



# Increased Flow Breast Pump

## Preliminary Presentation

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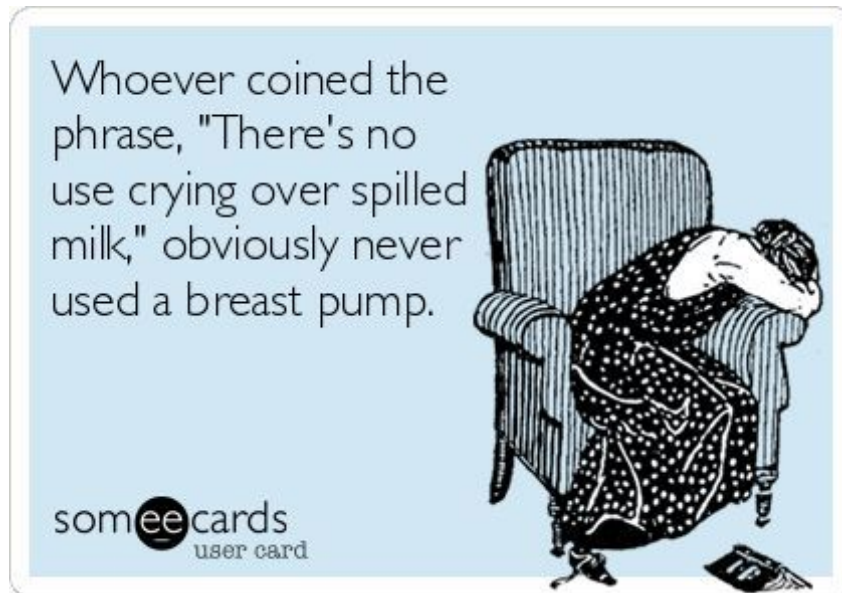
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# Overview

Problem Statement  
Background Information  
Design Specifications  
Design Alternatives  
Design Matrix  
Future Work



(5) <http://www.someecards.com/usercards/unsubmitted/MjAxMy0wNTE3ZW11NjBIZDFiNDZh>



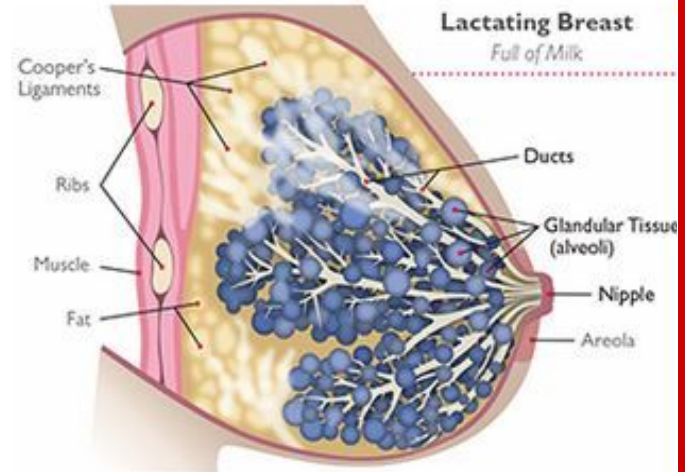


# Problem Statement

Many working women use breast pumps to obtain milk for their baby to be used later when they are unavailable. Present breast pumps use periodic suction to induce the expression of milk. However, in addition to sucking, babies use their tongue to massage the nipple to increase flow. We will be designing a breast pump that mimics the action of a human baby by massaging the nipple to increase flow.

# Physiological Background

- Estrogen and progesterone increase the size of number of milk ducts, allowing for better milk flow<sup>8</sup>
- Prolactin signals for milk to be made and stored in the alveoli<sup>8</sup>
- Oxytocin activates the milk ejection reflex, known as let down<sup>8</sup>
- The baby uses its tongue to compress the nipple against the hard palate<sup>8</sup>



(9) <http://www.ameda.com/breastfeeding/anatomy-physiology>





# Motivation

The breast pump market is rapidly expanding<sup>4</sup>

Breast pumping can be painful

There is a need to promote conditioning and letdown response

# Competing Designs

## Medela Freestyle

- Light and portable
- “2-Phase Expression” offers a faster initial pumping speed
- slower let-down phase
- This product costs \$399.99<sup>3</sup>

## NUK Double Electric Breast Pump

- Portable system with silicone breast shields
- Multi-phase settings and memory to store them.
- This product costs \$204.99<sup>2</sup>

## Philips Avent Comfort Double Electric

- Gentle stimulation mode that simulates a baby
- cyclic pressure changes in 5 circles around the breast shield
- This product is \$199.99<sup>1</sup>



