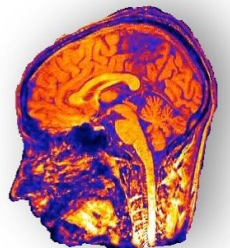




# *The Physics of Modern Medicine*

## *Applications in Imaging, Surgery, & Therapy*

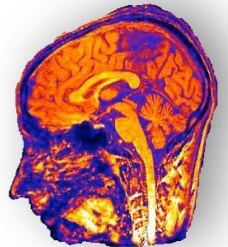
*Winter 2023*



# Course Outline



- **Lasers in Medicine** – *Light, Surgery & Therapy*
- **Ultrasound** – *Sound, Diagnosis & Therapy*
- **X-rays in Medicine** - *Light & Interaction of Radiation and Matter, Diagnosis & Treatment*
- **Nuclear Medicine** - *Interaction of Radiation and Matter, Diagnosis, Surgery, Therapy, & Treatment*
- **Radiation Safety**
- **Magnetic Resonance Imaging** – *Magnetism, Diagnosis*
- **Guest Lectures** - *Special Topics*

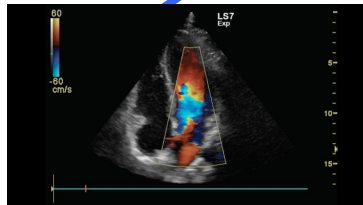


# Course Outline

- Lasers in Medicine
- Ultrasound



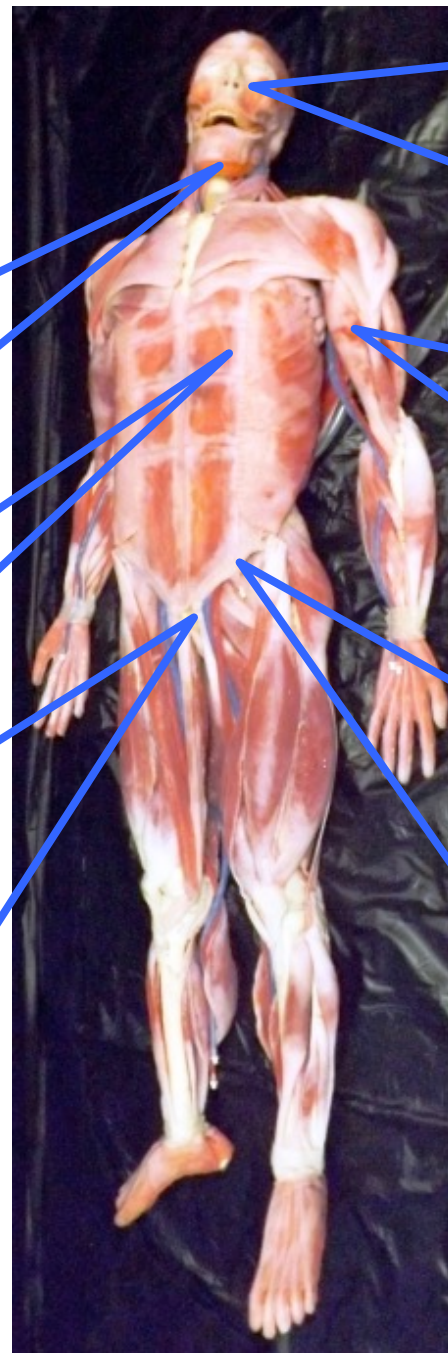
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[http://www3.gehealthcare.com/en/products/categories/ultrasound/logiq/logiq\\_s7](http://www3.gehealthcare.com/en/products/categories/ultrasound/logiq/logiq_s7)



[http://www.scumil.cn/Liu\\_BOOK\\_EN.htm](http://www.scumil.cn/Liu_BOOK_EN.htm)



<http://www.healthable.org/laser-eye-surgery-costs-explained/>



<http://www.cuded.com/wp-content/uploads/2014/01/13-Arm-tattoo.jpg>



<http://www.ultrasoundpaedia.com/normal-kidney/normal-kidney/normal-kidney/>

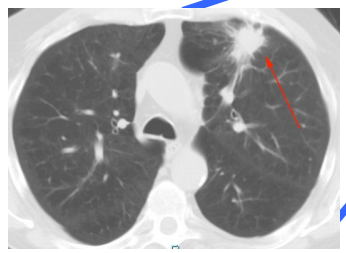
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# Course Outline

