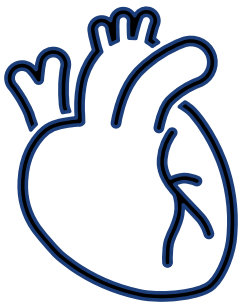




Identifying the extracellular matrix genes associated with re-endothelialization in aortic and pulmonary valves

By Helena Weiss



Supervisors: Professor Ruth Heying, Femke Bellen, Professor Elizabeth Jones

Introduction

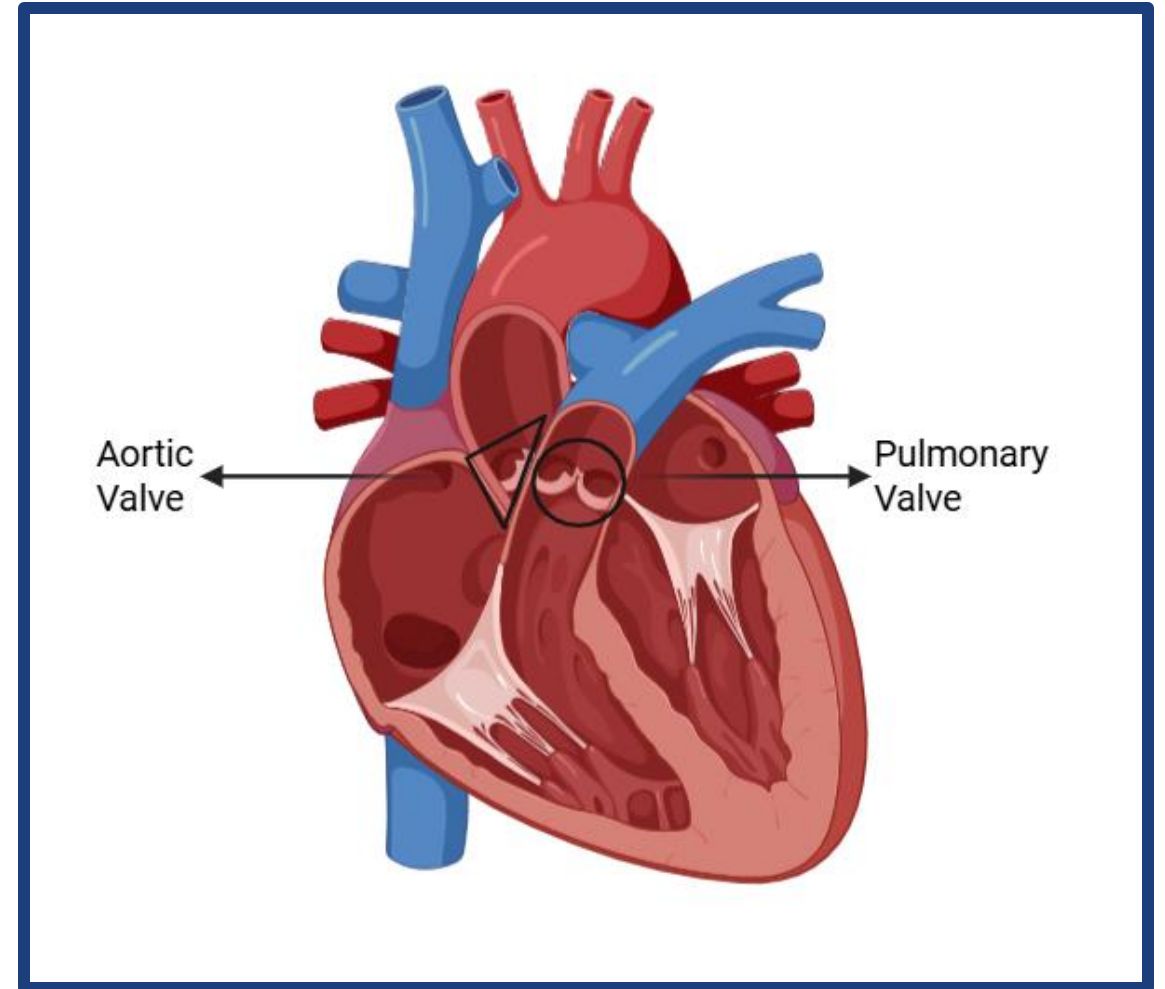
- **Home University:** University of Kentucky, Lexington, KY
- **Major:** Medical Laboratory Science
- **Host University:** KU Leuven
- **Research interests:** Muscle biology



