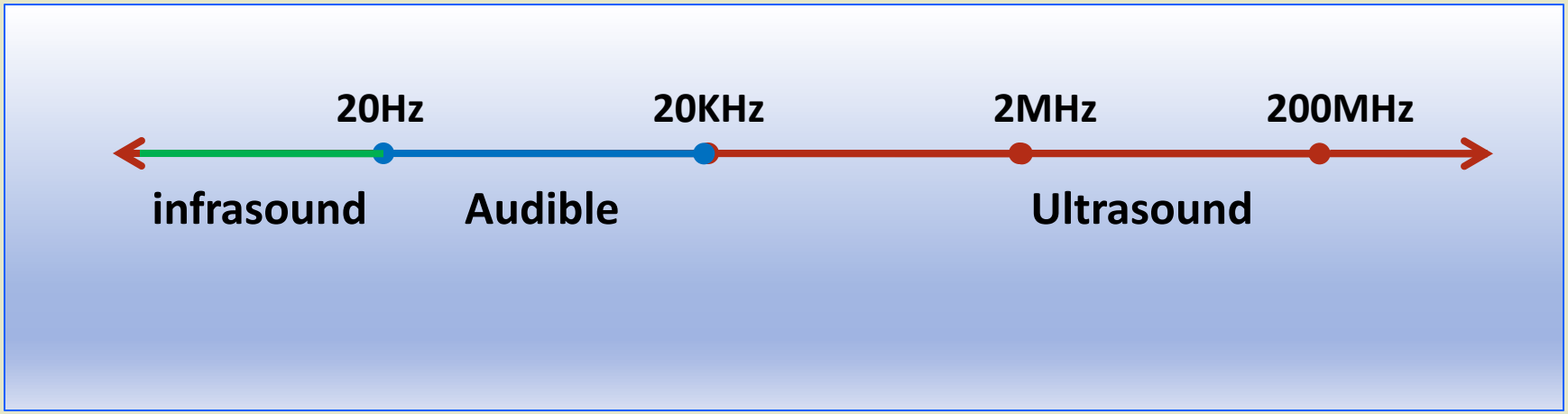
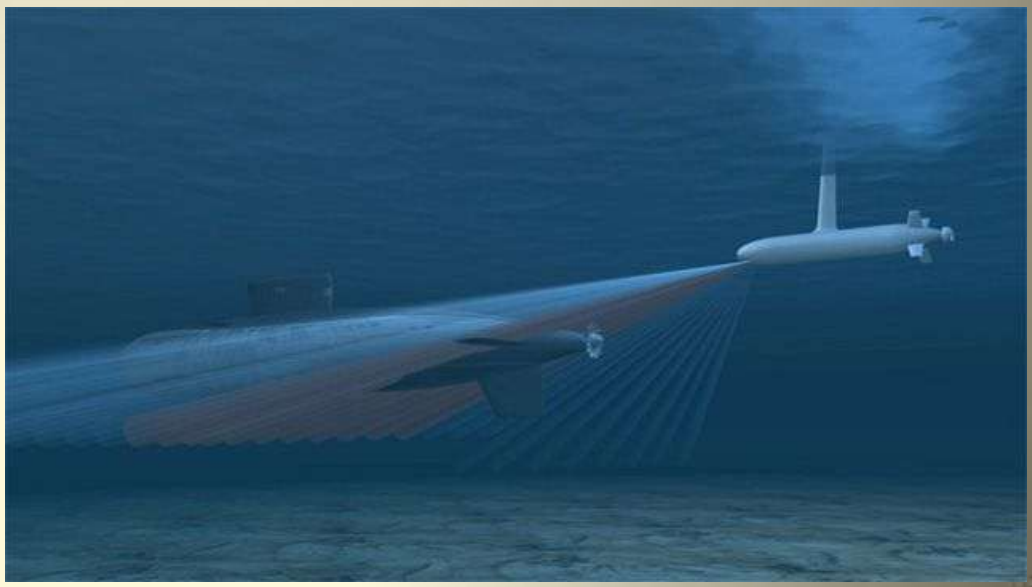
Practical Obstetrics
26-11-2014

Basic of Ultrasound
(B-mode ultrasound)
SONAR

Dr. yaseen m.


20Hz
20KHz
2MHz
200MHz
infrasound
Audible
Ultrasound

This technique is similar to the echolocation used by bats, whales and dolphins, as well as SONAR used by submarines etc..



Ultrasound :Medical Definition

-Diagnostic medical US is the use of high frequency sound to aid in the diagnosis and therapeutic procedures, using ultrasound to guide interventional procedures (for instance biopsies or drainage of fluid collections).

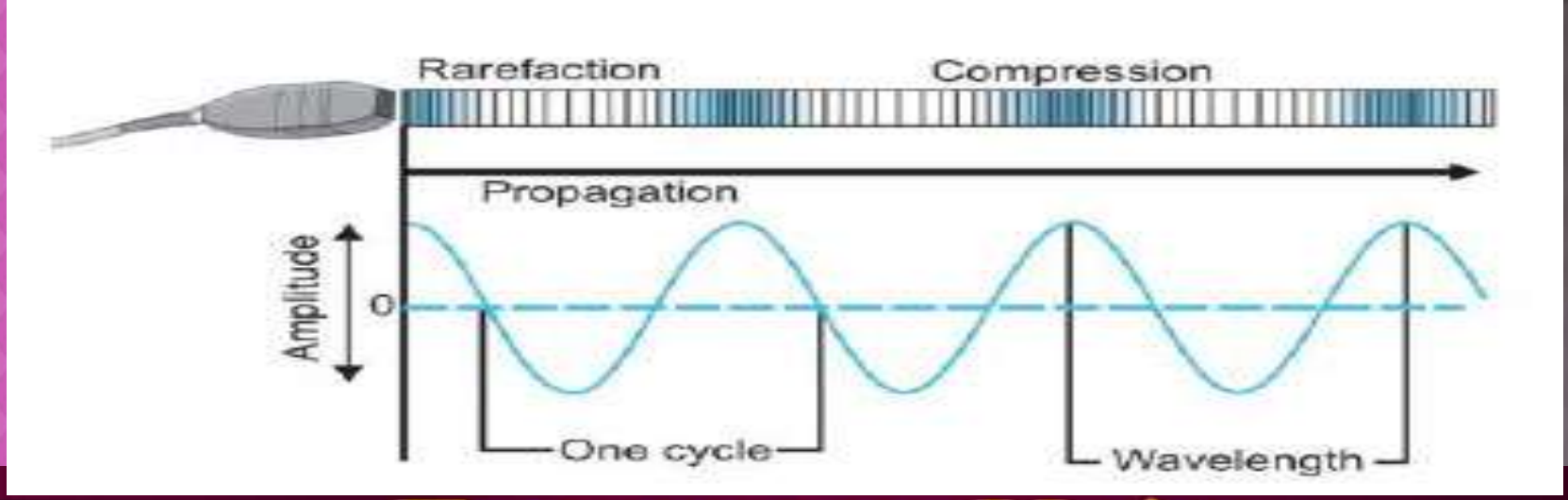
-Frequency ranges used in medical US imaging are 2-15 MHz.

Bandwidth

.ALL ultrasound transducer contain a range of frequencies ,termed *bandwidth*.

.Broad *bandwidth* technology produces medical transducers that contain more than one operating frequency, for example:

-2.5 – 5 *MHz* for general abdominal imaging.
-5 – 10 *MHz* for superficial imaging.



