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FESSwise

**Non-invasive sweat sensor platform
monitoring cortisol for stress management**

UCLA Innovation Fund Pitch

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Janet Tomiyama, PhD, Associate Professor of Psychology

Overview

Problem	Solution	Advantages
Current health monitoring wearables are not able to obtain insight into the body's chemistry	Our aptamer-based sweat sensor platform can track cortisol for stress management	<ul style="list-style-type: none">• Non-invasive• Measures molecular-level information• Clinically validated protocols

Team



Sam Emaminejad, PhD

Assistant Professor, Electrical Engineering

**Interconnected & Integrated
Bioelectronics Lab (I²BL)**

Lab Founder & Director



Janet Tomiyama, PhD

Associate Professor, Psychology

**Dieting, Stress, and Health
Laboratory**

Lab Founder & Director



Problem

Commercial health monitors lack non-invasive molecular-level insight



?



- ✗ Current health monitors mainly track vital signs and physical activity
- ✗ No insight into the body's chemistry

- ✗ Available platforms cannot measure biomarkers noninvasively
- ✗ Inconvenient for continuous, remote tracking

Unmet Need

Performance-driven groups need real-time health data to optimize training



Military Training

- **More training-related deaths** than combat deaths since 2001



Sports & Fitness Tracking

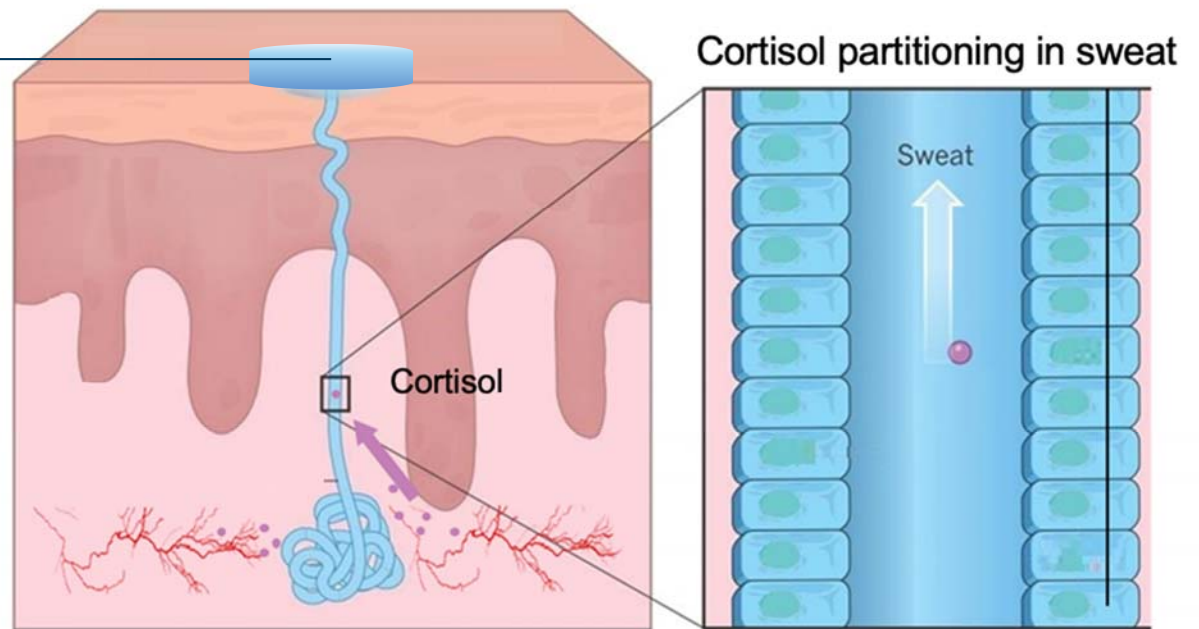
- Global revenues for sports, fitness and activity monitors are estimated to be **\$2.8bn in 2019**

