



Introduction to Ultrasound




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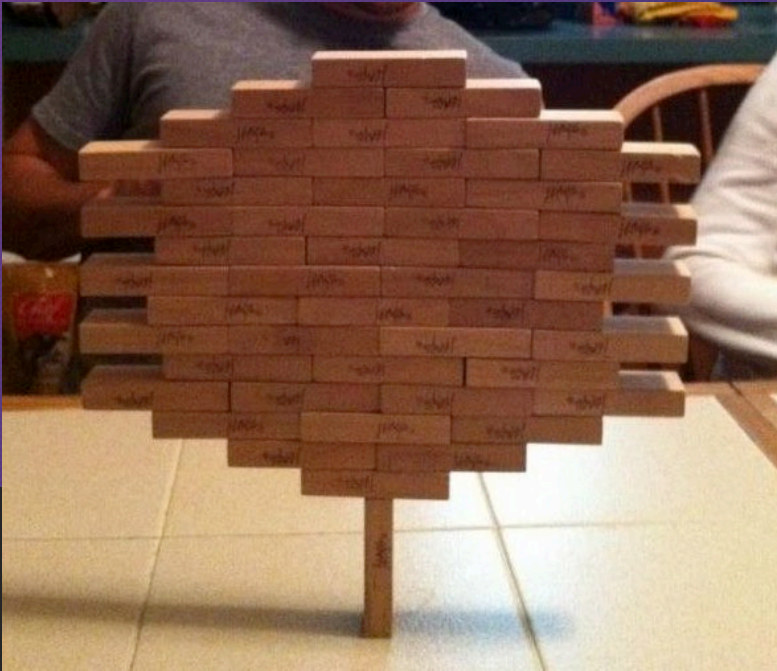
Ultrasound in Medicine

- Point-of-care ultrasound (PoCUS) is a limited exam with a focused question or goal
- Multiple applications across various specialties

Portable bedside ultrasound: the visual stethoscope of the 21st century

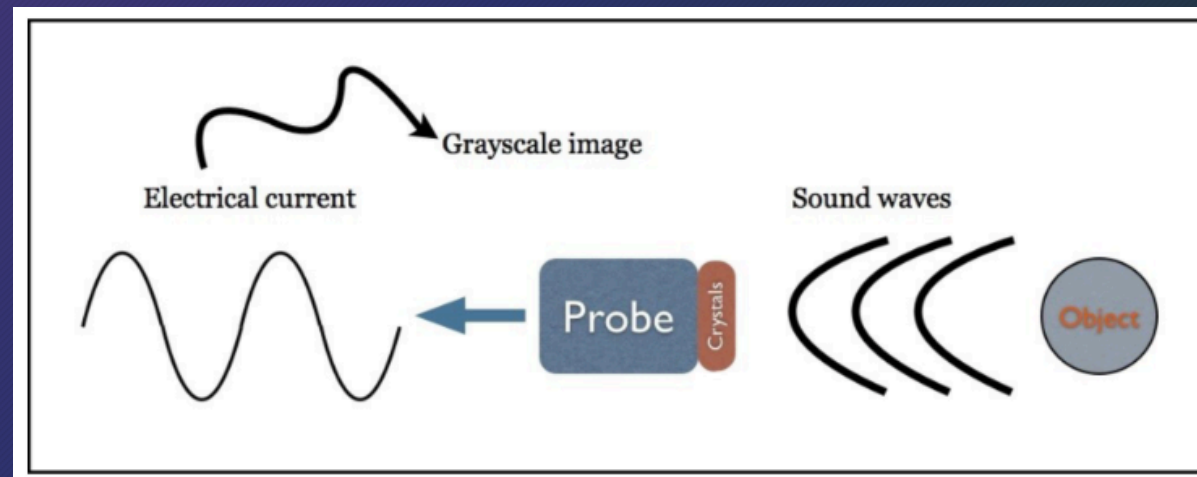
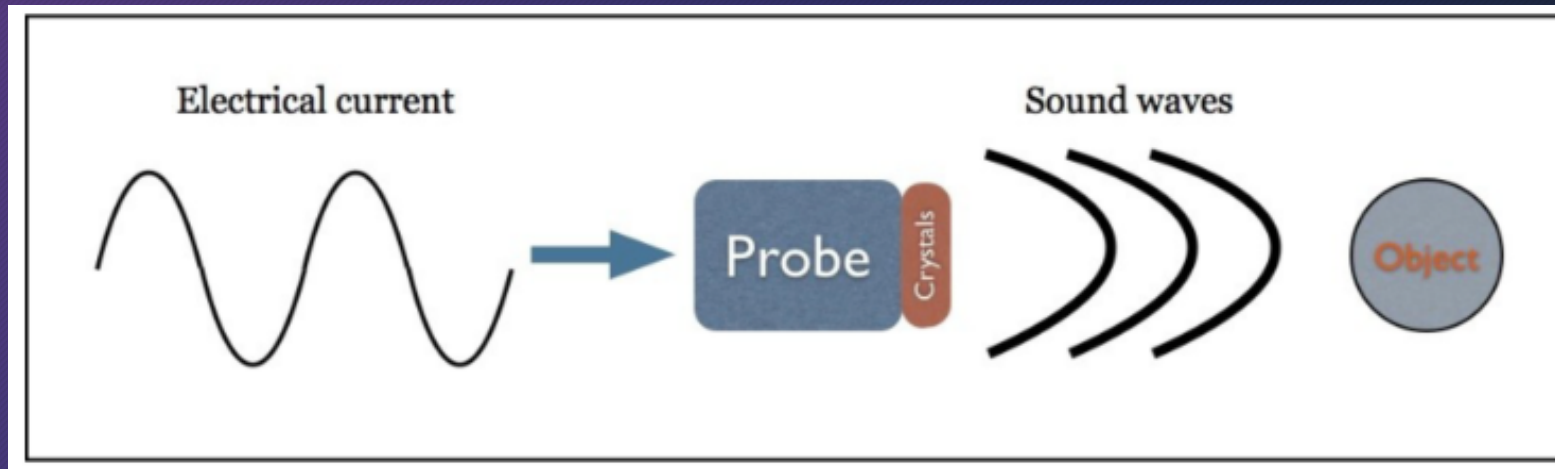
Lawrence M Gillman  and Andrew W Kirkpatrick

Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine 2012 20:18 | DOI: 10.1186/1757-7241-20-18 |



Basic Ultrasound Concepts

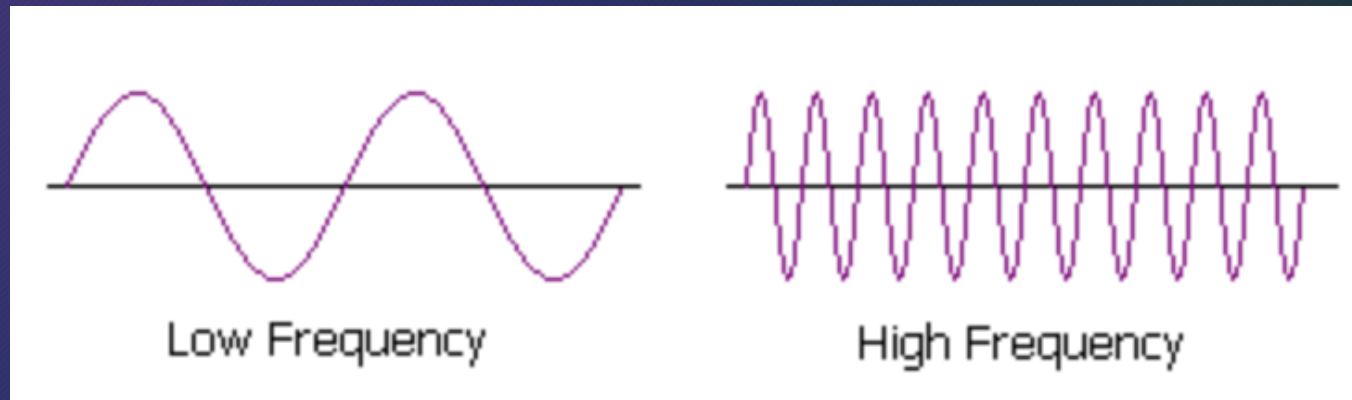
Mechanics of Ultrasound





Frequency: Image Resolution and Depth

- Higher frequency = Greater resolution = Lower penetration and depth
- Lower frequency = Lower resolution = Greater penetration and depth





Terminology

- Echogenic - bright (white) objects
- Hyperechoic - brighter (more white) than nearby structures
 - i.e. Bone, stones
- Isoechoic - same echogenicity as nearby structures
- Hypoechoic - darker (more black) than nearby structures
- Anechoic - dark (black) objects
 - i.e. Fluid filled structures - eye, bladder

