Science AMA Series: Hi Reddit, we're a group of passionate medical physicists working in clinical, industry and research, here to shed light on the wonderful world of medical physics. Ask us anything!

Medical-Physics [1] and r/Science AMAs[1]

[1]Affiliation not available

April 17, 2023

Abstract

EDIT: Thank you SO much for your very insightful and thought-provoking questions! We had a blast, and we are so excited so many of you are interested in medical physics! We're signing off for now, but will answer a few more questions throughout the day. Thanks again! So, who IS a medical physicist? We're concerned with three areas of activity: clinical service and consultation, research and development and teaching. In clinical work, medical physicists are heavily involved with responsibilities in areas of diagnosis and treatment, for individual patients and across the entire clinical environment. In radiation oncology departments, one important example is the planning of radiation treatments for cancer patients, using either external radiation or internal radioactive sources. In imaging departments, the focus is not only to take pictures of body form and function safely, but to more importantly achieve precise quantitative benefit. We also can play a lead role on medical research teams. For example, we design new imaging methods to see through the human body most effectively. In cancer, we work primarily on issues involving radiation, such as the basic physical mechanisms of biological change after irradiation, the application of new high-energy machines for patient treatment and the development of new techniques for precise measurement of radiation. We do important things – but the challenge of our work lies in trying to marry the basic science of physics with the applied art of medicine. We're strong proponents of the American Association of Physicists in Medicine's Medical Physics 3.0 initiative, which is based on the core premise that medical physicists have a unique calling and expertise to be scientific agents (i.e., catalysts): agents for precision and innovation in the development and practice of medicine. Within the medical physics community, we're focused on fostering a culture that empowers better communication, enabling better patient care. Ask us anything about our careers, research goals, trends in medical physics or anything else you can dream of! We're here to spread the word about how awesome it is to be a medical physicist and maybe inspire a few of you to join us someday! We are: Ehsan Samei, PhD, DABR, FAAPM, FSPIE, FAIMBE, a Persian-American medical physicist. As an imaging scientist and a clinical practitioner, I am passionate about bridging the gap between scientific scholarship and clinical practice. I like to see high-quality research effectively translated to benefit individual patients. Robin Miller, MS DABR FAAPM, a medical physicist focusing on clinical radiation therapy. As a part of the cancer care team, my passion is providing the highest quality care possible for each patient treated. Paul Naine, MSc. MIPEM, IEng, a medical physicist working for a device manufacturer. I work alongside teams of medical professionals whose vocation is to design and deliver products and services to enable healthcare providers to focus on providing the safest and most effective treatments to their patients.

the WINNOWER

REDDIT

Science AMA Series: Hi Reddit, we're a group of passionate medical physicists working in clinical, industry and research, here to shed light on the wonderful world of medical physics. Ask us anything!

MEDICAL-PHYSICS R/SCIENCE

EDIT: Thank you SO much for your very insightful and thought-provoking questions! We had a blast, and we are so excited so many of you are interested in medical physics! We're signing off for now, but will answer a few more questions throughout the day. Thanks again!

So, who IS a medical physicist? We're concerned with three areas of activity: clinical service and consultation, research and development and teaching.
In clinical work, medical physicists are heavily involved with responsibilities in areas of diagnosis and treatment, for individual patients and across the entire clinical environment. In radiation oncology departments, one important example is the planning of radiation treatments for cancer patients, using either external radiation or internal radioactive sources. In imaging departments, the focus is not only to take pictures of body form and function safely, but to more importantly achieve precise quantitative benefit.
We also can play a lead role on medical research teams. For example, we design new imaging methods to see through the human body most effectively. In cancer, we work primarily on issues involving radiation, such as the basic physical mechanisms of biological change after irradiation, the application of new high-energy machines for patient treatment and the development of new techniques for precise measurement of radiation.
We do important things – but the challenge of our work lies in trying to marry the basic science of physics with the applied art of medicine. We're strong proponents of the American Association of Physicists in Medicine's Medical Physics 3.0 initiative, which is based on the core premise that medical physicists have a unique calling and expertise to be scientific agents (i.e., catalysts): agents for precision and innovation in the development and practice of medicine. Within the medical physics community, we're focused on fostering a culture that empowers better communication, enabling better patient care.
Ask us anything about our careers, research goals, trends in medical physics or anything else you can dream of! We're here to spread the word about how awesome it is to be a medical physicist and maybe inspire a few of you to join us someday!

