

TRANSLATION **BUILDER**

This newsletter is designed to provide a place for members of the APTC to share news, collaborate and network, and discover each other and the services we offer.

JUNE 2017

Investigator's Corner

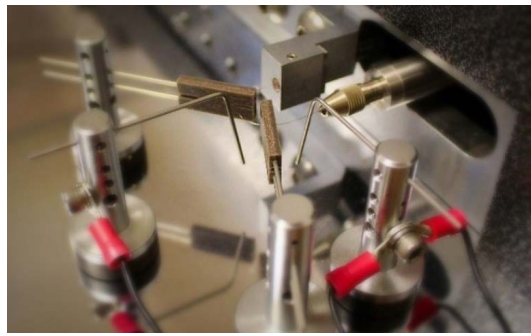
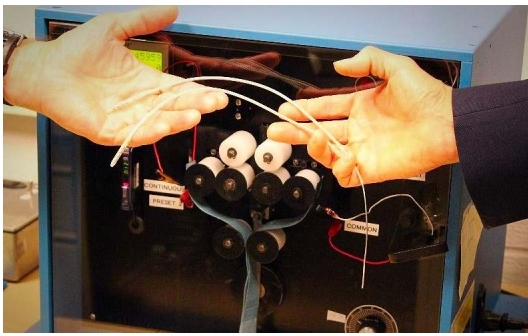


John J. Lewandowski, Ph.D.

Arthur P. Armington Professor of Engineering II
Professor of Materials Science and Engineering
Director - Advanced Manufacturing & Mechanical Reliability Center
Director - Nitinol Commercialization Accelerator Laboratory
Case Western Reserve University
APTC Research Area: Enabling Technologies

[Dr. John J. Lewandowski](#) is the Director of the [Advanced Manufacturing and Mechanical Reliability Center \(AMMRC\)](#) at Case Western Reserve University (CWRU). The AMMRC houses \$4.5M in equipment and **provides manufacturing and mechanical characterization expertise** that has been utilized by the CWRU community and beyond. With the capability to test materials in micrometer and much larger ranges, the Center offers **fatigue and fracture experimentation** as well as investigation of **high/low temperature effects** on mechanical behavior under quasi-static, cyclic, and dynamic conditions. **Manufacturing equipment** includes deformation processing on novel forging, forming, and extrusion equipment. **Materials systems** studied include organic and inorganic materials, including metals, ceramics, polymers, composites, electronic materials, and biomedical materials systems. APTC Investigators, including, Drs. Kath Bogie and Dustin Tyler have used this lab for pressure distribution testing for modular pressure relief seat cushions (*right*) and fatigue and tension testing for iSENS electrodes (*below, left*). Recently, the AMMRC conducted strength and fracture testing for eye surgery sutures that have the tendency to break during surgery.





Dr. Lewandowski is also the Director of the [Nitinol Commercialization Accelerator Laboratory](#) (NCAL) at CWRU. This lab was built to develop a better understanding of the **metallurgical processing and mechanical characterization of nitinol** (a combination of nickel and titanium) that can be used in **biomedical applications** such as orthodontia and implantable devices, in addition to various potential aerospace applications. The NCAL contains processing and characterization (thermal and mechanical) equipment, valued at \$1.3M, for the manufacturing and analysis of nitinol products. Extensive testing of nitinol wires such as dental archwires used for orthodontia applications has been conducted in collaboration with the CWRU School of Dental Medicine. Pictured *above, right* is a nitinol (superelastic) wire on the rotary bending fatigue tester, which can perform accelerated fatigue testing of fine wire and is the ASTM test standard that NCAL helped develop and test in an intralaboratory study.

The AMMRC and NCAL facilities are located in the White Building at CWRU. CWRU and non-CWRU users can access both facilities by contacting the Lab Directors or CWRU users can [schedule an appointment online](#).

