

Student Meeting 8:30-10 am

We will have audience participation for our panel

Please go to JoinQA.com and enter code 60913 to ask and upvote questions during this session



- 8:30 10 am | Annual Student Meeting

   10 10:30 am | Undergraf Vetworking Session

   11:30 1 pm | WGSTR Lunch plus Career EXPO (ticket)

   1 3 pm | Seidency Fair

   3 pm | Society of Physics Poster Session

   6 8:30 pm | Night Out Great Divide (ticket)

- .

Other Events

Identify STSC Members by their buttons!

- Monday, July 31 4:30 6 pm, Interview Workshop . Tuesday, August 1 9:30 -11 am, Expanding Horizons Tuesday, August 1 4:30 - 6 pm, New Member Symposium

- Also be sure to check out Partners for the Future! Tours on Sunday 3 PM, Monday 3:45 PM, Tuesday 3:45 PM, Wednesday 10:15 AM Meet at Member Services Desk



Student Meeting 8:30-10 am

We will have audience participation for our panel

Please go to JoinQA.com and enter code 60913 to ask and upvote questions during this session



If you want to continue this discussion check out...

#### **FUTURE: Provocative Questions in Medical Physics**

Monday 4:30-6 PM Four Seasons 4



Please go to JoinQA.com and enter code 60913 to ask and vote for questions during this session

Provocative Questions in Medical Physics Training Learn about changing skill sets of medical physicists in the clinic, academia, and industry

• Two speakers, then time for questions using Social Q&A



### VANDERBILT WUNIVERSITY MEDICAL CENTER

#### Questions

- 1. How are the skill sets of medical physicists changing?
- 2. What should people consider when they think about DMP programs?
- 3. How do we think the DMP affects the field as a whole?
- · Conclusions

#### VANDERBILT 🦭 UNIVERSITY



# 1. How are the skill sets of medical physicists changing?

#### VANDERBILT VUNIVERSITY 2. What should people consider when they think about DMP programs? CENTER

- · The DMP model was born about 10 years ago in response to the shortage of accredited clinical training residencies to produce board certified physicists.
- · The DMP is suitable as an option for Medical Physicists interested in a clinical career, i.e. positions requiring ABR certification.
- The DMP is another pathway to achieve clinical training -Different than the other three options: The DMP is INTEGRATED.
- A 4-year continuous CURRICULUM ALLOWS MORE FLEXIBILITY FOR INTEGRATION AND ADAPTABILITY.
- · The DMP implementation depends on the needs and orientations of each institution.

#### VANDERBILT VUNIVERSITY 2. What should people consider when they think about DMP programs? programs? Complete PhD in Physics or



MEDICAL CENTER

VANDERBILT WUNIVERSITY 2. What should people consider when they think about DMP programs?

#### THE VANDERBILT EXPERIENCE CURRICULUM: 92 credit hours adaptively integrated Research projects:



· Focused in clinical development and improvement. · Encouragement to generate national presentations and/or publications.

- · Performed in years 2, 3 and/or 4 with ad hoc timeline. Clinical rotations:
- Structured clinical training with assigned mentors in years 2, 3, and 4.
  - Flexible participation in clinical projects as they appear in years 3 and 4: Commissioning of new equipment/software, projects to solve/improve clinical situations, write-ups of new procedures, protocol submissions, etc.
- External Clinical Rotations in therapy in year 4 promotes adaptability (new teaching/learning environments):
  - > 4 months in a Proton Medical Center.
  - > 1 DMP resident spends 1 year in another Radiation Oncology Department.

VANDERBILT WUNIVERSITY 2. What should people consider when they think about DMP programs? MEDICAL CENTER

#### THE VANDERBILT EXPERIENCE (cont.):

32 DMP graduates (2011-2017): 27 in Therapeutic and 5 in Diagnostic/Imaging ABR-BOARD-EXAMS PASSING RATES AT FIRST ATTEMPT:

Part 1: 31/32 = 97% JOBS: Part 3: 25/28 = 89% Part 2: 25/28 = 89%





# VANDERBILT **VUNIVERSITY** 3. How do we think the DMP affects the field as a whole?

In the U.S., there are 4 CAMPEP-accredited DMP programs and other 4 institutions are thinking of or are in the process of implementing it.

