

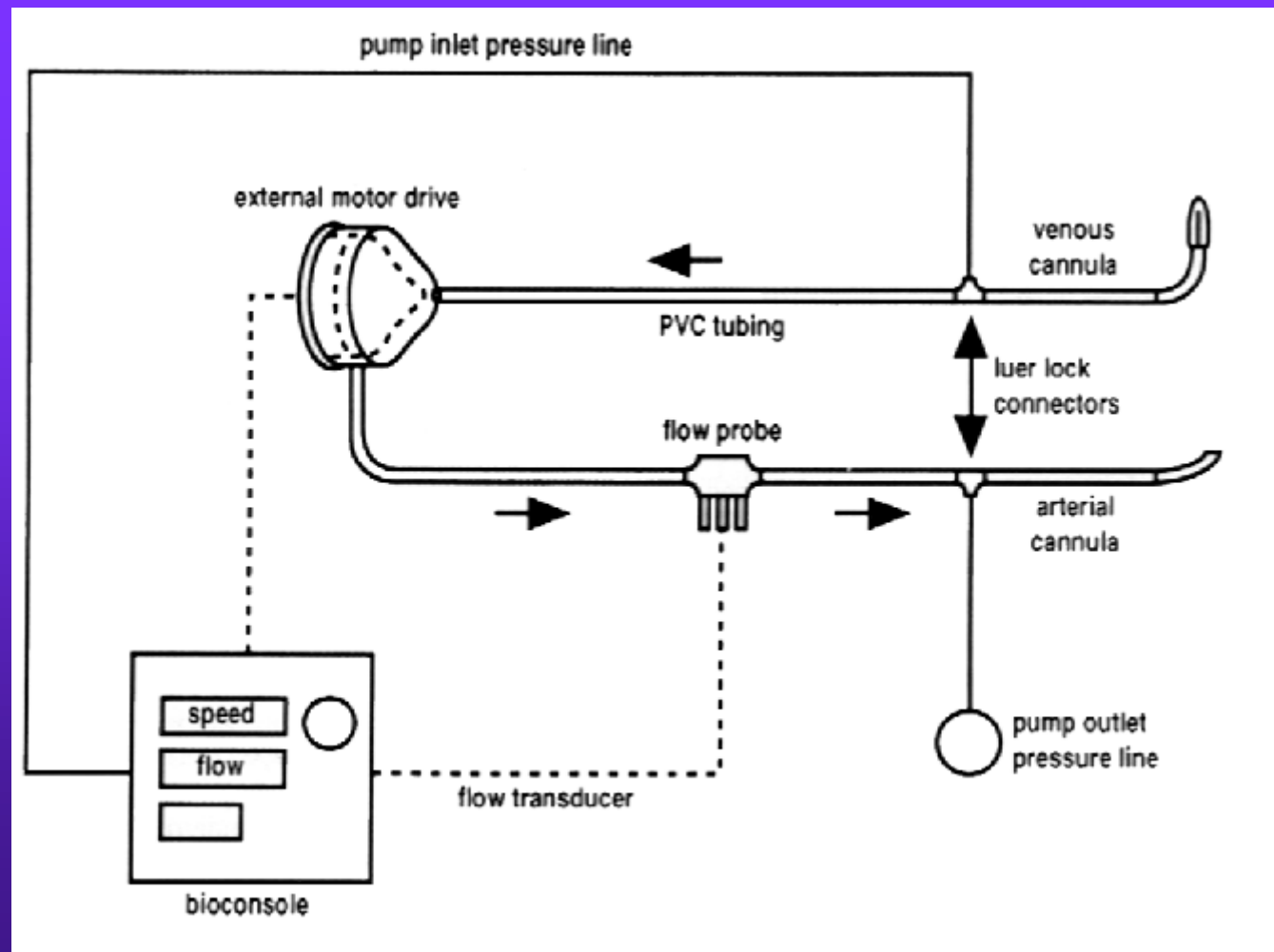
A landscape photograph featuring a vibrant rainbow arching across a cloudy sky. The foreground is filled with lush green trees and a grassy field. In the distance, a multi-story building is visible through the trees. The overall scene is bright and serene.

# VAD : The Royal Children's Hospital Experience

**Jan 1989 - 2001**



# VAD Circuit





# Low Cardiac Output Syndrome

- Leading cause of death after cardiac surgery
- Studies have shown potential for near normal left ventricular function in days to weeks
- Rapid restoration of normal systemic mean pressure & mean flow avoids the deleterious effects of the low flow state.