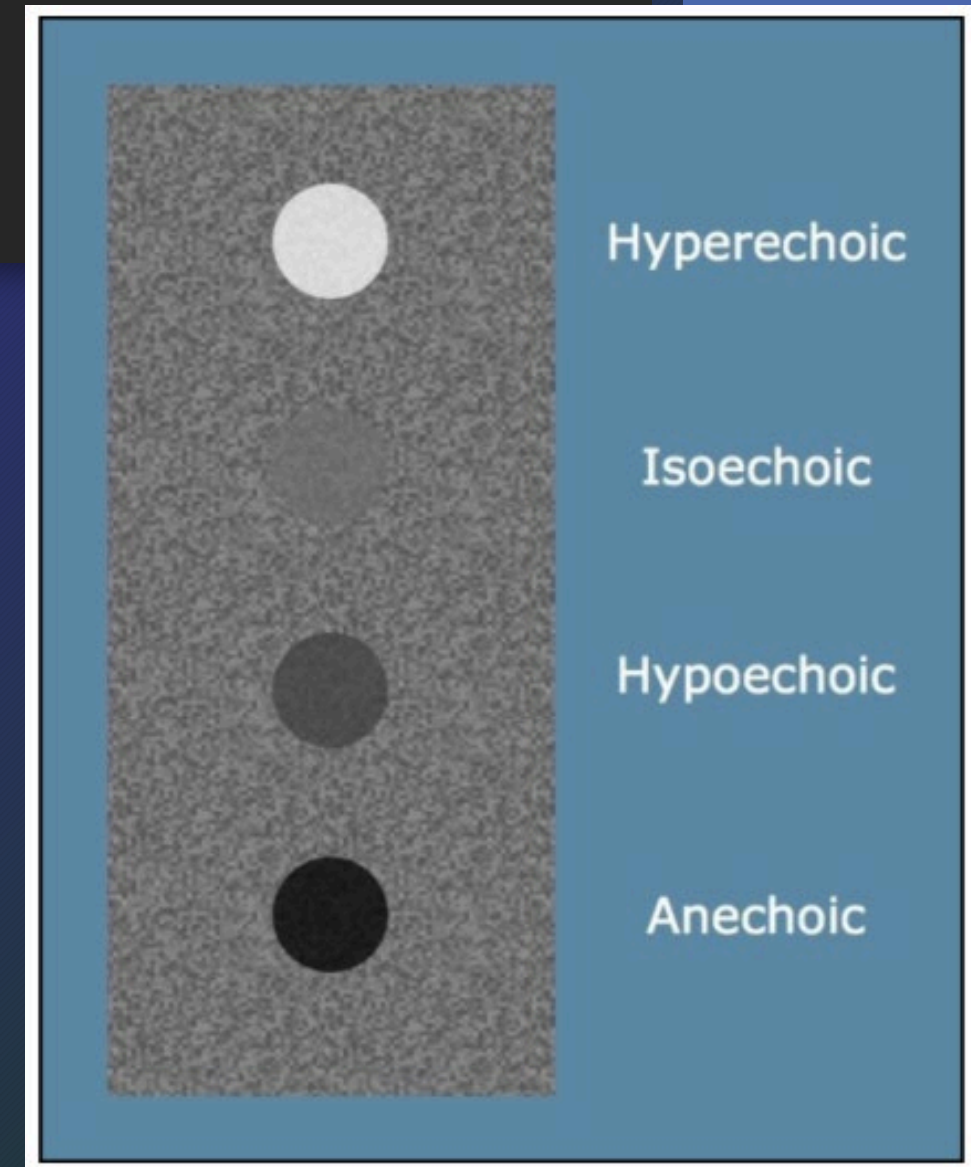
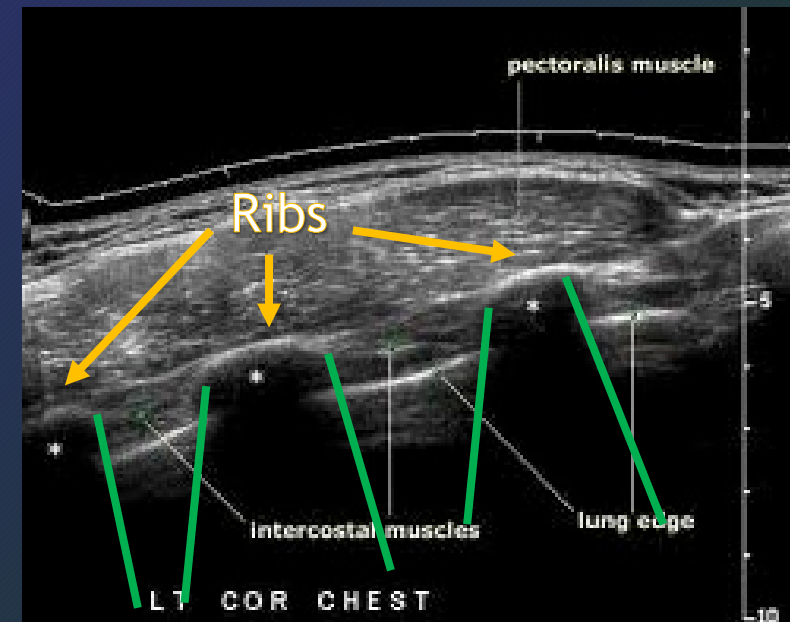
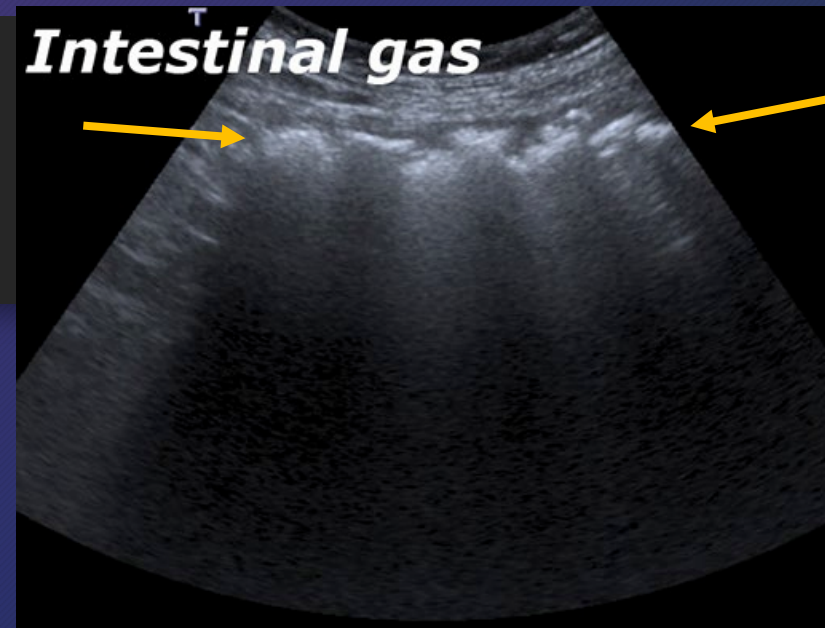


Image Acquisition Pitfalls

- Ultrasound waves do not like:
 - Air
 - Results in scattering of ultrasound beams
 - Bone
 - Results in shadowing behind





Operating the Machine

On to the Fun Stuff!

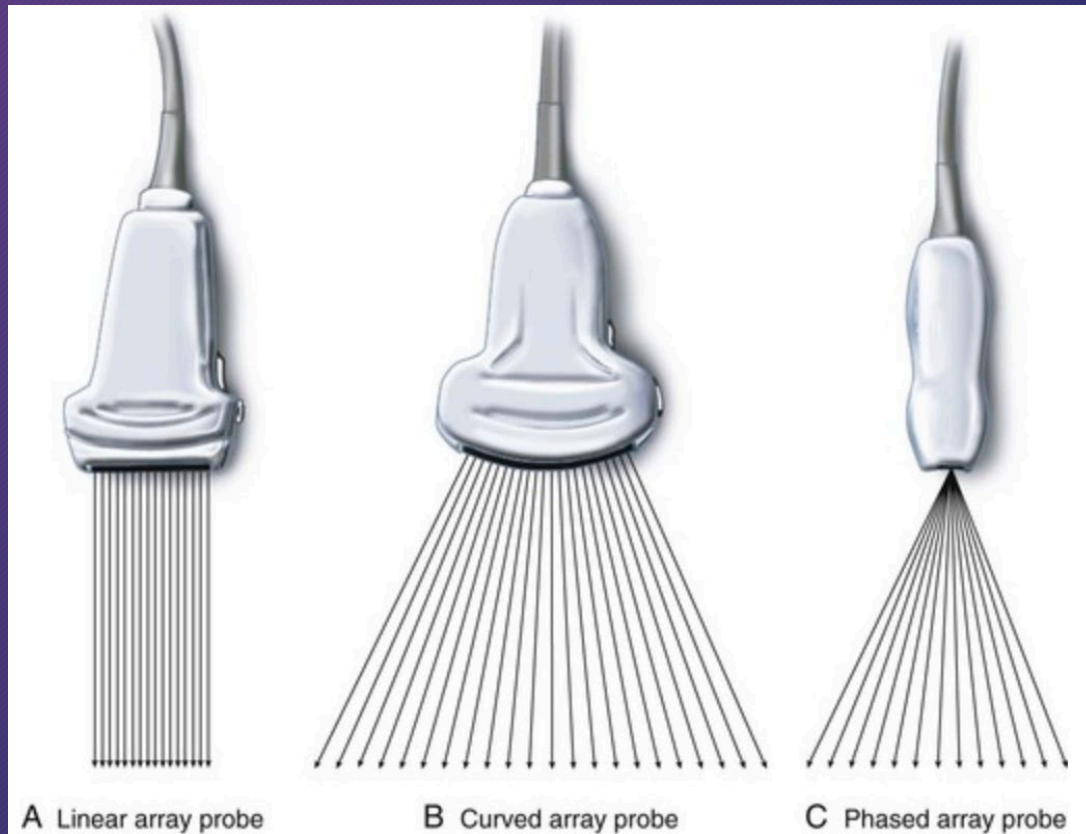
Gel is Your Friend!



