Synthetic Tissue Phantom

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Problem and Market Gap

Our teams mission is to enhance current testing mediums to improve consistency and veracity of results to improve patient and researcher safety.

Fig 2. Bard Marquee Device

In order to test the validity of core needle biopsies (CNBs), certain animal tissues such as pork shoulder, kidney, and connective tissue are being utilized as testing mediums. The use of these tissues has caused certain issues in the lab and with testing results such as:

- tissue degradation
- unpleasant working conditions (foul smell)
- poor sample consistency.

Our aim is to quantify the physiological/mechanical properties of animal tissue in order to design a synthetic tissue phantom to validate CNB devices.

Market Analysis

Our device lies within the biopsy devices Space. This market demonstrates growth and shows the growing need in the market for a proper testing medium.

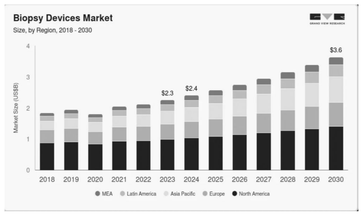


Fig 2. Market estimations of biopsy devices by Region [1]

<u>Market Breakdown</u>

- Global Biopsy device Market (2024) : USD 2.25 B [2]
- Biopsy Device CAGR (2024-2030) : 7.2% [2]
- CNB Market Projection (2030) : 1.15 B [1]
- CNB market projection: 4.7% [1]

<u>Target market breakdown</u>

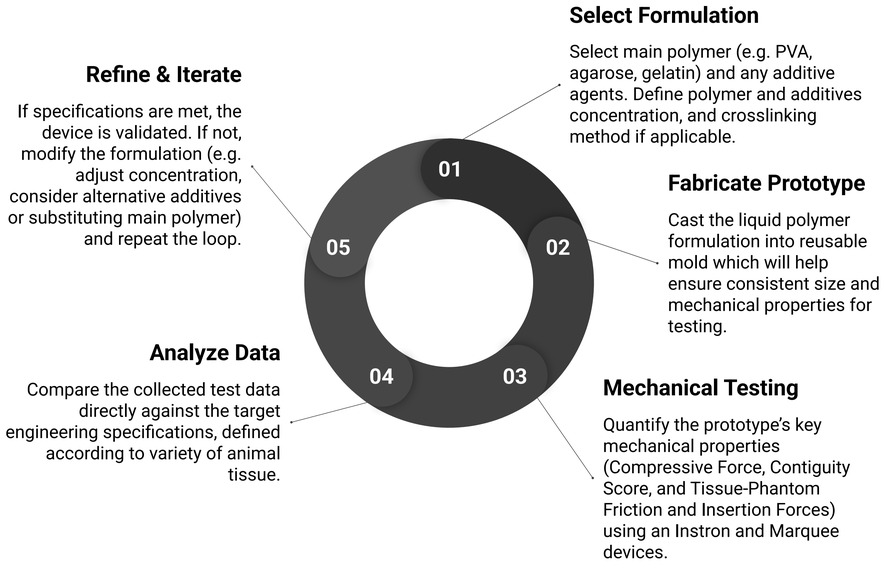
- North America biopsy device market represented 43.1% of 2023 global revenue [2]
- U.S represents 34.6% of global revenue CNB
- North America market represented 46.26% of 2024 global revenue [1]

Specifications and Design Input

Customer Needs	Specifications	Metrics
Material Properties	Compressive Force Elasticity CNB Resistance Force Shear Deformation Penetration Force	2-10 N 40-50 kPa 2.1-2.34 N 2.5 kPa 2.82 N
Longevity/Shelf Life	Time (Months)	3+ Months
Safe/Non-reactive	Hazard Level	0/1
Uniformity	Coefficient of Variation	0 ± 10 %
Similar Scoring	Contiguity Score	Average score of 2+

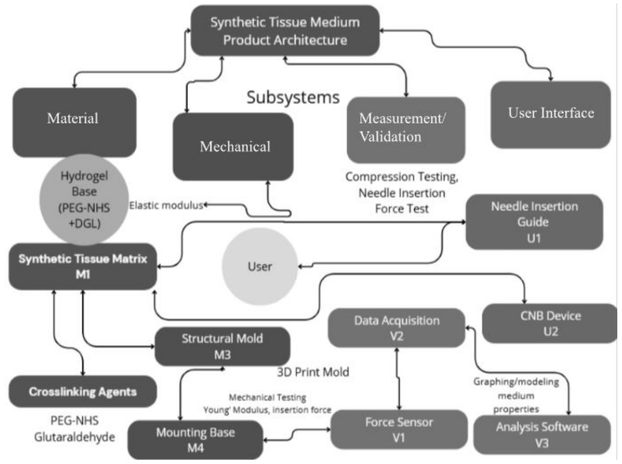
To translate our project goals into measurable engineering targets, we used a House of Quality (HoQ). This process allowed us to identify the most critical customer needs, including **consistency**, **realistic mechanical feedback**, and **low cost**, and link them directly to the engineering specifications shown in the above table. Our analysis confirmed that **Compressive Force**, **Contiguity Score**, and Tissue-Phantom **Friction** and **Insertion Forces** are the key metrics we must match to create a successful phantom.

Prototyping



Project Concept and Architecture

The selected concept is a mold-formed single compound polymer developed to mimic and replace the current animal tissue used. The phantom consists of a single polymer material mixed with a suitable binder casted into a reusable mold for consistent shape and composition. Potential polymer options include ballistic gelatin, alginate hydrogel, silicone, fibrin, or poly(vinyl alcohol) cryogels (PVA-C).



Future Directions

Our next steps are to begin testing the properties of current market solutions and doing deep research of chemical databases to find potential solutions that may match.

These steps will include, designing of testing devices, testing of mediums, acquisition of synthetic material properties, and testing of obtained synthetic mediums.

Acknowledgements

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References

[1] "Breast Cancer Core Needle Biopsy Market Size Report, 2030." Accessed: Sept. 25, 2025. [Online]. Available: https://www.grandviewresearch.com/industry-analysis/breast-cancer-core-needle-biopsy-market-report
[2] "Biopsy Devices Market Size & Share| Industry Report, 2030." Accessed: Sept. 25, 2025. [Online]. Available: https://www.grandviewresearch.com/industry-analysis/biopsy-devices-industry