- X-rays
- Nuclear Medicine
- Radiation Safety
- MRI



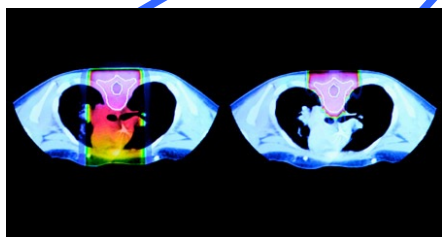
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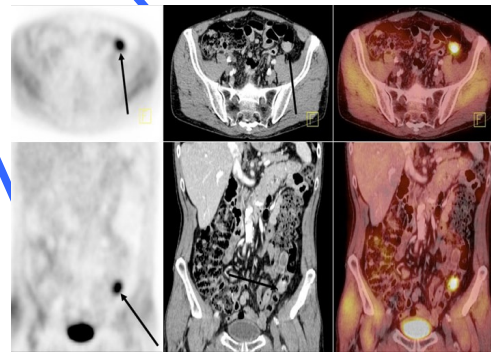
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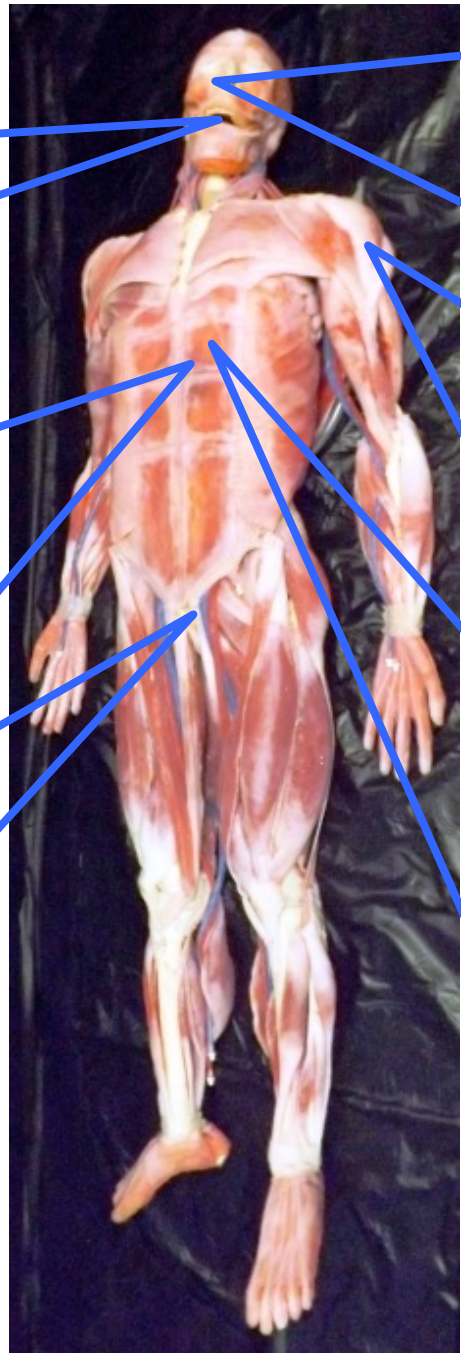
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<http://www.oncolink.org/treatment/article.cfm?c=186&id=433>



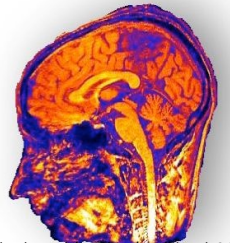
[http://www.mghradrounds.org/index.php?src=gendocs&ref=2012\\_august](http://www.mghradrounds.org/index.php?src=gendocs&ref=2012_august)



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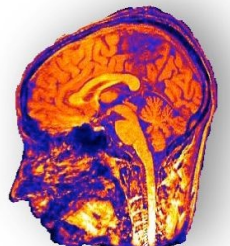
# Motivation

- Review physics & the connection between physics and medicine.
- To use physics to probe & study the body.
- To learn how to produce images of the body using technology and the underlying physics.
- To acquaint you with the “tools of the trade” that you’ll encounter in the future.
- To introduce you to professionals in the field.