Components of the Ultrasound Machine

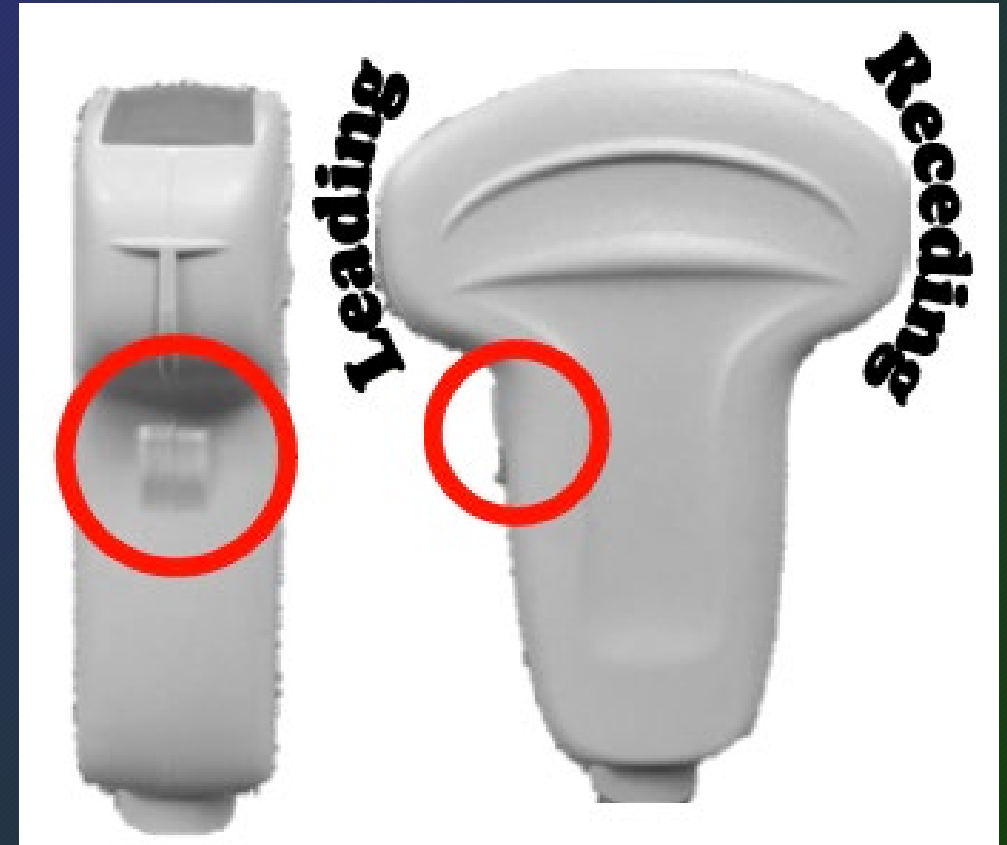


Probe = Flashlight



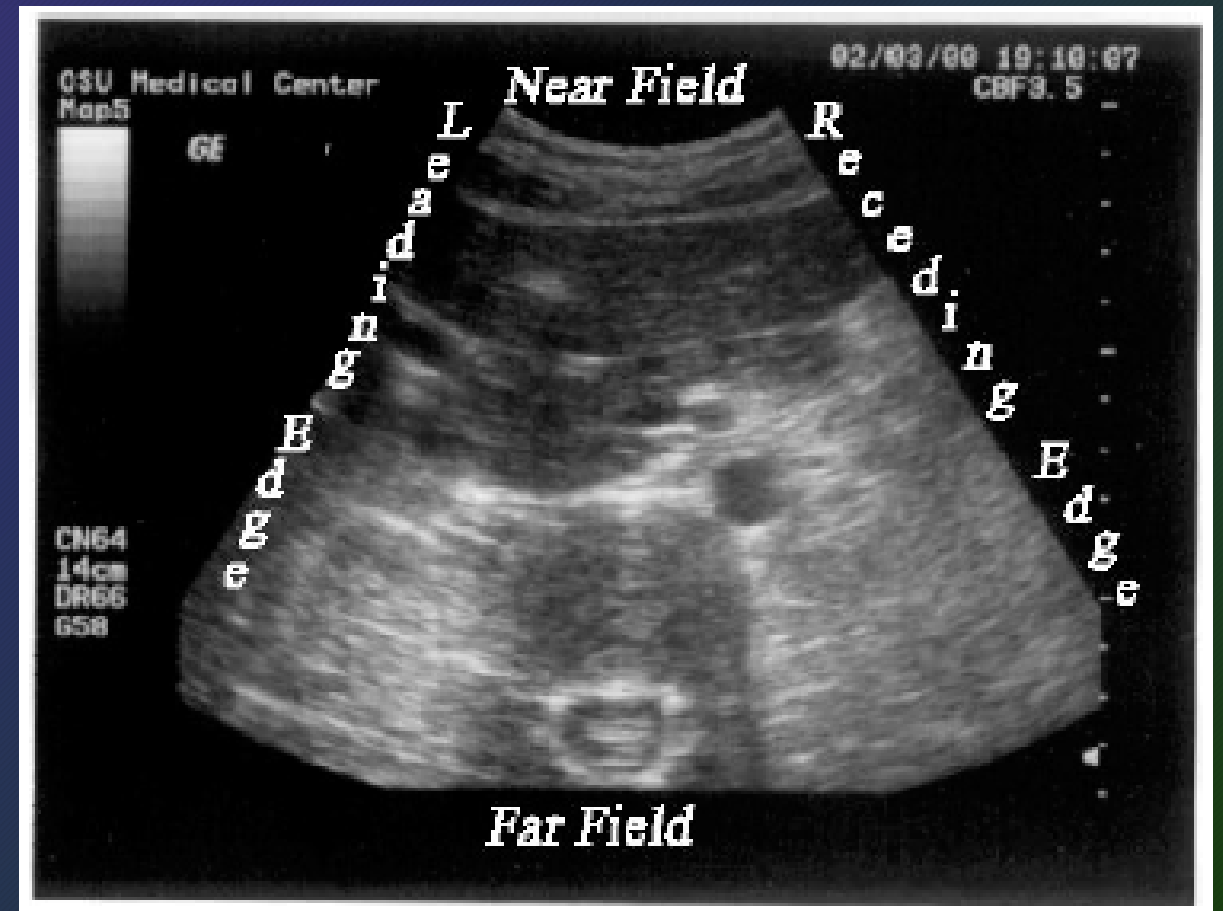
Probe / Transducer Basics - Orientation

- Probe marker
- Leading edge
- Receding edge
- Generally, the probe marker will be oriented towards the patient's right or head



Screen Orientation

- Leading edge corresponds to the probe marker
- Near field = Skin surface



Transducer Types

- Curvilinear
- Phased Array
- Endocavitary
- Linear



Curvilinear / Curved Array

- Low frequency (2-5 MHz)
- Decreased resolution
- Increased depth (scan depth 30 cm)
- Larger footprint
- Uses:
 - Thorax
 - Abdomen
 - Pelvis

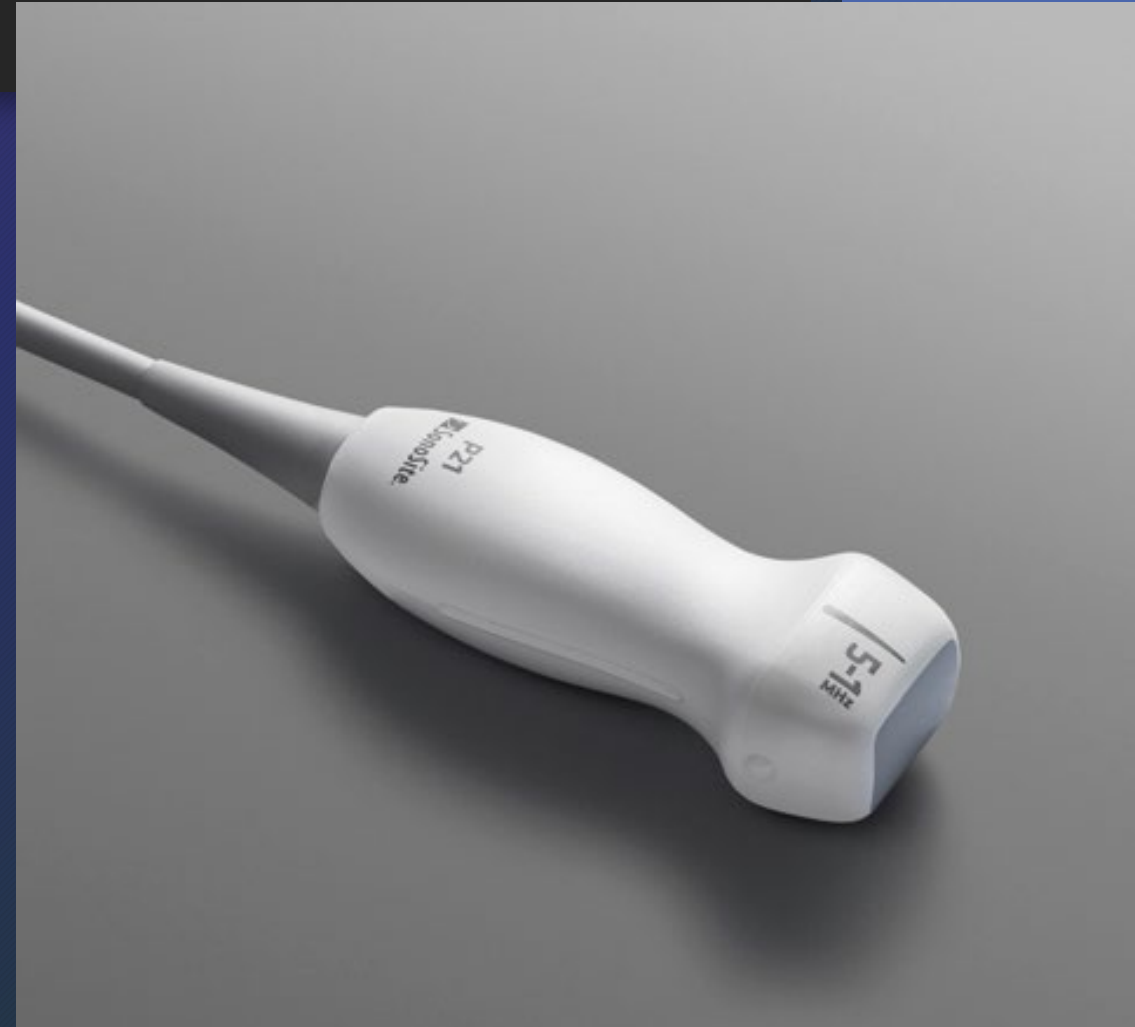


Curvilinear

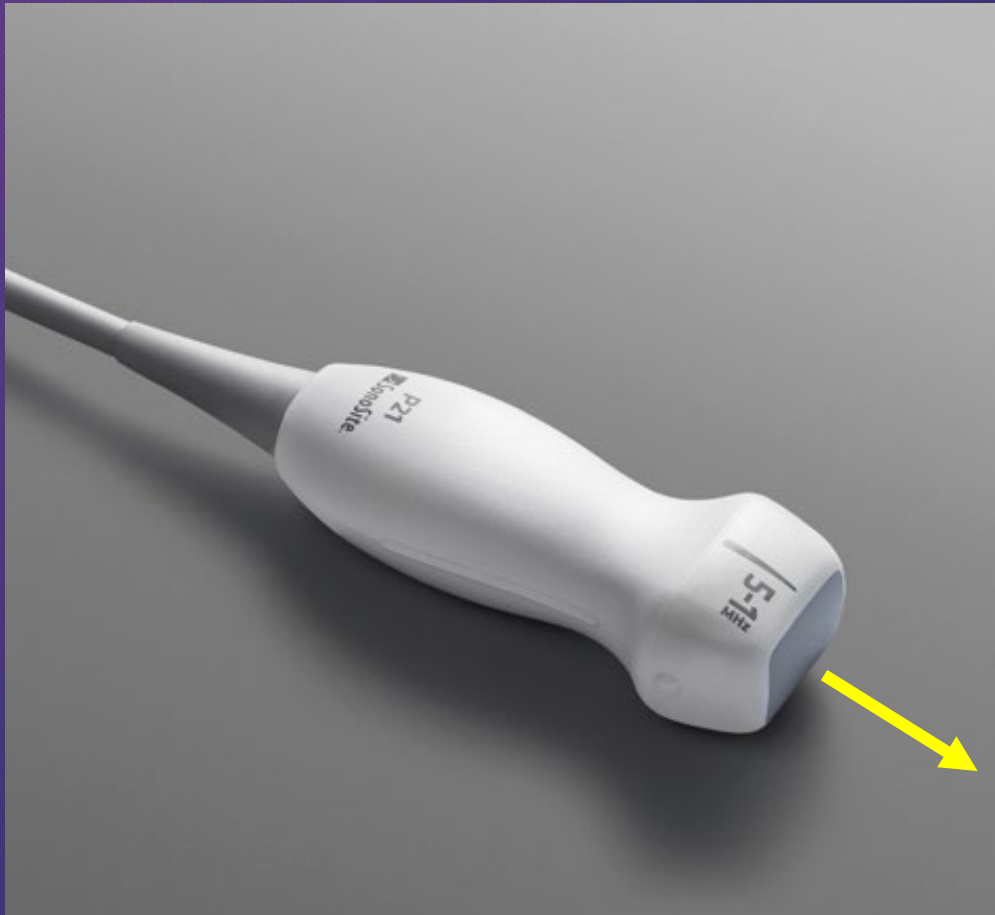


Phased Array

- Low frequency (1-5 MHz)
- Decreased resolution
- Increased depth (scan depth 35 cm)
- Smaller footprint
- Uses:
 - Ideal for cardiac studies (fits between ribs)
 - Thorax
 - Abdomen
 - Pelvis

