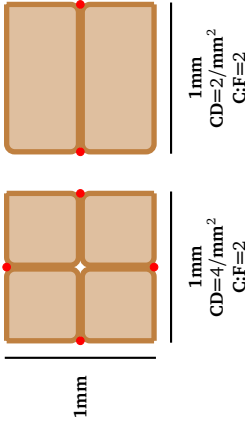
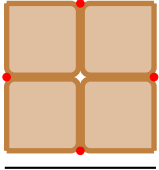
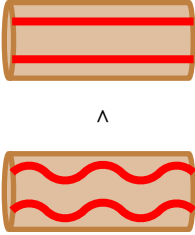
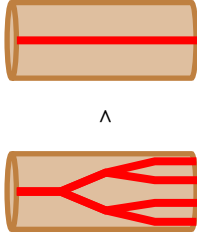
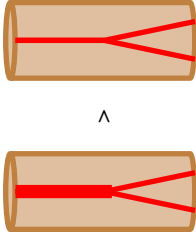
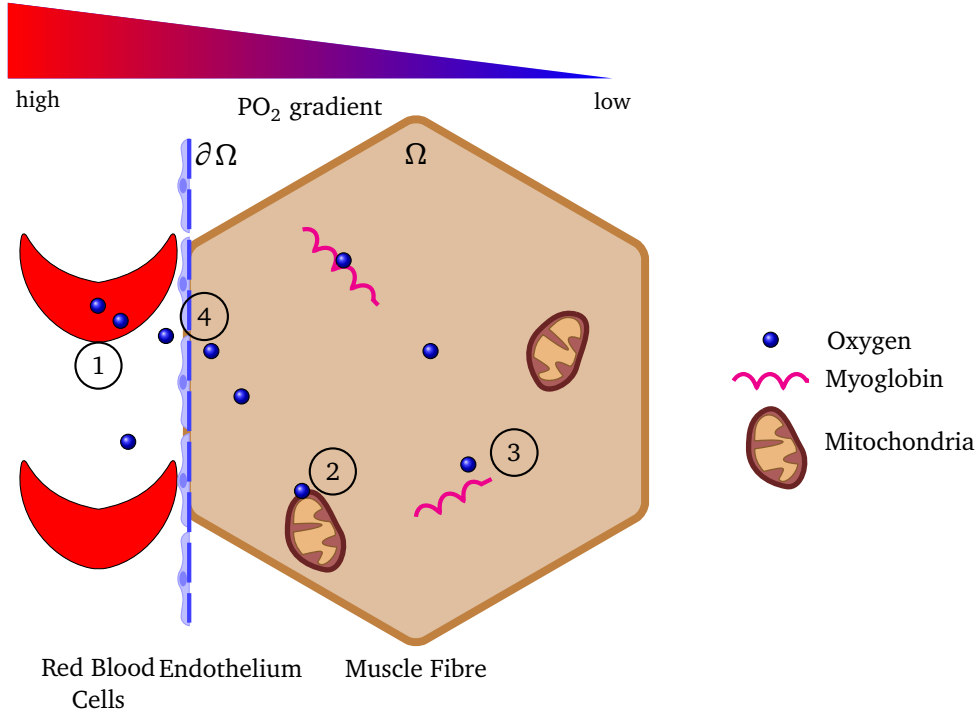