We are:
Ehsan Samei, PhD, DABR, FAAPM, FSPIE, FAIMBE, a Persian-American medical physicist. As an imaging scientist and a clinical practitioner, I am passionate about bridging the gap between scientific scholarship and clinical practice. I like to see high-quality research effectively translated to benefit individual patients.
Robin Miller, MS DABR FAAPM, a medical physicist focusing on clinical radiation therapy. As a part of the cancer care team, my passion is providing the highest quality care possible for each patient treated.
Paul Naine, MSc. MIPEM, IEng, a medical physicist working for a device manufacturer. I work alongside teams of medical professionals whose vocation is to design and deliver products and services to enable healthcare providers to focus on providing the safest and most effective treatments to their patients.

READ REVIEWS

WRITE A REVIEW

CORRESPONDENCE:

DATE RECEIVED:
March 30, 2018

DOI:
10.15200/winn.152232.27922

ARCHIVED:
March 29, 2018

CITATION:
Medical-Physics , r/Science , Science AMA Series: Hi Reddit, we're a group of passionate medical physicists working in clinical, industry and research, here to shed light on the wonderful world of medical physics. Ask us anything!, *The Winnower* 5:e152232.27922 , 2018 , DOI: 10.15200/winn.152232.27922

Thanks for spending some time to answer questions!

I'm a moderator over at r/MedicalPhysics, and we get a lot of questions from people exploring Medical Physics as a career option. However, lately we have been getting a lot of (U.S.) visitors who have been told that the pathway into the career is too restrictive and too competitive (e.g., CAMPEP requirements, limited residency spots, etc.). What advice can you offer to people interested in the field but worried about being able to actually find a job?

johnmyson

There are lots of roles that the medical physicist can play in our field including (but certainly not limited to!) research, clinical, industry and regulatory. Often we assume that the path to being a medical physicist follows the CAMPEP/Residency/ABR certification route to often a clinical role. However there are plenty of other areas where medical physicists can and are actively involved in contributing to the field that do not follow these paths. Checking out vendor and regulatory job posting is a great start to do this… most companies will post vacancies on LinkedIn so simply by following the company and checking the app sometimes you can keep an eye on positions that become available!

- Paul

I fully affirm Paul's response. CAMPEP/ABR pathway is a good pathway to become a medical physicist, but there is not only one way to be a medical physicist. There are also alternative pathways, even within the CAMPEP/ABR trajectory. If you are passionate and persistent in what you want to do or become, things will work out.

- Dr. Samei

Part of the issue is focusing only on the clinical pathways. That path is very prescriptive but there are many ways to be and contribute as a Medical Physicist. On the job training is no longer sufficient for clinical medical physicists as technology and the demands have become more complex with commiserate risks. There are alternative pathways and alternative opportunities. Being persistent is part of it, being creative, using more than one strategy and exploring a wider range of opportunities is key. Industry and regulatory avenues are alternate paths.

- Robin

How much interaction has your team had with using AI and machine learning in your field? Which technology companies provide the tools to help you with your research?

bcld1980

AI is an interesting field in relation radiation therapy and radiology. With the amount of data that radiation oncology generates it is uniquely suited to AI techniques. Recently the major vendors have been involved in acquisitions and partnerships in the field. For example Elekta has partnered with IBM Watson to develop AI in the field further. An interesting resource to expand on this answer is the recent JASON report.

- Paul

I work in a community practice setting. There are tools being introduced to harness the strengths of AI and machine learning, but we aren't quite there yet. We can use machine learning to track patient outcomes and also track the quality metrics of a treatment plan in ways that were only intuitive previously. I see machine learning as a tool that will be a disruptor (in a good way) to our current practices in the next few years.

- Robin

AI has much potential to advance healthcare. Most research groups and manufacturers are actively pursuing that. In that process, I believe Medical Physicists have much to contribute - in devising and

figuring out what is AI (artificial intelligence) and what is AS (artificial stupidity) and which one is which :)

- Dr. Samei

Two questions:

What is the most interesting project you've worked on?

What are some exciting projects that the future will hold in your field?

Waegithalos

I have been working on ways we can make physics-based measurements on clinical patient images so that those measurements can be used quantitatively to figure out what's going on with the patient or ascertain whether a particular therapy is working. This is where physics MEETS medicine. This is where a physics-based measurement can be used as a surrogate of the patient's health, thus enabling "physics to inform medicine," helping it to be more evidence-based and quantitative. This brings the best of human insight (in the realm of physical sciences) into advancing human health. I find this very inspiring.