# Some Things We'll Learn...

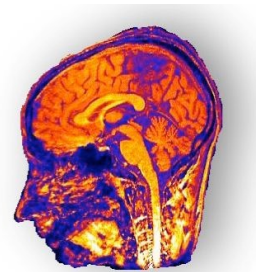
- Basic physics (again?).
- Some advanced physics & mathematics.
- Human anatomy & physiology.
- Structure and function of organs
- Biochemistry & biophysics.
- Medical imaging history and current technology.
- How professionals incorporate imaging physics into their fields.



# Medical Imaging



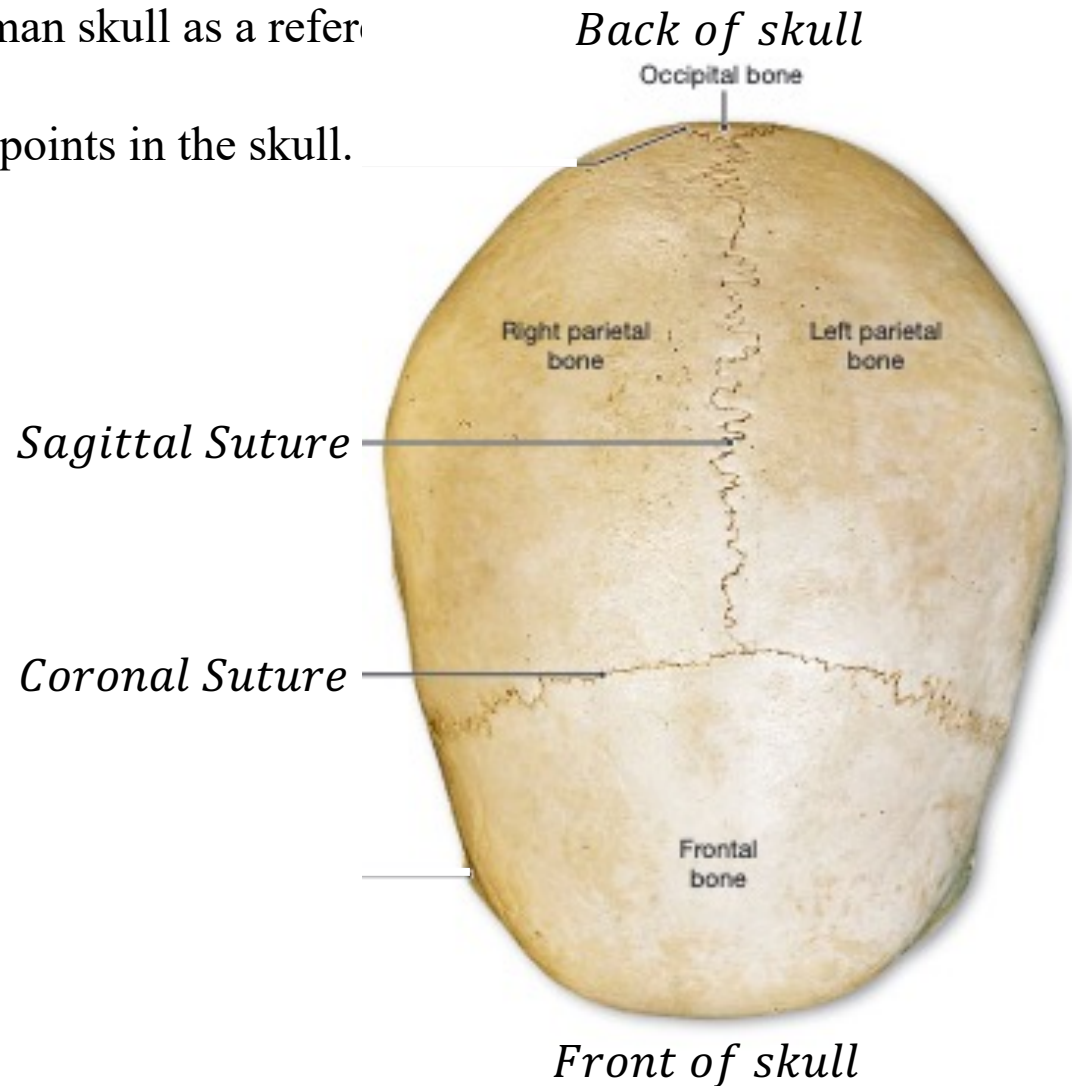
- Involves physicians, technicians, medical physicists, nurses, radiation safety staff, maintenance staff.
- Highly non-trivial to produce an image.
- Highly specialized and technical field.
- Long history that spans over a century.
- Mostly non-invasive.
- Relies on increasing energy of light (or sound) to probe deeper into the body.



