

醫用超音波 原理簡介



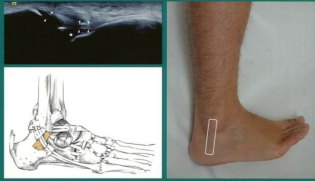

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Lien I-Nan Foundation for Promotion of Education and Research in Rehabilitation Medicine

Musculoskeletal Ultrasound Examination

EDITOR : Tyng-Guey Wang
Wen-Shiang Chen

Leader Book
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Musculoskeletal Ultrasound Examination, Part II: Essential Pathologies

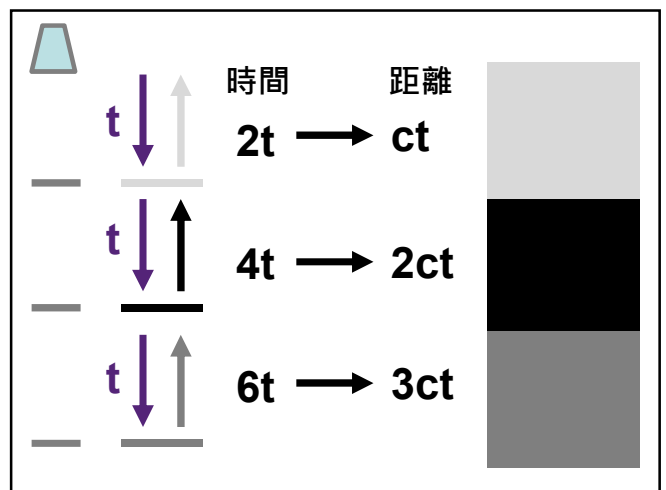
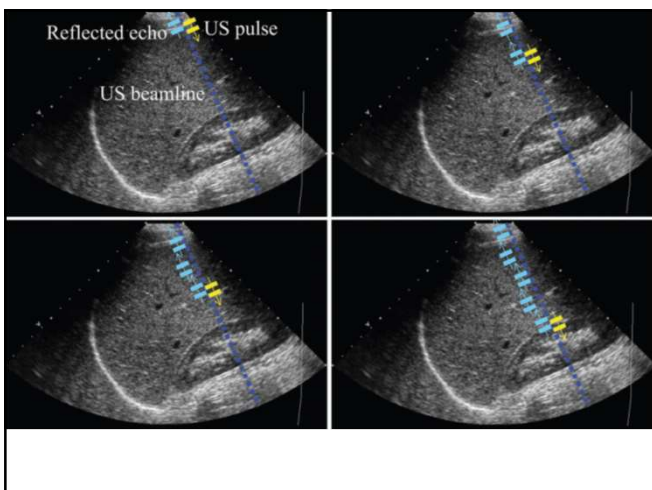
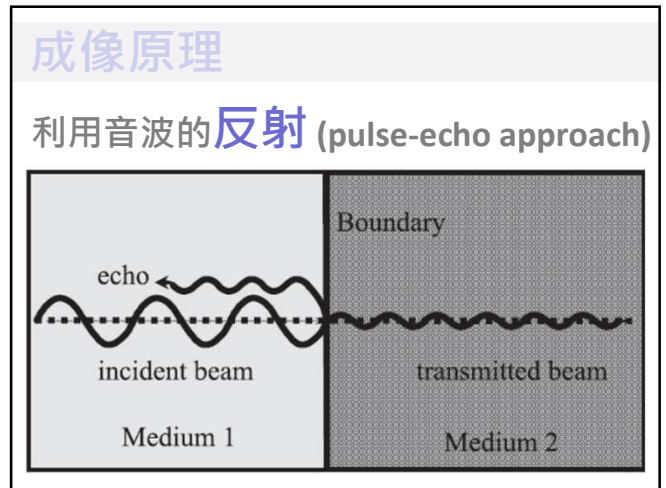
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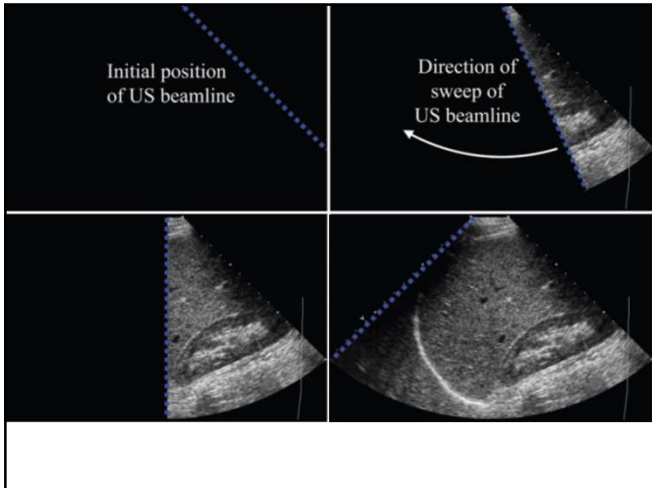
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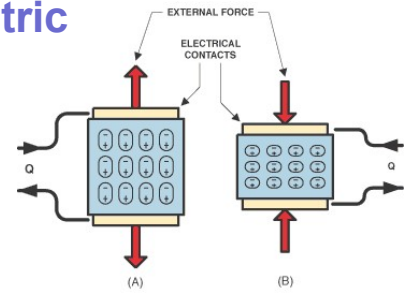

