerry Allison, Matt Podgorsak, Kalpana Kanal), and the content experts of associated volunteer committees to resolve any issues. If an item is found to be deficient, appropriate corrections are made to exam results.

The ABR also conducts oral exams as a final step for candidates seeking certification in medical physics. Oral exam items have a life cycle very similar to that of the written exams described above. Specific quality control processes are also in place: Each examiner is observed by the MP AED, a trustee or a

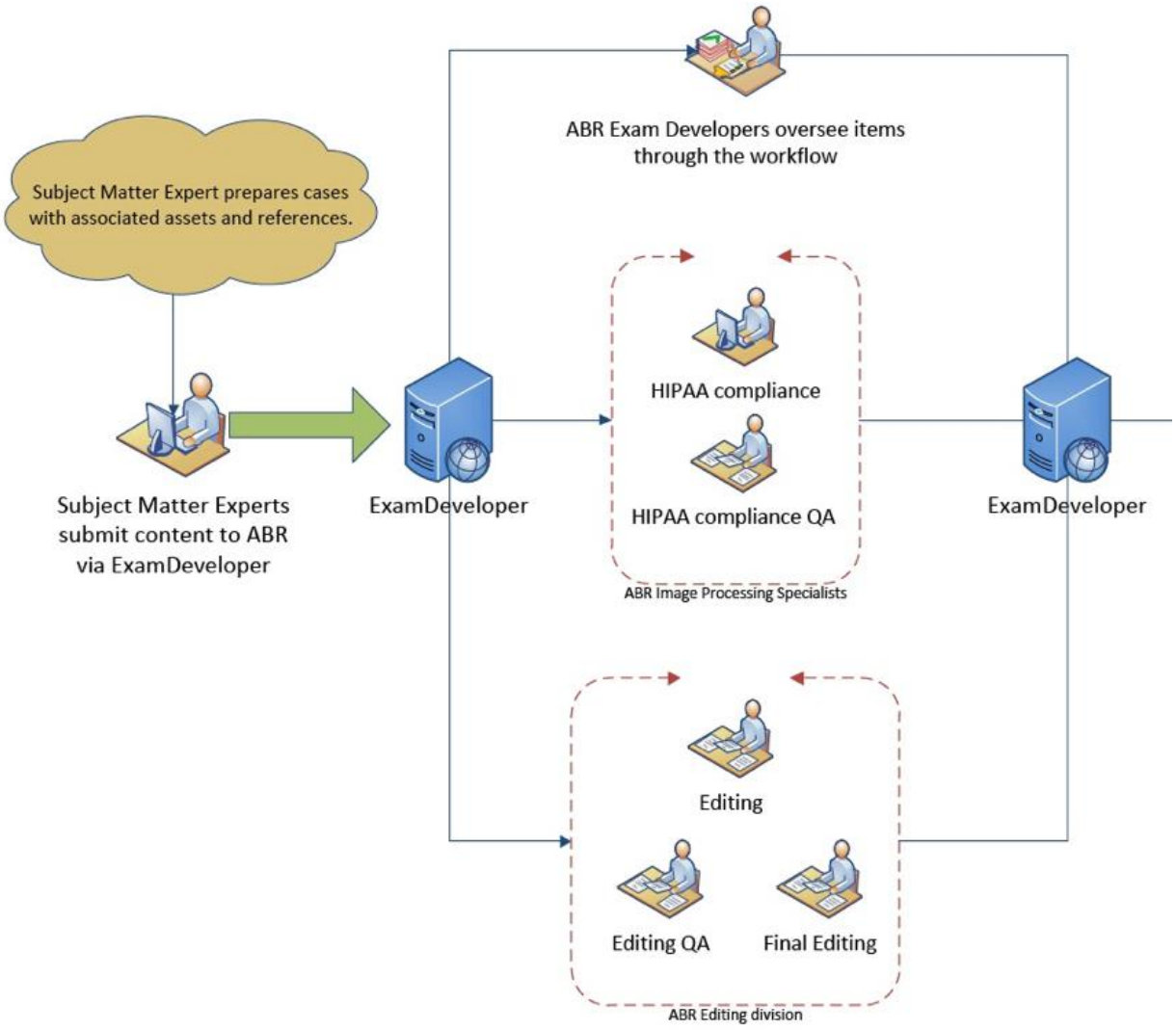
senior examiner to ensure that the conduct of the exam is consistent and fair. The performance of each examiner and each examiner panel is evaluated. Although oral exam panels have remarkably similar performances, any irregularities detected are addressed appropriately.

Clearly, the most precious commodity in the rather involved creation of ABR MP exam content is the participation of volunteer subject matter experts. THANK YOU TO OUR MP DIPLOMATE VOLUNTEERS!

It should also be pointed out that medical physicists contribute to exam creation for our clinical colleagues (diagnostic radiologists, radiation oncologists and interventional radiologists). Collectively, there are approximately 142 medical physicists contributing to ABR exam processes. Again, THANK YOU!

The illustrations below demonstrate the major phases in the life cycle of an ABR MP exam item and the development of an exam.

Writing of New Exam Items



Committee Review of New Exam Items and Exam Assembly

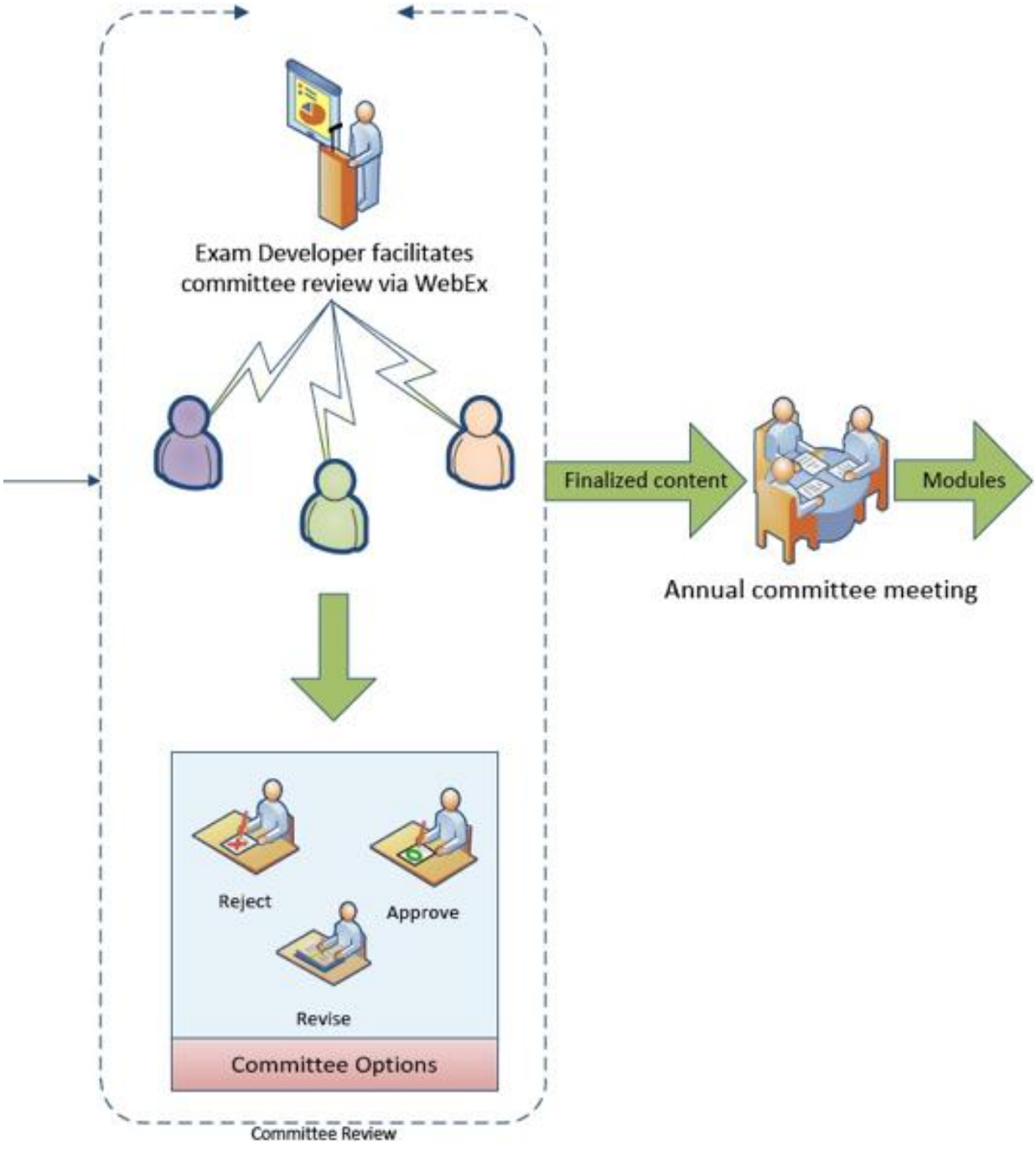
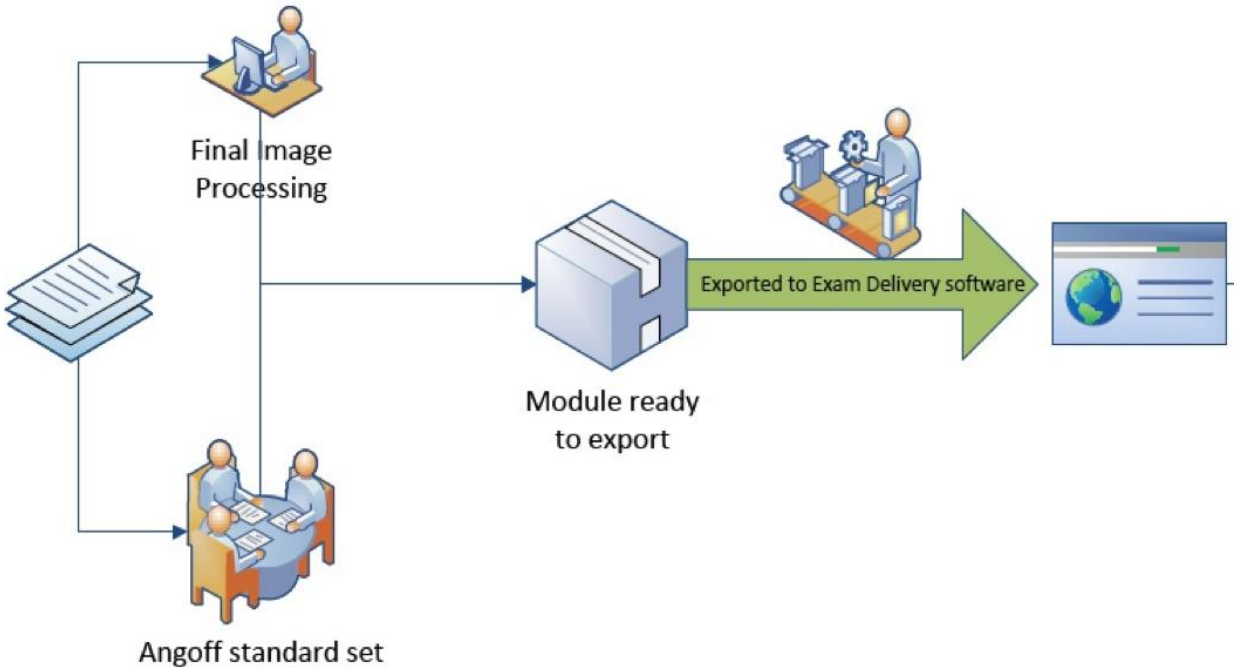
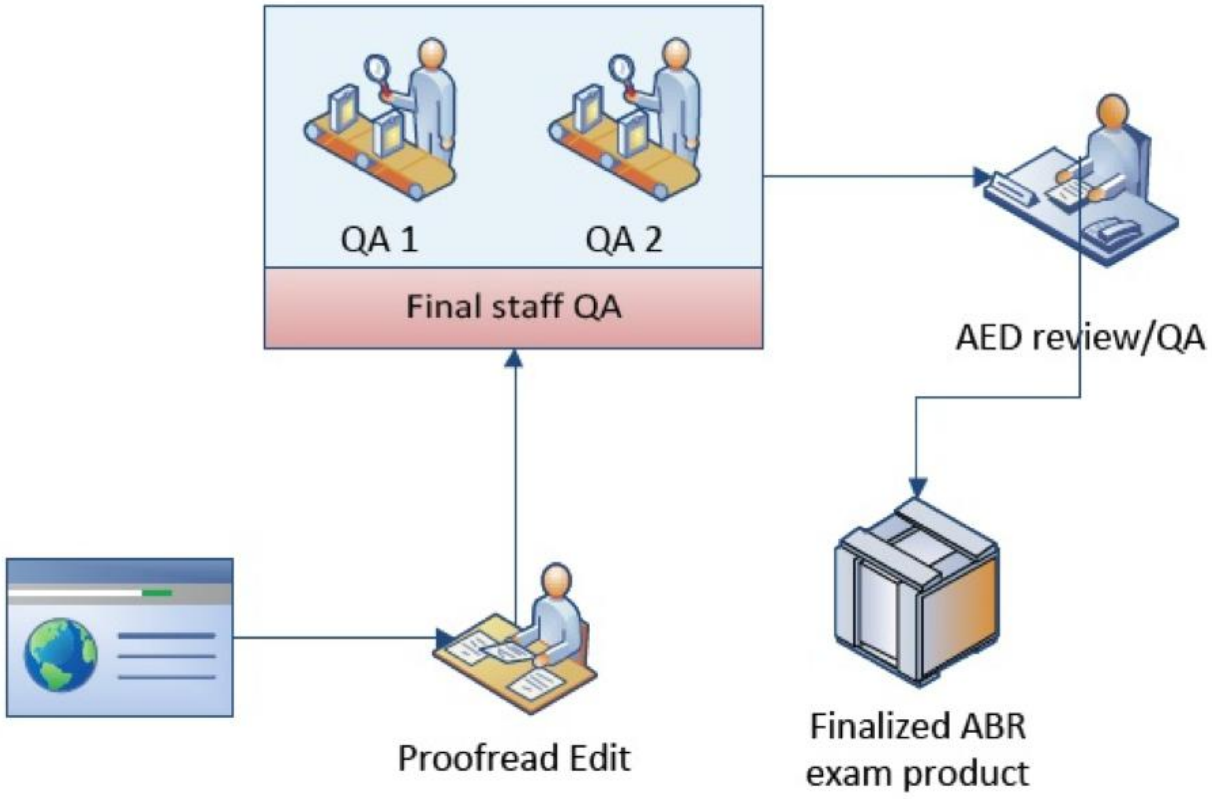