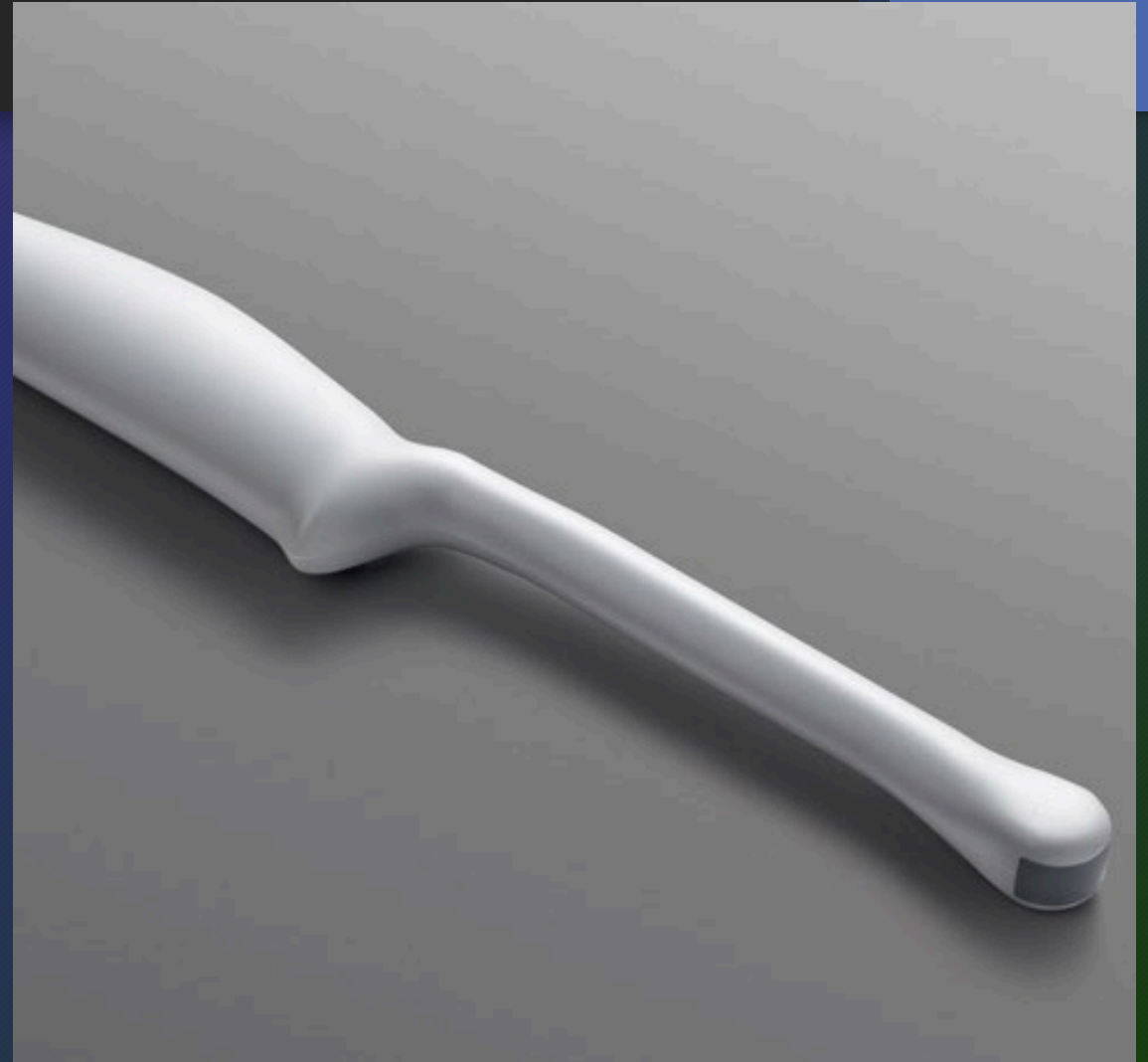


Phased Array / Cardiac Transducer

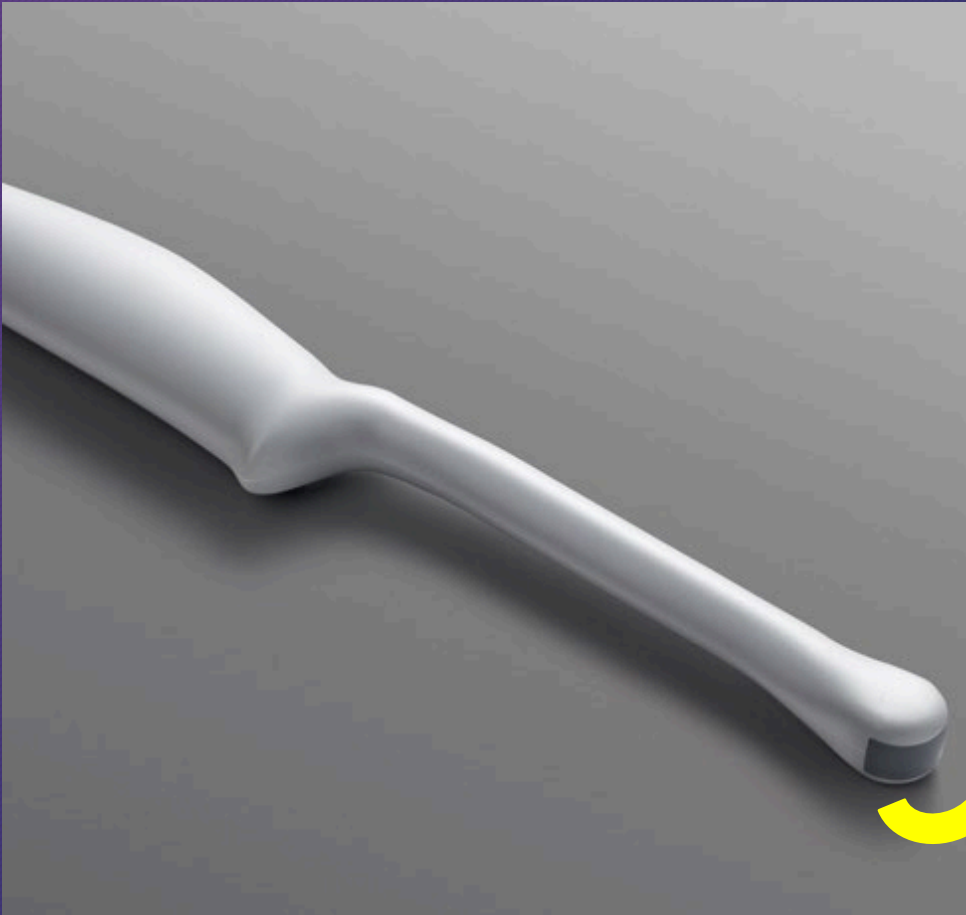


Endocavitary

- Mid to high frequency (8-15 MHz)
- Excellent resolution
- Mid depth (scan depth 13 cm)
- Small footprint
- Uses:
 - OB-gynecologic
 - Oral cavity



