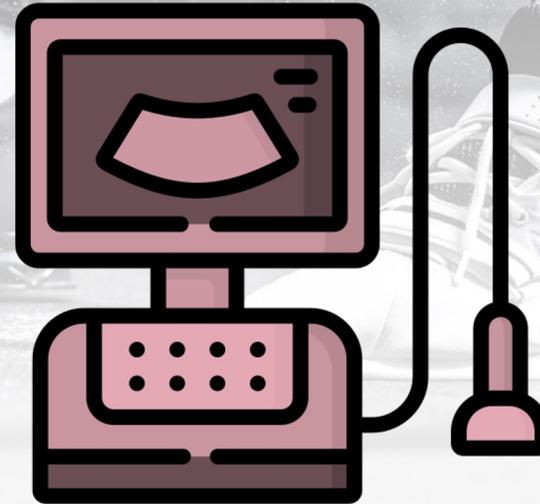


# EVALUACIÓN DE LA HIPERTROFIA Y ARQUITECTURA MUSCULAR CON DISPOSITIVOS ECOGUIADOS

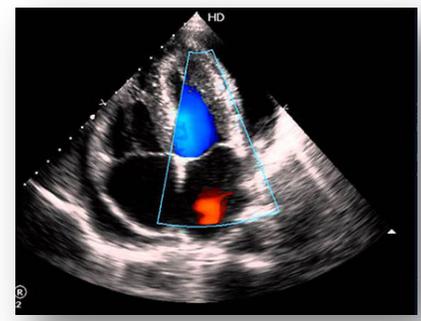


**Alejandro Hernández**  
**Eduardo Cimadevilla**

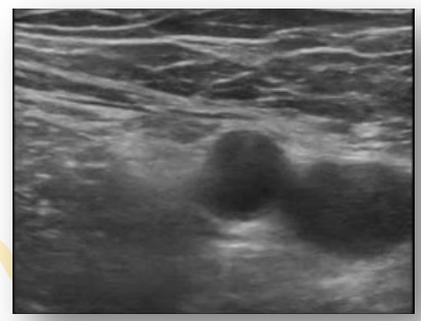


# APLICACIONES PRÁCTICAS

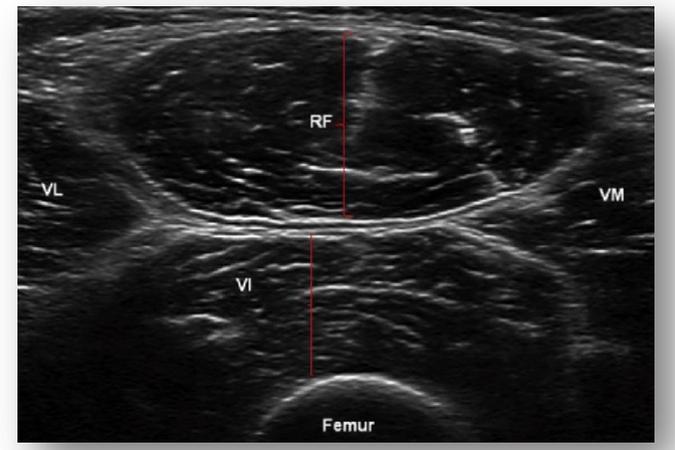
Órganos



Nervios y vasos sanguíneos



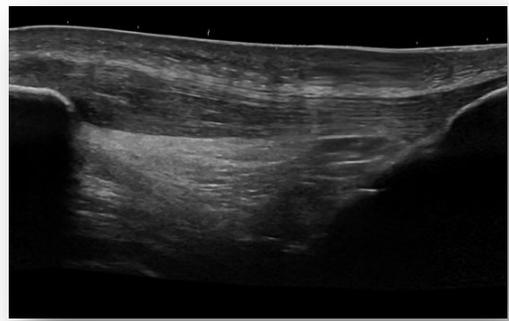
Músculos



Huesos



Ligamentos y tendones

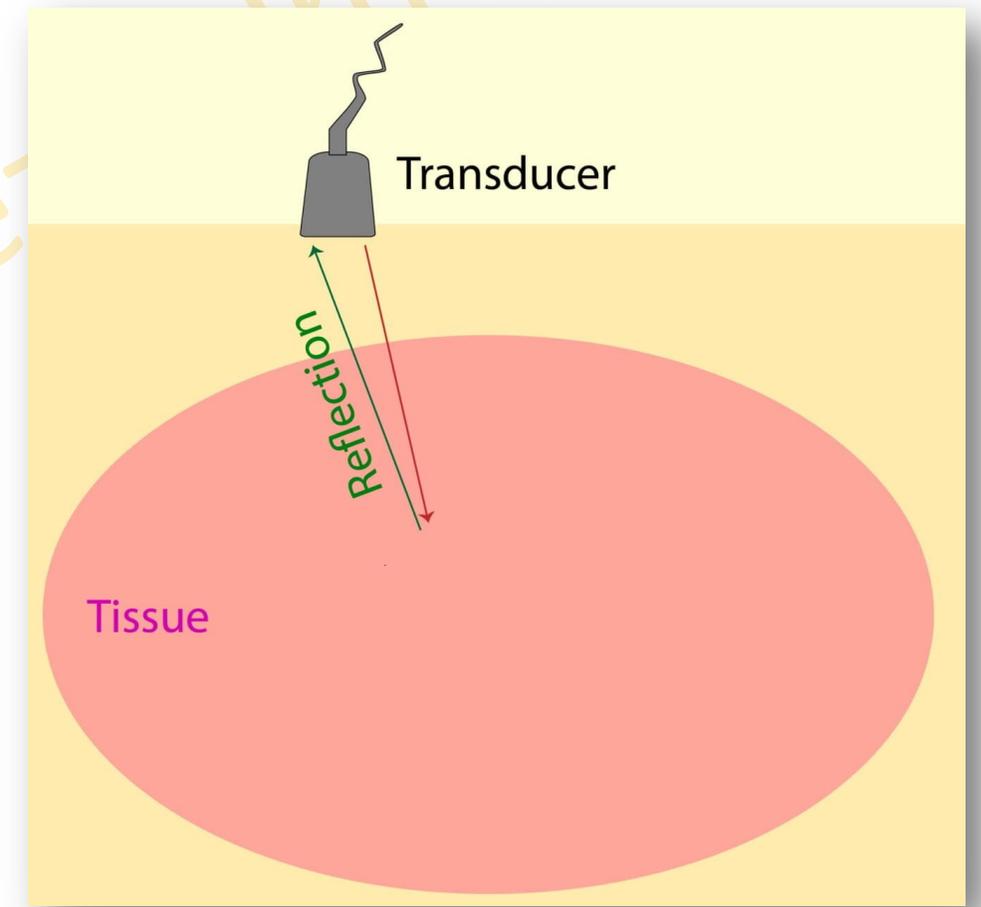
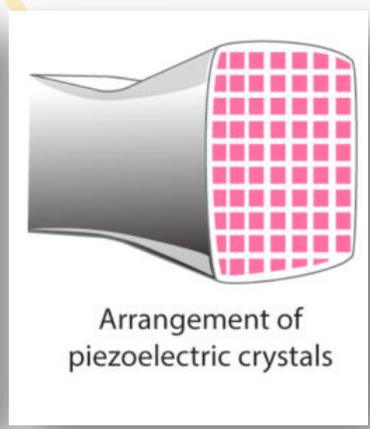
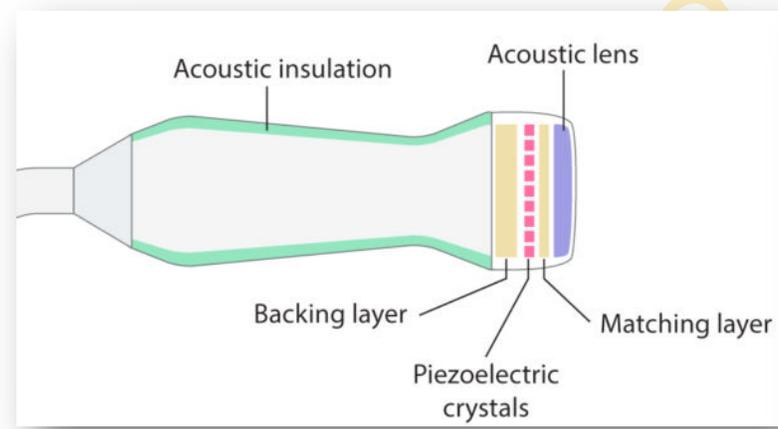
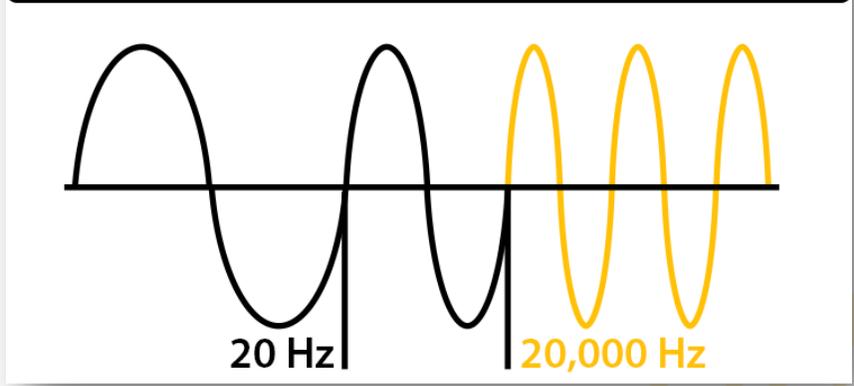


