Currently, there are over 93,000 people on the kidney transplant waitlist with an average wait time of 5-10 years, depending on the state. Transplantable organs are only viable up to 48 hours so a method to improve organ shelf-life would be one way to address this severe shortage in donor organs.

**Project Objectives**

1. Evaluate the presence of fixed charges in kidneys
2. Perfuse kidneys with hypo- and isotonic solutions to detect blood vessel impingement

**Background**

The process of turning an organ into a glass-like solid and essentially “freezing it in time.” Successful vitrification requires loading of tissues with a cryoprotectant solution.

**CRYOPROTECTANTS**

Substances that protect tissues from freezing damage. Organ cryoprotectant saturation is key to organ viability after vitrification.

**DONNAN EQUILIBRIUM & FIXED CHARGES**

Fixed charges (FC), shown right, affect the movement of cryoprotectants through tissues. Donnan Equilibrium describes the behavior of ions in the presence of fixed charges.

**KIDNEY ANATOMY**

We are focusing on the renal artery and vein as the kidney inlet and outlet, respectively.

**VITRIFICATION**

The process of turning an organ into a glass-like solid and essentially “freezing it in time.” Successful vitrification requires loading of tissues with a cryoprotectant solution.

**REFERENCES**


**CONCLUSIONS**

- More dye or solute diffuses into the kidney via perfusion rather than simply soaking
- Optimal perfusion platform parameters based on dye experiments:
  - Flowrate: 40 mL/min
  - Time: 30 minutes
  - Solute concentration: 780 µM
- Based on literature values for similar perfusion systems (50-95 mmHg) the pressure differences across the kidney suggest blood vessel impingement is occurring
- Fixed charges appear to be insignificant but further testing is required to verify this
- Older kidneys are prone to blood clotting, leading to blood vessel impingement

**FUTURE WORK**

- Construct mathematical model to predict relative mass for a given solution
- Perfuse kidneys with cryoprotectants for future vitrification

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**REFERENCES**