

# “RESIDUAL STRAINS IN CONDUIT ARTERIES”

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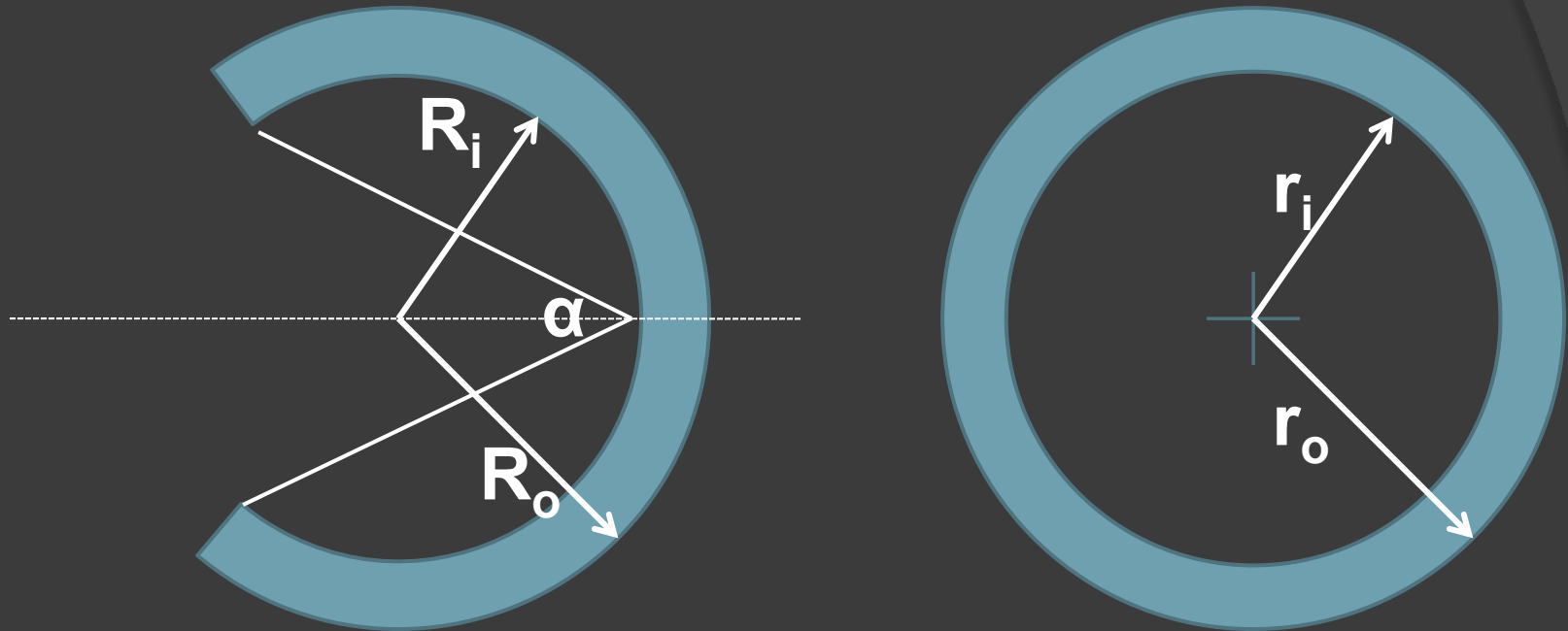
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*Eunice Yi*

# Definitions

- ⦿ **Residual strain** : strain that exists in a solid when all external loads are removed
- ⦿ **Opening Angle (OA)** : used to measure circumferential residual strain; angle formed by intersection of lines from the ends of the open inner arc at the midpoint of the inner arc
- ⦿ **Stretch ratio ( $\lambda$ )** : ratio of change in length