KU LEUVEN

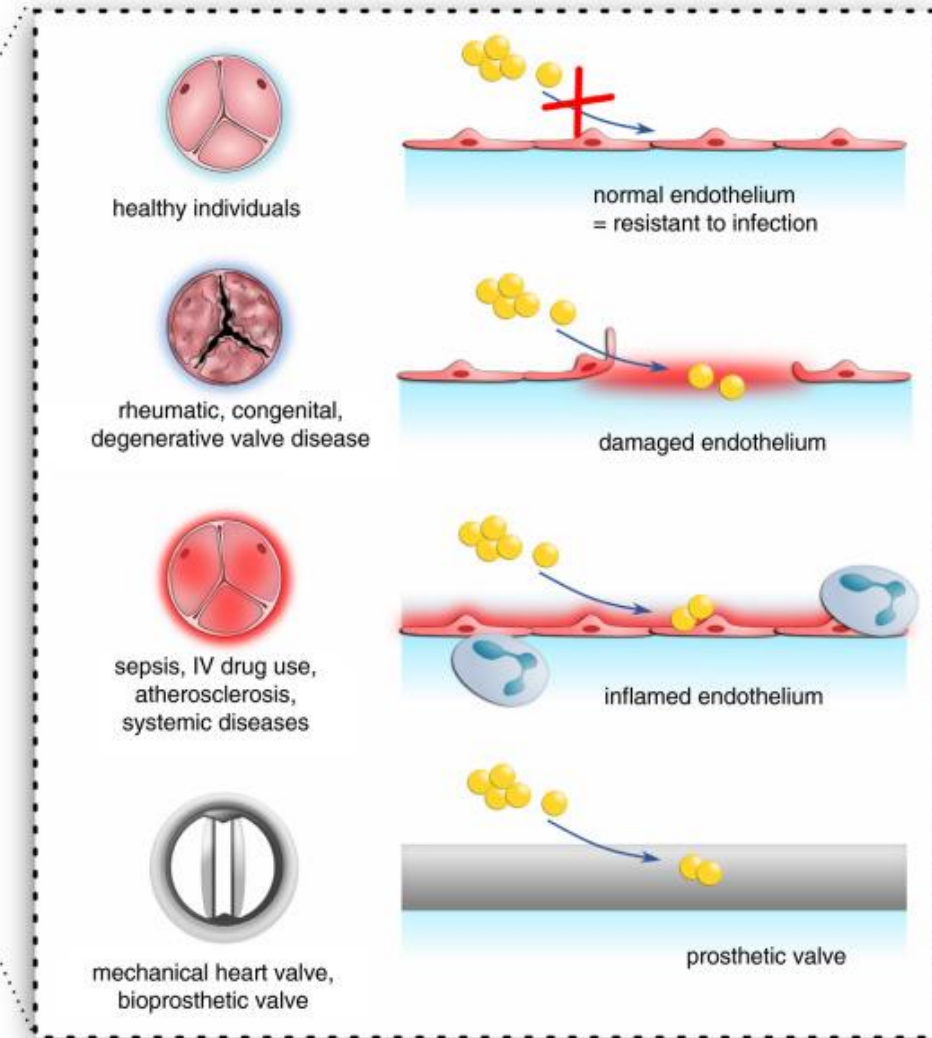
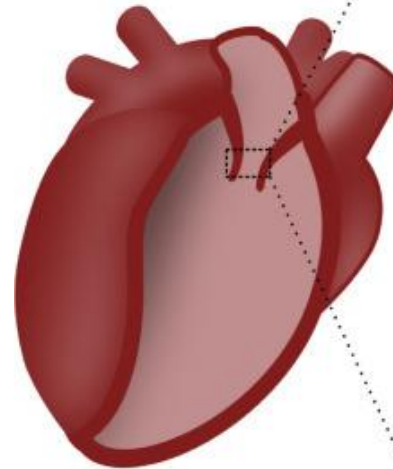
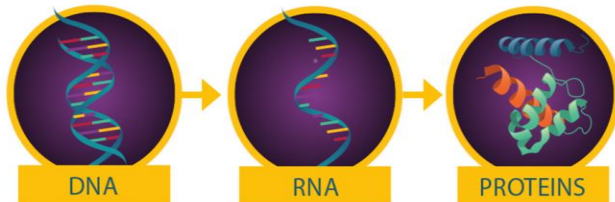
Clinical Significance

- ❑ **300,000** heart valve replacement surgeries/year worldwide
- ❑ **Endocarditis** can occur post-operation due to absence of endothelial tissue allowing bacterial adherence
- ❑ Artificial heart valves increase risk of endocarditis



Aims of Study

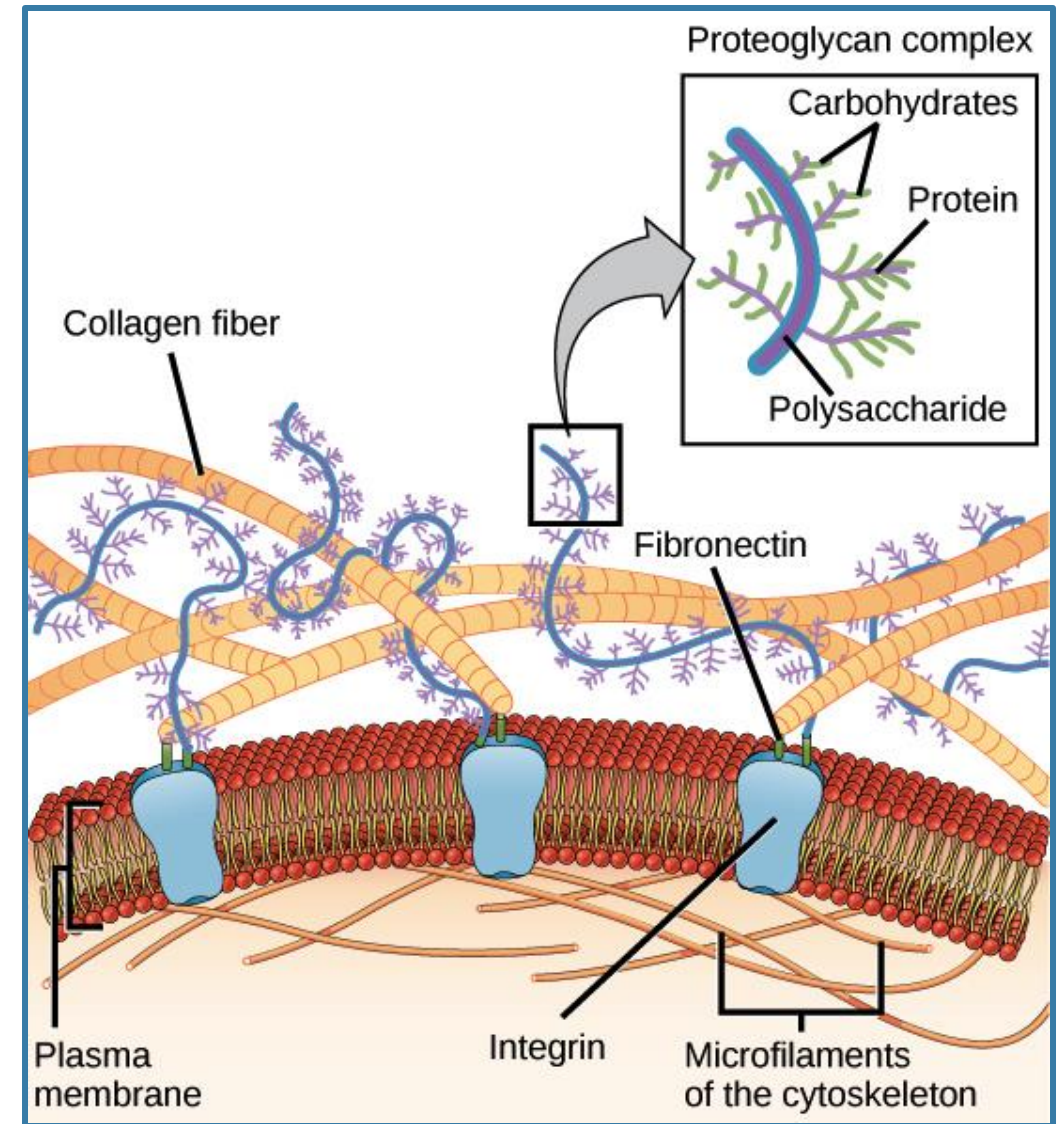
- ❑ Find ways to **accelerate re-endothelialization** of the heart valves to prevent infection
- ❑ The **extracellular matrix (ECM)** houses important proteins for tissue repair
- ❑ Investigate **genes encoding for proteins** in the ECM and later study those proteins



