(SEVEN STEPS) IN TRANSFORMING PRACTICE: THE EXPANDING ROLE OF MEDICAL PHYSICS IN NEUROSURGERY FOR MOVEMENT DISORDERS

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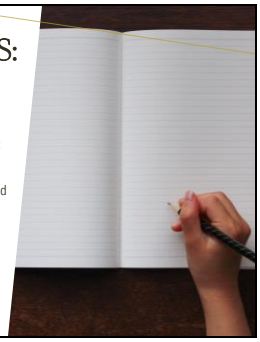
Professor & Chief, Technology Applications and Translational Research

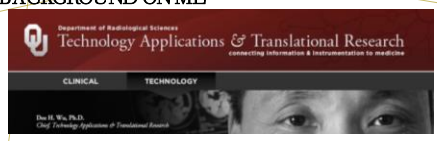
Caught MedPhys Residents interest! Caught MedPhys Students interest

LEARNING OBJECTIVES:

1. Understand the needs and **priorities of neurosurgeons** that medical physicists can meet in image-guided surgery and interventions.
2. Describe the **skills, traits, and practices** that drive successful medical physics engagement with neurosurgeons in movement disorders.
3. Analyze historical trends in physician practice consolidation and their potential applicability to medical physics. For example, UCSF and Stanford have strong movement disorders programs
4. Interpret **common terms and phrases in movement disorders** encountered during the evaluation and treatment within neuromodulation preparation with interoperative MRI.
5. Discuss the **potential impact to medical physics practice**, and future professional opportunities.



BACKGROUND ON ME



Developing Infrastructure and Improving Logistics for Clinical Medicine …

- We have expertise in improving clinical protocols and methodology. Collaboration is the cornerstone of our practice strategy for ***"clinical translation,"*** which seeks to improve medicine and society by novel technology implementation and appropriate use. To learn more, consider reading the ***OU Medicine Biannual Publication***, *Scientist Traverses Disciplines to Meet Needs in Medicine"*

Innovation becomes Practice

SOME RELATED CONCEPTS

Physics for Every Patient medical physicists can think beyond the QA in the background and try to assist in situations that are more 'fluid' in the hospital. In addition, because medical physicists are integrated into the hospital environment, they can have a particular impact on the healthcare milieu via the delivery of their **Multiple services and skills**. Well-designed, managed, and utilized EHR are particularly important for tumor board management, emergency pandemic response protocols, and even in patient survivorship. **Hospitals are complex organizations** with many opportunities to improve these services. **Medical physicists**, through participation on committees, oversight, and overlap/communication with departments, can serve vital needs in these processes.

ABOUT MULTIPLE SERVICES AND SKILLS.

Intervention	Internal medicine	Clinical Systems
- Breast Surgery	- Cardiovascular Disease	- Anesthesiology
- Emergency Medicine	- Gastroenterology	- Endocrinology
- Hematology/Oncology	- Infectious Diseases	- Genetics
- Orthopedic Surgery	- Nephrology	- Pathology
- Otorhinolaryngology	- Neurology	- Radiology
- Plastic Surgery	- Neonatology(NICU)	
- Radiation Oncology	- Pediatrics	
- Vascular Medicine	- Pediatric Oncology	
	- Pulmonary Disease	

Dr. Dee Wu has had projects in 22+ subspecialties of medicine at Some time over 20 years and will provide examples next

"Broad Portfolio"

COMMITTEES FOR AAPM, I SERVE ON:

- **AHFDS** - Ad hoc Committee to Explore Future Directions in the Science of Physics in Medicine
- **MP3.0C** - Medical Physics 3.0 Committee
- **W.G.MP3RD** - Working Group for MP3.0 Resources Development
- SDAMPSRVY - Society of Directors of Academic Medical Physics Programs on Surveys
- **MP3.ESC** - Smart Expansion Subcommittee (Chair)

OU HEALTH: MY ACADEMIC HOSPITAL

- Academy of Teaching Scholars (Chair of Mentorship and Scholarship)
- Cancer Survivorship Committee
- Adjunct in Computer Science
- Adjunct in Electrical Engineering
- **Data Institute for Societal Challenges**

SEVEN STEPS - MP3.0 MOVEMENT DISORDERS

WHAT ARE THE SEVEN ITEMS?