Aleja  
Hern

Belmonte

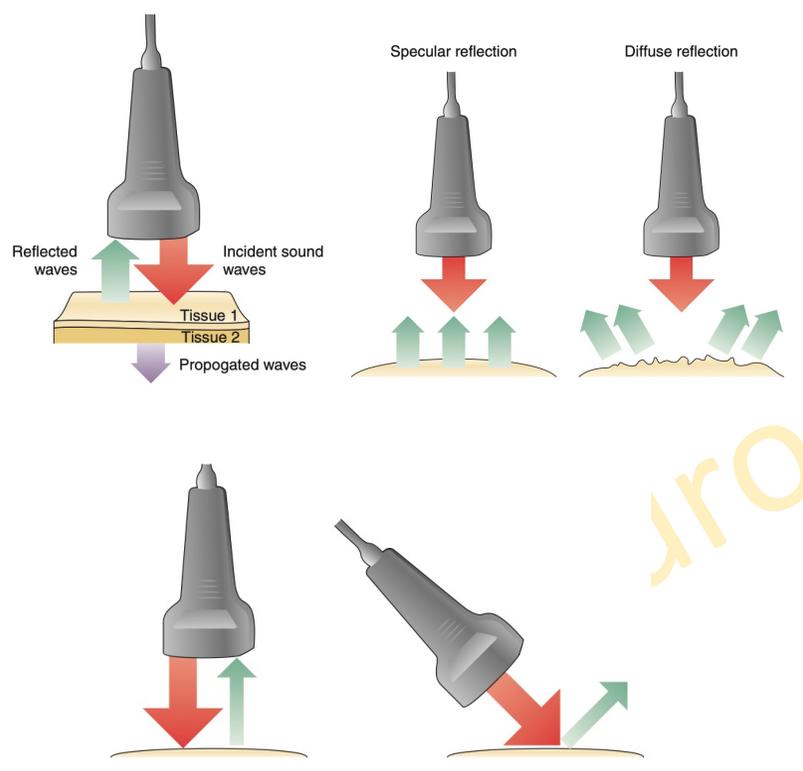
# BASES DE LA ECOGRAFÍA

sound waves with frequencies above 20,000 Hz

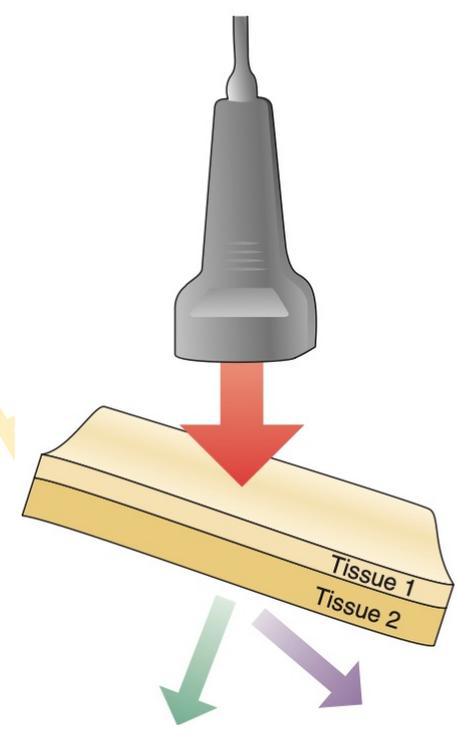


# REFLEJO, REFRACCIÓN, DISPERSIÓN, ABSORCIÓN

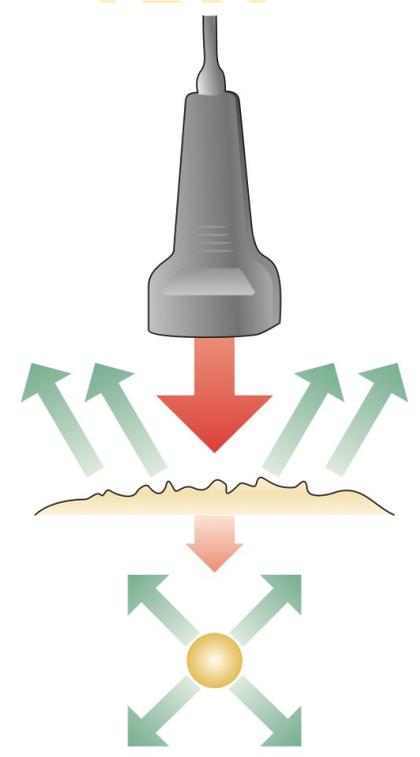
## REFLEJO



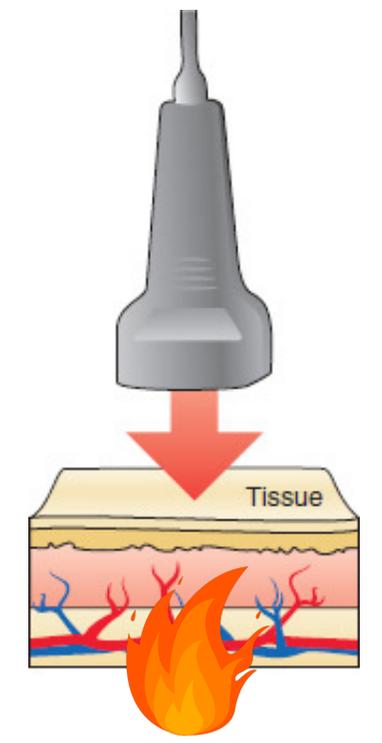
## REFRACCIÓN



## DISPERSIÓN



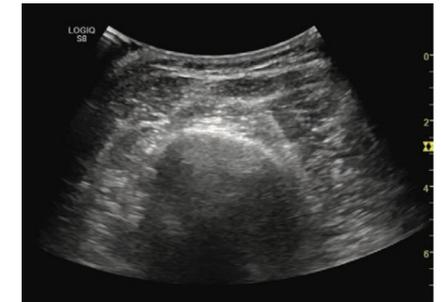
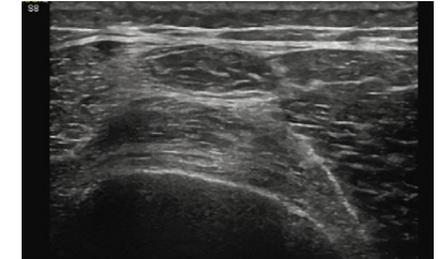
## ABSORCIÓN



## ASPECTOS A TENER EN CUENTA: SONDA

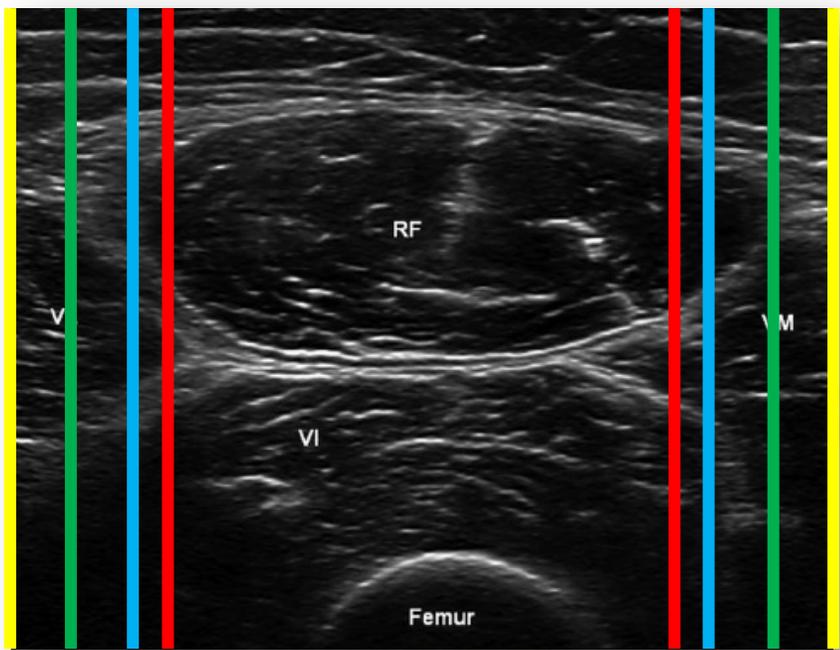


- Componente más importante
- Recibe las ondas y las convierte en impulsos eléctricos
- Determina la resolución de la imagen
- Sondas lineales: Altas frecuencias / tejidos superficiales
- Sondas curvilíneas: Bajas frecuencias / tejidos profundos
- Campo de visión (footprint)