(1) <http://www.usa.philips.com>



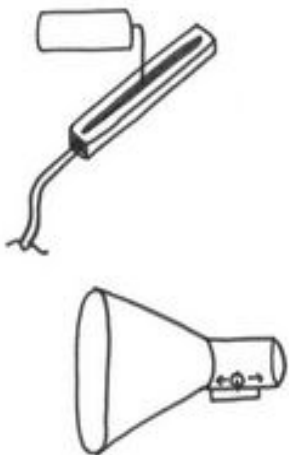
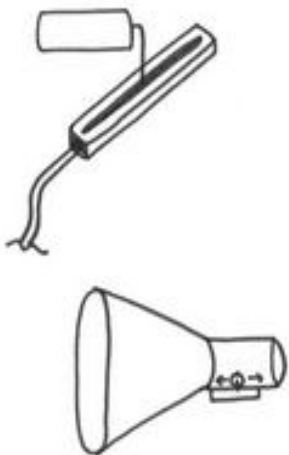
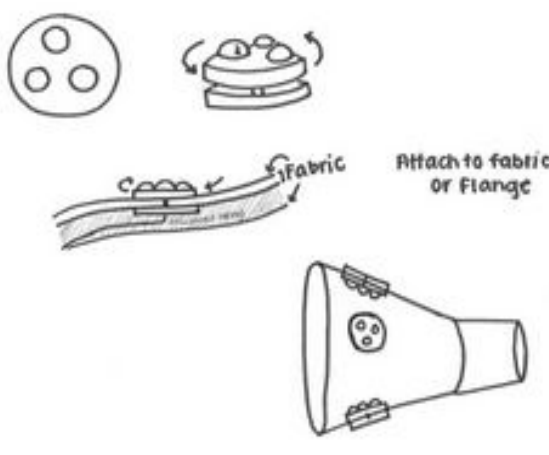
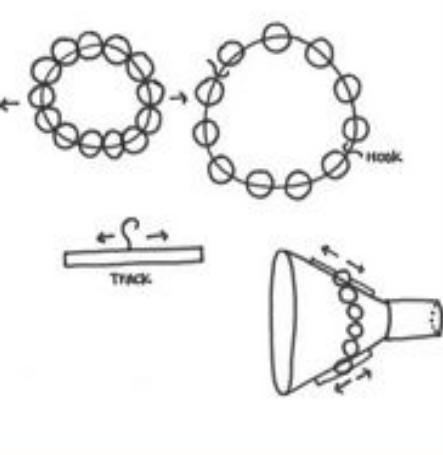


# Design Specifications

- Faster and more efficient
- Massage or stimulation to increase flow
- Does not harm the breast.
- Stimulation - infant tongue massaging
- Portable for use at home or in an office
- Comfortable to wear and use
- Maintain its durability
- 24mm and 27mm are standard size
- Weigh between 7 and 9 pounds - including pump

Budget of \$100

Prof. Rogers lent a Medela Breast Pump

| Design   | Paint Roller   |           | Massage Chair   |           | Bead Bracelet  |           |
|--|--|-----------|---|-----------|--|-----------|
|  |  |           |  |           |  |           |
| Criteria (Weight)  |  |           |   |           |  |           |
| Comfort (25)   | 3/5  | 15        | 4/5   | 20        | 5/5  | 25        |
| Milkability (20)   | 5/5  | 20        | 2/5   | 8         | 3/5  | 12        |
| Ergonomics(15)   | 2/5  | 6         | 3/5   | 9         | 5/5  | 15        |
| Safety (15)  | 4/5  | 12        | 5/5   | 15        | 5/5  | 15        |
| Weight/Bulk (10)   | 4/5  | 8         | 3/5   | 6         | 4/5  | 8         |
| Cost (5)   | 3/5  | 3         | 1/5   | 1         | 4/5  | 4         |
| Ease of Fabrication (5)  | 2/5  | 2         | 2/5   | 2         | 3/5  | 3         |
| Durability (5)   | 3/5  | 3         | 5/5   | 5         | 4/5  | 4         |
| <b>Total (100)</b>   |  | <b>69</b> |   | <b>66</b> |  | <b>86</b> |



# Paint Roller

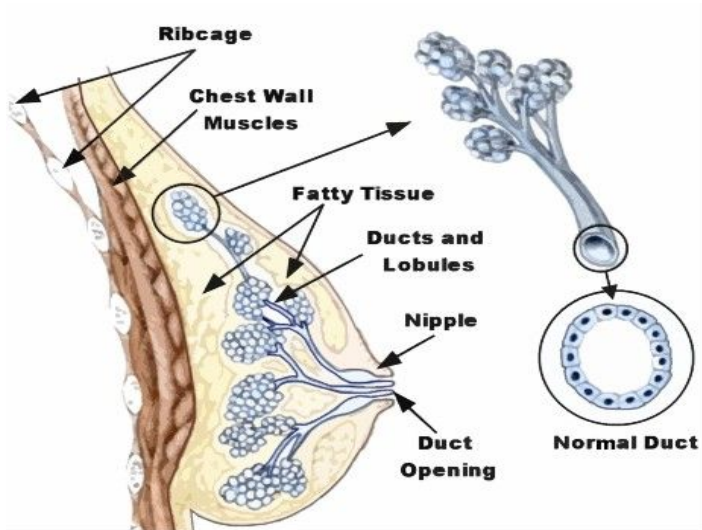
- Stimulates nipple by mimicking tongue
- Mechanical movement along track
- Slight hindrance of milk flow
- Friction