Solution

Sweat Analysis: a non-invasive proxy measure of blood biomarker levels

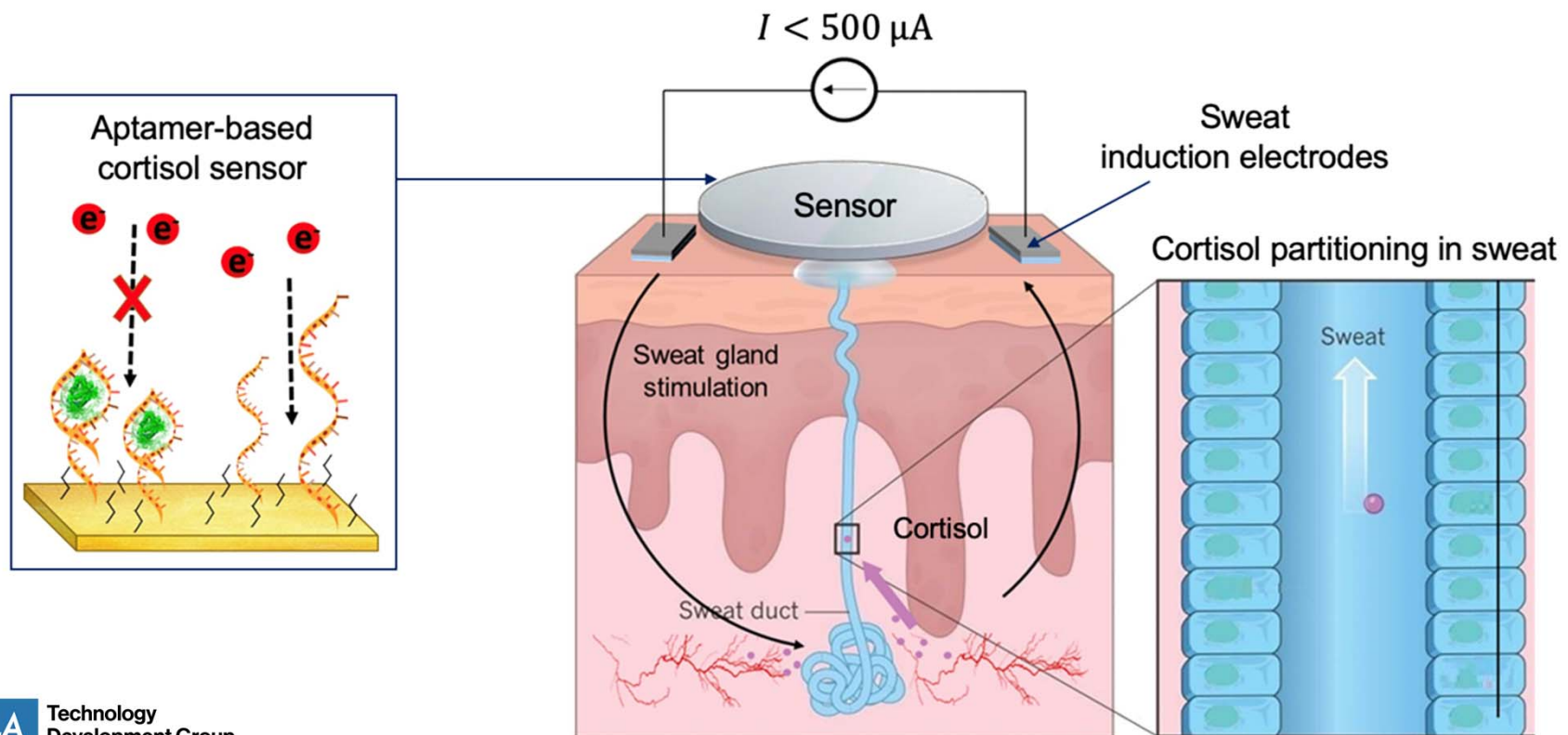
Example Sweat Biomarkers

Biomarker	Application	Concentration
Cortisol	Stress, Anxiety	0.3 – 15 nM
Testosterone	Physical performance	0.02 – 0.4 nM
Progesterone	Pregnancy Health	0.01 – 0.1 nM