# Miniaturising Adult Systems

- Limited experience in  $< 20$  kg group
- Reducing pump size alters flow dynamics increasing thrombus formation
- Berlin Heart/Medos-HIA VAD have been used for short term support & as a bridge to transplant



# VAD

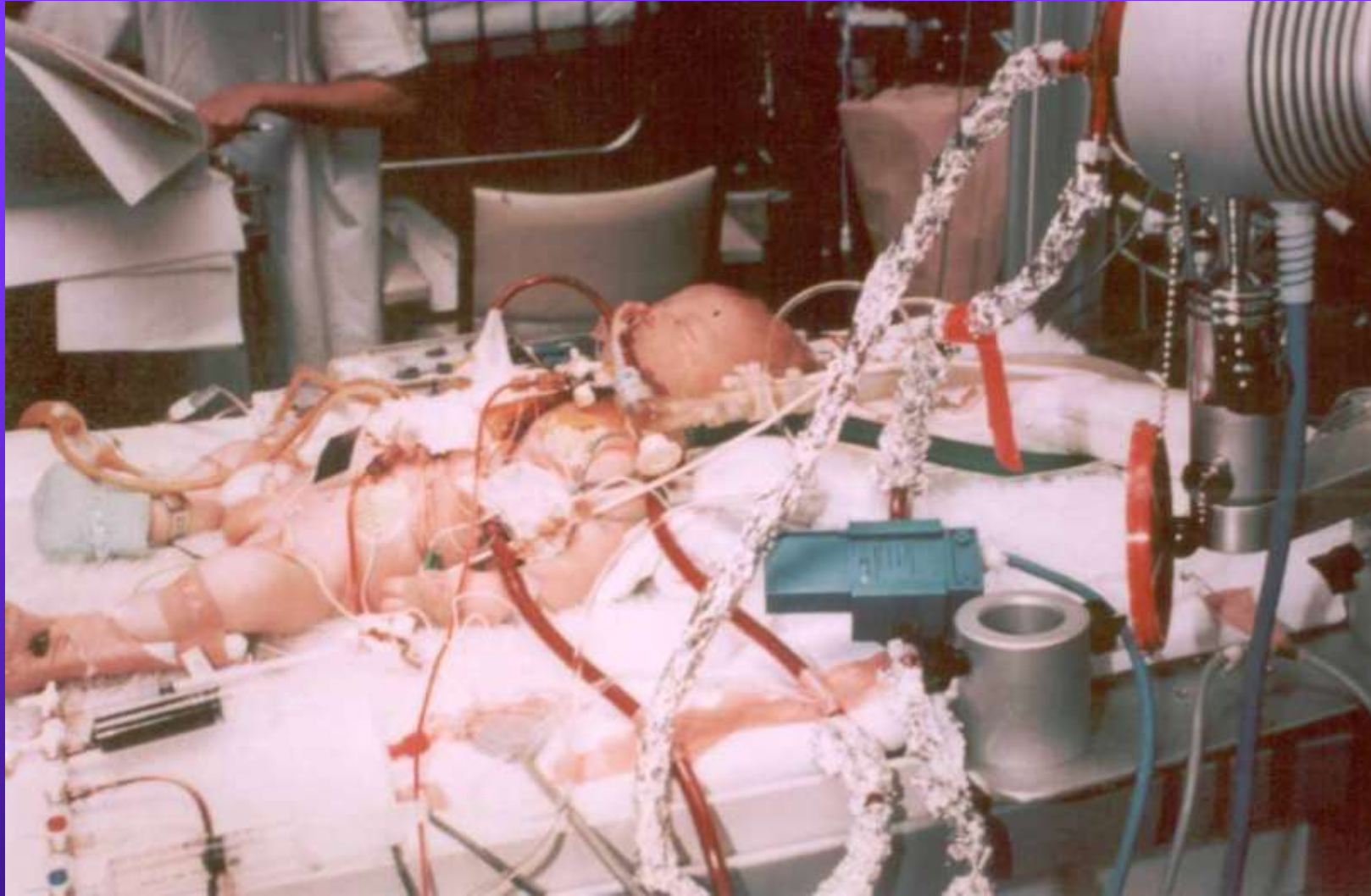
- n = 75
- 49 weaned (0.69, CI : 0.59 – 0.81)
- 32 discharged (0.43, CI : 0.31 – 0.55)
- Median age: 3.0 months (2 days – 19 years)
- Median weight: 4.6 kg (1.9 – 70 kg)