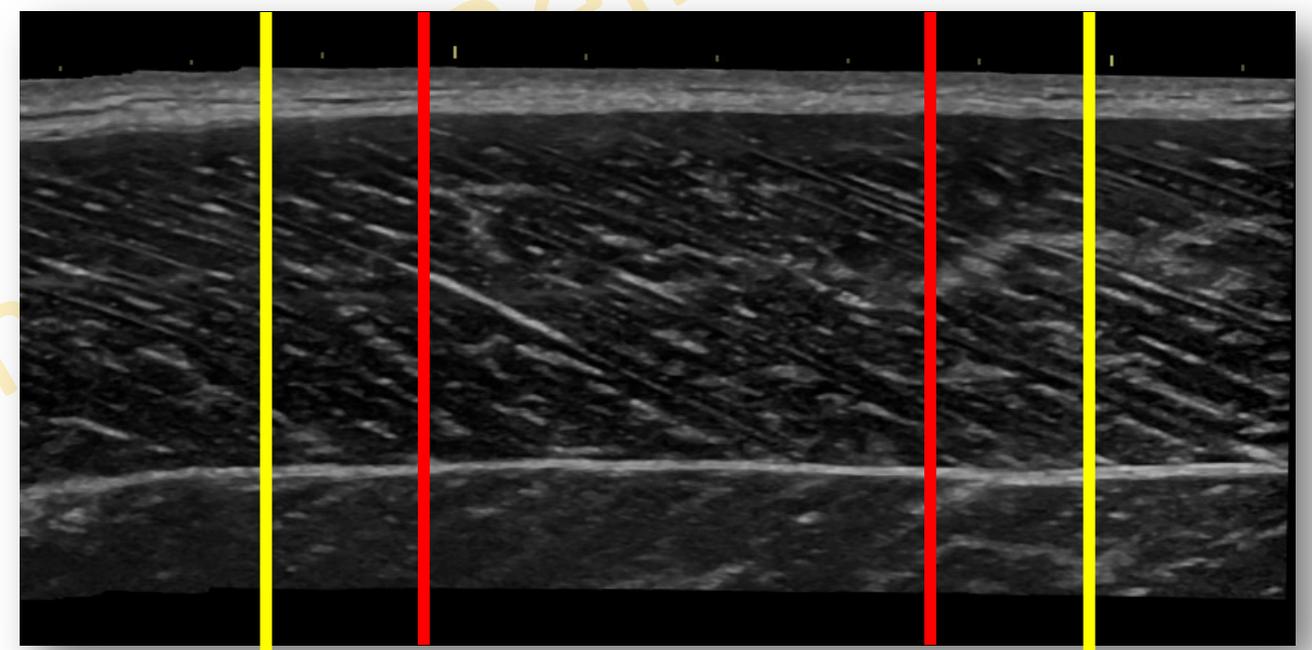


# ASPECTOS A TENER EN CUENTA: SONDAS

Campo de visión (footprint)



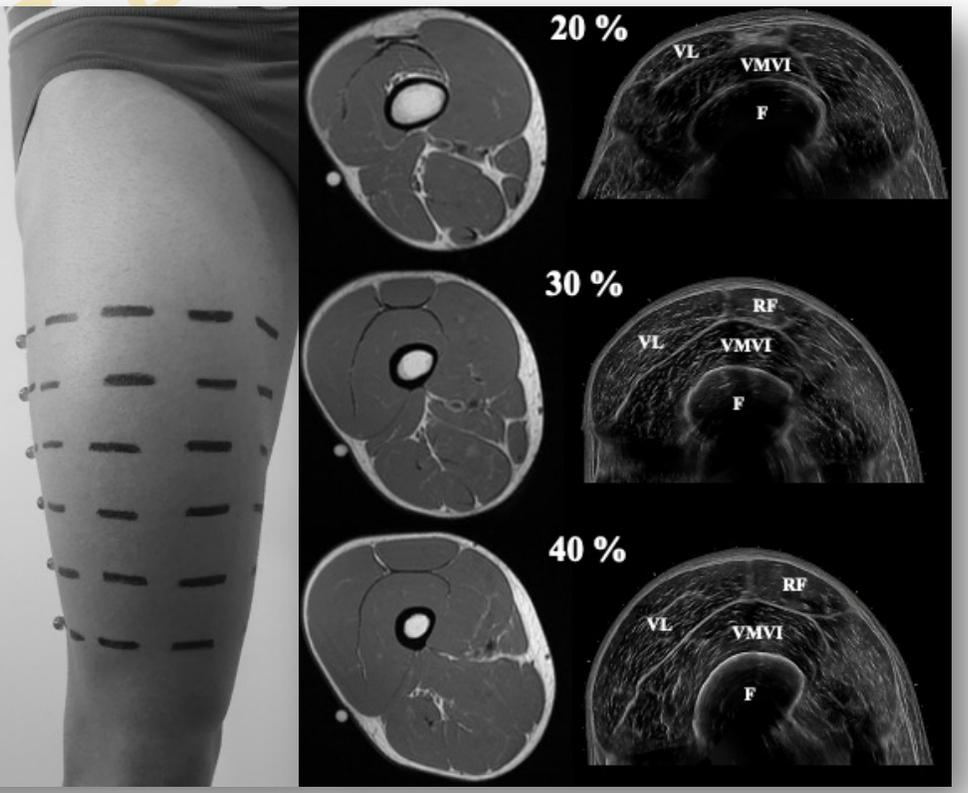
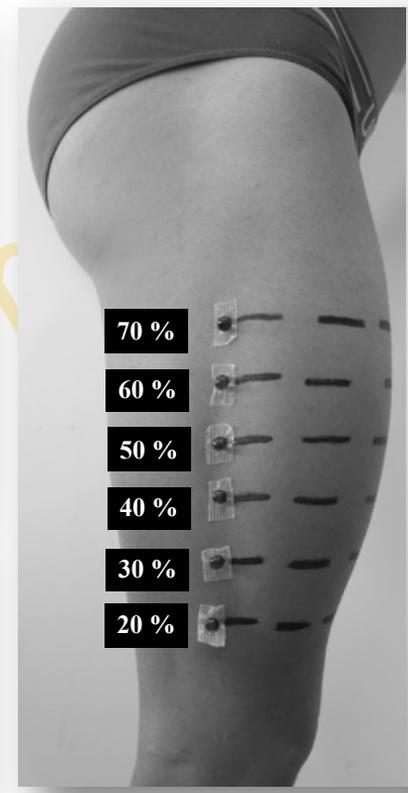
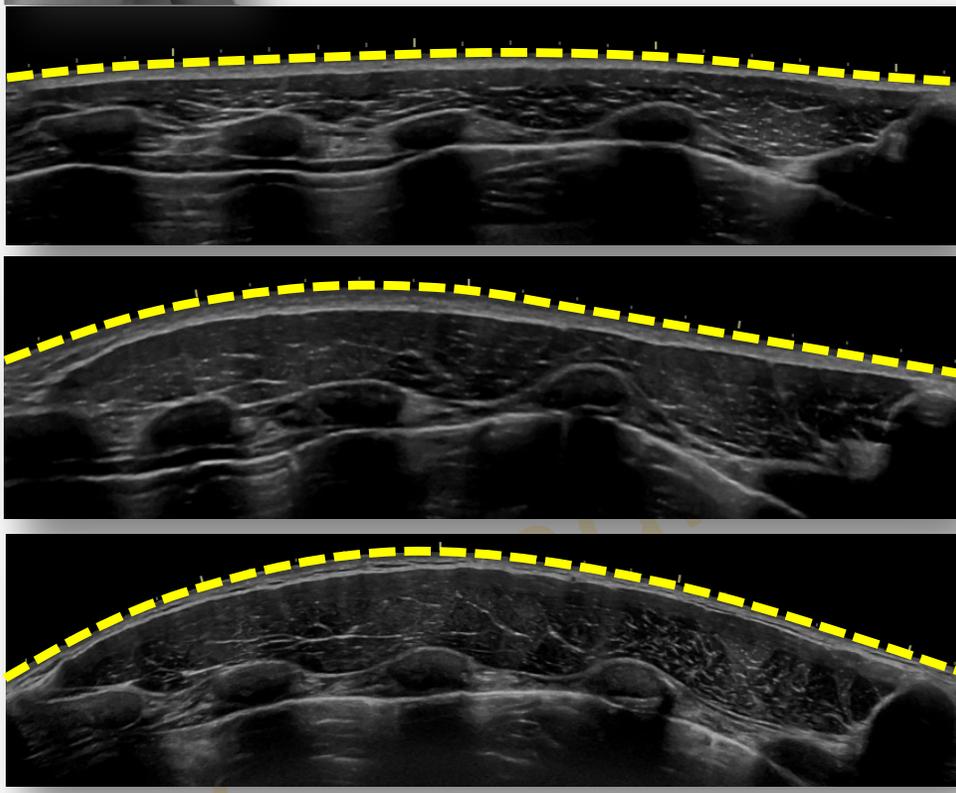
5.0 cm	4.5 cm
4.0 cm	3.8 cm