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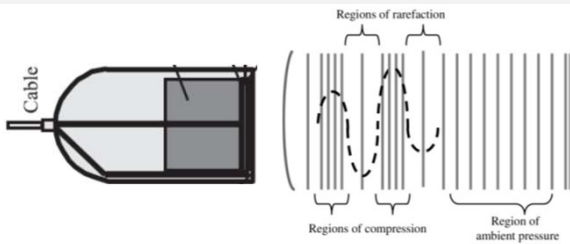


超音波的產生

Piezoelectric materials
壓電效應



超音波基礎物理學



縱波，機械波 / 需介質傳遞
沒有輻射，無侵入性

超音波回聲的偵測

回聲強度

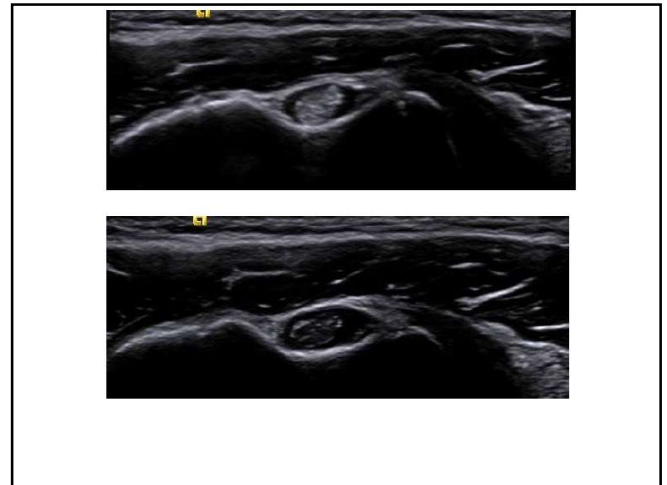
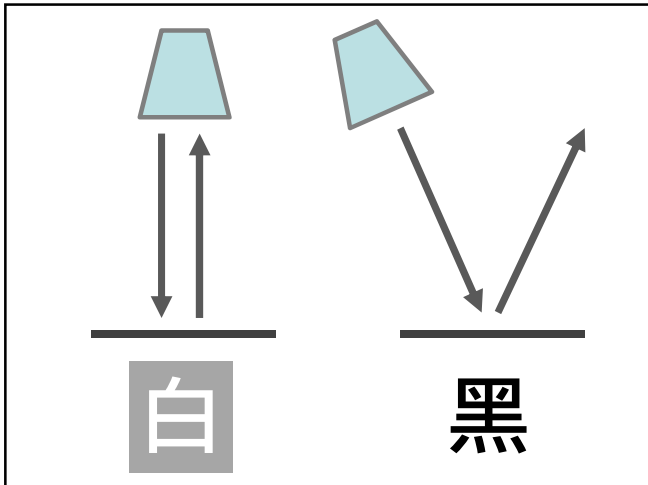
回聲方向

