Biomimicry: Streamlining the Front End of Innovation for Environmentally Sustainable Products

IRI Webinar
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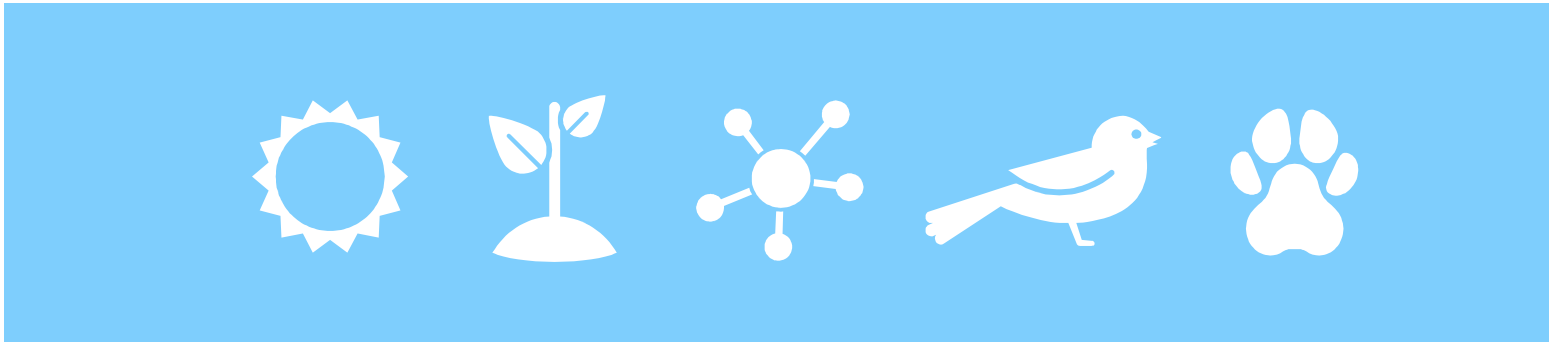
Environmental Sustainability

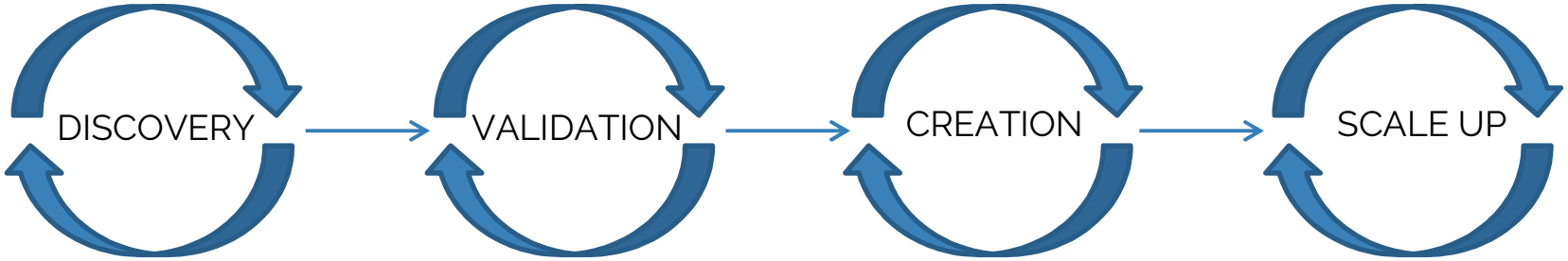
- increases competitive advantage
- generates business value
- enhances customer relations

For more information about GOJO sustainability visit http://www.gojo.com/en/Sustainability



Eco-design Tools

- conventional tools used to validate vs. generate
- need front end, solution discovery tool



Simplified illustration of the NPD Process*

*Blank, Steve, and Bob Dorf. 2012. *The Startup Owner's Manual: The Step-By-Step Guide for Building a Great Company*. K&S Ranch.