Endocavitary

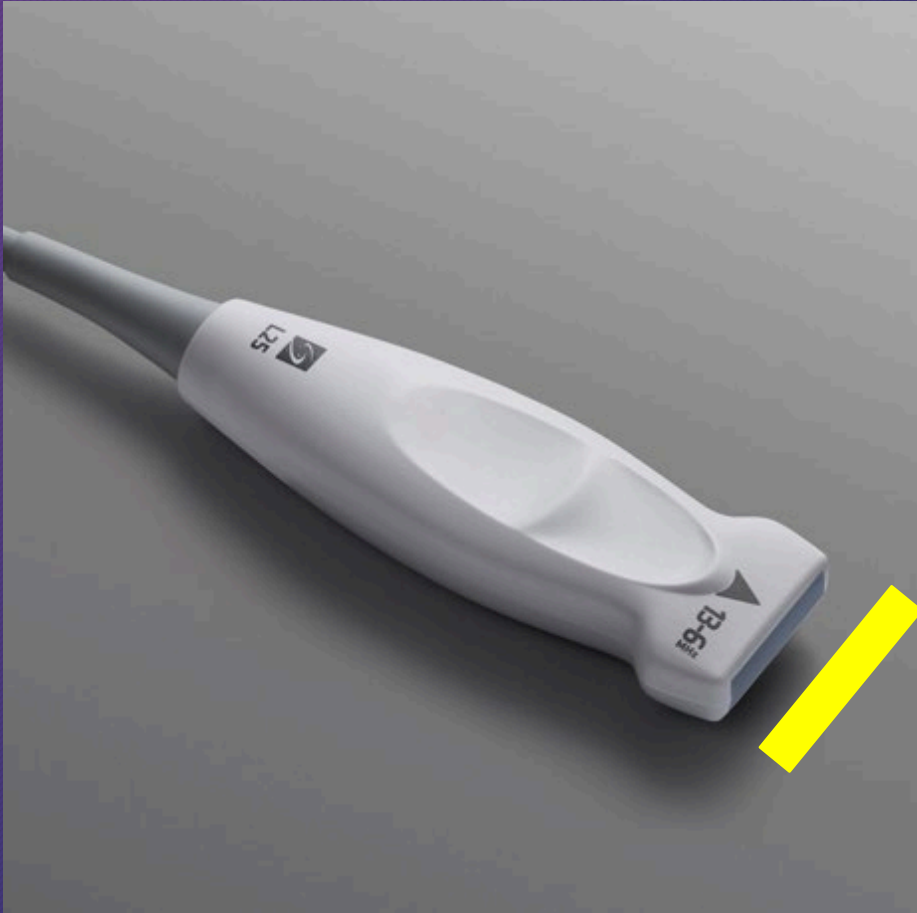


Linear

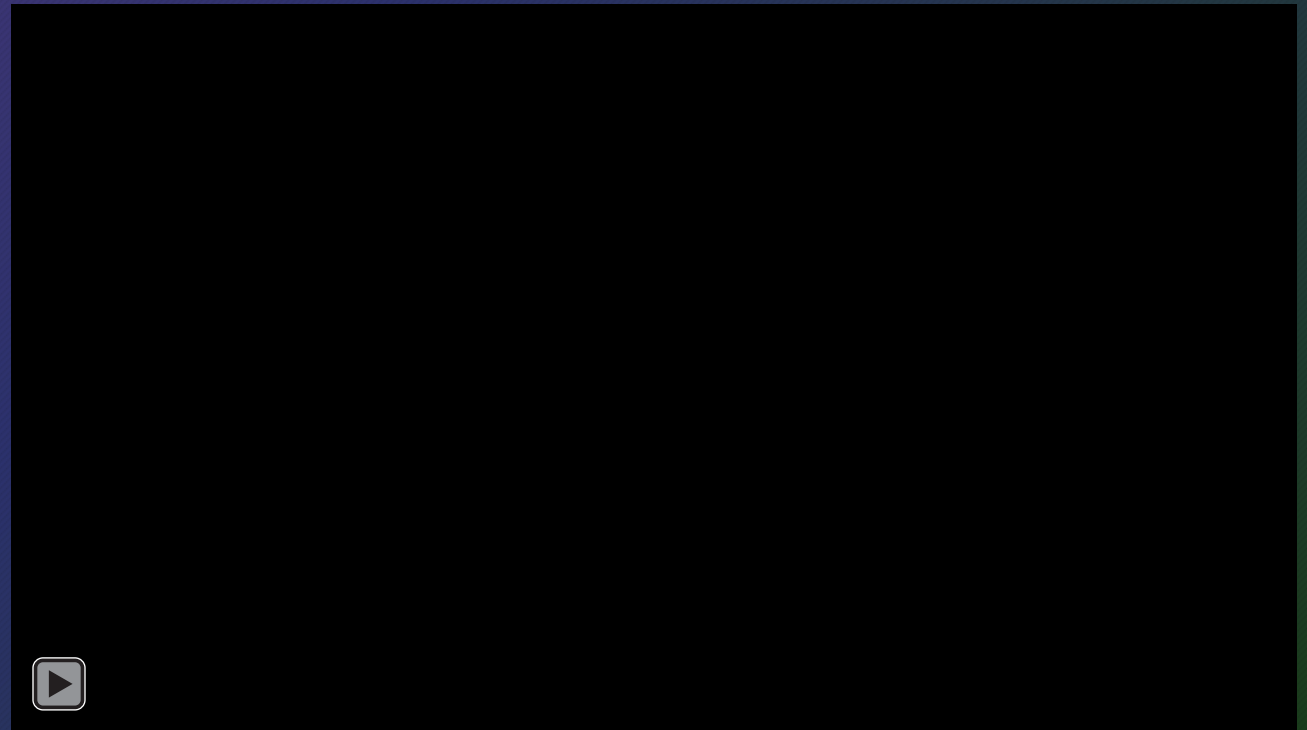
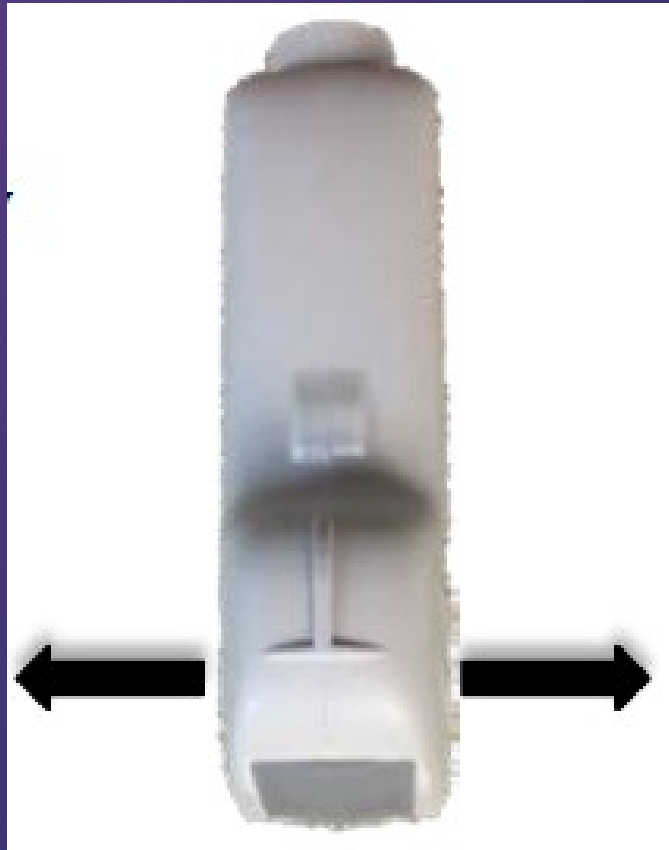
- Higher frequency (5-16 MHz)
- Higher resolution
- Decreased depth (scan depth 6 cm)
- Scanning area limited to probe size
- Uses:
 - Vascular
 - Musculoskeletal
 - Soft tissue
 - Ocular



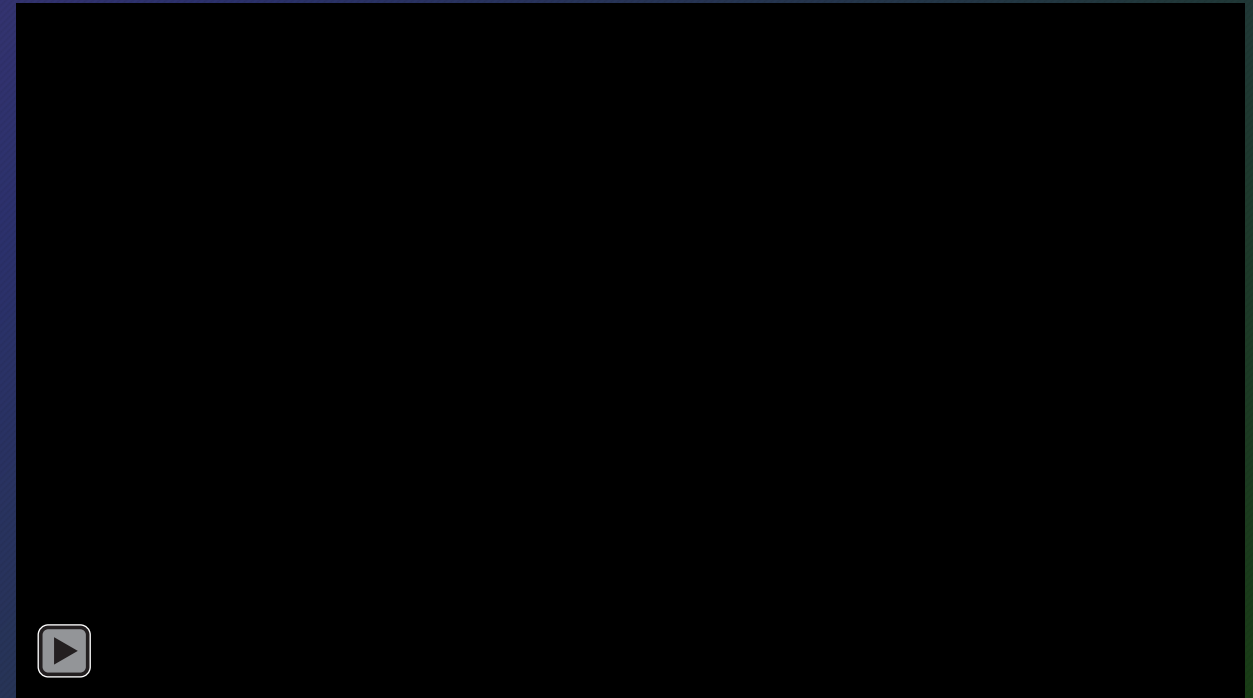
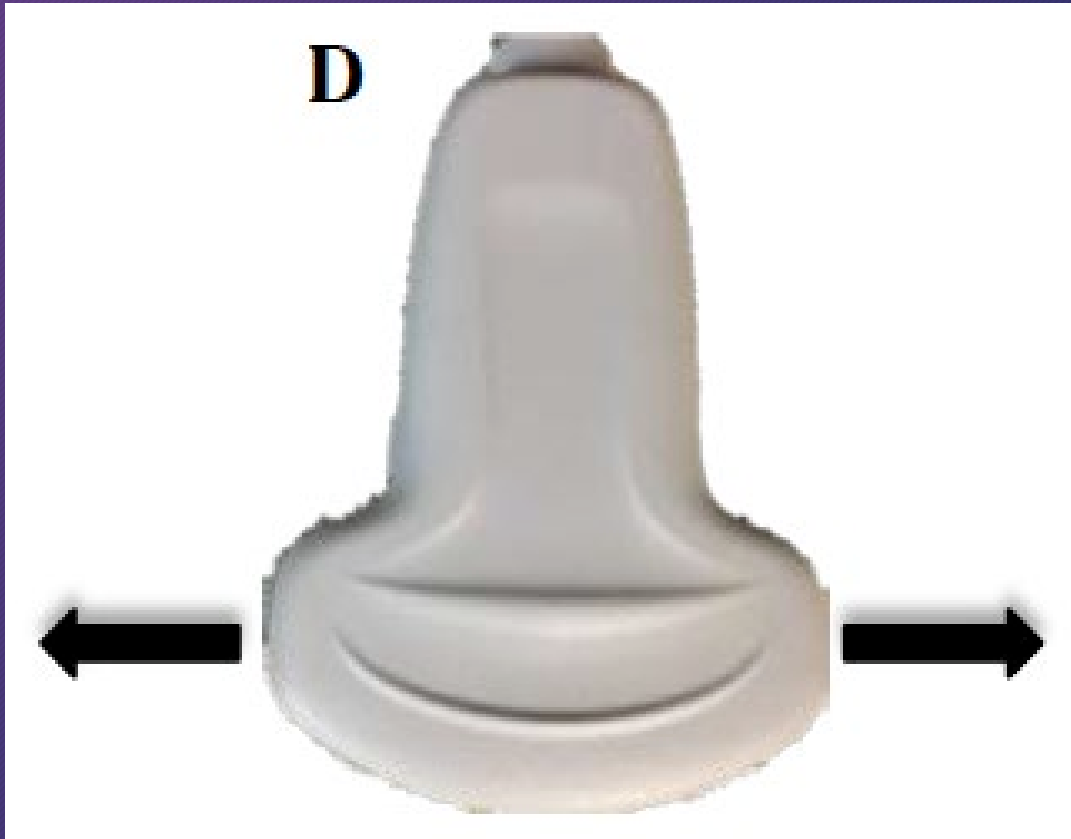
Linear