What is the extracellular matrix (ECM)?

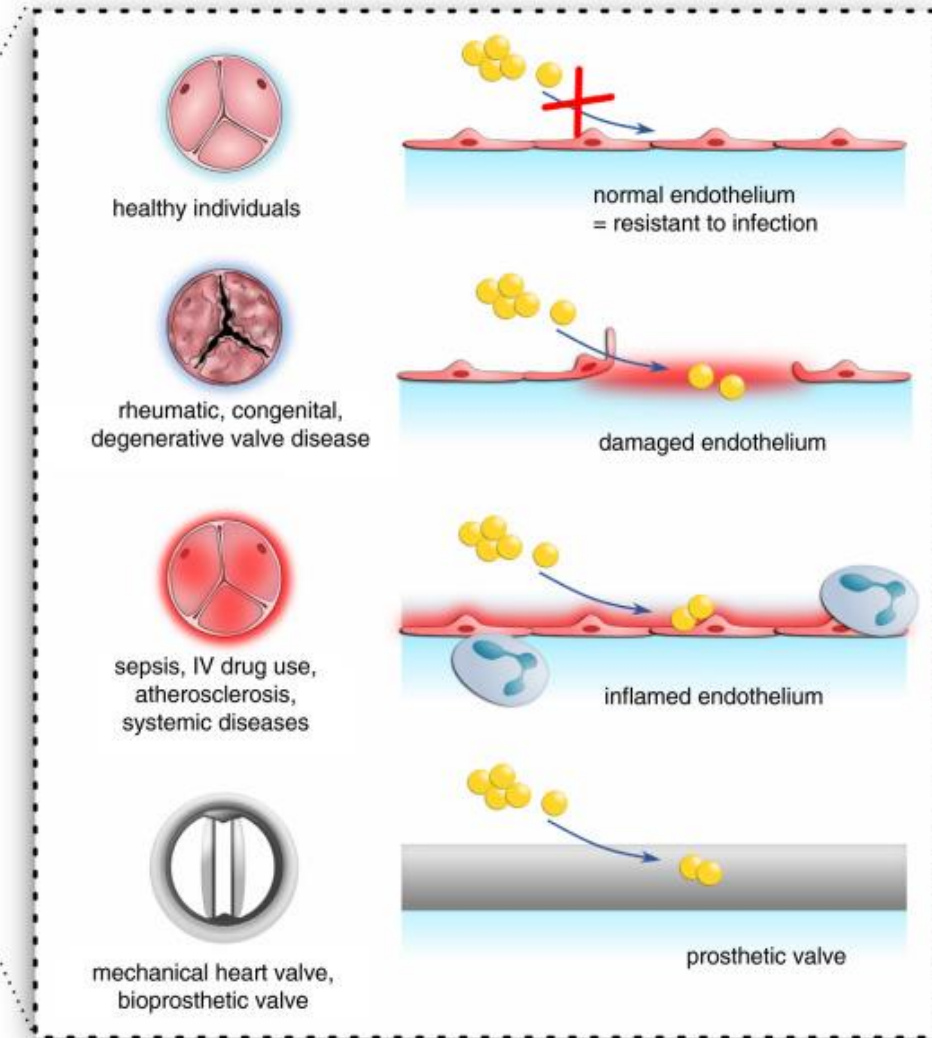
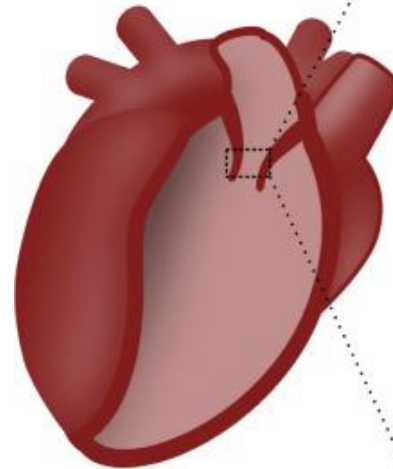
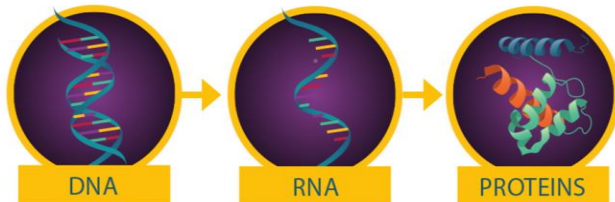
"A complex meshwork of proteins and carbohydrates"