Biomimicry

Technical emulation of biological forms, processes, patterns, and systems

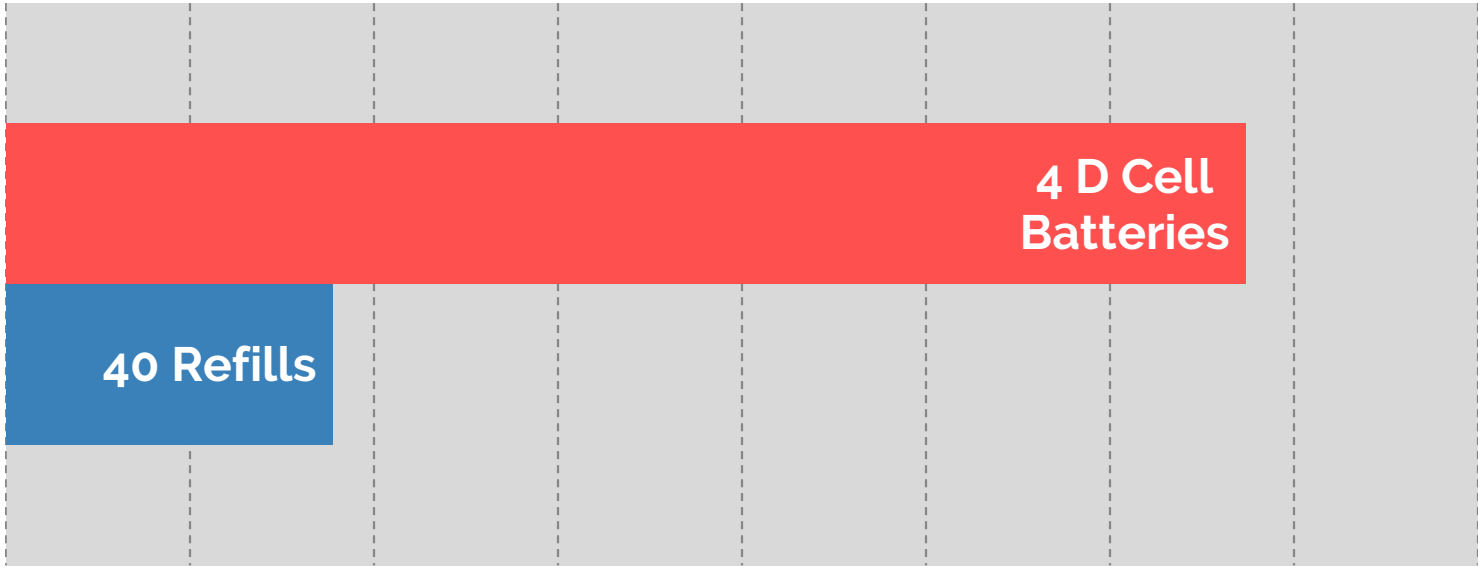
Biomimicry at GOJO

Touch-Free Soap and Sanitizer Dispensing

How

- Problem definition
- Function specfiication
- Biological model identification
- Design principle extraction
- Ideation

Problem Definition



[kg CO2-Equiv.]

Increase energy efficiency of touch-free dispensers

Function Specification

- Biomimicry Taxonomy*
  Get, Store, or Distribute Resources → Distribute → Distribute Fluid
- Engineering-to-Biology Thesaurus**
  Dispense = Excrete, Transfer

Desired function: Fluid distribution/transfer

*Sourced from The Biomimicry Institute's AskNature.org
**Nagel, J. K. S., R. B. Stone, and D. A. McAdams. 2010. "An Engineering-to-Biology Thesaurus for Engineering Design." In: 2010 ASME IDETC/CIE, Montreal, Quebec, Canada.

Biological Model Identification

How do biological systems distribute/transfer fluid?

Frame of Inquiry	Assumption
Similar context: What biological models exist in a context similar to the problem context?	Biological models inhabiting environments similar to the problem context will adopt strategies that may be relevant to the problem
Extremes: What biological models deal with extreme versions of the problem?	Biological models most challenged by the problem will embody the most robust strategies for addressing it.
Convergence: What biological strategy for accomplishing the function of interest is used by many, distantly related species?	A strategy independently evolved in different contexts is likely to be a beneficial approach.
Stasis: What biological strategy for accomplishing the function of interest has persisted over time?	A strategy that has been conserved through evolution is likely to be effective and difficult for competitors to defeat.

Biological Model Identification

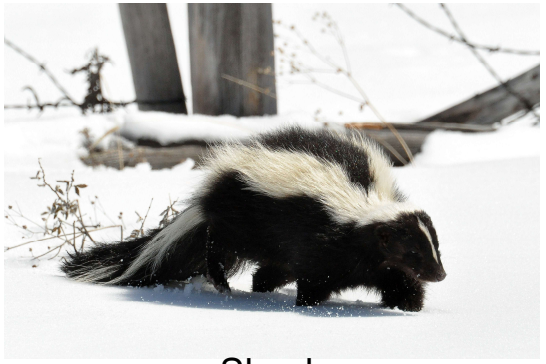
How do biological systems distribute/transfer fluid?