# Measurement of residual strain

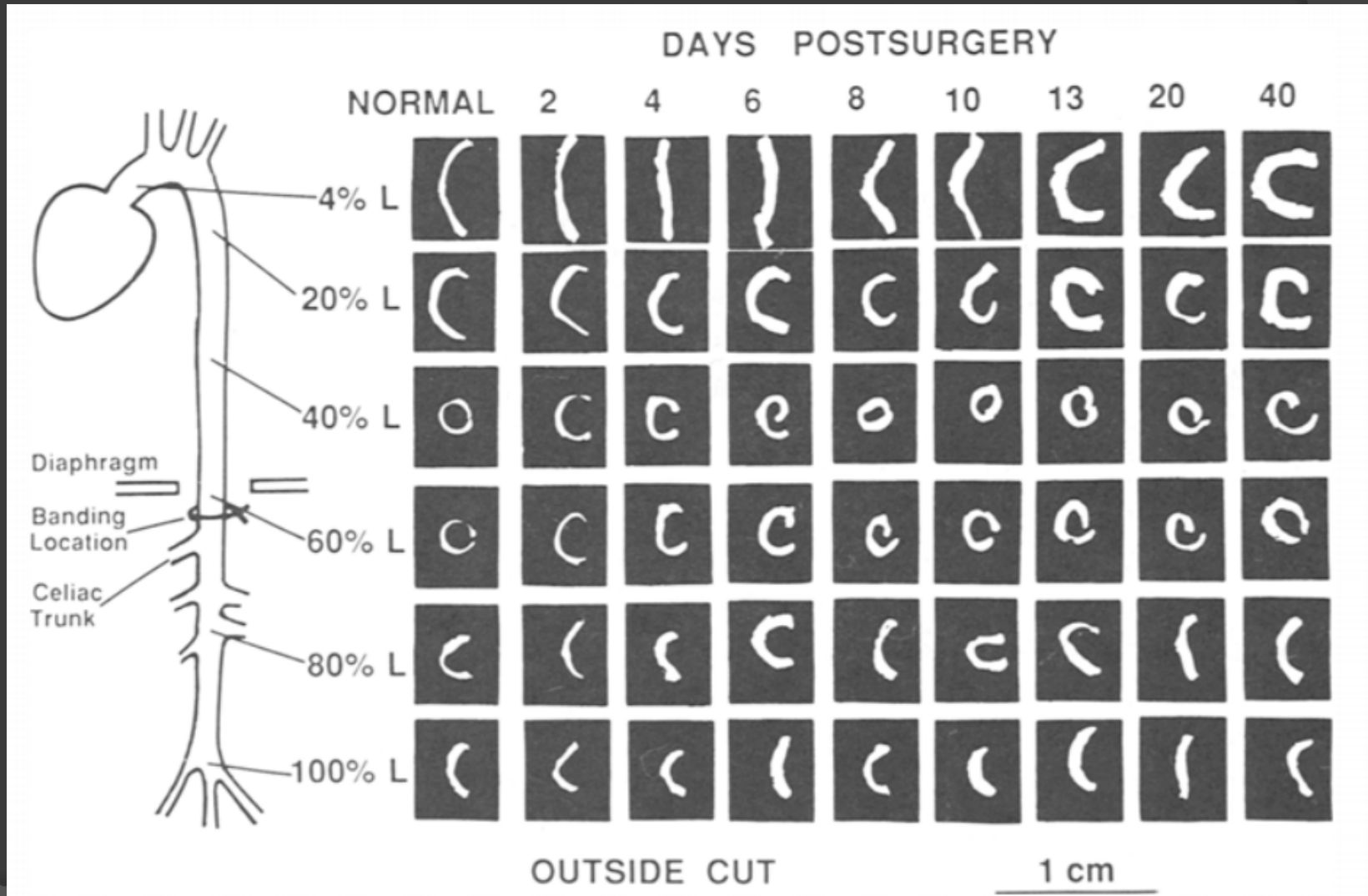


zero-stress state

no load state

- Residual circumferential stress ratio  $\lambda_\theta$
- Residual circumferential Green strain  $e_\theta$

# Y.C. Fung



# Experimental setup



Camera

Container  
with  
medium

Temp  
control

Tube



# Measuring OA

- ⦿ Rapid initial opening followed by more gradual opening
- ⦿ Effect of temperature not significant
- ⦿ Rings are actually non-circular

# Effects of residual strain

- ① Homogenize circumferential stress distribution
- ① Increase arterial lumen, wall tension, and mean circumferential stress
- ① Decrease wall shear
- ① Increases compliance

# Growth

- ⦿ Arteries sensitive to alterations in mechanical environment
- ⦿ Long-term response to changing environment
- ⦿ Changes of arterial geometry
- ⦿ Volumetric growth

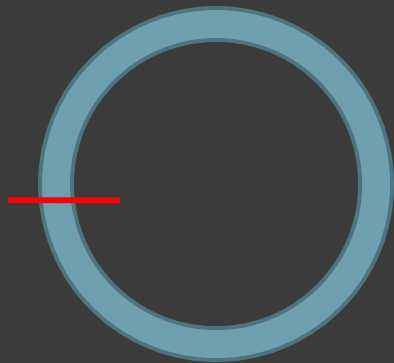


# OA Patterns

- General pattern : fall in OA towards periphery of subject
- Smooth muscle contraction
- Birth to puberty/After puberty (in rats)
- Induced hypertension