RESEARCH AREAS

In addition to directing these cutting-edge labs, Dr. Lewandowski is also a researcher. He is a Co-Investigator on various **NIH grants** with a biomedical focus, as well as several **federal, non-federal, and industry grants**. His other research areas range from aerospace, automotive, and naval to biomedical and nuclear energy projects. **Aerospace research** includes materials for engine components and other structures, while **naval research** is focusing on environmental degradation mechanisms and reliability of naval aluminum alloys. **Automotive research** includes next generation composites for structural applications, while **nuclear materials research** is focusing on novel processing methods to develop more radiation-resistant materials. Recent work has also increased in the area of process-structure-property relationships in additively manufactured materials. Research expenditures since 1986 exceed \$39M.

ACCOMPLISHMENTS & RECOGNITIONS

Dr. Lewandowski has received several national and international awards for research and teaching, including **Case School of Engineering Research Awards**, The Minerals, Metals & Materials Society (TMS) Leadership Award in 2014, and numerous nominations and recipient of the **John S. Diekhoff Award** for Graduate Mentoring. He is also on the editorial board of four journals and has co-organized over 30 conferences, including one Gordon Conference on Physical Metallurgy. He was elected **Fellow of ASM** in 1995 and is past Chair of ASM/TMS Joint Composites Committee. Publications and presentations exceed 300 and 900, respectively, with an h-index > 50 and his top 50 papers have been cited over 6,000 times. Dr. Lewandowski's [2006 article](#) in Nature Materials (NM) was selected as an Editor's Choice Paper in Science and was selected by NM editors as one of the **20 most influential papers** published in NM from 2002-2012. Personal interests include competing locally and nationally in a variety of road races, including various track events at the 2013 and 2017 Senior Olympics!

LAB TEAM

Dr. Lewandowski's team consists of visiting professors, staff, graduate and undergraduate students, and interns. Many were unavailable for a photo (it is summer, after all), but we snagged a few for a group shot.



(L-R) Dr. Hongwang Yang, Matthew Dahar, Dr. Mohsen Seifi, Benjamin Palmer, Janet Gbur, David Scannapieco, Chris Tuma, Dr. John Lewandowski

Featured Research Area: Prosthetics & Orthotics

Led by Paul Marasco, Ph.D.

The APTC's Prosthetics and Orthotics (P&O) Program investigates innovative methods for restoring nervous system and limb function, which may have been lost due to amputation, or sensory, neuromuscular, and skeletal disorders. Patients with amputation and paralysis can regain their mobility, independence, and function with the assistance of P&O devices. Below are some of the featured projects of this research area.

The **Natural Sensation for Amputees** project has created an advanced prosthetics system that sends feedback from sensors embedded in a prosthetic hand to the remaining nerves in an amputee's residual limb. The peripheral nerves carry these signals to the amputee's brain, and are perceived as tactile sensation – in essence, restoring their sense of touch. Study participants have been wearing their systems for more than one year, and can pick up, hold, and move small objects without needing to look at their prosthesis. *(photo credit: Dale Omori)*



Team: Drs. Dustin Tyler (PI), J. Robert Anderson, Michael Keith, Kevin Malone

Similarly, in the **Natural Sensation for Lower Limb Amputees** project, sensors in the prosthetic pylon or foot of lower limb amputees can sense contact with the floor and modulate stimulation to the sensory nerves in the thigh above the knee. Recipients say the electrically-evoked sensations feel as though they are arising from discrete locations on the toes, sole or ankle of the missing limb. These systems will eventually help users maintain their balance and navigate uneven terrains with less risk of falling.



Team: Drs. Ronald Triolo (PI), Clay Kelly, Paul Marasco, Gilles Pinault, Dustin Tyler

In recent years, the level of prosthetic technology available to veterans has improved substantially. Current silicone socket liners (the attachment point between the residual and prosthetic limbs) work well, but do not breathe, causing a buildup of moisture that can trigger irritation and infection. The goal of the study team for **Advanced Materials to Improve Moisture Management for Prosthetic Socket Liners** is to use advanced

materials to develop a multilayered socket liner for prosthetic limbs that manages sweat to improve comfort and stability.