- ❑ Structure
- ❑ Influence on cell behavior
- ❑ Tissue development
- ❑ Cell communication
- ❑ Maintain homeostasis



Aims of Study

- ❑ Find ways to **accelerate re-endothelialization** of the heart valves to prevent infection
- ❑ The **extracellular matrix (ECM)** houses important proteins for tissue repair
- ❑ Investigate **genes encoding for proteins** in the ECM and later study those proteins



Design of Study

- ❑ Previous study found **40 upregulated genes** in human endothelial cells or myofibroblasts
- ❑ Genes were related to **cell adhesion** in aortic and pulmonary valves
- ❑ **In-situ hybridization** can be performed to localize gene expression in heart valves in healthy sheep
- ❑ Future investigations on expressed proteins

Gene List

SPOCK1

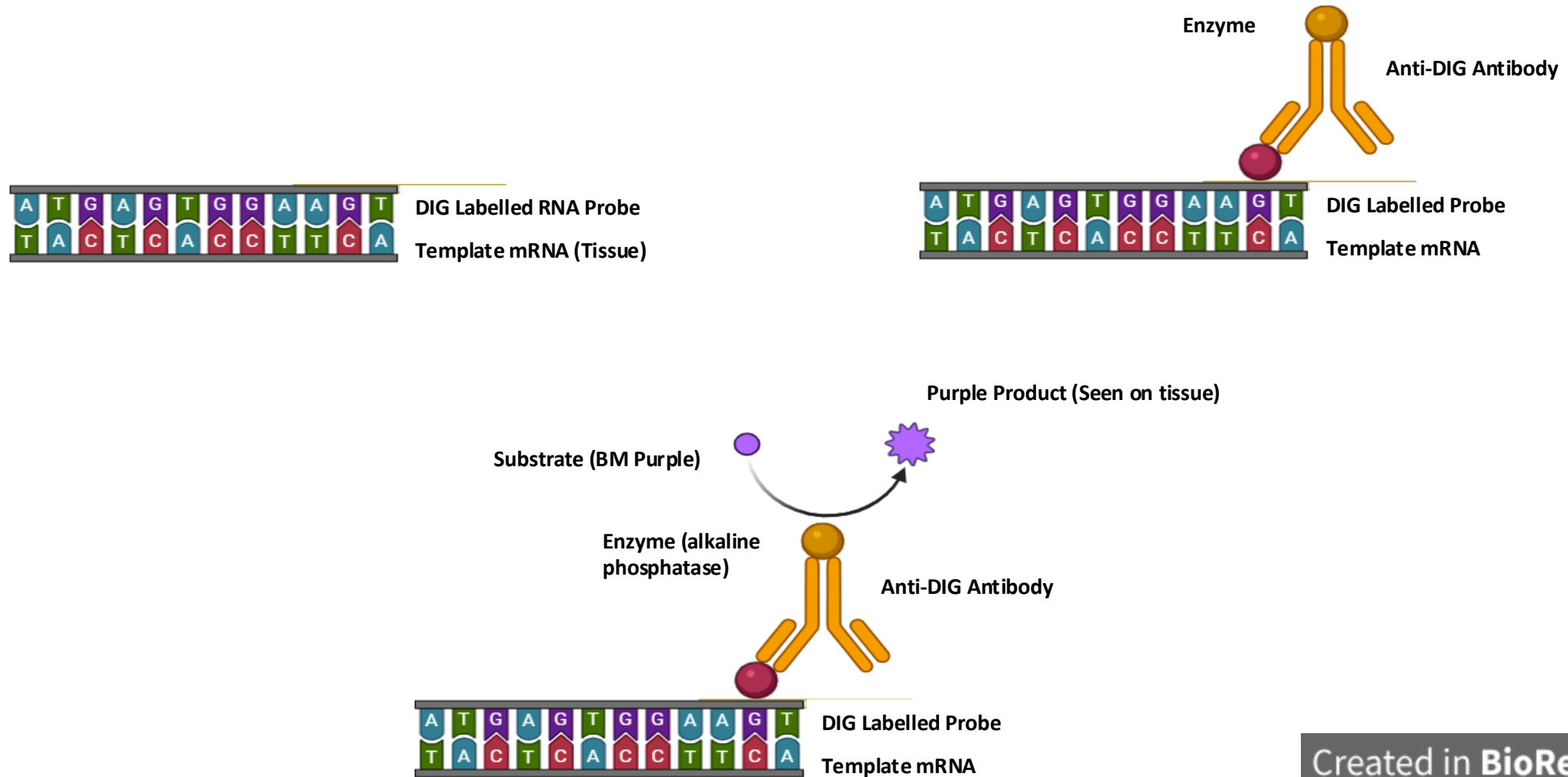
OMD

SRPX

CRELD1

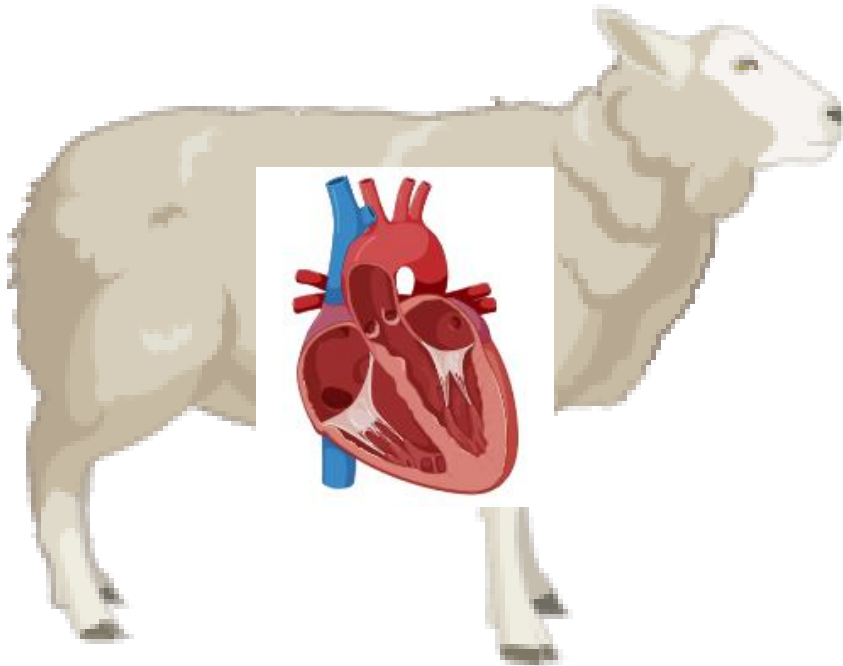
COL14A1

Methods



Methods

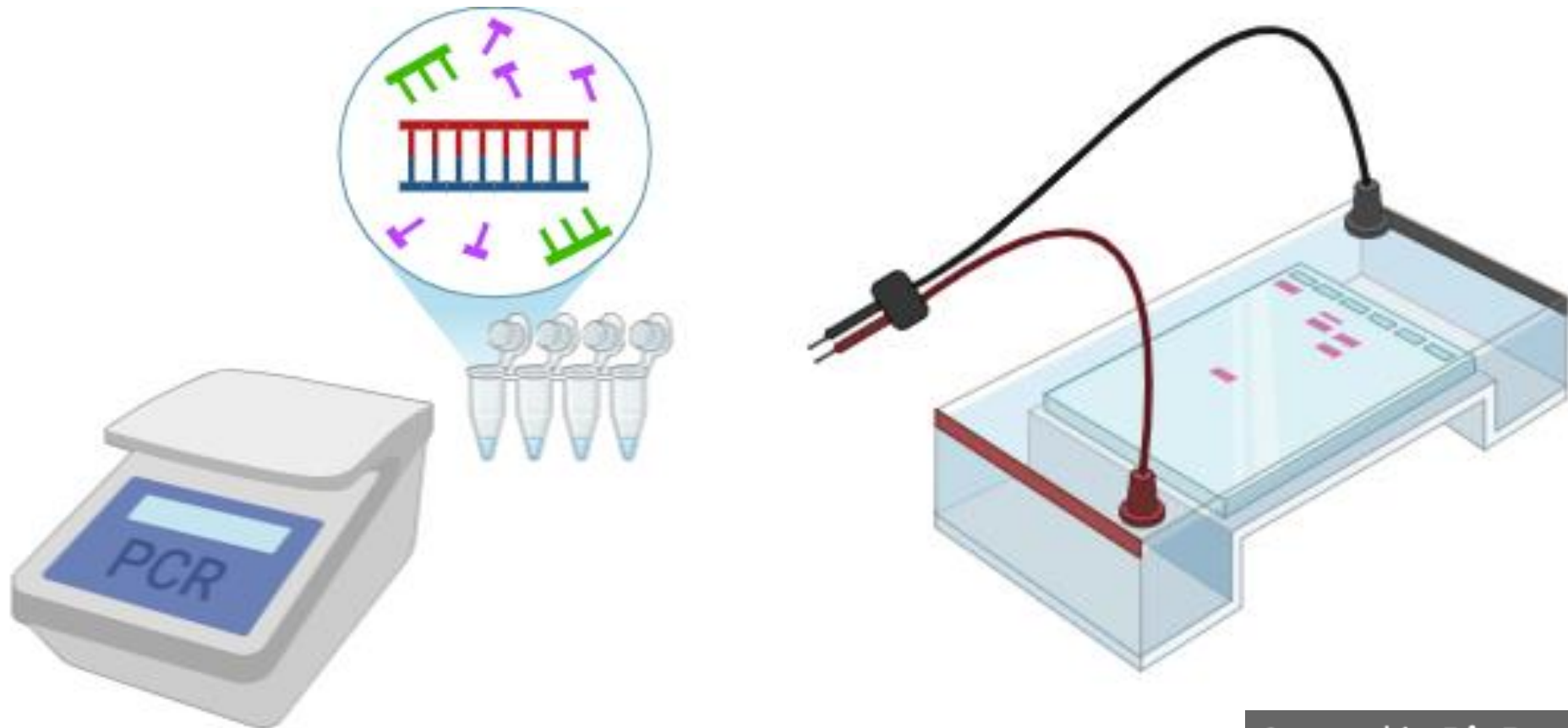
1. Homogenize tissue and obtained cDNA

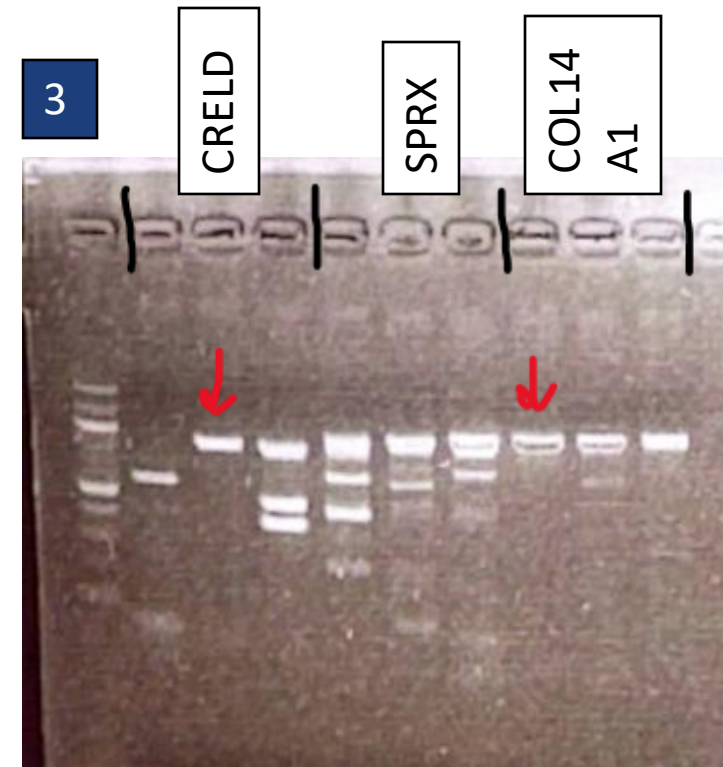
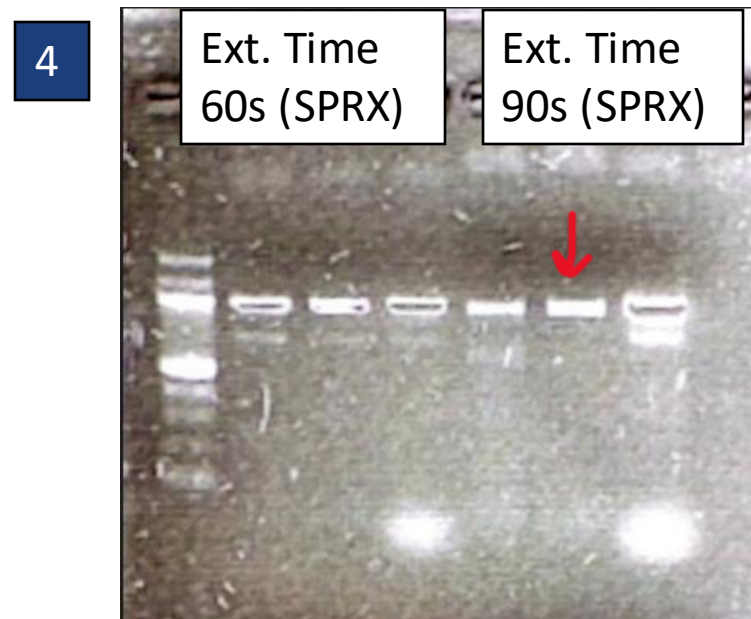
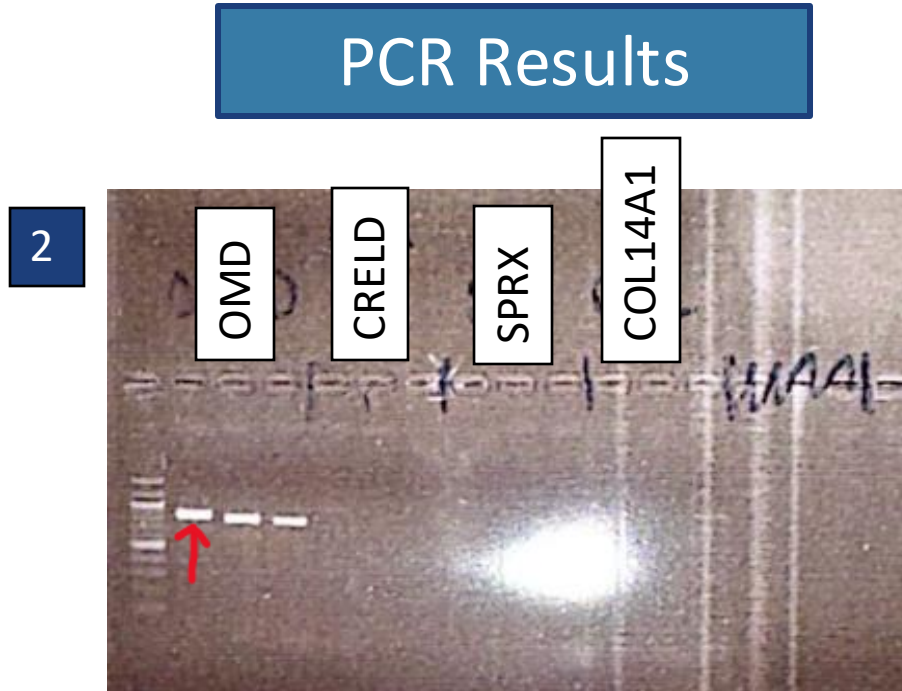
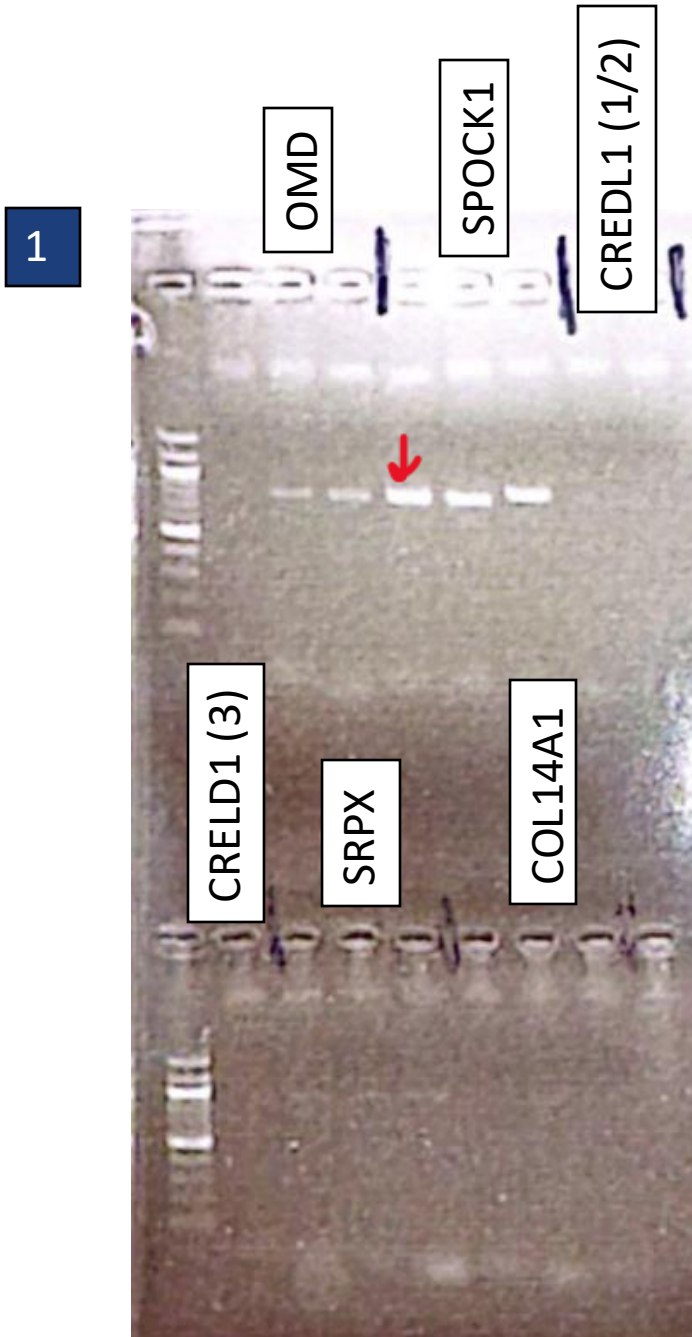