Frequency Units

- One cycle per second = one Hertz ***(Hz)***
- One thousand Hertz = One kilohertz ***(KHz)***
- One million Hertz = One megahertz ***(MHz)***

Example: a 7.5 MHz transducer operates at 7,500,000 cycles per second

Ultrasound modes

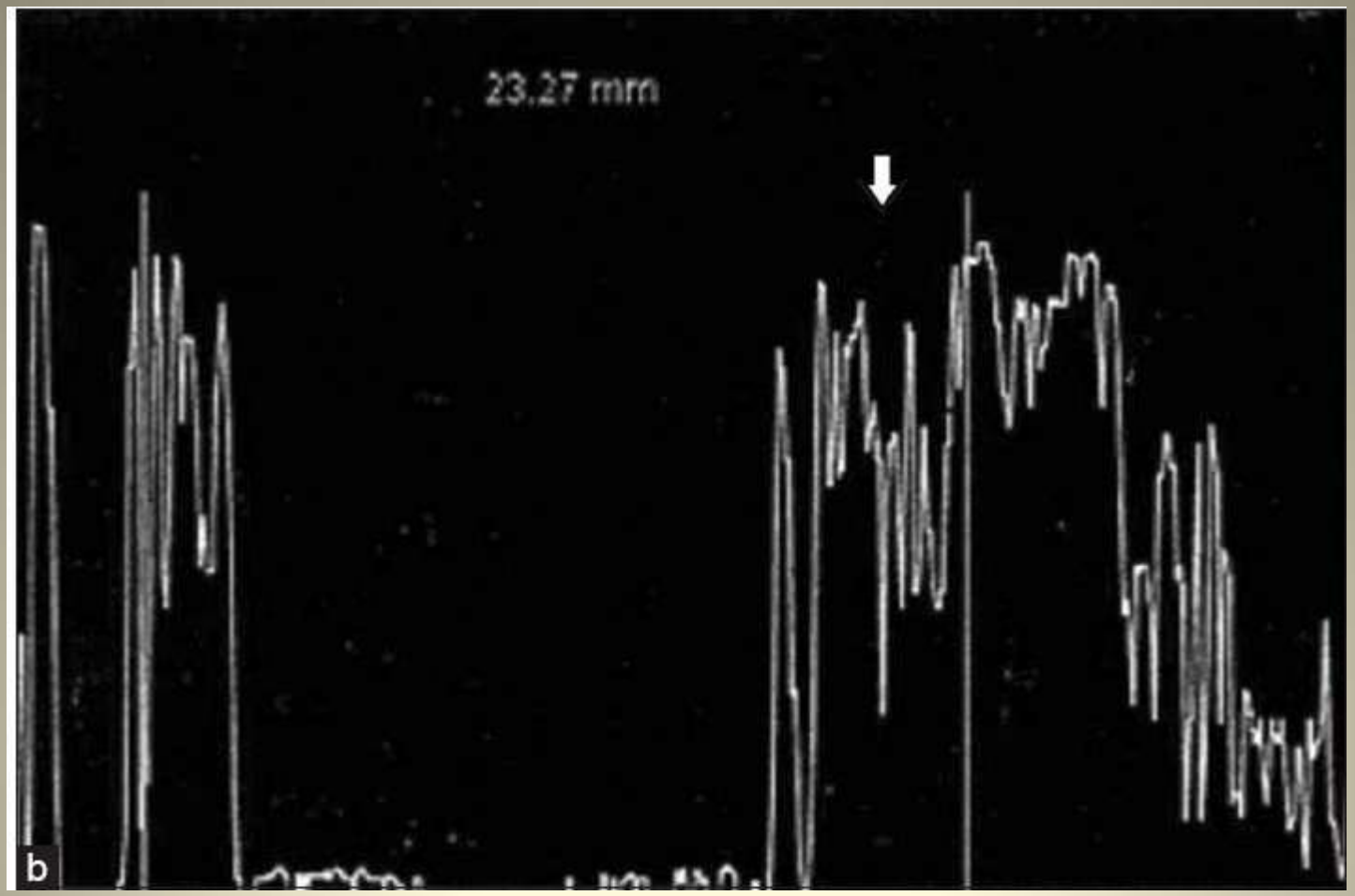
.A -mode (amplitude mode):
these units detect fluid-filled organs and U.S reflected converted to audible or visual signals ,now largely outdated . The A-mode scan had also been used for early pregnancy assessment (detection of fetal heart beat), and placental localization. This type of ultrasonography is used for ophthalmologic scanning.

.B -mode (brightness mode):
two-dimensional image on a screen. Allowing direct visualization of the tissues.

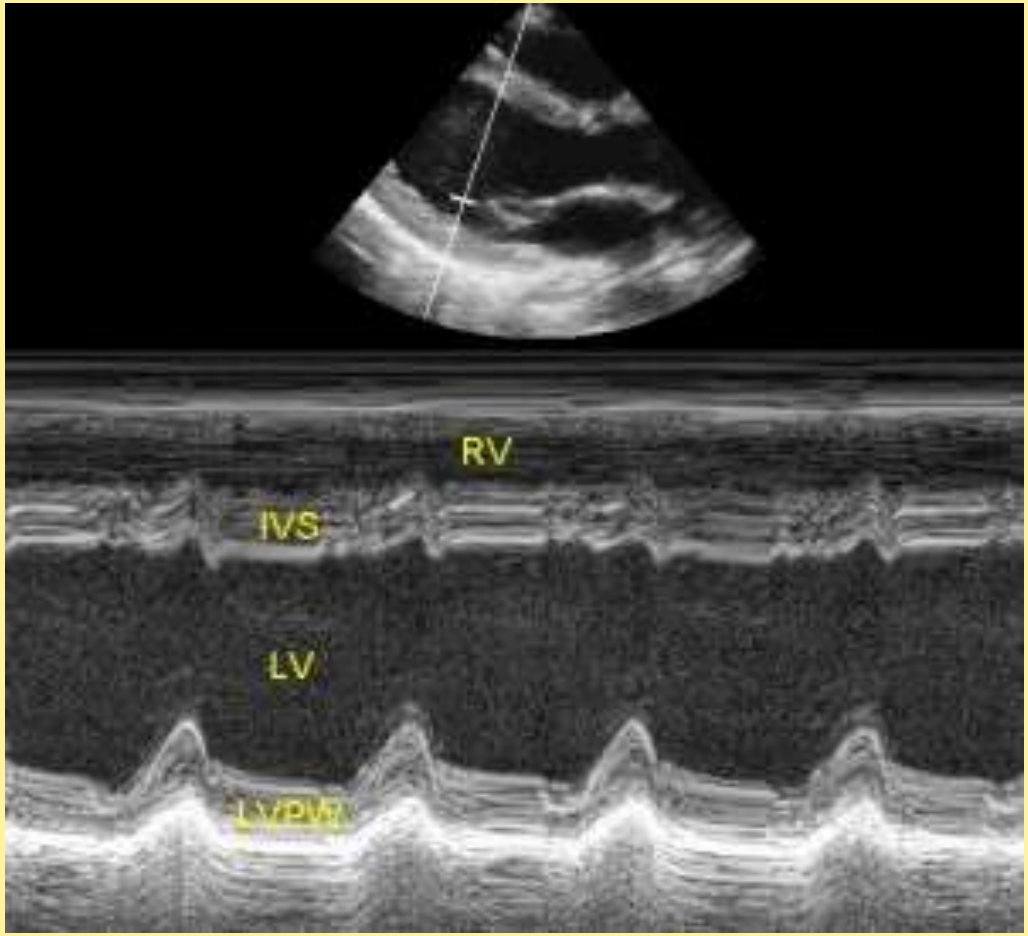
M- mode (motion mode):
This is used predominantly in echocardiography to assess dimensions of cardiac chambers and also to allow the thickness of the walls of the heart to be assessed in relation to the cardiac cycle.

.Doppler Ultrasound:
examinations include investigation of blood flow in arteries and veins in almost each body part.

