CHRONIC BRAIN INJURY PROGRAM

Fiscal Year 2020

THE OHIO STATE UNIVERSITY
VISION

Ohio State will be a global leader in the prevention, characterization, detection, and treatment of brain injuries and neurodegenerative disease.

MISSION

The Chronic Brain Injury Program (CBI)

- drives team science and translation in neurotrauma and neurodegenerative disease research,
- facilitates collaboration and engagement across complementary research teams and external partners, and
- invests in talent, innovation, shared resources, and experiential training.

discovery.osu.edu/cbi
The Centers for Disease Control and Prevention reports that in the United States, traumatic brain injury (TBI) and related long-term challenges cost $77 billion in direct care, rehabilitation, and lost productivity.

In the US, a TBI occurs every 15 seconds, more frequently than breast cancer and heart attacks. Brain injuries including strokes occur every 9 seconds.

In Ohio, 1 in 4 adults is a brain injury survivor. Care and consequences of TBI cost the state over $4 billion each year.

The individual variability in injury outcomes requires a comprehensive research and care approach to address the overt and unseen obstacles to independence, productivity, and living well after brain injury.

**OUR CHALLENGE**

TBI: The Invisible Epidemic

**OUR GOALS**

Develop and inform a comprehensive plan of care for brain injury survivors and caregivers

Translate an improved understanding of brain injury into new interventions and technologies

Enhance our ability to produce, use, and access clinical research data

Expand experiential training for professionals and students

Create a community of researchers, clinicians, and survivors across the university and its partners
OUTCOMES

Transforming Brain Injury Research at Ohio State

Ohio State’s strengths in neuroimmunology, spinal cord injury, and engineering complement its unique position as a large, diverse, and community-oriented research institution. Since 2014, CBI has built on this foundation by recruiting faculty, creating connections across colleges and disciplines, and investing in research to produce a portfolio of impactful projects.

Data for the period July 1, 2019 to June 30, 2020
Financials obtained from e-Activity

Ohio State NIH-Funded Traumatic Brain Injury Research
New Award Funding ($) & New Projects (n) by Fiscal Year

Source: NIH Project Reporter
Chronic Brain Injury Program | Annual Report | FY 2020

**IMPACT**

Building Success in Key Research Areas

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**Translational Neurotrauma**

Discovering the mechanisms and signs of brain injury and its chronic effects across the lifespan.

- Olga Kokiko-Cochran (Neuroscience) was granted Department of Defense (DOD) funding to study the inflammatory effects of sleep disruption after TBI
- Hongjun Fu, PhD (Neuroscience) was awarded DOD funding to investigate the genetic influences on development of Alzheimer’s-like pathology following TBI
- Ruth Barrientos, PhD (Psychiatry) was awarded a National Institute of Aging (NIA) funding to study how high-fat diets impair memory in older adults.
- Andrea Tedeschi, PhD (Neuroscience) received a National Institutes of Health (NIH) R01 grant to study new mechanisms promoting central nervous system repair
- Elizabeth Kirby, PhD (Psychology) was awarded funding from the National Science Foundation (NSF) to characterize self-regulation of adult neural stem cells, as well as promote high school education

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**Treatment & Prevention**

Informing holistic, coordinated recovery plans by connecting scientists, survivors, and clinicians.

- Jennifer Lundine, PhD (Speech & Hearing Sciences) and partners were awarded $2.2 million from the CDC to compare academic, social, and health outcomes of children with TBI participating in return-to-school program vs. variable transition services
- Jan Schwab, MD, PhD (Neurology) was awarded a National Institute of Neurological Disease & Stroke (NINDS) R01 award to reduce post-injury infection risk
- Catherine Quatman-Yates, PT, DPT (Physical Therapy) led development of the first American Physical Therapy Association-endorsed clinical practice guidelines for evaluating and intervening after potential concussions
- Jennifer Bogner, PhD (Physical Medicine & Rehabilitation) received the William Fields Caveness Award from the Brain Injury Association of America for a career of outstanding contributions to bettering the lives of people with brain injury

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**Detection & Data**

Improving our detection and monitoring of injury to evaluate interventions and predict recovery.

