Advanced Platform Technology Center (APTC)
Louis Stokes Cleveland VA Medical Center (LSCVAMC)

VA RR&D Research Center

http://www.aptcenter.research.va.gov

ANNUAL REPORT
For Activities during the period: October 1, 2021 – September 30, 2022

2022 Annual Report for activities during the period October 1, 2021 to September 30, 2022

Advanced Platform Technology Center (APTC)

Louis Stokes Cleveland VA Medical Center (LSCVAMC), Cleveland, OH

RR&D Center

RR&D Center funding number: A1871C

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Mission of the APT Center
To advance innovative technologies along the translational pathway that address the health and independence of disabled Veterans.

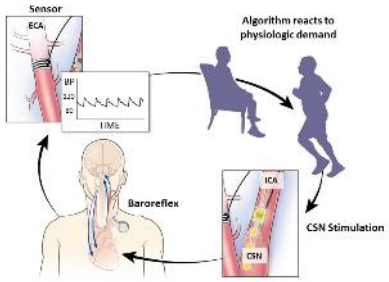
Vision of the APT Center
To be a national leader and valued partner for the discovery and clinical implementation of medical, rehabilitative or restorative technologies for the well-being of Veterans.

APT Center research sites
The APT Center is located on the premises of the LSCVAMC and operates in partnership with Case Western Reserve University (CWRU) Schools of Engineering and Medicine. In addition, our Core Investigators collaborate with clinicians and researchers located at University Hospitals Cleveland Medical Center (UH), MetroHealth Medical Center (MHMC), and Cleveland Clinic Foundation (CCF) and other institutions nationally. The APT Center capitalizes on significant local expertise in the areas of *microelectronics, micro/nanofabrication, materials science, and mechanics* to address unmet needs of disabled Veterans and the broader rehabilitation community. Center research and development activities are focused on four clinical application areas: **Prosthetics & Orthotics, Health Monitoring & Maintenance Neural Interfaces and Activity-Based Neurorehabilitation.**

Narrative Summary
KEY IMPACTS

1. Licensed UroMonitor Technology to Veteran-Owned Company *Bright Uro*
Core APT Center Investigators Drs. Margot Damaser and Steve Majerus, inventors of the UroMonitor, spearheaded a licensing agreement with a small Veteran-owned medical device company (*Bright Uro*) for the UroMonitor bladder pressure/volume sensor. UroMonitor promises to improve the quality of diagnostic data to guide health decisions and broaden access to advanced urinary tools, even in rural or remote clinics. Unlike existing diagnostic tools, UroMonitor can provide insights into how the bladder behaves in the Veteran's home environment, or in response to specific treatments. In addition, the Society of Women in Urology (SWIU) presented Dr. Damaser the 2022 *Award for Excellence in Urological Research* for her career and contributions to Urological Research, which in large part has led to the *Bright Uro* license.

2. Licensed Blood Pressure Sensing Technology to Address Hypertension to Startup *Barologics*



Core APT Center Investigators Drs. Jonathan Baskin, Steve Majerus, Gilles Pinault, and Dustin Tyler are partnering with a startup company (*Barologics*) to investigate a new technology that will help Veterans manage hypertension that is unresponsive to lifestyle changes or pharmacological interventions. Our vision is to develop and demonstrate key underlying technologies that will make a "pacemaker" for blood pressure a reality. While *Barologics* has licensed and is commercializing a stimulating electrode developed at the APT Center to treat HTN, our ongoing research focuses on improving the control of blood pressure. This may be accomplished using a new blood pressure sensor and a detection algorithm to identify when blood pressure is unsafely elevated and modulate the output of an implanted stimulator to lower it based on a Veteran's individual needs and activity levels.