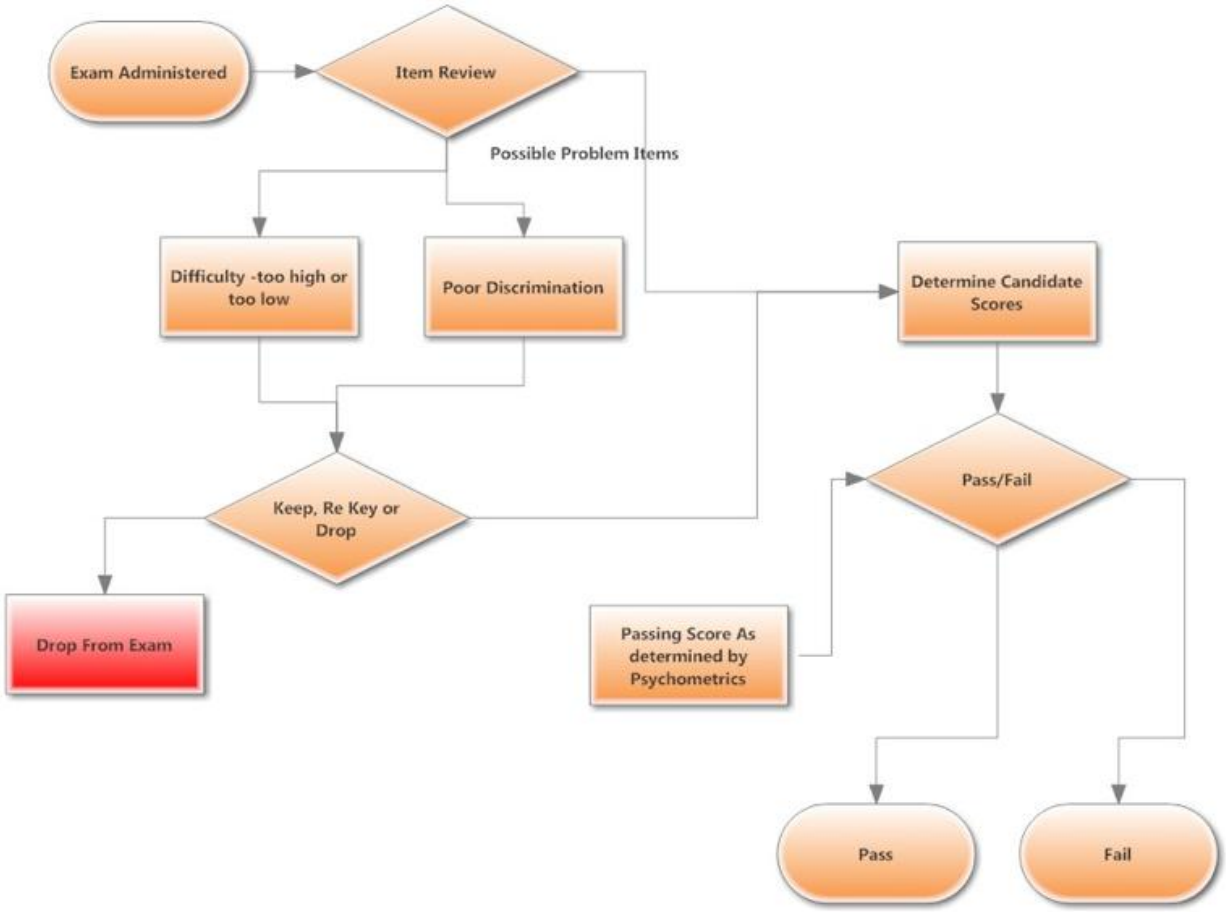
Image Processing and Rating of Item Difficulty (Angoff)



Exam Review Before Administration



Item Review After Administration


Exam Administered
Item Review
Possible Problem Items
Difficulty -too high or too low
Poor Discrimination
Determine Candidate Scores
Keep, Re Key or Drop
Pass/Fail
Drop From Exam
Passing Score As determined by Psychometrics
Pass
Fail

AMERICAN ASSOCIATION of PHYSICISTS IN MEDICINE

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ACR ACCREDITATION: FREQUENTLY ASKED QUESTIONS FOR MEDICAL PHYSICISTS

Dustin A. Gress, MS | Reston, VA

AAPM Newsletter — Volume 43 No. 5 — September | October 2018

Penny Butler driving into her retirement

We bid our beloved Penny a fond farewell and wish her all splendid things in retirement. In each issue of this newsletter, I'll continue to present frequently asked questions (FAQs) or other information of particular importance for medical physicists. You may also check out the ACR's accreditation web site portal for more FAQs, accreditation application information, and QC forms.

The ACR recently clarified requirements regarding medical physicist assistants and MR scientist assistants. The following FAQs address the ACR's requirements for use, training, and supervision of these assistants. Please contact us at accreditation@acr.org if you have questions.

Q. The ACR CT, MRI and Breast MRI Accreditation Program Requirements say that a medical physicist (or MR scientist for MRI accreditation) "may be assisted" by properly trained individuals in obtaining data in accordance with applicable regulations during the conduct of surveys and that the assisting individual must be under the direct supervision of the medical physicist (or MR scientist) during the surveys. However, the ACR Quality Control Manual says that the tests should be performed by the qualified medical physicist (or MR scientist) and does not mention the use of assistants. Is the use of assistants permissible?
A. Yes, the use of assistants that are directly supervised by the medical physicist (or MR scientist for MRI accreditation) is permissible.

Q. With regards to assistants, the ACR CT, MRI and Breast MRI Accreditation Program Requirements say that the medical physicist (or MR scientist for MRI accreditation) may be assisted by "properly trained" individuals in obtaining data in accordance with applicable regulations. Who is responsible for determining if the assisting individual is "properly trained?"
A. The medical physicist (or MR scientist for MRI accreditation) is responsible for determining if the assisting individual is "properly trained."

Q. With regards to assistants, the ACR CT, MRI and Breast MRI Accreditation Program Requirements say that "direct supervision" means that the medical physicist (or MR scientist for MRI accreditation) must be present in the facility and immediately available to furnish assistance and direction throughout the performance of the procedure. Can direct supervision be provided via phone or teleconference?
A. No. It is the intent of "direct supervision" that the person doing the supervision be physically present in the facility. Being "present in the facility" does not mean teleconferencing with the assistant. This would be "general supervision".

Q. With regards to assistants, the ACR CT, MRI and Breast MRI Accreditation Program Requirements say that "direct supervision" means that the medical physicist (or MR scientist for MRI accreditation) must be present in the facility and immediately available to furnish assistance and direction throughout the performance of the procedure. What does "the facility" mean?
A. For ACR accreditation purposes, "the facility" means "a geographical location where imaging is performed". It could consist of a single building or a group of buildings in close proximity such as those on a hospital campus. An office owned by the facility that is across town would not be considered part of the same facility and would be accredited as a different facility.

Q. The American Association of Physicists in Medicine (AAPM) is developing guidance regarding the use of medical physicist extenders. Will the ACR Accreditation Program requirements be consistent with this guidance?

A. Once the AAPM has completed their guidance on medical physicist extenders, the ACR physics subcommittees will review it and determine if changes to the current accreditation program requirements would be appropriate.

AMERICAN ASSOCIATION of PHYSICISTS IN MEDICINE

Improving Health Through Medical Physics

HEALTH POLICY & ECONOMIC ISSUES

Wendy Smith Fuss, MPH | Delray Beach, FL

AAPM Newsletter — Volume 43 No. 5 — September | October 2018

CMS PROPOSAL TO UPDATE EQUIPMENT PRICES YIELDS PAYMENT DECREASES TO RADIATION ONCOLOGY

The Centers for Medicare and Medicaid Services (CMS) recently released the 2019 Medicare Physician Fee Schedule (MPFS) proposed rule. The final rule will be published by November 1, with an effective date of January 1, 2019. The MPFS specifies payment rates to physicians and other providers, including freestanding cancer centers. It does not apply to hospital-based facilities. Payments to hospital outpatient departments is described in a separate article below.

As part of CMS authority under the Protecting Access to Medicare Act of 2014, CMS initiated a market research contract with StrategyGen to conduct an in-depth and robust market research study to update the MPFS direct practice expense (PE) inputs for medical supply and equipment pricing beginning in 2019. These supply and equipment prices were last systematically developed in 2004-2005. StrategyGen submitted a report with updated pricing recommendations for approximately 1,300 supplies and 750 equipment items currently used as direct PE inputs.

StrategyGen found that despite technological advancements, the average commercial price for medical equipment and supplies has remained relatively consistent with the current CMS price. However, while there were no statistically significant differences in pricing at the aggregate level, medical specialties will experience increases or decreases in their Medicare payments if CMS were to adopt the pricing updates recommended by StrategyGen. An initial analysis indicates that for radiation oncology the fluctuations in PE RVUs are significant, especially for SBRT and HDR brachytherapy services. In the aggregate, we anticipate an estimated two percent reduction in overall payment for radiation oncology services. CMS believes that it is important to make use of the most current information available for supply and equipment pricing instead of continuing to rely on pricing information that is more than a decade old. The table below details radiation oncology equipment items that will experience the greatest decline in reimbursement resulting from this proposal.

Given the potentially significant changes in payment that would occur, CMS is proposing to phase in the use of the new direct PE input pricing over a 4-year period from 2019-2022. CMS states that this transition period will not only ease the shift to the updated supply and equipment pricing, but will also allow interested parties an opportunity to review and respond to the new pricing information associated with their services.

AAPM will work with stakeholders to actively oppose inappropriate price reductions that do not reflect actual costs of equipment and will submit comments to CMS before the September 10 deadline.

Equipment Item	Current Price	Recommended Price	Percent Change from 2018-2022 after 4-Year Transition
SRS System, SBRT, Six Systems	$4,000,000	$931,965	-77%
HDR Afterload System, Nucletron - Oldelft	$375,000	$111,426	-70%
Water Chiller (radiation treatment)	$25,656	$9,847	-62%
Laser Targeting System (4 diodes)	$10,350	$4,603	-56%
Treatment Planning System, IMRT (Corvus w-Peregrine 3D Monte Carlo)	$350,545	$157,393	-55%
Radiation Virtual Simulation System	$967,000	$601,625	-38%
Brachytherapy Treatment Vault	$175,000	$134,998	-23%

A complete summary of the proposed rule and impact tables is on the AAPM website.

2019 PROPOSED RULE HAS PAYMENT INCREASES FOR RADIATION ONCOLOGY PROCEDURES IN THE HOSPITAL OUTPATIENT SETTING

The Centers for Medicare and Medicaid Services (CMS) recently released the 2019 Medicare Hospital Outpatient Prospective Payment System (HOPPS) proposed rule, which provides facility payments to hospital outpatient departments. AAPM will submit comments to CMS by the September 24 deadline. The final rule will be published by November 1, with an effective date of January 1, 2019. This rule does not impact payments to physicians or freestanding cancer centers.

CMS estimates an overall 1.25 percent increase in hospital outpatient facility payments in 2019 and all radiation oncology related Ambulatory Payment Classifications (APCs) have proposed payment increases from 0.1 percent to 3.2 percent (see table below). Payment for medical physics consultation codes 77336 and 77370 have a nominal 0.3 percent payment increase.

Summary of 2019 Radiation Oncology HOPPS Payments

APC	Description	CPT Codes	2018 Payment	2019 Proposed Payment	Payment Change 2018-2019	Percentage Change 2018-2019
5611	Level 1 Therapeutic Radiation Treatment Preparation	77280, 77299, 77300, 77331, 77332, 77333, 77336, 77370, 77399	$125.35	$125.68	$0.33	0.3%
5612	Level 2 Therapeutic Radiation Treatment Preparation	77285, 77290, 77306, 77307, 77316, 77317, 77318, 77321, 77334, 77338	$323.09	$327.18	$4.09	1.3%
5613	Level 3 Therapeutic Radiation Treatment Preparation	32553, 49411, 55876, 77295, 77301, C9728	$1,186.68	$1,208.10	$21.42	1.8%

APC	Description	CPT Codes	2018 Payment	2019 Proposed Payment	Payment Change 2018-2019	Percentage Change 2018-2019
5621	Level 1 Radiation Therapy	77401, 77402, 77407, 77789, 77799	$124.73	$127.79	$3.06	2.5%
5622	Level 2 Radiation Therapy	77412, 77600, 77750, 77767, 77768, 0394T	$219.83	$226.97	$7.14	3.2%
5623	Level 3 Radiation Therapy	77385, 77386, 77423, 77470, 77520, 77610, 77615, 77620, 77761, 77762	$522.31	$530.43	$8.12	1.6%
5624	Level 4 Radiation Therapy	77605, 77763, 77770, 77771, 77772, 77778, 0395T	$714.11	$714.95	$0.84	0.1%
5625	Level 5 Radiation Therapy	77522, 77523, 77525	$1,053.52	$1,081.08	$27.56	2.6%

APC	Description	CPT Codes	2018 Payment	2019 Proposed Payment	Payment Change 2018-2019	Percentage Change 2018-2019
5626	Level 6 Radiation Therapy	77373	$1,677.22	$1,702.73	$25.51	1.5%
5627*	Level 7 Radiation Therapy	77371, 77372, 77424, 77425	$7,565.69	$7,784.59	$218.90	2.9%

*Comprehensive APC

CMS maintains the Comprehensive APC (C-APC) policy for stereotactic radiosurgery (SRS), intraoperative radiation therapy and several brachytherapy needle/catheter insertion procedures in 2019. CMS defines a C–APC as a classification for the provision of a primary service and all adjunctive services and supplies provided to support the delivery of the primary service. Under this policy, CMS calculates a single payment for the entire hospital stay, defined by a single claim, regardless of the date of service span.

CMS proposes to continue making separate payment for the 10 planning and preparation services adjunctive to the delivery of SRS treatments using Cobalt-60-based or LINAC-based technology when these services are furnished to beneficiaries within 30 days of SRS treatment.

AAPM remains concerned regarding the accuracy of claims data for radiation oncology related C-APCs, as there is a great deal of discrepancy around how hospitals submit these claims. AAPM is also uncertain as to whether the rates associated with C-APCs adequately or accurately reflect all of the procedures and costs associated with those APCs.

A complete summary of the proposed rule and impact tables is on AAPM website.

AMERICAN ASSOCIATION of PHYSICISTS IN MEDICINE

Improving Health Through Medical Physics

UPSTATE NEW YORK CHAPTER REPORT

Mubin Shaikh, MS | Rochester, NY

AAPM Newsletter — Volume 43 No. 5 — September | October 2018

This year the Upstate New York Physicist Chapter hosted a meeting at the Jacobs School of Medicine in Buffalo, NY on June 22, 2018. The meeting included three distinguished speakers from within our community who shared their unique viewpoint about the current and future trends and directions of our profession.

> *"He who does not contemplate the future is destined to be overwhelmed by it "*
>
> **H.G. Wells**

Dr. Daryl Nazareth is a board certified therapy physicist and Associate Professor at the University of Buffalo. His presentation discussed clinical applications of quantum computing and digital annealing to radiotherapy optimization. He also spoke about the growth of deep learning and it's promising applications to the future of imaging and therapy physics.

Dr. Stephen Rudin is a fellow of AAPM and Director of the Medical Physics Program at the University of Buffalo. He has been active in the development of a host of cutting-edge technology and methodology in the area of medical diagnostic and interventional imaging. His talk discussed the expanded role of a medical physicist with the implementation of high resolutions cameras, dose tracking technology and 3D printing.

Dr. Richard Harvey is the Radiation Safety Officer of Roswell Park Cancer Center, and he spoke about the rapidly changing imaging and therapy treatments and the need for cross-certification.

In addition to the distinguished talks, we hosted a slam competition audition and invited three non-physicist judges to choose between six ambitious participants. The winner of our competition was Naveed Islam and he received a $500 cash award to present on the behalf of the chapter at the 2018 AAPM Annual Meeting.

The proffered and paper session included 10 student speakers from the Roswell Cancer Center Institute and Toshiba Stroke and Vascular Research Center who shared their research and competed for three cash award prizes. In total, we gave our young aspiring medical physicists $1100 in cash award prizes.

The next meeting is scheduled for October 2018 in Rochester, NY and we plan to honor a diagnostic physicist with a Lifetime Achievement Award for their contributions to our profession. More details about the event can be found on our new website.

UNYAPM Board and Young Investigator winners (left to right) : Lalith Kumaraswamy, Harish Malhotra, Mubin Shaikh, Stephen Bhagroo, Alexander Podgorsak, Naveed Islam, Vikas Patel, and Sanjay Raina.

AMERICAN ASSOCIATION of PHYSICISTS IN MEDICINE

Improving Health Through Medical Physics

IMAGING PRACTICE ACCREDITATION SUBCOMMITTEE REPORT

Tyler Fisher, MS | Costa Mesa, CA

AAPM Newsletter — Volume 43 No. 5 — September | October 2018

GUIDANCE AND CLARIFICATION OF THE JOINT COMMISSION FLUOROSCOPY STANDARDS

On June 25, the Joint Commission released the Prepublication Requirement for accredited organizations providing fluoroscopy. The standards will go into effect on January 1, 2019. The Joint Commission received a number of comments during the preceding comment period and modified the standards significantly to arrive at the current standards.

Many physicists, however, still have questions and have been asking for clarification regarding the new standards. During the Imaging Practice Accreditation Subcommittee meeting that took place in Nashville at the AAPM Annual Meeting, we were able to speak with Andrea Browne, Diagnostic Medical Physicist at the Joint Commission. She provided significant guidance and clarification regarding the intent and expectation of the Joint Commission regarding the new fluoroscopy standards.

The standards have been written with input from numerous stakeholders, including physician, technologist, and manufacturer representatives in addition to the input of the AAPM. The standards apply to all diagnostic uses of fluoroscopy, including mini C-Arms, standard C-Arms, traditional R/F equipment, and advanced interventional and cardiac cath equipment. The only exempted systems are those used for radiation therapy treatment planning or delivery (OBI).