cDNA

Methods

2. Perform Polymerase Chain Reaction (PCR)





3. Make Probe for In-Situ Hybridization



RNA from PCR with
sequence for probe



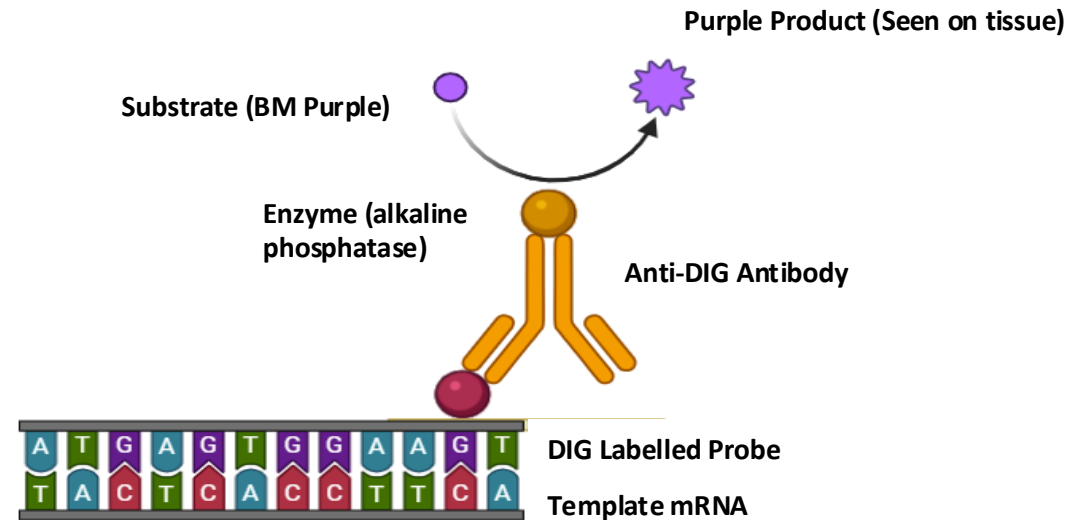
DIG Labelled RNA (Probe)