Spitting Cobra

Bladderwort

Squid

Xylem



Skunk

Rove Beetle

Design Principle Extraction

- Abstract representation of the biological strategy sans biological jargon
- Generalized to eliminate irrelevant specifics

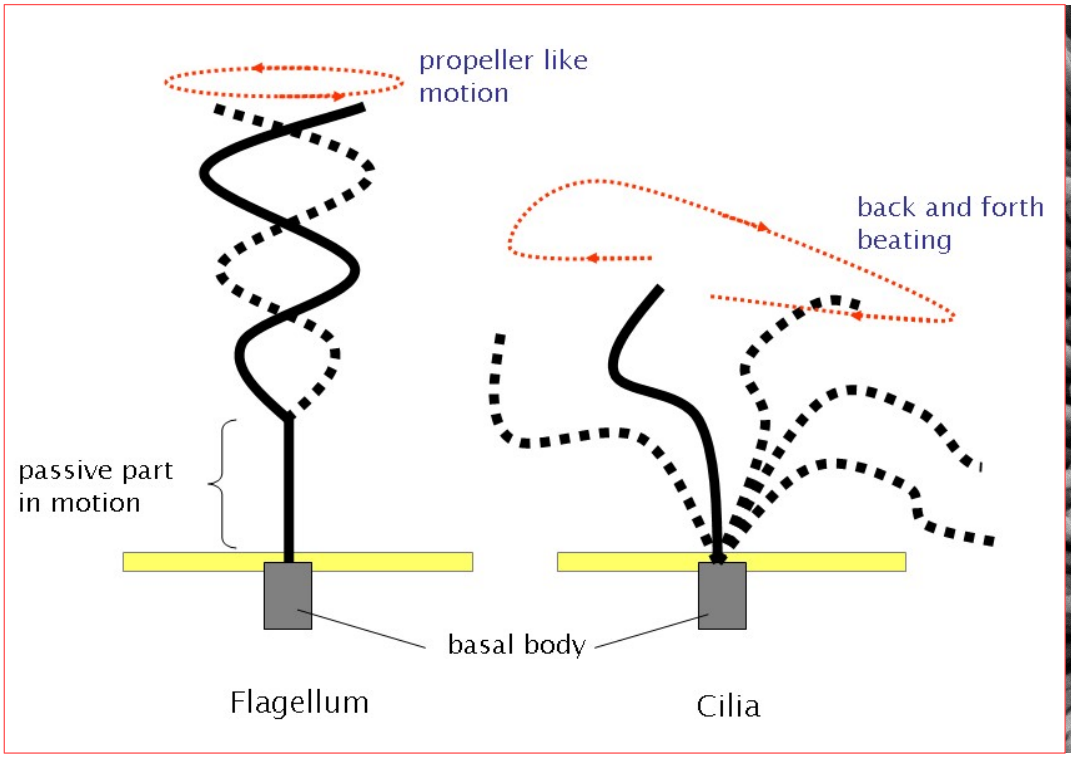
Fundamental hurdle in biomimicry

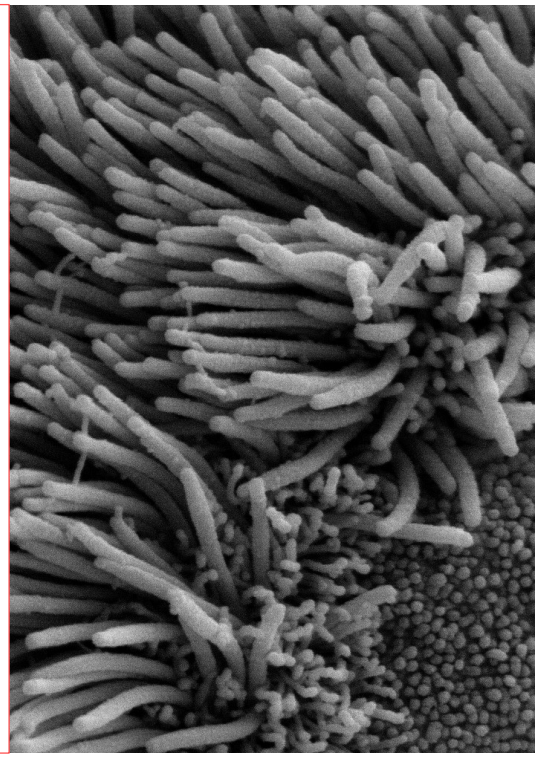
Archerfish

An elongated liquid that is in motion tends to amass and accelerate due to surface tension.

