



Allerjif: Low-Cost Food Allergy Lateral Flow Assay

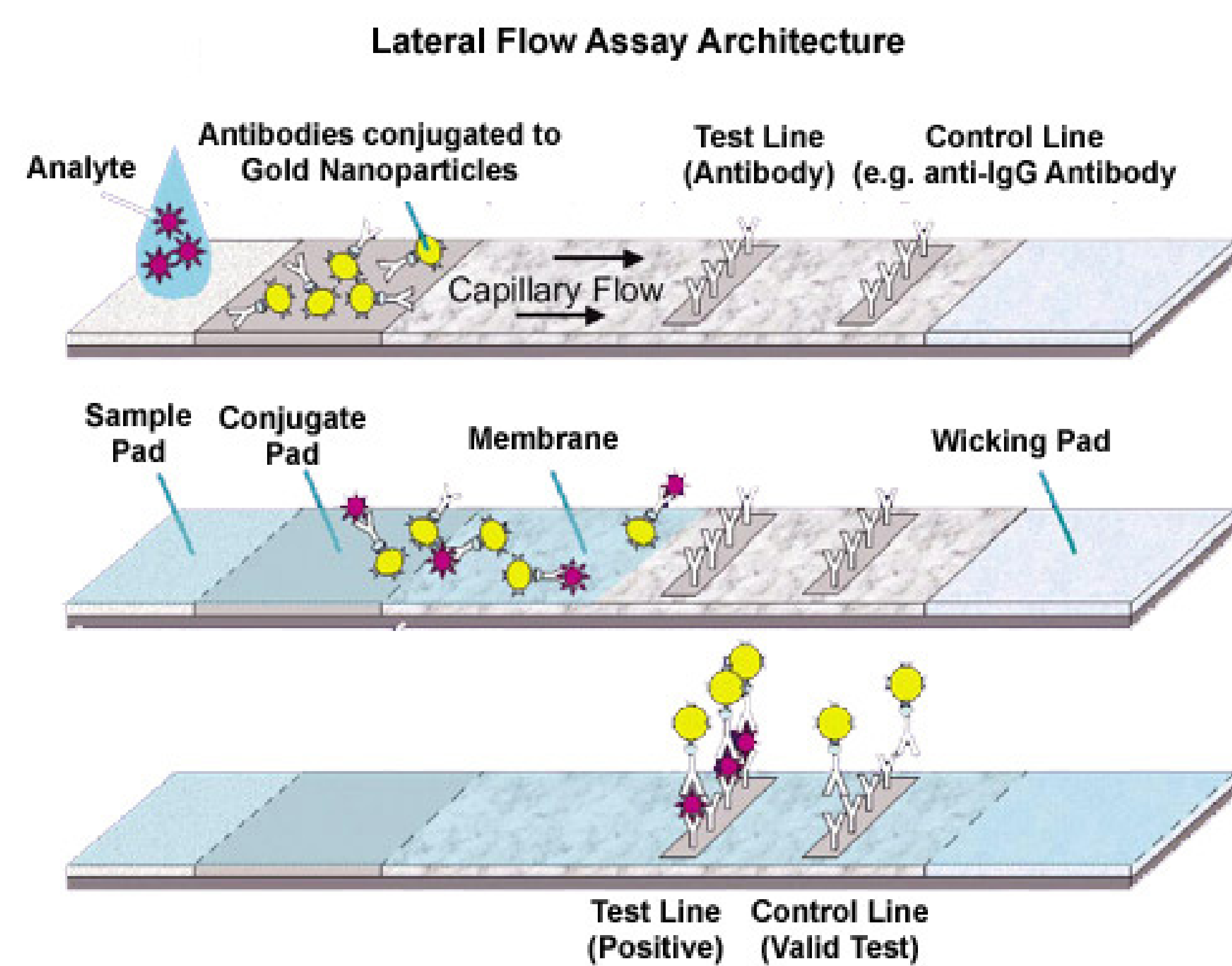
Motivation



1. Food allergies afflict more than 13 million Americans.
2. Costs total nearly \$25 billion per year.
3. Eight foods account for 90% of all food allergen reactions.
4. A disposable, handheld, accessible, single-allergen detector delivering results in less than 15 min is a missing key product from the current market space.
5. We have created a device of this kind, specifically a peanut-allergen detector as a proof of concept.

