# Mentoring a Student in Completing a Directed Study -"Using Stem Cells for Heart Valve Engineering." Amitoj S. Sawhney, Nalini V. Broadbelt and Michelle A. Young

# BACKGROUND

- There are more than 100,000 heart valve surgeries in the USA per year
- Goal: to advance the current approach to heart valve replacement by using autologous stem cells
- Target population: individuals with congenital heart valve disease (CHVD) or heart valve malformations

## **EXPERIMENT**

# **In-vitro development**

- Isolation of cardiac stem cells and porcine valve interstitial cells (pVICs)
- Creation of 3D-scaffold of heart valve using polycaprolactone (PCL) and poly L-lactic acid (PLLA) blend
- Seeding of stem cell and pVICs onto 3D scaffold lacksquare
- Complete cellular colonization, 15 days growth

# **TECHNIQUES**

- Cell isolation and cell culture
- 3D stent created using 3D printer
- Create 3D scaffold via electrospinnin
- Cell seeding using static and rotary d seeding

#### REFERENCES

- Created with BioRender.com
- *Biomechanics*, 47(9), 1949–1963. https://doi.org/10.1016/j.jbiomech.2013.09.023
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## **Testing the heart valve**

- Cell Proliferation/ Colonization
- Mechanical & Structural
- Elasticity and Resistance to stress/strain
- Physiological performance

•	mmunofluorescence sta
• [	MTT Assay
•	Fensile mechanical stress
• F	Pulse Duplicator System
• [	Doppler Echocardiogram

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### CONCLUSION

### **Advantages:**

- Eliminate the need for mechanical or animal xenograft heart valve transplants
- Reduce the risk of rejection
- Increase durability
- Reduce multiple transplants as seen with mechanical valves

#### **Disadvantages:**

Risk of rejection





# **In-vivo testing**

Surgical implantation into heart Check for thrombosis, bleeding, calcification, and regurgitation Compare blood flow and valve

Testing longevity in sheep model

Surgery to implant heart valve in mouse and