Annual Student Meeting:
Provocative Questions in Medical Physics Training

A Research Career in Medical Physics: Skill Sets and Professionalization

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COI

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Topics of session

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

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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
  - 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

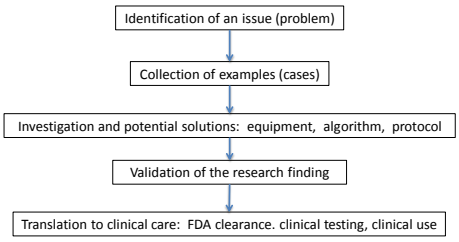
Destination of PhD graduates

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

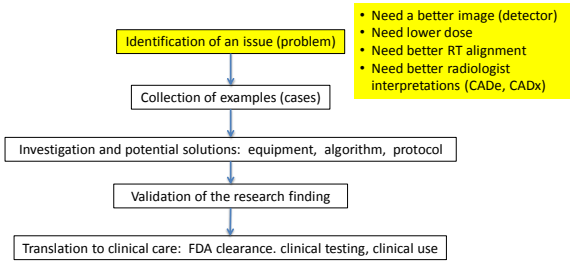
http://campep.org/2015AnnualGraduateReport.pdf

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

Research Chain



Research Chain



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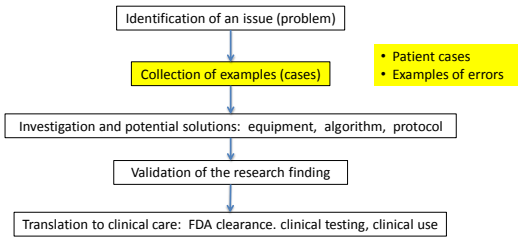

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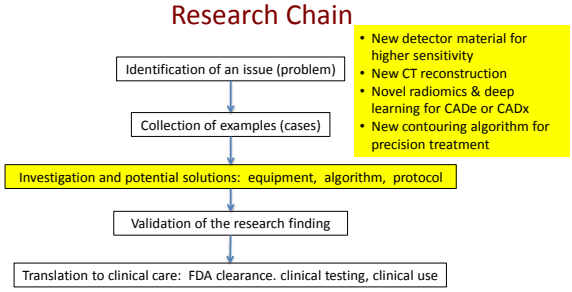

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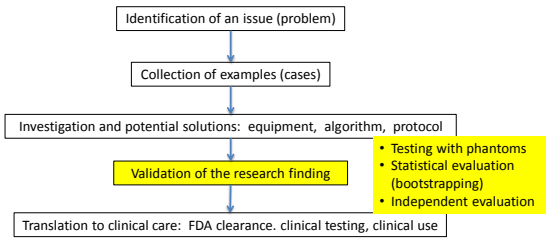

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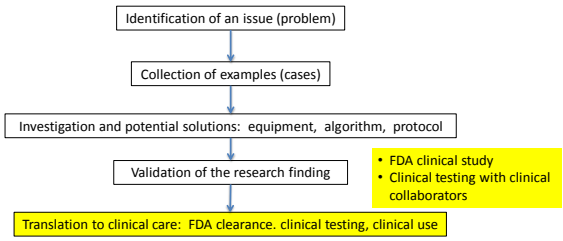


Education for a Medical Physics Research Career

- 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 while a student
- 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

My Life and Medical Physics

- **Illinois Benedictine College** (1974-1978)
  - Professor Shonka tissue-equivalent plastic (1960's)
  - Professors Spokas and Meeker – started Exradin company making ion chambers for dosimetry (Standard Imaging, Inc.)
    - Exradin Miniature Shonka Thimble Chamber

EXRADIN A1SL ION CHAMBER

For relative dosimetry scanning and measuring points in water, air, or other phantom material

My Life and Medical Physics

- **Illinois Benedictine College** (1974-1978)

  - Professor Rose Carney, who had worked on the Manhattan Project
  - Professor of Mathematics at IBC
  - My advisor & mentor in college
  - Many opportunities – teaching HS summer Algebra & at Fermi Lab

My Life and Medical Physics

- Summers at **Fermi National Labs** (1976-1978)
  - Drs. Mike Shea and Bob Goodwin – **beam line diagnostics**

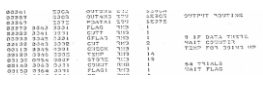
"Protons are being accelerated through Linac's nine cavities for the first time at 200 MeV. Here, at the control console, are Robert Goodwin and Mike Shea. (1970)"

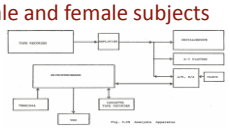
"Miguel Awschalom, Lionel Cohen watch final preparation of Fermi Lab's Neutron Therapy Center"

  - Dr. Miguel Awschalom – **neutron therapy** center opened in 1976

My Life and Medical Physics

- **University of Exeter, England** (1978-1979)
  - Rotary Fellowship
  - M.Sc. in physics
  - The detection of low frequency rhythms in the electrocardiograms of male and female subjects





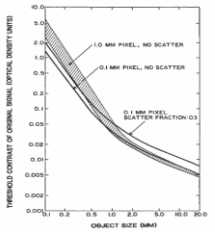
My Life and Medical Physics

- **The University of Chicago** (1979-1985)
  - Ph.D. in medical physics: Basic Imaging Properties in Digital radiography

$$S_p = \left| \int_{-\infty}^{\infty} |SS(u,v)|^2 \, VRF^2(u,v) \, du\,dv \right|^{1/2}$$

and

$$R_p = \left\{ \frac{\int_{-\infty}^{\infty} [\,|SS(u,v)|^2 \, VRF^2(u,v)\,] \, [\,WS(u,v) \, VRF^2(u,v)\,] \, du\,dv}{\int_{-\infty}^{\infty} |SS(u,v)|^2 \, VRF^2(u,v) \, du\,dv} \right\}^{1/2}$$



My Life and Medical Physics

- **The University of Chicago** (1986-present)
  - Assistant Professor to A. N. Pritzker Professor (tenured full professor)
  - Run a federally–funded research lab on CAD/quantitative radiomics
    - Apply for grants constantly
    - NIH (NCI, NIBIB, NIAMS), DOD, DOE, Whitaker, ACS, …)
    - Involve senior members of lab in the training and supervision of junior members in the lab.
    - All are "equal" around the research table and learn to ask probing questions
  - Involved in teaching within our CAMPEP-accredited PhD. Program
    - Highly value graduate students
    - Have 4-6 summer students (HS, undergrads) each year
    - Best "payback" - When a student/trainee becomes a colleague!