- Scott Hayes, PhD (Psychology) was awarded NIA funding to exploring real-time alterations in cerebral blood flow, corresponding magnetic resonance imaging biomarkers, and cognition during physical activity
- Kiryung Lee, PhD (Electrical & Computer Engineering) received an NSF Career award to use modern data science methods to improve signal processing and data acquisition challenges in super-resolved human imaging
- Asimina Kiourti, PhD (Electrical & Computer Engineering) was awarded NSF funding with interdisciplinary partners to develop smart and connected health systems featuring personalized wearable biomarker monitors
- Lauren Southerland, MD (Emergency Medicine) received an NIA training award to enhance detection of falls and delirium in geriatric patients through improved screening methods in emergency departments
Chronic Brain Injury Program | Annual Report | FY 2020

RESEARCH

Seeding Interdisciplinary Team Science

CBI’s signature program invests in teams of scientists that bridge colleges and institutions. Each team is granted $25,000 to realize ambitious ideas and to advance projects to the next level. Since 2016, CBI has launched 42 team projects, which have already brought in $12.5 million in subsequent extramural awards to the university.

Counteracting Maladaptive Plasticity and Chronic Neurodegeneration Following Brain and Spinal Cord Injury Using a “Smart” Drug Delivery System (SDDS)
Andrea Tedeschi, John Lannutti, Craig McElroy
Engineering, Medicine, Pharmacy

Pilot Study for Empowering Survivors of Traumatic Brain Injury to be Physically Literate and Active for All Years (TBI-PLAAY)
Catherine Quatman-Yates, Jennifer Bogner, Leann Lower-Hoppe, Laura Schmitt, Lise Worthen-Chaudhari
Education & Human Ecology, Medicine

Optical Coherence Tomography for the Diagnosis of Chronic Traumatic Encephalopathy
Andrew Sas, Kevin Weber, Nathan Doble, Stacey Choi
Medicine, Optometry

Embodied Effects Of Rhythmic Music Among Adults With Brain Injury
Lise Worthen-Chaudhari, Eugenia Costa-Giomi, W. Jerry Mysiw, Catherine Quatman-Yates, Jinghua Li, Asimina Kiourti
Arts & Sciences, Engineering, Medicine

Assessing Needs of FQHCs to Become Partners in Chronic Brain Injury Detection and Rehabilitation among Domestic Violence Survivors
Julianna Nemeth, Rachel Ramirez
Public Health, Ohio Domestic Violence Network

INNOVATION

2020 Pilot Award Projects

$1.2M INVESTED BY CBI
$1.5M MATCHED FUNDS
$12.5M EXTRAMURAL AWARDS
80 FACULTY AWARDEES
45 PUBLICATIONS
9 COLLEGES FUNDED
EDUCATION

A BRAIN-INJURY INFORMED WORKFORCE

CBI GRAND ROUNDS

CBI launched interdisciplinary lectures for clinicians to raise awareness of brain injury treatment practices across clinical disciplines, and to jointly discuss research and clinical insights.

CBI has partnered with five Wexner Medical Center departments to host this series. CBI continued its NeuroTrauma Research in Progress Seminars (NT-RIPS) series and Research Day events, moving to virtual presentations in the summer.

CBI Grand Rounds in Neurological Surgery, January 2020

BRAIN HEALTH HACK

CBI co-hosts this innovation competition with the Human Performance Collaborative, teaming undergraduate students from Engineering, Arts & Sciences, and Medicine to competitively develop mobile health tools for brain injury research and recovery in a weekend sprint. 2020 project sponsors from Bertec and the Wexner Medical Center challenged 30 competitors to create balance assessment and concussion monitoring solutions. Additionally, Hack alum Jennifer Schlegel became a finalist for the Schmidt Futures-funded Alliance for the American Dream competition with her 2019 BHH project, 119, a smarter approach to managing emergency situations for those with chronic conditions.

SUMMER UNDERGRADUATE RESEARCH FELLOWSHIPS (SURF)

CBI offers SURF awards to support young researchers completing summer projects with our affiliates. These fellowships create an additional training component to funded research projects.