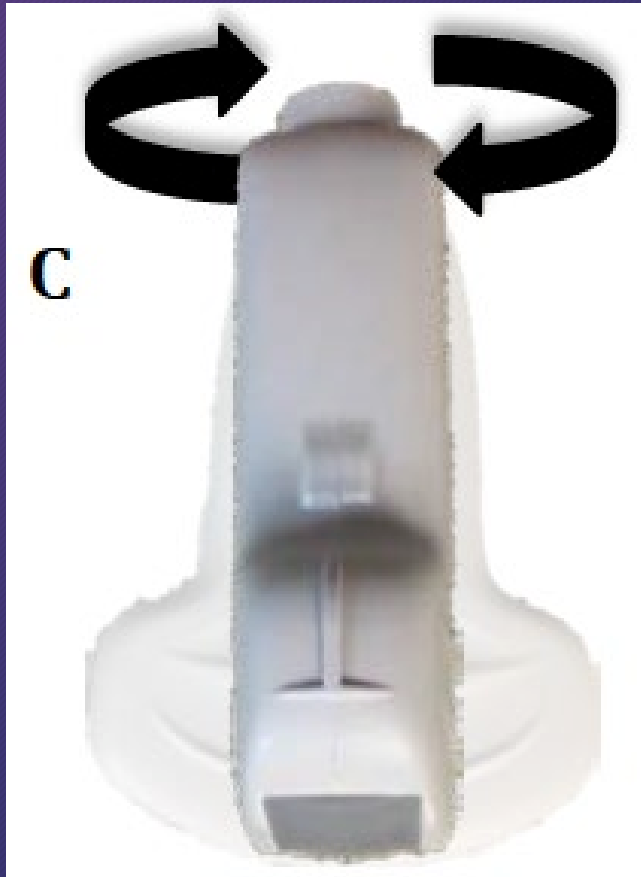
The "ART" of Transducer Movements - Sweep



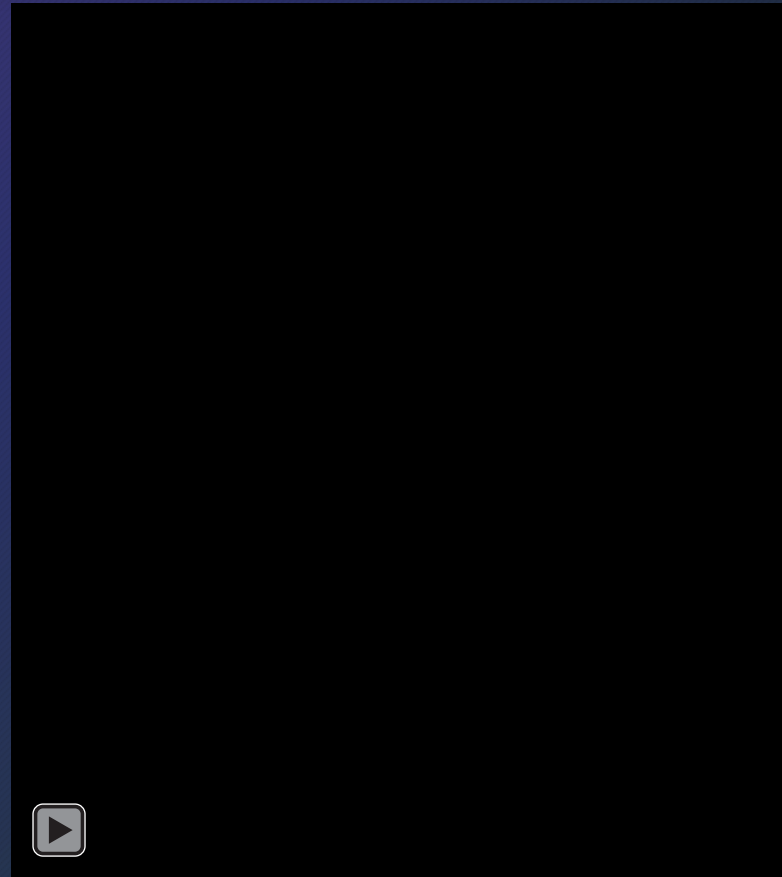
The "ART" of Transducer Movements - Slide