| Design                  | Paint Roller |           |
|-------------------------|--------------|-----------|
|                         |              |           |
| Criteria (Weight)       |              |           |
| Comfort (25)            | 3/5          | 15        |
| Milkability (20)        | 5/5          | 20        |
| Ergonomics(15)          | 2/5          | 6         |
| Safety (15)             | 4/5          | 12        |
| Weight/Bulk (10)        | 4/5          | 8         |
| Cost (5)                | 3/5          | 3         |
| Ease of Fabrication (5) | 2/5          | 2         |
| Durability (5)          | 3/5          | 3         |
| <b>Total (100)</b>      |              | <b>69</b> |

# Massage Chair

- Stimulates milk ducts
- Reduced friction

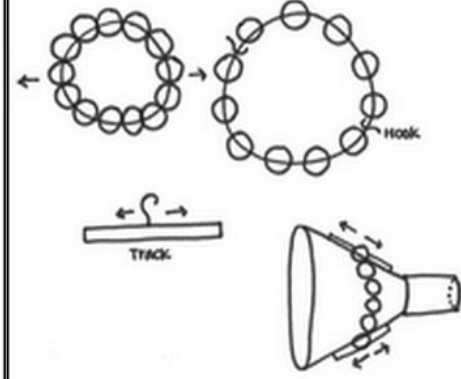


(7) <http://www.canfightcancer.com>

| Design                  | Massage Chair |           |
|-------------------------|---------------|-----------|
|                         |               |           |
| Criteria (Weight)       |               |           |
| Comfort (25)            | 4/5           | 20        |
| Milkability (20)        | 2/5           | 8         |
| Ergonomics(15)          | 3/5           | 9         |
| Safety (15)             | 5/5           | 15        |
| Weight/Bulk (10)        | 3/5           | 6         |
| Cost (5)                | 1/5           | 1         |
| Ease of Fabrication (5) | 2/5           | 2         |
| Durability (5)          | 5/5           | 5         |
| <b>Total (100)</b>      |               | <b>66</b> |

# Bead Bracelet

- Silicone breast shield
- Motor controls mechanical movement of beads along the outside of the shield
- Compatible with a heating element

| Design                  | Bead Bracelet   |           |
|-------------------------|---|-----------|
|                         |  |           |
| Criteria (Weight)       |   |           |
| Comfort (25)            | 5/5   | 25        |
| Milkability (20)        | 3/5   | 12        |
| Ergonomics(15)          | 5/5   | 15        |
| Safety (15)             | 5/5   | 15        |
| Weight/Bulk (10)        | 4/5   | 8         |
| Cost (5)                | 4/5   | 4         |
| Ease of Fabrication (5) | 3/5   | 3         |
| Durability (5)          | 4/5   | 4         |
| <b>Total (100)</b>      |   | <b>86</b> |



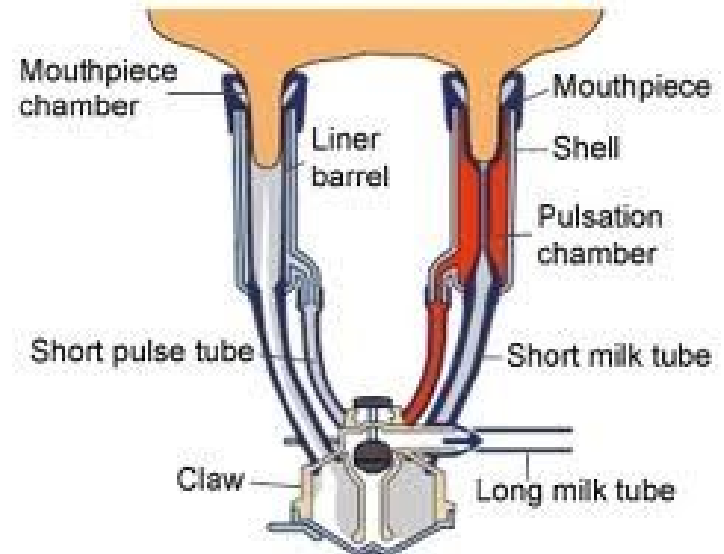
# Future Work

Advice from Prof. Paul Thompson about the dairy industry

- Compression & suction
- Role of oxytocin and conditioning
- Two layers

Continue developing design alternatives

- Heating element
- Hands-free holder
- Discrete bottle belt



(6) <http://www.dairynz.co.nz/milking/in-the-dairy/milking-tasks/milk-let-down/>

# Acknowledgements

Prof. John Webster

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Prof. Paul Thompson

Sharon Marshall

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