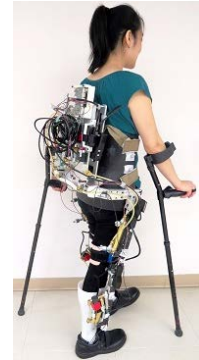
Team: Drs. Paul Marasco (PI), Clay Kelly, Stuart Rowan, Dave Schiraldi

Patients with SCI often have impaired posture, which makes it difficult to be mobile in their wheelchairs and enjoy independence. The team behind the **Seated Balance and Trunk Control with Implanted Neuroprostheses** project send stimuli to study participants' hip and trunk nerves to improve their posture, leading to an enhanced ability to reach for objects and control their wheelchairs.

Team: Drs. Musa Adu (Co-PI) Ronald Triolo (Co-PI), Gilles Pinault, Stephen Selkirk

The **Advanced Exoskeletons for Independent Mobility** project is creating a next generation Hybrid Neuroprosthesis (HNP) which uses a "muscle-first" approach to restore walking in individuals paralyzed from SCI. The HNP combines electrical stimulation to the paralyzed muscles of the leg, and a hydraulics-controlled exoskeleton to provide support during movement. Computerized hip and knee joints allow the wearer to alternate between moving their joints and staying still, making walking and climbing and descending stairs easier and more natural.

Team: Rudi Kobetic (PI), and Drs. Musa Adu, Gilles Pinault, Roger Quinn, Stephen Selkirk, Ronald Triolo



FDA & Quality Fast Facts

The Role of Quality in Translation & the Design History File

WHAT IS A DHF?



A **design history file (DHF)** is a record of the complete development of your device. It is important to establish a DHF when working with a commercial partner for product development and translation. A commercial partner will request many details of your design over time and as the handoff is taking place from development to release, a DHF will allow them to answer many of their own questions – especially for regulators – without having to involve you every time. A DHF also demonstrates the full value of your IP for discussions of royalties.

Generally, a DHF contains the following:

Design Inputs - These are typically the initial requirements that describe the medical device to be produced. They should focus on requirements for the device without focusing on any specific solutions at this stage.

Design Outputs – These are the results of the design and engineering efforts, generally documented in models, drawings, engineering analysis and other documents. They are normally the final specifications for the device, including the manufacturing process and the in-coming, in-process and finished device inspection, measurement/test methods and criteria. The output needs to be directly traceable to the input requirements. This would also include a complete risk analysis and device specification.

Design Verification – This is the process that confirms that the design outputs conform to the design inputs and should demonstrate that the specifications are the correct specifications for the design. Design verification must be documented in the DHF and include the verification date, participants, design version/revision verified, verification method and verification results.

Design Changes – This is the process in which the design changes are identified and documented.

There are other portions of a DHF; however, for most projects, their applicability (such as design transfer to production) is outside the APTC Quality Management System's scope of work. Those portions would be completed by the commercial partner for regulatory submission. Other questions such as channels to

market, reimbursement, competitive landscape, workflow at point of care, etc. will also be addressed when a commercial partner considers your device.



Read over the FDA's Design Control Guidance For Medical Device Manufacturers [here](#). This Guidance relates to FDA 21 CFR 820.30 and Sub-clause 4.4 of ISO 9001.

NEED HELP?

Please contact Edward Panek at (216) 791-3800, ext. 6067, or Edward.panek@va.gov with questions or for assistance regarding your design history files.

The APTC offers regulatory and quality support, including consulting services, to investigators at any point along their research and development continuums, from earliest concept to human trials. Developing a medical device with the ultimate goal of investigation via human studies? We provide a variety of resources to assist you.

NEWS



Congratulations to [Kristi Henzel, MD, PhD](#), for her academic appointment to the rank of Assistant Professor in Department of Physical Medicine & Rehabilitation of the Case Western Reserve University School of Medicine.



A double congratulations to [John McDaniel, PhD](#), who has been promoted to the rank of Associate Professor of Exercise Science in the School of Health Sciences at Kent State University and awarded tenure.