5.0 cm	3.8 cm
--------	--------

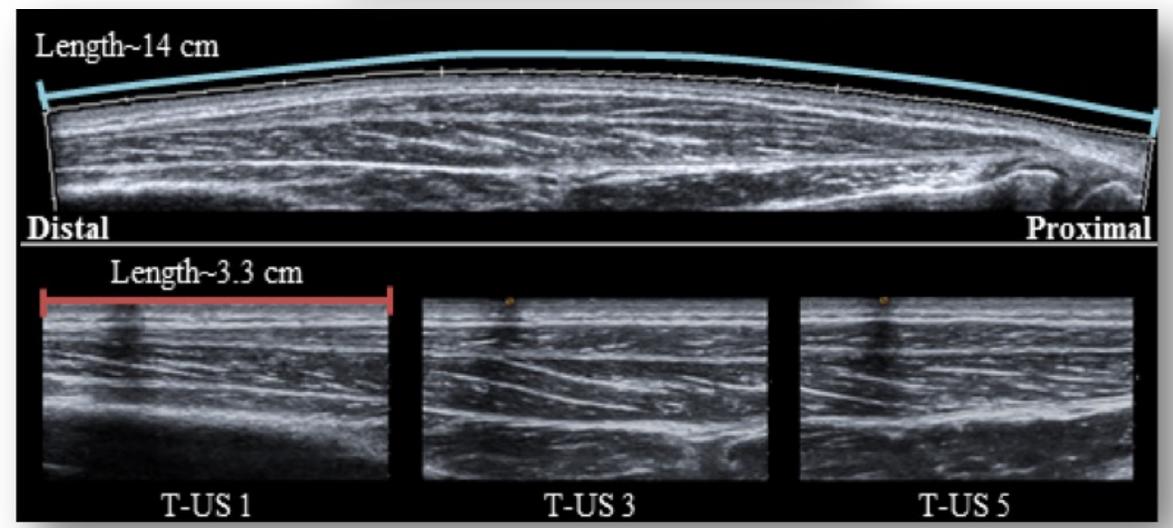
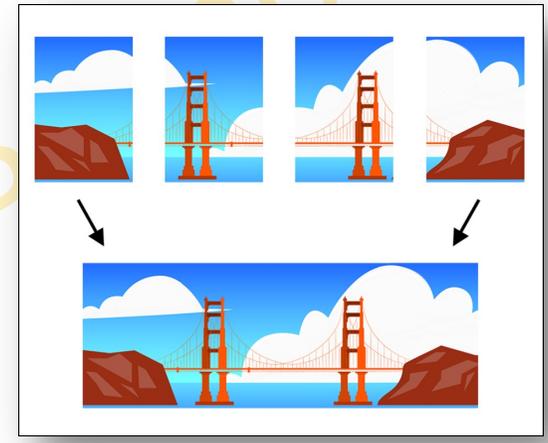
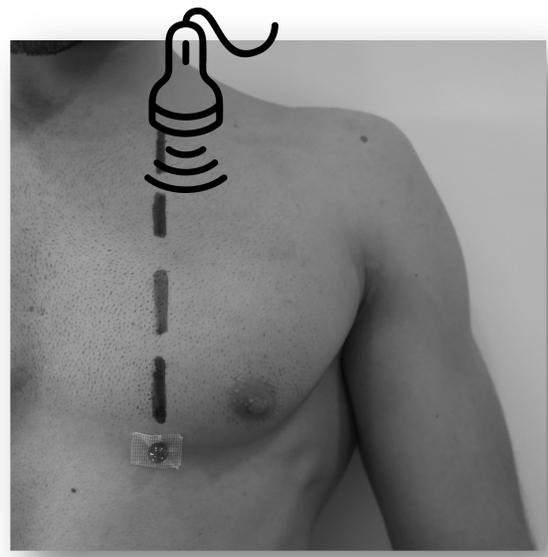
# ASPECTOS A TENER EN CUENTA: SONDAS

Campo de visión (footprint)



# ASPECTOS A TENER EN CUENTA: PANORÁMICA

*Extended field of view*



Alejandro

# ASPECTOS A TENER EN CUENTA: ADQUISICIÓN

**PLANO**

Sin desviaciones del plano principal



**VELOCIDAD**

Controlada y constante



**INCLINACIÓN**

Perpendicular a la superficie objetivo



**PRESIÓN**

Mínima presión necesaria



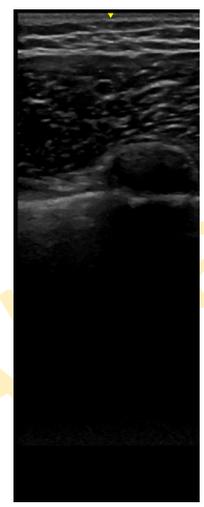
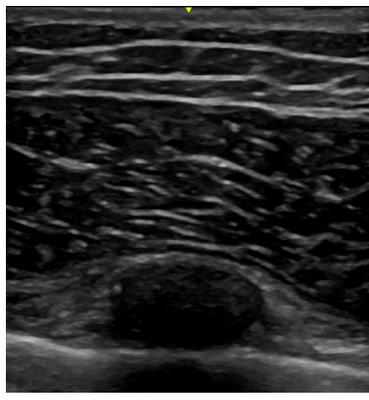
**REFERENCIAS ANATÓMICAS**

Inicio y final de la adquisición

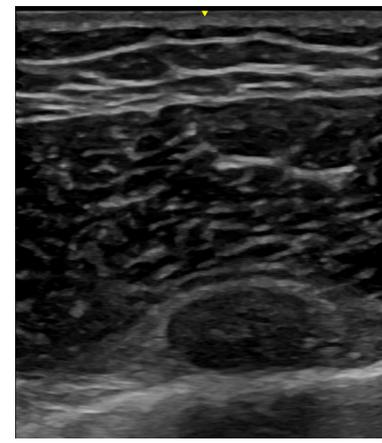
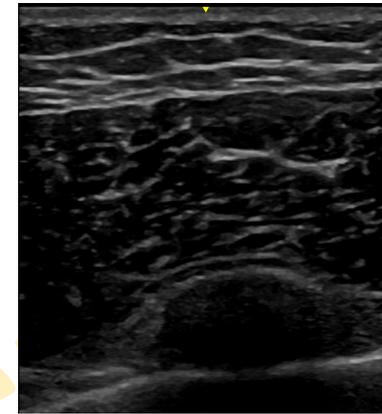


# ASPECTOS A TENER EN CUENTA: PARÁMETROS

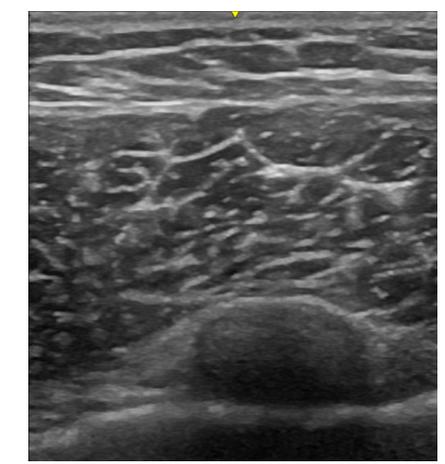
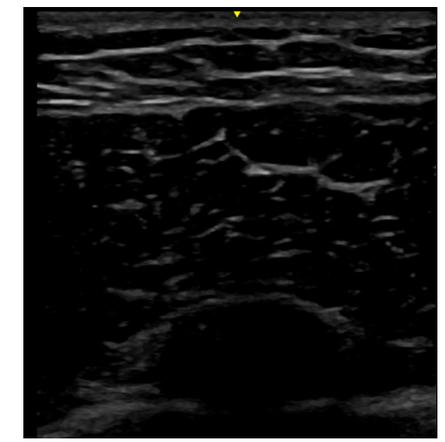
PROFUNDIDAD