3. Captured National Recognition for Sensorized Upper Limb Prostheses

APT Core Investigator Dr. Dustin Tyler and research participant Branden Prestwood were invited to the White House to meet with President Biden to discuss our approach to restoring natural touch to upper limb amputees. They joined other representatives of the medical and scientific communities to launch the new Advanced Research Projects Agency for Health (ARPA-H). In addition, Dr. Tyler and Mr. Prestwood appeared on an episode of National Geographic's "Overheard" podcast to discuss Prestwood's sensorized hand prosthesis.

4. Advanced TBI Treatment by Employing Virtual Reality Technology
APT Core Investigator Dr. Mark Walker and collaborator Dr. Michael Fu were featured in a 2022 VA Research Week video for their work on studying persistent eye focus issues resulting from Mild TBI (i.e., concussion). Individuals with concussions may experience visual challenges like blurred vision, making some tasks related to schoolwork or employment difficult. Drs. Walker and Fu are employing Virtual Reality (VR) equipment and applications to understand how eye movement, control and coordination relate to the vision symptoms so the most appropriate interventions can be identified.

5. Accelerated Development of Neurotherapeutic Devices by Mapping the Vagus
APT Core Investigator Dr. Andrew Shoffstall received a $15.75 million grant from the National Institutes of Health to seek new treatment options for conditions such as hypertension, heart failure and gastrointestinal disorders. The three-year research project will map the vagus nerve, which controls major organ functions, in order to speed development of therapeutic devices that improve chronic medical conditions.

6. Completed FY22 iNet SPREAD Projects Impact Veteran Health across the VHA

Core APT Center Investigator Lisa Lombardo's Clinical Stimulation-Driven Rowing Program for Veterans with Paralysis successfully installed their new exercise modality in the Minneapolis VA Medical Center. The system improved upon the previous generation by refining the graphical user interface and the seating system for enhanced usability and stability. Clinical outcomes will be collected throughout 2023. In addition, Dr. Mark Walker disseminated a new ambulatory eye recording device developed at the APT Center for diagnosing dizziness at home to the Pittsburgh VAMC for expanded pilot testing. Clinical outcomes will be collected throughout 2023.

KEY SERVICES

1. Established Summer Internship Program Research Symposium and Award Recognition

APT Center Core Investigators Drs. Jeff Capadona and Allison Hesl established our inaugural Research Symposium that featured 23 interns who presented their research projects in a juried posted session. Interns Michael Sobota, Sydney Mountcastle and Elizabeth Jitendran won top prizes and were funded by the Center to attend the 2022 *Biomedical Engineering Society Annual Meeting* to present their posters on a national stage. Oluatumininu "Tumi" Adeeko, a Mechanical Engineering major at Youngstown State University (YSU), was honored as YSU's *2022 STEM Intern & Co-op of the Year Award*. She was also selected as YSU's *Cooperative Education & Internship Association (CEIA) Intern of the Year*. As a result, YSU named the APT Center as their *Co-Op Employer of the Year*. These accomplishments further our goal of attracting and developing a new generation of VA investigators who will continue to pursue new approaches to improve the health, daily functioning, and societal participation of disabled Veterans.

2. Initiated New Summer Internship Program Focused on Diversity, Equity and Inclusion

Drs. Capadona and Hess also led the APT Center effort on a new ORD program to provide summer research opportunities for undergraduate STEM and Pre-Health students from Veteran, Minority, Disabled and other disadvantaged backgrounds. *Eight* students participated in the inaugural 2022 class, including students who are Veterans and Underrepresented Minorities. This program expands and extends the Center's ongoing undergraduate capacity building, outreach, and inclusion efforts.

3. Acquired New Equipment for Studying Human Motion and Quantifying Rehabilitation Outcomes

The APT Center enhanced the capabilities of researchers at the LSCVAMC to quantify the neuromuscular control and functional capabilities of disabled Veterans in the Motion Study Laboratory (MSL), which is a shared facility available to all rehabilitation researchers. A new *Bertec spilt belt instrumented treadmill* was acquired and installed that allows researchers to perform dynamic analysis of human walking with high precision control and accurate load measurements, and to quantify responses to perturbations. Also, three new AMTI force plates with easily reconfigurable spacing were integrated into the walkway to allow for the capture of data from disabled Veterans with a variety of presentations and gait deficits.