Congratulations to [Christian Zorman, PhD](#), who has been elected a fellow of the [American Vacuum Society](#) for pioneering work in the development of CVD deposition techniques and mechanical characterization of silicon carbide thin films that proved critical to the development of harsh environment MEMS. AVS Fellowship is the premier membership recognition within the society, with fellowship not exceeding 0.5% of the membership. The induction will occur on November 1, 2017 at the AVS Awards Ceremony during the AVS International Symposium in Tampa, Florida.

NEW PATENT AWARDED

Implantable Cuff and Method for Functional Electrical Stimulation and Monitoring

APTC Inventors: M. Miller, M. Schiefer, R. Triolo, D. Tyler

Date of Patent: March 28, 2017

Patent No: US 9,603,538 B2

Abstract: This disclosure relates to an implantable cuff for biological soft tissue that can be used as an electrode interface for selective stimulation and/or monitoring of nerve groups. An implantable cuff includes an elastic collar, at least one conductive segment disposed on or within the elastic collar, and at least one conductor in electrical communication with the at least one conductive segment. The elastic collar defines an internal opening configured to receive an internal body tissue. At least a portion of the elastic collar includes a stiffening region having a stiffness greater than a second region of the elastic collar. The at least one conductor is configured to operably mate with an apparatus capable of delivering electrical stimulation to, and/or recording an electrical activity of, the internal body tissue.



APTC SUMMER INTERNS

The APT-Summer Internship Program (APT-SIP) is for UG STEM students who have completed at least their sophomore year of college. The 10-week program will allow students to participate in cutting-edge biomedical research projects under the mentorship of our world-class investigators. In this inaugural year, the APTC received 16 applications for 4 slots!

Meet the APT-SIP recipients:

Keying Chen

Mentor: Dr. Evon Erefej

Project: Topographical Neural Electrode Recording at Chronic Time Point

Keith Dona

Mentor: Dr. Jeffrey Capadona

Project: Effect of Chronic Intracortical Microelectrodes Implantation in the Motor Cortex on Rat Motor Behavior

Fangze "Helen" Liu

Mentor: Dr. Ronald Triolo

Project: Correlating spinal electrode location to electrode performance

Joshua Rosenberg

Mentor: Dr. Matthew Schiefer

Project: Modeling the sciatic and splanchnic nerves

Also welcome summer interns Akhil Bheemreddy (Dr. Musa Audu), Lisa Stout (Dr. John McDaniel), and Alex Wolkoff (Drs. Ronald Triolo & Hamid Charkhkar). All of our summer interns will be attending regular [Neural Engineering Center Seminars](#) and [SOURCE Tuesday Lunch & Learn Sessions](#). They will have the opportunity to present posters as well. Thank you to **Dr. Matt Schiefer** for coordinating the summer internship program!



(L-R) Alex Wolkoff, Helen Liu, Keith Dona, Akhil Bheemreddy, Keying Chen, Joshua Rosenberg

High school student, Suraj Srinivasan, represented some of the work being conducted in [Dr. Jeffrey Capadona](#)'s lab at the Intel International Science and Engineering Fair (ISEF) in Los Angeles. He won a [Grand Award: 1st Award](#) in the Biomedical Engineering category for his presentation "*Mosquito-Inspired Insertion Guide Prevents Flexible Intracortical Microelectrodes from Buckling during Implantation.*"

The Intel ISEF, a program of Society for Science & the Public (the Society), is the world's largest international pre-college science competition. He qualified for the Intel ISEF competition by winning 1st place in the regional [Northeastern Ohio Science and Engineering Fair](#).

Congratulations to all of our CLEVELAND MARATHON runners!!

We work our bodies as hard as we work our brains at the APTC. The dedication and determination of our investigators, staff and students at the 2017 Cleveland Marathon was remarkable. Joining veteran runners Breanne Christie, Emily Graczyk, and Lisa Lombardo (*below with her biggest fan, son Owen*) were first-time marathon runners Dr. Hamid Charkhkar and Kevin Tloczynski (*below*).