The "ART" of Transducer Movements - Rotate



SUSME Ultrasound Basics Handout



<https://giphy.com>

The "ART" of Transducer Movements - Fan



SUSME Ultrasound Basics Handout

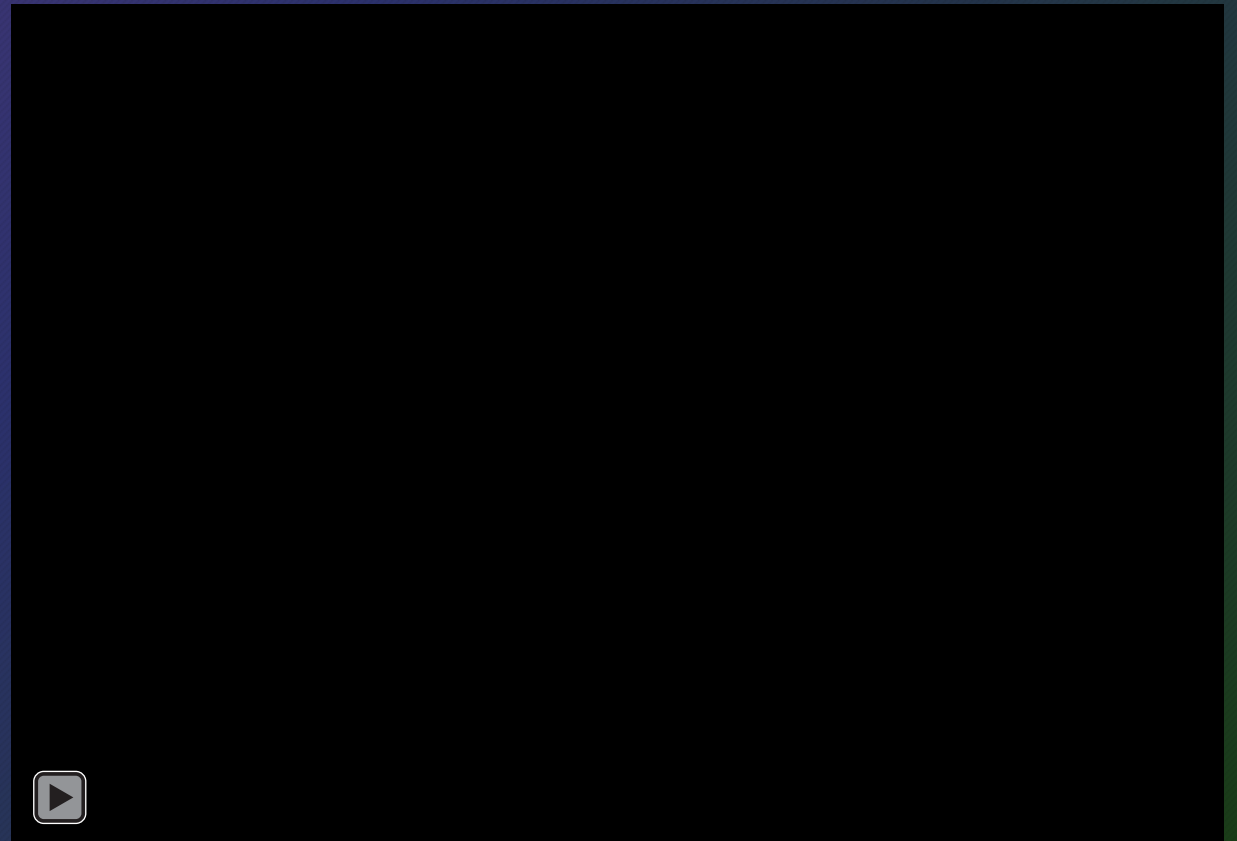


<https://giphy.com>

The "ART" of Transducer Movements - Rock



SUSME Ultrasound Basics Handout

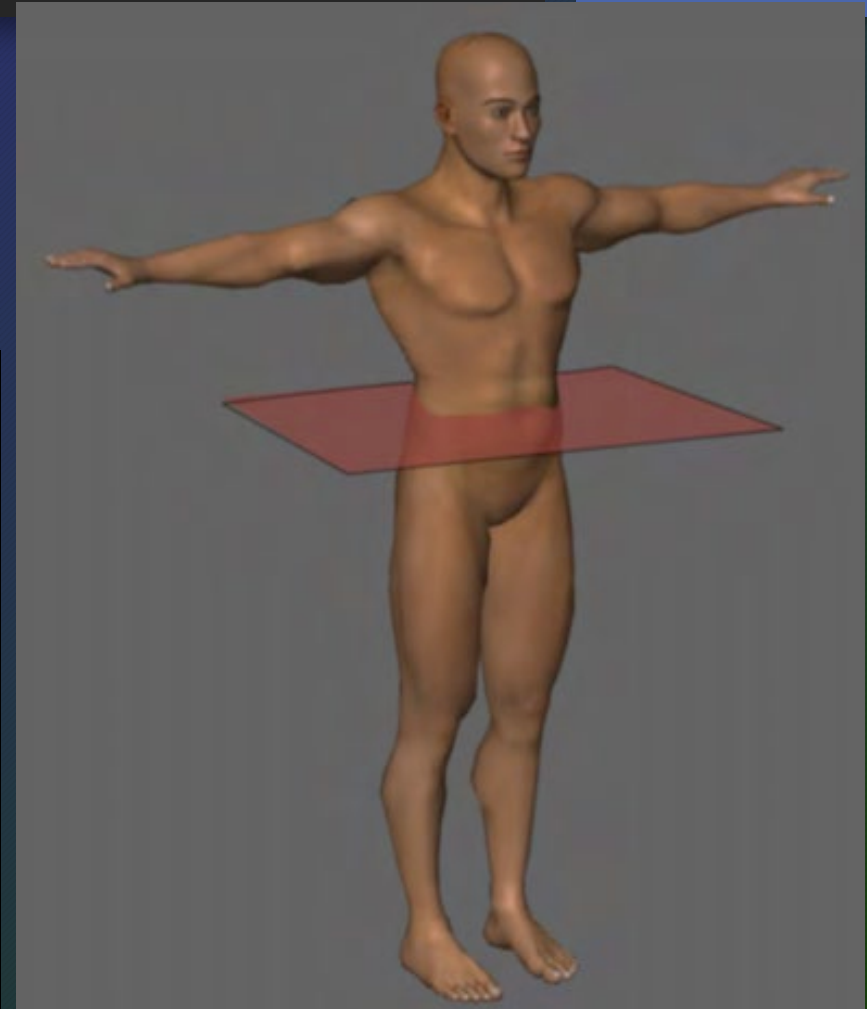
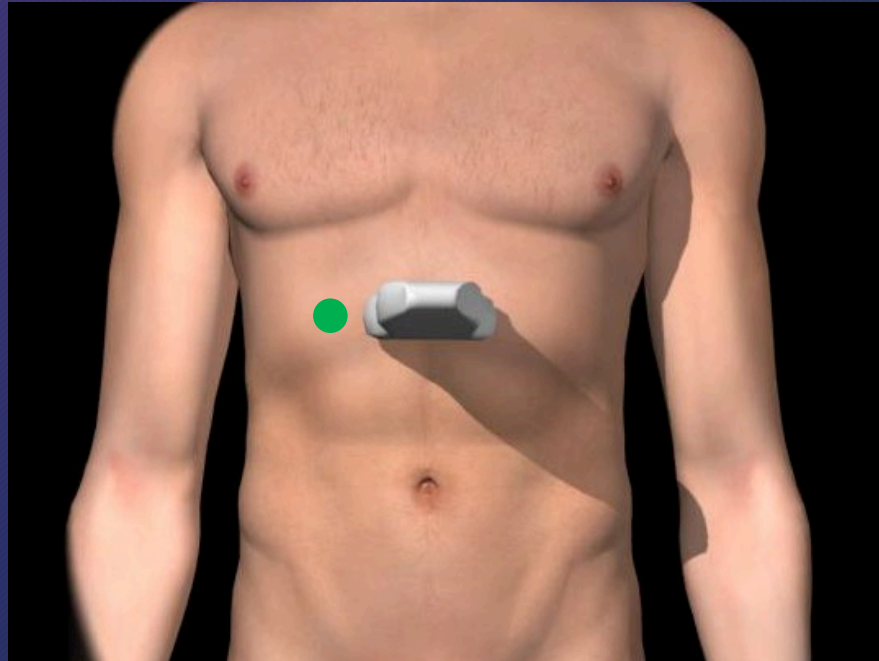


<https://giphy.com>

Transducer Planes

Transverse Plane (axial or cross section)

- Runs parallel to the ground
- Separates the superior from the inferior, or the head from the feet



Transducer Planes

Sagittal Plane (longitudinal)

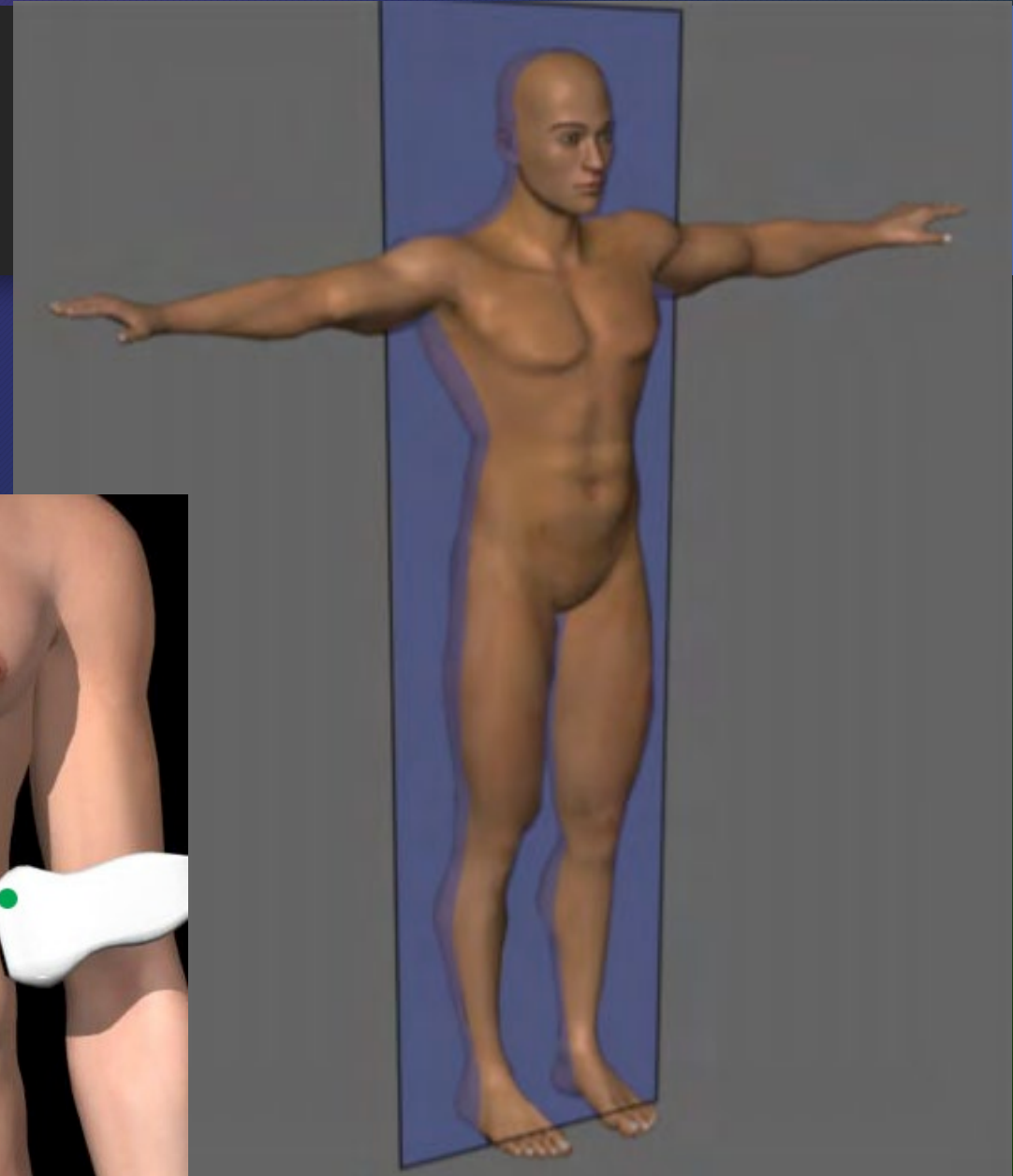
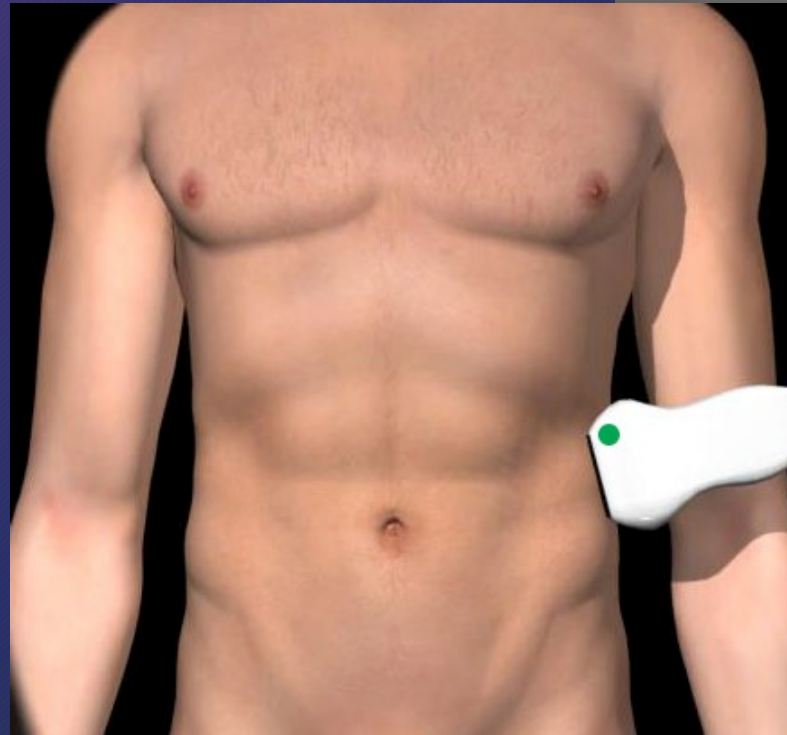
- Oriented perpendicular to the ground, separating left from right



Transducer Planes

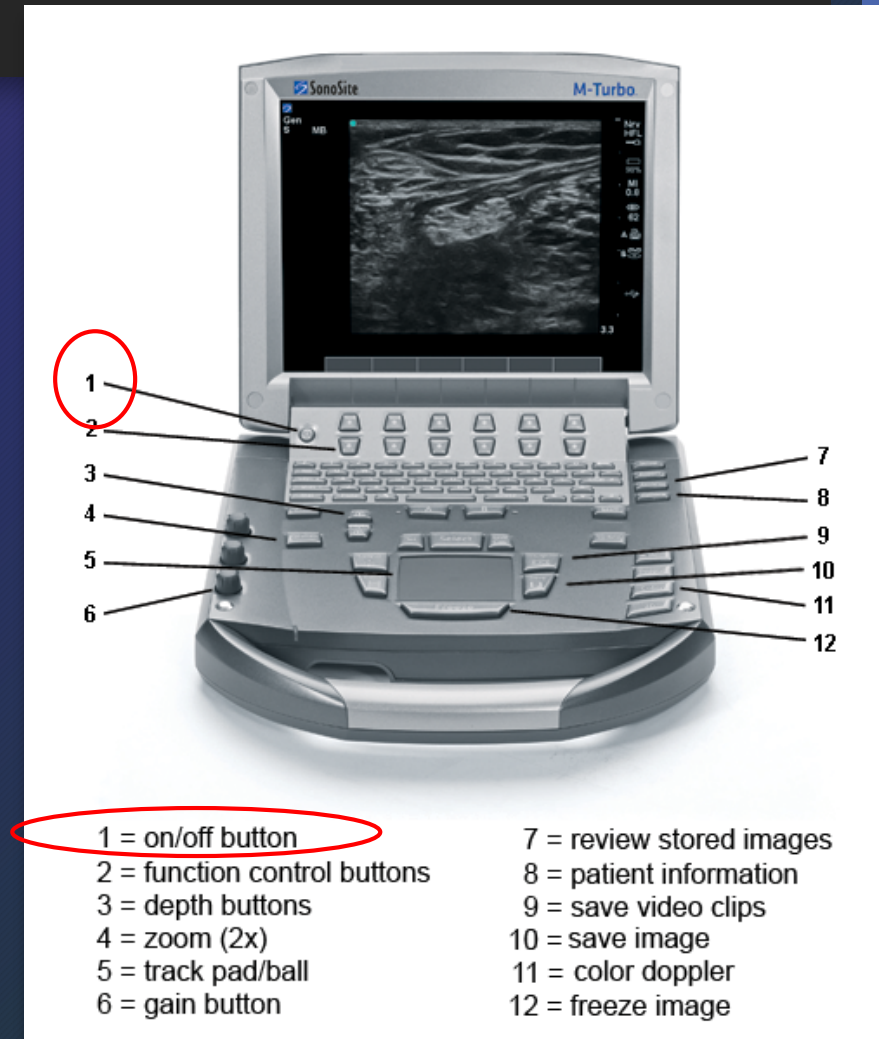
Coronal Plane

- Separates the anterior from the posterior, or the front from the back.



