Democratizing Placement of Endoluminal Negative Pressure Devices for Gastrointestinal Leaks

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Problem statement

Currently, large defects in the GI tract (often caused by surgical complications) are treated with surgery. For external wounds, the use of negative pressure wound therapy has become widely used. This therapy, colloquially called VAC therapy, leads to improved healing of superficial wounds. For the past few years, some surgeons have been placing similar VAC devices into the GI tract through the mouth or anus to treat defects in the GI tract. The success of this therapy has been outstanding, with some studies finding that 90% of wounds that would have otherwise required surgery can be closed without making any additional incisions at all. The process of VAC placement is currently labor intensive and requires some skill in manipulating an endoscope, which has limited its widespread use. Development of a streamlined way to deploy VAC therapy into the GI tract would allow more surgeons to use this therapy to heal anastomotic leaks.

Brief status update

This week the team continued to prototype potential films. Each iteration has pros and cons that the team is evaluating to create the best possible prototype. Also, the team attended the show and tell last week and received valuable feedback from BME 400 students. This feedback and potential alternate materials will be considered to help the team continue to prototype and begin testing.

Difficulties / advice requests

One difficulty has been fabricating a material that will last. The team is working on the best way to evaporate more water from the gelatin films so that they will last longer. Evaporating more water will also improve the mechanical properties of the film. The team could use some advice on how to assemble the film and the sponge to create a final prototype.

Current design

The current design to be fabricated and tested is a gelatin film and a sodium alginate film. Fabrication and testing of the degradation properties will indicate the plausibility of either film in being used as an encapsulating, degradable film. This film will then be used as the sponge coating and its application into an esophagus can be tested.

Materials and expenses

Item	Description	Manufac-turer	Mft Pt#	Vendor	Vendor Cat#	Date	#	Cost	Link
Category 1									
Porcine Gelatin	CAS 9000-70-8 Type A powder, ~300 g Bloom, suitable for cell culture	Sigma Aldrich	G1890	Sigma Aldrich	G1890-100g	Mar 11 2026	100g * 1	$53.40	Link
Glycerin	CAS 56-81-5 Density 1.261 g/mL USP/FCC grade	Fisher Chemical	G314	Fisher Scientific	G314	Mar 11 2026	4L * 1	$676.7	Link
Alginate acid sodium salt from brown algae	CAS 9005-38-3 Medium viscosity	Sigma Aldrich	A2033	Sigma Aldrich	A2033-100G	Mar 12 2026	100g * 1	$82.80	Link
							Total:	**$812.9**	

Major team goals for the next week

1. Write executive summary
2. Continue prototyping
3. Create preliminary final design of combined sponge and film
4. Create plan for testing and analysis

Next week's individual goals

- Simon Fetherston
    - Build and test options to create final assembly of film and sponge
    - Continue to fabricate films

    - Establish testing protocols
- Evelyn Mikkelson
    - Look into drying and crosslinking methods to make gelatin stronger
    - Research gelation in varying ratios of gelatin and water
    - Research ways to reduce hardness of crosslinked sodium alginate
- Mariah Smeeding
    - Continue film fabrication
    - Research more degradable material options
    - Research degradable testing options we can implement
- Yeanne Hwang
    - Fabricate films with different ratios of materials
    - Research PVA film 3D print
    - Research recipe for gelatin with amining mechanical characteristics

Timeline

Task	Jan	Feb				March					April				May	
	24	1	8	15	22	1	8	15	22	29	5	12	19	26	3	10
Project R&D																
Empathize	X	X	X													
Background	X	X	X	X	X	X	X									
Material Fabrication							X	X	X							
Mold Fabrication							X	X								
Prototyping				X	X	X	X	X	X							
Testings																
Deliverables																
Progress Reports	X	X	X	X	X	X	X	X	X							
Prelim presentation				X												
Show and Tell																
Final Poster																
Meetings																
Client		X		X		X										
Advisor	X	X	X	X	X	X	X	X	X							
Website																
Update	X	X	X	X	X	X	X	X	X							

Filled boxes = projected timeline
X = task was worked on or completed

Previous week's goals and accomplishments

- Individual:

    - Evelyn Mikkelson
        - Got feedback at show and tell and researched suggestions
        - Continued prototyping with the team
    - Simon Fetherston
        - Continued to prototype films
        - Used feedback from show and tell to brainstorm ideas of how to use different materials
    - Mariah Smeeding
        - Continue to fabricate gelatin films, using different amounts of gelatin
        - Take inspiration from show and tell and research PVA 3D printed films
        - Speak with Joshua Brockman about degradable material options
    - Yeanne Hwang
        - Prototype films
        - Take feedback from show and tell and research suggested improvements/materials
- Team :
    - Completed engineering ethics activity and discussed how it should be considered in the scope of the project
    - Continued to prototype biomaterial
    - Created a negative pressure sponge and tube assembly using a suture.

Activities

Name	Date	Activity	Time (h)	Week Total (h)	Sem. Total (h)
Evelyn M	03/23/2026 03/26/2026	Research show and tell suggestions Research gelatin crosslinking	1 1	2	26.5
Simon F	03/25/2026 03/25/2026	Film fabrication Work on engineering ethics activity	1 0.5	1 1.5	29
Yeanne H	03/25/2026 03/23/2026	Prototype films Take feedback from show and tell and research suggested improvements/materials	1 1	2	28
Mariah S	03/25/2026	Film fabrication and engineering ethics	2	2	26.6