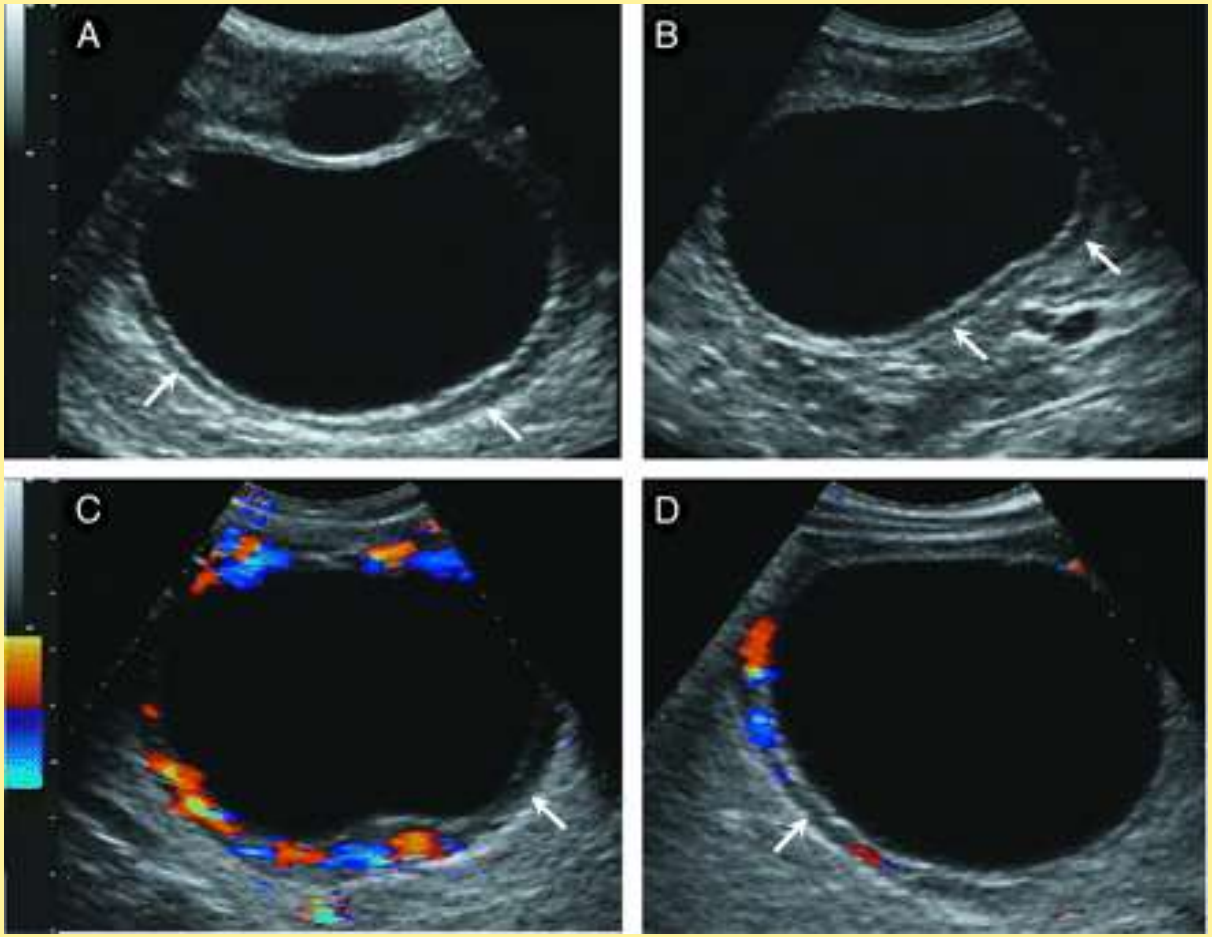
A-mode US



M-MODE ECHOCARDIOGRAM



Doppler Ultrasound:



Principal components of the real time (B-mode)ultrasound apparatus:

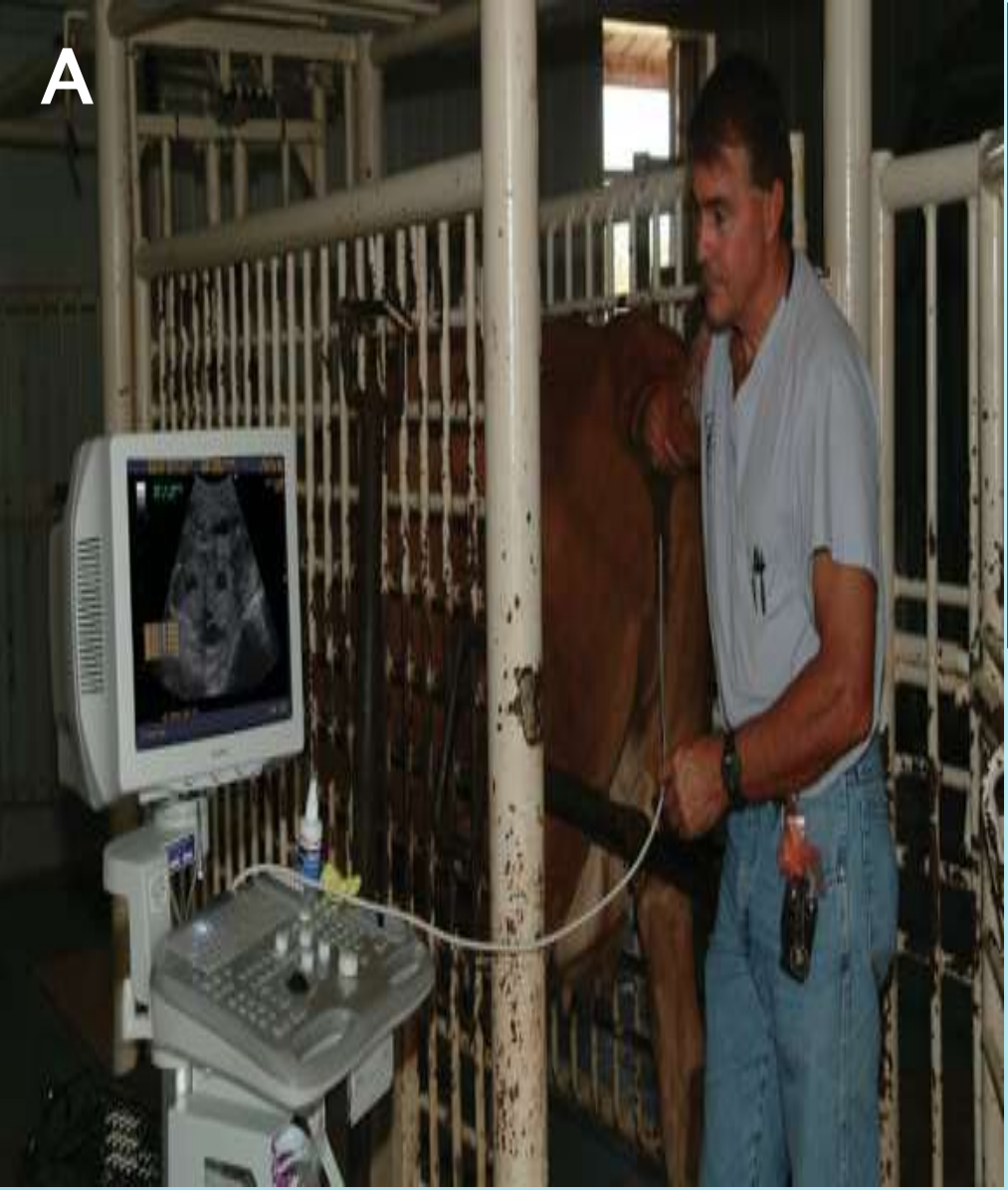
- Monitor
- Command keyboard
- Transducer (Probe)
- Printer

Types of B-mode Ultrasound unit:

1-NON-TRANSPORTABLE U.S UNIT.

