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

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.

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

SIMBA Capsule
Small Intestine Micro-Biome Aspiration
A small, ingestible capsule that transits the GI tract and passively samples luminal fluid from the small intestine.

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.

Mucous Test
Porcine Small Intestine:
Sample Test Brush:
Testing:

Internal Design:
External Design:
Collected 125mg of mucous
Collected 16.1mg of mucous
Successful closure
Unsuccessful closure

Prototype Testing

Internal Design: External Design:

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 brush to enter the capsule and the sealing components 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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