Session Title: Professional General Poster Discussion (Poster #: SU-I-GPD-P-14)
The DMP:

Where Are We and Where Do We Go From Here? Jy Burnetter, Clarks Cafer, Man Landers Patter, Har Paparkanani (1) Want State Unserfactmann Conference and Advances of Advances of Pattern State (1993) (2) Want State Unserfactmann Conference of Advances of Advances of Pattern State (1993) (2) Want State Unserfactmann Conference of Advances of Advances of Pattern State (1993) (2) Want State Unserfactmann Conference of Advances of Advances of Pattern State (1993) (3) Want State Unserfactmann Conference of Advances of Advances of Pattern State (1993) (3) Want State Unserfactmann Conference of Advances of Advances of Pattern State (1993) (3) Want State Unserfactmann Conference of Advances of Advances of Pattern State (1993) (4) Want State (1993) (4) Want State (1993) (5) Want State (1993) (5

Based on a survey performed in September 2016 which collected data from 8
institutions (including the 4 CAMPEP accredited institutions)
 Matriculating Students/ Year



The DMP could ultimately provide an increase of approximately 15% and 10% in the number of board-eligible trainees in Radiotherapy and Diagnostic/Imaging, respectively.

VANDERBILT WUNIVERSITY MEDICAL CENTER

#### CONCLUSIONS

- The DMP is a four-year program that allows eligibility for ABR Part-2 and Part-3 exam certification.
- The DMP is one more option to achieve clinical training -Different than the other three options: It is integrated.
- A continuous 4-year program allows flexibility to adapt and integrate a curriculum to rapid changes in the skill sets of medical physicists.
- The DMP should fit into the needs of the institution: A model to train clinicallyoriented medical physicists in an integrated fashion.
- Results of a 2016 survey indicates that the DMP could provide an increase of approximately 15% and 10% in the number of board-eligible trainees in Radiotherapy and Diagnostic/Imaging, respectively.



# The PDMP

Why is it a really bad idea on all fronts?

Jan Seuntjens McGill University, Montreal, Canada

NSERC CRSNG





Medical Physicists apply knowledge and scientific methodology of physics to all aspects of medicine, to conduct research, develop or improve theories and address problems related to diagnosis, treatment, and rehabilitation of human disease



The Lancet, 379 (9825) 1463 (April 2012) This issue of The Lancet prominently discusses role of physics in medicine. MPRTN - CREATE - Aug 12, 2013

# What is the PDMP (a.k.a. DMP)?

- Professional doctorate in medical physics
- . In most implementations it can be seen as the combination of 2 years of didactic training followed by 2 years of clinical training
  - Vanderbilt
  - U. Cincinnati Texas Health Science Center, San Antonio
     U. Nevada
- The student pays for the training
- Idea comes from other health care professionals, such as dentists, •
- veterinarians, etc.
- The impetus was the "2014 deadline"

#### POINT/COUNTERPOINT

Suggestions for topics studied for them PointConsecution debusies housed for addressed to Colin G. Orom, Popiszor Emerina, Nigos Star University, Dennis' control(focunatione). Persons participating in PointeTonomyoint discussions a electeral for their housingles and communicative skills. Their positions for or against a proportion routy on may not reflect their personal options or the positions of their employment.

# A professional doctoral degree that does not require dissertation research is an appropriate alternative to a Ph.D. as preparation for a career in medical physics

John D. Hang, Ph.D. Bysenerod Changer, Phys. The University of Hass M. D. Andress Gaver Create, Phys. Rev. D 10, 101 (1997). Control (1997) 101 (1997) 101 (1997) 101 (1997) 101 (1997) 101 (1997) 101 (1997) 101 (1997) 101 (1997) 101 Material Anti Phys. Control (1997) 101 (1997) 101 (1997) 101 Material Antipolicy Control (1997) 101 (1997)

#### Dr. Hazle:

"While the need for a professional doctoral degree was debatable before the ABR announced its 2012 and 2014 initiatives, I believe that the only way we can meet the need for formal clinical training the paradigm for our clinically focused professionals. We need financially viable and sustainable programs to generate somewhere between 200 and 250 new practicing clinical medical physicists per year. The current model for "research oriented" training will not meet."