<u>Name</u>	<u>Net Time</u>	<u>Clock Time</u>	<u>Pace</u>	<u>Event</u>
Breanne Christie	1:02:40	1:12:06	10:05/mi	10K
Hamid Charkhkar	2:44:39	2:53:38	12:33/mi	Half
Emily Graczyk	2:17:29	2:21:43	10:29/mi	Half
Lisa Lombardo	2:02:03	2:06:22	9:18/mi	Half
Kevin Tloczynski	5:17:30	5:19:05	12:06/mi	Marathon

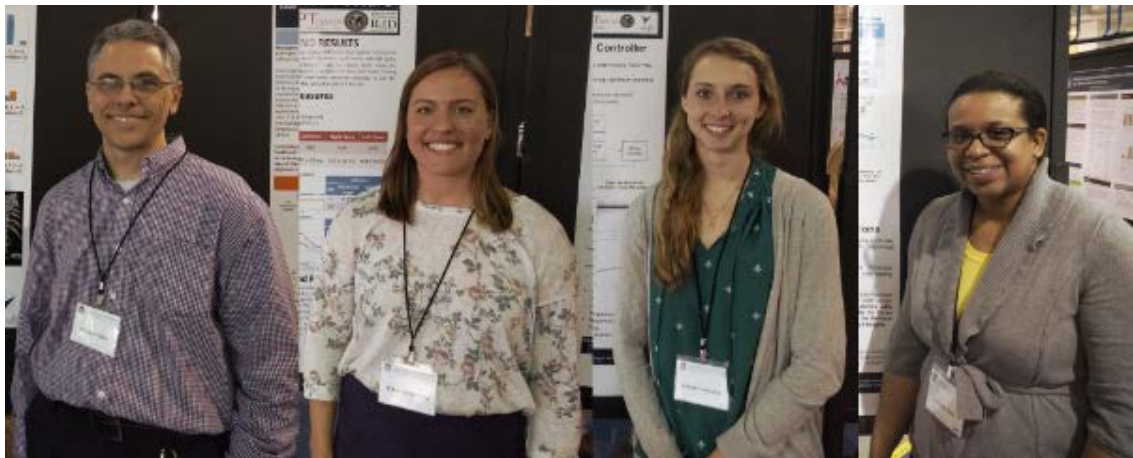


RESEARCH ShowCASE