# Obtaining zero stress state

- One radial cut vs. additional circumferential cut



**Fung/Liu**

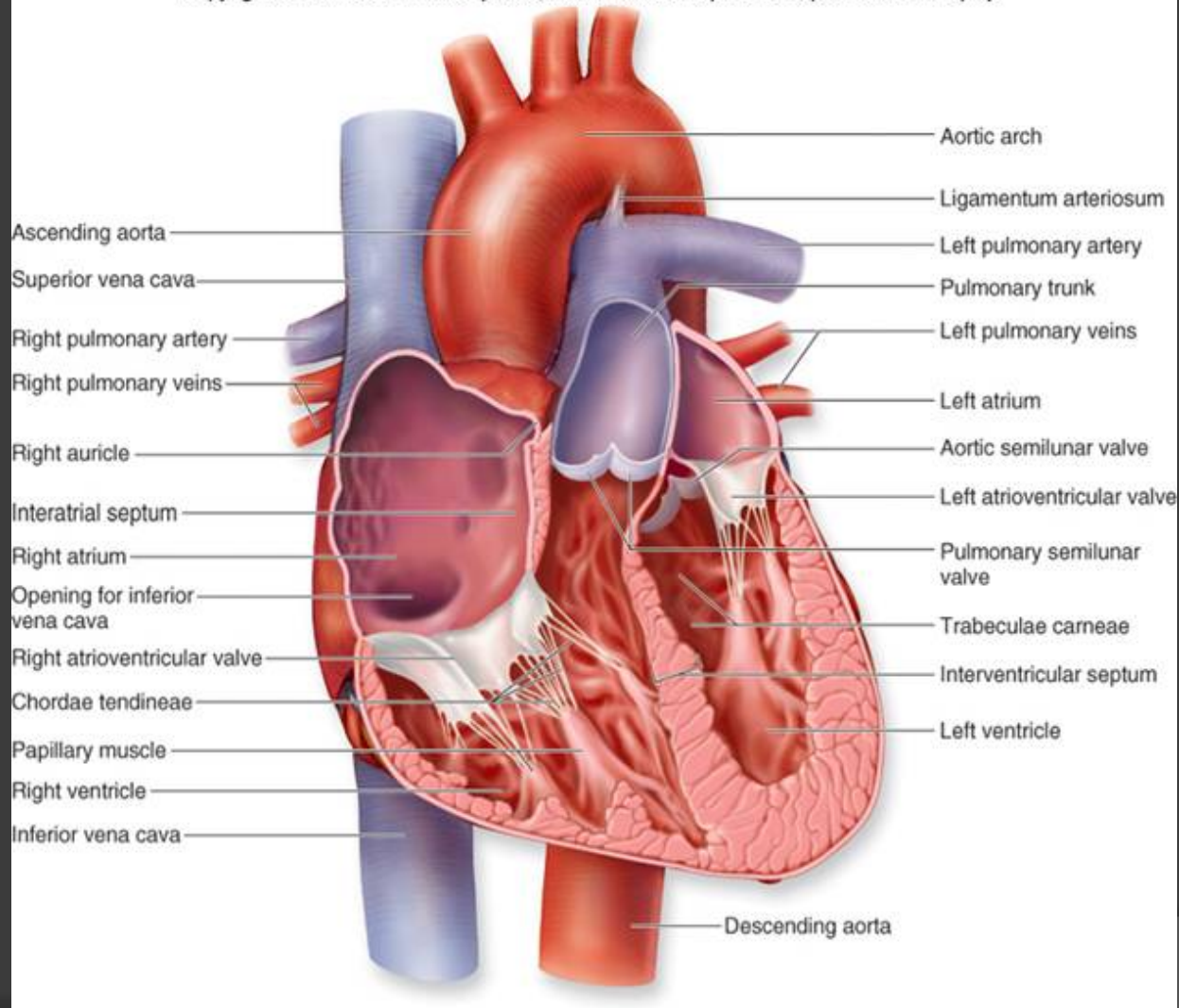


**Vossoughi**

- Porcine Aorta

# My research

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- Characterize growth in native ovine pulmonary trunk tissue
- How different aspects change with growth

# Connection to tissue engineering

- Ultimate goal is to have engineered tissue mimic growth of native tissue
- Applications: pediatric valve replacements