Solution

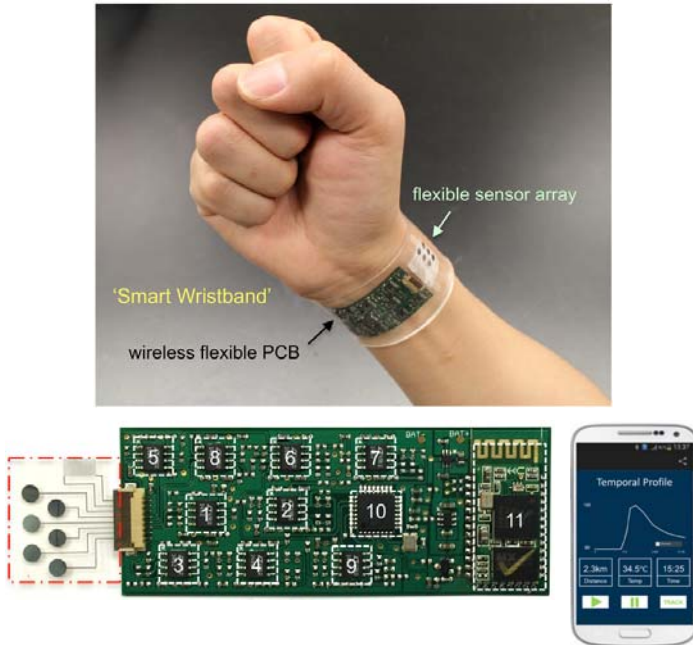
Sensor that employs aptamer-based technology to track cortisol in sweat



Technology Overview

Development of wearable sweat extracting and cortisol sensing platform

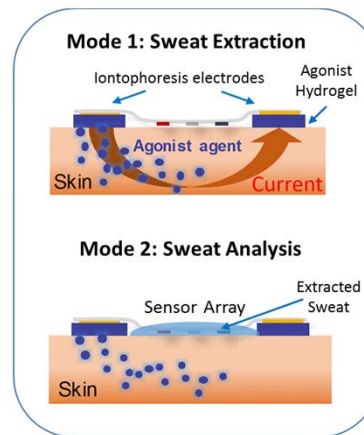
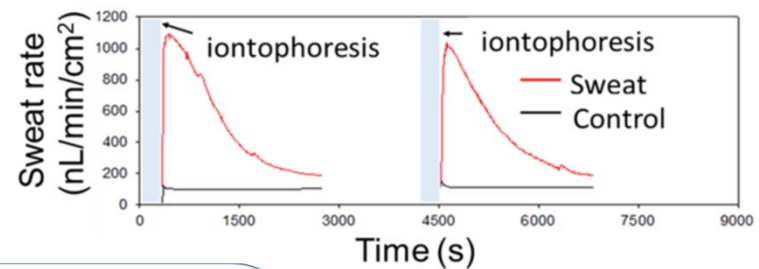
Wireless and temperature-calibrated biomarker readout with a complete system



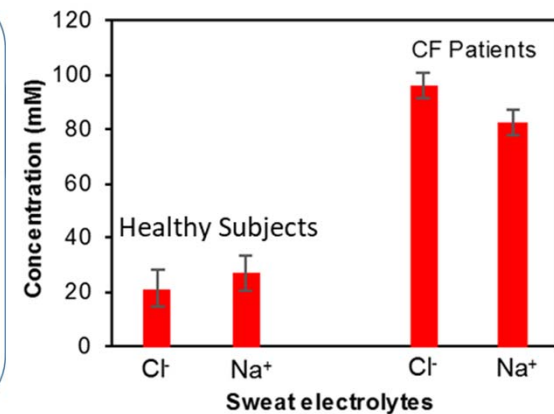
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Nature 2016