# Prior Operations

- Norwood procedure (n=15)
- Mitral valve replacement (n=3)
- Aortic root procedure (n=13)
- Arterial switch (n=16)
- Repair of supra-aortic stenosis (n=4)
- Heart or lung transplant (n=3)
- ALCAPA (n=6)
- Cavopulmonary connection (n=4)
- & others

# ALCAPA repair & Arterial Switch Patients





# VAD Details

- Median support time: 75 hours (1 - 428) **weanable**
- Median support time: 79.5 hours (2 - 114) **not weanable**
- Median support time: 73.5 hours (38 - 144) **discharged**
- Median support time: 91 hours (19 - 428) **not discharged**
- Median CPB time: 208 min (181 - 235)
- Median X Clamp time: 70 min (58 - 82)
- Median CPB time: 85 min (8 - 654) **All patients**
- Median X Clamp time: 41 min (0 - 369) **All patients**





# Children under 6 kg

- N = 46 patients
- Median age: 26 days (2 - 258 days)
- Median weight: 3.4 kg (1.6 - 6.0)
- 30 weaned (0.65, CI: 0.45 - 0.78)



# Complications

- Bleeding requiring exploration (n = 19)
- Sepsis (positive blood culture) (n = 3) **with clinical signs**
- Sepsis (positive blood culture) (n = 5) **without clinical signs**
- Neurologic defects (transient) (n = 3) **survivors**
- Mechanical (n = 26)



# ECMO

- N = 53
- 36 postoperative
- 19 weaned (0.36, CI: 0.23 - 0.50)
- 2 bridged to transplant
- 11 discharged (0.21, CI: 0.11 - 0.34)
- median CPB: 186 mins (131 - 241 mins)
- median X Clamp: 53 mins (36 - 70 mins)



## ELSO ECMO Results → July 2000

- N = 21,547 (total)
- 3159 children in cardiac category (14.7%)
- 2451 cardiac surgery prior to support
- 205 transplant related indication
- 108 myocarditis
- 219 other coagulopathies
- 494 other
- 1696 weaned (0.537, CI: 0.519 - 0.554)
- Overall survival 1242 (0.393, CI:0.376 - 0.510)

# ELSO ECMO Results → July 2000



- RCH (0.36) wean
- ELSO (0.54) wean
- RCH (0.21) discharge
- ELSO (0.39) discharge
- RCH VAD (0.69) wean
- RCH VAD (0.43) discharge
- RCH ECLS (0.53) wean
- RCH ECLS (0.34) discharge



# VAD or ECMO?

- Global RV & LV failure - ECMO (or BiVAD)
- Assess intra-operatively



Partial left heart bypass



Patient stable for 20 mins



else

**ECMO**

- (RA < 12 mmHg, PA systolic < 1/2 systemic)  
With or without NO
- No RV dilation