4. Expanded Social Media Presence to Reach More Disabled Veterans and Healthcare Professionals

APT Center continued to build its LinkedIn presence to broadly disseminate information about our VA centric research to the community. Currently there are 264 followers of the APT Center page and growing. Users who follow the page can get timely updates about recent publications, investigator / staff recognitions, recent news mentions, conference presence, and announcements about APT Center programs. Investigators and students have also been regularly featured on our YouTube channel talking about the wide variety of research projects being conducted at the APT Center.

5. Facilitated Community Outreach Efforts

The APT Center sent representatives to the Case Western Reserve University and Cleveland State University Engineering Career Fairs in September 2022, where we connected with potential applicants for our summer internship and Coop programs. In addition, APT Center had booths at the *Amputee Coalition* (August 2022) *and Paralyzed Veterans Association (PVA) Summit* (September 2022) conferences, where we engaged Veterans, potential research subjects, clinicians, and collaborators. We also celebrated Dr. Kristi Henzel, who received the *Physician Clinical Excellence Award* at the PVA Summit!

6. Grew NanoString GeoMx Program

The *NanoString GeoMx* and *nCounter* platforms are shared equipment for VA investigators housed in the Capadona/Shoffstall/Hess-Dunning Laboratories at the APT Center. This system is capable of providing cell-specific spatially resolved (1 um resolution) proteomic and whole transcriptome analysis of rodent and human tissue. The Lab has focused on brain tissue, but the capabilities for collaborative projects in any tissue space exists. This past year, collaborations were established, and samples were received for processing from across the country.

7. Engaged Expert Consultants to Provide Project Management Training

In 2022, *Indigo Anchor* kicked off training for the APTC Operations team on Agile (Sprint/Scrum) project management methodology. Since then, the Operations team has continued weekly sprint sessions and is aligning investigators and staff on project priorities and progress. This builds upon the 2021 training for the Engineering Core team with plans to continue rolling out across the Center for PIs and their professional staff and trainees.

8. Advanced VehiCLE (Technology Transfer Assistance Program)

The APT Center was instrumental in establishing a VA Technology Transfer Assistance Program site in Cleveland. The VA Engineering Health Innovation in Cleveland (VehiCLE) successfully launched in FY22 by developing and implementing management and engineering quality system processes, along with hiring technical staff. This led to successfully designing and delivering seven new prototypes for novel healthcare devices to clinical inventors across the national VA system. The team researched and developed products ranging from assistive aids to specialized sensors to improved personal protective equipment (PPE).

9. Contributed Significantly to Journals, Scientific Review Panels, and Professional Societies

APT Center Core Investigators contributed their time and expertise as editors / associate editors (3), on editorial boards (9), or as reviewers (19) for professional scientific journals, clinical publications, or practice guidelines. We also served as committee members (23) and committee/session chairs (4) of professional societies, or organizational bodies for conferences, meetings, symposia, or workshops. Of note Core APT Investigators Dr. Kath Bogie became the Editor-in-Chief for the *Journal of Rehabilitation and Assistive Technologies Engineering* and Margot Damaser serves as the Associate Editor of *the Journal Neurourology and Urodynamics*.

Summary

The APT Center continues to advance the state of rehabilitation technology, fulfill our mission, and improve the lives of Veterans and the general population through important discoveries, contributions to community outreach, and cutting-edge intellectual property that leads to active industry conversations and licensing opportunities. This past year, APTC investigators made important advancements in their projects, increased mentoring capabilities, and engaged Veterans through research projects, demonstrating that core research programs of the APTC are impactful and vital to Veterans, other federal agencies, and the public.