

NeuroTechnology Center

The University of Colorado School of Medicine Neurotechnology Center (NTC), directed by Mark Dell'Acqua, PhD, celebrated its second anniversary on July 1, 2021. The NTC missions are: 1) To support core facilities that provide School of Medicine investigators access to key, cutting-edge technologies that are essential for neuroscience research at CU Anschutz; and 2) To work with School of Medicine departments to jointly recruit additional neuroscience-focused faculty to CU Anschutz who emphasize development and application of novel technologies, with a goal of building strong collaborative, cross-disciplinary research teams. Eight School of Medicine departments have joined the NTC as members, representing both basic science and clinical programs.

The NTC also engages in educational and outreach activities by hosting/co-hosting and administering research seminars, retreats, and symposia in partnership with the Neuroscience Graduate Program, the Rocky Mountain Neuroscience Group, and the NSF-funded Rocky Wearable Microscopes Summit. In addition, the NTC is a sponsor of the Summer Research Training Program and a supporter of the NINDS-funded BRAiN summer research program that provide research internships on the campus for undergraduate students from groups historically underrepresented in science.

NTC website: <https://medschool.cuanschutz.edu/neurotechnologycenter>

NTC Director: **Mark Dell'Acqua, PhD.**

NTC Administrator: Paula Robinson

NTC IT Specialist/Web Support: Christopher McClendon

NTC accomplishments 2020-21:

Faculty Recruiting:

In Fall 2020, Daniel Kramer, MD, joined the School of Medicine faculty. Kramer, an NTC joint recruitment with the Department of Neurosurgery, is a neurosurgeon whose research program employs cutting-edge electrophysiological recording, signal processing, and data analysis methods to support deep brain stimulation implantation surgeries and other novel brain-computer interface technologies.

In Spring 2021, Jason Christie, PhD, joined the School of Medicine faculty. Christie, an NTC joint recruitment with the Department of Physiology and Biophysics, uses cutting-edge optical imaging and manipulation approaches and electrophysiological recording both in vitro and in vivo to study circuit function and plasticity in the mammalian cerebellum that underlies control of movement and motor learning.

NTC Cores:

The NTC manages six cores operating as three service-oriented core clusters that provide investigators with powerful transformative tools to incorporate cutting-edge approaches.

Core Cluster 1-Advanced Light Microscopy Core (ALMC): Richard Benninger, PhD (Director); Radu Moldovan, PhD (ALMC Manager); Dominik Stich, PhD; Gregory Glazner, MS

ALMC 20-21 Highlights:

- Total usage of the core: 3,460 hours
- Total number of laboratories that have used the core: 99
- Number of new users of the core: 55
- Number of papers published that acknowledge usage of the core: 21
- 2 OER grants received
- New light-sheet microscope system established
- Submitted NIH S10 grant for new STED super-resolution microscope system

Core Cluster 2-Optogenetics and Neural Engineering (ONE) Core, (IDEA) Core, and the Neuroscience Machine Shop: Gidon Felsen, PhD (Director); Andrew Scallan, MS (ONE Core manager); Ryan Williamson, PhD (IDEA Core manager); Michael Hall, PhD (Neuroscience Machine Shop manager)

ONE Core 20-21 Highlights:

- Designed novel equipment and method for acute and chronic stereotaxic control of high-density (Neuropixel) electrophysiological recording probes.
- Engineered robust hardware and software for concurrent recording of multiple commonly utilized signals in systems neuroscience experiments.
- Designed circuit to real-time transform an alternating analog signal into a signal suitable for commonly utilized analog-to-digital converters.

IDEA Core 20-21 Highlights:

- Conducted preliminary rat sciatic nerve recordings for a School of Medicine investigator working with the NTC In vivo Neurophysiology Core leading to a successful grant application to study peripheral nerve injury recovery.
- Automated an experiment for a School of Medicine investigator to deliver a water reward at various locations along a radius surrounding a head-fixed mouse.
- Produced a mobile device for neurology that can acquire three-dimensional video of patients performing a hand-motion task with the assistance of a physician. For HIPAA compliance, the computer was controlled without the use of a keyboard, mouse, or monitor.

Neuroscience Machine Shop 20-21 Highlights:

- Designed and built a surgical microscope mount and joystick control system for a prism-directed laser for otolaryngology.
- Phantom boxes and stainless steel probes for physician training purposes for radiation oncology.
- Novel hexagonal open-field chambers with accessories for the NTC Animal Behavioral Core.
- Custom designed behavioral apparatuses for neurosurgery.
- Designed and built a micro-drive system working with the NTC In vivo Neurophysiology Core to allow GRIN lenses and electrodes to be simultaneously lowered into brain (for recording and visualization of neuronal activity).

Core Cluster 3-Animal Behavior Core (ABC) and In Vivo Neurophysiology Core (IVNC): Michael Mesches, PhD (Director); Nicolas Busquet, PhD (ABC manager); Connie Brindly, BS; Jessica Carlsen, MS

Animal Behavior Core (ABC) 20-21 Highlights:

- Helped research teams design, plan, and perform long-term and short-term behavioral studies.
- Instituted new behavioral testing paradigms (Dynamic Weight Bearing, Gait Analysis, Home Cage Monitoring)
- Total number of laboratories that have used the core: 15
- School of Medicine departments/divisions served: 10

In Vivo Neurophysiology Core (IVNC) 20-21 Highlights:

- Instituted new visual evoked potential recording and analysis and sciatic nerve recording and analysis services (collaboration with NTC ABC).
- Added new electrode placement verification service
- Added new EEG recording data analysis service
- Upgraded rat EEG recording equipment
- Total number of laboratories who have used the core: 9
- School of Medicine departments/divisions served: 7