On-demand sweat induction and analysis for sedentary patient testing

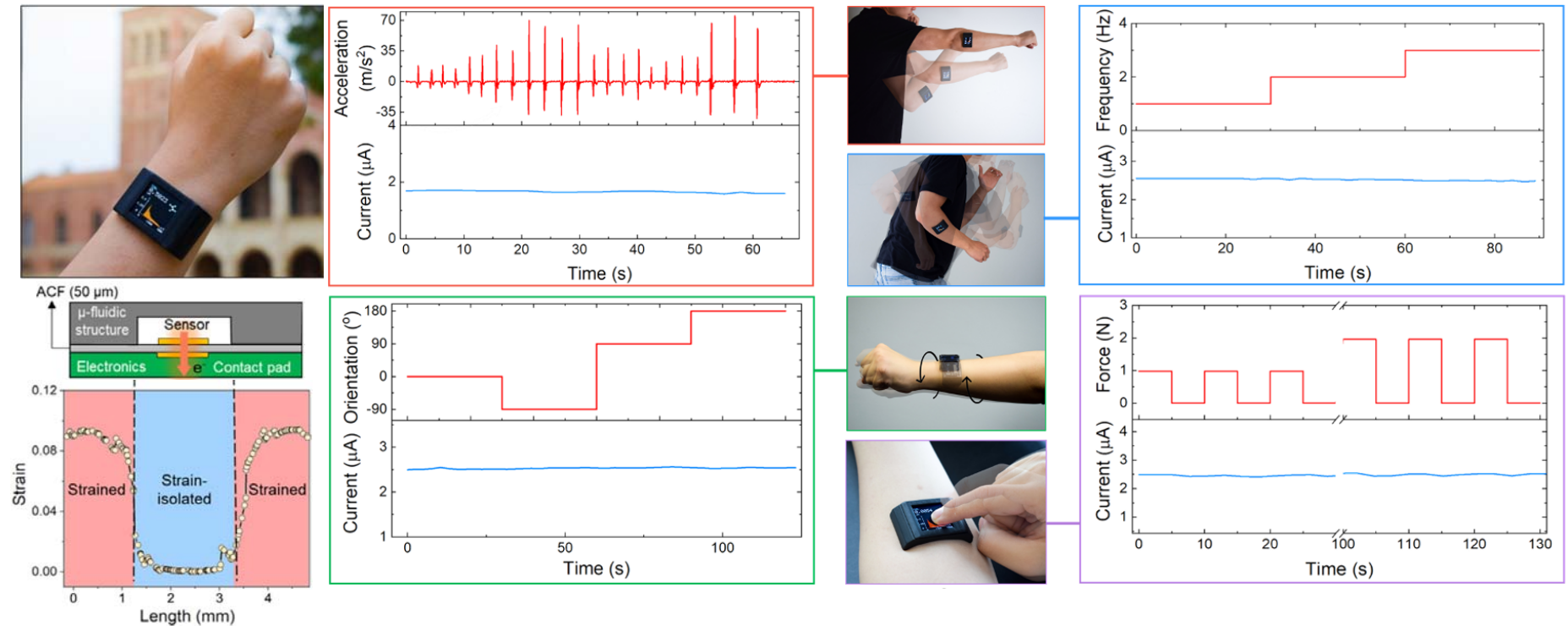


PNAS 2017



Technology Overview

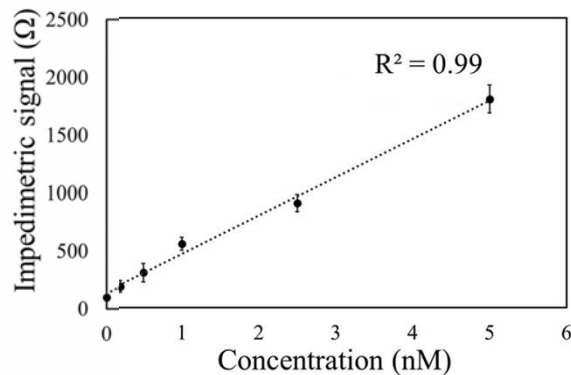
Robust sensing during daily activities and ability to integrate into electronics