Parameter	Definition	Example	Advantages	Disadvantages	Reference
Capillary density (CD)	# capillaries per muscle area	 <p>1mm</p> <p>1mm CD=4/mm² C:F=2</p> <p>1mm CD=2/mm² C:F=2</p>	<ul style="list-style-type: none"> • Easy to compute • Easy to automate 	<ul style="list-style-type: none"> • Dependent on fibre size and type • 2D measure 	<ul style="list-style-type: none"> • $476 \pm 12 / \text{mm}^2$ rat soleus [22]
Capillary to fibre ratio (C:F)	# capillaries per muscle fibre	 <p>1mm</p> <p>1mm CD=4/mm² C:F=2</p>	<ul style="list-style-type: none"> • Gives information on metabolic activity • Independent of fibre size • Dependent of fibre type • Easy to compute • Easy to automate 	<ul style="list-style-type: none"> • 2D measure 	<ul style="list-style-type: none"> • 2.30 ± 0.03 mouse soleus [21] • 2.17 ± 0.06 mouse soleus [23] • 1.83 ± 0.04 mouse soleus [24]
Tortuosity	$\frac{\text{Vessel segment length}}{\text{Euclidian distance}}$	 <p>></p>	<ul style="list-style-type: none"> • Easy to automate 	<ul style="list-style-type: none"> • Not related to oxygen demand but sarcomere length • Different definitions available • Connected vessel network required 	<ul style="list-style-type: none"> • 1.86 ± 0.06 in healthy rat soleus vs. 1.19 ± 0.10 in diabetic rat [25]
Length density	$\frac{\text{Vessel segment length}}{\text{Tissue volume}}$	 <p>></p>	<ul style="list-style-type: none"> • Indication for available oxygen exchange length 	<ul style="list-style-type: none"> • No information on exchange volume • May differ to original stereological definition • Depends on tortuosity 	<ul style="list-style-type: none"> • $1.88 \pm 0.07 \cdot 10^3 \text{mm}^2$ mouse soleus [23] • $12.06 \pm 0.90 \cdot 10^3 \text{mm}$ mouse soleus total capillary length [24]
Volume fraction	$\frac{\text{Vessel volume}}{\text{Tissue volume}}$	 <p>></p>	<ul style="list-style-type: none"> • Indication for available oxygen exchange volume 	<ul style="list-style-type: none"> • No information on exchange length • Computationally difficult 	<ul style="list-style-type: none"> • 0.07 ± 0.01 in healthy rat soleus vs. 0.03 ± 0.01 in diabetic rat [25]



Governing Equation of Conservation

$$\frac{\partial \alpha P}{\partial t} = \nabla \cdot [\alpha D \nabla P] + D_{Mb} C_{Mb} \nabla \cdot \left(\frac{dS_{Mb}}{dP} \nabla P \right) - M(P) \quad \text{in } \Omega$$

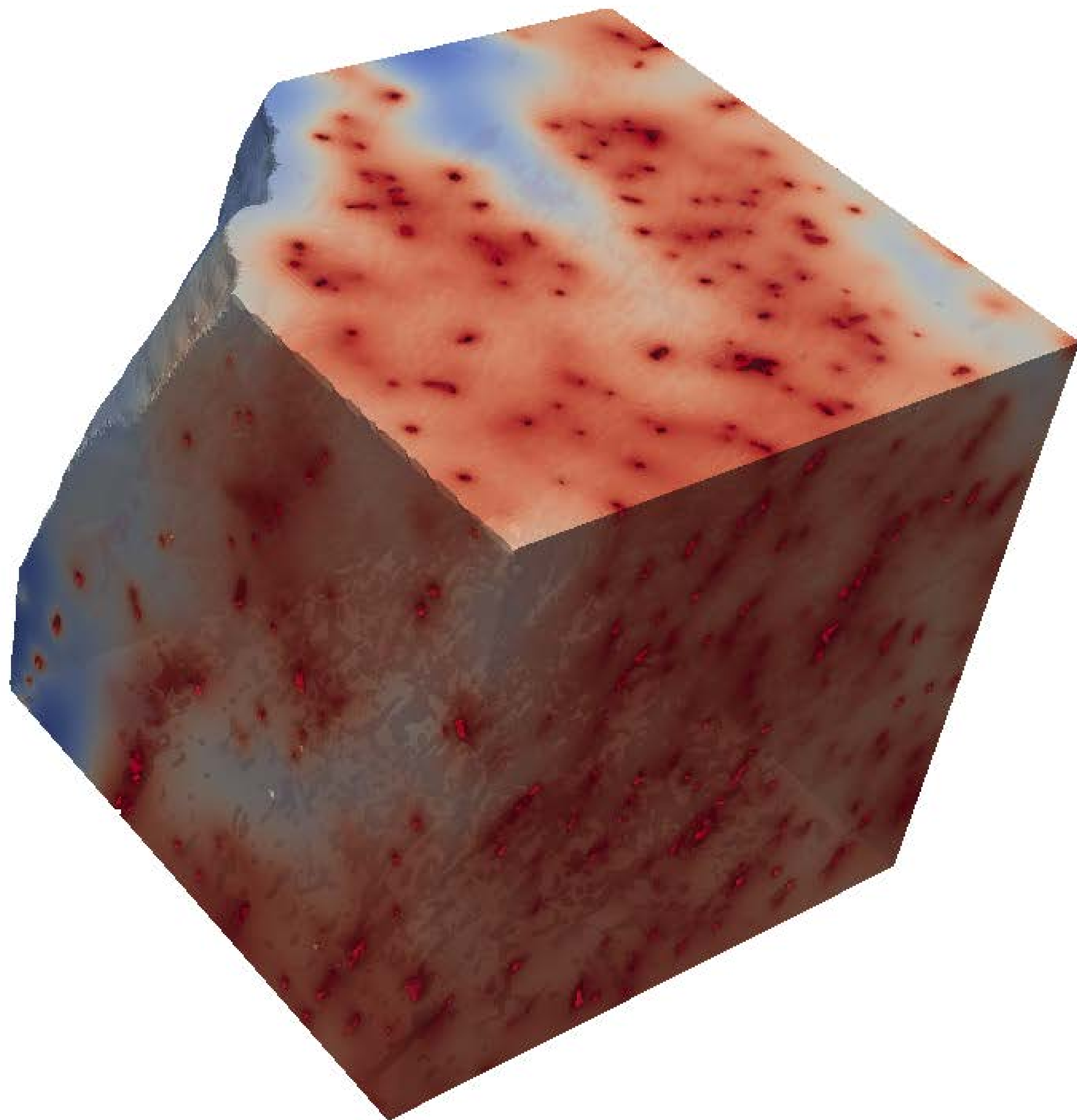
$$(1) \quad SO_2(P) = \frac{P^n}{P^n + P_{Hb,50}^n} \quad \text{in } \Omega$$