### To the candidate / applicant of a PDMP

#### program

- Pro PDMP
- Once accepted in the program and the financial means are available, the path to a degree and to being ready for job market is largely secured
- There is a perceived respect associated with a "doctorate"
- Con PDMP • The tuition fees are to be paid and the students graduate with a debt
  - There is no research training this may
  - limit the candidate's agility & readiness for professional change during their career
     lead to lack problem-solving skills
  - lead to lack problem-solving skills on the part of the graduates from the DMP program

# To the degree-granting institution

#### Pro PDMP

 \$\$! Since the trainees pay for their training, the program is possibly lucrative to the institution

#### Con PDMP

 Limits the learning environment in medical physics – portrays an incomplete picture to the trainee of what medical physics training should/could be

# To the field and profession of medical

### physics

- Pro PDMP · Graduates are ready for the profession as soon as they leave school – solves a short-term issue of shortage
- in trained medical physicists DMP would reduce the disparity in compensation between M.S. and Ph.D. physicists
- Con PDMP
- Creates tensions with already employed M.Sc. and Ph.D. level medical physicists
- Creates preception problems from the allied health care professions to the value of the Ph.D. (and the M.Sc.) .
- Portrays a limited picture of the role of the physicist in a health care environment .
- The disparity between M.Sc. and Ph.D. physicists is smaller than the difference in median and 20<sup>th</sup> or 80<sup>th</sup> percentile in salary

### Discussion

- What problem did the architects of the PDMP want to solve? The 2014 crunch? Funding issues with residencies?
- A possible lack of respect for the medical physicist in the clinical environment?
   What problem could be created by the establishment of the PDMP?
- Create a training path that contradicts the very nature of the profession, i.e., that of a scientifically trained individual bringing those skills into a clinical environment – The medical environment is in need of rigorously trained quantitative physical scientists since that particular skillset is complementary that need is not fulfilled by graduates from a PDMP \_
- Confusion about what the title "doctorate" means in the case of the physicists The only upside of the PDMP really is limited to the institutions that confer the PDMP and goes no further than possible limited financial gain

## Conclusion

- Training programs have the obligation to provide an education that maximizes the job opportunities for graduates ٠
- Medical physics plays a role not only in the clinical environment but also in industry, R&D, academia, government and regulatory environment
- The model of M.Sc. + residency or Ph.D. + residency works adequately for the training of clinical medical physicists
- The PDMP program did not significantly contribute to dealing with the 2014 crunch. Residency programs did.
- The role of the medical physicist in a clinical environment is SPECIAL and UNIQUE and unlike that of other health professions (dentists, pharmacists, etc); there is no need to "copy" from another model

#### POINT/COUNTERPOINT

Suggestions for topics satisfies for these I Emeritas, Wayne State University, Detroit selected for their knowledge and commun reflect their personal axinions or the peni ortone@conveast.net. Persons participating in PointConnerpoint dises attive skill. Their positions for or against a proposition may or may not not of their positions.

A professional doctoral degree that does not require dissertation research is an appropriate alternative to a Ph.D. as preparation for a career in medical physics John D. Haller, Ph.D. Depressed of physics (Dismity of Rear M.D. Advine Carer Crear, 10:1175742, 7 and J. Madighandarowang) Denris Mark, Ph.D. Monther Modul Crear, Mark Tause Coller of Molice, Bena, New York, 1987 (IN: 7574201, Test College (Molice, Bena, New York, 1987 (H: 13/93/390, E-mail: analign-modper.org) Colin G. Orton, Ph.D., Moderator (Received 10 February 2008; secepted for publication 11 February 2008; published 6 May 2008) [DOI: 10.1118/1.2001091]

#### Dr. Mah:

"Developments in research, accreditation and training will improve the stature of medical physicists, not the PDMP program"



Please go to JoinQA.com and enter code 60913 to ask and vote for questions during this session

# Access Q&A

Medical Physics in Industry: Educational Readiness

# Conflict of Interest

#### Disclaimer

 I am CEO of a company that strives to create high-quality, reliable, predictable products In the interest of

- Safety
- Reliability, consistent performance
- Predictable outcomes
- Affordability
- these products will automate many tasks Medical Physicists have historically done manually.
- This is not unique. If it can be automated, it will be.
   (Darwin's Law of Product Evolution)