Technology Overview

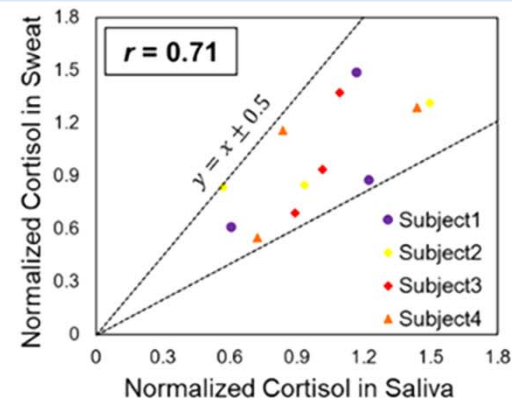
Clinical studies to establish physiological utility of cortisol found in sweat

Aptamer-based cortisol sensor

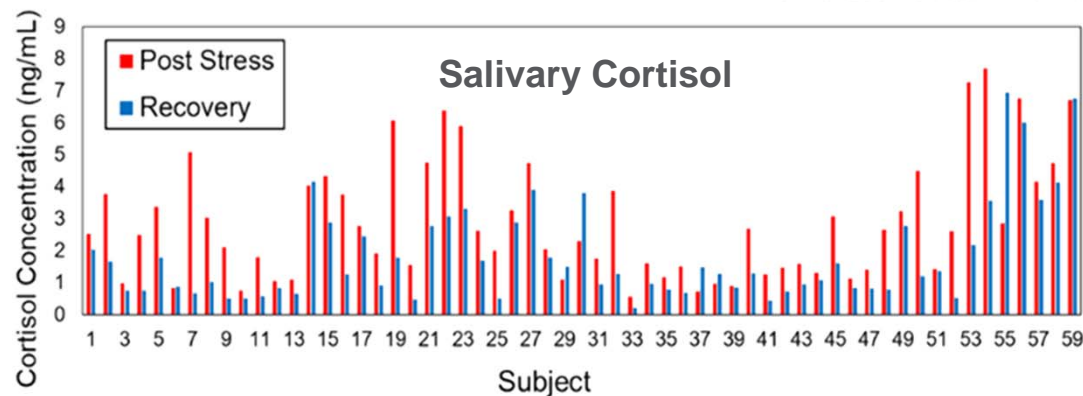


Hilton Head
2018

Sweat vs. saliva correlation



Clinical validation

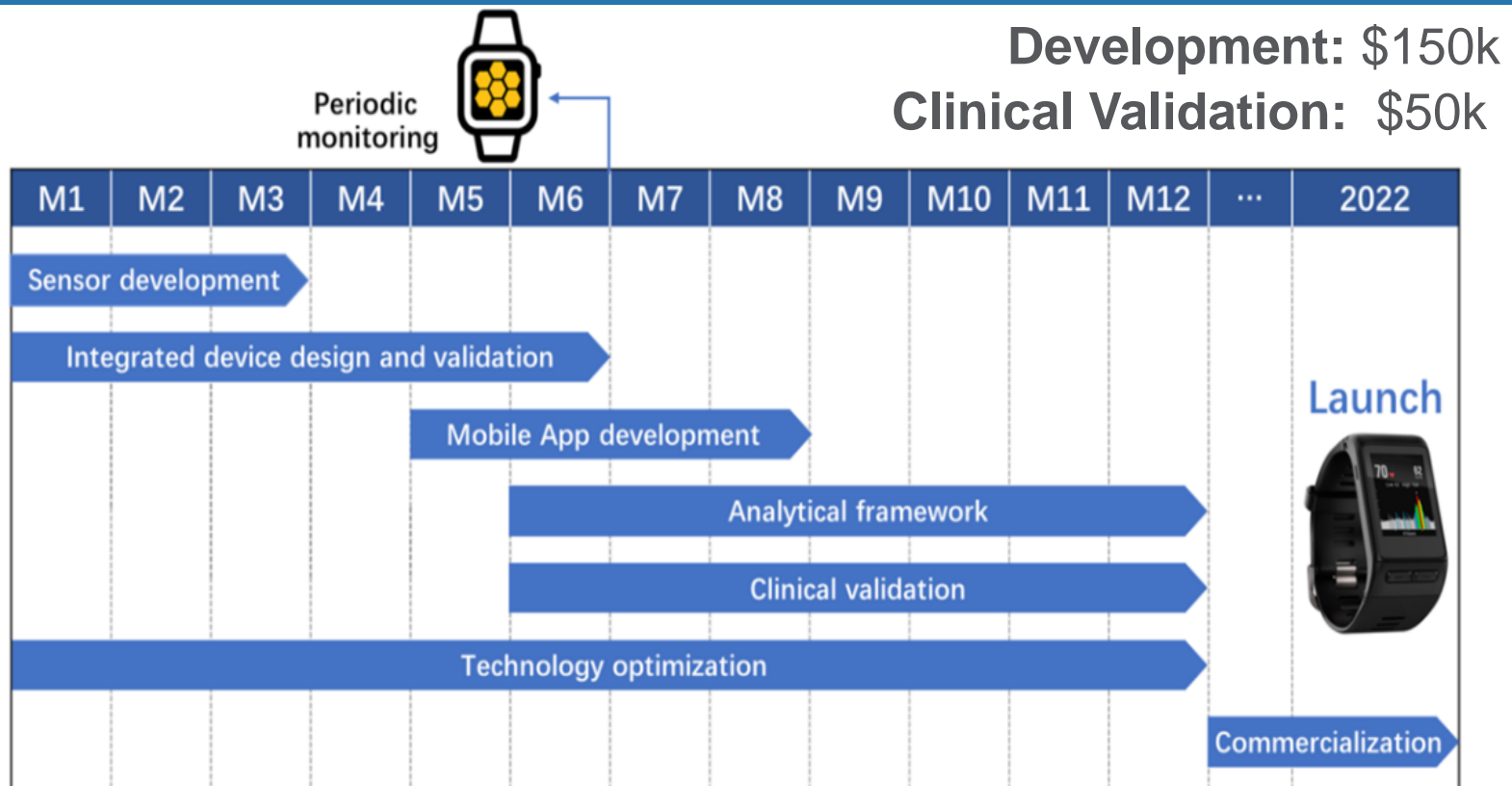


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Development Plan





Projected activities and milestones: \$200K



Risk Mitigation

Risks	Mitigation Strategy
Scalability of the sensor	Tape-based sensor with embedded vertical interconnects for integration with existing platforms
Continued usability of disposable sensor	Target populations with high likelihood of adoption and need for continuous monitoring
Establishing physiological utility of cortisol sensor	Collaboration with DiSH Lab for clinical validation with Trier Social Stress Test (gold standard social-evaluative stressor)