$$(2) \quad M(P) = \frac{M_0 P}{P + P_{50}} \quad \text{in } \Omega$$

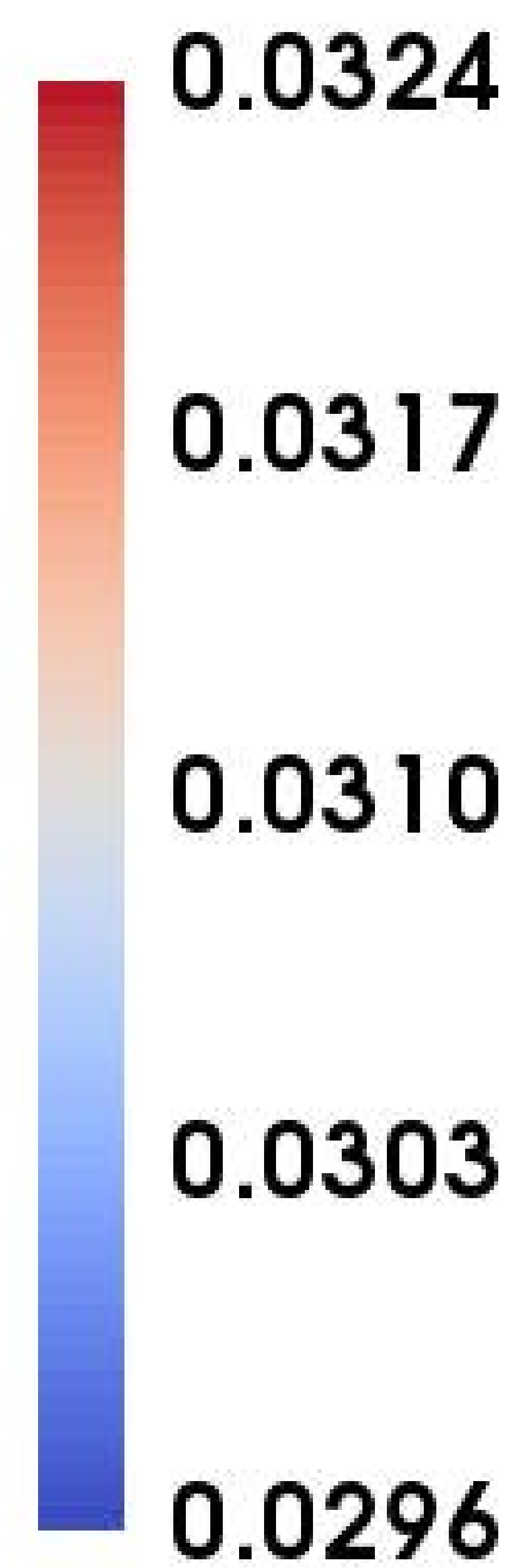
$$(3) \quad S_{Mb}(P) = \frac{P}{P + P_{Mb,50}} \quad \text{in } \Omega$$