2-TRANS-PORTABLE U.S UNIT.

3-PORTABLE U.S UNIT.


A


B


C
ESAOTE Pie Medical

ROUTES OF ULTRASOUND EXAMINATION

- Trans-abdominal
- Trans-rectal
- Trans-vaginal

Types of Transducers (probes)

Linear Transducer

-CONTAIN A LARG NUMBER OF CRYSTALS.

-TRANSDUCER FACE IS FLAT.

-GENERATE A RECTANGULAR-SHAPE IMAGE.

-PREFERED FOR TRANSRECTAL USE EXAMINATION OF LARGE ANIMALS REP. ORGANS.

-5/10MHz

Sector transducer

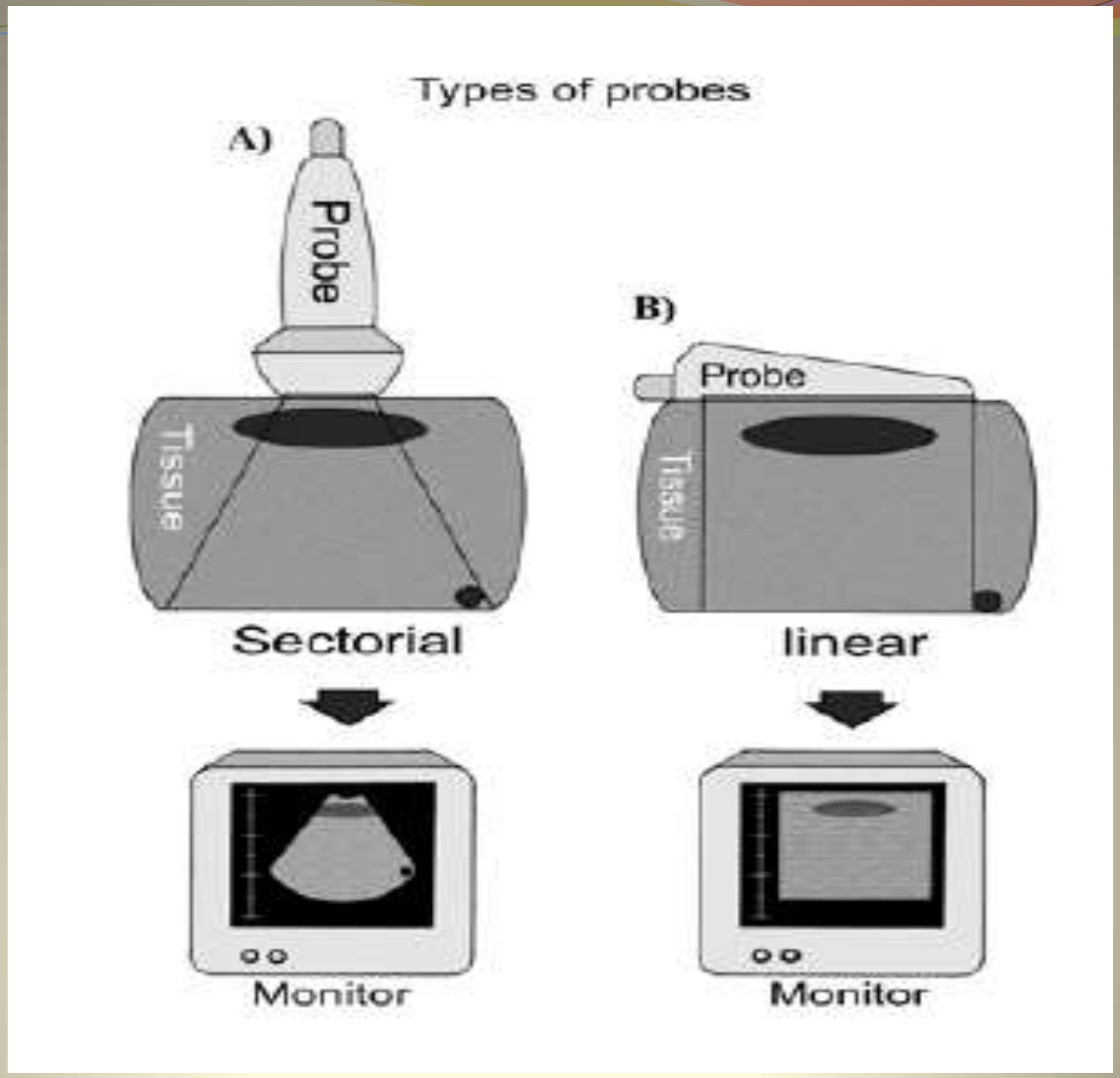
-CONTAIN A SMALL NUMBER OF CRYSTALS.

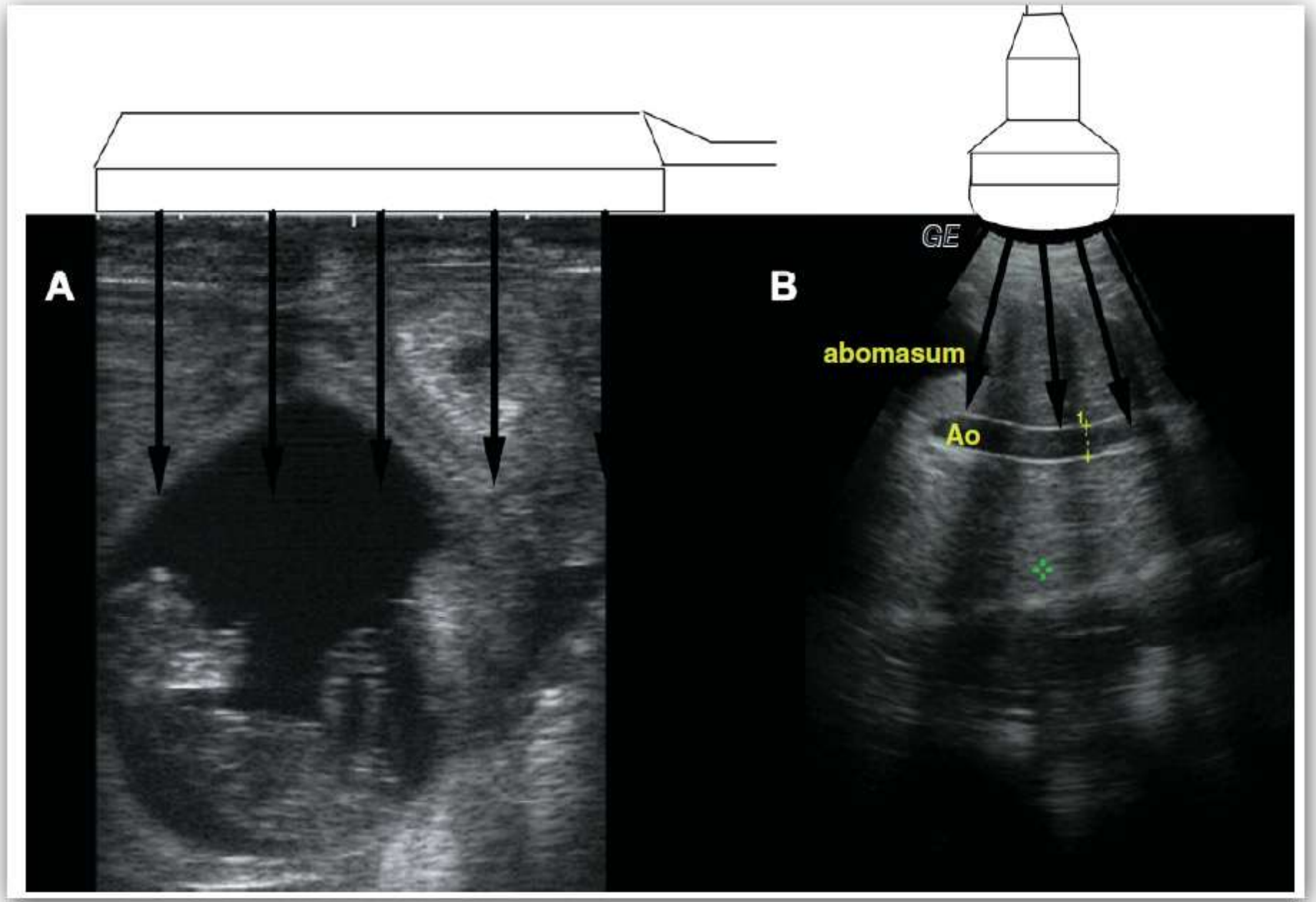
-TRANSDUCER FACE IS CURVED .

