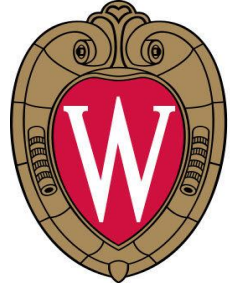

Conversion of Human COBE Plateletpheresis Machine for Large Animal Use



THE UNIVERSITY
of
WISCONSIN
MADISON

Overview

- Problem Statement
- Background
- Product Design Specifications
- Design Alternatives
- Design Matrix
- Future Work

Background material

- Plateletpheresis
- COBE Spectra Apheresis System by Terumo
 - Unlike whole blood collection
- Platelet Lysate

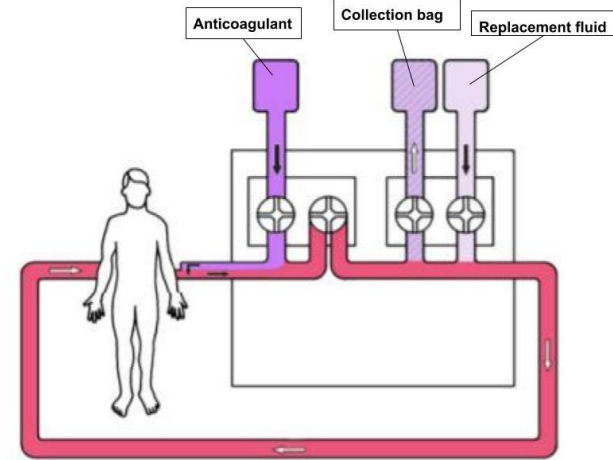
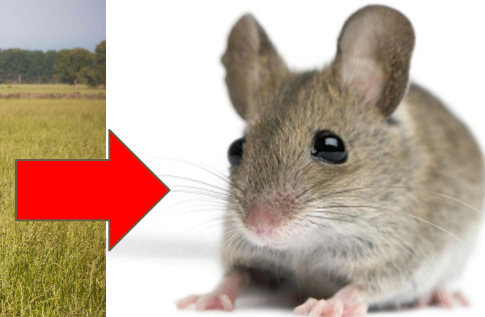


Image Urls:

<https://www.thesprucepets.com/importance-of-turnout-for-your-horse-1886932>
<https://www.elisagenie.com/mouse-glutathione-gsh-elisa-kit/>



Problem statement

- \$2000-2600 per use
 - Blood borne pathogens
- Replace tubing and connection points
- Reduce cost to \$100 per use
 - Cheap or easy to sterilize

Image URL:

<https://patentimages.storage.googleapis.com/6b/4f/3b/eac079365762ac/US6022306.pdf>

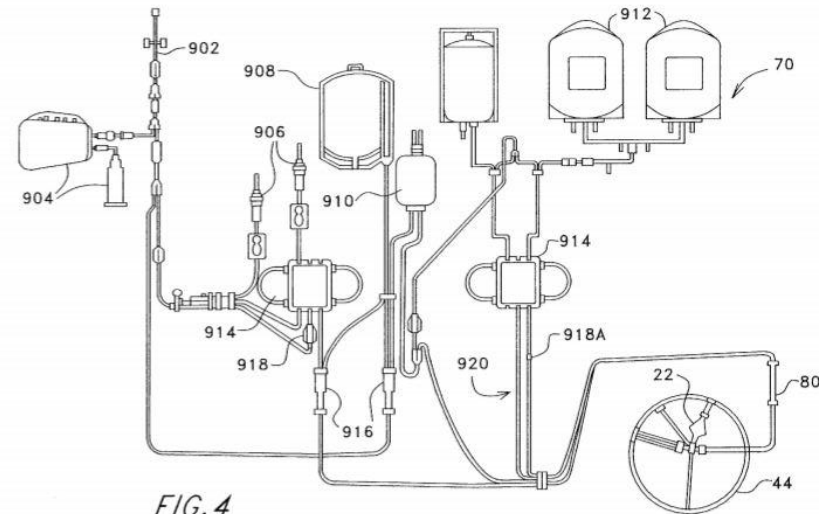


FIG. 4

Summary Product Design Specification

Client's Requirements

- Replace all tubing within the apheresis
- Tubing cost must be brought down from \$2600 per use to \$100 per use
- Final deliverable of a cheaper reusable tubing or more effective sterilization technique

Design Specifications

- Low cost tubing with sterilization abilities
- Ability to handle repeated uses without losing structural integrity
- Able to handle temperatures upwards of 250F
- Tubes of varying sizes should be able to be easily assembled with airtight joints
- Malleable enough to curve around the peristaltic pumps
- Material and size properties of original tubing

Design alternatives considered

Simplify Cheap Tubing

- Recreate a simplified version of the COBE spectra apheresis tubing
- Purchase tubing, clamps, connection pieces, collection bags, catheters, needles, etc and separately and then assemble them
- Eliminate unnecessary complications from tubing