Background

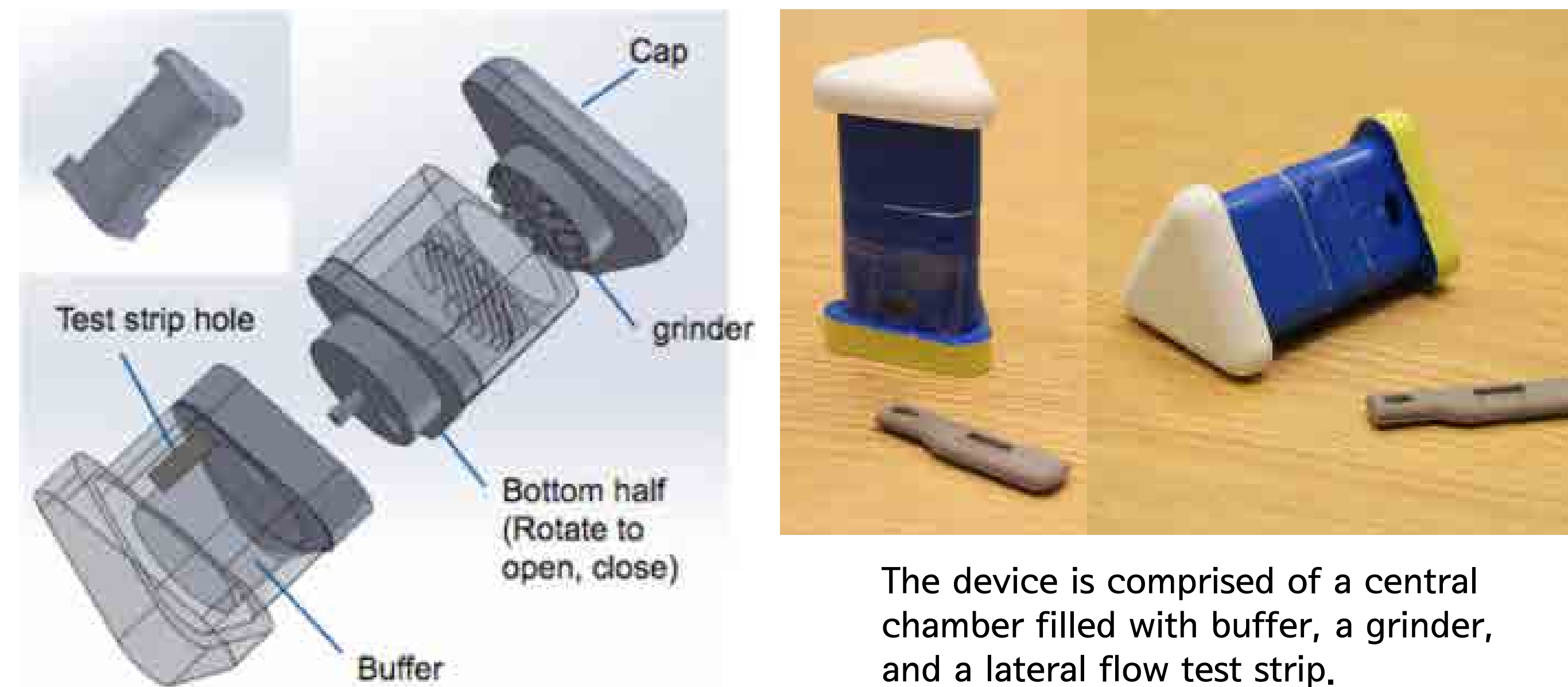
The Allerjif device works using the same testing mechanism as pregnancy tests, the lateral flow assay.



<http://www.cytodiagnosics.com/store/pc/Lateral-Flow-Immunoassays-d6.htm>

1. An analyte of interest (in this case the peanut allergen) is applied to a porous membrane
2. The analyte binds to a corresponding antibody attached to a visible marker (gold nanoparticle, colored dye, etc)
3. The antibody/analyte complex flows through the membrane and binds to a "Positive" test line
4. Unbound antibody/marker complexes will continue to flow and bind to a "Control" line of antibodies as a viability check
5. If both the "Positive" and "Control" lines are visible, the analyte of interest exists in the test sample (Food being tested)