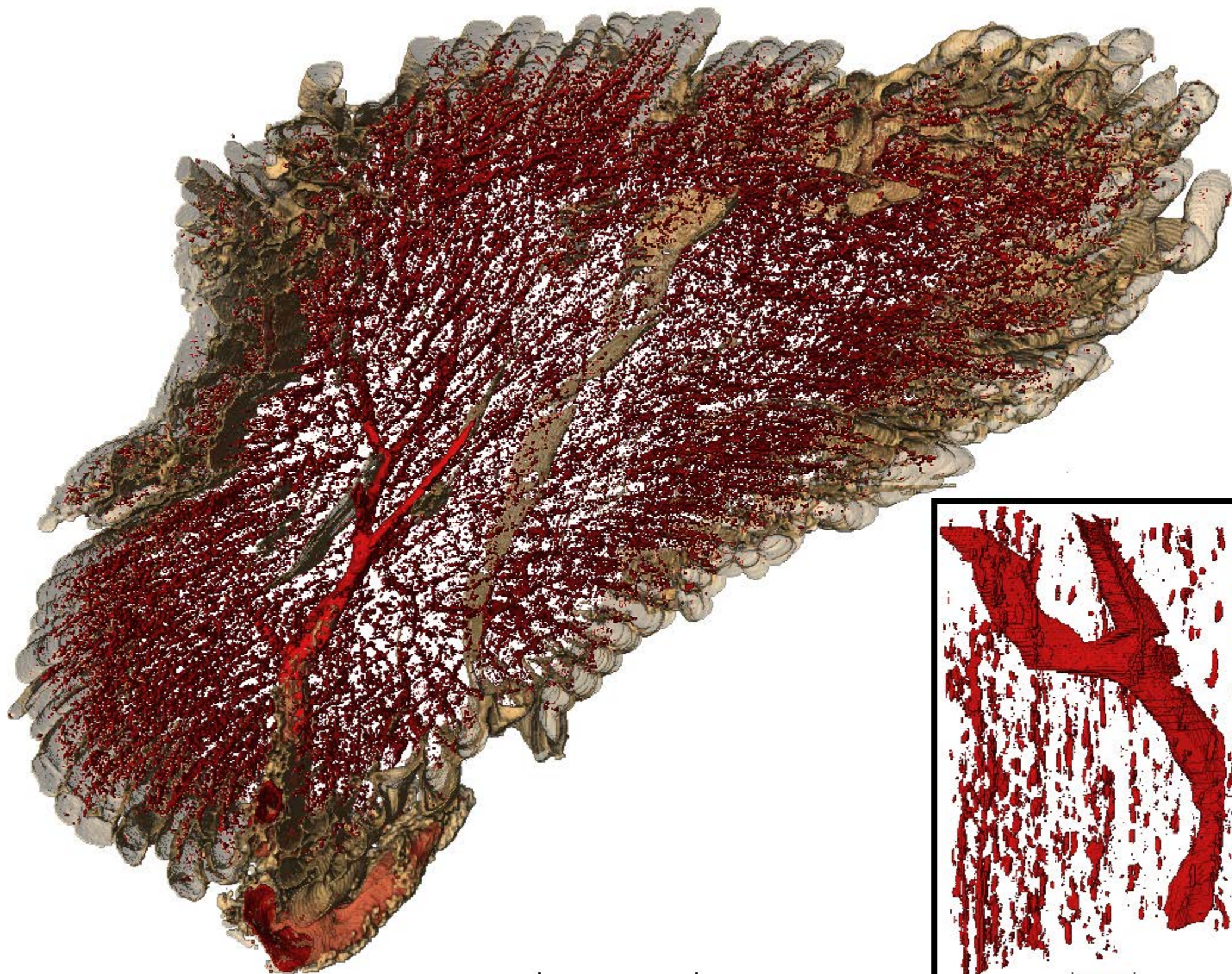
$$(4) \quad -n_v \cdot (D \alpha \nabla P) = k \alpha (P_0 - P) \quad \text{on } \partial \Omega$$