**VAD**

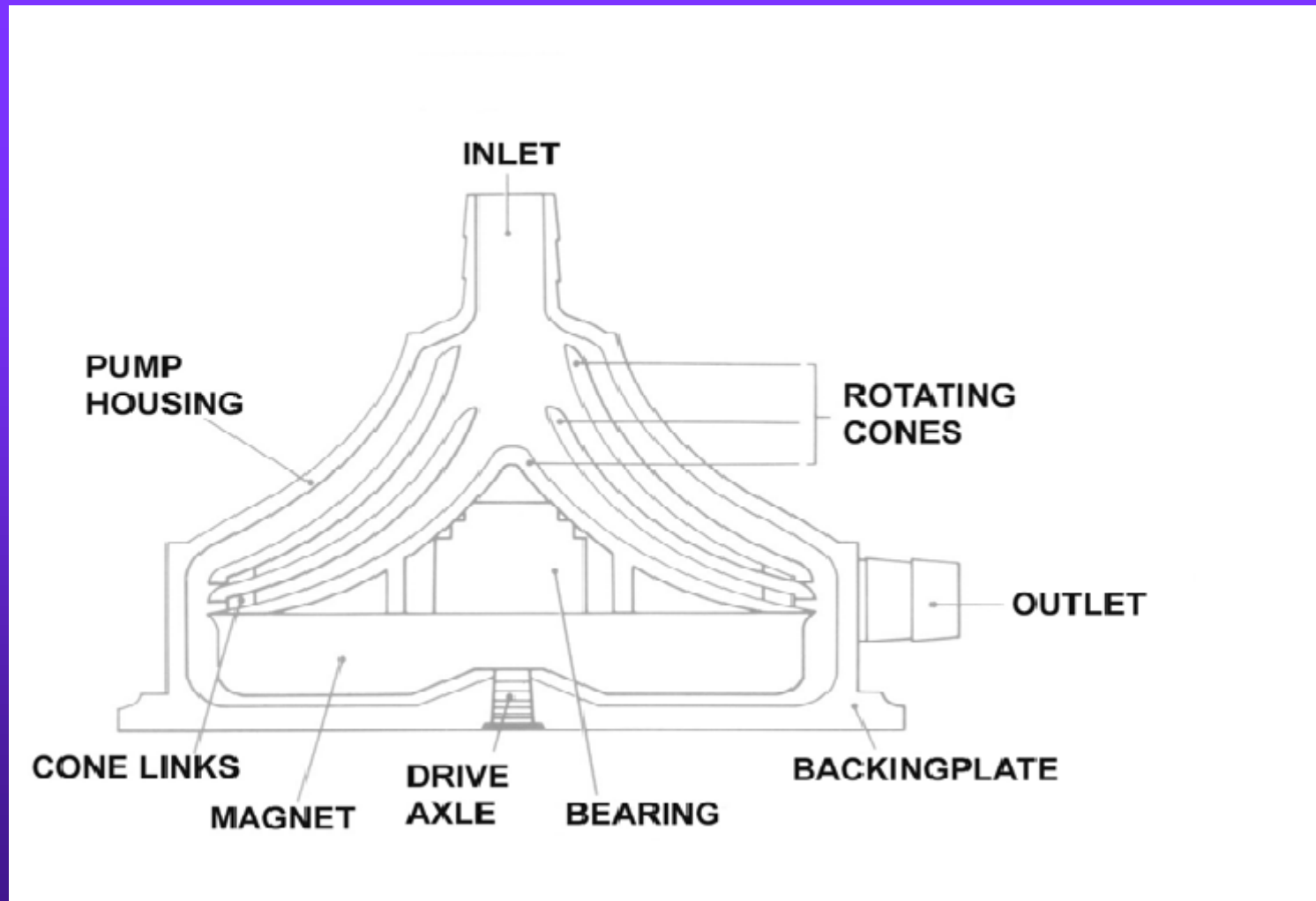


# VAD - First Option

- May improve pulmonary hypertension, RV dysfunction & TV function
- Each patient must be individually assessed
- Simpler circuit
- Less surface area