Getting Started - Turning on the Machine

1. Find and press On/Off button (#1)



Adjusting Depth (#3)

Depth:

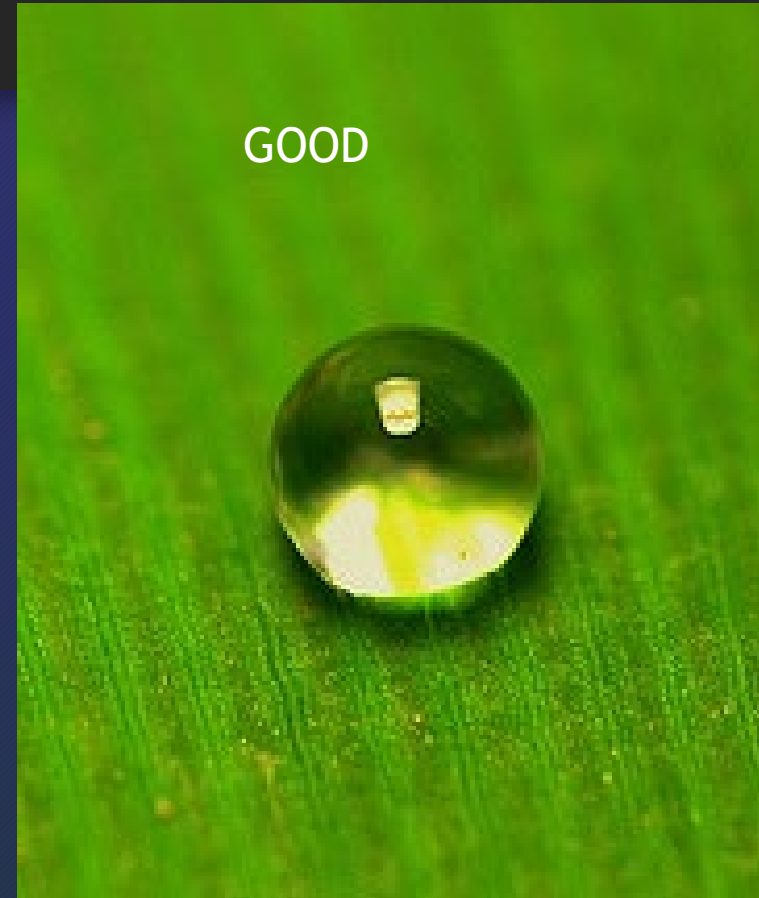
- How deep or shallow you are viewing the structures on the screen



- 1 = on/off button
- 2 = function control buttons
- 3 = depth buttons
- 4 = zoom (2x)
- 5 = track pad/ball
- 6 = gain button

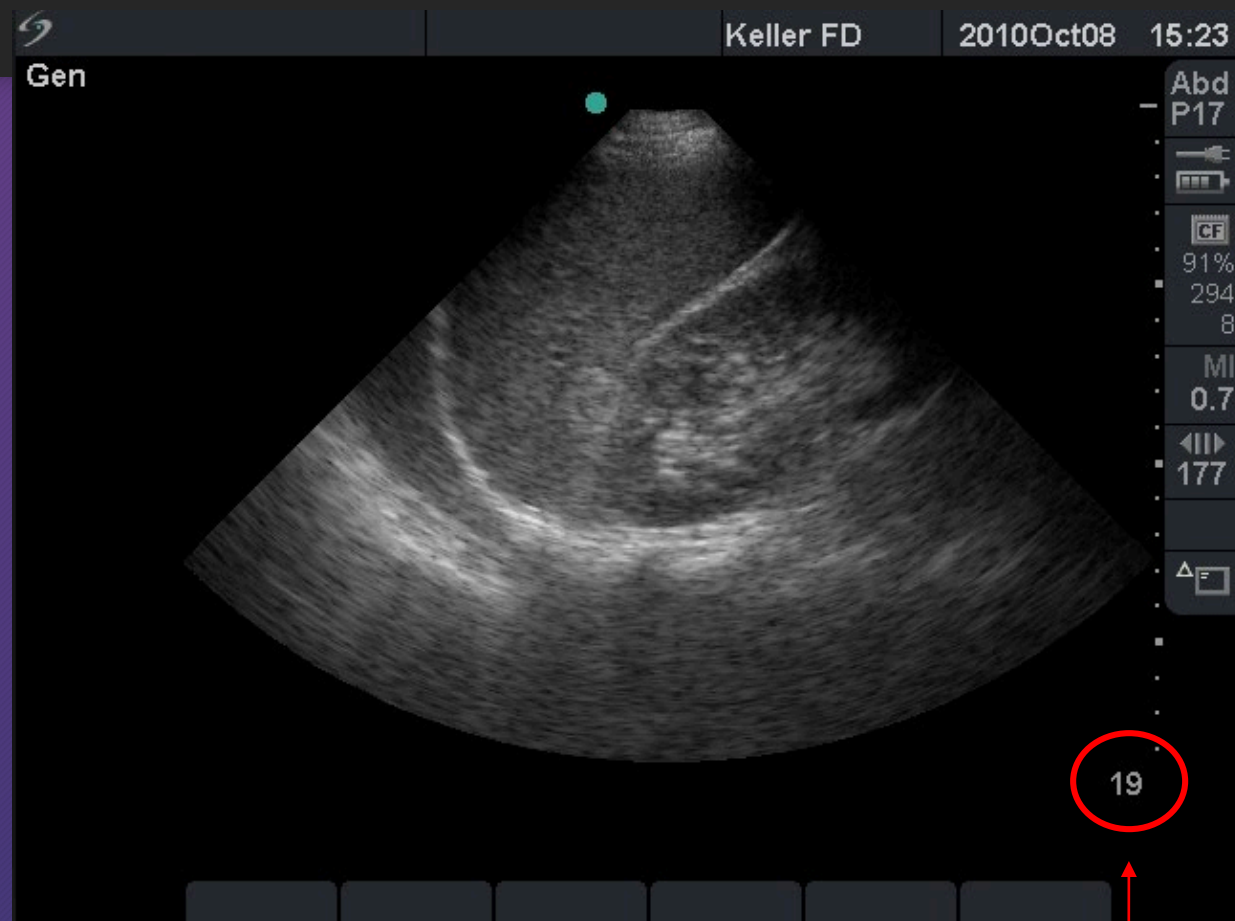
- 7 = review stored images
- 8 = patient information
- 9 = save video clips
- 10 = save image
- 11 = color doppler
- 12 = freeze image

Depth



Goal is to have your target image in the center of the screen.

Depth Markers



(In cm)



Adjusting Gain (#6)

Gain:

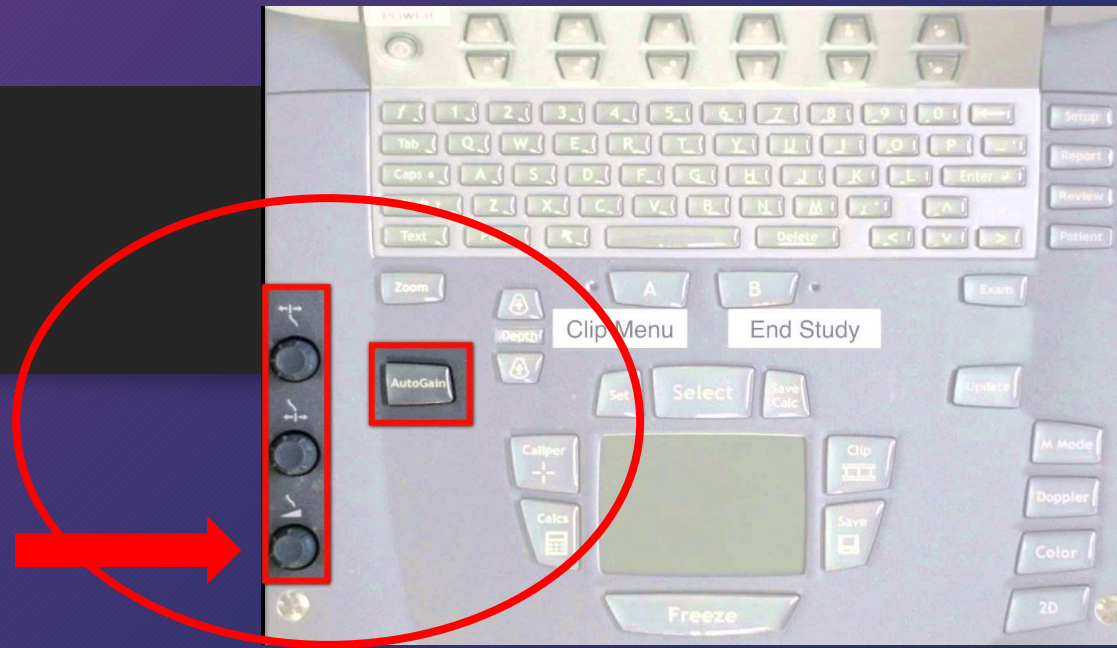
- Overall brightness of the image
- Similar to brightness control on a computer monitor



1 = on/off button
2 = function control buttons
3 = depth buttons
4 = zoom (2x)
5 = track pad/ball
6 = gain button

7 = review stored images
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Gain



Too Little!

Just Right!

Too Much!

Ultrasound Etiquette

- Introduce yourself to your patient and ask permission to scan
- Only expose the area of the body being scanned
- Wipe the patient off after the exam is completed
- Clean off the probe and cord
 - Soap and water
 - Alcohol wipes
 - Damp wash cloth or gauze pad
 - DO NOT use bleach containing germicidal wipes!
- Do not drop the probes
- Be aware of the cord - no stepping on or running over with wheels
- Plug in or place in charger when not in use



Questions?

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