Competitor Landscape

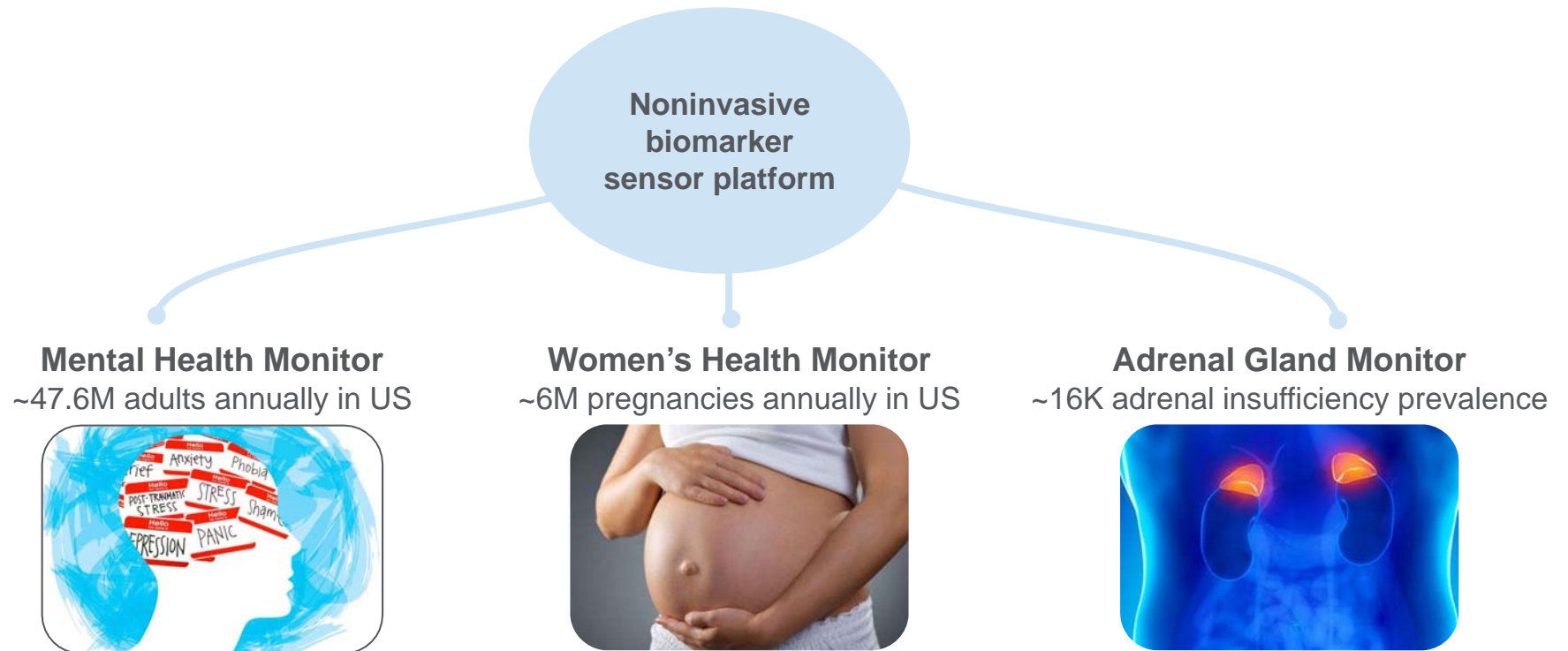
Types of Stress Monitors	Smartwatch (Heart Rate Variability) 	Cortisol sweat sensor interface  	Cortisol-tracking sweat sensor 
Molecular-level insight?	X	✓	✓
Wireless system integration	✓	X	✓
Validation with clinical samples?	X	X	✓
Actionable clinical intervention?	X	X	✓
Development status	In Market	R&D	R&D

Intellectual Property

- **Pending IP (non-provisional)**

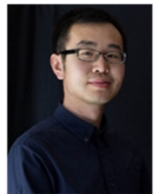
- "Wearable Device for *In-Situ* Analysis of Hormones," S. Emaminejad, S. Pilehvar, Filed: 4/19/2018, Serial No: 62/660,144
- "In-situ Sweat Rate Monitoring for Normalization of Sweat Analyte Concentrations," S. Emaminejad, Filed: 1/16/2018, Serial No: 62/617,634
- "Multiplexed Sweat Extraction and Sensing Wearable Device for Normalized and Time-Sequential Sweat Analysis," S. Emaminejad, Filed: 9/6/2018, Serial No: 62/555,537
- "Low Cost, Transferrable and Thermally Stable Sensor Array Patterned on Conductive Substrate for Biofluid Analysis," S. Emaminejad, Y. Zhao, Filed: 4/19/2018, Serial No: 62/660,173
- "Three-Dimensional Microfluidic Actuation and Sensing Wearable Device for *In-Situ* Biofluid Processing and Analysis," S. Emaminejad, H. Lin, Filed: 3/23/2018, Serial No: 62/647,320

Future Applications



Acknowledgements

Postdoc & Graduate Students



Bo Wang



Yichao Zhao



Hannaneh Hojajli



Jiawei Tan



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Chester Hulse



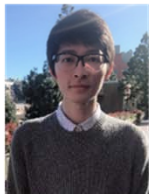
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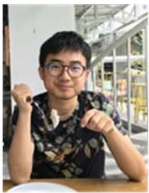
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Thank You

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