[www.physics.leeds.ac.uk/graphics/med\\_head\\_2.jpg](http://www.physics.leeds.ac.uk/graphics/med_head_2.jpg)

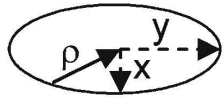
# Anatomical Orientations

- Views are derived using the human skull as a reference
- We use two of the main fusion points in the skull.
  - The sagittal suture
  - The coronal suture

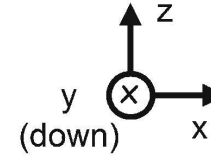
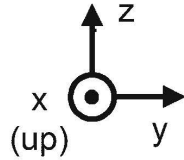




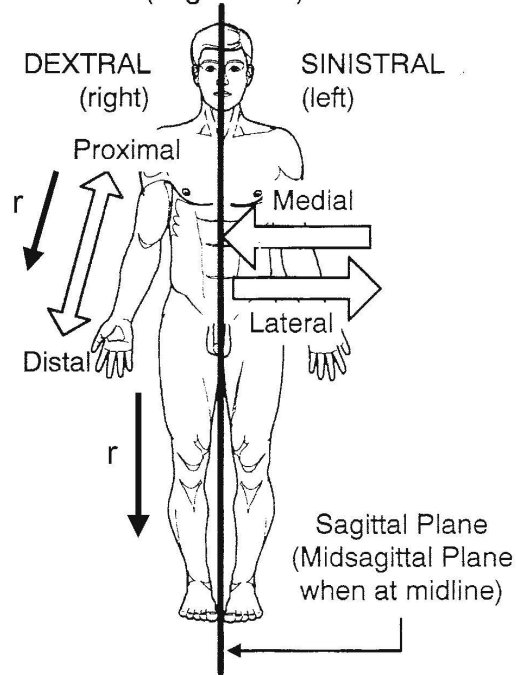
# Anatomical Orientations



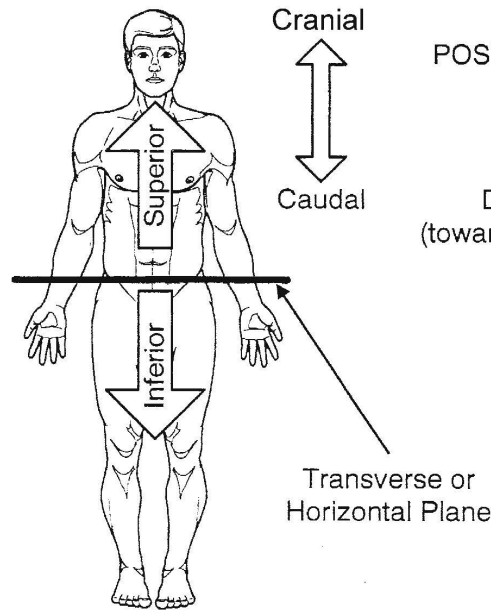
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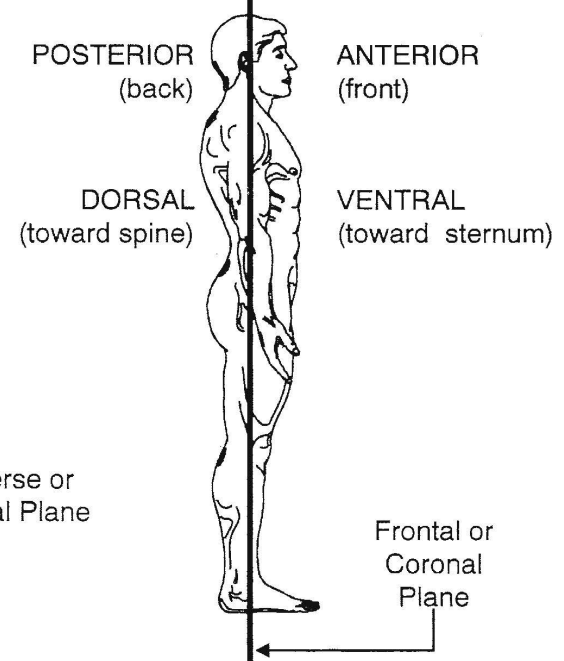
**SAGITTAL**  
(Right-Left)