-PRODUCE A FAN-SHAPED IMAGE.

-USE IN ABDOMINAL EXAMINATION IN SMALL ANIMALS ,EVALUATION OF FETAL HEALTH IN ADVANCED GESTATION OF LARGE AND SMALL ANIMALS.

- 2.5/5MHz


Types of probes
A)
Probe
Tissue
Sectorial
Monitor
B)
Probe
Tissue
linear
Monitor

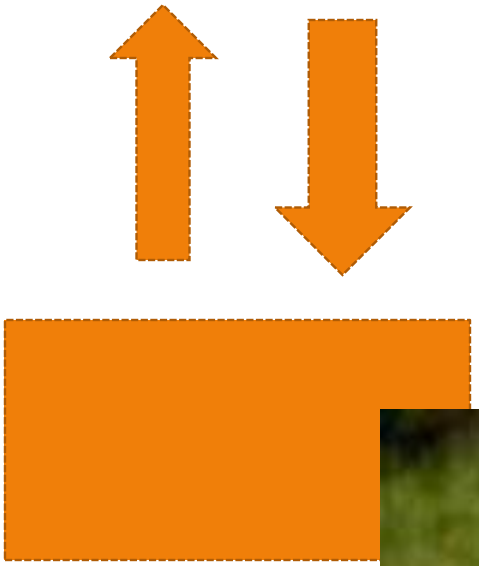

A
B
GE
abomasum
Ao

Characteristics and indications of probes with different frequencies used in theriogenology

3 MHz	5MHz	7.5MHz
Best field depth (0-20)cm	Intermediate field Depth(0-12)cm	Reduced field depth(0-8)cm
Lower resolution	Good resolution	Higher resolution
Advanced gestation, postpartum uterus.	Routine pregnancy diagnosis ,determining fetal gender .	Follicles and corpus luteum ,early pregnancy ,determining fetal gender.

Reflection

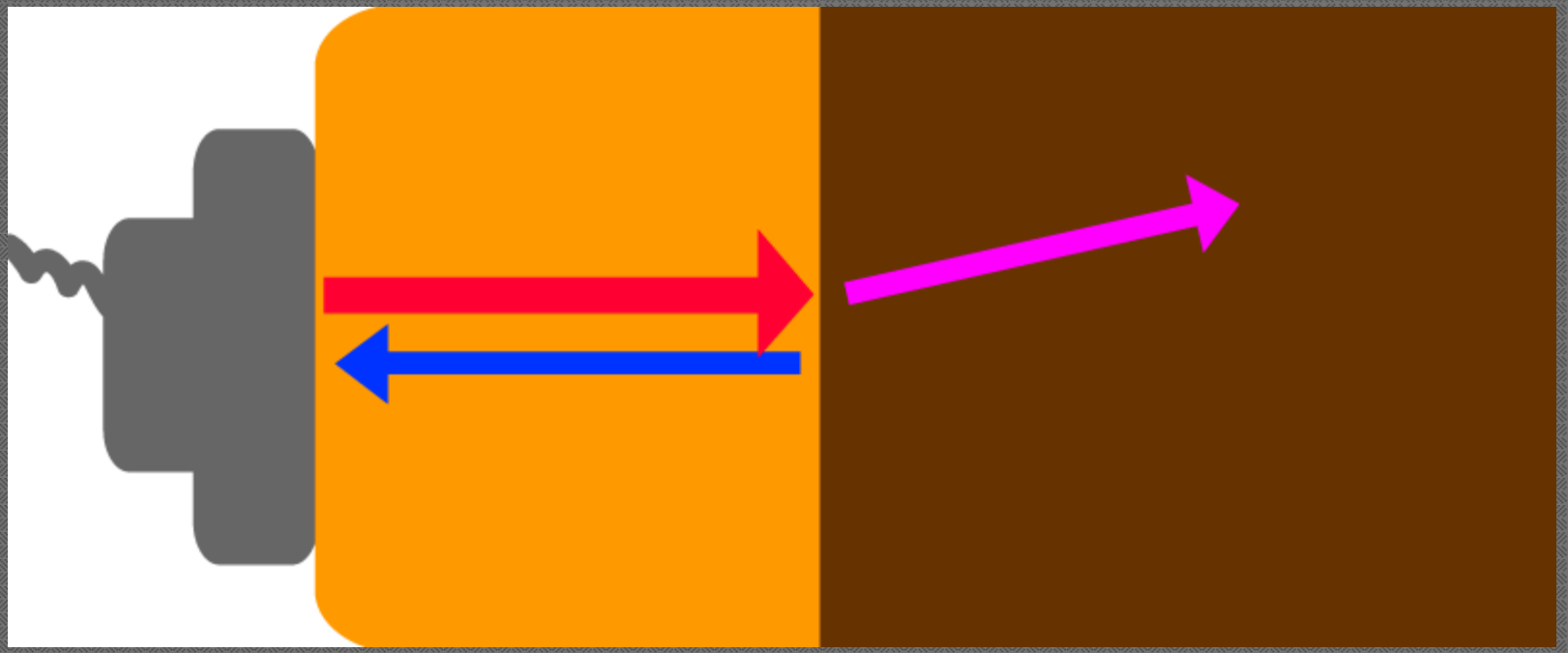
Sound wave bounces back towards the probe



Reflection of sound waves is the key to image generation

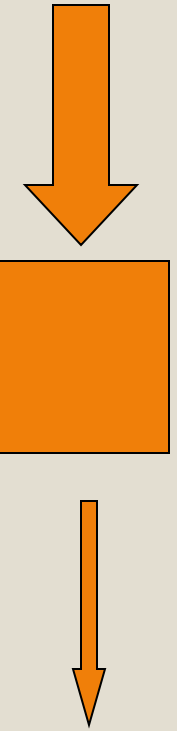
Refraction

Is the deviation of the ultrasound wave.