Technique	Excitation Signal	Maximum Spatial Resolution	2D/3D	Penetration Depth	Tissue Preparation	Acquisition Time	<i>in vivo</i> / <i>ex vivo</i>
Light Microscopy (LM)	Light	0.2 μm	2D	-	staining	seconds	<i>ex vivo</i>
Confocal Laser Scanning Microscopy (CLSM)	Light Laser	0.1 μm	2D	150 μm	fluorescent staining	minutes	<i>ex vivo</i>
Lightsheet Fluorescence Microscopy (LSFM)	Light Laser	0.2 μm	2D	1 cm	fluorescent staining	hours	<i>ex vivo</i>
Single Photon Laser Scanning Microscopy (SPLSM)	Light Laser	0.2 μm	2D	-	fluorescent staining	minutes	<i>in vivo</i>
Multi Photon Laser Scanning Microscopy (MPLSM)	Light Laser	0.2 μm	2D	1 mm	fluorescent staining	minutes	<i>in vivo</i>
Optical Coherence Tomography (OCT)	Light Laser	5 μm	3D	2 mm	-	minutes	<i>in vivo</i>
Laser Speckle Contrast Imaging (LS)	Light Laser	10 μm	2D	1 mm	-	minutes	<i>in vivo</i>
Laser Doppler Flowmetry (LDF)	Light Laser	10 μm	2D	1 mm	-	minutes	<i>in vivo</i>
Serial Blockface Scanning Electron Microscopy (SBF SEM)	Electron Beam	2 nm	3D	500 μm	heavy metal staining	hours	<i>ex vivo</i>
Transmission Electron Microscopy (TEM)	Electron Beam	0.2 nm	2D	100 nm	heavy metal staining	minutes	<i>ex vivo</i>
Micro-Computed Tomography (μCT)	X-rays	0.7 μm	3D	1 m	staining or perfusion	hours	<i>ex vivo</i>
Synchrotron Radiation based Computed Tomography (SR CT)	X-rays	0.3 μm	3D	1 m	staining or perfusion	minutes	<i>ex vivo</i>
Micro-focused Magnetic Resonance Imaging (μMRI)	Magnetic Pulse	60 μm	3D	1 m	contrast agent perfusion	hours	<i>in vivo</i>
Positron Emission Tomography (PET/SPECT)	Positrons	1-2 mm	3D	1 m	contrast agent perfusion	hours	<i>in vivo</i>
Photoacoustic Tomography (PAT)	Acoustic Waves	50 μm	3D	1 mm		hours	<i>in vivo</i>



Oxygen concentration C (mol/m³)