**TRANSVERSE**  
(Top-Bottom)



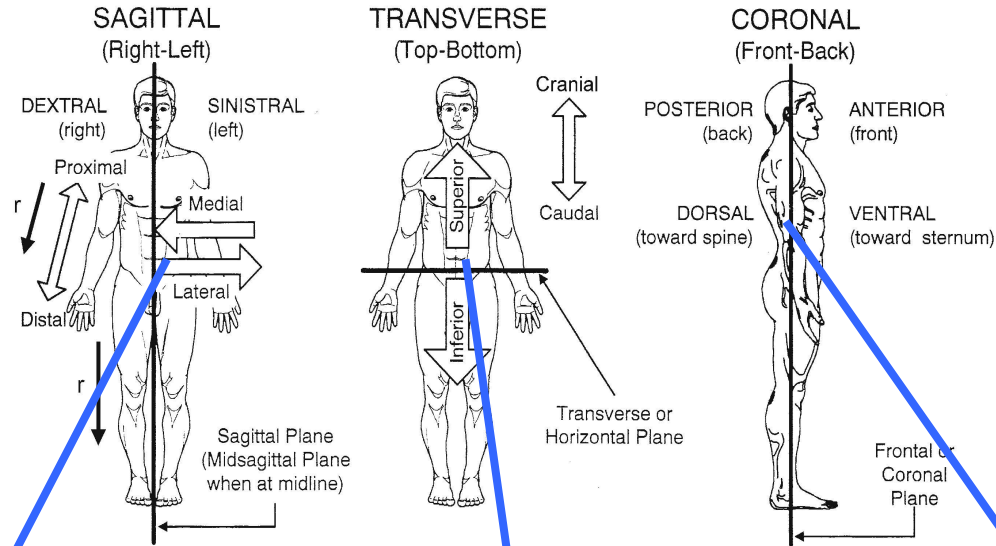
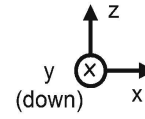
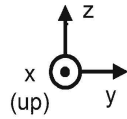
**CORONAL**  
(Front-Back)



# Anatomical Orientations



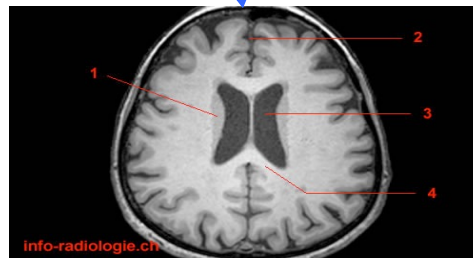
(from above)



Physics of the Human Body, Irving Herman, Springer 2007



[http://w-radiology.com/atlas\\_brain\\_mri.php](http://w-radiology.com/atlas_brain_mri.php)



[http://w-radiology.com/atlas\\_brain\\_mri.php](http://w-radiology.com/atlas_brain_mri.php)



[http://w-radiology.com/atlas\\_brain\\_mri.php](http://w-radiology.com/atlas_brain_mri.php)



For Friday – Review of Optics

Homework Assignment

Read Kane Chapter 1

Read Kane Chapter 2 – sections 2.1 – 2.2

Question: What type of images are these?