- Dr. Samei

1) Working on combining an MR and a linear accelerator is an incredible opportunity for any medical physicist to be involved with. The idea of having accurate radiotherapy in a magnetic field was thought at one time to be impossible! Being able to be part of this project is without a doubt one of the most exciting projects as the resulting technology has the potential to really change the way we think about treating cancer.

2) As we move forward the use of the data that we have and continue to capture will likely be the area where the most discoveries and excitement will come from. AI is a tool that we can expect to become integral to this field as we have seen from other fields with large data sets. The recent JASON report provides some fascinating insight into this area.

- Paul

The most interesting project for me is implementing new technology into the clinic. This can include commissioning a new linear accelerator with new modalities. The challenge is making certain the technology works as expected but also finding a way to seamlessly introduce the technology to the staff. The patients enjoy the benefit without any knowledge of the hours of testing and training that went into more precisely targeting, imaging and treating their disease. It is an opportunity for me to use my engineering and physics background to understand the mechanics of how something works and see how people can be positively impacted.

- Robin

Who is MedPhys 3.0 for?

In your article on the AAPM website, 'Redefining and Reinvigorating the Role of Physics in Modern Medicine', it sounds like this is for us in medical physics. You promise to 'define and practice sustainable excellence in medical physics' to 'foster a culture within medical physics of seizing such opportunities, engaging proactively and meaningfully in patient care, and growing and building upon the unique skills of medical physicists'

You then lay out a list of corporate buzzwords: Expertise. Visibility. Sustainability. Expansion.

And you cap it off by saying you are working on 'the production of a video series designed to express

the value of medical physics to patients, administrators, and physicians, educational offerings at the upcoming RSNA and AAPM meetings, a webpage with examples of “MP3.0 in practice”, and white papers to delineate how physicists can enact, express, and enhance the full value of physics towards human health'

Ok. So this sounds like you guys are a Public Relations squad trying to convince administration, doctors, and the general public why our profession is important. Then why open by saying you are going to redefine practice?

Deeper into the website you guys go into 'Areas of Clinical Growth' and list off 'Areas of Opportunity' such as:

Practice precision in customization of care for individual patient.

Focus on both in-patient and out-patient care

Optimize quality and patient safety.

Provide peer-review for plan of care

etc, etc, etc. The problem with this is simple: we already do all these things you've listed. There are already numerous AAPM Task Group reports defining how to do these things. If MedPhys 3.0 is for us medical physicists, you aren't really offering us anything we don't already have unless your charge is to rewrite everything. I simply can't believe that's what all this is for, so it's almost as if you're implying we don't already do all these things – which is a bit insulting

Which leads me to an even bigger concern: If you guys are supposed to be our PR cheerleaders, then carelessly implying we don't already do these things is somewhat dangerous and damaging to our field. Will patients treated before the dawn of MedPhys 3.0 fret that they weren't getting precision customized care? That we weren't optimizing their safety? You might succeed in scaring some administrators into funding more medical physicists, but at what cost?

Then the website shares some feel-good stories that tangentially involve medical physics in some way – I already get those kinds of fluff pieces every so often through the MedPhys listserv. Why do I need the AAPM to repeat it for me?

Plus to cap it all off, your squad also tried pushing MedPhys 2.0 a few years ago. So, what then? The OG MedPhys was good enough to last 100 years, then whatever it was you were trying to accomplish with 2.0 didn't take so now it's time for strike 3? Since there's no way this is the paradigm shift (heh, corporate buzzword) you are implying, maybe it shouldn't be named like one?

So to summarize a long-winded rant – why should I, a dues-paying member of the AAPM, encourage my organization to continue investing time/money in whatever it is you guys are doing? At the most benign, it looks like a way to claim you chaired a committee dedicated to sharing feelgood news stories, but at your worst you're potentially using fear tactics to scare normal people into demanding a level of quality care they are already receiving...