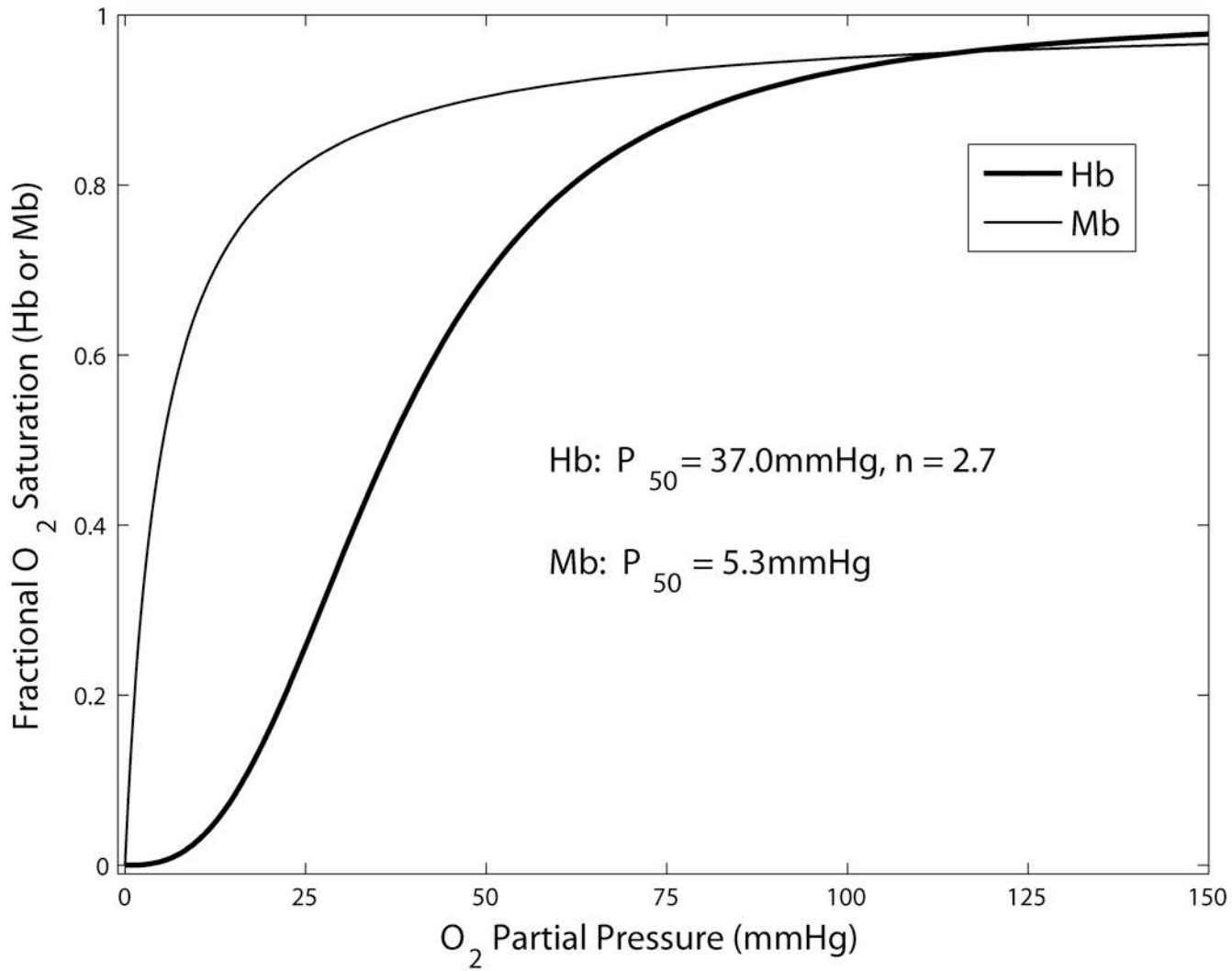


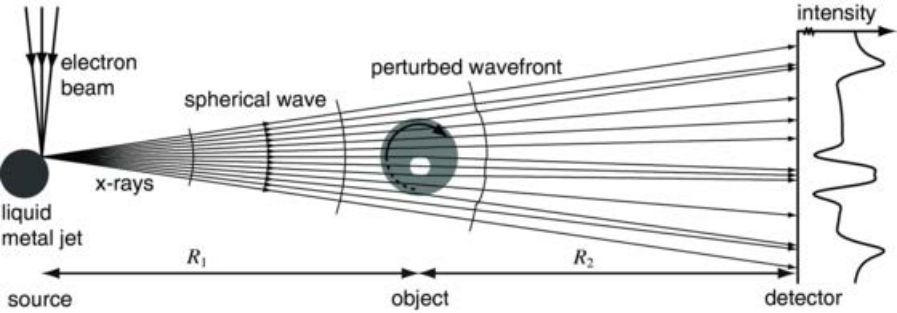


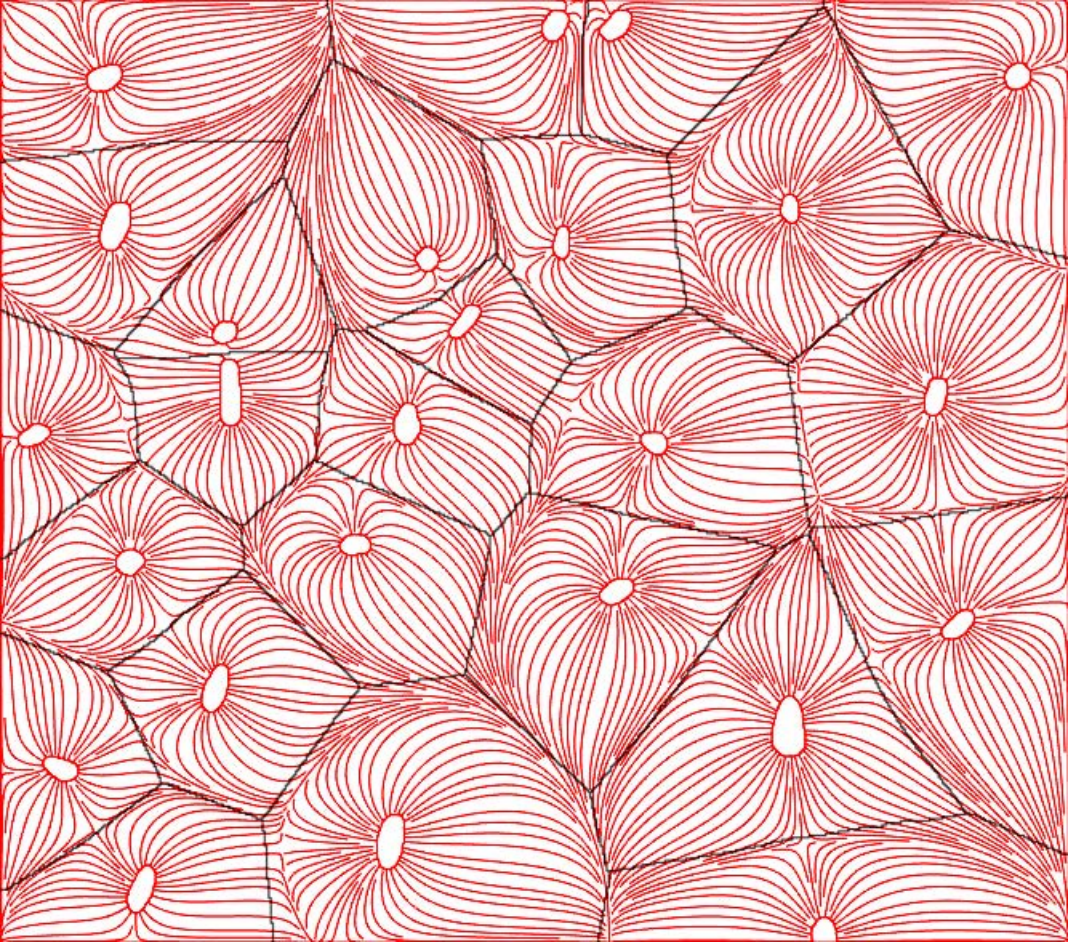
0.2 mm