Prototype



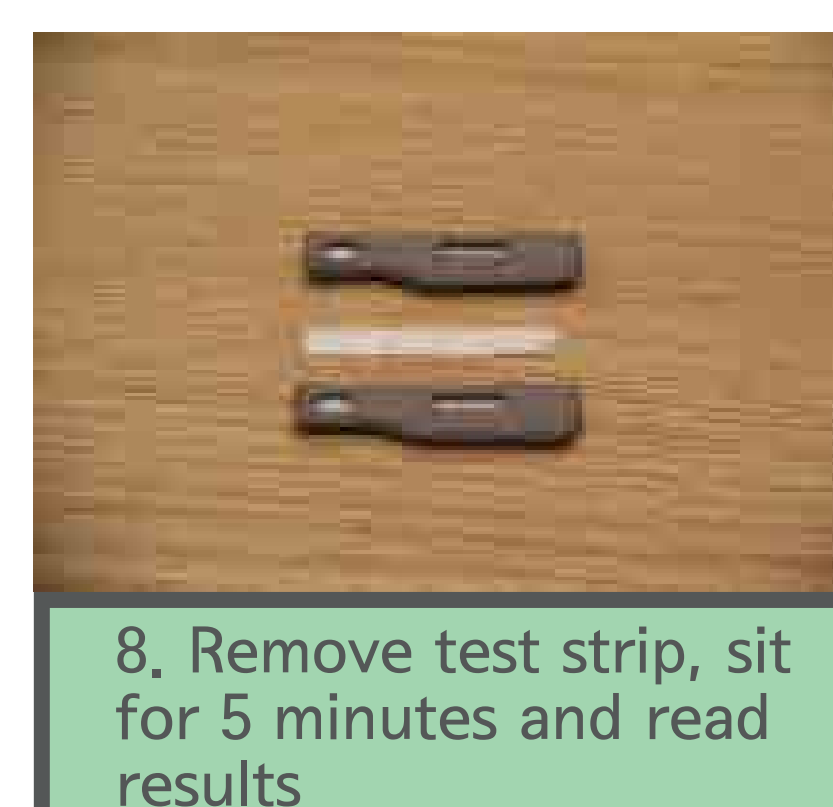
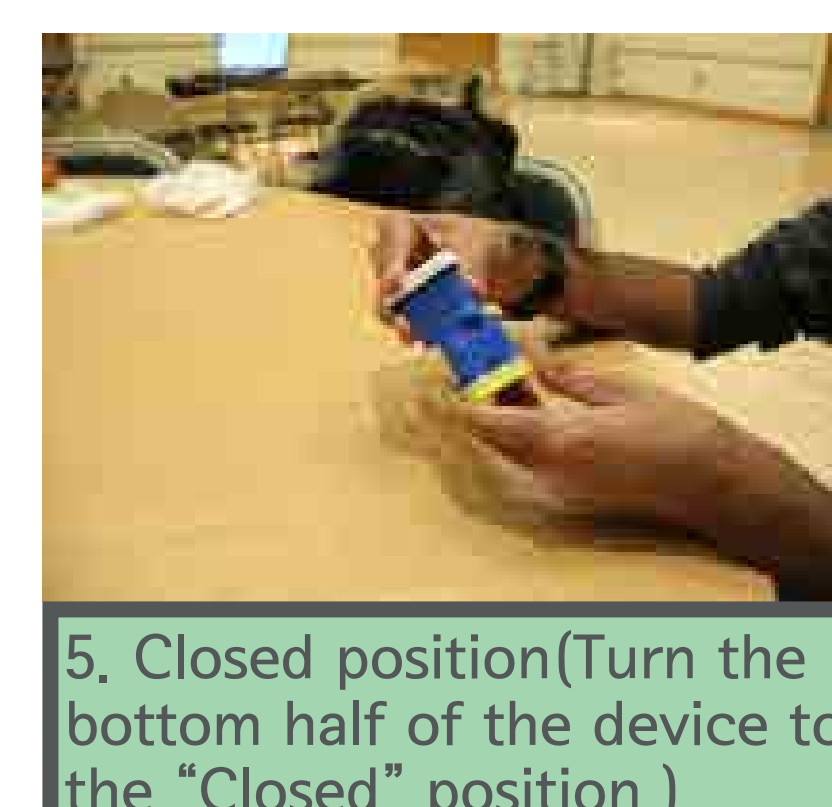
The device is comprised of a central chamber filled with buffer, a grinder, and a lateral flow test strip.



The grinder will maximize the surface area of the food to help the buffer adsorb potential allergens.

After the buffer has been exposed to the food, the lateral flow test strip is inserted into the side of the device and will give the results of the test.

How it Works



Possible test strip results (There are 4 different possible outcomes, as shown from left to right: Negative, Positive, High Positive, and Invalid. Negative means that no peanuts exist in the food. Positive or High Positive means that there are peanuts in the food. Invalid (C line is not marked) means that the test must be completed again.)

