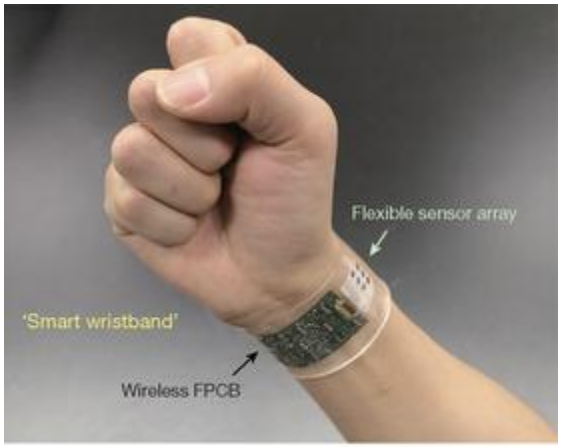
# Wearable Chemical Sensing – Optimizing Fluidics for Real-Time Sweat Analysis

**Jennifer Deignan, Larisa Florea, Shirley Coyle and Dermot Diamond**

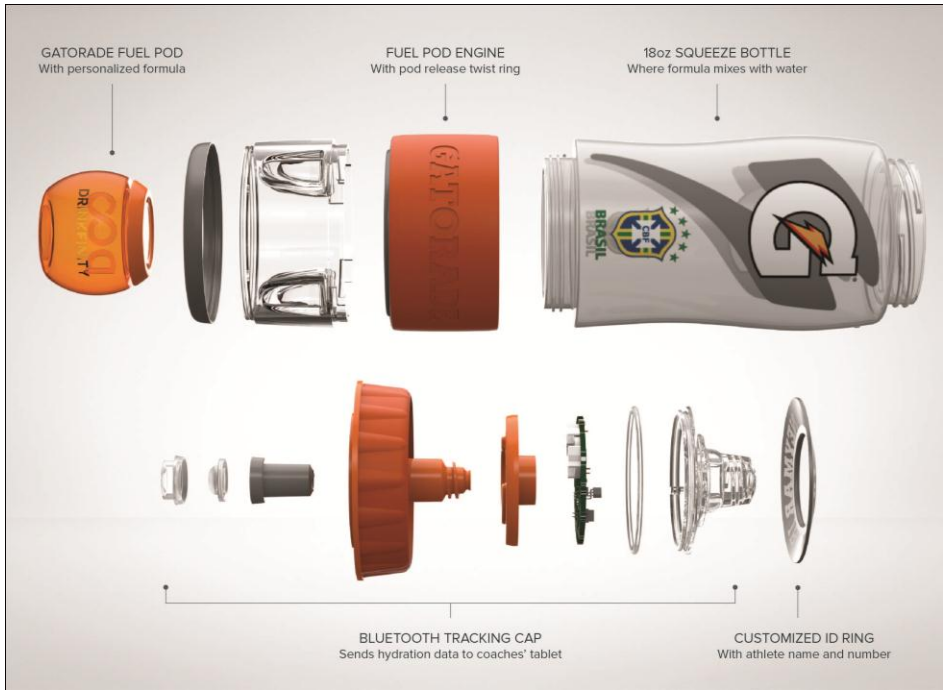
Poster 32

# Background

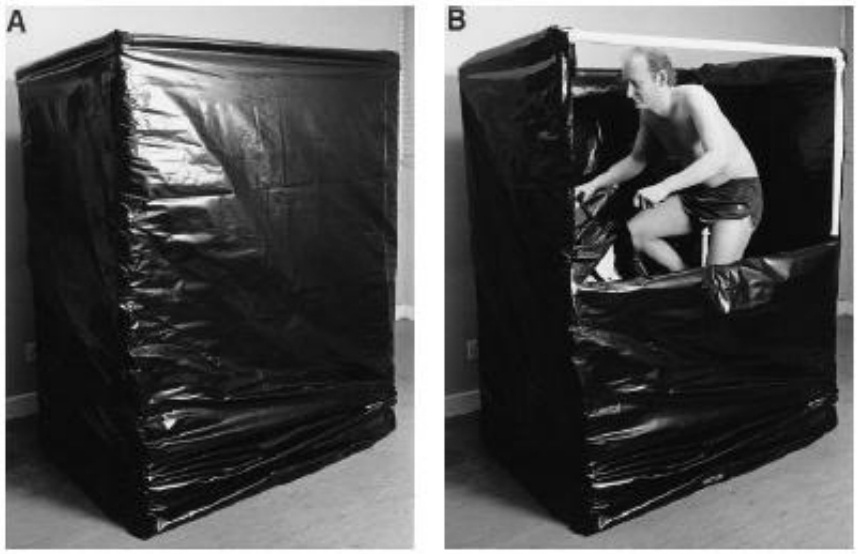
- Monitoring hydration
- Cystic fibrosis treatments