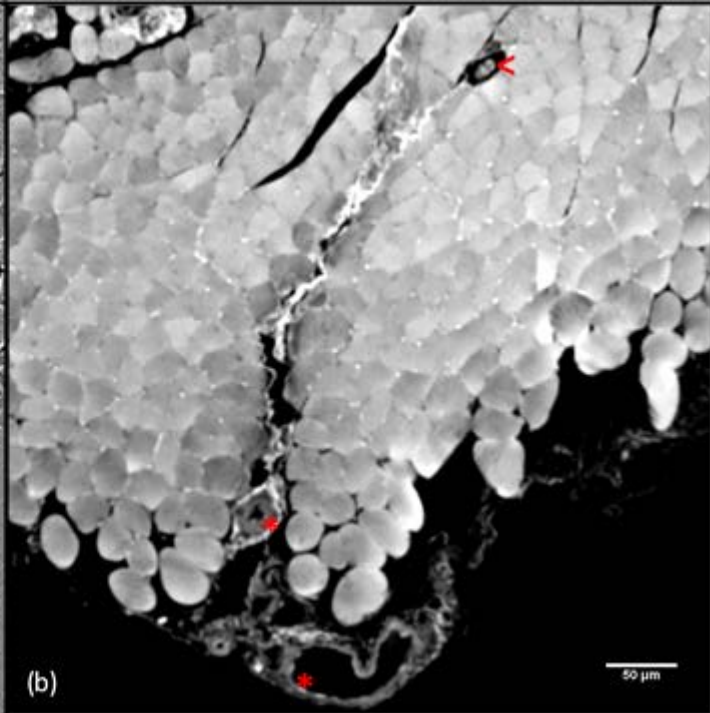
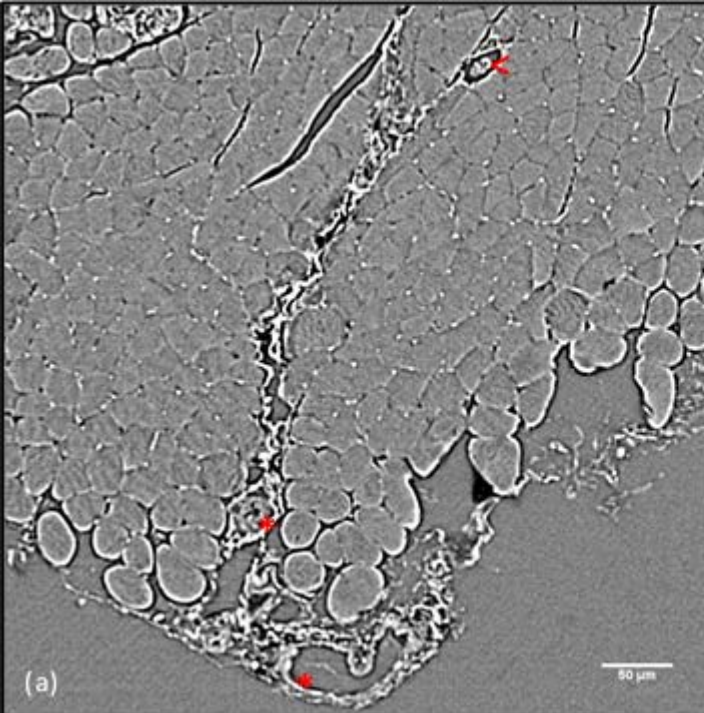


0.025 mm



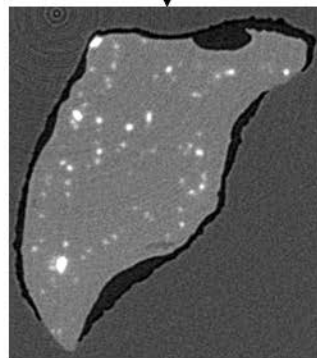








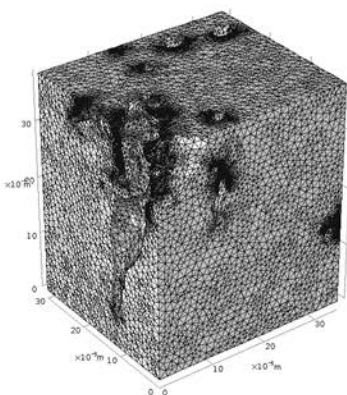
Imaging



Segmentation

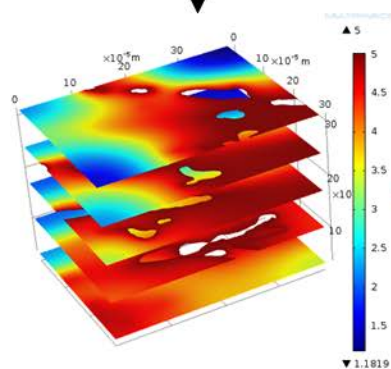


Meshing



3D Morphology

Modelling



Structure-Function Association