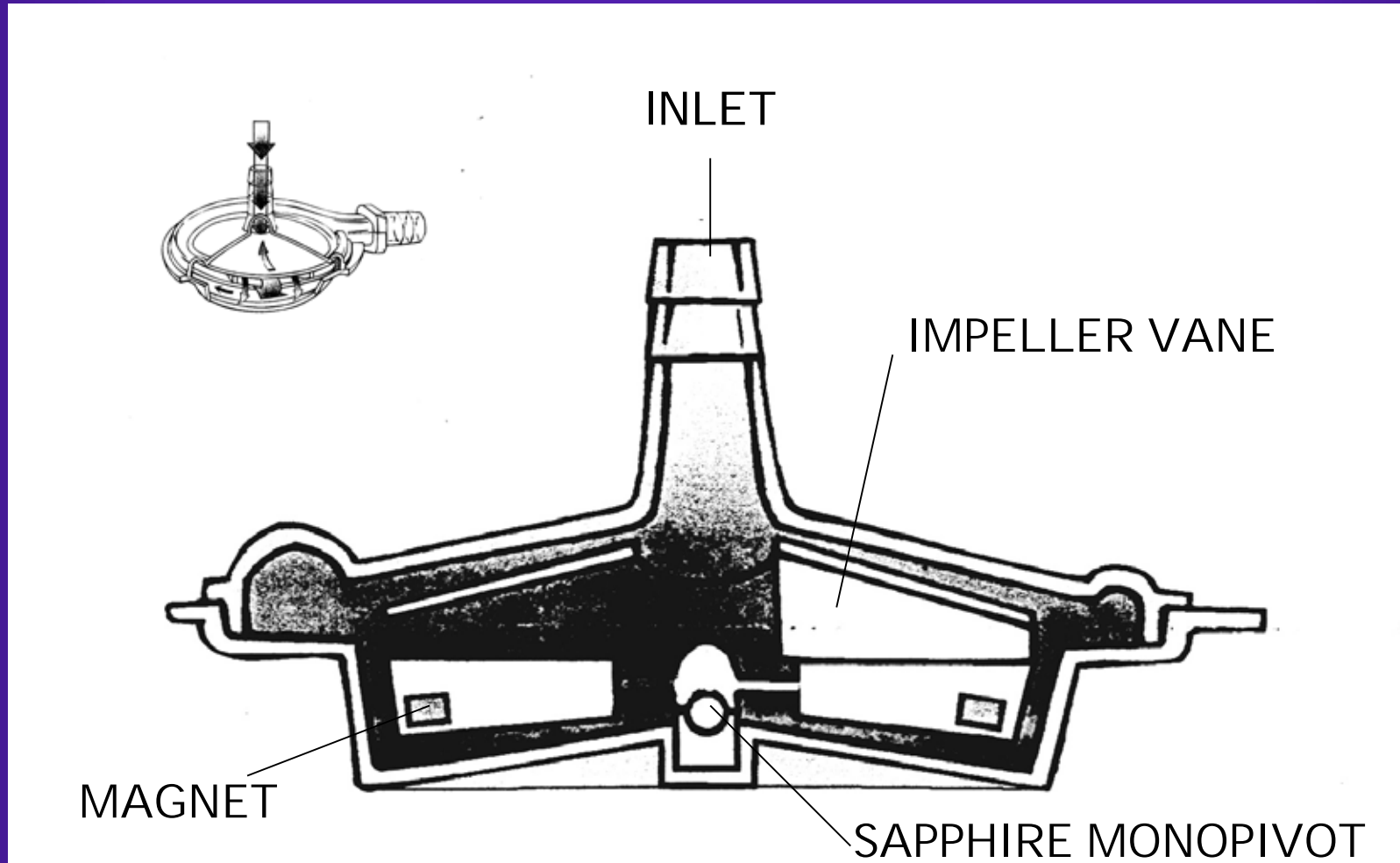


# Biomedicus Bio-Pump





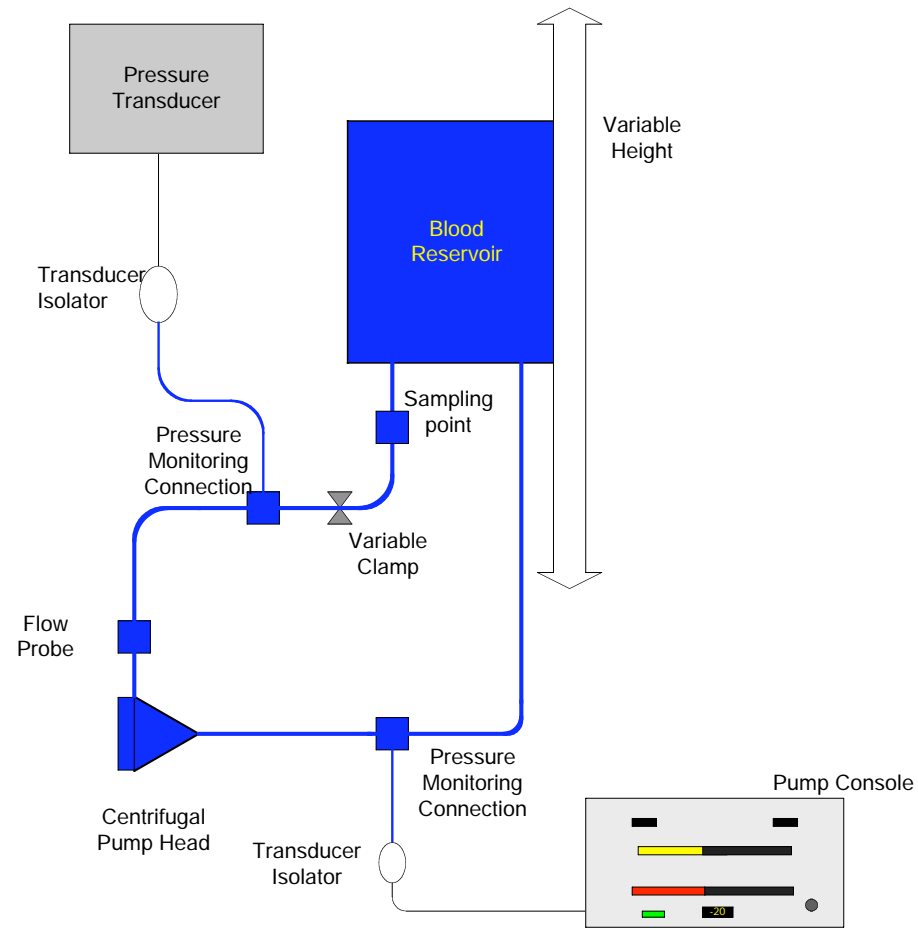
# Jostra RotaFlow





# In-vitro Test

## Test Circuit

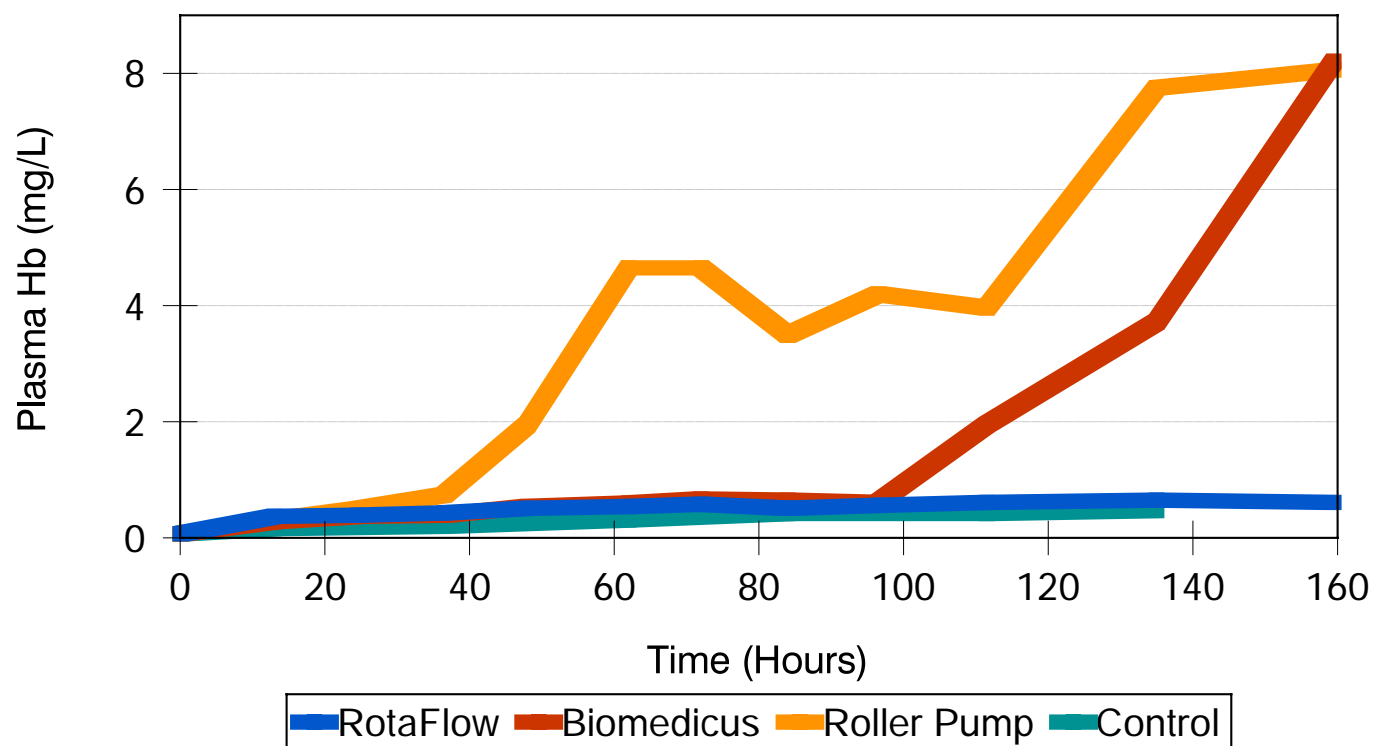




# Centrifugal Pump Haemolysis Trial

## Plasma Free Haemoglobin

Week 3





# Acknowledgments

- Professor Tom Karl
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