Attenuation

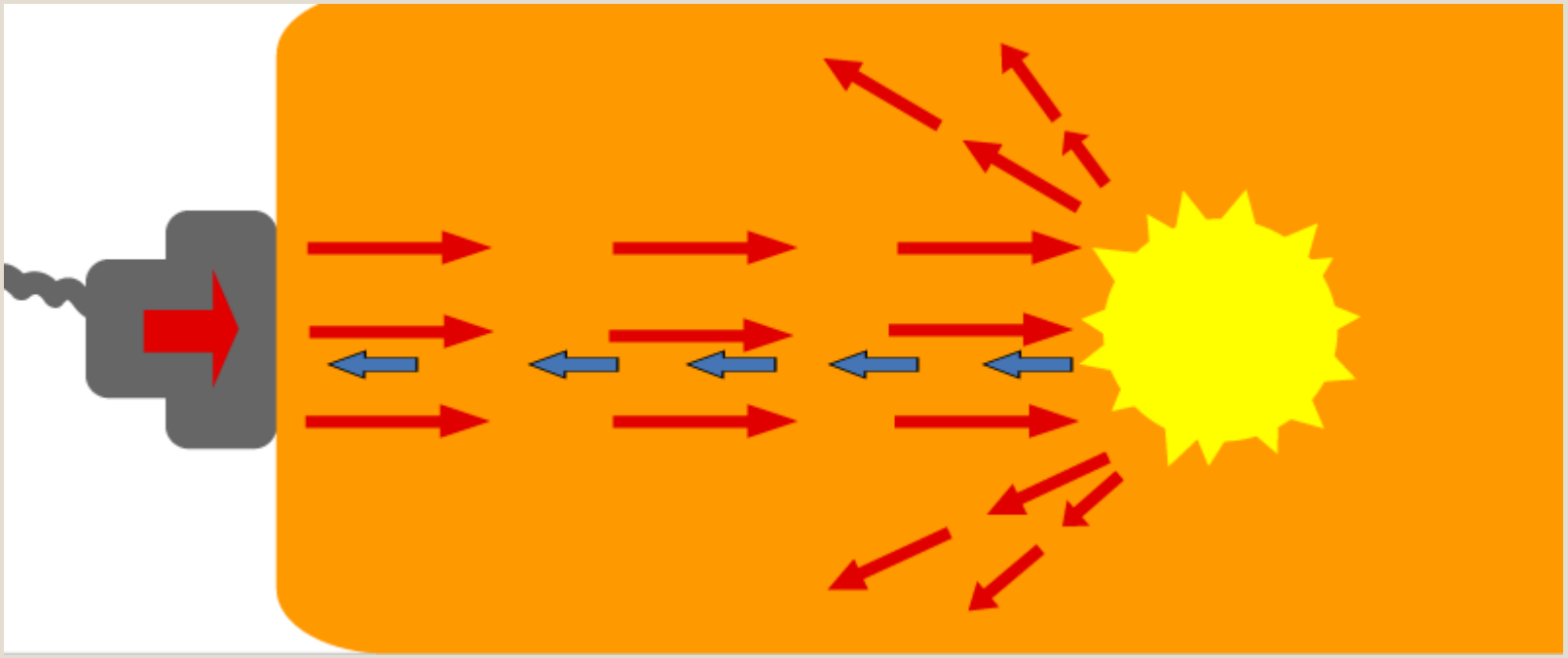
- Reduction in intensity of the ultrasound beam as it passes through tissue .



Scatter

Diffusion of the ultrasound energy in all directions

- due to reflections by small interfaces or a rough surface

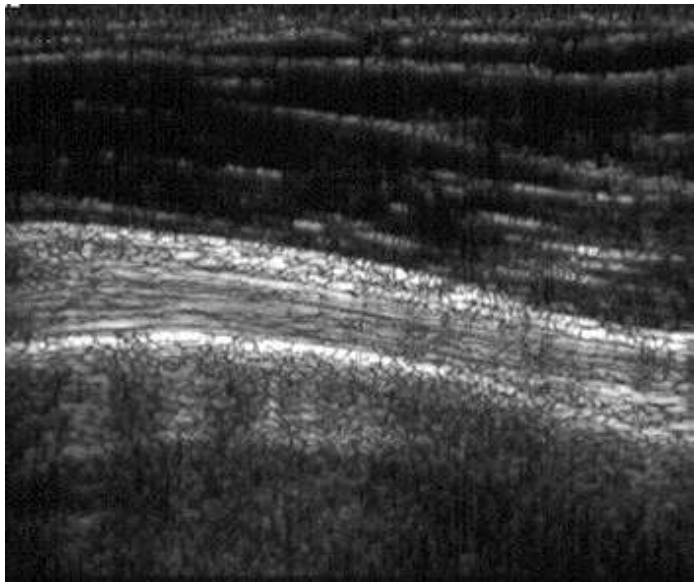


ECHOTEXTURE TERMINOLOGY

- Strong Reflections = White dots

  Diaphragm, tendons, bone

  ‘Hyper-echogenic’



ECHOTEXTURE TERMINOLOGY

Weaker Reflections =
Grey dots

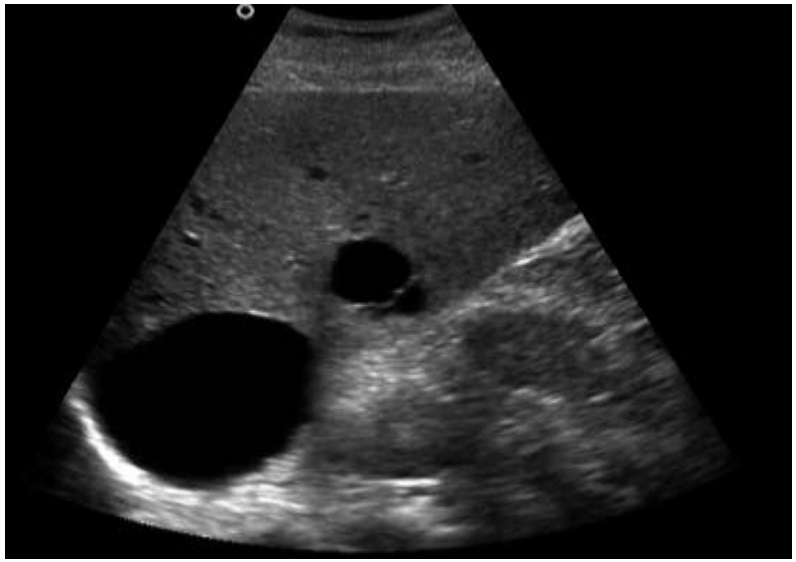
- Most solid organs,
- thick fluid –

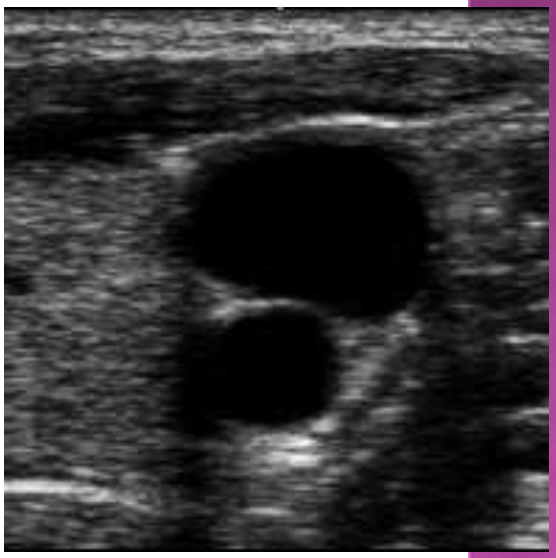
'Iso-echogenic'