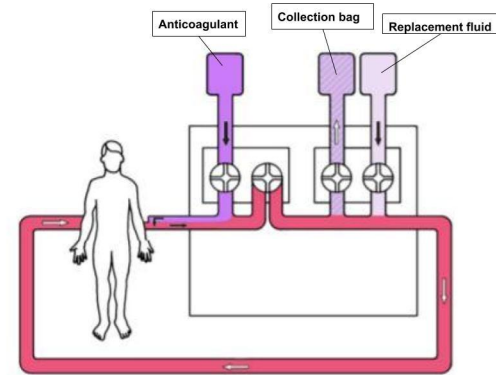


Image urls:

<https://www.flickr.com/photos/canadianbloodservices/4932208506>

<https://www.terumobct.com/Public/306670728.pdf>

Design alternatives considered

Sterilization Protocol For Current Tubing

- Use heat or chemical sterilization to sterilize current tubing
 - Heat sterilization- Using hot steam or hot temperature to sterilize a material. Less effective yet cheaper
 - Chemical sterilization- Using gases such as ethylene oxide to sterilize a material. More effective yet more expensive
- Develop a method to quantify the sterilization of tubing

Image url:

<https://www.ptc1.com/assets/images/autoclave-sterilizer.jpg>



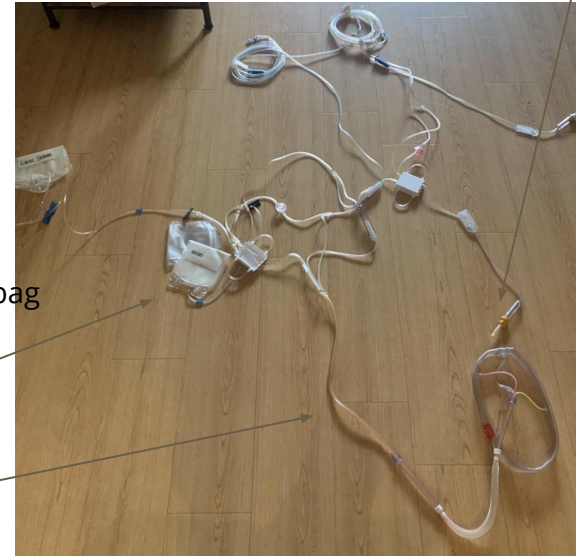
Design alternatives considered

Remake Cheap Tubing

- Recreate the COBE apheresis tubing following the parameters exactly but using cheaper materials
- Buy all materials and reassemble separately
- No simplifications
- Possible intellectual property concerns

COBE Spectra
Apheresis tubing from
client

Anticoagulant bag
Collection bag
Tubing



Catheter

Design matrix

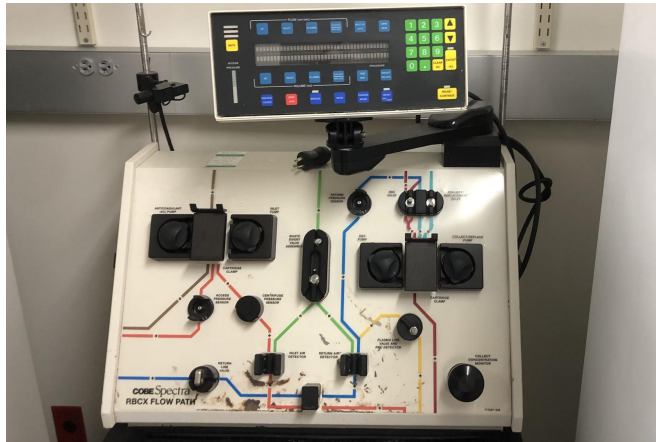
		Simplify cheap tubing			Sterilization protocol for current tubing		Fabricate cheap tubing (no changes)	
	Criteria	Weight	Score (max 10)	Weighted Score	Score (max 10)	Weighted Score	Score (max 10)	Weighted Score
1	Cost per Use	26	9	23.4	10	26	6	15.6
2	Sterility	21	10	21	7	14.7	6	12.6
3	Safety of patient	19	8	15.2	10	19	7	13.3
4	Durability	18	7	12.6	6	10.8	6	10.8
5	Ease of Fabrication	10	7	7	8	8	10	10
6	Ease of Use	6	10	6	6	3.6	5	3
	Sum	100	Sum	85.2	Sum	82.1	Sum	65.3

Future work - Short Term

- 3rd Party Contractor
 - Evaluate cost/ timeline of construction from outside vendor
 - No word back yet - pursue sterilization as possible alternative
- Take Measurements
 - Measure existing tubing, create detailed graphics for vendor
- Machine Accessibility
 - Move machine from WIMR to more accessible testing space
- Finalize Materials
 - Finish conducting research to determine best material for fabrication, check availability with vendor

Future work - Long Term

- Blood Volume Calculations
 - Use current (or fabricated) tubing measurements and desired L quantity to determine optimal flow rate over an hour
 - Attempt to adjust machine settings to cater to a horse test subject
- Testing
 - Form a plan to test sterilization techniques, client has access to an autoclave
 - Test fabricated tubing with blood or blood-like substitution in machine



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