U-STEP: A Diabetic Foot Monitoring Device

*Elaine Cho, Shonit Sharma, Marisa Stubbs, Jacqueline Yee*

**The problem:** Preventing diabetic foot ulcers

- Diabetic patients are at increased risk for foot ulcer development because they often suffer from diabetic neuropathy
- If undetected and untreated, they can become severe and potentially life-threatening, necessitating amputation
- **Solution:** A device coupled with a mobile app enabling patients and clinicians to continuously monitor foot health
Hydrocrit: NMR Relaxometry as a Tool for Measuring Plasma Water Content
Shahab Chizari, John Madsen, Joseph Pourtabib, Johnny Phan

The problem: Preventing diagnostic errors

- Many clinical tests are performed on blood plasma—diagnostic errors impact 12 million patients per year at great expense
- These tests depend on the volume of water in the plasma (PWC), which is not currently measured
- Some common conditions affect PWC and can lead to inaccurate results
- **Solution:** A method using NMR relaxometry to measure the PWC with the potential to be implemented in the clinical laboratory setting
CardioVision: Non-Contact Heart Rate Monitoring of Burn Patients

Tanishq Abraham, Connor Dougherty, Michelle Mao, Benjamin Price, Sagar Shah

The problem: Monitoring burn patients

- Measuring heart rate in burn patients is challenging since electrodes cannot be adhered to burned skin
- Alternatives are invasive and patients are susceptible to life-threatening infection
- **Solution**: A portable device that uses a non-contact method to continuously monitor the heart rate of burn patients in real-time
**StrideSight: Device to Monitor Activity Related to Overuse Injury**  
*Samir Akre, Krishna Basude, Angela Tolwani*

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**The problem: Monitoring overuse injury**

- 27% - 70% of runners experience overuse injuries during any 1 year, including Achilles tendinopathy, shin splints, and plantar fasciitis
- Repetitive loads at lower forces are predicted to contribute to these injuries
- There is currently no good way to monitor and predict these injuries
- **Solution:** A portable device that uses inertial measurements to quantify biomechanical metrics associated with overuse injury in runners
K-wire Alleviating Device

Alex Allaert, Xenia Ivanova, Jeremy Lowen, Sean McCutcheon, Maggie Wang

The problem: Preventing sharps injuries

- Kirschner wires used to fixate bone fragments during orthopaedic surgery
- Cutters produce sharp ends--Risk of sharps injuries to medical personnel, risk of tendonitis, skin irritation, and nerve irritation for patients
- **Solution:** A device compatible with K-wire drivers that smooths sharp ends, consisting of a burr cup and cap to contain debris
Clinical/ Translational/ POC Project Examples

Tissue Flap Remote Monitoring Device
Stephanie Chee, Jeffrey Ma, Michael Nguyen-Truong, Connie Yuan, Annie Zhou

The problem: Monitoring graft viability

- Free flap transfer is commonly used in reconstructive surgery
- Post-operatively susceptible to blood clots which impact viability
- Currently no means to remotely monitor flap viability
- Partnership with CS team
- **Solution:** A device to remotely monitor tissue flaps postoperatively in real-time, and alert surgeon if flap becomes compromised
Mediastinal Access Device

Thomas Brodt, Patrick Govea, Melanie Klich, Robert Wiener, Ryan Wong

The problem: Accessing lymph nodes

- Biopsy of mediastinal lymph nodes needed for cancer diagnosis
- Access by guiding needle can lead to serious complications
- **Solution:** Bone drill specialized for mediastinal access
Thorafit: A Customized Approach to Chest Wall Reconstruction

Mason Becker, Lauren Damian, Hailey Hinkle, Matthew Kennedy

The problem: Need for customizable implant

- Surgery to remove metastatic breast cancer leads to defects in the chest wall
- Current implants to repair defects are not customizable
- **Solution:** Process for creating a 3D printed chest wall implant that is customized to the patient’s defect
MVD: Metronome Ventilation Device

Peter Burkard, Yimeng Dou, Richard Perez, Sartaj Sangha, Lingyu Zhang

The problem: Maintaining proper ventilation

- Resuscitation procedures with a BVM lack feedback on the desired ventilation rate
- Hyperventilation is common during resuscitation procedures and is associated with poor outcomes
- Solution: A metronome that emits 3 distinct feedback signals to direct medical personnel in ventilating adults at the proper rate
CoagVISTA: Point of Care Bioimpedimetric Thromboelastography

Kevin Leung, Alexander Godbout, Brent Weyers, Victoria Chiu, Jeffrey Le

The problem: Monitoring blood clotting

- Devices used to measure the clotting properties of blood are fragile, bulky, and cannot be used in field hospitals
- This delays their use in guiding therapeutic decisions by up to 24 hrs
- **Solution:** A non-mechanical, robust, point-of-care device that measures time-based properties of blood coagulation, to guide therapeutic decisions in a trauma setting