Cilia

A flexible appendage with optimized row stroke can produce a net propulsive force





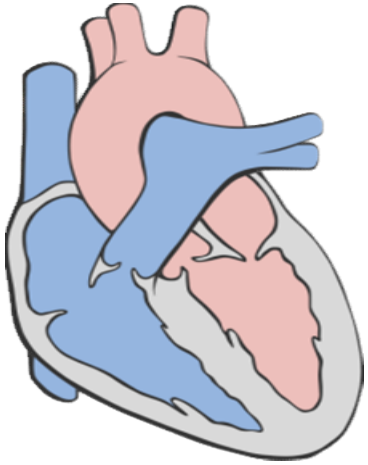
Pause

Any questions?

Ideation

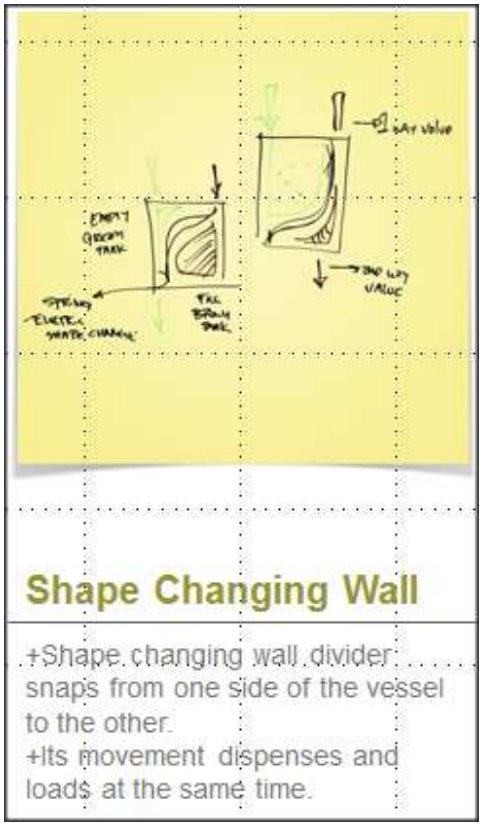
STIMULUS

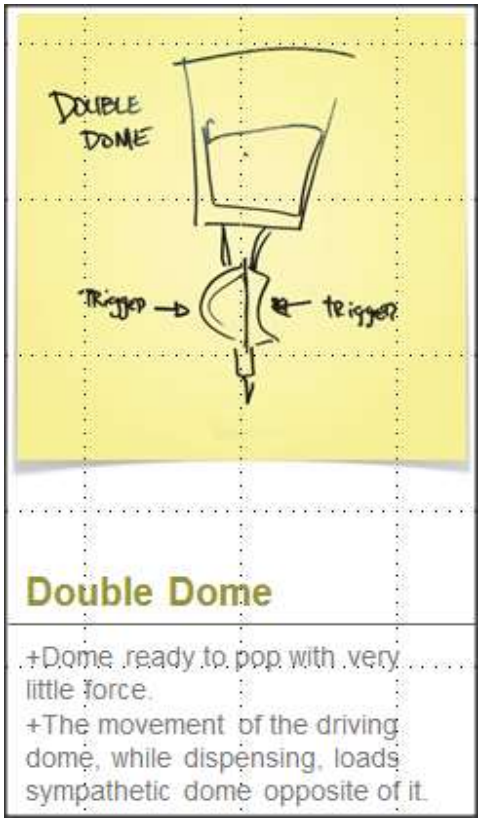
Human Heart



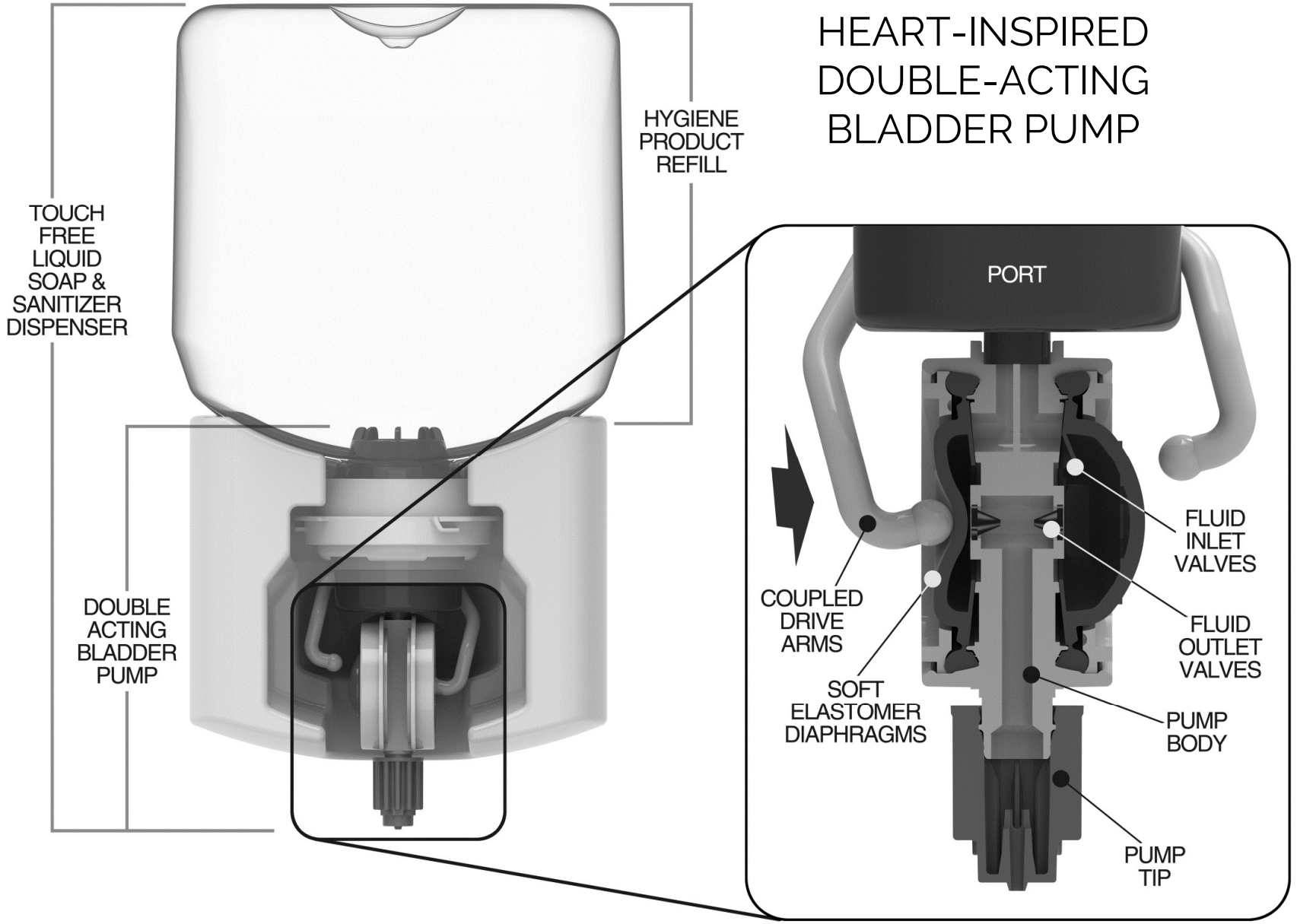
Multi-chambered pump with common walls

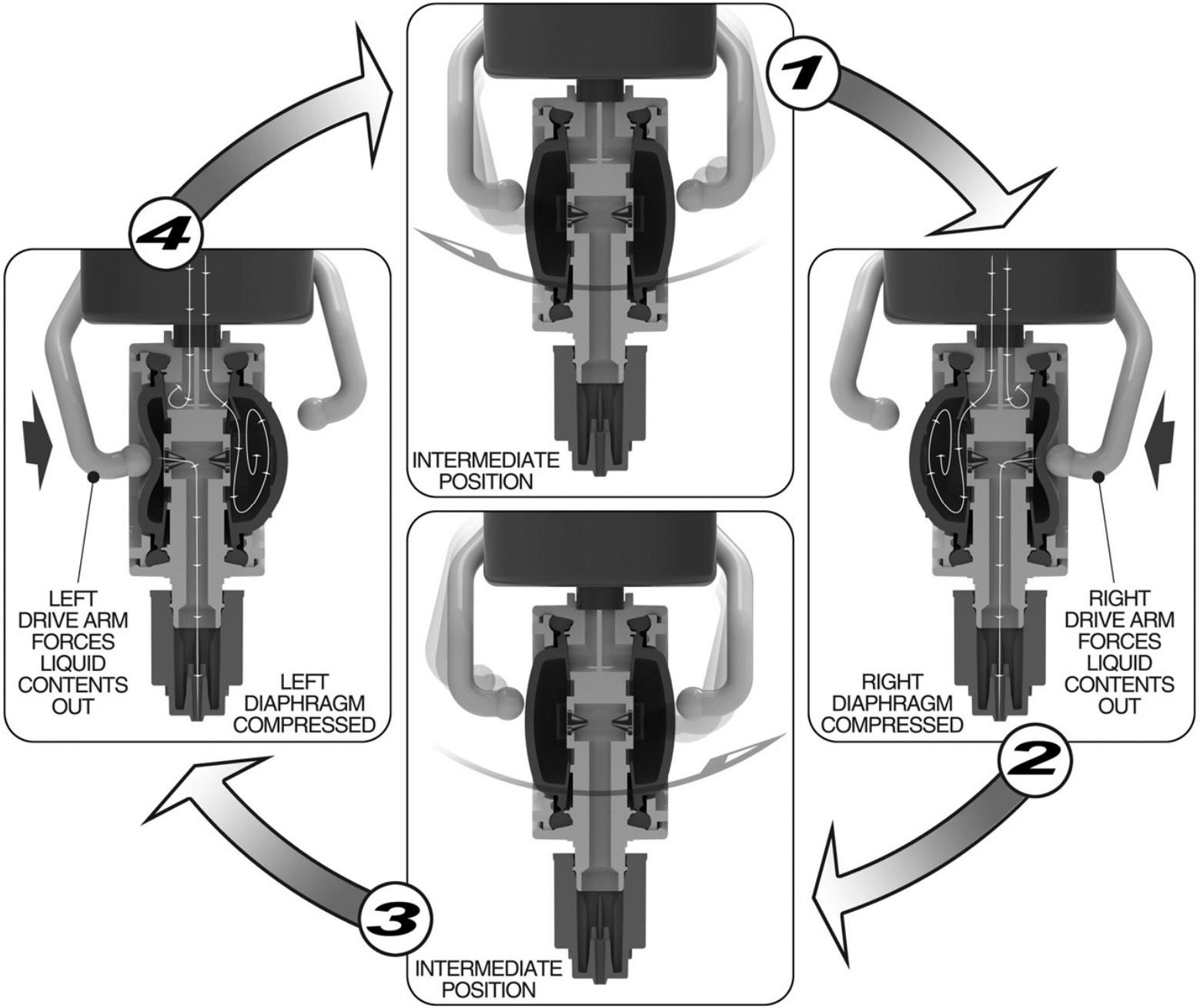
STARTER CONCEPTS





HEART-INSPIRED DOUBLE-ACTING BLADDER PUMP




1
INTERMEDIATE POSITION
2
RIGHT DRIVE ARM FORCES LIQUID CONTENTS OUT
RIGHT DIAPHRAGM COMPRESSED
3
INTERMEDIATE POSITION
4
LEFT DRIVE ARM FORCES LIQUID CONTENTS OUT
LEFT DIAPHRAGM COMPRESSED

1/6 the resources