April 21, 2017

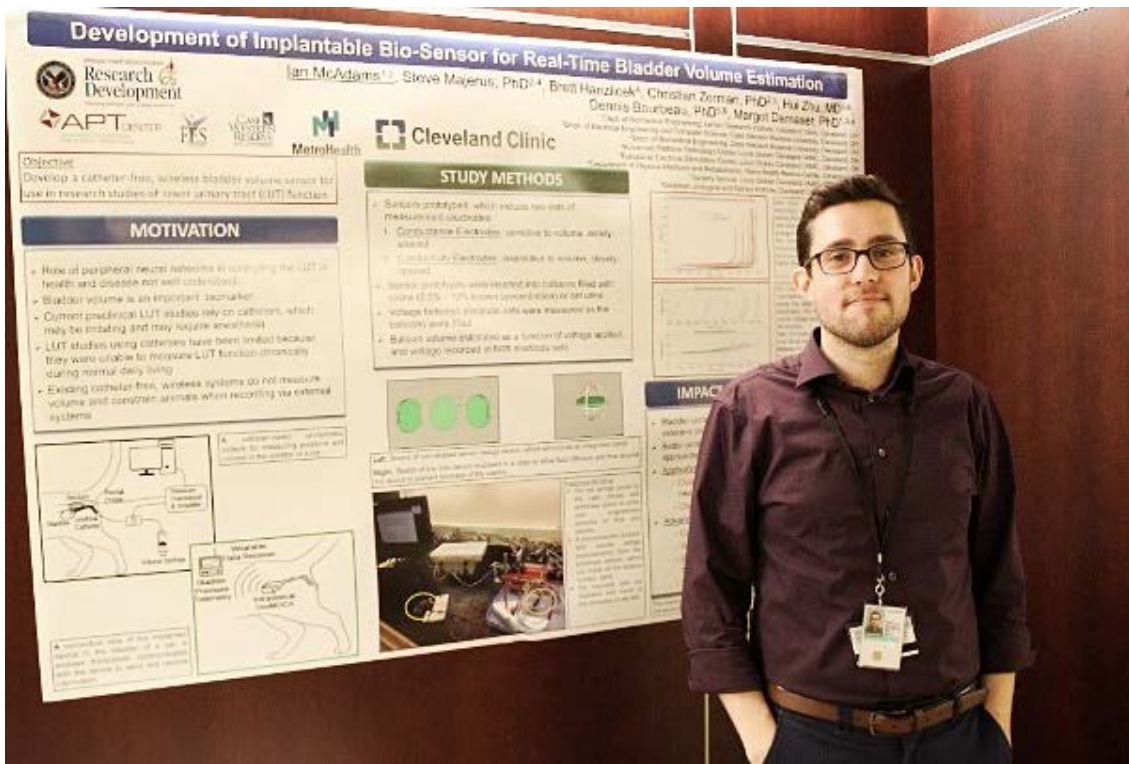
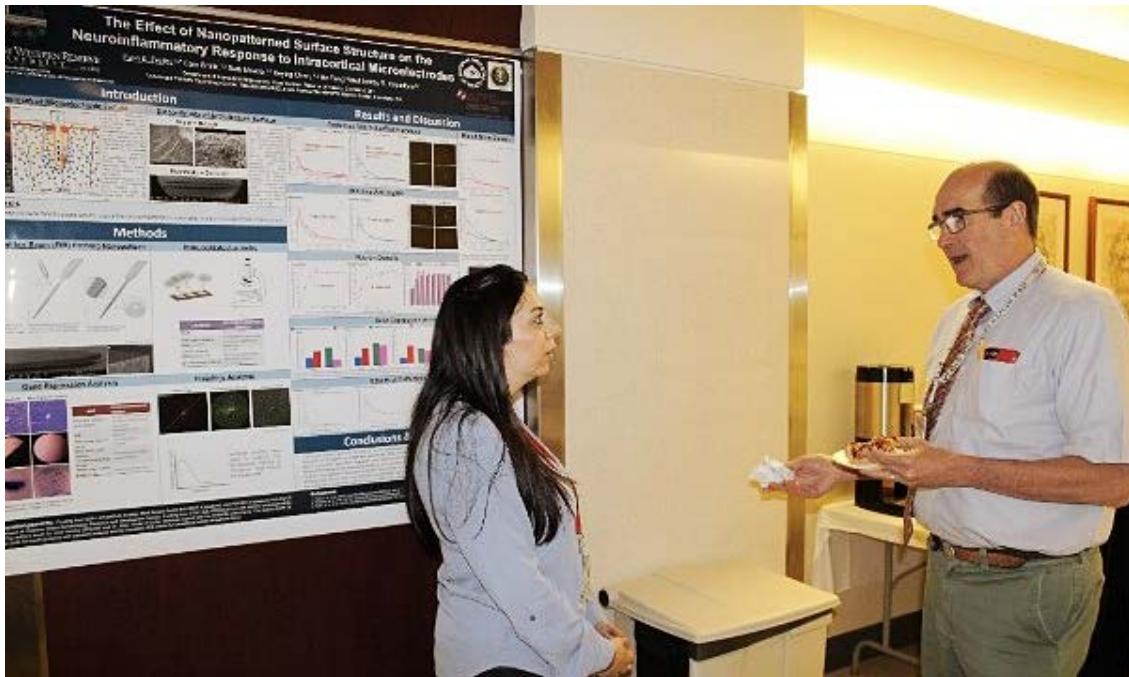
Congratulations to [Dr. Hamid Charkhkar](#) who was awarded \$500 for his poster at this year's Research ShowCASE titled *Sensory Restoration in Lower-Limb Amputees Using Neural Interface Technology*. All winners were honored at the Graduate Studies Awards Ceremony on May 3rd.

