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# Micromachined, Hydrogel-driven, Glucose-sensitive Valve for Microfluidic Control of Insulin Delivery

University of Minnesota  
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# Insulin Pump: Need Statement

- Highly sensitive glucose sensor & insulin delivery system for Type 1 Diabetics
- Minimally-invasive and patient-friendly enough



# Current Glucose Evaluation



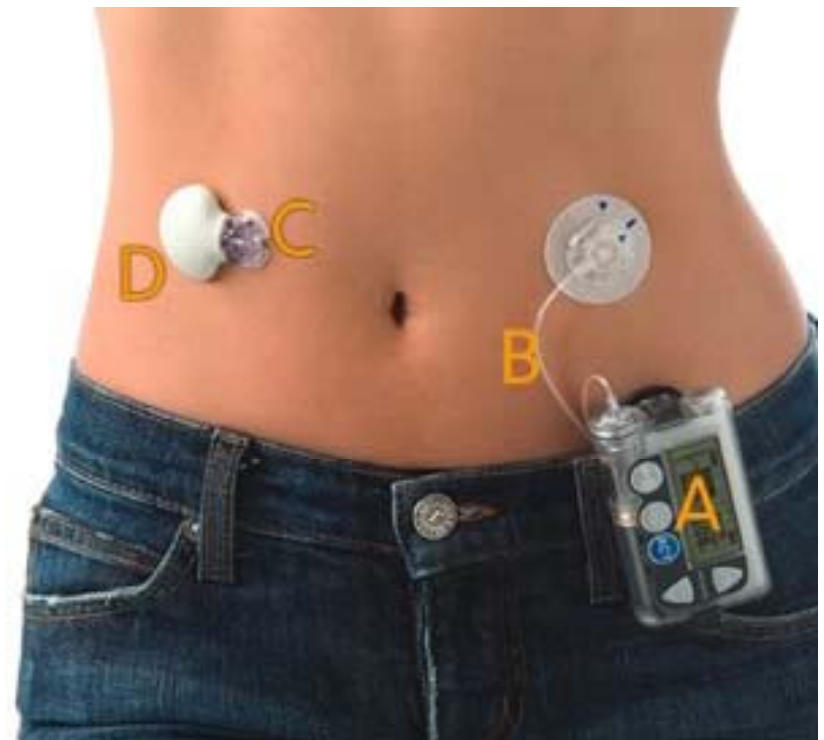


# Current Insulin Injection Systems

## Syringes or Cartridges



## External Pumps



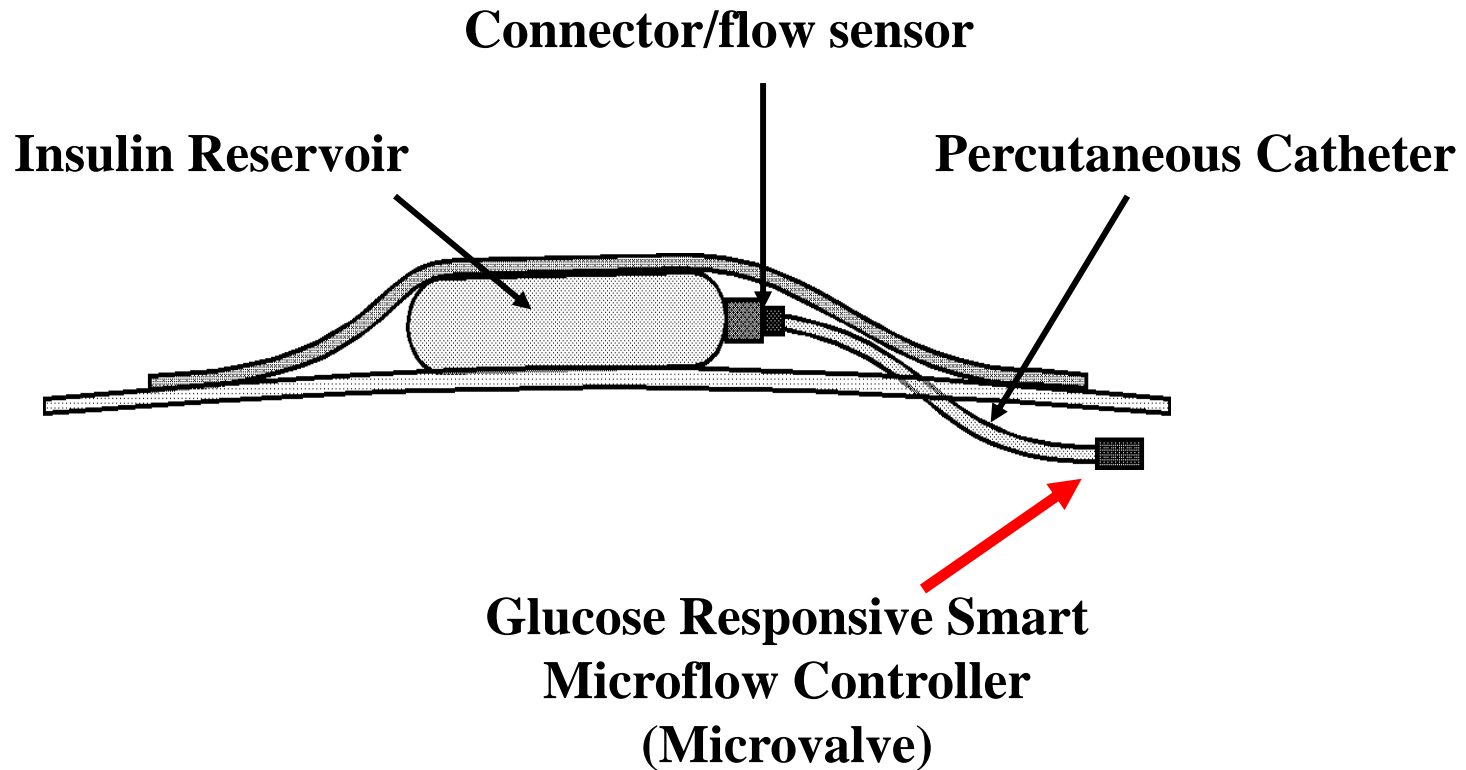


# Optimized Insulin Delivery System: Customer Requirements Specifications

- No finger pricks
- Accurate infusion volume & timing
- Function independent of patient
- High glucose sensor accuracy at low levels