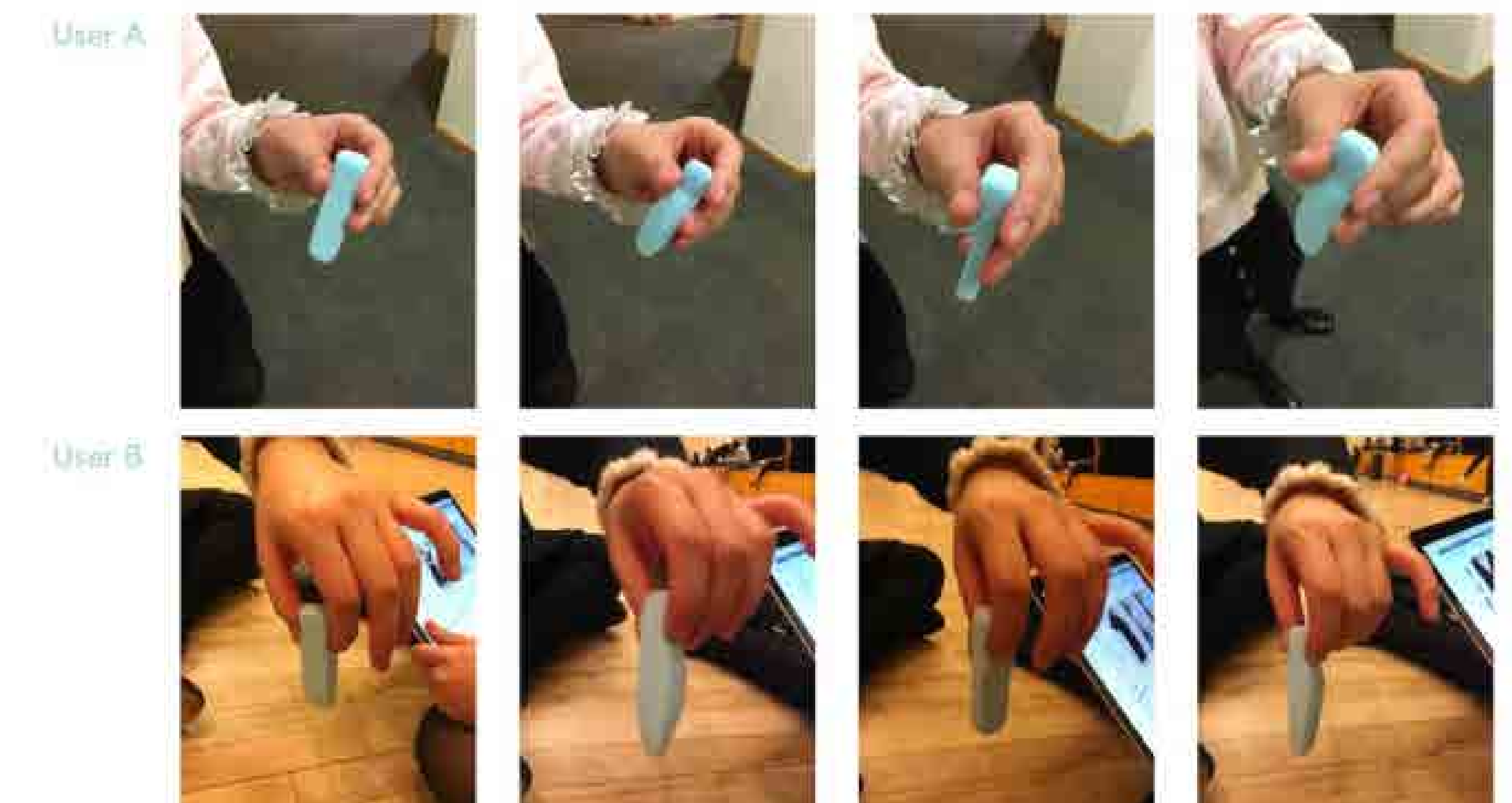
Results of Testing

Viability Tests

Test	Image of Result	Result
0% peanut		Negative
100% peanut		Positive
Primary Peanut based food (Ex: peanut butter/Nutter Butter)		Positive
Made with equipment exposed to peanuts products (almond from trail mix)		Positive
Testing in Thai Restaurant (Noodlehead)		Positive

User Tests

Ergonomics | 5 Adult Users | Orientation, comfort, accuracy



	Prototype 1	Prototype 2	Prototype 3	Prototype 4
User 1	Correct	Correct	Incorrect	Correct
User 2	Correct	Correct	Correct	Correct
User 3	Incorrect	Correct	Incorrect	Correct
User 4	Correct	Correct	Incorrect	Correct
User 5	Incorrect	Correct	Incorrect	Correct

Incorrect position (Red) Correct position (Green)



Interactive (Ergonomics)

Easy to carry (Size)

Aesthetics (Design)

Acknowledgements

Thank you to Dr. Conrad Zapanta, Dr. Jerald Redmond, Medtronic Incorporated, Bruce Che, the Carnegie Mellon Small Undergraduate Research Grant (SURG) program, and the Carnegie Mellon Biomedical Engineering Department for supporting this project.