A key point is that any Elements of Performance that are considered annual, specifically the medical physics testing requirements and the documentation of training of individuals that perform fluoroscopy, those standards must be met no later than December 31, 2019. For those other elements of performance, specifically designating a radiation safety officer to oversee diagnostic imaging, recording dose metrics in a retrievable format, identifying dose thresholds that require follow-up, and review of incidents requiring follow-up, those processes must be in place starting January 1, 2019.

Regarding the specific testing requirements of the annual medical physics performance evaluation, the following clarifications are our committee's interpretation of our discussion with Andrea. Comments in bold are considered minimal standards and any discussion thereafter represents an encouraged, best practice.

- Beam Alignment and Collimation
    - This evaluation **should** consist of a numerical result. Some states have this requirement, with pass/fail criteria, in place already, but others do not. For those states that do not have such limits, the following guidance from the FDA should be applied: "Neither the length nor the width of the x-ray field in the plane of the image receptor shall exceed that of the visible area of the image receptor by more than 3 percent of the SID. The sum of the excess length and the excess width shall be no greater than 4 percent of the SID."
- Tube Potential/kilovolt Peak Accuracy and Beam Filtration (Half-Value Layer)
    - There **should** be more than one kVp station recorded for kVp accuracy and HVL. For those using solid state dosimeters, these values are available for every measurement, so why not include that data. For those without solid state detectors, a representative sample over the range of clinical settings and the maximum rate should be performed. Results should be compared to state and/or FDA limits.
- High-Contrast Resolution
    - This **must** include a numerical result for resolution, not simply a pass/fail. Different magnification modes should also be indicated and significant discrepancies from baseline testing should be noted.
- Low-Contrast Resolution
    - This **must** include a numerical value, not simply a pass-fail. There are many phantoms available that provide this evaluation.
- Maximum Exposure-Rate in All Imaging Modes
    - This evaluation **must** include at least the Maximum Exposure setting in fluoroscopic mode and in a cine mode. For advanced systems (cardiac cath labs, angiography, interventional), best practice would include results for low, normal, and high fluoroscopy modes, a digital acquisition setting, and a DSA setting. The intent is not to require every frame rate at every dose setting, but to help users of fluoroscopy equipment to understand the differences between imaging modes.
- Displayed Air-Kerma Rate and Cumulative Air-Kerma Accuracy
    - The Joint Commission clarified that it would be acceptable to infer air-kerma rate accuracy from cumulative air-kerma accuracy. This element of performance will also be interpreted to include kerma area product accuracy if it is the only metric available. The Joint Commission does not specify a limit for accuracy, but the FDA recommended limit is ±35%.

For advanced systems capable of a 3D acquisition, the Joint Commission does not require any testing beyond what may be required by state regulation. For systems that may not be capable of performing a certain test (cumulative air-kerma), the physicist should document in the annual evaluation that this test is not available on the unit.

The Joint Commission included ongoing, annual education requirements for all individuals who perform fluoroscopy and specifically made a point to include physicians in that element of performance because they found a lack of awareness among some physicians to how they can best implement low doses. This element of performance, however, gives significant discretion to the facility as to how best to achieve the education. A surveyor will expect to see a written policy that states that education will be performed, that education will include radiation dose optimization techniques and safe operating procedures for the specific equipment, and documentation that all individuals have received the training. Online modules, staff meetings, or a daily huddle may be appropriate venues to receive this education.

The element of performance that requires cumulative air-kerma or kerma-area product be documented in a retrievable format does not require the use of dose monitoring software. A facility may use a paper log. The Joint Commission will want to see a written policy that states how this element of performance will be performed and then to verify that the facility does it as they say. For most facilities, fluoroscopy time is already being recorded, so the documentation of the more meaningful dose metrics should not be burdensome. Again, this element of performance applies to all fluoroscopy systems, including C-Arms and Mini C-Arms.

The final elements of performance require the facility to establish dose thresholds that, when exceeded, trigger further review that may include patient follow-up as well as a facility review of the incident. During the Annual Meeting, some suggested dose thresholds were 3 Gy for Peak Skin Dose (not displayed on most systems), 5 Gy for reference air-kerma, 500 Gy-cm^2 for kerma-area product, or 60 minutes of fluoro time.

Finally, the Joint Commission emphasized that, if you have questions regarding the standards, especially during an inspection, to please call the Standards Interpretation Hotline and you will be able to speak to an expert and they will provide clarification to you and/or the surveyor regarding the standards.

AMERICAN ASSOCIATION of PHYSICISTS IN MEDICINE

Improving Health Through Medical Physics

WGIMRT ARTICLE WATCH

Collaboration with the University of Miami (led by Nesrin Dogan) and the University of Chicago (led by Kamil Yenice)

AAPM Newsletter — Volume 43 No. 5 — September | October 2018

1. A novel approach to EPID-based 3D volumetric dosimetry for IMRT and VMAT QA

Alhazmi et al. developed a novel EPID-based approach to reconstruct a 3D dose distribution for patient-specific pre-treatment dosimetric QA of IMRT and VMAT plans. The 2D dose distributions were acquired in air and then converted to 2D dose distributions in water for each depth. The integrated 3D dose distribution was obtained by summing the reconstructed 3D dose distributions during treatment delivery. The reconstructed 3D dose distributions of the treatment plans were compared against the dose distributions measured from Octavius phantom using 3%/3mm gamma criteria with results showing 99% and 96% pass rate for static step-and-shoot IMRT and VMAT respectively.
Phys. Med. Biol. May 2018, 63 (11), pp: 1 – 13

2. A fast optimization approach for treatment planning of volumetric modulated arc therapy

Yan et al. proposed a novel, fast optimization algorithm for VMAT planning. The algorithm utilizes a progressive sampling strategy, starting with the coarse sampling first and then increasing the sampling resolution continuously. Authors used a gradient-based fluence-map optimization followed by a mixed integer linear programming algorithm for leaf sequencing. The new VMAT optimization algorithm was evaluated using a head and neck, a lung and a prostate. IMRT cases planned with a conventional IMRT method using a commercial TPS. For all cases, the quality of the VMAT plans are similar or better than the ones obtained with the IMRT plans. As expected, much better sparing of the OARs is achieved with the VMAT. In addition, the treatment delivery time of <5 min was achieved with the VMAT.
Radiation Oncology. May 2018, 13:101

3. The impact of robustness of deformable image registration on contour propagation and dose accumulation for head and neck adaptive radiotherapy

Zhang et al. evaluated the accuracy of two commercial DIR algorithms in Ray Station TPS as well as their ability to propagate contours and accumulate dose in Head and Neck ART. In this retrospective study, authors selected ten head and neck cancer patients who had weekly CT scans and received offline ART during the course of radiotherapy. The deformed and radiation oncologist-drawn contours on weekly CT scans were compared. The weekly doses were accumulated back to planning CT based on the two DIR

algorithms. The results showed Dice > 0.8 and HD < 0.1cm and mean dose variation < 60 cGy using the detailed settings of both DIR algorithms. However, simple settings in both DIR algorithms resulted in large geometric and dosimetric variations. Overall, this study showed that there were significant differences in both geometric and dosimetric parameters between two DIR algorithms and that individual parameter settings in each DIR algorithm found to have a significant impact on the results of the DIRs.
J Appl Clin Med Phys. May 2018, Volume 101, Issue 2, Pages 1-10.

4. Utilizing skin sparing technique in HN VMAT treatment

Spencer et al. investigated the reduction in skin dose using a skin sparing technique for ten head and neck patients treated with VMAT. The technique utilized a 5mm thick skin sparing structure which was created by subtracting wall from the 5Gy isodose line structure. The VMAT plans were then reoptimized using the new skin sparing structure. The comparison of the VMAT plans which were optimized using skin sparing structure showed up to 13% reduction in skin doses as compared to the VMAT plans optimized without skin sparing structure. This study demonstrated that the use of a skin sparing structure in the VMAT optimization has potential to reduce the skin dose, therefore reducing the skin toxicity during the course of treatment.
Medical Dosimetry. May 2018, Volume 43.

5. Optimal collimator rotation based on the outline of multiple brain targets in VMAT

Kim et al. investigated the ideal collimator rotation which resulted in the best dosimetric plan quality and MU efficiency using twenty patients with multiple target regions. The technique utilizes the integrated MLC apertures which is based on the outline of multiple brain lesions. Study results showed that 400 collimator angle resulted in lowest point-averaged field size values which were 1.5 times smaller than the one obtained with the fixed collimator angle currently used with the conventional IMRT plans. Furthermore, the improved sparing of some OARs and reduction in MU were achieved for VMAT planning of multiple brain targets.
Radiation Oncology. May 2018, Volume 13:88 Pages 1-10.

6. Volumetric modulated arc therapy of head-and-neck cancer on a fast-rotating O-ring linac: Plan quality and delivery time comparison with a C-arm linac

Michiels et al. compared the plan quality achievable with new O-ring, jawless linac (Halcyon, Varian Medical Systems) to the conventional C-arm linac for 30 patients with head and neck cancer. While standard C-Arm linac VMAT plans utilized 6MV beam with 2 arcs the O-Ring VMAT plans used 6FFF beam with both 2 arcs and 3 arcs. The same optimization weights were used for both C-Arm and O-Ring based VMAT plans. Minor improvements in target dose homogeneity and OAR sparing were obtained using the O-Ring based 3 arc VMAT plans as compared to the 3 arc VMAT plans. The results also demonstrated that the O-Ring based linac maintains the dosimetric quality of the C-arm based 2 arc VMAT plans.
Radiotherapy and Oncology. May 2018

7. VMAT optimization with dynamic collimator rotation

Lyu et al. developed a VMAT optimization method for dynamically varying collimator angle during the arc motion. The so-called dynamically collimated VMAT (DC-VMAT) optimization alternates between direct aperture optimization (DAO) and collimator angle selection. Feasibility of DC-VMAT using one full-arc

with dynamic collimator rotation was tested on a phantom with two small spherical targets, a brain, a lung and a prostate cancer patient. The plan was compared against a static collimator VMAT (SC-VMAT) plan using three full arcs with 60 degrees of collimator angle separation in patient studies. With the same target coverage, DC-VMAT achieved 20.3% reduction of R50 in the phantom study and reduced the average max and mean OAR dose by 4.49% and 2.53% of the prescription dose in patient studies, as compared with SC-VMAT. While DC-VMAT plans require slower gantry motion to accommodate multiple collimator angles, DC-VMAT with a single arc manages to achieve superior dosimetry than SC-VMAT with three full arcs.
Med. Phys. 45 (6), June 2018, pp.2399-2410

8. Interplay effect on a 6-MV flattening-filter-free linear accelerator with high dose rate and fast multi-leaf collimator motion treating breast and lung phantoms

Netherton et al. investigated the dosimetric delivery error (interplay effect) caused by the combined motions of patient anatomy and multileaf collimation (MLC) sequences of a new linear accelerator (Halcyon, Varian Medical Systems) having a high dose rate and fast MLC and gantry speeds. The authors developed IMRT and VMAT plans for breast and lung with varying complexity levels and arc numbers and measured delivered dose to MOSFET detectors implanted in motion phantoms under sinusoidal breathing motion simulations. The mean beam modulation for plans created for the Halcyon 1.0 linear accelerator was 2.9 MU/cGy (two- to four-field IMRT breast plans), 6.2 MU/cGy (at least five-field IMRT), and 3.6 MU/cGy (four-arc VMAT). Maximum and mean dose deviations increased with increasing plan complexity under tumor motion for breast and lung treatments. Concerning VMAT plans under motion, maximum, and mean dose deviations were higher for one arc than for two arcs regardless of plan complexity. To minimize dose deviations across multiple fractions for dynamic targets, the authors recommend limiting treatment plan complexity and avoiding one-arc VMAT on the Halcyon 1.0 linear accelerator when interplay effect is a concern.
Med. Phys. 45 (6), June 2018, pp.2369-2376

9. Increased accuracy of planning tools for optimization of dynamic multileaf collimator delivery of radiotherapy through reformulated objective functions

Engberg et al. investigated the potential of a new formulation of objective functions based on mean-tail dose and dynamic multileaf collimator (DMLC) deliverability constraints with an interior point method to efficiently solve the resulting multi-criteria optimization (MCO) to facilitate better automation in plan optimization than afforded by conventional planning objectives using penalty functions. The proposed formulation of objective functions and optimization strategy were tested on Pareto optimal DMLC plans for three patient cases: a prostate, a lung, and a head-and-neck case, subject to fulfilment of several PTV and OAR dose requirements expressed in terms of dose-at-volume, average, minimum and maximum dose limits. DMLC plans for the three clinical cases Pareto optimal to the proposed formulation compared well with those DMLC plans resultant from the penalty-based MCO module in RayStation, indicating the potential to streamline the planning process with appropriate objective functions, potentially eliminating the need for trial and error and time-consuming re-optimizations in the current planning process.
Phys. Med. Biol. 63 (2018) 125012 (12pp)

10. Comparative analysis for renal stereotactic body radiotherapy using Cyberknife, VMAT and proton therapy based treatment planning

Baydoun et al. carried out a retrospective analysis of stereotactic body Radiotherapy (SBRT) planning comparison for renal cell carcinoma (RCC) on five different platforms utilizing CyberKnife, VMAT, and pencil beam scanning (PBS) proton therapy at two institutions with an intention to evaluate the feasibility of multi-center RCC SBRT trial. Ten previously treated patients in a phase I trial were selected for this study. Using the anonymized CT data sets, treatment planning was performed across all five platforms with the goal of delivering 48 Gy to the PTV in five fractions. Treatment planning comparison produced comparable results for all platforms and techniques used. The study was limited to treatment planning aspects without looking into delivery and dose verification issues on different platforms and treatment units.

J Appl Clin Med Phys 2018; 19:3:125–130

11. Fully automated searching for the optimal VMAT jaw settings based on Eclipse Scripting Application Programming Interface (ESAPI) and RapidPlan knowledge-based planning

Huang et al. investigated automatically finding optimal VMAT jaw settings based on Eclipse Scripting Application Programming Interface (ESAPI) and RapidPlan knowledge-based planning in Eclipse workspace. Ten previously treated rectal cancer VMAT patient cases were selected to study the dosimetric impact of jaw settings on the VMAT planning and to find the best jaw configuration for MLC sequencing. The authors used ESAPI to create and evaluate a large number of plans automatically using various jaw settings such that X jaws were gradually extended toward the isocenter while the Y jaws were retracted by the width of an adjacent MLC leaf for adequate scatter contribution. The authors used a predeveloped and validated RapidPlan model to automate the assignment of objective functions and used a plan scoring function using a mean dose volume component and a high dose volume component corresponding to the mean dose and maximum dose to OARs, respectively. They confirmed the insensitivity of RapidPlan DVH estimate to actual jaw settings among plans with various jaws settings. Their scoring system showed that conformal jaw settings did not always produce the optimal VMAT planning.