### Notably Useful things I learned

#### Playing scientist

- Hands-on lab exercises with group
- Figuring out equipment, data analysis, discussing to consensus, writing up results
   Journal club/ manuscript "peer" review → critical thinking skills, articulation
- Clinical Trial design, writing protocol. Most stolen textbook from my shelf!
- Being a TA
  - Teaching, bridging the gap with people who don't understand
     Giving presentations, getting feedback, giving feedback
- Computational skills. Python programming is a super pow Special projects. Pitching a "Monte Carlo lab" in the Physics Computing room
- . CREATE. Be a "developer". Led me to create the Varian Developer Community ۲

# Do you need ABR or Residency

### for a Career in Industry?

- I have neither, but did get 2 years of clinical experience Worked closely with pioneering clinical teams around the world
- Draw on that experience every day
- Would be an advantage. No other clear route to get clinically savvy.
- Will help land you the job in a competitive market
- If you don't have it, need relationships with those that do
- You might think you don't need these for a career in industry, but

#### Companies build products to solve problems.

How are you going to solve clinical problems without clinical experience?

### How Are Industry needs Changing?

- More emphasis on "Design", especially safety by design
- More emphasis on Outcomes. Prove the product has impact.
- Clinical workflow, usability, interconnection, smoothness, automation
- More Integration of Big Data
  - Machine performance
  - Treatment planning automation
  - More standards and protocols in workflow, outcomes

#### Al will change everything!

## Al is About to Change Everything

- If it can be automated, it will be automated.
- Today AI helps with a few tasks:
  - Plannina: Contourina, beam selection, dose calc, intensity modulation, "sanity checks" Machine QA: performance baselines, trend analysis, scripting of tests
- "Tomorrow" AI will be first-line responsibility for most routine responsibilities Chart checks
  - Machine commissioning, running and repeating QA checks, data analysis, reporting outliers
  - Suggesting protocols, estimating prognosis
  - Taking images during treatment as needed, adapting plan as needed ۲
- Anticipating uncertaintities, compensating for errors

### What's left for the Medical Physicist ?

As repeatable, "technician-style" tasks disappear, what does the MP of next decades do?

#### Department Safety Officer



- Supervise and Maintain them. QC and QA of systems. Risk analysis to identify and prevent failures
- IT-like role for medical decisions and support
   Reading reports and recommendations from AI, choosing w

Designer of new products "Design the Robots" ► Create solutions that are better, safer, faster





### What would I add to MP Education?

- Product Design creating solutions for clinical problems
  - ▶ Pay attention to what isn't working well, not in your vision of the future Finding unmet needs

  - Making stuff to solve problems and meet needs Much of the value is in the Quality of what you do,
  - Foolproof, robust, support, superior u
- Project Management how to get stuff done with limited resources
- ▶ Leadership training. Persuasion. Negotiation.
- CREATORS change the world. Create solutions to your problems. Distribute them to others.

### Biggest thing my education lacked

- Formal education is only the beginning
  - What you do with the rest of your life that matters
  - If you weren't born with it cultivate it, learn it, get out of your comfort zone
     No one is limited by what they're born with, what is "natural" for them
  - Emotional Intelligence: how to get the most out of working with teams
  - Seeing & using healthy conflict as part of an optimization process
  - LLNL 20 year study of success showed El was more important than IQ as predictor
  - Do you want to be "right", or effective??
  - Avoid burn-out. Maximize your influence.



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WISCONSIN

# Important skills for a clinical medical physicist

Michael Lawless, PhD Assistant Professor, Human Oncology University of Wisconsin Madison

University of Wisconsin-Madison

### My background

- Ph. D. in Medical Physics from University of Wisconsin Madison
   May 2016
  - · Did not do a residency
- Worked as a solo physicist at a satellite clinic for ~ 1 year
  - Part of the UW system
    1 Elekta, 1 CT, 1 dosimetrist, 1 MD
- Currently at UW Main campus
  - 2 Truebeams, 2 Tomotherapy, brachytherapy program
  - 1 CT scanner, 8 dosimetrists, 17 MDs