ECHOTEXTURE TERMINOLOGY

- No Reflections = Black dots
  - Fluid within a cyst, urine, blood

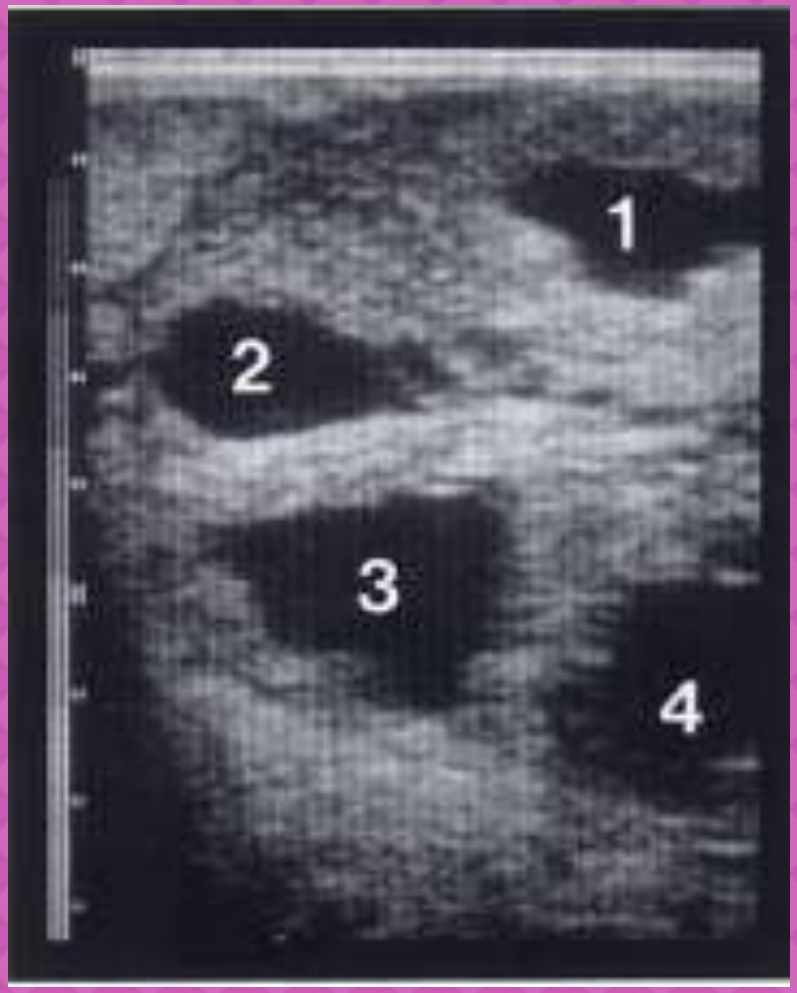
‘**Hypoechoic’ or an-echogenic**





Practical applications of ultrasonic imaging in reproductive biology

- **Ovarian and uterine evaluations .**
- **EARLY PREGNANCY DIAGNOSIS.**
- **Fetal Evaluation, assess fetal growth and fetal well-being.**
- **Ultrasound Characteristics of the Uterus in the Cycling animal.**
- **Determination of fetal gender.**
- **Ultrasonographic evaluation of the placenta.**
- **evaluation of testes and accessory sex glands of male .**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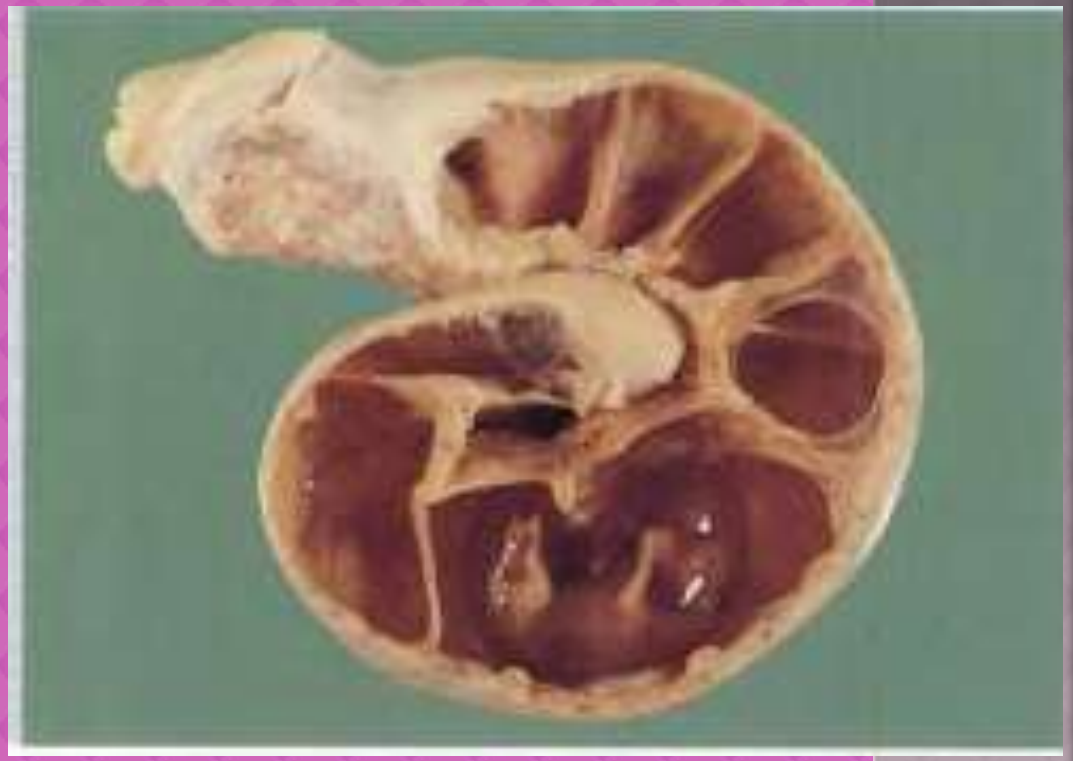
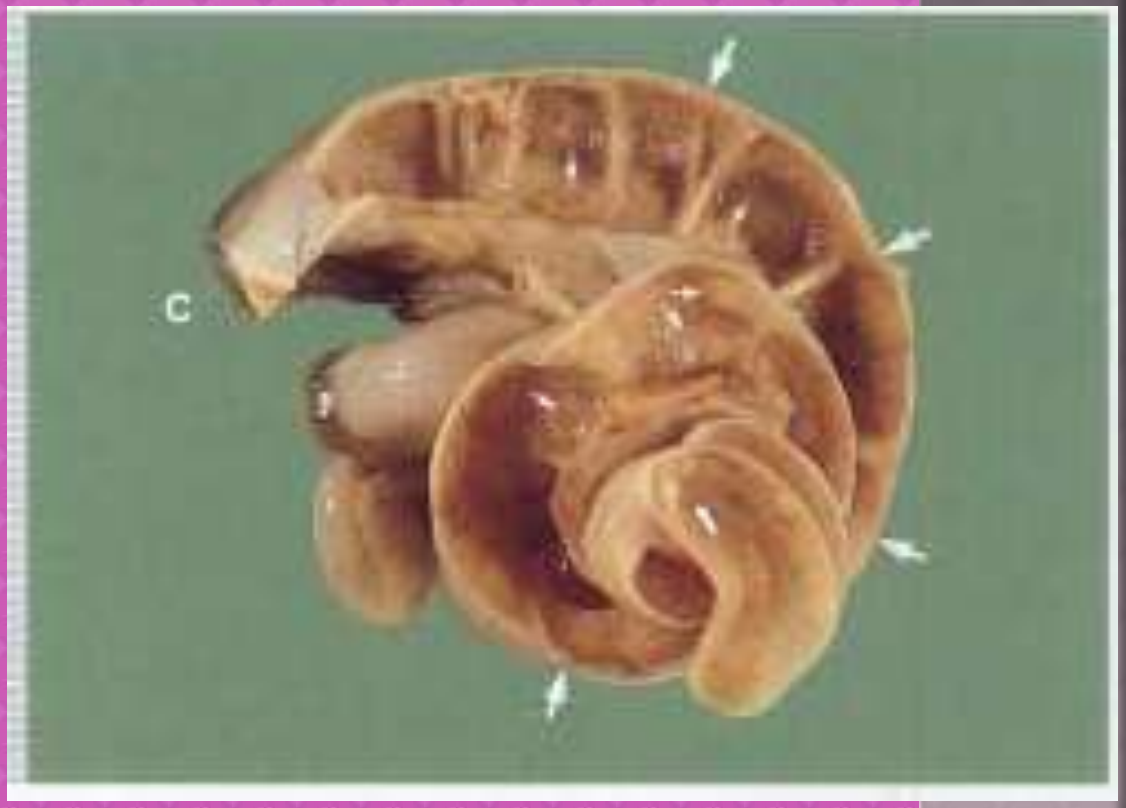



C

Advantages of ultrasound:

1. Ultrasound examinations are non-invasive.
2. Ultrasound methods are relatively inexpensive, quick and convenient.
3. No harmful effects have been detected.
4. Ultrasound is particularly suited to imaging soft tissues.
5. It is rarely necessary to anesthesia of animals.
6. Most ultrasound examinations are painless, fast and easy, usually no discomfort from pressure.