從發出到回探頭的時間

看到特別白的地方
表示該處回聲特別_____

看到特別黑的地方
表示該處超音波大多穿透

Anisotropy



超音波基礎物理學

隨著超音波的**頻率愈高**
 成像解析度愈**好**
 但衰減會變強
 因此**穿透力較差**

如果你想看深一點的部位
 頻率應該調_____一點

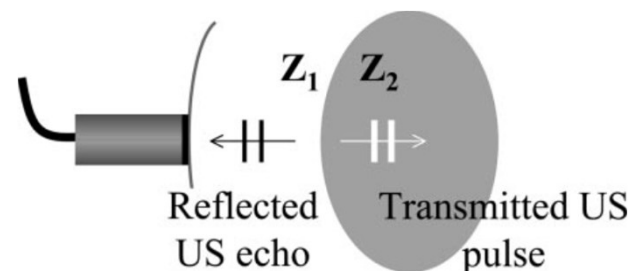
超音波的速度

$c=1540$ m/s (在生物體內)

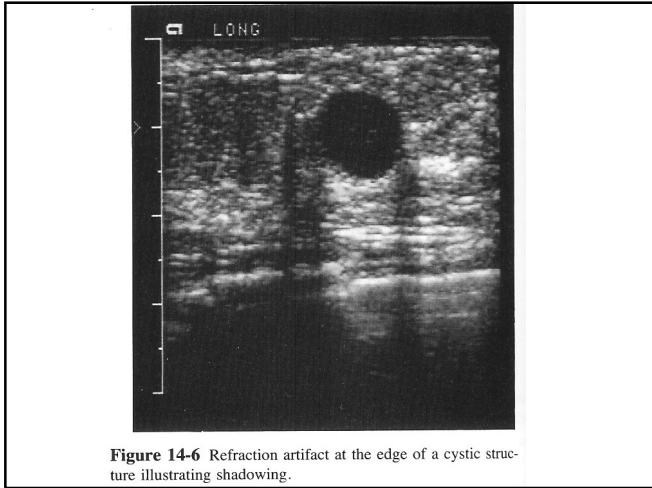
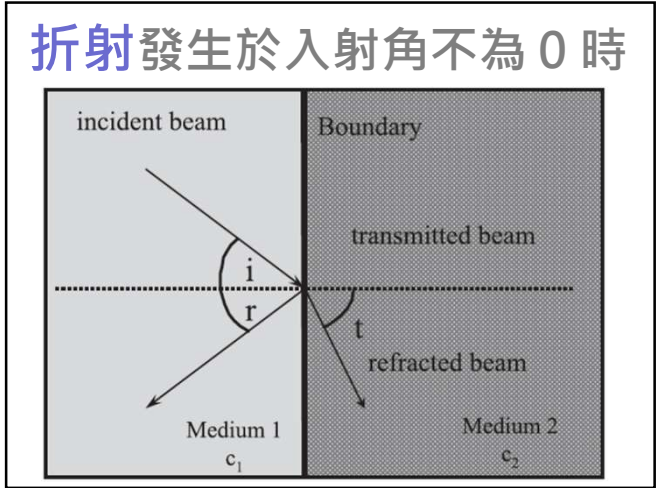
聲速 = 波長 \times 頻率

波長 = 0.77 mm at 2 MHz,
 0.10 mm at 15 MHz

反射發生於組織介面
 聲阻抗差距愈大，反射愈強



組織	聲阻抗 ($\times 10^6$)
空氣	0.0004
脂肪	1.3400
水	1.4800
肝	1.6500
血	1.6500
腎	1.6300
肌肉	1.7100
骨頭	7.8000



Equally echogenic interfaces

Echo Intensity vs Depth

4 MHz

8 MHz

0.5-1.0 dB/MHz/cm

超音波衰減 (吸收和散射)

