Why this course?

Medical imaging is important in medicine
  • better diagnostic studies
  • trend away from surgery to
    image-guided minimally invasive therapies

Many of us work with medical images
  • imaging technology
  • medical devices
  • biomechanics
  • medical profession

Great way to learn anatomy

Other reasons…
Course goals

- 40% Introduce the basics physics of medical imaging.

- 60% Introduce normal human anatomy, with an emphasis on how it appears on images, and with an emphasis on what kinds of imaging are used in different regions of the body.
Course goals

• At the end of this course, you will:
  – Be able to identify x-ray, CT, MRI, and ultrasound images
  – Understand the basics of how these images are produced
  – Know the body areas in which each type of imaging is used and why
  – Know basic human anatomy and how it appears on images
  – To answer, “What am I looking at?”
# Course Outline 2019-2020

<table>
<thead>
<tr>
<th>Date</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan 6</td>
<td>Introduction, Imaging Language, The Bony Anatomy</td>
</tr>
<tr>
<td>Jan 8</td>
<td>Radiography</td>
</tr>
<tr>
<td>Jan 13</td>
<td>The Chest, Mammo, &amp; Cardiovasculature</td>
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<td>Jan 15</td>
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</tr>
<tr>
<td>Jan 20</td>
<td>no class</td>
</tr>
<tr>
<td>Jan 21</td>
<td>Image Processing Lab @ 5pm</td>
</tr>
<tr>
<td>Jan 22</td>
<td>MRI: Magnetization and Precession, Relaxation 1</td>
</tr>
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<td>Jan 27</td>
<td>The Gastrointestinal System</td>
</tr>
<tr>
<td>Jan 29</td>
<td>MRI: Relaxation 2, Fat, Gad</td>
</tr>
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<td>Jan 30</td>
<td>Ultrasound Lab @ 5 pm</td>
</tr>
<tr>
<td>Feb 3</td>
<td>The Genitourinary System</td>
</tr>
<tr>
<td>Feb 5</td>
<td>MRI: Frequency Encoding, Spin Echoes &amp; MRA</td>
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<tr>
<td>Feb 10</td>
<td>Muscles and Joints</td>
</tr>
<tr>
<td>Feb 12</td>
<td>Midterm 1 and DWI</td>
</tr>
<tr>
<td>Feb 17</td>
<td>no class</td>
</tr>
<tr>
<td>Feb 19</td>
<td>Brain 1&amp;2: Intro to CNS and Brain Anatomy</td>
</tr>
<tr>
<td>Feb 24</td>
<td>Midterm 2, fMRI, PWI</td>
</tr>
<tr>
<td>Feb 26</td>
<td>Brain 3: Meninges, Vasculature</td>
</tr>
<tr>
<td>Mar 2</td>
<td>The Spine and Spinal Cord</td>
</tr>
<tr>
<td>Mar 4</td>
<td>Paranasal Sinuses, Head and Neck Structures, and Brain Unique Structures</td>
</tr>
<tr>
<td>Mar 9</td>
<td>Physics Review and Body Cases/Review</td>
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<td>Final exam (8:30am - 11:30am)</td>
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Course Outline: Modality

Bio220/Rad220: Intro to Imaging and Image-based Anatomy

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Instructors

40% Imaging Physics
Kim Butts Pauly, Ph.D.

60% Anatomy
Pejman Ghanouni, M.D., Ph.D.
Raag Airan, M.D., Ph.D.
TAs

Choi Mihyun
mhchoi@stanford.edu
Graduate Student in Bioe

Jacqueline Tao
jjtao@stanford.edu
Medical Student

Weekly Review Sessions and Office Hours (Fri?)
Lecture Notes

- Lectures posted on the web in Adobe Acrobat (.pdf) format at:
  - http://bioe220.stanford.edu
  - Or
  - http://rad220.stanford.edu

- Password protected page for handouts

- All homeworks, announcements etc. will be via website
Bioengineering 220
vs.
Radiology 220

• no difference
• check your grading basis
  (some people have selected medical school grades)
Textbooks: Bushberg and Weir

Bushberg
- right level, physics material is right out of this book
- more information than we will cover, great resource
- 2nd Edition vs 3rd Edition (doesn’t matter)

Weir
- single frames vs stack of images in a movie (qt or avi)
- more detail than we require

- anatomy lists on the website specify exactly what you are responsible for knowing
Course Work

• Reading Material

• Problem Sets
  – Physics Problems
  – Identification of anatomy - open book

• Labs (Demos)
  – fun, review of what we learn in class

• Exams:
  – physics understanding
  – identification of anatomy on images (memory - closed book)

• Grading
  – Problem sets: (30% of grade)
  – Midterm Exams (30% of grade)
  – Final Exam (40% of grade)
Thorax Anatomy

1. 1st rib
2. 2nd rib
3. 3rd rib
4. 4th rib
5. 5th rib
6. 6th rib
7. 7th rib
8. 8th rib
9. 9th rib
10. 10th rib
11. 11th rib
12. 12th rib
13. Breast - fatty tissue
14. Breast - fibro glandular tissue
15. Carina
16. Costa-diaphragmatic sulcus
17. Costal cartilage
18. Costa-vertebral sulcus
19. Diaphragm
20. Esophagus
21. Intercostal muscles
22. Intermediate bronchus
23. Lingula
24. Lingular bronchus
25. Lower lobe
26. Pulmonary vein – lower lobe
27. Pulmonary vein – upper lobe
28. Sternum (body)
29. Trachea
30. Upper lobe
31. Upper lobe bronchus
32. Xyphoid process
If you move a bar magnet around a coil loop, you will induce a current in the coil.