“RESIDUAL STRAINS IN CONDUIT ARTERIES”

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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

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

zero-stress state no load state
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**Diaphragm**

**Banding Location**

**Celiac Trunk**

**Outside Cut**

1 cm
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

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

- Porcine Aorta
My research

- 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