Probe Synthesis Results

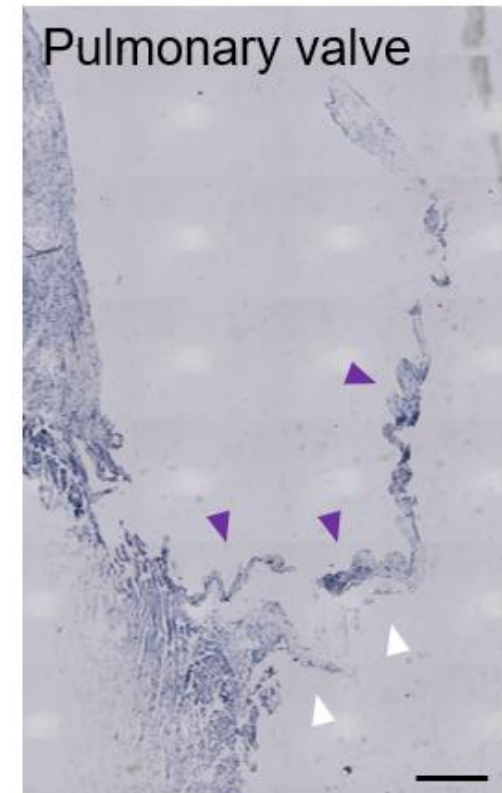
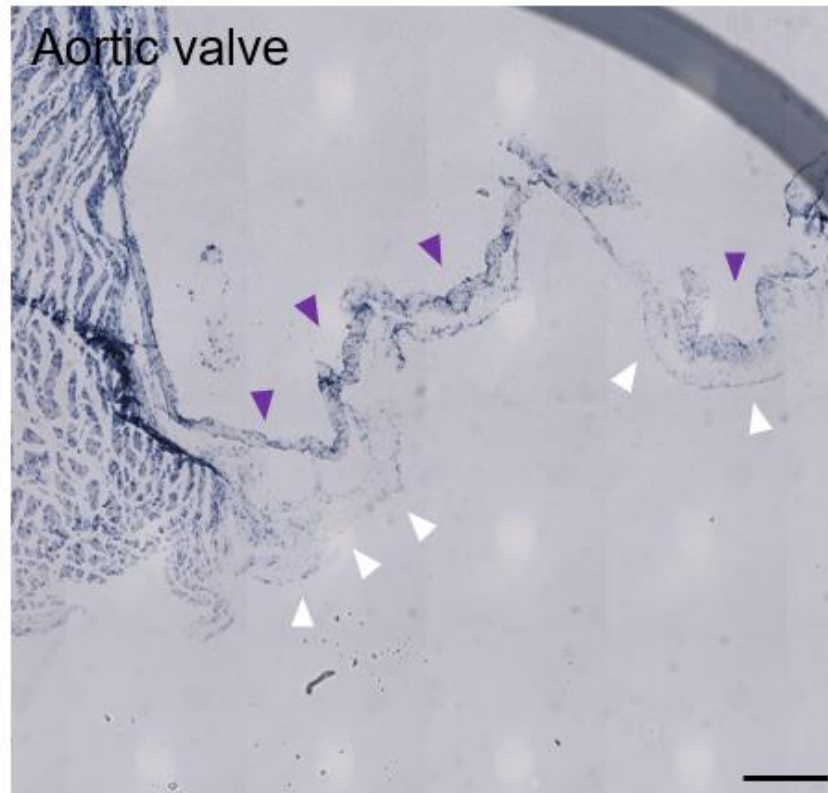
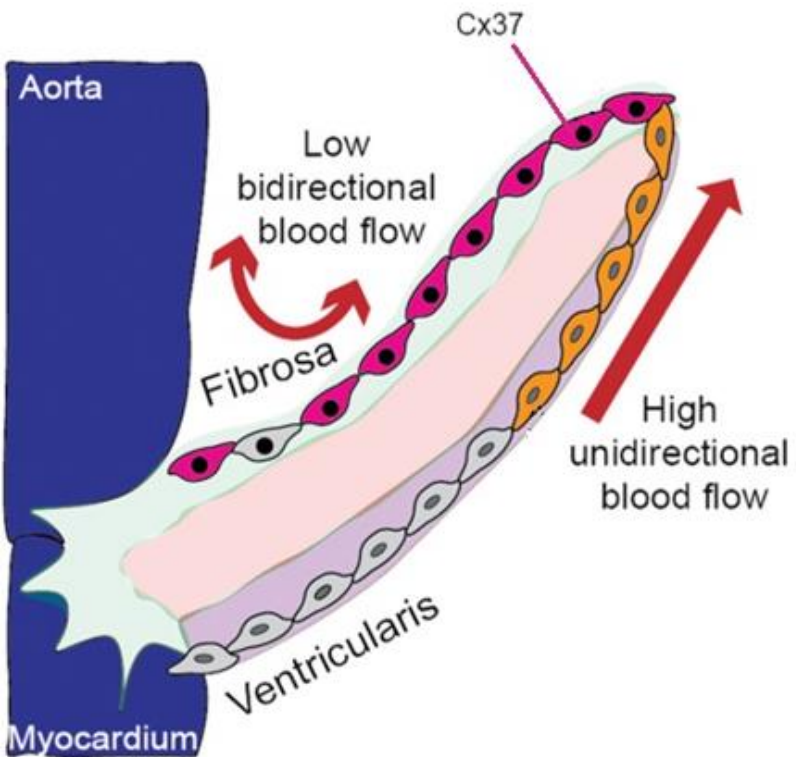
Gene List	Nucleic Acid Concentration (ng/uL)
SPOCK1	101.5
OMD	107.7
SRPX	103.4
CRELD1	TBD
COL14A1	110.2

Methods

4. Perform In-Situ Hybridization



Future Results: In-Situ Hybridization



Future Aims – Big Picture

- ☐ Identify localized expression of ECM genes in healthy sheep valves
- ☐ Investigate associated proteins and elucidate molecular mechanisms
- ☐ Perform research on human valves for translation to clinic
- ☐ Modify heart valve replacements
- ☐ Decrease rates of endocarditis following surgery

Thank you for
listening!

References

Biorender. BioRender App. (n.d.-a).

<https://app.biorender.com/illustrations/67efa645d5f58fa8509f2cff>

Roberts-Pilgrim, A. (2020, September 24). *Intro to proteogenomics*. Intro to Proteogenomics - NCI. <https://www.cancer.gov/ccg/blog/2020/intro-proteogenomics-central-dogma>

Liesenborghs, L., Meyers, S., Vanassche, T., & Verhamme, P. (2020). Coagulation: At the heart of Infective Endocarditis. *Journal of Thrombosis and Haemostasis*, 18(5), 995–1008.

<https://doi.org/10.1111/jth.14736>

Khan Academy. (n.d.). *The extracellular matrix and cell wall*. Khan Academy.

<https://www.khanacademy.org/science/ap-biology/cell-structure-and-function/membrane-permeability/a/the-extracellular-matrix-and-cell-wall>