WeimarRepublic

I am grateful for your critical question. I suspect the ambiguity might be due to the broad charge of the effort. But let me see if I can clarify a few items that you question:
In current practice of medical physics we have done great things and we are continuing to do so. We need to cherish them and make them better publicized. e.g., a typical patient being benefited by our work should know who a medical physicist is. Likewise administrators who are resourcing healthcare. That is the case today. MP3.0 aims to help with that.
Current practice, while great in many respects, is UNEVEN across physics practices. Many places practice at the lowest common denominator. Case in point, we don’t apply the same QC rigor across

the clinical practice as we do for clinical trials? Is quality and safety for clinical practice is less important than those for clinical trials? Physicists have the ability and skill to make our contributions more uniformly excellent everywhere. But to do so, we need a stronger peer expectation, regulatory mandate, tools, and manpower. MP3.0 aims to help with that.

On MP2.0 vs MP3.0, 2.0 only pertained imaging but 3.0 captures all practices of physics in medicine.

And pertaining funding MP3.0, we have essentially been operating like one of 100+ TGs and WGs of the AAPM. This effort has not required much finances.

- Dr. Samei

Medical Physics 3.0 is for everyone. For practicing Medical Physicists, newly in the field or established, it is an opportunity to reflect on what we do and how we do it. In some ways it is a chance to re-imagine what you do every day. Have you optimized what you are doing? Can you be more efficient? Hand something off? Stop doing something because there is no longer a reason to do it anymore (TG100)? It is easy to fall prey to doing something because you always have or its always been done a certain way. MP3.0's purpose in part is for introspection. Technology changes, tools change, philosophies change, regulations change. As for everyone outside medical physics it is a peek under the hood.

- Robin

Medicine is constantly advancing - even some techniques from as few as 10 or 15 years ago can seem barbaric compared to current practice. Do you have any specific predictions for how you think the role of Medical Physicists will evolve over the next 10 to 15 (or more) years, and what current practices will seem barbaric by then?

Failmongerer

When we look back a large number of advances in the field since then have been driven by hardware and software technology. When we look forward it is likely that the data we gather will be come just as important in driving the field even further. Translating technological advances into usable tools that can support clinical decisions has always been a major part of the role of the physicist and it is likely to continue to be; but it could be that we will be translating technology advances in hardware, software AND information to be usable in the fight against cancer.

- Paul

To me the biggest advance will be the merging of imaging and treatment. Paul mentioned this in another question with the new technology and marriage of a linac and MRI. In the recent past, we would image weekly with MV images; those were grainy port films where you could imagine the boney anatomy. We have graduated to daily CBCT's. We can see soft tissue, air bubbles, bones, etc. Soon the technology will allow constant target tracking which will trigger the radiation beam. We are almost there – and may be - in some settings though it has not trickled down to the community clinic yet. This will allow very precise tumor tracking and allow the margins of normal, uninvolved tissue and organs to be minimally treated.

- Robin

Echoing my colleagues, generally speaking, I believe there are three areas of significant advances before us:

1) combinatorial technologies that take advantage of correlative signals from multiple sources echoing the condition of a disease in different domains (eg, different images, patient records, longitudinal data),

2) quantitation enabling characterization, monitoring, and optimization of medicine with scientific methods, and

3) precision enabling customization of care to the specific patient.

Medical Physicists (should) have the expertise (by the virtue of being a scientist) and the ethical mandate (by the virtue of claiming the term medical) to contribute to all these three.

- Dr. Samei

I totally do not understand what is your job and your description ? Can ELI5 please.

What is the medicine art that you are mentioning?

Vini_Dalvino

I practice physics in the context of medical imaging. Imaging medical physicists are primarily involved in devising new ways of looking into human anatomy and function, in inspecting if an imaging technology is performing as expected in terms of quality and safety, in figuring out how best the imaging can be performed to safely get the most relevant information from the patient, and in analyzing how the imaging practice is performing across a health system. In doing these, we apply the physics principles and we do so with innovation, strong scientific mindset, and strong ethical mandate for maximum human benefit.

Regarding your second question, sometimes we refer to medicine as art. In reality medicine is both an art and a science. In practicing medicine as science we apply the known knowledge, obtained through scientific process (hypothesis formation, testing, validation, etc), to a particular health problem. While this is ideal, it is impossible to practically apply this to every patient situation. Each patient is different, and his/her situation might not exactly fit into the predictions of a prior scientific study. Likewise, there are many things and many correlative factors that we have not yet had a chance to explore scientifically. Meanwhile the patient's health situation is something that needs an answer now; it cannot wait. This is where a physician invokes the principle of medicine as art. He/she applies much the collective and personal knowledge into the situation, and in the midst of not having all the information, makes the wisest choice to the benefit of the patient.