Gao, Wei, et al. "Fully integrated wearable sensor arrays for multiplexed in situ perspiration analysis." *Nature* 529.7587 (2016): 509-514.



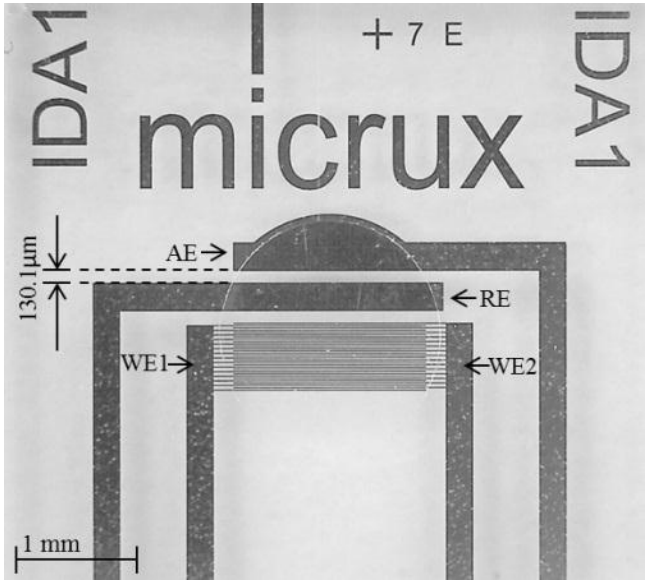

http://design.pepsico.com/gatorade.php?v=19#section2



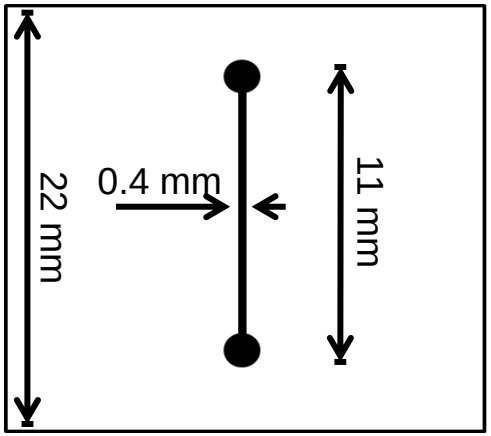

S. M. Shirreffs and R. J. Maughan, Journal of Applied Physiology January 1, 1997 vol. 82 no. 1 336-34

# C⁴D

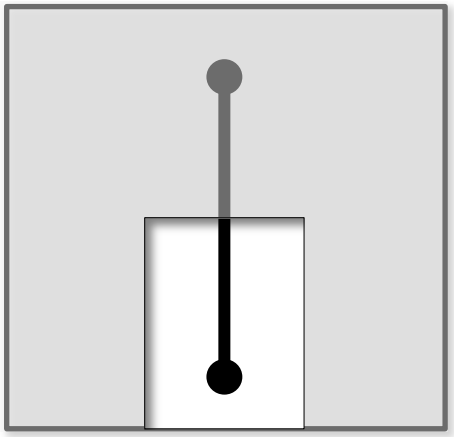
- **Capacitively coupled contactless conductivity detection (C⁴D)**
- **No biofouling of sensor**



