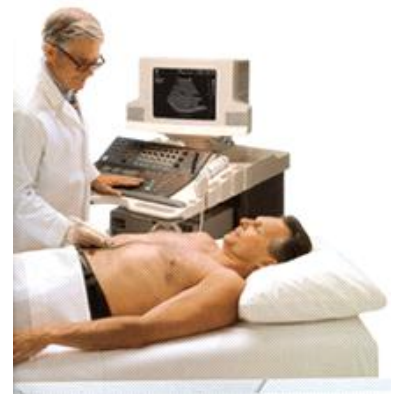
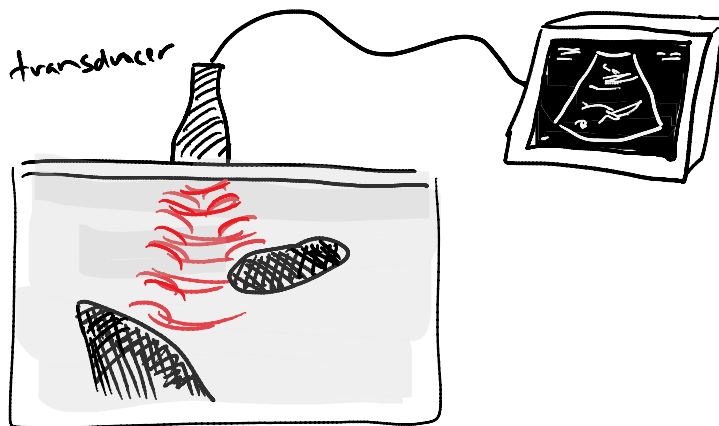


Ultrasound

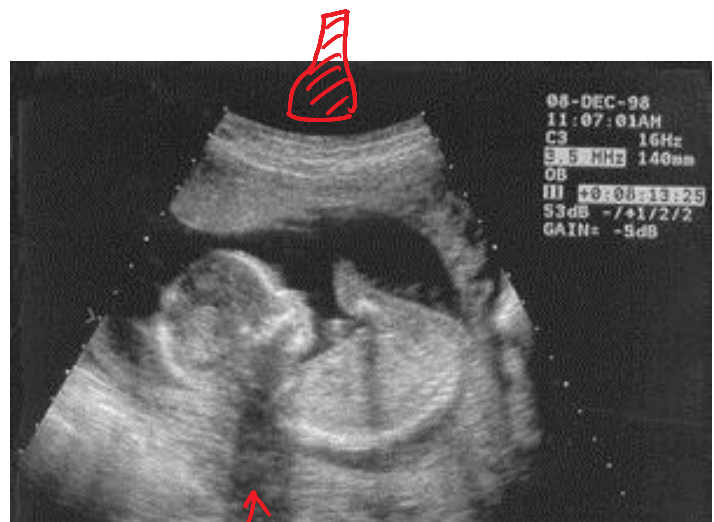
L15

Goal: To find out how ultrasound works (briefly), what it is used for, and what are its advantages and disadvantages.

Ultrasound (US) uses **sound waves** above the audible frequency. These sound waves reflect off **tissue interfaces** (eg. At the interface between heart muscle and blood). An US transducer sends these waves into the body, then **listens for echoes**. The longer it takes an echo to arrive, the **further away** the reflecting interface.



Fetal US



Properties of US

Safe

There are no known dangers to US, so it is used frequently. Eg. To monitor fetal development.

Cheap

US scanners are small and relatively cheap:

- approx. \$20,000
- CT scanner, approx. \$500,000
- MRI scanner, approx. \$4,000,000

Speed (Real-Time)

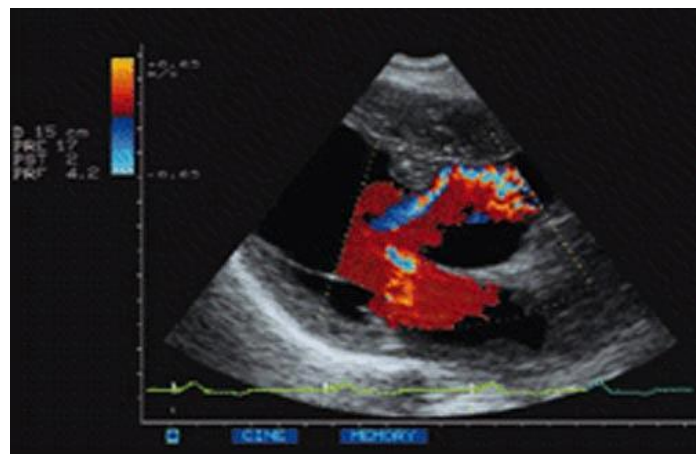
US images are displayed in real-time, as a video. You can actually watch things moving, like a heart pumping or a fetus shifting.

("heart-tongue" video)

Doppler Imaging

US is also capable of detecting the **motion** of objects (or blood) toward or away from the transducer.

US The velocities can then be rendered as colours in the video (red & blue as opposite directions). This is helpful for diagnosing heart valve regurgitation (leaking).



(doppler video)

(hearing).

(doppler video)

Noisy

US images are notoriously noisy, with lots of "salt and pepper" speckle noise. Because of this, single static images can be difficult to interpret. The noise has less of an impact when viewed as a video.

(why is that?)

Shadows

Dense structures do not transmit sound very well, so it can be difficult to image some parts of the body.

eg. • US cannot be used for brain imaging unless the skull is opened.

• Also, the heart must be viewed between ribs.

(see fetal US image above)

(show 3D-US videos)

Other Modalities

MEG - Magneto Encephalography

EEG - Electro Encephalography

OCT - Optical Coherence Tomography

SPECT - Single Photon Emission Computed Tomography

⋮

—END