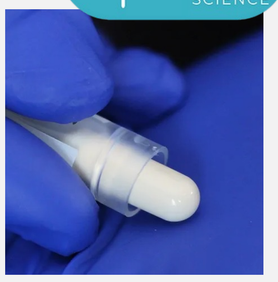
PASSIVE AUTONOMOUS INTESTINAL MUCOSAL – TARGETING CAPSULE
Sponsor: Nimble Science

Meet the Team

Joseph Cline: Communications Lead
Nicole Linares: Project Manager
Graciela Moscoso: CAD Lead
Grace Mutasingwa: Materials Research Lead
Sanjana Robinson: Prototyping and Testing Lead

Nimble Science and the SIMBA Platform



SIMBA Capsule

Small **I**ntestine **M**icro-**B**iome **A**spiration

A small, ingestible capsule that transits the GI tract and passively samples luminal fluid from the small intestine.

Our Goals

Project Statement: Expand on the current SIMBA M01 platform using the design process to develop and integrate a sampling system that passively samples the mucosal layer of the small intestine. This would increase the quality of the sample, expanding the clinical and R&D capabilities of Nimble Science's SIMBA capsule.

User Needs	Functional Requirements
• Material is safe and does not cause any adverse reactions • Capsule is easy to use/swallow • Consistent and reliable sampling	• Dissolution mechanism is reliable and consistent • Effective self-closing mechanism that activates after sample collection • Able to contact mucosal layer and collect sample

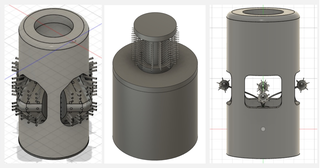
Biodesign Process

Initial Risk Analysis — Identified potential **hazards** and estimated associated **risks** to understand the limitations of our device.

User Needs and Functional Requirements — Defined the requirements of both the **end users** of the device and our **sponsor**.

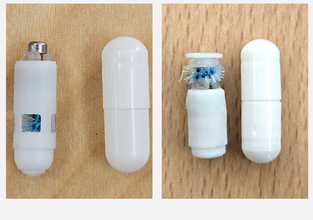
Brainstorming and Decision Matrix — Generated **20 design ideas** in a brainstorming session and evaluated them against predefined design criteria.

Conceptual Designs



Iterative Prototyping

Final Prototypes



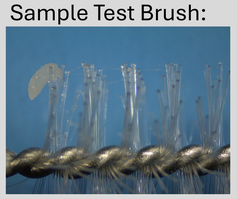
Verification and Validation Testing — Mucous sampling and closure tests completed to confirm efficacy and reliability through multiple testing protocols.

Prototype Testing

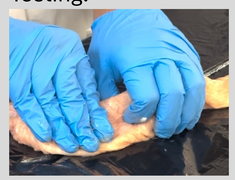
Mucous Test

Porcine Small Intestine:

Sample Test Brush:



Testing:



Internal Design:

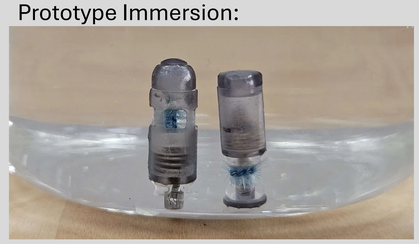
Collected 125mg of mucous

External Design:

Collected 16.1mg of mucous

Closure Test

Prototype Immersion:



Internal Design:

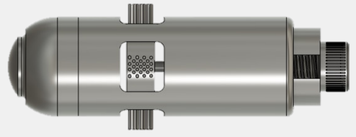
Successful closure

External Design:

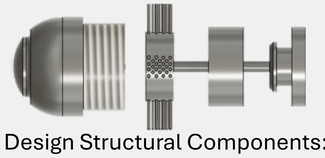
Unsuccessful closure

Final Design: Internal Brush

Internal Design Assembly:



Internal Design Sealing/Sampling Components:



Internal Design Structural Components:

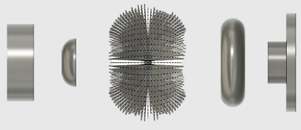
Internal Design Internal Components:

This design uses an internally housed bush which extends from the ports of the capsule body to sample mucous. The latch dissolves when exposed to moisture, allowing the sealing components and brush to lower. This seals the sample in the twist cap.

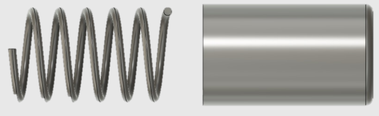
External Brush Design

External Design Assembly:

External Design Sealing/Sampling Components:



External Design Structural Components:



External Design Internal Components:

This design uses an externally located brush at the top of the capsule body to sample mucous. The latch dissolves when exposed to moisture, allowing the brush to enter the capsule and the sealing components to lower. This seals the sample in the capsule body.

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