The art of medicine in my experience is that every person is unique and every instance of cancer has unique properties. Though there is a body of research and experience on how to treat, for instance breast cancer, each patient has a variety of medicines they may or may not be taking, the extent of disease is different and though we have predictive tools, may react to radiation in an unexpected way. There is also a body of evidence on what should provide a cure. Still, some instances are resistant. There are also ways to treat side effects, with a varying results based on the individuality of every case. Medicine is a science, a practice and an art. The art part is because often we think about what we want to achieve, tweak as we go along the way and get something unexpected.

While the science of medicine has been advancing ad continue to do so, the art of medicine cannot be underestimated. I believe medical physicists by the virtue of being "medical" and being "physicists" have the awesome opportunity to see and contribute to this art-science practice in the most meaningful way, again always for the benefit of the patient.

- Dr. Samei

The art of medicine in my experience is that every person is unique and every instance of cancer has unique properties. Though there is a body of research and experience on how to treat, for instance breast cancer, each patient has a variety of medicines they may or may not be taking, the extent of disease is different and though we have predictive tools, may react to radiation in an unexpected way. There is also a body of evidence on what should provide a cure. Still, some instances are resistant. There are also ways to treat side effects, with a varying results based on the individuality of every case. Medicine is a science, a practice and an art. The art part is because often we think about what we want to achieve, tweak as we go along the way and get something unexpected.

- Robin

I am hoping to become a doctor someday. Can you suggest some fields of medicine that has physics strongly affiliated with them?

NavinYP

Currently Radiology and Radiation Oncology practice their foundation in physics more strongly than others. So that could be the places to look or target for you. But as my answer implies, physics is a principle science that can meaningfully be practiced and used in other subspecialties of medicine. If that inspires you, you can be more of a trail blazer in areas where physics is still below the surface.

- Dr. Samei

Radiation Therapy and Radiology are typically the two fields that are closely related to the medical physics field.

- Paul

We're strong proponents of the American Association of Physicists in Medicine's Medical Physics 3.0 initiative, which is based on the core premise that medical physicists have a unique calling and expertise to be scientific agents

Hi there! where I'm based the official declaration of the medical physicists association say that medical physicists should be at the center of research and innoviation in hospitals. However, their preparation is totally lacking for anything research related. They can do basic statistics better than a physician but they lack, a lot, any training regarding "serious" research. Also, they end up trying to exclude engineers, IT specialists and all the other professional figures that are as good as physicists in developing algorithms. I mean... The training here is basically 2.5 years of radiotherapy planning, 1 month of radiation protection measures, 1 month of x-ray devices quality tests, 5 days of nuclear medicine and 1 month for a supposed "research" thesis. That's how you train a technologist, not a researcher.

How is the situation in the US association? Are medical physicist there really ready to be researchers?

lucaxx85

I am not sure where you are, but my general response is that regardless of your setting, the goal is and should be ensuring strong scientific AND clinical foundation in training medical physicists so that they can effectively practice their science and medical wisdom in any setting (being research, clinical, industry, regulatory, etc), and do so in collaboration with others members of the healthcare enterprise effectively.

- Dr. Samei

I am uncertain where you are based, but for PhD Medical Physicists there are strong research related requirements in the US. I also can't speak to the exclusion of other colleagues as that appears to be an unfortunate side effect of work environment or work culture. I've been fortunate to collaborate with a variety of stakeholders on clinical projects. My background is not strong in research but I am lucky to know many outstanding medical physics researchers who do basic science research and have been generous with their knowledge. The journal of Medical Physics is where much of the research is published but that is not the only peer reviewed journal supporting medical physics research.

- Robin

What feelings do you have about the DMP programs?

medphyslife

"Feeling" I give to you! I think DMP can be done meaningfully, and I am a proponent of it under that condition. Being more specific, I think DMP does not make sense as MS+residency. Rather it needs to be constructed as a new degree that while it incorporates the residency, includes a strong 2+ year scholarship component. This is not something quite like a research-based PhD thesis, rather a clinical scholarship project that is scientifically as much rigorous but with explicit clinical endpoint as opposed to research endpoints.