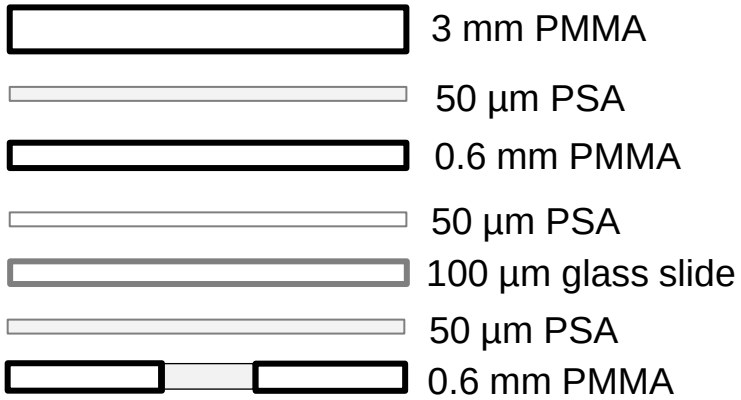

10mm x 6mm x 0.75mm



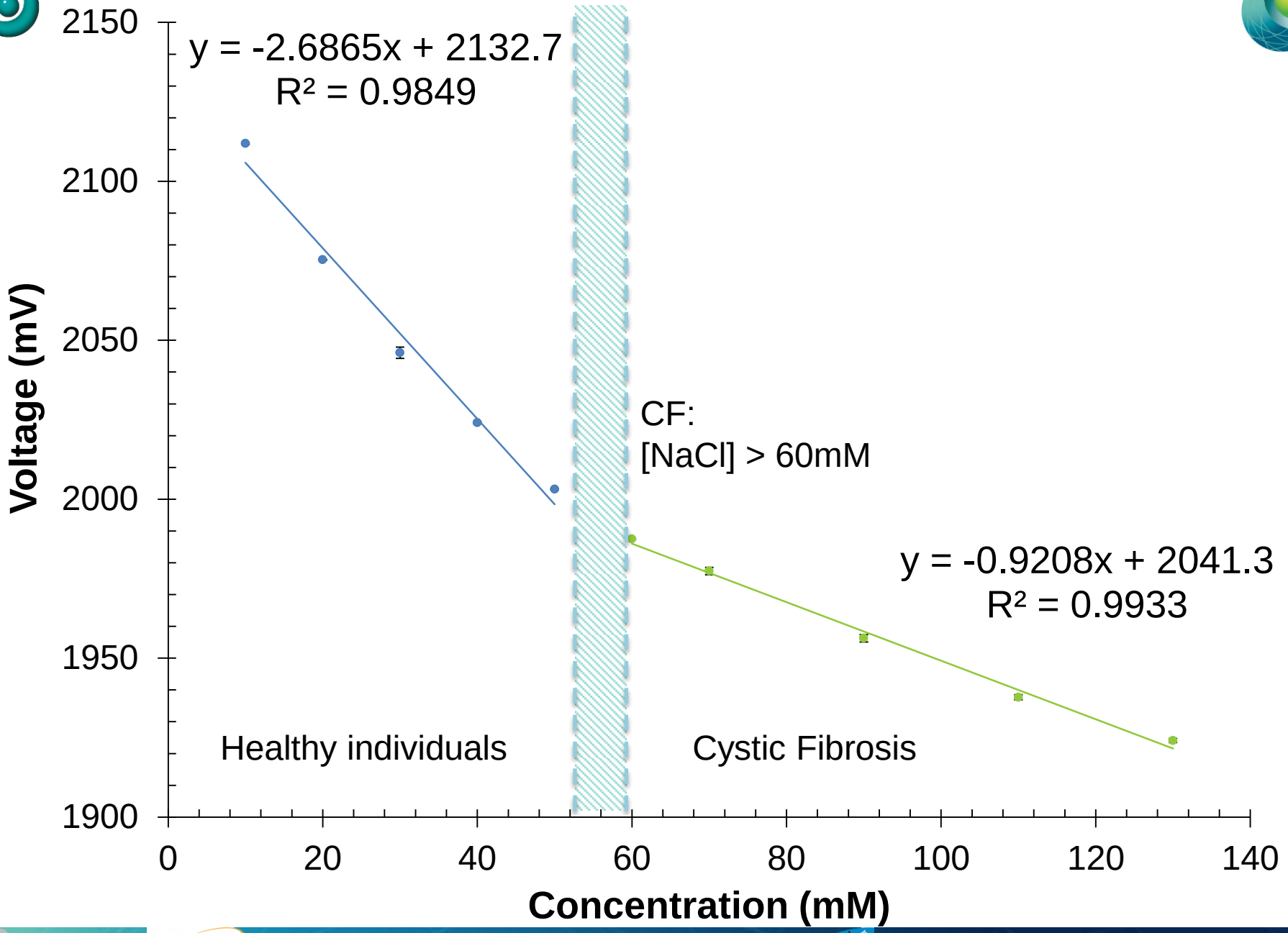

Top View



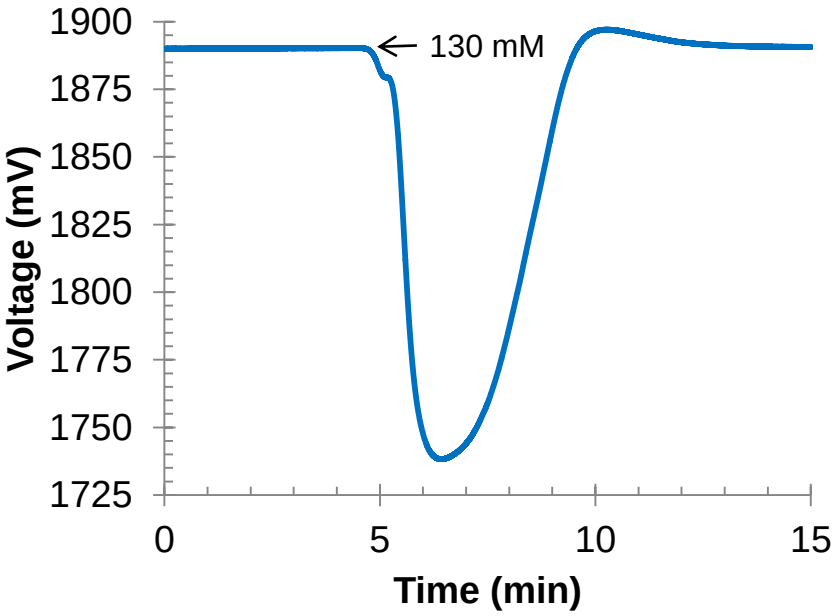
Bottom View

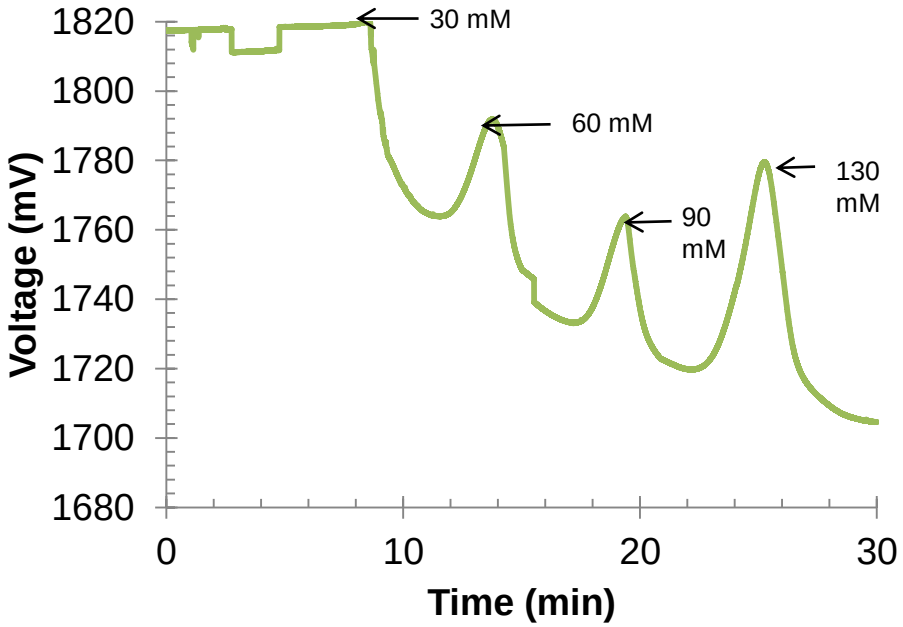



Expanded Side View


y = -2.6865x + 2132.7
R² = 0.9849
CF:
[NaCl] > 60mM
y = -0.9208x + 2041.3
R² = 0.9933
Healthy individuals
Cystic Fibrosis
Voltage (mV)
Concentration (mM)
2150
2100
2050
2000
1950
1900
0
20
40
60
80
100
120
140

