


2022 AAPM Education Council Symposium 

**Teaching medical physics to graduate students  
along their path to becoming independent  
investigators**

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**Teaching medical physics to graduate students along their path  
to becoming independent investigators**

- **Teaching** Medical Physics through coursework
- **Mentoring** students so they can become independent investigators
- **Sponsoring** graduate students to push their boundaries, get out of their comfort zone, network, and enable their path to becoming leaders in medical physics
- Conducted in such a way that the student may not even realize they are being “taught”
  - While day to day change may look small, look at the change from day one to the day they complete their graduate degree!

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- All I Really Need To Know I Learned In Kindergarten
  - Share everything.
  - Play fair.
  - Don't hit people.
  - Put things back where you found them.
  - Clean up your own mess.
  - Don't take things that aren't yours.
  - Say you're sorry when you hurt somebody.
- Play nice in the sandbox
- Respect the strengths (& weaknesses) of team members

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### Teaching Medical Physics through coursework

- University of Chicago has a CAMPEP-accredited graduate program in medical physics
  - Diagnostic and therapy medical physics faculty
- Different faculty teach based on their expertise
- Didactic lectures, lab practicums, and TA requirements
- Statistics – usually solidified during their research
- Coursework – breadth and depth
- Periodically stop and review the coursework
  - Student reviews
  - Changing times, e.g., the rise of Data Science

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### Mentoring students so they can become independent investigators

- Skills and experience to complete a dissertation on a topic in medical physics
  - That topic is the “media” on which they learn the scientific process
  - Need to think on their feet and be creative
  - Provide them with the needed resources
- “See one, do one, teach one”
  - Have their research niche clarified
  - Start off working with senior members of the lab
  - They take ownership of their research
  - Expand their research (show their creativity)
  - Mentor summer students (mutually beneficial)
- Along the way, learn more medical physics, medicine, radiology, computer science, statistics, etc, since medical physics is an interdisciplinary field
- Customize their dissertation committee based on the choice of career
  - Clinical medical physics, academia, government (FDA, NIH), industry

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### Examples – the mentee becomes the mentor

- Graduate Student Jordan Fuhrman and an **AAPM summer undergrad research fellow**
  - *AAPM abstract* – “Attention U-Net Segmentation of Indeterminate Nodules on Thyroid Ultrasound”
  - **Josh Genender**, **Jordan Fuhrman**, Hui Li, ..., Xavier Keutgen, Maryellen Giger
- Graduate Student Jordan Fuhrman and two University of Chicago undergraduates
  - *RSNA abstract* – “A Novel Deep Learning Pipeline for Simultaneous Segmentation of Lung and COVID-19 Involvement in Thoracic CT Scans”
  - **Elise Katsnelson**, **Beatrice Katsnelson**, **Jordan Fuhrman**, Chaojie Wei, Feng Li, Hui Li, Zhe Luo, Zegang Dong, Fleming Lure, Zhenshun Cheng, Maryellen L. Giger
- Graduate Student Lindsay Douglas and a summer high school student
  - *SPIE abstract* – “Comparison of 2D and 3D U-Net Breast Lesion Segmentations on DCE-MRI”
  - **Roma Bhattacharjee**, **Lindsay Douglas**, Karen Drukker, Qiyuan Hu, Jordan Fuhrman, Deepa Sheth, Maryellen Giger

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**Sponsoring** graduate students to push their boundaries, get out of their comfort zone, network, and enable their path to becoming leaders in medical physics

- Become mentors of summer students
- Present early at national meetings like AAPM
- Get them involved early in my own research collaborations with other institutions (“the glue”)
  - Example: Mount Sinai – Jordan Fuhrman on LDCT
  - Example: MD Anderson – Natalie Baughan on breast cancer imaging
- Example: MIDRC (the Medical Imaging and Data Resource Center)
  - Senior students participate in the TDPs and CRPs
  - Give presentations in monthly seminars and town hall
  - Be the center of live demos at meetings (SPIE MI and PBDW)
- Review manuscripts
- My former graduate students and grand-students are some of the leaders of AAPM today

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**Need both a nurturing and exciting environment**  
Giger Lab: Unique and Outstanding Individuals




- Senior researchers
- Expert research staff
- Awesome post docs and graduate students

Plus, many clinical collaborators and multiple undergraduate and HS students (usually 6 per summer)

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**Need both a nurturing and exciting environment**  
Giger Lab: Unique and Outstanding Individuals



- Enable them to find their own niche
- Don't micromanage
- Give them the space to be creative
- Respect the strengths (& weaknesses) of team members
- Mentor and sponsor them to grow in their career
  - Opportunities for chapters, reviews
- Similarly for the undergrad/HS students
- Equal around the research table
- Play nice in the sandbox

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PhD Graduates from my UChicago Med Phys Lab

Destination of PhD graduates

- Approx. 40% go into residencies (RT or IP)
- Approx. 60% go another route
  - Post doc to faculty
  - Government lab (FDA, NIH)
  - Industry

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  - **Best reward is when my student becomes my colleague**

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Recent & Current Graduate Students

Joel Wilkie, PhD  
 Martin King, PhD  
 Nick Gruszaszkas, PhD  
 Yading Yuan, PhD  
 Robert Tomek, MS  
 Neha Bhooshan, PhD  
 Andrew Jamieson, PhD  
 Hsien-Chi Kuo, PhD  
 Martin Andrews, PhD  
 William Weiss, PhD  
 Chris Haddad, PhD  
 Natasha Antropova, PhD  
 Adam Sibley, PhD  
 Kayla Robinson, PhD  
 Jennie Crosby, PhD  
 Qiyuan (Isabelle) Hu  
 Jordan Fuhrman  
 Lindsay Douglas  
 Natalie Baughan  
 Joseph Cozzi

**Thank you  
 Giger Lab**

**Research Lab**

Karen Drukker, PhD  
 Hui Li, PhD  
 Heather Whitney, PhD  
 Yu Ji, MD  
 Chun Wai Chan, MS  
 Li Lan, MS  
 John Papaioannou, MS  
 Sasha (Alexandra) Edwards, MA  
 Madeleine Durkee, PhD  
 Summer medical students,  
 undergraduates, and  
 high school students



**Over the past 3 decades-- At the University of Chicago, we discover new ways to use computers (AI) to enrich the information extracted from medical images so that radiologists can better find, diagnose, treat, and understand disease (such as cancer, COVID).**



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