J Appl Clin Med Phys 2018; 19:3:177–182

12. Comparison of MLC error sensitivity of various commercial devices for VMAT pre-treatment quality assurance

Saito et al. investigated sensitivity of detecting MLC delivery errors by several commercial QA devices including Scandidos Delta4, PTW 2D-array, iRT systems IQM, and the PTW Farmer chamber. The authors retrospectively selected nine previously treated VMAT plans for SBRT, prostate, and head-and-neck sites and introduced systematic MLC leaf position errors ranging from -0.75 mm to 0.75 mm in steps of 0.25 mm as well as a random error of 0.5 mm into MLC delivery files for selected VMAT plans. They evaluated the sensitivity of each measurement device for detecting intentionally introduced errors with respect to baseline measurements from original plans without the errors and determined the global gamma passing rates at 1%/1, 2%/2, and 3%/3 mm and dose differences at 1%, 2%, and 3%. The authors found a strong linear correlation for the cumulative dose differences from the original plans measured by the two ion chambers as a function of introduced MLC errors, with a statistically significant higher sensitivity for the IQM than that of the farmer chamber. Both Delta4 and PTW 2D-array performed similarly in

gamma analysis of pass rates. However, they were both found to be insensitive to small MLC positioning errors in the order of ±0.25 mm for small treatment fields such as SBRT. The authors also concluded that dose difference could be used as a better criterion than gamma for daily MLC QA.
J Appl Clin Med Phys 2018; 19:3:87–93

13. Creation of knowledge-based planning models intended for large scale distribution: Minimizing the effect of outlier plans

Aviles et al. proposed a process to properly identify outlier plans in creating knowledge-based planning (KBP) models and how to remove outliers from the model to increase accuracy and reliability of the model predictions for DVH calculations in prostate and head-neck test sites using the commercially available RapidPlan platform. They used statistical tools to classify outlier plans in three categories: geometric, dosimetric, and over-fitting outliers. They used an independent set of clinical plans than those used for training the model to validate DVH estimates obtained by the model. By removing the geometric and over-fitting outliers and replacing the dosimetric outliers after re-planning they were able to improve the accuracy of DVH estimation as measured by several DVH metrics (V50, V85, and V99) by -2% to 4% for the prostate model and -2.0% to 7.6% for the head-and-neck model.
J Appl Clin Med Phys 2018; 19:3:215–226

AMERICAN ASSOCIATION of PHYSICISTS IN MEDICINE

Improving Health Through Medical Physics

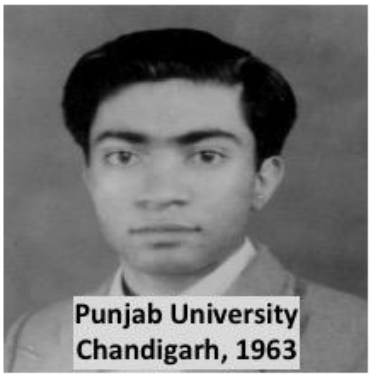
WILLIAM D. COOLIDGE GOLD MEDAL INTRODUCTION SPEECH

Thomas R. Bortfeld, PhD | Boston, MA

AAPM Newsletter — Volume 43 No. 5 — September | October 2018

It is an honor to introduce our 2018 Coolidge Award Winner **Dr. Radhe Mohan**. Everybody in this room knows Dr. Mohan. But what are the characteristics that made him win the highest award of our society, in addition to many other awards over the years? I believe number one is his enormous passion for his work. Number two is his drive to innovate and change things. And number three is his unlimited energy, which has kept him going as a Medical Physics Innovator for nearly half a century and counting.

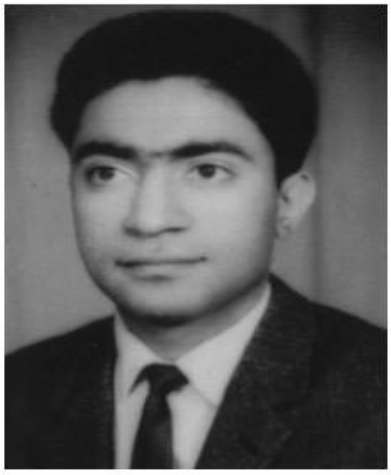
Radhe, brother & cousin, mid 50's]



Punjab University
Chandigarh, 1963

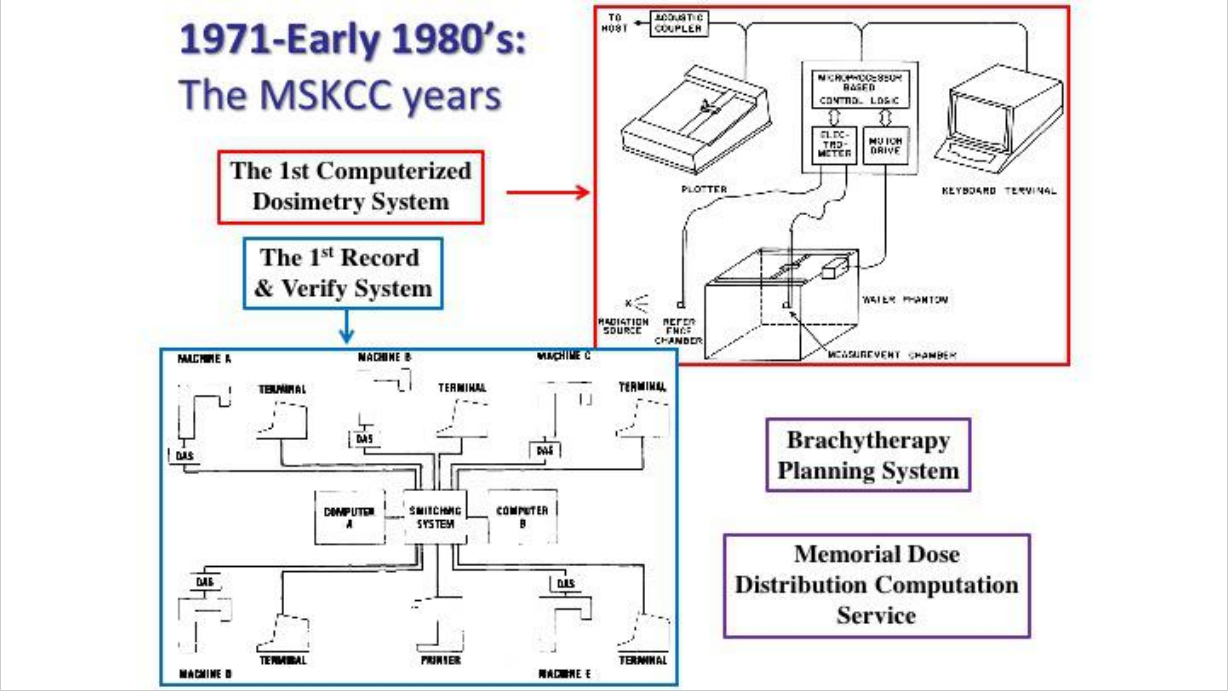
Chandigarh, planned city
Le Corbusier design
One of the "perfect cities of the world"

Radhe grew up in India and developed an early interest in physics. He did his BS and MS degrees in physics at Punjab University, Chandigarh. Chandigarh has an interesting history, it is one of the planned cities, designed primarily by the French architect Le Corbusier, and it has recently been named one of the perfect cities of the world.

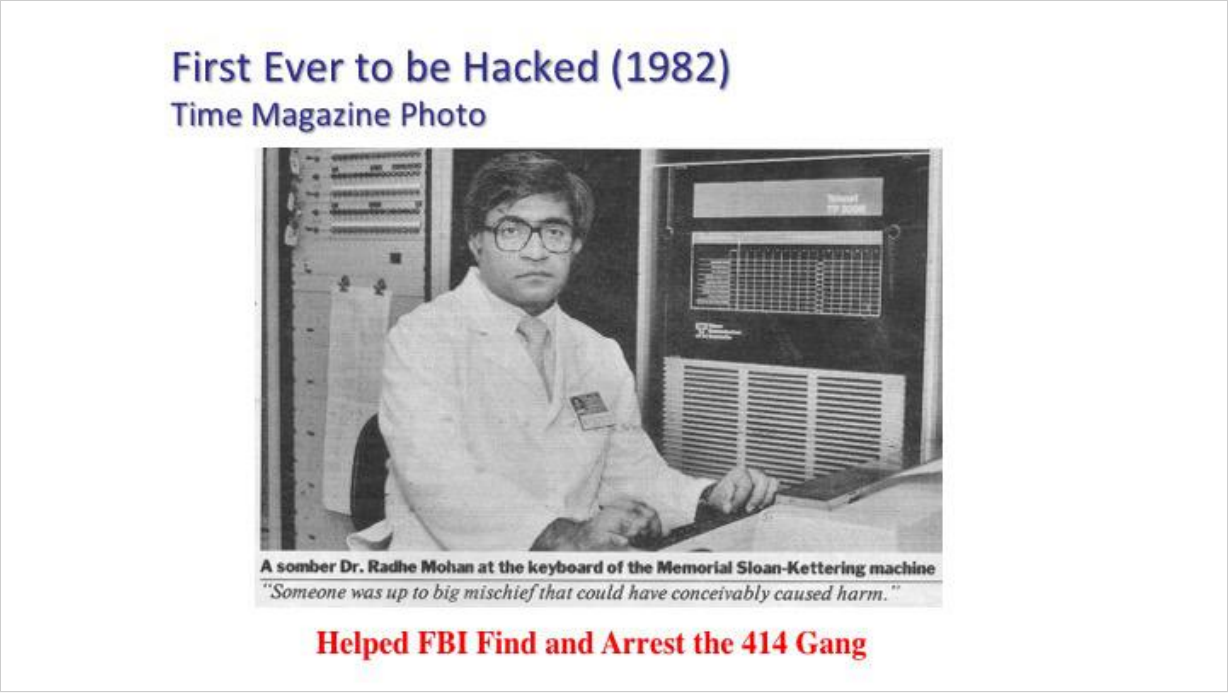


Fulbright Fellow USA 1965
PhD in Nuclear Physics
Duke University, 1969

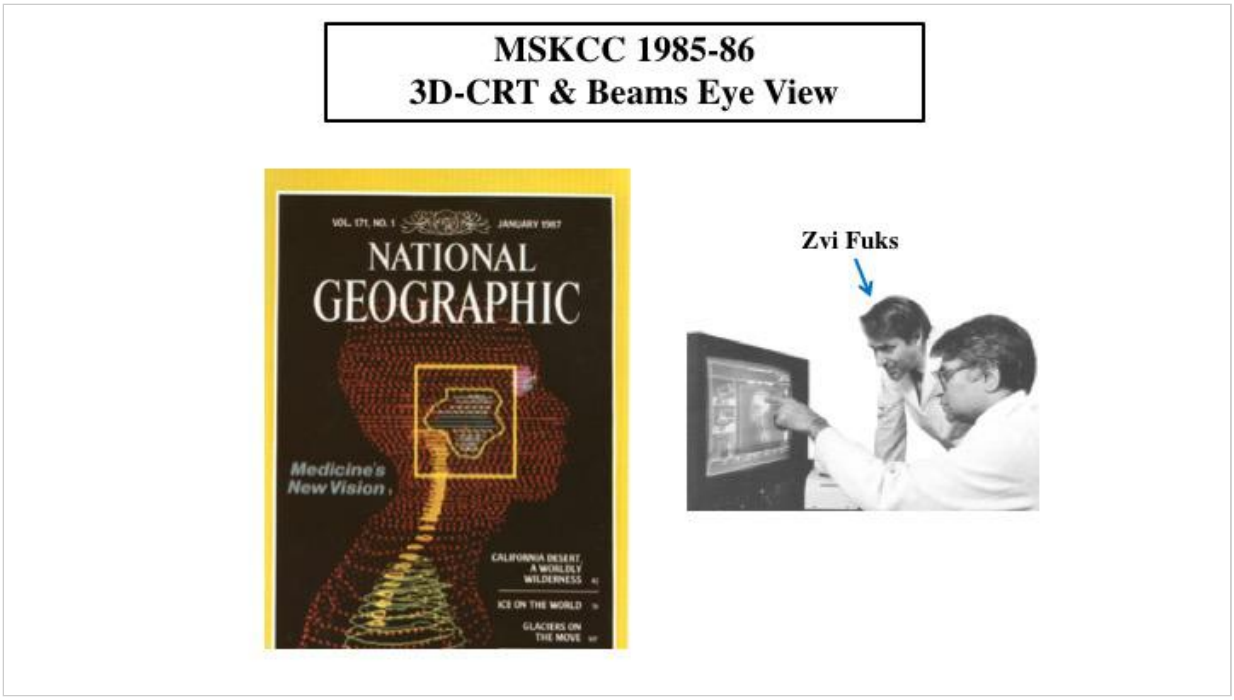
Nevertheless, Radhe decided to leave Chandigarh and move to the US with a Fulbright fellowship. He came to Duke where he did his PhD in nuclear physics. More importantly, he met and married his lovely wife **Millie** (an English major) and, two years later, welcomed their son **David**. A few years later, they adopted their daughter **Denise**.



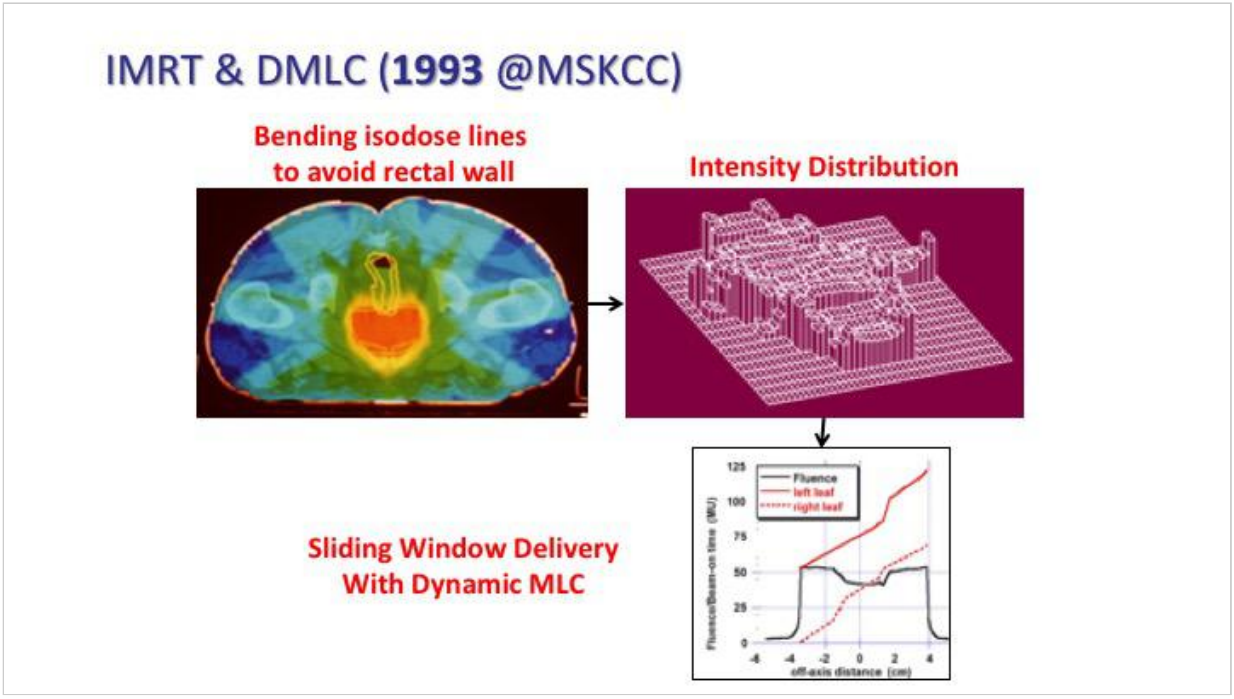
In 1971, Radhe started an enormously successful stretch of 25 years at MSKCC. His primary mission was to bring computers and programming to Medical Physics. His first project was to computerize dose measurements, and he was instrumental in developing the first record and verify system. Most importantly, he was a pioneer of dose calculation algorithms using pencil beams and Monte Carlo.



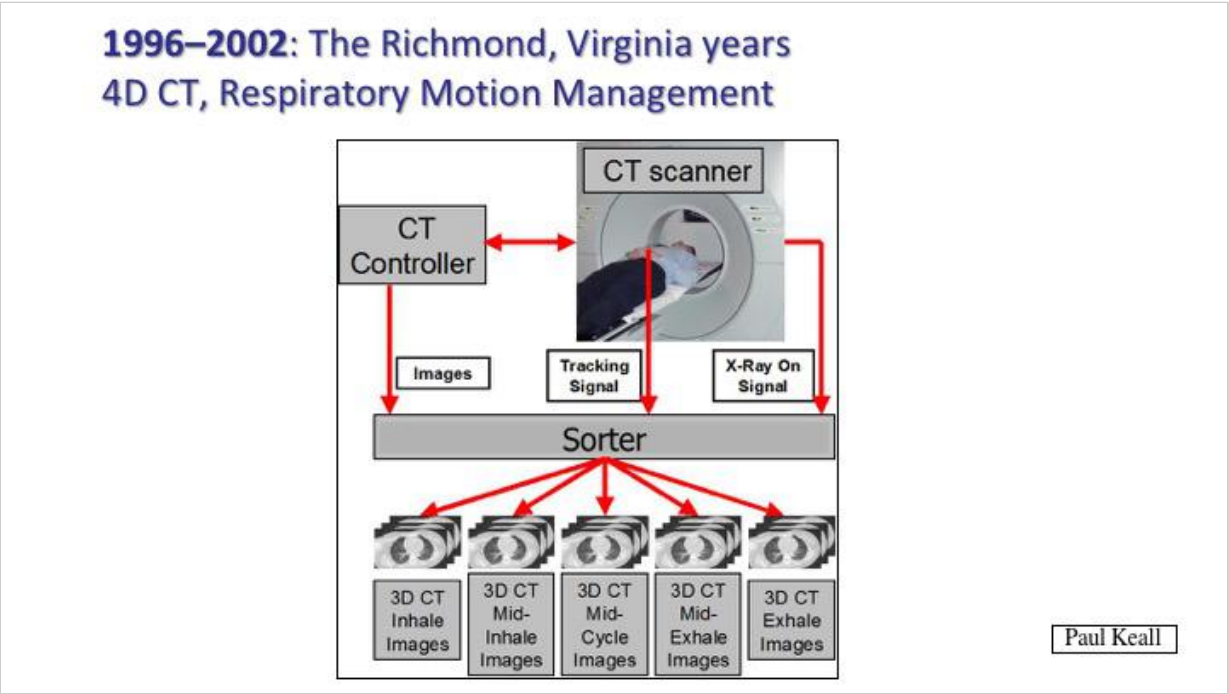
In 1982, Radhe and his group were the first target of a computer hacker attack. He worked with the FBI and helped to track the hackers.