University of Wisconsin-Madison

### **Relevant skills**

University of Wisconsin-Madison

- Technical
- Project Management
- Social
- Analytical

#### WISCONSIN

#### **Technical Skills**

- The science behind what is done in the clinic every day
  The necessary knowledge and ability to use and implementations.
- The necessary knowledge and ability to use and implement the technology
- This knowledge base is expanding rapidly
- Where are these skills learned?
  - Graduate classes
  - · Training on the equipment/software being used
  - Publications
  - Residencies

University of Wisconsin-Madison

#### 

### **Project Management Skills**

University of Wisconsin-Madison

- How to handle and balance the various tasks and projects that all overlap
- Prioritize needs and projects and address them thoroughly and efficiently
- · Where are these skills learned?
  - · Graduate school thesis work on top of classes, etc.
  - Residency

#### WISCONSIN

#### Social Skills

- · Communication, collaboration, teamwork, leadership
- · No physicist works on an island
- Constant interaction with dosimetrists, therapists, and physicians
- Important to be able to effectively and efficiently communicate and collaborate with all of these other professions
- · Where are these skills learned?
  - Residency
  - Other

#### WISCONSIN

#### **Analytical Skills**

University of Wisconsin-Madison

- Problem solving applying your technical knowledge to the clinial environment The ability to think quickly is an essential part of being a clinical physicist •
- Can be put under pressure to deal with uncommon scenarios . Will need to draw on your other skill sets to help solve them

  - Identify the problemDevelop a plan
  - Take action accordingly
- · Where are these skills learned?
  - · Graduate school
  - Residency

### My personal experience

- Strengths •
- · Technical and project management skills
- Weaknesses
  - · Analytical/Problem solving and Communication
- · Residency or not?
  - · Residency program definitely would have helped develop skills I was deficient in
  - · Would not have taken any job UW was a great oppotunity

WISCONSIN

#### Conclusions

- · A variety of skills are necessary to be a clinical medical physicist
  - Technical
  - · Project Management
  - Social
  - Analytical
- · These skills are learned in different places and are stressed to different degrees



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# Conflict of interest

• License royalties from IBA

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#### Why research from the clinical perspective?

- PhD students are trained as researchers, but the majority of medical physics PhD students take jobs in the clinic
  - Work impacts patient lives
  - Practical applications



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http://campep.org/2015AnnualGraduateReport.pdf

#### What kind of research opportunities exist in the clinic?

As a clinical physicist, you don't need to ponder problems, problems present themselves everyday!

Our training helps us identify solutions
 Solutions based on clinical issues represent "highly relevant" research







Lego QA

James Dempsey, PhD University of Florida Dan Hyer, PhD University of Iowa

 Multic, S., & Dempury, J. F. (2014). The Viewflay system: magnetic resonance-golded and controlled radiatherapy. Semin Radiat Oncol. 24(1), 196-199. doi: 10.1016/j.semradonc.2014.02.008
 Sacolt, R., & Pennington, E. C., Waldom, T. J., & Baryouh, J. E. (2009). Addiation therapy glan check in a paperine clinic. J Appl Cin Med Phys. 12(1), 2004. Phys. C B., Marc. C. J. Nincon, E. (2011). A conference and implementation of an PDD-sale minibation for an PDD-sale minibation for an PDD-sale minibation. Phys. C B., Marc. C. J. Nincon, E. (2011). Resolution: A conference and a paperine minibation of an PDD-sale minibation for an PDD-sale minibation. Phys. Resolution: A second conference and implementation of an PDD-sale minibation. Phys. Resolution: A second conference and implementation of an PDD-sale minibation. Phys. Resolution: P

# Where do you start your clinical research career? Papers Students Grants

The University of Iowa

#### How is research funding in medical physics changing?

NIH funding is becoming harder to get...
 – Gold standard: R01 equivalent grant



The University of Iowa

https://report.nih.gov/success\_rates/

#### So how does a clinical physicist fund their research?

· We work with real equipment every day

#### Applications development

- · Vendors can lend hardware/software or even fund research
  - Vendor sponsored research can drive development of current or future clinical products
- Start a business
  - STTR/SBIR funding is available to help drive the development of new products/software
    - STTR: Small Business Technology Transfer
       SBIR: Small Business Innovation Research