Thank you to all of the investigators, staff and students that volunteered at the APTC booth during Research ShowCASE and participated in the event.



VA RESEARCH DAY
May 18, 2017

Thank you to all of the investigators, staff and students that volunteered during Research Day and participated in the event.





RECENT PUBLICATIONS

A small-scale, rolled-membrane microfluidic artificial lung designed towards future large area manufacturing

Biomicrofluidics, 2017

Authors: AJ Thompson, LH Marks, MJ Goudie, A Rojas-Pena, JA Potkay



This [article](#) presents a new manufacturing technology for a microfluidic artificial lung. It is the first step in developing a scalable method for creating large area microfluidic artificial lungs.

Reactive stepping with functional neuromuscular stimulation in response to forward-directed perturbations

Journal of Neuroengineering and Rehabilitation, 2017

Authors: AJ Hunt, BM Odle, LM Lombardo, ML Audu, RJ Triolo

This [article](#) presents progress towards a controller which can improve the safety and independence of persons with spinal cord injury using implanted neuroprostheses for standing.



TRAINING AND EVENTS

Invention Disclosure and Commercialization Process Presented by Daniel Pendergast, MSE, MBA

June 28, 2017
2:00 - 3:00p

Daniel Pendergast from Case Western Reserve's Technology Transfer Office (TTO) will be at LSCVAMC to explain some of services provided by CWRU's TTO. The TTO serve both faculty and student innovators with full-spectrum intellectual property and commercialization services that span the research & development continuum. They serve researchers by assessing and building upon the commercial potential of new ideas and inventions.



Through interaction with inventors, regional and national networks, including affiliate healthcare systems, and potential commercial partners, the TTO endeavor to determine the best path of translation and ultimate commercialization for University intellectual assets.

AMERICAN SOCIETY OF BIOMECHANICS

Boulder, CO

August 8-11, 2017

If you are at the 41st Annual Meeting of the American Society of Biomechanics this August, be sure to stop by the poster session on Thursday to see Dr. Brooke Odle's "Feedback Controller to Adopt Task-Dependent Postures in a Standing Neuroprostheses." Dr. Odle was awarded a Diversity Travel Award to attend the meeting.



UPCOMING GRANT DEADLINES

JUNE

27 - HHMI: Howard Hughes Medical Institute Investigator Competition (for non-VA biomedical researchers)

JULY

5 - NIH: R01, U01 Renewal, Resubmission, Revision Applications

12 - NIH: K Renewal, Resubmission, Revision Applications

12 - CDMRP: Peer Reviewed Ortho. Research Program (PRORP) Pre-Applications

13 - CDMRP: Peer Reviewed Medical Research Program (PRMRP) Pre-Applications (due 13-20, depending on type)

16 - NIH: R21 Renewal, Resubmission, Revision Applications

AUGUST

1 - VA RRD: SPIRE LOI and Waiver requests for Fall Cycle

SEPTEMBER

1 - VA BLRD/CSR, HSRD: RCS Applications

12 - VA RRD: SPIRE Application

13 - VA BLRD/CSR: Merit, CDA, Pilot Applications

27 - CDMRP: PRORP and PRMRP Applications

30 - DOD: USAMRMC BAA for Extramural Medical Research [Full Proposal](#) (submit pre-proposal; wait for invite to submit [Full](#))

LINKS TO ANNOUNCEMENTS

[CDMRP: PRORP](#)

[CDMRP: PRMRP](#)

[DOD Announcement](#)

[Howard Hughes Competition](#)

[NIH Parent Announcements](#)

[VA RFAs](#)

Have something to share? Send YOUR good news and professional accomplishments to Rebecca Polito at rpolito@aptcenter.org to include in a future APT Center eNewsletter.