- Dr. Samei

Medical physics seems to be a well established field in the US, with strong organizations and structure to regulate a physicist's work in the clinic. I was wondering if the same applies abroad; do many other countries distinguish the difference in the role of a medical physicist, compared to, for instance, a physician and an engineer? What is the most impactful task/responsibility a medical physicist can provide for a country that may or may not have laws to regulate protocols as well as the US?

SARCASTIC_JOKE

In working for a vendor, industry physicists who talk to clinical physicists are all over the world. It is absolutely true that the ‘specification’ of a medical physicists varies quite dramatically as we move countries. Regardless of the legal or regulatory requirement it is important that the services that a medical physicist provides are routinely and accurately applied. This is primarily focused on the safe and effective treatments for patients. Fortunately many professional organizations (such as, but not limited to AAPM) often openly provide guidelines on what these responsibilities are. I would encourage anyone performing these activities to invest in developing their understanding of the technology whether mandated legally or not. This can be achieved through attending training courses, researching papers or any other avenue of learning.

- Paul

Medical physics seems to be a well established field in the US, with strong organizations and structure to regulate a physicist's work in the clinic. I was wondering if the same applies abroad; do many other countries distinguish the difference in the role of a medical physicist, compared to, for instance, a physician and an engineer? What is the most impactful task/responsibility a medical physicist can provide for a country that may or may not have laws to regulate protocols as well as the US?

SARCASTIC_JOKE

You are absolutely right that the practice of physics in medicine is not the same across countries, especially when you go beyond the US, Canada, and Europe. I believe a good approach is looking at the medical practice as done within a country, and ask the question how that practice can be improved using the tools and insights that a physicist can be bring in. In my experience, the most common need is managing and reducing the diverse variability across patient care, and helping with practices that do not personalize the care to the specific attributes of the patient.

- Dr. Samei

Are there other medical fields outside of radiology, nuclear medicine, and radiation oncology that you envision medical physicists playing an increased role in? Is the AAPM working toward that kind of a vision?

johnmyson

When you consider how quickly radiology, nuclear medicine, and radiation oncology have progressed (radiation itself was only discovered in 1896!) it's amazing to think about how far we have come. In the last few years the medical physicist has been quite influential in driving the technology development and adoption. As we move forward to a more holistic and outcome based approach to treatment of diseases it is probable that physicists will start considering other medical fields… and in doing so we have the opportunity to help drive those fields forward in the same way we have been working to drive the fields that we currently focus on. The important thing is to focus on what it is to BE a physicist…. Focus the core physics skills of analytical thinking, innovation and problem solving.

- Paul

Physics is a foundational science. As such is has and should have a foundational presence in medicine (like chemistry or biology). This, however, is not recognized in much of medicine today. Radiology, nuclear medicine, and radiation oncology are doing better in that regard, but even there, ask a typical patient receiving those services and they will not know who a medical physicist is. So, what about physics in surgery, in ophthalmology, orthopedics, cardiology, dentistry, urology, etc? Physics is also present there and practiced but not by physicists! The hallmark of a civilized society is having specialized workforce. We do not ask an electrician to do a plumbing job. In the same way you can argue we need a physicist to do physics in all domains of medicine, provided that we recognize the potential, figure out how best it can be done, and train a workforce for that expansion. This is the **smart expansion** goal of MP3.0 that I noted to an earlier comment. This is an aspiration of MP3.0 that **every clinic will have a medical physicist and every patient's care will be improved by a medical physicist**.

- Dr. Samei

Is there any successful research going on for a more efficient mri system? One that lowers cost of use. If not could you say what limitations there are? Thanks

recyclops-robotheart

This would be best answered by a physicist who works in industry or research specifically in the diagnostic area, which unfortunately I am not. However, given that the patient throughput for any large and expensive equipment is critical in the viability of any device we can hypothesize that it most likely is a priority for research and manufacturers of MRI devices.

- Paul

Is mri scanning the best method to see what's going in in a body? Are there any better methods?

recyclops-robotheart

There are several methods to 'look' inside the body. MRI is one method, but there is also CT, PET and Ultrasound. It depends on whether you want geographical or functional information.

- Robin

- As someone who is an undergrad at a university, what is the best way/path to eventually become a medical physicist? Obviously studying something related to it, but outside of school (research, shadow a doctor, internship, etc.)

Och-Aye

Industry often offers internships for medical physics. Elekta offers these every 4 months and can be found on the Elekta Careers page. 100% of our interns have gone onto residency, study or employment. Other vendors have similar programs so I would strongly suggest keeping an eye on their

career pages.

