2022 AAPM Education Council Symposium
Teaching medical physics to graduate students along their path to becoming independent investigators
Maryellen L. Giger, PhD
A. N. Pritzker Distinguished Service Professor of Radiology / Medical Physics
The University of Chicago
m-giger@uchicago.edu

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!

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

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.
- 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.
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
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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

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)

- 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 the table
- Play nice in the sandbox
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

Recent & Current Graduate Students

Joel Wilkie, PhD
Martin King, PhD
Nick Grezczynski, PhD
Yating Yuan, PhD
Robert Toshak, MS
Neha Bhosale, PhD
Andrew Janisseon, PhD
Hsin-Chi Kuo, PhD
Martin Andrews, PhD
William Weiss, PhD
Chris Haskell, PhD
Natalia Antropova, PhD
Adam Niewy, PhD
Kyle Robinson, PhD
Jennie Crosby, PhD
Qiyan (Isabelle) Hu
Jordan Folkman
Lindsay Douglas
Natalie Brauchos
Sammi Gais

Research Lab
Karen Wilkie, PhD
Hai Li, PhD
Heather Whitney, PhD
Yu Ji, MD
Chan Wai Chan, MS
Li Lan, MS
John Pappas, MS
Sasha (Alexandra) Edwards, MA
Madeleine Dickler, 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).