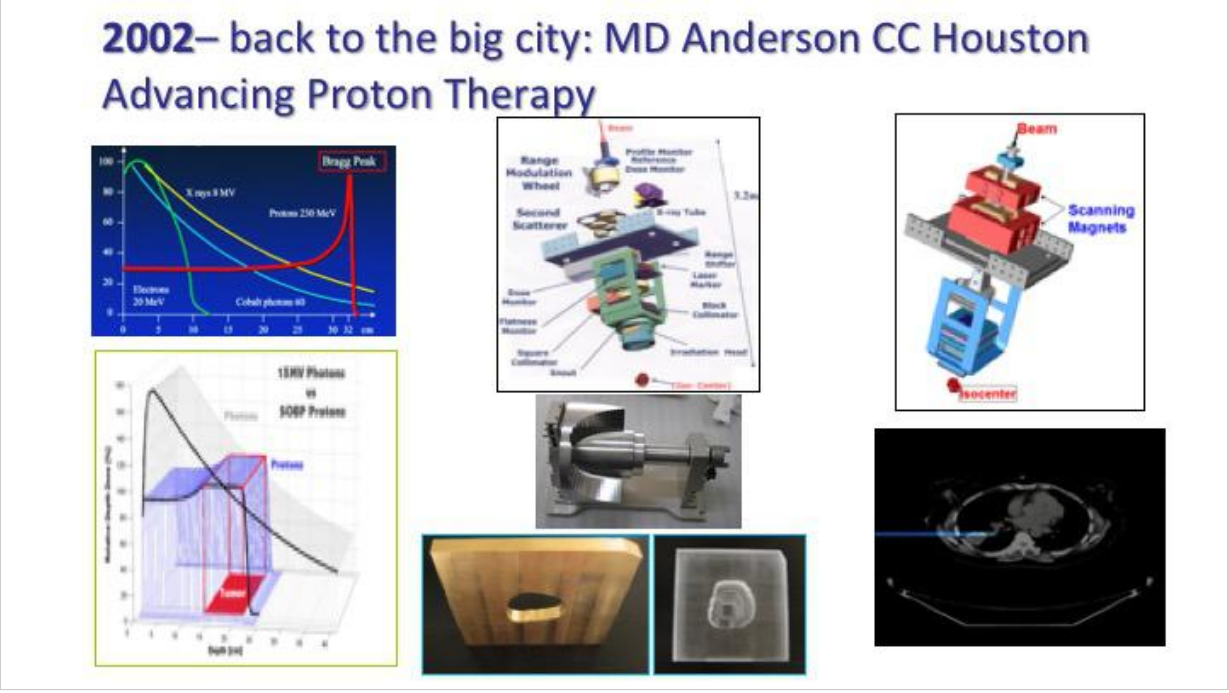
In 1987 his team's work on 3D conformal treatment planning made it to the front page of the National Geographic Magazine.



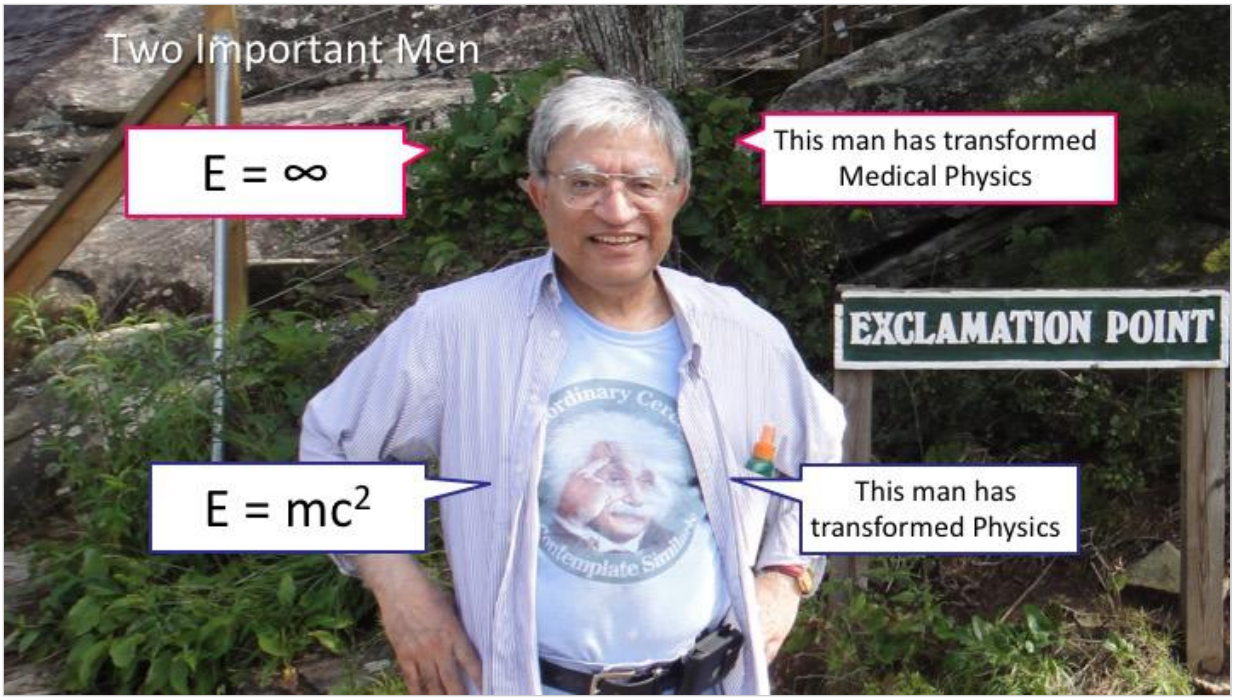
I met Radhe for the first time in 1993, when he invited me to MSKCC to implement my inverse treatment planning algorithm in their treatment planning system. Based on that system MSKCC treated their first MLC-based IMRT patient in 1995, which started the widespread use of IMRT in the world.



After 25 years in Manhattan, the Mohans decided it was time to move to Richmond, VA, where Millie is originally from. Radhe attracted a group of enormously talented people to VCU, including **Paull Keall** from Australia, **Jeff Siebers**, and **Qiuwen Wu**. They did groundbreaking work on 4D CT and respiratory motion management.



The last move (for now) happened in 2002, when Radhe became the chair of the medical physics department at **MD Anderson in Houston** — back to a big city. There he focused primarily on advancing proton therapy and helped pave the way for its rapid growth in the US and around the world. It also brought Radhe and me together once again through the fruitful collaboration on our program project grant between MGH and MDACC.



I like this photo of Radhe. Einstein has transformed our understanding of physics. I believe you will agree with me that Radhe Mohan has transformed medical physics. Radhe, I wish to thank you personally for sharing your passion for medical physics with me and with many others in this room. The field of medical physics, radiation oncology and especially our patients owe you a lot for bringing so many innovative technologies into the clinic.

We look forward to your next developments. You are the most deserving person to receive the 2018 Coolidge award.

AMERICAN ASSOCIATION of PHYSICISTS IN MEDICINE

Improving Health Through Medical Physics

WILLIAM D. COOLIDGE GOLD MEDAL ACCEPTANCE SPEECH

Radhe Mohan, PhD | Houston, TX

AAPM Newsletter — Volume 43 No. 5 — September | October 2018

Thank you, Thomas. And thank you for nominating me and for your glowing introduction. I do remember your visit in 1993 on your way back to Germany from MD Anderson. We worked together for just a couple of weeks to marry your IMRT algorithm with our 3D planning system. The results were just amazing and created a lot of buzz among my colleagues. This collaboration charted my research and development path for the next decade and a half. For that, I will forever be grateful.

Many thanks also to **Clif Ling**, **Paul Keall**, **Dave Rogers**, **Saiful Huq**, **Jatinder Palta**, and **Harald Paganetti** for their letters of support and to 20 others for their endorsements of the letters.

It is indeed a great honor to be the recipient of the 2018 Coolidge Gold Medal. It is truly humbling to be in the company of past Coolidge awardees who were the giants of our field. I would like to express my sincere thanks to AAPM and the Awards and Honors Committee.

I have been extremely fortunate in my life and career. I have had the privilege of working at the top two cancer centers– **Memorial Sloan Kettering** and **MD Anderson**. In between, I enjoyed five very productive years working with some of the very best at **Virginia Commonwealth University**.



I would like to pay tribute to my heroes, and those who influenced me. The late **John Laughlin** who gave me the opportunity to enter medical physics and who became a close friend and advocate; the late **Michael Goitein**, perhaps the most gifted medical physicist ever, a pioneer ahead of his time, from whom I learned the power of analytical thinking; and **Clif Ling**, from whom I learned the importance of biology for a medical physicist and how to lead and how to deal with bureaucrats and other thoughtless people.

You raise me up, so I can stand on mountains;
You raise me up, to walk on stormy seas;
I am strong, when I am on your shoulders;
You raise me up To more than I can be

Brendan Graham, an Irish songwriter and novelist
"You Raise Me Up" (2002)

I am a big fan of Irish music, and this Irish song you may have heard of says "You raise me up to more than I can be." This is very appropriate to my life; I have stood on the shoulders of outstanding and talented physicists, physicians, engineers and industry collaborators. There is a large number of individuals I owe this honor to; and not enough time to thank everyone, but I must mention a few.

My colleagues at MD Anderson **Mary Martel**, **Mike Gillin**, **Ron Zhu**, **Narayan Sahoo**, **Lei Dong**, **Uwe Titt**, **Dragan Mirkovic**, **Amy Liu**; and my physician colleagues: **David Grosshans**, **Stephen Lin** and **Xing Liao**, research program manager indispensable **Mei-Hwa Ferguson** and many others. It is also a matter of great pride for me to see many of my students, post-docs, and mentees being successful.

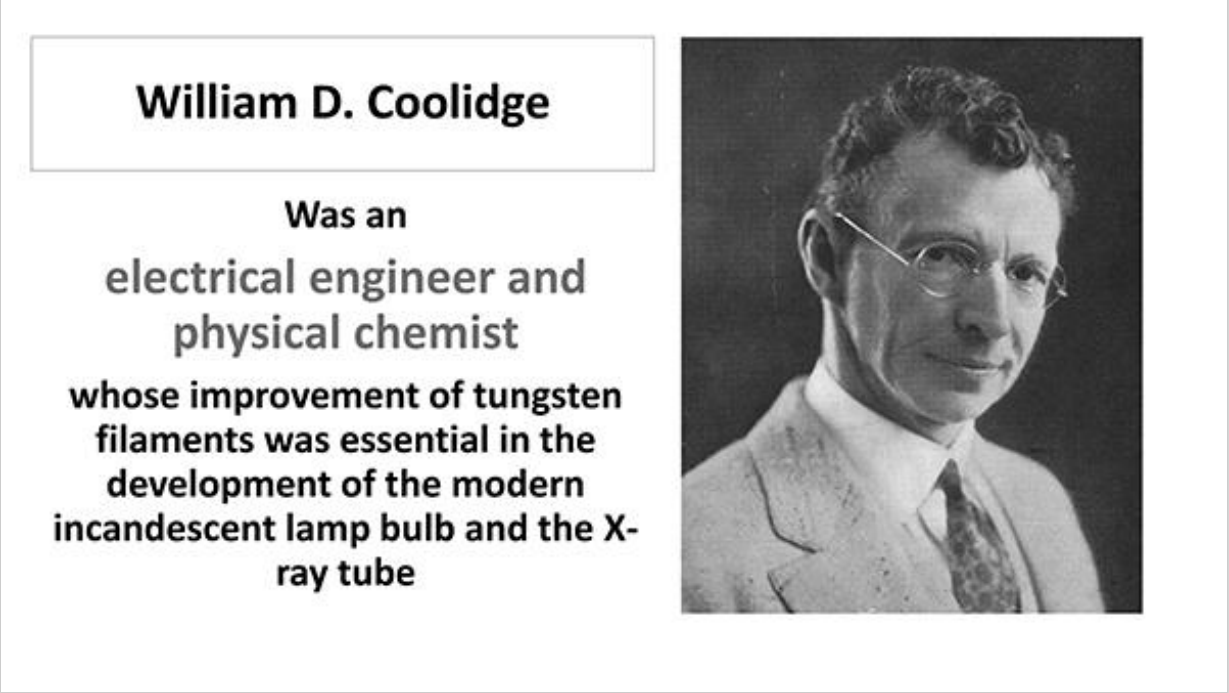
My former colleagues at Memorial Sloan Kettering (in addition to Clif Ling) **Andy Jackson**, **Michael Lovelock**, **Gig Mageras**, **Larry Rothenberg**, **Margie Hunt**, among others.

At Virginia Commonwealth University, **Paul Keall**, **Jeff Siebers**, and **Qiuwen Wu**. And my collaborators at MGH. I am thankful to all of them for contributions to my career.

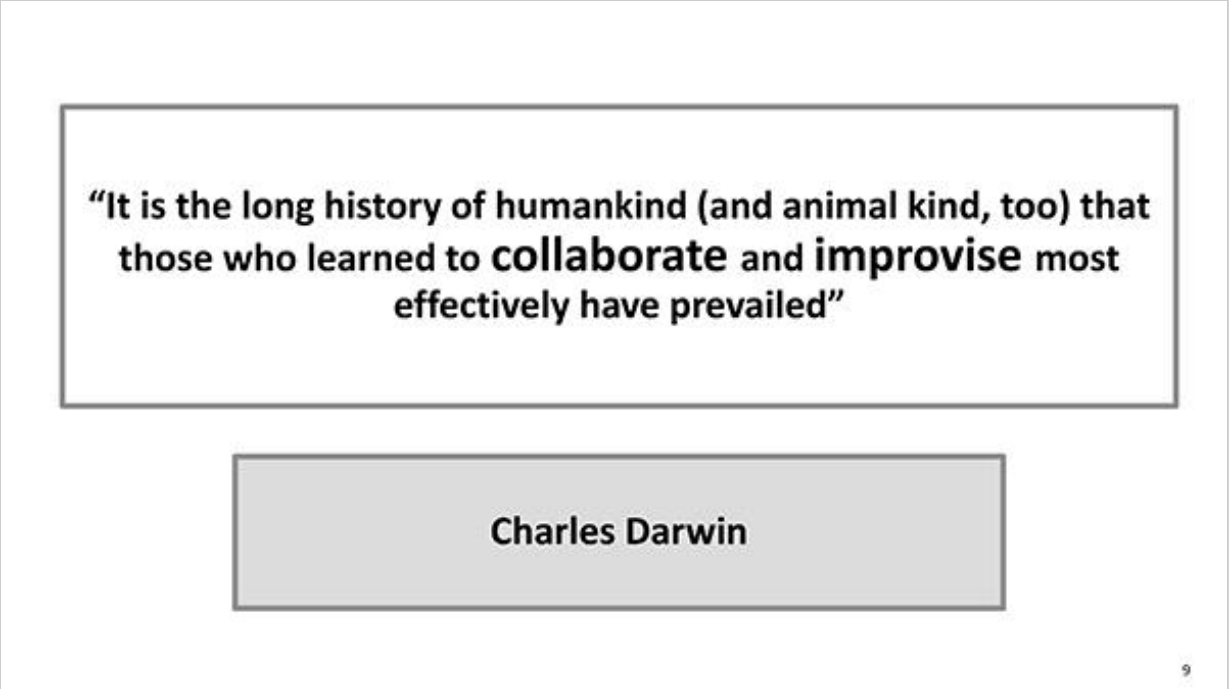
Most importantly, to my family for their love, understanding, and support throughout. My wife Millie, the real secret of my success, who used her skills as an English teacher to be of enormous help in my work. Actually, that was the easy part. Fixing my idiosyncratic cultural differences was a bigger challenge. She succeeded only partially in that I still misbehave on occasion. For instance, I selected this photo with horns on our grandson's head. And to our daughter Denise, her husband Ed and their children Robert and Amanda; and our son David and his partner John for their forbearance of my busy work life.