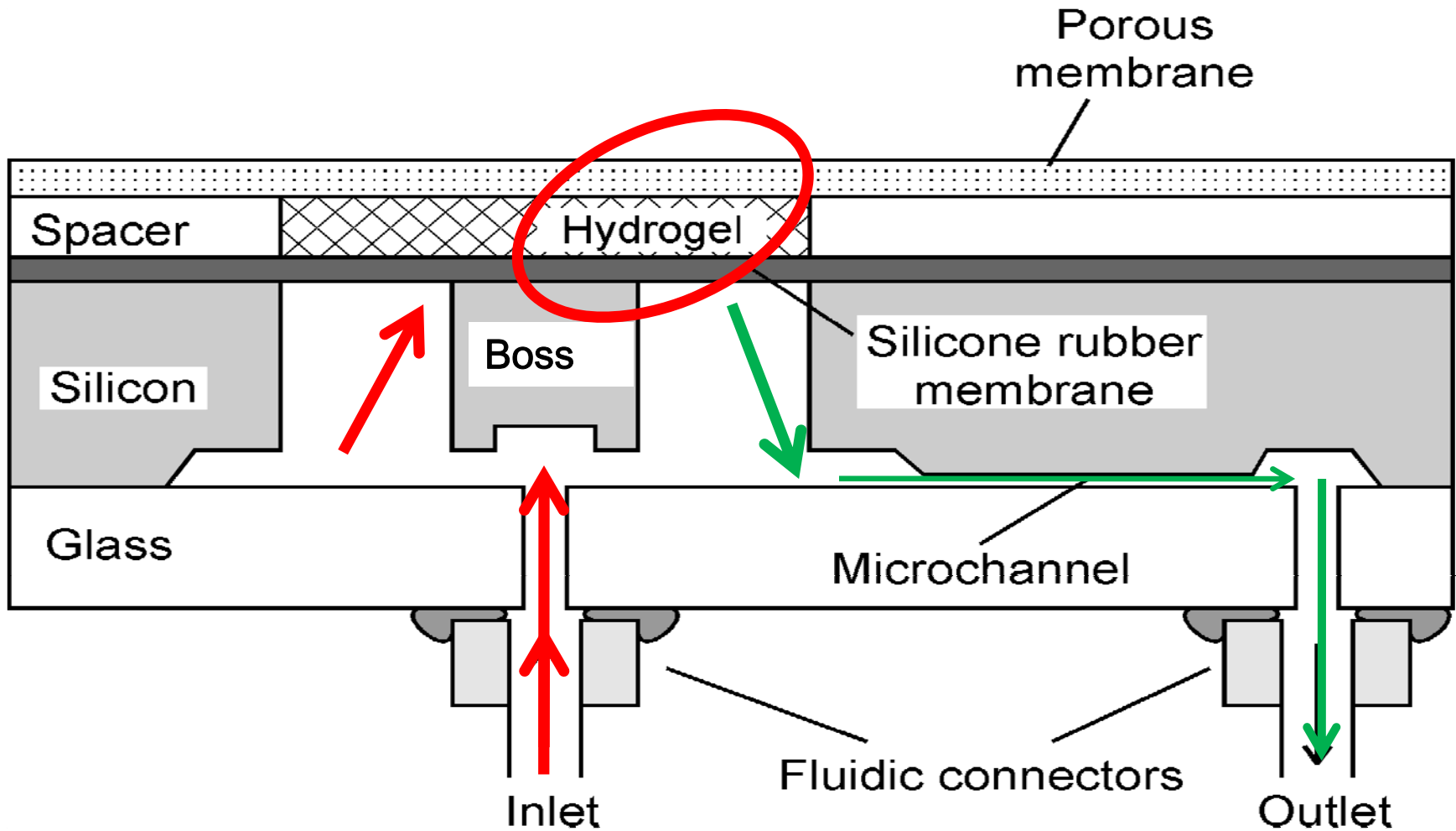


# Microfluidic Insulin Pump





# Microvalve Design Concept





# Features and Benefits

## Features

## Benefits

Fully-implantable automated system

- Removes dependence on patient judgement & skill

Automated, highly sensitive glucose sensor

- Eliminates daily blood draws
- Highly-accurate glucose levels

Glucose-sensitive membrane

- Just-in-time insulin delivery
- Accurate insulin infusion volumes

Chemically-responsive system with no moving parts & extremely low power needs

- Extended device lifetime
- Minimal need for interventions



# Value Proposition

Elimination of external parts, & automation of sensor & injector functions

Improved glucose sensitivity and accuracy of insulin infusion improves outcomes and quality of life

Increased physician & patient acceptance, market penetration and revenues



# US Market

- Prevalence type 1 diabetes 340,000\*
  - 15,000 new cases annually\*
- U.S. insulin pump market \$564M
- U.S. installed pump base 200,000
- 7.45M Insulin-dependent in 2010\*\*

\*National Institute of Allergy and Infectious Diseases \*\*Frost & Sullivan, 2004



# Intellectual Property

- US patent pending  
Publication number 2004/0248326
- Key claims: flow control using a signal from outside the device, sensed by diffusion





# Contact Information

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- [www.research.umn.edu/techcomm/TechConnect2009.htm](http://www.research.umn.edu/techcomm/TechConnect2009.htm)

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