Introduction to Radiology

The imaging modalities

- X-Rays or Plain Films
- Fluoroscopy
- Angiography
- Computed Tomography (CT)
- Magnetic Resonance (MR)
- Ultrasound (US)
- Nuclear Medicine (PET or Bone Scan)

Types of Imaging

- Ionizing Radiation
- Magnetic Field and Radiofrequency Pulses
- Sound waves (Echos)
- Ionizing Radiation
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**Best Spatial Resolution**
Good for High-contrast Structures

**Best Soft Tissue Contrast Resolution**

**Best used with soft tissue and fluid**

**Best for physiologic imaging**
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Best Spatial Resolution

Worst Spatial Resolution
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Transmission technique: Source of energy is outside the patient, passes through the patient, and is then captured to make the image

Emission technique: Energy source is a radiotracer injected into the patient; energy emitted from the patient is captured to make the image
<table>
<thead>
<tr>
<th>Modality</th>
<th>Good for</th>
<th>Not good for</th>
</tr>
</thead>
<tbody>
<tr>
<td>X-ray</td>
<td>Heart, lungs, bowel w/ air</td>
<td>Soft tissues</td>
</tr>
<tr>
<td>Fluoro</td>
<td>GI investigations</td>
<td>Anything outside the investigated tract</td>
</tr>
<tr>
<td>Angiography</td>
<td>Vessels + interventions</td>
<td>Anything outside the investigated vessel</td>
</tr>
<tr>
<td>CT</td>
<td>Most body parts</td>
<td>Soft tissues with little change in density</td>
</tr>
<tr>
<td>MR</td>
<td>Soft tissues, young/pregnant</td>
<td>Lungs; anything with metal; BEWARE OF MAGNET</td>
</tr>
<tr>
<td>US</td>
<td>Fluid-filled structures, superficial parts,</td>
<td>Lungs, air, lots of fat, bones</td>
</tr>
<tr>
<td></td>
<td>young/pregnant</td>
<td></td>
</tr>
<tr>
<td>Nuclear Medicine</td>
<td>Functional imaging; whatever the specific</td>
<td>Small objects; anything other than the specific target</td>
</tr>
<tr>
<td></td>
<td>target of the study is</td>
<td>of the study</td>
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</tbody>
</table>
Rad Modalities: a summary

Which is the best modality?
“It depends on what you mean by ‘best’.”

<table>
<thead>
<tr>
<th>Modality</th>
<th>Spatial resolution</th>
<th>Soft tissue contrast</th>
<th>Radiation</th>
<th>Speed</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>X-ray</td>
<td>Excellent</td>
<td>Poor</td>
<td>Low</td>
<td>Fast</td>
<td>Low</td>
</tr>
<tr>
<td>Fluoro</td>
<td>Good</td>
<td>Poor</td>
<td>High</td>
<td>Fast</td>
<td>Medium</td>
</tr>
<tr>
<td>Angiography</td>
<td>Good</td>
<td>Poor</td>
<td>High</td>
<td>Fast</td>
<td>High</td>
</tr>
<tr>
<td>CT</td>
<td>Good</td>
<td>Good</td>
<td>High</td>
<td>Fast</td>
<td>High</td>
</tr>
<tr>
<td>MR</td>
<td>Fair</td>
<td>Excellent</td>
<td>None</td>
<td>Slow</td>
<td>Very high</td>
</tr>
<tr>
<td>US</td>
<td>Fair</td>
<td>Good</td>
<td>None</td>
<td>Medium</td>
<td>Low to medium</td>
</tr>
<tr>
<td>Nuclear Medicine</td>
<td>Poor</td>
<td>Variable</td>
<td>High</td>
<td>Slow</td>
<td>Variable (medium to very high)</td>
</tr>
</tbody>
</table>