Being a member of the AAPM for over the last 47 years has been wonderful for me personally. It has helped me grow professionally and scientifically. Based on my observations about the direction in which our field is heading, I would like to share a couple of thoughts.

Like in many fields, there is a growing trend toward automation in our profession. Much of what we do in the clinic will be automated, a lot of it is already happening. To ensure that our profession thrives for our sake and for the sake of the patients we care for, we as a society need to increase emphasis on creativity, on problem solving, and on research and development.



Secondly, over the past many decades, our field has gained enormously from the infusion of talent from such fields as pure physics, mathematics, computer science, biomedical and electrical engineering, etc. I make a plea that AAPM lower barriers to the entry of scientists from other disciplines. William Coolidge would have found it virtually impossible to become a medical physicist by today's rules. We need multidisciplinary input to make progress and raise the value of our contributions.



This is a quote by Charles Darwin. Let me end with this statement: In this diamond Jubilee year of the AAPM, I believe that we're on the verge of a major leap forward in cancer therapy through the combination of advances in our field and the advances in biology and immunology, for example through

immunomodulatory properties of radiation, especially protons and heavier ions. I strongly believe that we, medical physicists, by combining our talents and skills with those of members of other disciplines can make a huge difference in enhancing cancer outcomes in years Beyond the Future.

AMERICAN ASSOCIATION of PHYSICISTS IN MEDICINE

Improving Health Through Medical Physics

EDUCATION MATERIALS AVAILABLE FOR MEDICAL RESIDENTS

Ashley Cetnar, MS | Columbus, Ohio & Matthew Studenski, PhD | Miami, Florida

AAPM Newsletter — Volume 43 No. 5 — September | October 2018

WHAT ARE THESE MODULES?

We want our physicians to have a strong understanding of the physics behind their practice. AAPM volunteers on the Radiation Oncology Medical Physics Education Subcommittee (ROMPES) have created web-based educational modules to aid in the education of medical residents. The topics are based on the American Society of Radiation Oncology's 2016 Core Physics Curriculum for Radiation Oncology Residents. The pilot release is now available for review and feedback, which includes 27 short videos covering topics such as basic physics, atomic and nuclear structure, production of x-ray beams, linear accelerators, and radiation interactions.

WHO ARE THEY FOR?

There are many challenges to teaching medical residents including attendance during a busy clinic day. One of the ways the modules can be used is for the residents to review the videos outside of class and spend valuable time within the class discussing and practicing what they have learned. This is known in the educational community as a flipped classroom approach. The modules were created for you as an instructor to use as a resource to help facilitate your classroom teaching and for the medical residents as a tool to help them learn about medical physics. Additionally, these modules could be useful for medical physics residents and graduate students, as well.

HOW CAN I ACCESS THEM?

The modules are web based and able to be viewed on any device including cell phones. The videos are hosted on Vimeo and the library can be accessed through the AAPM website.

Since this is a challenging website to remember, it can be more easily distributed to your colleagues and students by: tinyurl.com/RadOncPhysics

HOW CAN I HELP?

Your feedback is essential in guiding the future of our subcommittee. We appreciate your feedback for the pilot modules which will help direct the final product that will be helpful to you as an educator and your students as they learn the physics of radiation oncology. You can either contact us directly via email, complete the survey on the pilot page, or directly at: https://goo.gl/forms/tDg5jP87EDOw4zOJ2

AMERICAN ASSOCIATION of PHYSICISTS IN MEDICINE

Improving Health Through Medical Physics

WORKING GROUP FOR NON-CLINICAL PROFESSIONALS REPORT

Christine Gnaster, MS | Greensboro, NC

AAPM Newsletter — Volume 43 No. 5 — September | October 2018

The newly-formed Working Group for Non-Clinical Professionals (WGNC) is tasked with addressing the professional needs of non-clinical medical physicists (Professional Council | Professional Services Committee | Working Group for Non-Clinical Professionals). This cohort includes medical physicists in industry, regulatory, research, and academic careers. As the number of professionals from these cohorts increases in our membership, the Association is focused on being proactive to address their needs. The contribution of non-clinical medical physicists is significant to our field and the Association wishes to provide the essential foundation of support to all tracts of medical physics.

The group comprises AAPM members from each of the involved cohorts. This also includes Student and Junior members, who are critical in providing the unique perspective of the current educational tract and possible limitations being faced when entering or after entering non-clinical professional pathways. Additionally, a majority of the WGNC members had a start in clinical physics, giving a unique perspective to challenges that upcoming medical physicist may face in the future when choosing a non-clinical career path—even when transitioning from the clinic.

Collaboration with currently existing committees and groups will be critical to realize the outlined charge of the WGNC. One such group is the Working Group to Promote Non-Clinical Career Paths for Medical Physicists [WGNCMP], under the "parent" Student and Trainees Subcommittee. While the charge of this group is distinct from the WGNC, our goals are parallel in our focus on the non-clinical career pathways. The WGNCMP is working to promote pathways for current students and trainees to become involved in non-clinical medical physics while the WGNC is focused on addressing the needs of currently employed non-clinical medical physics professionals.

The charge of the WGNC includes tasks such as: identify AAPM activities and provide additional resources to serve the needs of non-clinical medical physicists; recommend methods to increase the number of such professionals joining and maintaining membership within the AAPM; promote leadership development for non-clinical medical physicists, both within AAPM and the workplace; and to

identify obstacles in membership contribution and MOC that may disproportionately affect medical physicists in non-clinical careers. To view a detailed list of the charge of the Working Group for Non-Clinical Professionals, we invite you to visit the WGNC webpage.

If you have any tasks you wish for the Working Group to address, or would like to get involved in some way, please contact the Working Group Chair, Christine Gnaster, via email at cgnaster@yahoo.com.

AMERICAN ASSOCIATION of PHYSICISTS IN MEDICINE

Improving Health Through Medical Physics

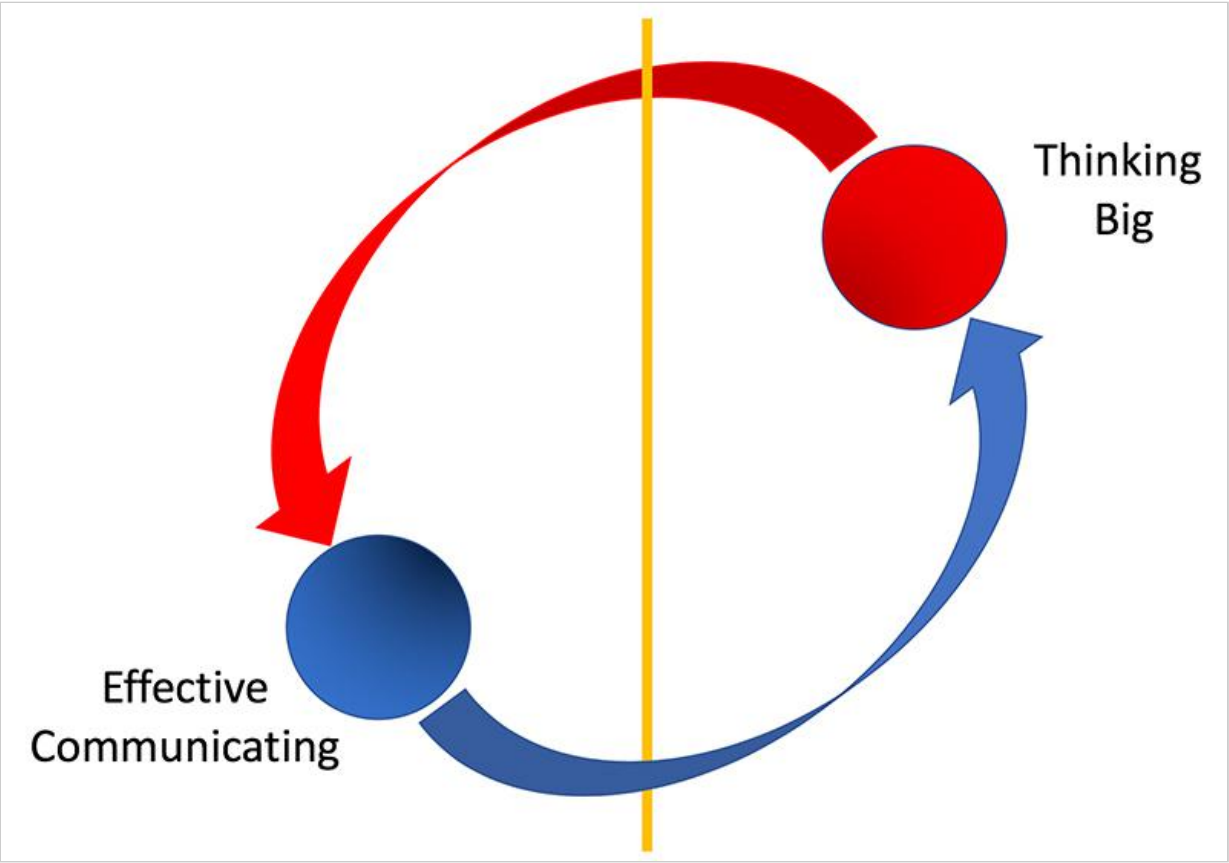
2018 PRESIDENT'S WORKSHOP

Bruce Thomadsen, PhD | Madison, WI

AAPM Newsletter — Volume 43 No. 5 — September | October 2018

I titled this the 2018 President's Workshop, but there has never been one before. This Symposium was intended to generate ideas for making the future for medical physics and the AAPM. **Paul B. Brown**, one of the keynote speakers at the President's Symposium facilitated the workshop. Without making you read through too much, in short, the assignment was for each of the nine tables to make a magazine cover from the future, looking back at "how medical physics became so great," with quotes and headlines about great things medical physics has done. The assignment also indicated that the featured article should address the obstacles we overcame. Lastly, we were to include the most important characteristics we needed to address to overcome those obstacles.

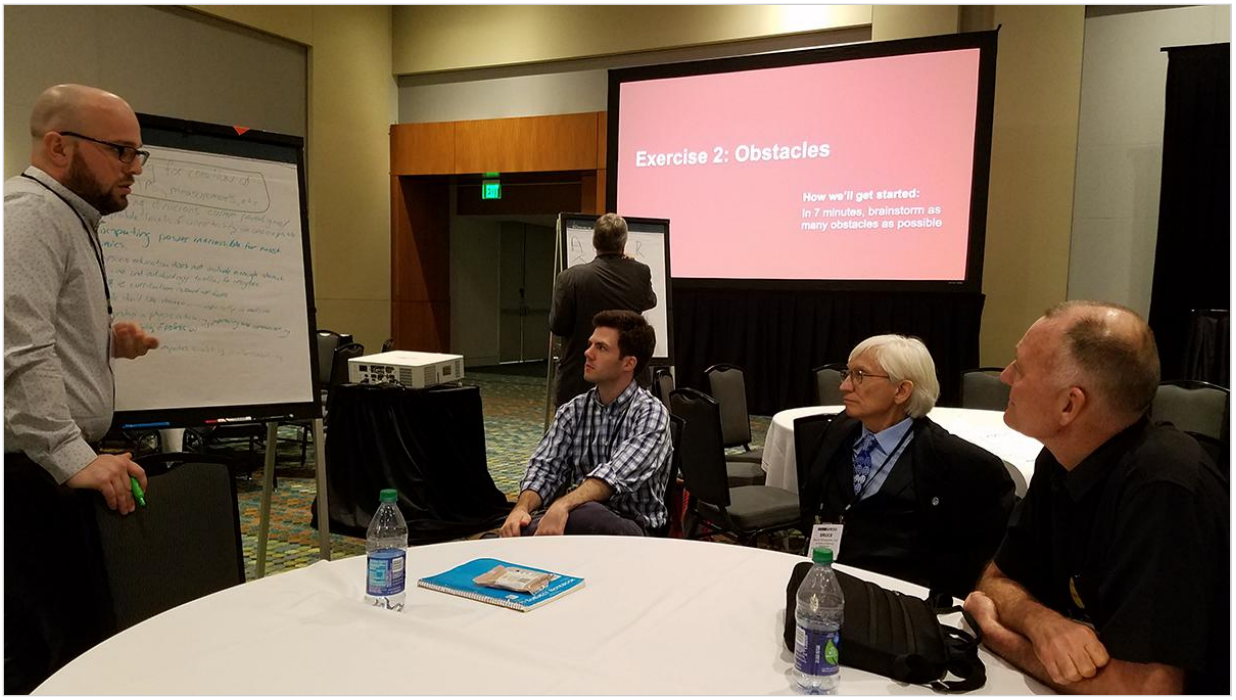
Each table made a list of reasons medical physicists fail: fail to get grants, fail in the clinic, fail to impress administrators, fail to be appreciated, fail to get regulations passed or repealed, etc. Then, Paul said, the next step is when the bloodletting begins. We were to pick the two most important causes. Each table did, with a minimum of bloodshed. But then, pick the most important! That was painful.



The results were surprising. About half the tables came to inadequate communication and the other half failure to think big enough. For almost all tables, whichever one was picked, the other was still high on the list. The final exercise was for each table to present arguments supporting its pick. At that point, however, I realized it was not a choice. Effective communication about us and thinking big enough go together inseparably. As in the figure (not my photograph at the top), they circle around each other like binary stars.

No, in one two-hour workshop, we did not solve the riddles of how to own our future, but using the concepts from the symposium, we did get to the heart of some of what we need to do. Examples of communicating, thinking big and communicating big were brought up, and I still have about 30 large flip-chart pages to digest and summarize. These will come in next Newsletter.

For this article, I spared you the details of what Paul B. Brown said at the President's Symposium — that also will be for the next Newsletter. Until then, think big thoughts.



Intense participants at the workshop plotting the future

AMERICAN ASSOCIATION of PHYSICISTS IN MEDICINE

Improving Health Through Medical Physics

TIPS FOR ASKING FOR AND WRITING PROFESSIONAL LETTERS OF RECOMMENDATION

From the New Professional Subcommittee and the Professional Mentorship Working Group

AAPM Newsletter — Volume 43 No. 5 — September | October 2018

This article can serve as advice to both those who need to request letters of recommendation and also to those who need to write letters of recommendation. These are professional letters of recommendation (school, residency, postdoc, job), which are different than the character references often requested by a potential landlord.

Why does a potential employer want a professional letter of recommendation?

- ✔ Your credentials look great, but what are you like in person? A reference letter can fill in the more human side of your application.
- ✔ Your qualifications on paper are thin, but maybe you have something unconventional to offer? A reference letter can show how the candidate has exceptional drive/ambition/skill.
- ✔ You are just starting out in the field, should the employer take a chance on you? A reference letter from someone who is trusted by the employer may vouch for the candidate as having a lot of potential.
- ✔ Your supervisor might explain why you have a great research career but are now interested in a clinical career.

Who should I ask to write a professional letter of recommendation for me?

- ✔ Your direct supervisor.

- ✔ Your professor/teacher.
- ✔ It's okay to ask someone you trust who they think you should ask for letters of recommendation.
- ✔ A professional who is senior to you and familiar with your work in medical physics (or science, technology, or math).
- ✔ Someone you have worked closely with and knows your work ethic, reliability, and competence, like a co-investigator.
- ✔ If applying to graduate school, current teachers/employers; it is okay to use any current and past employer since you will have relatively little experience within the medical physics field.
- ✔ When applying to residency, you will likely want to have more references from within the medical physics community (i.e. if you are still using many of your old references from undergraduate, this may be noticed as a negative). Supervisors and mentors from graduate school are fine.
- ✔ When asking for letters outside of medical physics, explain The Match, deadlines, and what can usefully be put in the letter.
- ✔ When applying to first job out of residency, it will help to have recommendation letters from individuals working in the field, preferably medical physicists you worked with during residency.
- ✔ It may be ok to use one or two older employers if you worked very closely with them or they know and will remember you very well.
- ✔ If you're applying for a job and you want to maintain confidentiality, you may ask for letters of recommendation from peers who know about your work, who you trust to keep your secret.