1. Fundamentals
2. Context (includes fundamentals)
3. Blending In
4. Communications
5. Understanding Patients First
6. Test/Test/Test
7. Logistics/Supply Chains and Vendors

* (this includes with **context** – will go over this more in next slide)

1. FUNDAMENTALS

- You are medical physicists so know the ins and outs of the scanners you work on
- For MRI
  - Pulse Sequences
  - Hardware (such as coils)
  - Advanced Apps

- **Baseline: The weekly, daily QAs. They are the entry point. This is how we get in the door…**

MORE ON FUNDAMENTALS WITH CONTEXT

THIS RELATES TO UNDERSTANDING OPERATIONS AT THE SCANNER (WHAT HAPPENS AT SCANNING WITH PATIENTS)

- **Tradeoffs**
- **Artifacts**
- **Pulse Sequence Basics**

Book on MRI Fundamentals

https://www.amazon.com/MRI-Made-Simple-IPEM01-Dee/dp/0750328158

*CLINICAL DOMAIN SCIENCES INTEGRATION (COLLECTIVE LANGUAGE)**

it is helpful to come from a perspective of where does medical training emerge – a portion content withing first portion of medical school?

Some Domains that Medical Personnel

- Physiology and Anatomy
- Humans and Molecules
- Pathology and Disease
- Psychological and Social

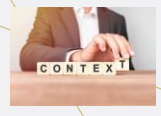
Some Vocabulary We Used

- *High frequency neuromodulation*
- *Globus pallidus internus (GPi)*
- *Neurostimulator*
- *Pallido-capsular border*
- *Subcortical structures*
- *Phase sensitive inversion recovery (PSIR)*
- *Putamen*
- *Internal capsule*
- *Medullary lamina*
- *White matter tracts*

Dee Wu, PhD

2. CONTEXT

the setting, in time or space, surrounding the occurance of a given event.



- Relationships may develop over the years
- Make yourself useful
- Listen and share (i.e. teach and learn)
- Do the work

CONTEXTS

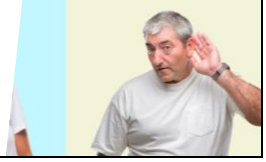
(Relevant to your Institution)

CONTEXTS (LOCALLY RELEVANT TO ME)

1. Neurosurgery is very hard to get into. They have a rotating set of volunteers medical students 10-20 students for research projects. Expectation is very high for neurosurgery so they need publications. They come and go and will have their own projects but they might be able to work with you if you help them at same time.
2. Neurosurgeons are very **results** oriented!
3. Humble and Smart. (for the kind of work they do, this is my impression of our neurosurgeons and the ones I work with).
4. Our Radiology Technologists are solid, we need to **p a r t n e r** with them on getting the best results

3. BLENDING IN

- **Active Listening**
- Being a team member
- Realize that there may not be tradition of medical physicists in these procedures, so you might be the first one. Build trust is the first goal.



GOOGLE SEARCH FOR "MOVEMENT DISORDER CENTER & PHYSICS" TERMS

Movement Disorders Center | Stanford Health Care
https://stanfordhealthcare.org › medical-clinics › move...
With comprehensive evaluation and treatments, we treat a number of **movement disorders**, including tics, ataxia, Parkinson's disease, and dystonia.

Movement Disorders & Ne...
https://movementdisorder...
The **Center** for **Movemen**... and ...
Missing: ~~physics~~ | Must i...
People also search for
center for movement disor...
movement disorder clinic...

Parkinson's Disease and ...
https://www.hopkinsmedi...
The **Movement Disorders**...
Missing: ~~physics~~ | Must i...

Rocky Mountain Moveme...
https://www.movementdi...
Rocky Mountain **Moveme**... **Disorders**.
Missing: ~~physics~~ | Must i...

Parkinson's Disease and ...
https://www.kumc.edu › ...
The **Center** offers diagno... palsy, ...
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Dr. Helen Bronte-Stewart is the John E Cahill Family Professor in the department of Neurology and Neurological Sciences. She is a neurologist, neurophysiologist and movement disorders specialist, who has used her training in mathematics and **physics**, bioengineering, neurology, movement disorders, and single unit electrophysiology in primates to develop a rigorous translational program in motor control research in human subjects with movement disorders. Dr. Bronte-Stewart is the Director of the Human Motor Control and Neuromodulation Laboratory, where she has developed computerized, quantitative measurements of motor behavior, which are being implemented in a wide range of Movement Disorders. She is also the Co-Director of the Stanford Balance Center, Her research investigates the brain's contribution to abnormal movement in human subjects, using synchronous brain recordings and quantitative kinematics, and how these are modulated with different frequencies and patterns of neurostimulation. Dr. Bronte-Stewart's team was the first in the United States to implant a sensing neurostimulator, from which they can record brain signals directly, and use the patient's own neural activity to drive the first closed loop neurostimulation studies in Parkinson's disease. This work has led to her team receiving a BRAIN Initiative grant to perform the first closed loop deep brain stimulation studies for gait impairment and freezing of gait in Parkinson's disease. She is the North America Lead Investigator for the first pivotal international trial of adaptive DBS in Parkinson's disease – the ADAPT trial.