FRECUENCIA



GANANCIA

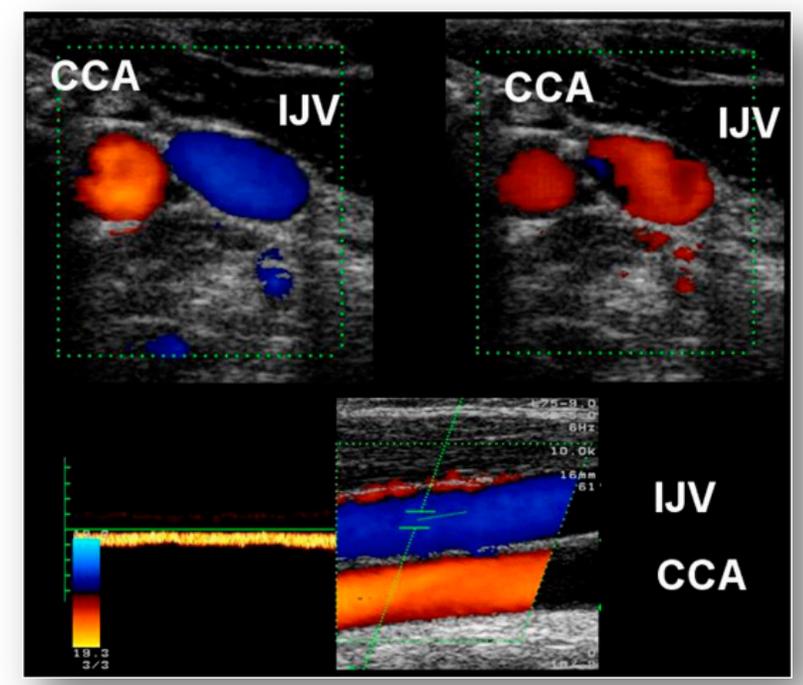
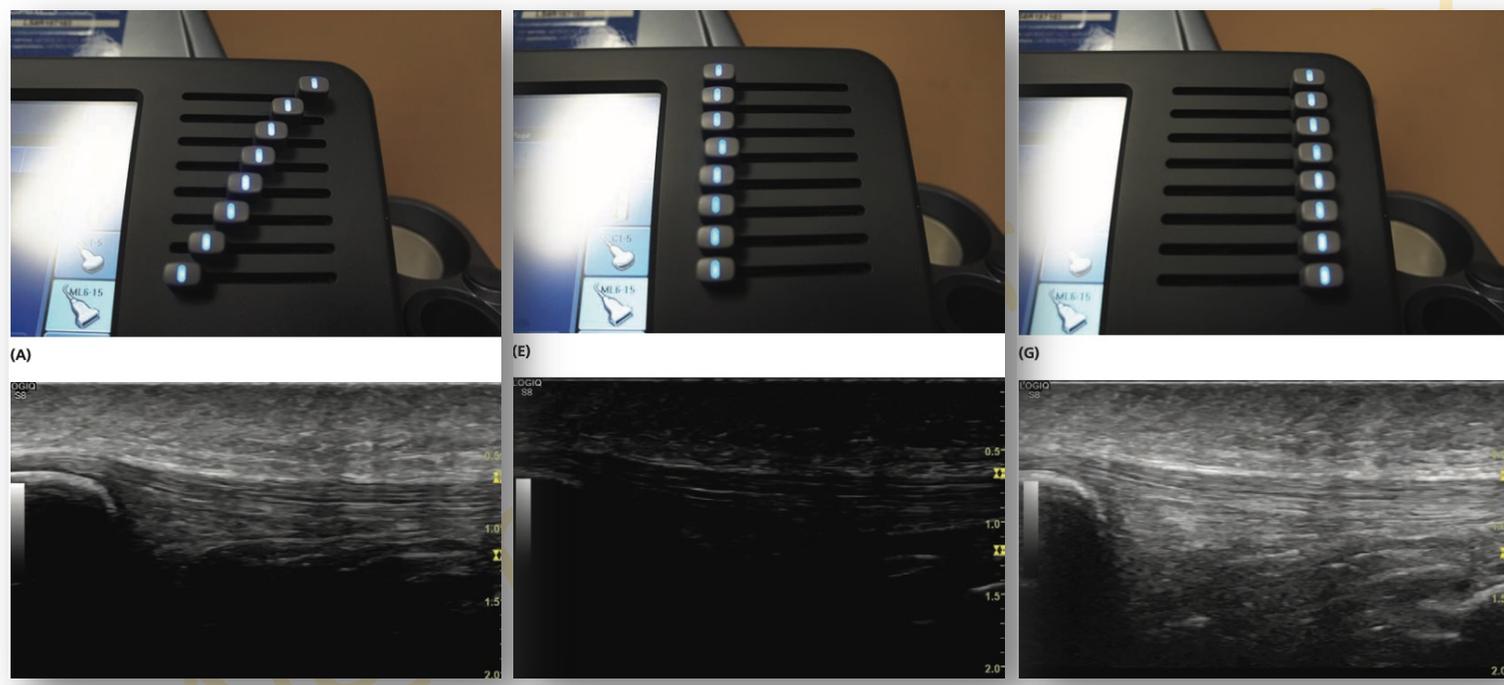


Andrés Belmonte

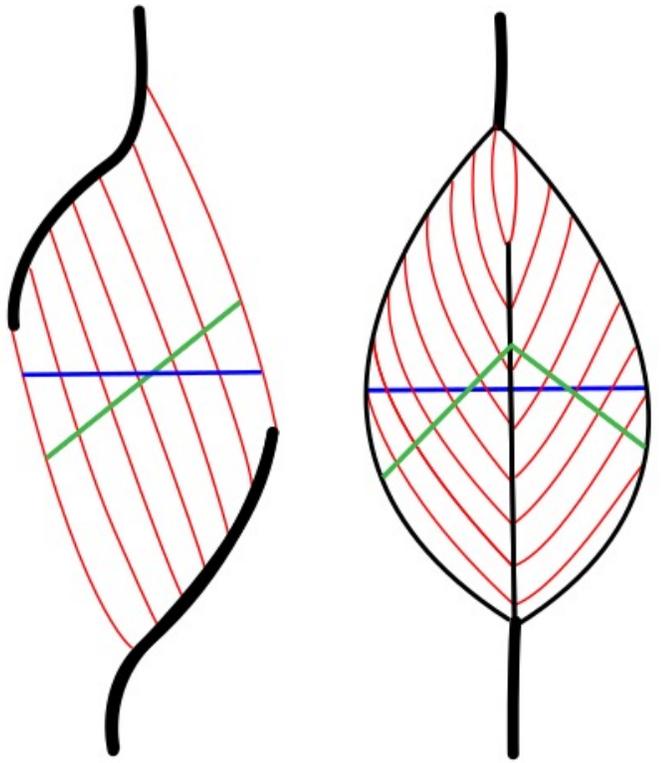
# ASPECTOS A TENER EN CUENTA: PARÁMETROS

COMPENSACIÓN DE GANANCIA

DOPPLER



# ASPECTOS A TENER EN CUENTA: ANÁLISIS CSA

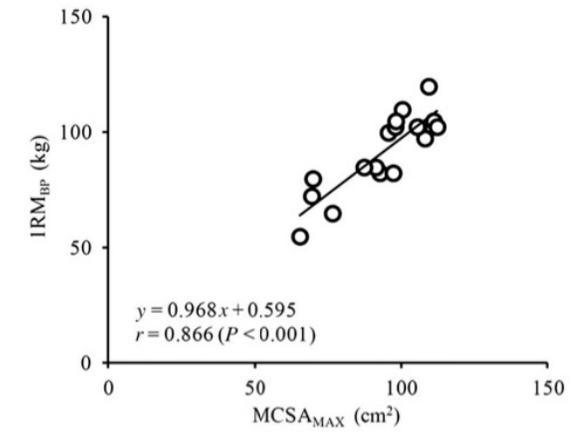


ACSA

PCSA

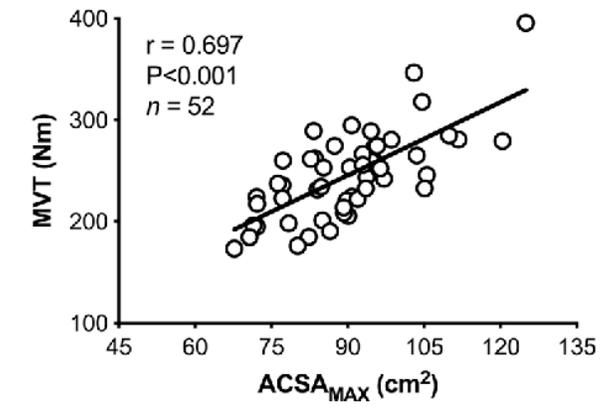
## Relationship of pectoralis major muscle size with bench press and bench throw performances

Ryota Akagi<sup>1</sup>, Yukihiro Tohdoh, Kuniaki Hirayama, Yuji Kobayashi



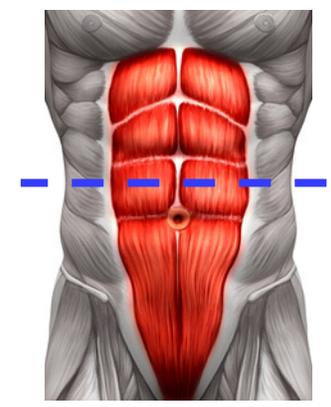
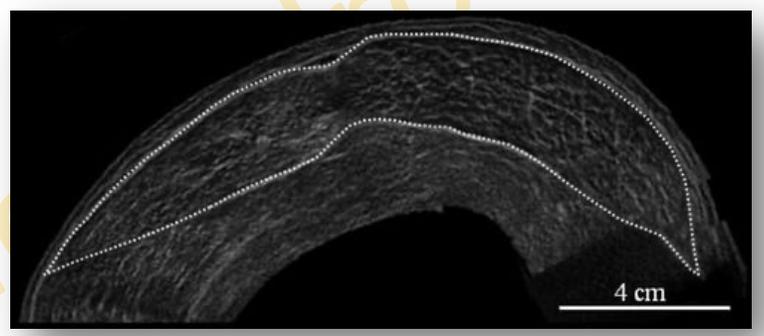
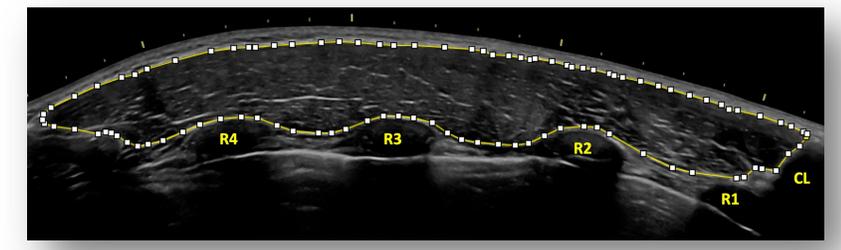
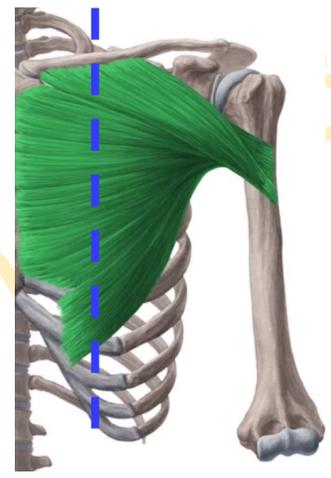
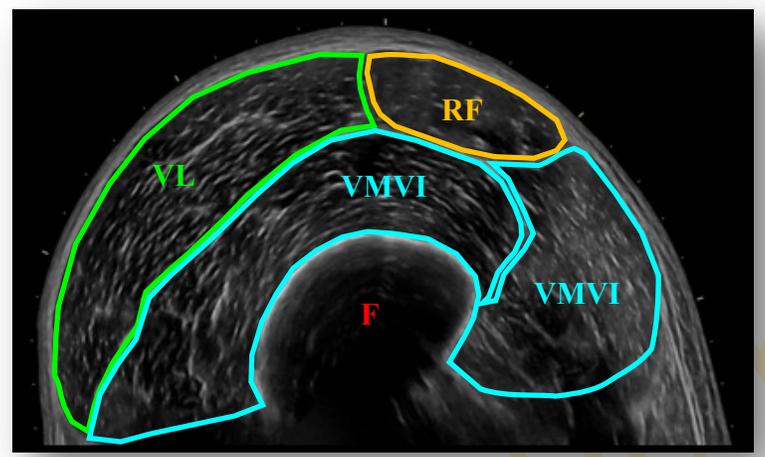
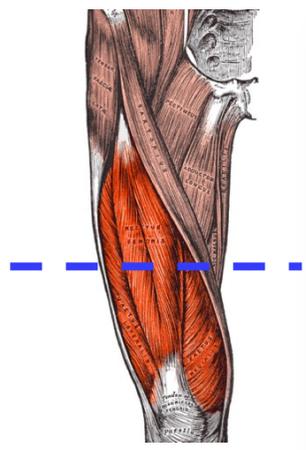
## The Human Muscle Size and Strength Relationship: Effects of Architecture, Muscle Force, and Measurement Location