- Paul

- As someone who is an undergrad at a university, what is the best way/path to eventually become a medical physicist? Obviously studying something related to it, but outside of school (research, shadow a doctor, internship, etc.)

Och-Aye

The AAPM has two opportunities for undergraduates, though the deadline has already passed for the summer of 2018. There is a Summer Undergraduate Program and DREAM - Diversity Recruitment Recruitment through Education and Mentoring Program. See this link, but you need to scroll almost to the end of the page. Good luck for next year! http://gaf.aapm.org/index.php

- Robin

Thanks for taking time to do this AMA!

What area of the field do you think needs the most improvement?

What emerging technologies are you most excited about or consider the most promising?

How do you see the role of the dosimetrist evolving in The next 5-15 years, if at all?

While treatment certainly is and can be an art, how do you believe inconsistencies in standard of treatment should be addressed?

What newer techniques are people apprehensive about but you feel should be embraced?

What is preventing imagining from being more accessible (cost of scan is high and sometimes lacks reimbursement, wait times can be weeks to months), how would this problem be best addressed?

Thanks again for the AMA and hopefully this wasn't too many questions!

SenorDarcy

What area of the field do you think needs the most improvement? One word: Collaboration. We can't keep our clinical/research/industry silos; we're all medical physicists with the same goal to improve patient care. We will be stronger collaborating together.

What emerging technologies are you most excited about or consider the most promising? In the short term the combination of MR and a Linac is extremely cool. In the longer term the use of AI in data analytics in healthcare is a fascinating area with potential that we might not even understand yet.

How do you see the role of the dosimetrist evolving in The next 5-15 years, if at all? In the way that the role of the dosimetrist evolved with the move to forward to inverse planning, we may see the role evolve in the future. As some areas of planning become more efficient the dosimetrist role will likely take a role of understanding how new technologies are used, and oversee how those technologies are applied.

While treatment certainly is and can be an art, how do you believe inconsistencies in standard of treatment should be addressed? Data analytics is the logical answer, however it is an area that we still need to invest effort in to see fully realized. The benefits however could be unimaginable!

What newer techniques are people apprehensive about but you feel should be embraced? AI seems to have us all over the spectrum in terms of acceptance. At one end of the scale Dr Hawking ('not afraid of blackholes, AI is another story') all the way through to Mark Zuckerberg ('worried? Tell my AI butler').

One of the important things to recognize is that there is essentially three types of AI: Artificial Narrow Intelligence, Artificial General Intelligence and Artificial Super Intelligence. We tend to fear the latter two, but realistically we are working towards the first one: Artificial Narrow Intelligence. Embracing ANI is something that really should help us advance cancer care in the next few years and could help a tremendous amount of patients.

What is preventing imagining from being more accessible (cost of scan is high and sometimes lacks reimbursement, wait times can be weeks to months), how would this problem be best addressed? This is a very big question… obviously the cost of device manufacture and deployment can be reduced but there are also governmental policy decisions that would drive accessibility. The likely answer is to address this from multiple angles as there may be no single silver bullet.

- Paul

What is Medical Physics 3.0 working on now?

CATScan1898

Latest has been figuring out exactly how we can encourage MP3.0 practice. In order to do so we need **smart regulations** that enforces constraints on the practice that are more relevant and meaningful. Likewise we need **smart tools** in the hands of practitioners, **smart physicists** focusing on our training, **smart practice and workflow**, **smart advocacy**, **smart grassrooting and community engagement**, and **smart expansions** beyond the current bounds of the discipline. We have subgroups focusing on these initiatives, and in this process we try to define **key performance indicators** that can be used to assess and monitor our progress toward the eventual goal of highest contribution of physics to human health.

- Dr. Samei

Can you define all those acronyms after your names? And, serious question, why list all those?

medphysadonc

Hi medphysadoc, sure! MSc=Master of Science (UK)/MIPEM=Member of Institute of Physicists and Engineers in Medicine/IEng=Incorporated Engineer. In terms of why they're listed, two reasons; (1) They were really expensive letters ;) (2) A PR team helped us put this together for us and included them.

- Paul

Why list the acronyms? Well, I've earned them! :) The DABR = Diplomate of the American Board of Radiology and FAAPM= Fellow of the American Association of Physics in Medicine. MS = Master of Science. Think of it as the Good Housekeeping seal of approval from my peers. And to echo Paul's comment, there was time, money and tremendous effort involved in obtaining the right to use all the letters.