Who should I NOT ask to write a professional letter of recommendation for me?

- ✔ If the purpose of the letter is to establish professional qualifications, references outside the field will not be able to contribute to that purpose, for example;
- ✔ Your friend.
- ✔ Your family.
- ✔ If the purpose of the letter is to show how you will contribute to the future employer or program, references who are unfamiliar with your work or skills will not be able to contribute to that purpose, for example:
  - A professor who doesn't know you.
  - Someone you worked with a long time ago.
  - Someone who barely knows you .
  - Current supervisor, fellow student, or co-resident, if you need to maintain confidentiality — unless you feel you can trust them.

People who do not know you well will likely write a generic letter which will stand out as a red flag to future employers. Be cautious of directors of programs who may know your name but have little specific information about graduate students, since they often only meet them outside of the classroom. It may

be difficult for them to write a strong letter affirming your experience.

When should I ask someone to write a professional letter of recommendation for me?

- ✔ As soon as you have an address/website for them to upload it to — or even sooner. They could start writing before you know where the letter will be sent.
- ✔ Be sure to tell them the deadline; if there are several deadlines, let them know in writing which jobs have which deadlines.
- ✔ It's okay to check the writing progress with them, but don't ask too often. Some people are very busy and others might be forgetful — if you know this person well, you can gauge when/if they'll need a reminder.
- ✔ If you're asking just a couple weeks before the deadline, then ask them if they can write a letter in time.

How should I ask someone to write a professional letter of recommendation for me?

- ✔ Do not ask over text message/instant messaging, even if you know the person very well. This looks unprofessional.
- ✔ Asking in person or on the phone might allow you insight into how confident the letter writer feels about being able to write a letter for you.
- ✔ Asking, "Could you write an effective recommendation letter for me for [graduate school/residency/job]?" encourages the person you're asking to think about how familiar they are with your work and whether that's relevant to the type of letter you need. It's important to make sure that the writer will write a positive letter on your behalf; confirm beforehand!
- ✔ Offer a copy of your resume or CV to the person you're asking to write a letter of recommendation for you.
- ✔ Offer a copy of the ad to the person you're asking to write a letter of recommendation for you, so they know specifically what's required for the job.
- ✔ Prepare a list of points you want the individual to cover (that may help customize the application) to aid in the process of writing the letter.
- ✔ It's okay to discuss your career plans and the skills/strengths you have, as well as projects you worked on with the person you're asking to write a recommendation for you.
- ✔ Be prepared in case your reference wants you to write a first draft of his/her reference letter.
- ✔ If three letters of recommendation are requested, it's (usually) okay to ask more than three people to write letters for you. Note that The Match will only allow three letters.

Should I waive my right to review professional letters of recommendation?

- ✔ In a small community like medical physics, we want to establish trust.
- ✔ You want the recommender to feel free to be candid.
- ✔ If you don't trust your recommender, maybe you shouldn't ask that person to recommend you.

What if someone refuses to write a professional letter of recommendation for me?

- ✔ That usually means they don't feel they know you well enough to write the kind of letter you need.
- ✔ Think of someone who knows you better and/or more recently who you could ask.
- ✔ They may not have time to prepare a good letter for you.
- ✔ Usually a person who doesn't feel they can give you a good recommendation will try to gently refuse.
- ✔ Accept a refusal. Do not insist that someone who gently says no must write a letter for you.

What should be in a professional letter of recommendation?

- ✔ It should open with a description of how the letter writer knows the candidate.
- ✔ If a graduate student is applying for both diagnostic and therapy residencies, try to keep the letters open-ended and not tailored to one specific area.
- ✔ It depends upon what type of school/residency/job the recommendation is for. Some examples include your honest assessment of the candidate's:
  - Match for the position
  - Knowledge of medical physics (or physics, chemistry, engineering, math, etc.)
  - Willingness to learn
  - Responsibility - do they show up on time to meetings, do they accomplish what they need to, do they look ahead and proactively get things done, etc.
  - Ability to solve problems
  - Ability to work professionally
  - Ability to work independently and follow through on projects
  - Ability to communicate (spoken and written) with a variety of kinds of people
  - Attitude, particularly in professional situations
  - Flexibility to adapt to change
  - Flexibility to work with the clinic's schedule
  - Ability to work ethically
  - Creativity
  - Ability to organize information
  - Research abilities

- Ability to works as a team player
- Ability to work under stress
- Strengths

- ✔ Brief anecdotes that will support any of your assessments above can strengthen the letter.
- ✔ If a candidate has a significant weakness, a brief mention of that weakness and how they're able to compensate for it can be useful to the search committee.
- ✔ Close with a statement of why you think this candidate will be good for this job, stressing the candidate's strengths that are relevant to this job.

What should NOT be in a professional letter of recommendation?

- ✔ Any information that your professional responsibilities (e.g. doctor, pastor) require you to keep confidential.
- ✔ Intricacies of the candidate's work, unless they specifically illustrate how the candidate works/thinks or unless they're directly applicable to the school/residency/job the candidate is applying for.
- ✔ Personal details about the candidate (e.g. family, marital status, demographics).
- ✔ Unprofessional hobbies (e.g. drinking tendencies).
- ✔ It should not be a very brief statement lacking details. For example, "Jane Doe was a good student," may not add anything to the application.

AMERICAN ASSOCIATION of PHYSICISTS IN MEDICINE

Improving Health Through Medical Physics

IROC HOUSTON REPORT

Stephen Kry, PhD | Houston, TX

AAPM Newsletter — Volume 43 No. 5 — September | October 2018

CALIBRATION AS DOSE-TO-WATER OR DOSE-TO-MUSCLE

Calibration protocols such as TG-51[1] describe how to calculate dose-to-water and thereby provide the link between MU and dose-to-water. However, there is a disconnect when a patient is involved because the patient comprises (primarily) soft tissue, not water. Soft tissue has a different chemical composition than water and therefore different interaction cross sections. (Soft tissue also has a different density than water, but this by itself does not affect dose deposition because dose is energy per unit mass—more energy is deposited in the more dense soft tissue, but this is offset by the increased mass). The difference in chemical composition, however, means that there is approximately 1% less dose deposited in soft tissue than in water.

Historically, this 1% difference was often incorporated into the calibration of the linac. That is, after calibrating the unit as dose to water, a 0.99 factor was applied to this calibration. Such an approach was reasonable to ensure dose was calculated to tissue, and was also consistent with clinical trial standards as the NCI and IROC[2] support a dose-to-muscle standard.

However, there are several problems with trying to account for differences between soft tissue and water by using a manual 1% correction during the linac calibration. First, this is not done consistently by the medical physics field; 25% of IROC-monitored institutions apply this 1% correction, while the remainder do not. Second, this is a simplified correction that only approximates the difference in dose; for example, it doesn't account for changes in attenuation with depth between water and muscle. Third, and most importantly, it overlooks the impact of the treatment planning system in the dose calculation process. If the planning system incorporates material composition (not just density) into the calculation algorithm, then the calibration in water will automatically be converted to dose-to-tissue in the dose calculation. However, many algorithms do not incorporate chemical composition into the dose calculation (just density), in which case the algorithm simply calculates dose-to-water (albeit water of varying density).

To understand the impact of the algorithm, and how it relates to the application of a correction factor during the calibration, there are several scenarios that can be considered. If a 0.99 correction is applied to a linac calibration and the planning system algorithm accounts for the fact that the patient is not water, then this difference has been double counted and the delivered dose will be incorrectly low by 1%. On the other hand, if a 0.99 correction is not applied to the linac calibration, and the planning system algorithm treats the patient as made of water, then the delivered dose will be incorrectly high by 1%.

Although this is only a 1% correction, this is a systematic issue that affects calibration and therefore all patients treated. Therefore, to address this issue, and provide consistent guidance to the medical physics community, a report is being prepared through AAPM to provide practical guidance on this issue: "AAPM report on reference dose specification for dose calculations: dose-to-water or dose-to-muscle?" This report aims to provide a common standard (dose-to-tissue) to ensure consistent dose calculation across the practice of radiation oncology. This report, which is expected to be published soon, will recommend how to move from a calibration in water to a dose calculation in tissue by accounting for the differences in different commercial treatment planning system algorithms.

1. Almond PR, Biggs PJ, Coursey BM, et al. *AAPM's TG-51 protocol for clinical reference dosimetry of high-energy photon and electron beams. Med Phys. 1999;26(9):1847-1870*.
2. Gladstone DJ, Kry SF, Xiao Y, Chetty IJ. *Dose specification for NRG radiation therapy trials. Int J Radiat Oncol Biol Phys. 2016;95(5):1344-1345*.

AMERICAN ASSOCIATION of PHYSICISTS IN MEDICINE

Improving Health Through Medical Physics

2018 AAPM SUMMER SCHOOL REPORT

Parham Alaei, PhD | Minneapolis, MN

AAPM Newsletter — Volume 43 No. 5 — September | October 2018

This year's Summer School attracted 187 participants from 13 countries to gather at Vanderbilt University in Nashville, TN. The school focused on "Image Guidance in Radiation Therapy: Techniques, Accuracy, and Limitations" and was held just prior to the AAPM Annual Meeting. It consisted of 2.5 days of sessions covering all current IGRT techniques. The attendees had various levels of involvement with IGRT ranging from less than one year to over ten years.

The lectures started with a review of the history of IGRT, reviewed current IGRT techniques, and provided perspectives on the potential future developments. Some of the topics covered were 2D and 3D x-ray based imaging devices and techniques, imaging dose, CT and MR simulation, and non-ionizing radiation IGRT including ultrasound, surface, and image guidance.

The program consisted of 16 sessions, ending with an additional Q&A session on the last day. A chapter in the Summer School Proceedings book accompanied each lecture. A copy of the book was included with the meeting registration and is available through Medical Physics Publishing. All lectures were approved for Medical Physics Continuing Education Credits (MPCEC) and Self-Assessment Modules (SAM) credits.

The didactic sessions were complemented with the traditional Summer School social events, icebreaker and evening socials, which provided more opportunities for the attendees to interact with each other and the faculty. An informal survey of the participants by program directors indicated that both attendees and faculty had a favorable impression of the School and that, in addition to the learning, participants benefited from the networking opportunity and sharing of their experiences. Although formal program evaluations by the attendees is not completed at the time of this writing, preliminary post-school survey data indicates a very positive overall rating of the program.

The success of 2018 Summer School could not be possible without the yearlong commitment of the faculty, and expert management of **Karen MacFarland** from AAPM. Other AAPM HQ staff who contributed to the school and accompanying book include **Jaime Hoza**, **Phyllis Doak**, **Jackie Ogburn**, **Laurie Allen**, and **Abby Pardes**. Summer School Subcommittee Chair, **Holly Lincoln**, and Vice-Chair,

Vrinda Narayana were also instrumental in arranging a successful Summer School. Vrinda Narayana also volunteered as the emcee and photographer of the school and added "phun" to "physics" during the School.

Group photo, Summer School registrants

Summer School faculty and staff: front row L to R: Parham Alaei, Carri Glide-Hurst, Karen MacFarland, Hania Al-Hallaq, Emma Harris, Lei Ren; back row L to R: Ryan Flynn, Patrick Hill, Kevin Teo, Alonso Gutierrez, George Ding, Jonathan Sykes

Vrinda Narayana, Summer School Subcommittee Vice Chair, provides closing comments.

AMERICAN ASSOCIATION of PHYSICISTS IN MEDICINE

Improving Health Through Medical Physics

AIP'S TEAM UP

Skye Haynes, AIP Marketing and Communications Intern | College Park, Maryland

AAPM Newsletter — Volume 43 No. 5 — September | October 2018

HOW AIP'S TEAM-UP IS ADDRESSING RACIAL DIVERSITY IN THE PHYSICAL SCIENCES

The number of physics degrees awarded to African Americans is stagnating, and AIP's TEAM-UP plans to find out why.

As the number of physics bachelor's degrees increases each year, one group remains consistently underrepresented. African Americans earn only four physics bachelor's degrees for every 100 that are awarded. This dilemma has many asking: why do so few African Americans pursue a degree in physics or astronomy? AIP's Task Force to Elevate the Representation of African Americans in Undergraduate Physics and Astronomy (TEAM-UP) intends to find out.

AIP has dedicated itself to ensuring that inclusion and diversity are represented in the physical sciences. In 2017, AIP launched TEAM-UP to examine and assess the persistent underrepresentation of African Americans in physics and astronomy at the bachelor's level. The goal of TEAM-UP is to eventually bring the rate of African Americans obtaining physics and astronomy degrees to parity with their overall graduation rate (from 4 percent to 9.5 percent).

AIP's **Arlene Knowles**, the project manager for TEAM-UP, graduated from Cornell with a degree in human development and pre-medical studies. At Cornell, Knowles enrolled in her first physics course and instantly felt the disparity.

"I came from a regular public school, and there were a lot of students who came from private schools that had a lot more resources. They just had better preparation. It was a little intimidating at some points," Knowles said. "There was a physics class where there was no instructor, so you had to teach yourself. I had major questions, and only had ten minutes with a grad student. That was discouraging. I believe I could have benefitted from some good teaching."

After school, Knowles spent many years at a member society doing diversity work in the physics community.

Reflecting on her diversity experience, Knowles believes the low participation of African Americans in physics and astronomy programs is in part due to bad PR, but also due to experiences once they have entered programs.

"People don't realize what you can do with a physics degree," Knowles said. "If you get an engineering degree, you're an engineer. If you get a law degree, you're a lawyer. When you get a physics degree, what are you? Nobody knows. Most people think you have to become a physics professor and that may not be what they want to be. Studies have shown that women and minorities are really motivated by helping their communities, and there's a disconnect between getting a physics degree and what you can really do to advance your community. I don't think we do a good job of educating people on that."

With regard to experiences in their departments, members of the physics and astronomy communities can do ordinary, everyday things to help close this racial gap, Knowles says.

"First, faculty have to build trust with students. Particularly students who are from different cultures and races... Letting students know that you believe in them and that they have what it takes to succeed, and that you're willing to support their success... Listen to what they have to say and what their motivations are. Figure out what they want to do and help them achieve that."

Knowles says that AIP Member Societies can shape the culture of physics and astronomy by prioritizing diversity and creating initiatives to uplift African American physicists, and society members can do the same by communicating the need for diversity to member societies.

"You can't solve problems with people who are all the same. You need different perspectives and ideas," Knowles said. "Diverse teams care about diverse problems."

TEAM-UP created a survey to measure the experiences of African Americans who are either studying physics or dropped out of their physics studies. This survey, which Knowles says is the first of its kind, seeks to uncover the factors that impede or encourage African American participation in physics and astronomy.

Once the survey's data has been collected and analyzed, TEAM-UP plans to visit institutions that produce higher levels of African American physics and astronomy bachelor's degrees. Afterward, the task force will develop evidence-based recommendations for the broader scientific community.

"My hope is that the broader community will see these recommendations and really feel it's important to act on them," Knowles said.

On Twitter, TEAM-UP hosts Twitterchats that are aimed at explaining their mission and showcasing the staff dedicated to accomplishing it. Follow @AIP_TEAMUP to stay updated on TEAM-UP's progress as they work to end the disparity in African American representation in physics and astronomy.