Thomas G Balshaw, Thomas M Maden-Wilkinson, Garry J Massey, Jonathan P Folland

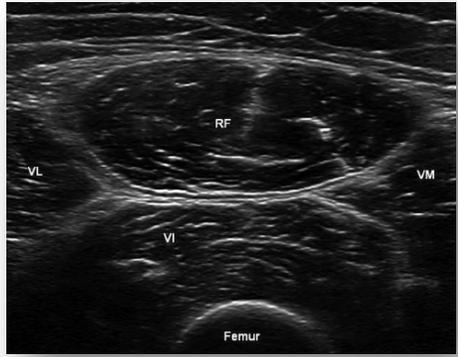


# ASPECTOS A TENER EN CUENTA: ANÁLISIS ACSA

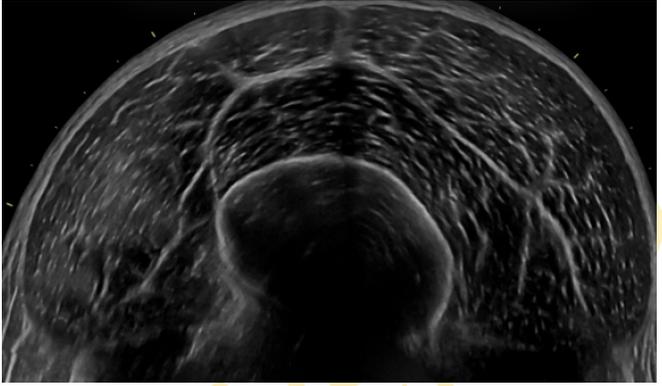
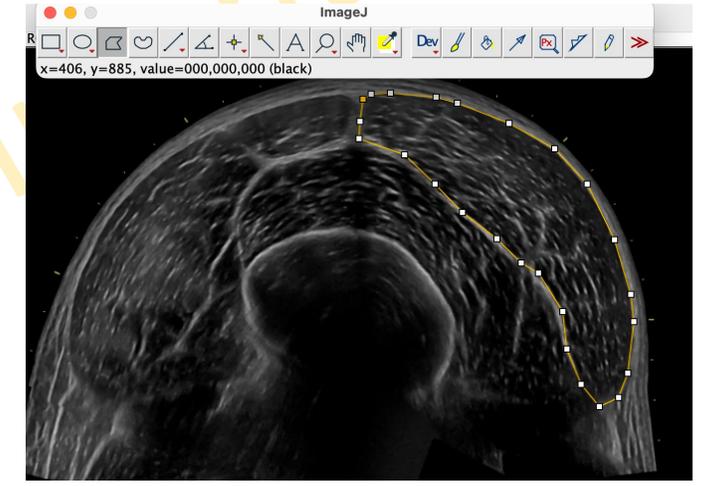
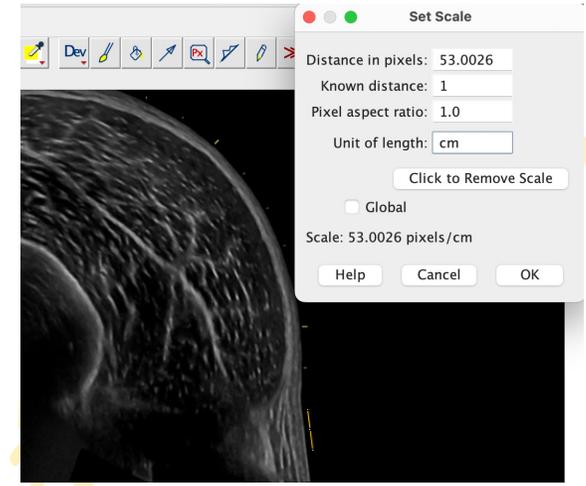
Corte perpendicular al eje (origen-inserción) del músculo



# ASPECTOS A TENER EN CUENTA: ANÁLISIS ACSA



Análisis manual

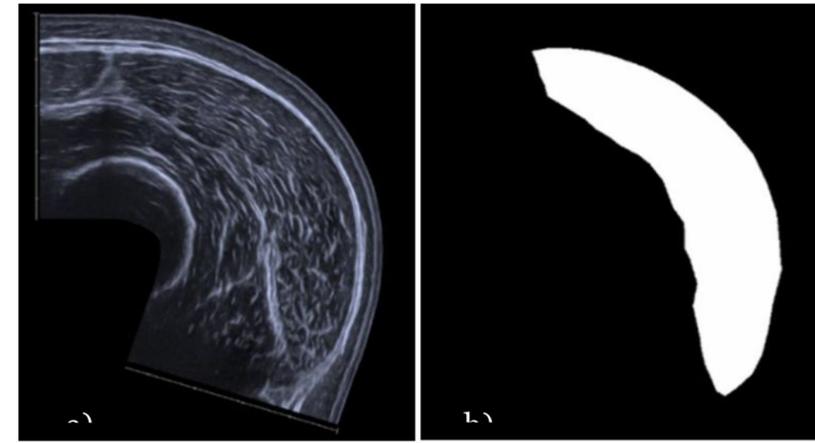


Análisis automático

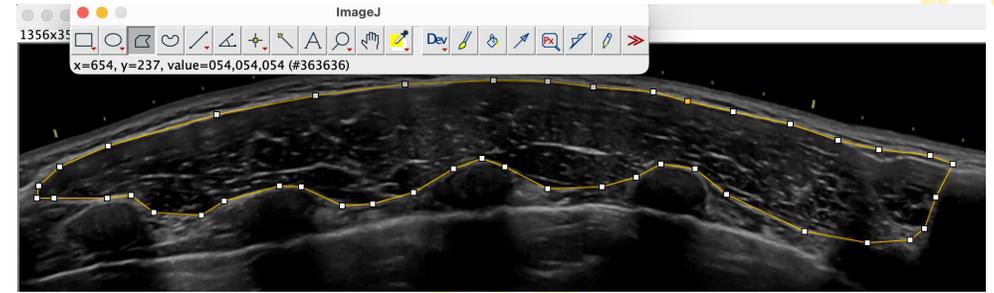
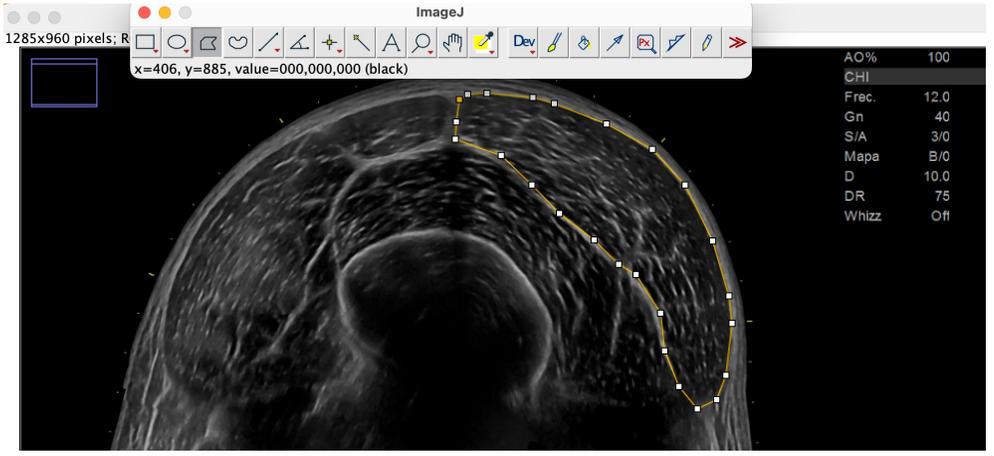


**DeepACSA: Automatic Segmentation of Cross-Sectional Area in Ultrasound Images of Lower Limb Muscles Using Deep Learning**

RITSCHÉ, PAUL; WIRTH, PHILIPP; CRONIN, NEIL J.; SARTO, FABIO; NARICI, MARCO V.; FAUDE, OLIVER; FRANCHI, MARTINO V.