# Injection of varying NaCl concentrations

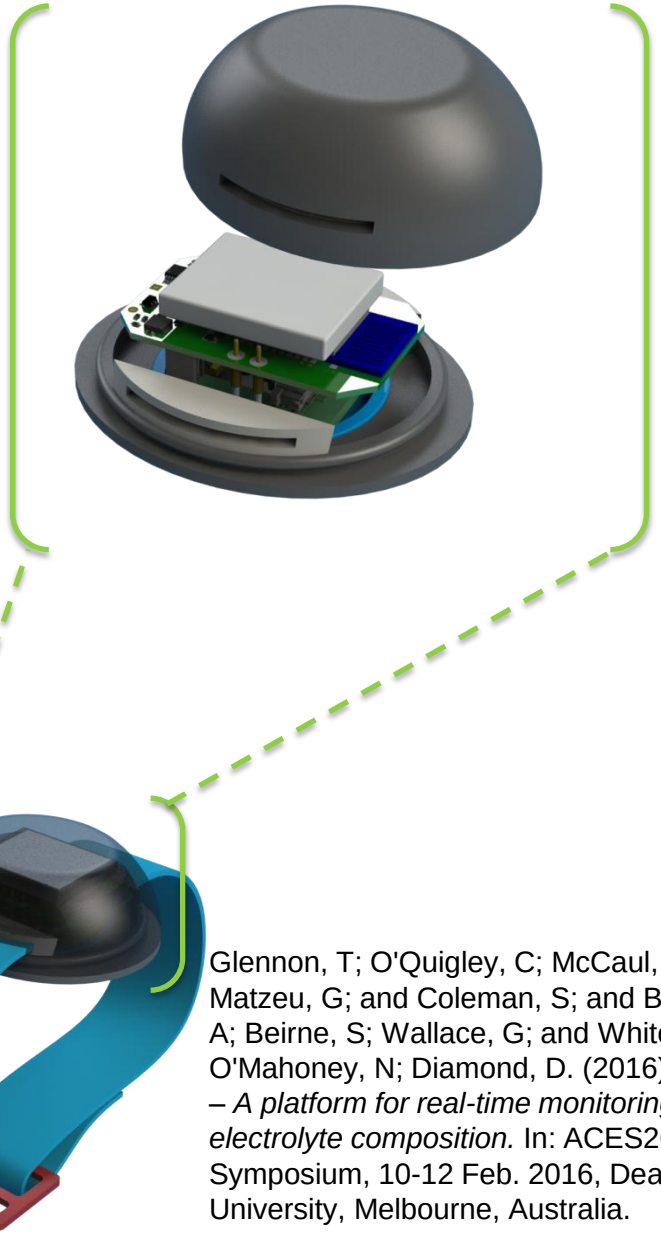



*Au microelectrode voltage vs. time graph using 10 mM NaCl as the eluent and injecting 100µL of (A)130 mM NaCl and (B) 30, 60, 90 and 130 mM NaCl at a flow rate of 20µL/min. A PMMA microchannel with a surface area over the electrodes of 0.36 mm$^2$ was used.*

# Next steps

- **New PMMA channel designs**
  - Minimizing fluidic volume
  - Maximizing surface area
- **Varying flow rates**
- **Integration into on-body platform**



Glennon, T; O'Quigley, C; McCaul, M; Coyle, S.; Matzeu, G; and Coleman, S; and Ben Azouz, A; Beirne, S; Wallace, G; and White, P; O'Mahoney, N; Diamond, D. (2016) *'SWEATCH' – A platform for real-time monitoring of sweat electrolyte composition.* In: ACES2016 Symposium, 10-12 Feb. 2016, Deakin University, Melbourne, Australia.

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