Depth-gain compensation

Time-gain compensation

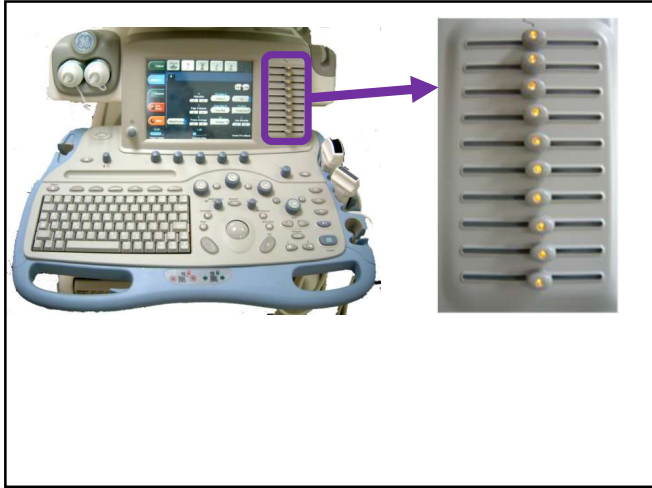
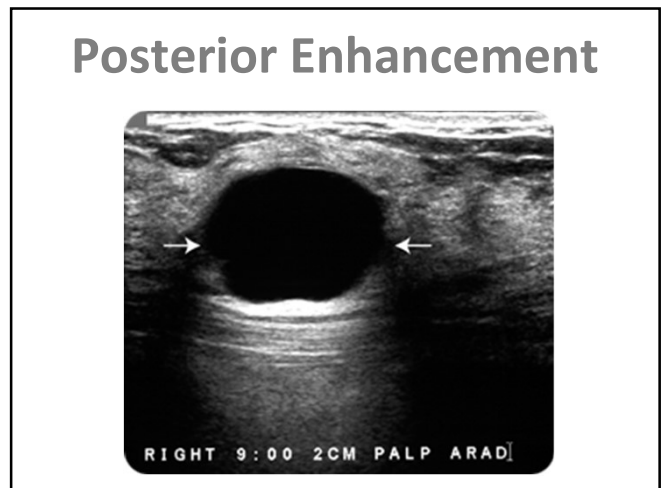
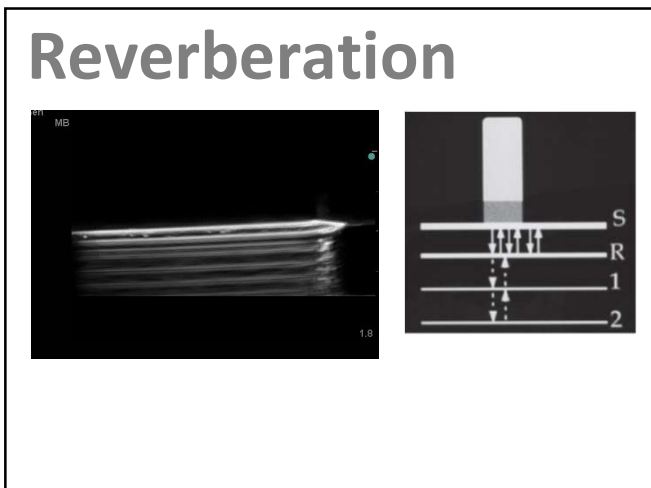
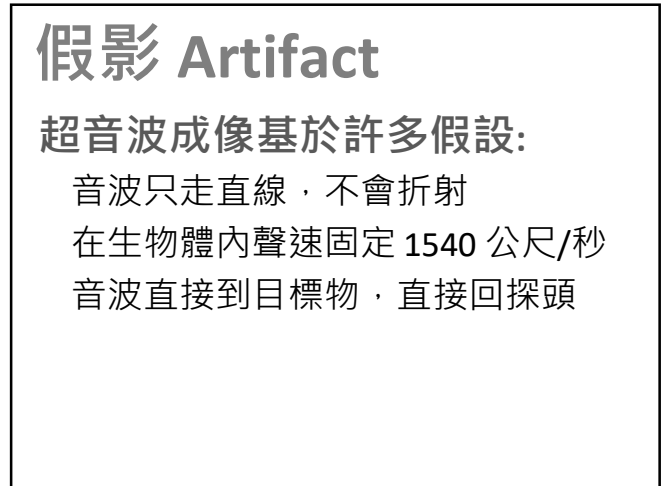
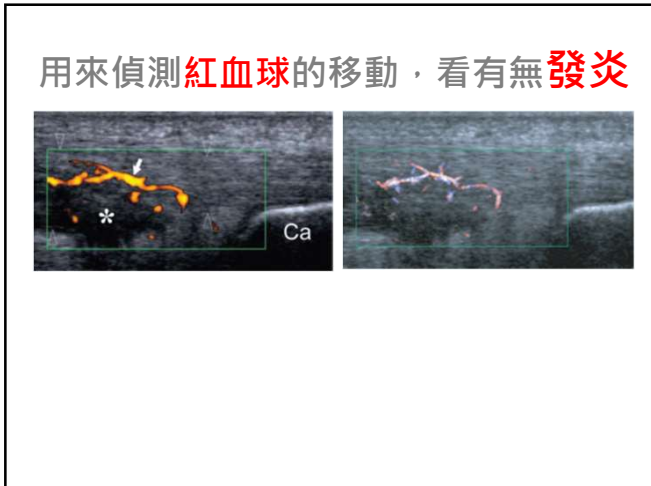
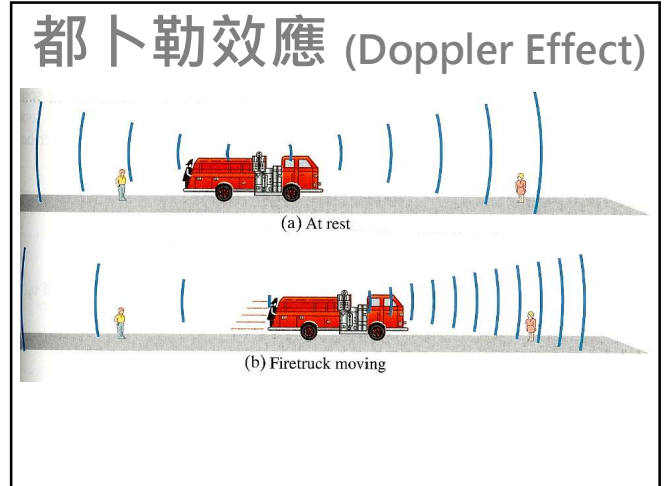
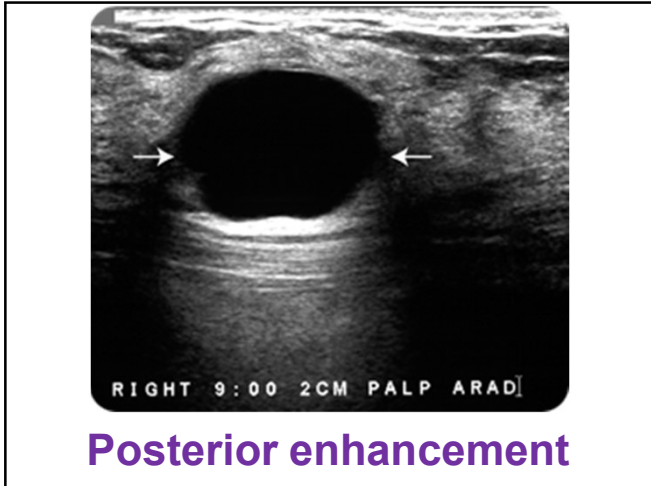
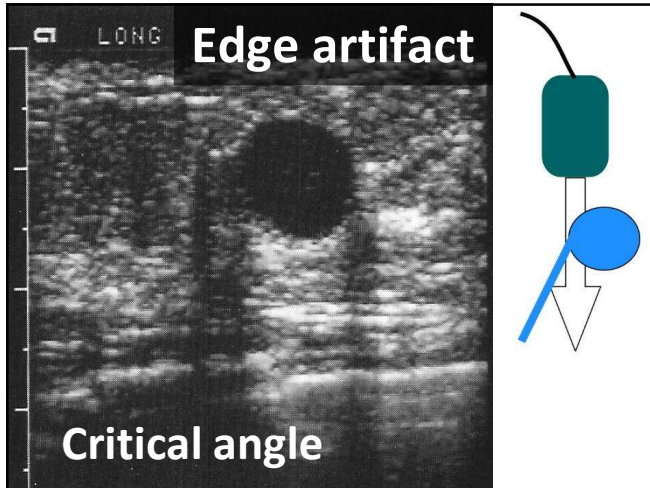


Table 1-11 Attenuation of Human Tissues and Other Media at 1 MHz

Material	dB/cm
Blood	0.18
Fat	0.6
Kidney	1.0
Muscle (across fibers)	3.3
Muscle (along fibers)	1.2
Brain	0.85
Liver	0.9
Lung	40.0
Skull	20.0
Lens	2.0
Aqueous humor	0.022
Vitreous humor	0.13
Water	0.0022
Castor oil	0.95
Lucite	2.0





超音波成像最主要基於音波的**反射**

較白的地方表示回聲較**強**

後回聲增強表示可能**積水**

都卜勒效應可用來偵測**發炎**

吳爵宏



<http://www.tnmskus.org.tw/>

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