Would like to see the word 'physicist' in this list

The Physicists' Leadership Role in Academic Radiology: The Chair's Perspective Ronald Arenson, MD
On Physicists or other PhD Scientists at UCSF

Co-chair with radiologists Research Interest Groups
- Run the research labs including cyclotron
- Run Master's program in Imaging – Alastair Martin (AAPM member) and David Saloner (have physics degrees)
- Support graduate program and post-docs in Bioengineering – joint program with Berkeley

Major leadership positions
- On steering committee for Cancer Center (Imaging) – Sarah Nelson Chaired department with School of Pharmacy – Sarah Nelson
- Vice-chair for Research (also on KC and exec ctte) – Sharmila Majumdar
- Lead physics and radiation training for residents, fellows, grad students, post-docs and masters' student

FELLOWSHIP TRAINED AT UCSF

http://amos3.aapm.org/abstracts/pdf/115-31948-385514-119639.pdf

4. COMMUNICATIONS

- When I am able to gain results to **inform** (positive and/or negative)
- Be a **Partner**
- Even when delays, explain (we had many, covid, research agreements, IRB, testing etc.). You may have to do this work*

* This section also interconnected with logistics (a topic we cover later)

5. UNDERSTANDING PATIENT FIRST

Physics for Every Patient

Medical Physics 3.0 (MP3.0) is an initiative to enact, express, and enhance the full value of physics towards human health that includes practice, administrative, scientific, and educational goals. It also includes exploration of areas beyond radiotherapy and imaging.

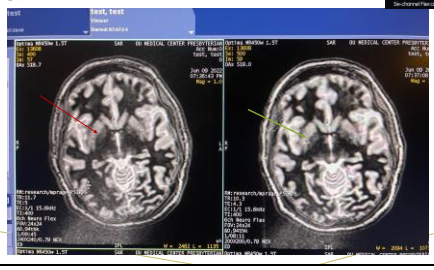
MEDPHYS 3.0

6. TEST/TEST/TEST*

- Image quality: We have to help assist with getting this done. We don't have a research magnet so have to work this in 'between patients', 'after hours' etc..
- We had to schedule testing even when there was covid concern
- We had to deal with several coil change outs (there is a special coil that needed to be used – neuroflex)

* when permitted, can we do adequate testing, minimizing patient table time and optimize results?

TEST



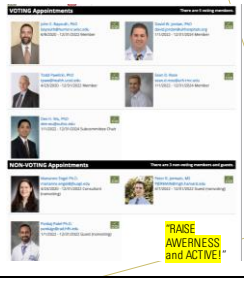
7. LOGISTICS

- Covid Work arounds
- Supply Chain issues
- IRB/Regulatory
- Safety
- Working with Vendors (Clearpoint™, GE™)

RESULT (THIS IS WHAT PHYSICIANS/HOSPITALS WANT)

- Neurosurgery and I are **now writing the paper** (about the details of our collaboration). We also are continuing to setting up other collaborations (such as coil development, pulse sequences and other possible procedural improvements)
- Good relations with neurosurgery, radiology technologists can be helpful for radiology and other departments. Their procedures can drive the hospital and has high visibility to the community. (they see med physics and radiology)

MEDICAL PHYSICS 3.0 SMART EXPANSION



"RAISE AWERNESS and ACTIVE!"

CONCLUSION (& TAKEAWAYS)

1. Fundamentals: Being in the Hospital and Relevant.
2. Context (that includes fundamentals): Learn the Language.
3. Blending in: You Might Be The First One In. Make Yourself Useful.
4. Communications: Partner and Inform.
5. Understanding Patients First: Physics For Every Patient.
6. Test/Test/Test: Do What You Need To Do To Ensure Procedure Has Best Opportunity.
7. Logistics/Supply Chains and Vendors: Regulatory/Safety/Research Agreements.

Questions?

MRI Fundamentals Book

Additional Med Phys 3.0 Webinar

Dee Wu Lab's Website