AMERICAN ASSOCIATION of PHYSICISTS IN MEDICINE

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SOUTHERN CALIFORNIA CHAPTER OF AAPM (AAPM-SCC) REPORT

Varun Sehgal, PhD | Orange, CA

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The Southern California Chapter of the AAPM held the 2018 Norm Baily Awards and the Inaugural MedPhys Slam on May 8, 2018 at The Cove at UCI Applied Innovation on the UC Irvine Campus in Irvine, CA. Sixteen entries were received in all for the research competition open to Graduate Students/Post-doctoral researchers and residents from various schools around Southern California. Cash prizes were distributed to the first and second places in the Graduate Student and Post-doc/Resident category respectively. The first-place winner in the graduate student category was **Kaley Woods** of University of California at Los Angeles for her study entitled "A Double-Focused Sparse Orthogonal Collimator for Small Animal IMRT Using Rectangular Aperture Optimization". The second-place winner in the graduate student category was **Dylan O'Connell** also from University of California, Los Angeles. In the Post-doc/Resident category the first-place winner was **Victoria Yu**, PhD for her research entitled "Novel Optical whole-body patient surface mapping for robust personalized collision modeling and prevention in external beam radiotherapy" while the second-place winner was **Wenbo Wei**, PhD from the University of California, Irvine. The first-place winners in each category gave a 10-minute presentation on their respective research efforts.

The second part of the Awards Ceremony was dedicated to the MedPhys Slam competition. Four students/residents participated in the MedPhys Slam wherein they highlighted their research in a 3-minute presentation aimed at sharing the what, how, and why of their research and convincing the audience that their work is impactful and important. The audience was polled using a web-based audience response platform to determine the winner. **Kaley Woods** from the University of California, Los Angeles was judged the winner of the MedPhys Slam Competition and represented the Southern California Chapter at the MedPhys Slam competition held on July 31, 2018 at the AAPM Annual Meeting in Nashville, TN.

In other news, the Chapter recently held elections and **Laura I. Cerviño** from University of California, San Diego and **Sharon Qi** from University of California, Los Angeles were elected President-Elect and Board Representative respectively.

The next Chapter Meeting (Fall Meeting) is scheduled for October 2018 at the University of California, Los Angeles Campus. Program details will be posted on the Chapter website in the near future.

The winners of the 2018 Norm Baily Awards at the Awards Ceremony and Dinner held at The Cove at UC Irvine Applied Innovation in Irvine, CA. From left to right, Wenbo Wei, Kaley Woods, Victoria Yu, Dylan O'Connell and Southern California Chapter Education Committee Co-Chair, Marianne Plunkett, MS.

Ryan Neph from the University of California, Los Angeles presenting a 3 minute overview of his research as part of the MedPhys Slam competition organized by the Southern California Chapter of the AAPM at the Norm Baily Awards Ceremony and Dinner held at The Cove at UC Irvine Applied Innovation in Irvine, CA.

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WORLD CONGRESS ON MEDICAL PHYSICS AND BIOMEDICAL ENGINEERING, JUNE 3-8, 2018 | PRAGUE, CZECH REPUBLIC

Melissa Martin, PhD, IOMP Delegate | CA

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The AAPM was well represented at the World Congress on Medical Physics and Biomedical Engineering which was held June 3-8, 2018 in Prague, Czech Republic. Our three IOMP delegates were **Yakov Pitman**, **Melissa Martin**, and **Jatinder Palta**. The Congress was held over six full days of presentations with sixteen simultaneous tracks from which to choose presentations by excellent speakers. The International Organization of Medical Physics (IOMP), in which the AAPM is a member society, holds their official meetings on the Tuesday morning of the Congress. At that time the site selection for the meeting to be held in six years is discussed and the presentations are made on Monday evening by each of the sites bidding to host the meeting in 2024. Other resolutions and items of discussion are acted upon by the delegates from around the world during the morning meeting of the delegates. On Tuesday, the delegates met to vote on the site selection with the winner announced. The 2021 World Congress will take place in Singapore and the 2024 World Congress will take place in Adelaide, Australia at their Biotechnology Center. Three of the officers in the IOMP that are leaders within the AAPM: **Yakov Pitman**, **Geoff Ibbott**, and **Ibrahim Dahini** are all elected officers.

A meeting of the Regional Organizations Board of the IOMP is also held at lunch during this meeting. Each regional representative gives an update on activities of their organization or region. With the AAPM, EFOMP, and Australian Medical Physics Society being the most developed and active groups, the other organizations look to us to help them move forward in their countries. Setting up the International Certification Board is a major project of the Regional Organizations for those areas that do not have their own certification boards already. The value of access to AAPM's Virtual Library is a prime project for discussion among the other organizations.

On Tuesday evening the Presidential Reception was held for the IOMP. This year was a very special year for AAPM at this reception where Fellowship and Honorary Membership Awards are presented. Three out of the four IOMP members who were awarded Fellowship in the IOMP are AAPM members: **Geoff Ibbott**, **Yakov Pitman**, and **Melissa Martin**. The other member awarded Fellowship this year was **Magdalena Stoeva** of Bulgaria. **Mathuna (Matthew) Al-Ghazi** from UC-Irvine was awarded Fellowhip in 2017 but was unable to attend the last meeting so he also was awarded his IOMP Fellow Certificate and Lapel Pin at this year's reception. Congratulations to these members for their work towards the objectives of the IOMP for the global development of medical physics.

One of the Special Session Tracks this year was on "Women in Medical Physics and Biomedical Engineering" organized by **Eva Bezak**, PhD, from Adelaide, Australia. **Melissa Martin** made the presentation on "Outstanding Female Physicists within the AAPM" featuring **Edith Quimby**, **Rosalyn Yalow**, **Ann Wright**, **Maryellen Giger**, **Marilyn Stovall**, **Jean St. Germain**, **Melissa Martin**, **Mary L. Meurk**, **Cari Borras**, **Cynthia McCullough**, and **Mary Martel**. Statistics on female membership throughout AAPM's history were presented and correlated with other organizations. Many other members of AAPM presented scientific work at this World Congress which contributed to the very successful meeting that it was. The Wednesday night dinner for attendees was held in one of the oldest castles in Prague for a fantastic highlight of the meeting. Participation in these World Congress meetings provides our members unequalled opportunities to interact with other medical physicists from around the world to compare techniques and results.

2018 IOMP Fellowship Recipients(L - R): Yakov Pitman, Melissa Martin, and Geoff Ibbott with 2017 IOMP Fellowship Recipient, Matthew Al Ghazi

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CRCPD UPDATE

Jennifer Elee, BS | West Monroe, LA

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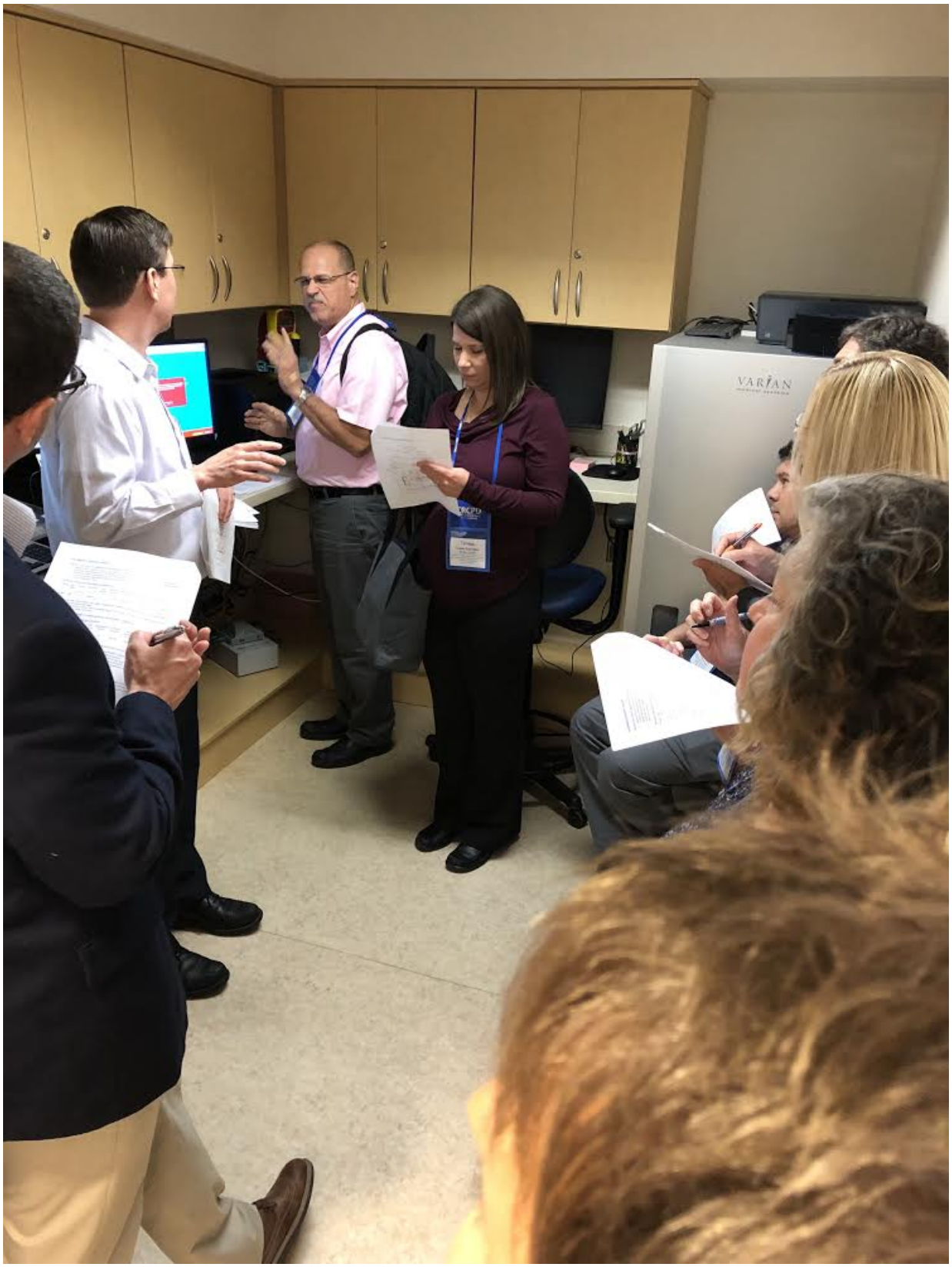
"50 Years Strong" was the theme for this year's Conference of Radiation Control Program Directors Annual Meeting in Charleston, SC. As always, AAPM had a strong presence at this meeting as trainers, presenters, and attendees. AAPM members provided a one-day technical training for State personnel on "Shielding: Up Close and Personal," which included a field trip to the Medical University of South Carolina —many thanks to **Ken Vanek**, PhD and **Russ Ritenour**, PhD. There were over fifty regulators at this session. In keeping with the 50th anniversary theme, AAPM also moderated a topical session on "Medical Physics: Past, Present and Future." Multiple AAPM members, including current President, **Bruce Thomadsen** PhD, were also featured presenters in the proceedings Healing Arts session. **Kathleen Hintenlang**, PhD and **Melissa Martin**, MSc, AAPM's CRCPD Committee Chair and liaison to CRCPD RPAC respectively, also attended the CRCPD Board meeting. The interaction with and input from AAPM continues to be an invaluable resource to CRCPD. The relationships that we have forged over the past fifty years have grown and flourished. There are currently many AAPM members serving as resource members and advisors to CRCPD committees on healing arts issues as well as on the suggested state regulations committees. As state regulators and the physicist community deal with similar issues, we will continue to work together and strengthen the relationship between AAPM and CRCPD constituencies.

In a similar vein, "Beyond the Future!" was the theme for the 60th Annual AAPM meeting in Nashville, TN. The CRCPD sent several representatives to the meeting. The State of Tennessee also benefited from AAPM's regulator registration category and sent several of their staff for training. CRCPD maintained a booth in the exhibit hall. The booth highlighted the SCATR program and the QMP Registry. Over the four-day period, the booth attracted many visitors.

Attendees at the AAPM Hands-on Training held at the Medical University of South Carolina

Jennifer Elee, CRCPD's liaison to AAPM, attended several meetings which were held in conjunction with the AAPM meeting. Jennifer attended the Government and Regulatory Affairs Committee meeting, the Regional Organization Committee meeting, as well as the Chapter Leadership meeting. At these meetings, Jennifer and Kathleen encouraged Chapters to reach out to the State programs in their areas. We would like to see States take advantage of the local Chapter meetings for training and get involved as speakers. The Chapters were receptive to working with their States and advisory committees. Please try to work with your local regulators to promote these relationships. Jennifer and **Mary Ann Spohrer**, CRCPD Healing Arts Council Chair, also met with the AAPM Executive Committee and CRCPD Committee liaisons and staff. Some of the topics covered were proposed training at the 2019 CRCPD meeting, IEC challenges, and the new Joint Commission fluoroscopy requirements.



Attendees at the AAPM Hands-on Training held at the Medical University of South Carolina

The CRCPD Committee on IEC Standards also met at the AAPM meeting. Jennifer and Mary Ann were joined by committee members **John Winston** and **Lisa Bruedigan**. The group met to discuss the proposed charts to map IEC standards to the CFR standard that it would replace and the impact on State regulations. The proposed table or chart is essentially a list of the IEC standards that are different from the 21 CRF standard and will be available for each x-ray device when the manufacturer chooses to

conform to the IEC standard instead of the Federal Performance standard. CRCPD has numerous concerns about the table including: where it would be located, how it would be accessed, and how it would correlate to individual State standards. The CRCPD committee then attended the AAPM's Working Group on IEC Coordination meeting with additional stake holders including FDA, MITA, and ACR. The FDA indicated that they will be moving forward in the Fall of 2018 to publish final guidance. The first x-ray modality to be implemented will be interventional fluoro, and the tables will be available on the MITA website. The FDA guidance document will provide additional detail on the changes and how to access the website. The move to IEC standards will be for x-ray devices manufactured from the date specified by FDA and going forward. All devices manufactured prior to that date are still held to the standards in 21 CFR. It is also important to note that while it is anticipated that larger manufacturers may choose to adopt the IEC standards, it is an optional choice; smaller x-ray device manufacturers (such as dental) may elect to remain with the FDA standards.

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REGULATORS CONTINUE TO ADDRESS TRAINING AND EXPERIENCE REQUIREMENTS

Richard Martin, JD | Alexandria, VA

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The Nuclear Regulatory Commission's (NRC's) Advisory Committee on the Medical Uses of Isotopes (ACMUI) once again will address training and experience issues at its meeting on September 20-21, 2018. NRC staff will present a stakeholder outreach plan for the ongoing evaluation of training and experience requirements for authorized users (AUs).

Previously, on July 16, 2018, the ACMUI Training and Experience for All Modalities Subcommittee presented an update on its review of training and experience requirements for different categories of radiopharmaceuticals in Title 10 of the Code of Federal Regulations (10 CFR), Part 35, “Medical Use of Byproduct Material," Subpart E, "Unsealed Byproduct Material--Written Directive Required." The subcommittee noted the U.S. Food and Drug Administration's (FDA's) recent approval of Lutathera (lutetium Lu 177 dotatate) treatment for gastrointestinal tumors and expressed concern that patients have access to these treatments, while ensuring safety by requiring adequate training of AUs providing these treatments. The subcommittee recommended reconsideration of the existing pathways to AU status under 10 CFR 35.300. It cited the need to have an objective method to assess AU competency and the need for broader stakeholder engagement in crafting training and education requirements. Moreover, the subcommittee noted the importance of having the NRC conduct ongoing monitoring for potential AU shortages, including collecting data on the geographic distribution and practice patterns of AUs.

State regulators also are evaluating training and experience issues for specific emerging or evolving modalities. The Conference of Radiation Control Program Directors (CRCPD) H-45 Task Force currently is looking at use of electronically-generated low-energy radiation sources (ELS) used for treatment of skin

cancers. This work group hopes to provide guidance to states that are seeing increased use of these devices within their jurisdictions.

Regulators are challenged to provide patient access to therapies, while ensuring the safe use of devices and administration of therapies. Training and education requirements for providers authorized to administer these therapies is key.

We will continue to provide updates on training and education regulatory issues. Contact Richard Martin, JD, AAPM's Government Relations Program Manager, at richard@aapm.org if you have any questions or concerns.

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INTERNATIONAL DAY OF MEDICAL PHYSICS

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To raise awareness about the role medical physicists play for benefit of patients, the **International Organization for Medical Physics** (IOMP) organizes annually the **International Day of Medical Physics** (IDMP) on November 7, an important date in the history of medical physics. On that day in 1867, Marie Sklodowska-Curie, known for her pioneering research on radioactivity, was born in Poland. We celebrate the 6th IDMP on November 7, 2018. The theme of IDMP 2018 is **'Medical Physics for Patient Benefit'**. Your support and active participation is greatly appreciated! There are three posters available to participate in the celebration located at: http://www.iomp.org/idmp/