# ASPECTOS A TENER EN CUENTA: ANÁLISIS ACSA



Results				
	Area	Mean	Min	Max
1	29.096	29.573	0	186

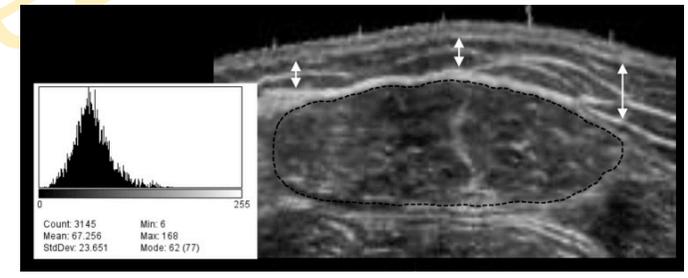
ACSA      ECOINTENSIDAD

## ECOINTENSIDAD

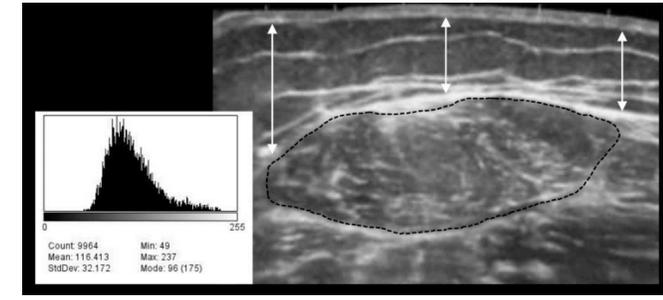
“Calidad” muscular

Echo intensity as an indicator of skeletal muscle quality: applications, methodology, and future directions

Matt S Stock <sup>1 2</sup>, Brennan J Thompson <sup>3 4</sup>



↓ ECO = ↓ Tejido no contráctil = ↑ Calidad muscular

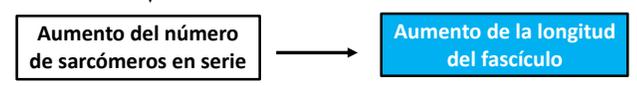
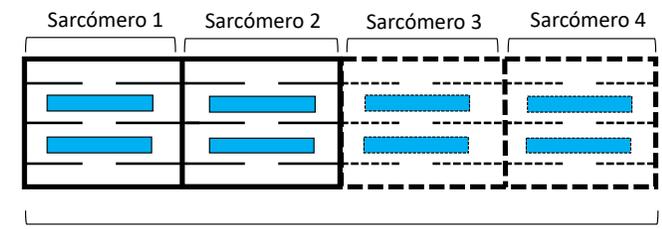
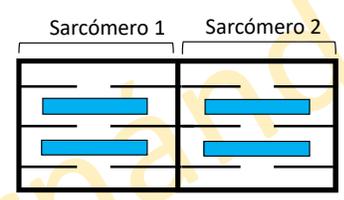
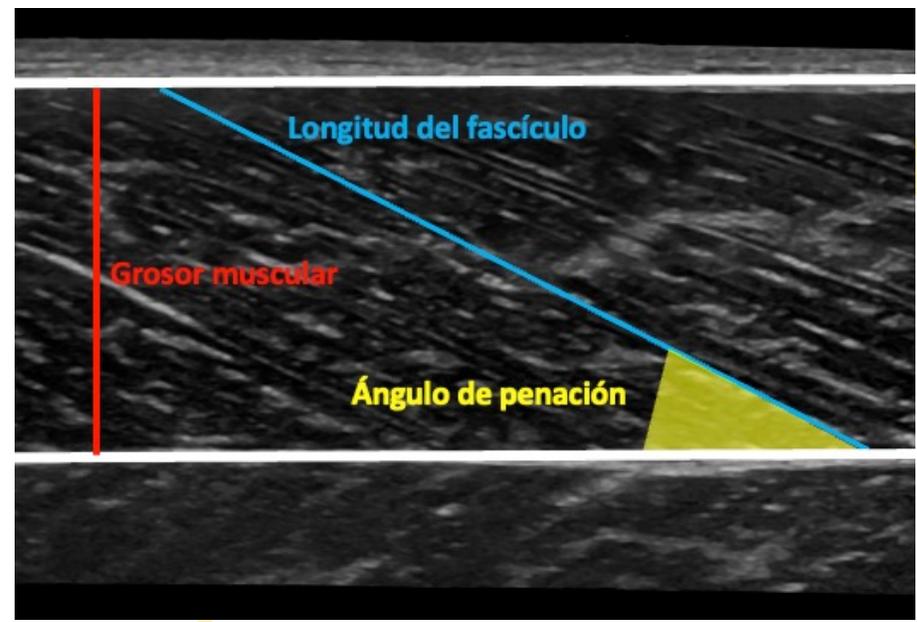
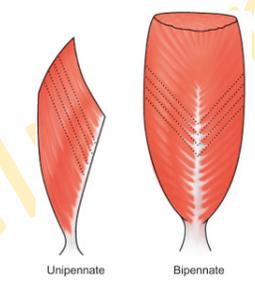


↑ ECO = ↑ Tejido no contráctil = ↓ Calidad muscular

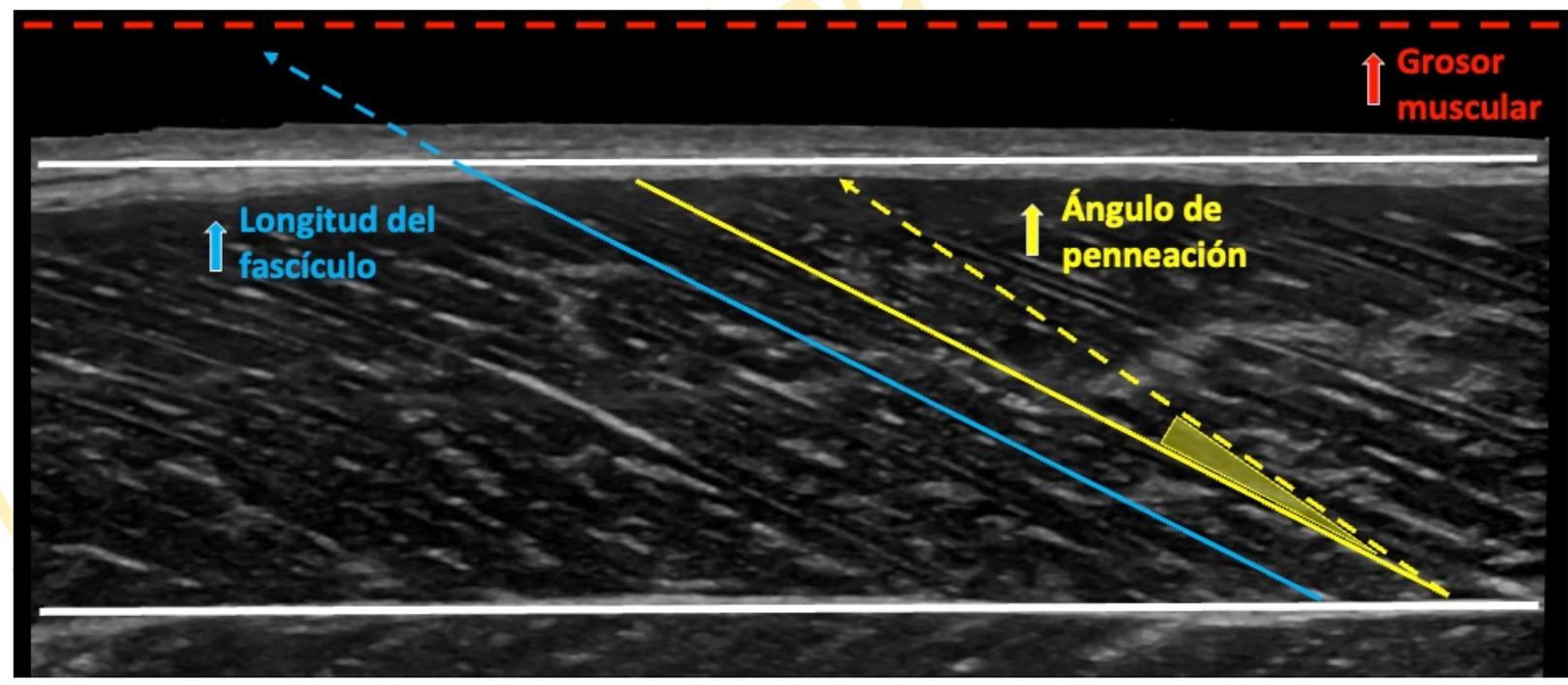
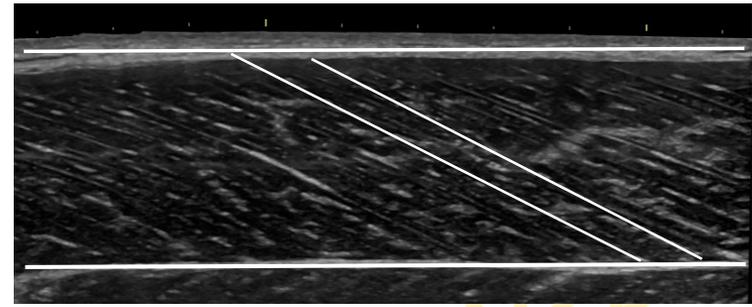
# ASPECTOS A TENER EN CUENTA: ANÁLISIS ARQUITECTURA