Disadvantages of ultrasound:

1. The resolution of images is often limited.
2. Ultrasound cannot penetrate bone and performs poorly when there is air between the scanner and the organ of interest.
3. Ultrasound is reflected very strongly on passing from tissue to gas, or vice versa.
4. the depth penetration of ultrasound is limited, making it difficult to image structures that are far removed from the body surface.

Common names of US:

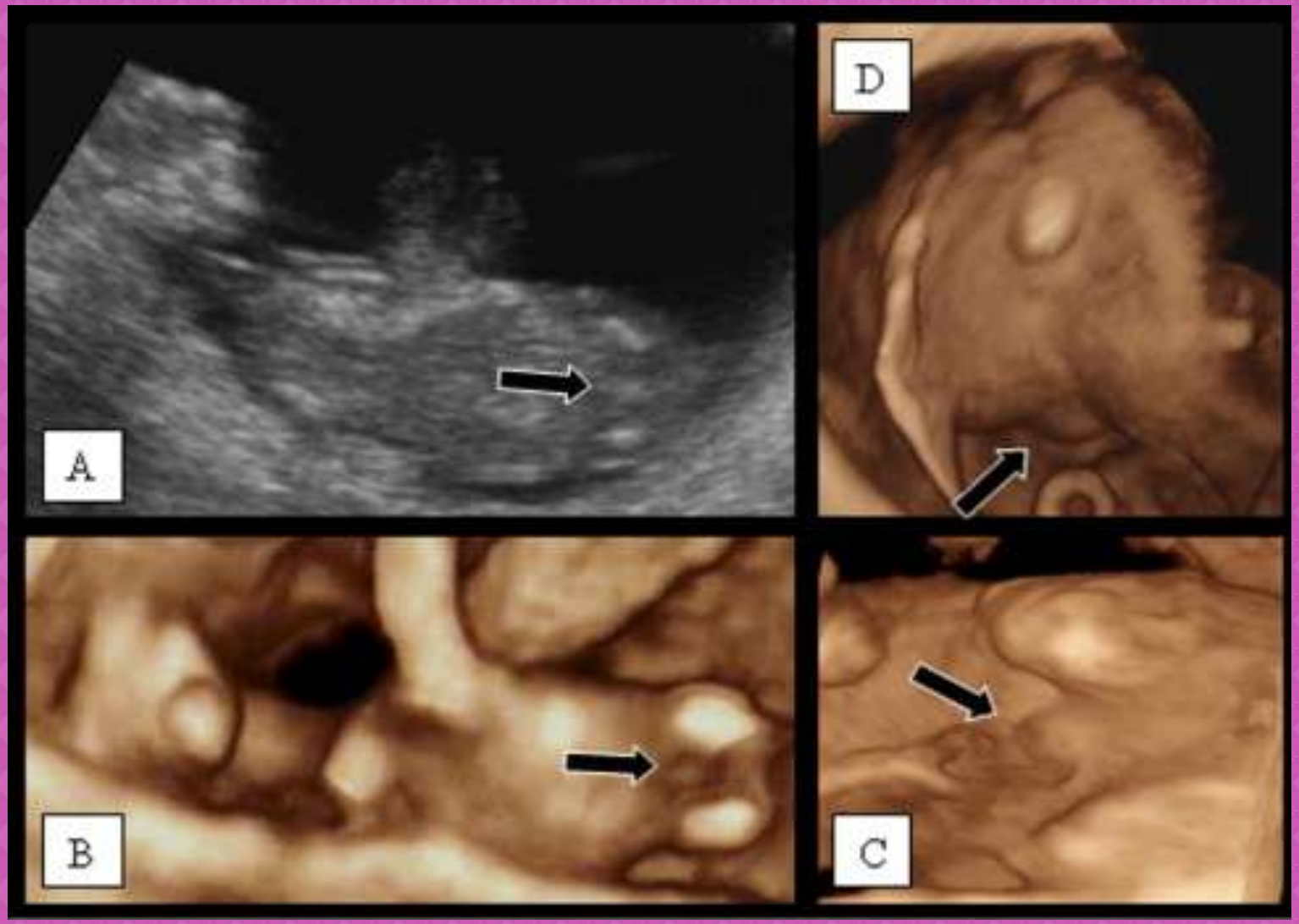
-Two-dimensional, 2D-mode.

-gray scale.

-real-time mode.

- B-mode.

-SONAR (Sound Navigation And Ranging)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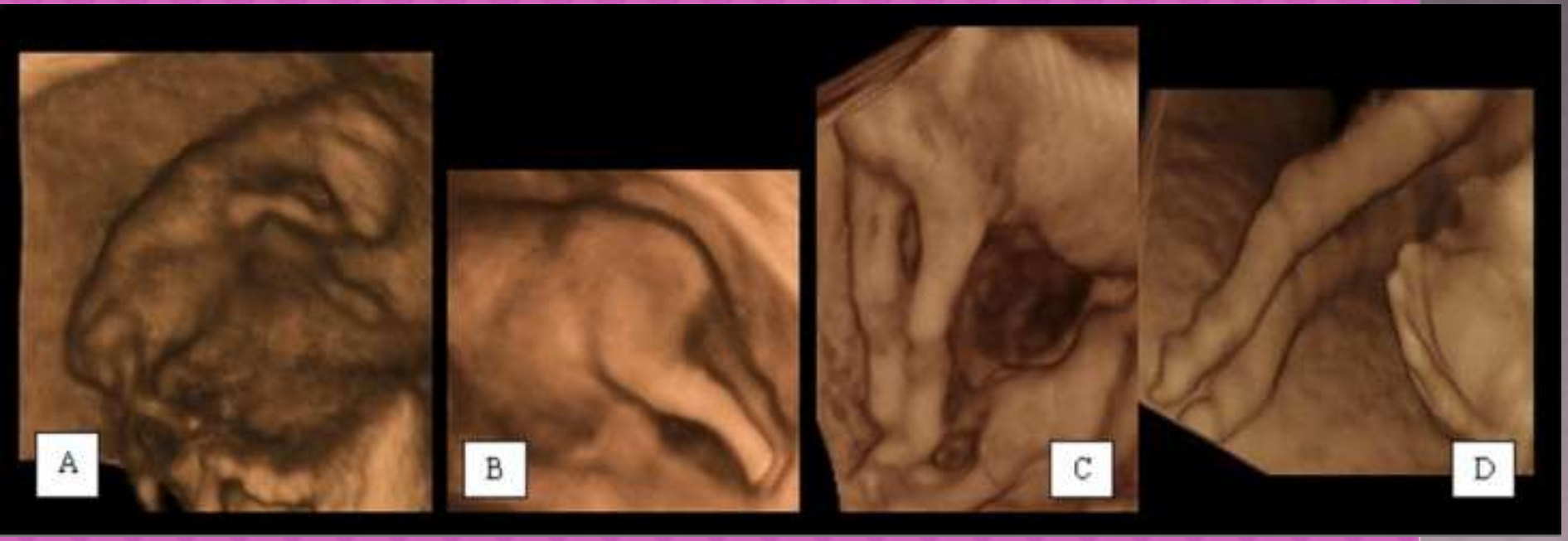
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B

? -What is 4D ultrasound scan—- - YouTube.mp4