- Robin

In the era that opinions seem to matter more than evidence, it is important to enlist credentials. Not all opinions are equal. Not that credentials would be a seal of inerrancy, rather an attestation that the person has some authority to answer a question relevant to his/her expertise. FSPIE = Fellow International Society for Optics and Photonics; FAIMBE = Fellow the American Institute of Biomedical Engineering.

- Dr. Samei

Im under the impression that the three pillars of Medical Physics (the clinic, industry, and academia, as mentioned) don't communicate very well. For example, the research projects grant committees may be interested dont often line up very well with what industry is interested in, and the clinical physicist may not have the time or expertise to pursue either, particularly if it is truely fundamental research.

What are each of you individually doing to facilitate the hands talking to each other more effectively? What are some examples where there is a cohesive approach across all three pillars in fundamental research that you have facilitated or participated in?

Also, will we all be out of a job in 30 years? Everyone seems to be saying that...

greatnessmeetsclass

I understand the impression that there are silos. Within the AAPM community there are initiatives for collaboration among the various councils - or pillars. Personally, I have to collaborate with a variety of professionals. For instance, I needed hospital IT, the vendor and myself in order to install, test and accept some new software. That is a very specific instance and I suspect you are speaking about broader initiatives. I think it helps to demonstrate the need for collaboration personally and live it by example. As for the AAPM, this has been identified as something that needs improvement.

- Robin

Im under the impression that the three pillars of Medical Physics (the clinic, industry, and academia, as mentioned) don't communicate very well. For example, the research projects grant committees may be interested dont often line up very well with what industry is interested in, and the clinical physicist may not have the time or expertise to pursue either, particularly if it is truely fundamental research.

What are each of you individually doing to facilitate the hands talking to each other more effectively? What are some examples where there is a cohesive approach across all three pillars in fundamental research that you have facilitated or participated in?

Also, will we all be out of a job in 30 years? Everyone seems to be saying that...

greatnessmeetsclass

In terms of collaboration it is critical that the three areas of medical physics recognize that it is an interdependent ecosystem: Research goes to industry to create products, who are used by clinical, who in turn require better products, which drives research… It's a feedback loop and we all play our part. Communication is a key part of keeping 'The Loop' flowing. Aside from specific initiatives such as grants and research agreements we need to be open in talking about what the driving factors in each of our segments are… and that may involve developing some empathy for those not in our segment. From a personal level I am pushing hard to communicate how the industry aspect is being driven and listening hard to how research and clinical is being driven. This AMA is a good example of bringing together the three pillars and building communication; working with Ehsan and Robin on this has been enlightening for me and I hope that we all start reaching out to our colleagues in other areas to start those dialogues. In terms of will we have a job? There will always be a need to innovate, so in my opinion, yes… absolutely.

- Paul

Im under the impression that the three pillars of Medical Physics (the clinic, industry, and academia, as mentioned) don't communicate very well. For example, the research projects grant committees may be interested dont often line up very well with what industry is interested in, and the clinical physicist may not have the time or expertise to pursue either, particularly if it is truely fundamental research.

What are each of you individually doing to facilitate the hands talking to each other more effectively? What are some examples where there is a cohesive approach across all three pillars in fundamental research that you have facilitated or participated in?

Also, will we all be out of a job in 30 years? Everyone seems to be saying that...

greatnessmeetsclass

You are right on the mark. By and large, the pillars stand apart, resulting in much loss in our potential to impact patient care. MP3.0 is an initiative that aims to tackle this, though it is hard as it involves a culture change. This is not unique to medical physics, thus the buzz word "translational medicine" so commonly invoked.

I do hope we can have jobs in 30 years. If not, I am not as sorry for us but for patients who would not be benefited by our insights!

Within our domain, MP3.0 is one of the few initiatives that aims to tackle this challenge.

- Dr. Samei

When delivering drugs, lets say my pills, do these drugs find their target on their own, knowing where it is; or do they just wander around, bumping into everything until they get there? This has been gnawing at me for some time.

Tylos_Of_Attica

Most drugs are distributed and effect tissues non-discriminately, but newer smarter drugs have stronger affinity to abnormal cells or tissues. As you might imagine this is an active area of research, particularly in cancer therapy where we aim to kill cancer cells and spare the healthy tissues.

- Dr. Samei