Personnel and financial

2x intellectual property

Higher NOI to patent application conversion rate

2-4x energy savings

Biomimicry vs. Historical Projects

	Biomimicry Project	Historical Project
Man Hours	**285**	**1620**
Total Cost	**$23,000** *$13,000 Employee Time* *$10,000 Contracted Design Services*	**$129,000** *$100,000 Employee Time* *$29,000 Contracted Design Services*
Notices of Invention	**6**	**5**
Patent Applications	**4**	**2**
Lead Concept Energy Savings	**50%-80%***	**20%****

*engineering estimate
**prototype performance data

The stimuli were completely different and allowed for completely unique ideas rather than building upon prior art.

[Biomimicry] pushed us to look beyond the initial project scope and not just look at the pump technology but look at the overall system—the packaging, the actuation—in order to optimize the whole product. Looking at the overall system is something I've carried forward from that approach."

This is fun!

Recent Work

Biomimicry Open Innovation Experiment

GOJO

University Hospitals

NOTTINGHAM SPIRK
THE BUSINESS INNOVATION FIRM

Avon Lake Regional Water

SMUCKER'S

GREAT LAKES BIOMIMICRY

Lubrizol

Ongoing Research

- frames of inquiry
- industrial vs. biological analogies
- hedgehog spine impact mechanics

Thanks!

Any questions?

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