THE UNIVERSITY OF IOWA

### Educating for research

- No matter what your path, gain these experiences in graduate school
  - What is the hardest abstract/paper/grant to write?
  - The first one!
  - Learn how to program!
  - If your research deals with patients (even just their imaging datasets) you will likely need an IRB
    - IRB: Institutional Review Board An ethics committee that assures the appropriate steps are being taken to protect the rights of humans in a research study

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### Skills of a successful clinical researcher

- Conception of ideas
  - As a clinical physicist, this is the easy part
- Salesmanship
  - EmployerVendors
  - vena – NIH
- Persistence!
- Communication
  - Need to be excellent at writing and communicating

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Annual Student Meeting: Provocative Questions in Medical Physics Training

### A Research Career in Medical Physics: Skill Sets and Professionalization

Maryellen Giger, Ph.D. A. N. Pritzker Professor Department of Radiology/Medical Physics The University of Chicago

### COI

- M.L.G. is a stockholder in R2/Hologic, co-founder and equity holder in Quantitative Insights, shareholder in Qview, and receives royalties from Hologic, GE Medical Systems, MEDIAN Technologies, Riverain Medical, Mitsubishi, and Toshiba.
- It is the University of Chicago Conflict of Interest Policy that investigators disclose publicly actual or potential significant financial interest that would reasonably appear to be directly and significantly affected by the research activities

# Topics of session

- The changing education and skills of medical physicists
- The nature of medical physics research
- Professionalization

# Topics of session

- The changing education and skills of medical physicists
- The nature of medical physics research
- Professionalization

Exciting career as a academic researcher

### Who am I?

- Academic medical physicist
  - the A. N. Pritzker Professor at the University of Chicago
  - Radiology, Medical Physics, and the College
- Research
  - NIH Grant-funded lab CAD, quantitative image analysis, radiomics, machine learning
- Ph.D. students, undergrads, post-docs, senior researchers Education
- ٠
  - Teach in our CAMPEP-accredited Ph.D. program
  - Advise graduate, undergrad, medical students...

#### Who am I?

- Administration
  - Prior Director, CAMPEP-accredited Ph.D. program
  - Vice-Chair of Radiology for Basic Science Research
  - Chair and/or member of various university committees, etc.
    - E.g., Co-chair of Committee on Appointments and Promotions

#### Who am I?

- External Memberships and Leadership Roles
  - AAPM, RSNA, SPIE, AIMBE, IEEE ...
  - National Academy of Engineering
  - Editor-in-Chief, SPIE Journal of Medical Imaging (JMI)
  - Prior President of AAPM
  - Current President-Elect of SPIE
  - Grant reviewer for NIH and other funding agencies
  - Scientific Advisor/Consultant to various companies Quantitative Insights

## The nature of medical physics research

Destination of PhD graduates

- Approx. 60% go into residencies (RT or IP) or junior physicist position
- Approx. 40% go another route

http://campep.org/2015AnnualGraduateReport.pdf

- Students trained in my lab have pursued both routes.
- Main career difference is the % time allowed for research.

#### **Research Chain**



#### Research Chain





#### **Research Chain**





# Research Chain





#### **Research Chain**

Identification of an issue (problem)					
Collection of examples (cases)					
Investigation and potential solutions: equipment, algorithm, protocol					
Validation of the research finding	<ul> <li>FDA clinical study</li> <li>Clinical testing with clinical collaborators</li> </ul>				
Translation to clinical care: FDA clearance. clinical testing, clinical use					

#### Education for a Medical Physics Research Career

- Obtain a solid didactic education in a CAMPEP medical physics graduate program
- Be an active member of a lab
- Help supervise junior students/summer students
- Write abstracts/presentations and papers/peer-reviewed publications <u>while a student</u>
- Write pre-doctoral grants, seed grants
- Learn how to write an IRB
- · Learn how to work with others
  - Collaboration (play nice in the sandbox)

### Skills of a successful researcher

- · Be creative
- Be hard working and dedicated
- Don't give up & always look for opportunities
- Helps if you can program/code
- Know statistics
- Collaborate with others
- Communicate
- Realize that research is not a homework problem!
- Know how to work with others
  - Collaboration (play nice in the sandbox)

# Thank you



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# Access Q&A

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If you want to continue this discussion check out...

**FUTURE: Provocative Questions in Medical Physics** 

Monday 4:30-6 PM Four Seasons 4

THE UNIVERSITY OF IOWA