## Muscle architecture in relation to function

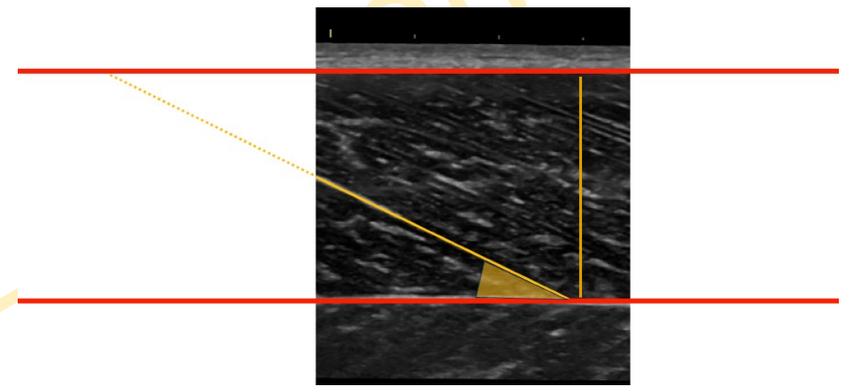
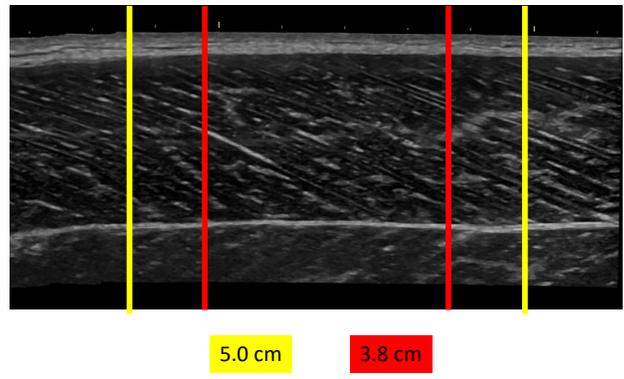
C Gans<sup>1</sup>, A S Gaunt



# ASPECTOS A TENER EN CUENTA: ANÁLISIS ARQUITECTURA



# ASPECTOS A TENER EN CUENTA: ANÁLISIS ARQUITECTURA

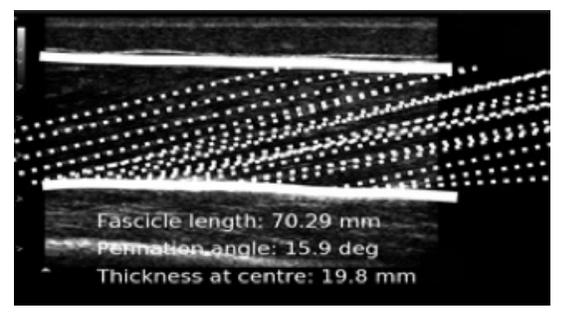
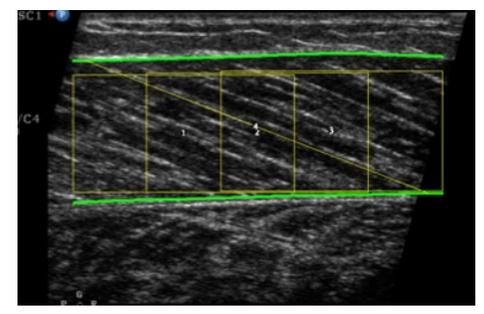
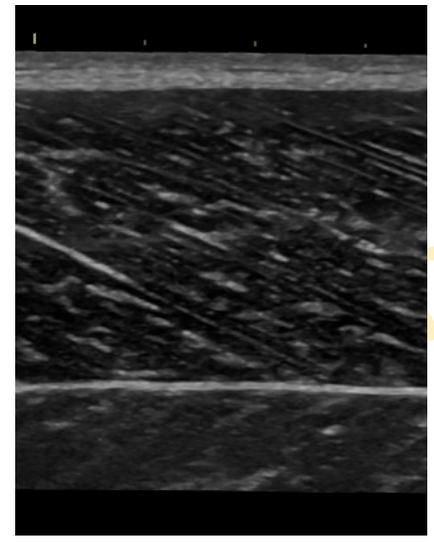


Análisis manual 

Extrapolación lineal

Simple Muscle Architecture Analysis 

 DL\_Track

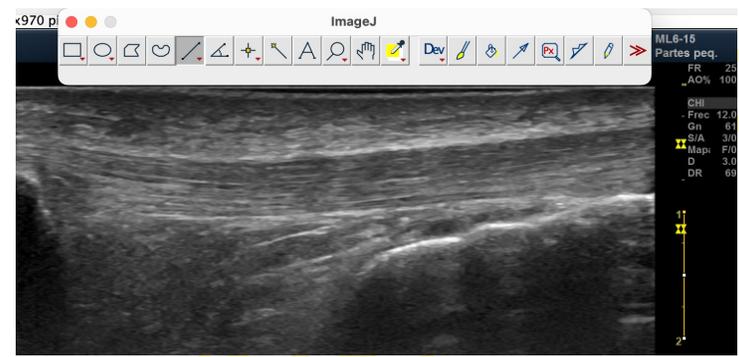
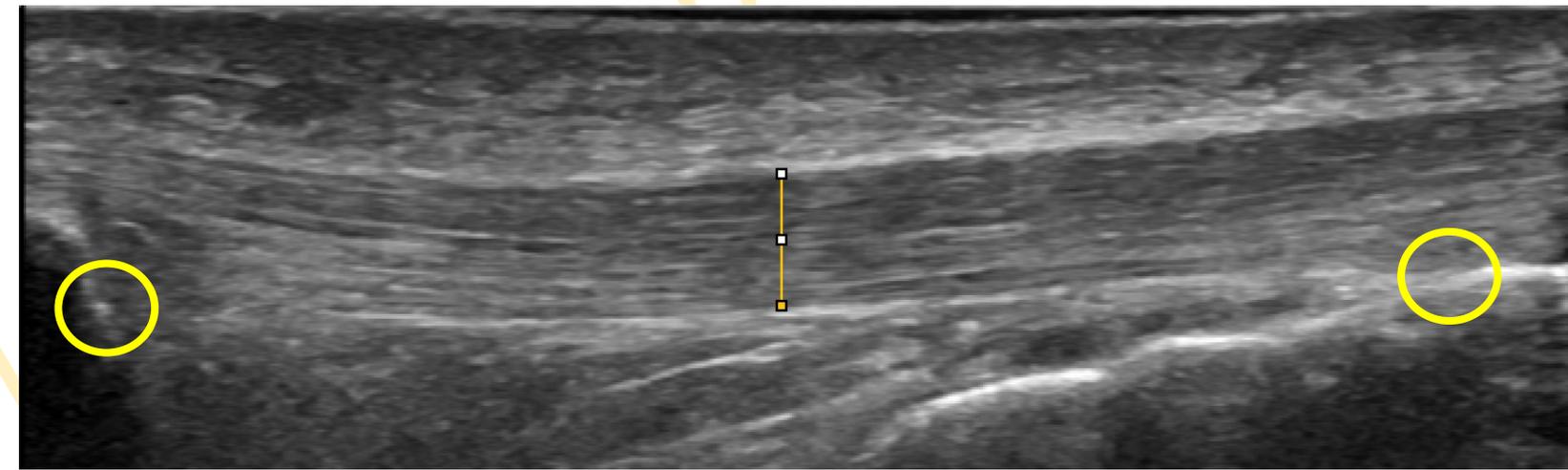


Análisis automático

> PLoS One. 2020 Feb 12;15(2):e0229034. doi: 10.1371/journal.pone.0229034. eCollection 2020.  
Simple Muscle Architecture Analysis (SMA): An ImageJ macro tool to automate measurements in B-mode ultrasound scans  
Olivier R Seynnes <sup>1</sup>, Neil J Cronin <sup>2</sup>

DL\_Track\_US: a python package to analyse muscle ultrasonography images  
Paul Ritsche <sup>1</sup>, Olivier Seynnes <sup>2</sup>, and Neil Cronin <sup>3,4</sup>

# ASPECTOS A TENER EN CUENTA: ANÁLISIS TENDÓN



							Results
	Area	Mean	Min	Max	Angle	Length	
1	0.002	82.712	47	117.418	-88.958	0.423	

# ASPECTOS A TENER EN CUENTA: ANÁLISIS

ÁREA DE SECCIÓN TRANSVERSAL (ACSA)

Media de los resultados obtenidos en 2 adquisiciones analizadas 1 vez.

ECOINTENSIDAD

Media de los resultados obtenidos en 2 adquisiciones analizadas 1 vez.

**CUIDADO CON GANANCIA DE LA IMAGEN**

ARQUITECTURA MUSCULAR

Media de los resultados obtenidos en 2 fascículos de la misma adquisición.

Análisis de una 3<sup>a</sup> adquisición si  $CV \geq 5.0\%$

Análisis de un 3<sup>er</sup> fascículo si  $CV \geq 5.0\%$