Engaging key stakeholders to improve rehab care for Ohio children with TBI
Fellow: Kayla Bruns
Speech & Hearing Sciences, Spanish
Mentor: Jennifer Lundine, PhD
Speech & Hearing Sciences

Morphological and behavioral effects of astrocytic gap junction coupling modification
Fellow: Lindsay Trank
Neuroscience
Mentor: Min Zhou, PhD
Neuroscience

The Utility of Concussion Baseline and Post-Injury Assessments for Predicting Subsequent Musculoskeletal Injuries and Concussions
Fellow: Levi Weitzel
Biology
Mentor: Jaclyn Caccese, PhD
Health & Rehabilitation Sciences
OUTREACH

Implementing the Land-Grant Mission

NEURONIGHTS

Responding to pandemic-related needs for social wellness among brain injury survivors, limited family caregiver education during inpatient rehabilitation, and barriers to undergraduate experiential learning, CBI partnered with Wexner Medical Center therapists and undergraduates from Buckeyes Raising Awareness in Neuroscience (BRAIN) to create NeuroNights, an online wellness education series.

Featuring faculty research talks, patient education classes, and socials with community members, NeuroNights has hosted 15 sessions for 118 registrants since January 2020 on topics including coronavirus safety, financial planning, mindfulness, music and drama, and animal companionship. The program is supported by funds raised at the annual student-led Brain Injury Awareness 5K Race.

OHIO TBI SUMMIT

The Brain Injury Association of Ohio (BIAOH) is the largest advocacy and support organization for TBI survivors, caregivers, and health professionals across Ohio. CBI works with BIAOH and members of Ohio’s Brain Injury Advisory Council (BIAC) to better understand the needs and goals of key stakeholders in brain injury treatment and recovery.

In response, CBI has helped expand research presentations at the Ohio TBI Summit, a state-wide conference that educates professionals and community members on brain injury topics that promote best practices for recovery. At the 2020 Summit, CBI faculty and trainees presented 20 posters on therapeutics, policy, biosensors, and arts-based interventions. Additionally, several CBI faculty participated in panel discussions on a variety of behavioral health topics.

New topics of interest identified by BIAOH include building advocacy networks, modernize their helpline, improve connections with brain injury survivors via social media, and educating primary care providers. CBI has created channels for undergraduate internships to aid with these needs, CBI Program Manager, Kedar Hiremath, will curate the 2021 conference.
Creating a Collaborative Community

NEURODEVELOPMENTAL RESEARCH
Pediatric TBI is woefully understudied, but researchers at Ohio State and NCH are collaborating to address this important gap. CBI worked with faculty and leaders at Nationwide Children's Hospital (NCH) to develop the Neurodevelopmental Research Affinity Group (NRAG) featuring traumatic brain injury and neurodevelopment researchers.

SPECIAL POPULATIONS
CBI is developing new partnerships to address key at-risk populations. Faculty appointments with the Columbus Veterans Affairs research group and new research projects with the Ohio Domestic Violence Network will provide new opportunities to study special populations across the translational spectrum.

IMAGING TECHNOLOGIES
CBI is building on College of Arts & Sciences expertise in brain imaging with partner OBELAB to provide bedside functional near-infrared spectroscopy (fNIRS) for stroke patients in the intensive care unit. fNIRS projects are ongoing in several clusters of CBI faculty affiliates.

PARTNERS CAMPUS & COMMUNITY PARTNERS
College of Arts & Sciences
Institute for Behavioral Medicine Research
Brain Injury Association of Ohio
Center for Brain & Spinal Cord Repair
Center for Cognitive & Behavioral Brain Imaging
College of Engineering
Human Performance Collaborative
College of Medicine
Nationwide Children's Hospital
Neurological Institute
College of Nursing
Ohio Brain Injury Program
Ohio Domestic Violence Network
Ohio TBI Model Systems
PROGRAM ACTIVITIES
Growing & Supporting Neurotrauma Communities

CBI programming supports the University's research, education, outreach, and stewardship goals. We continue to recruit new faculty to Ohio State with partner departments across campus. Our program staff manage competitive funding programs, research presentation series, an annual symposium, and educational workshops. Additionally, CBI connects researchers to colleagues and organizations across the university and beyond through team-building events, discussions and town halls.

NEW FACULTY HIRES

Jaclyn Caccese, PhD  Health & Rehabilitation Sciences  College of Medicine  Detection & Data
Jinghua Li, PhD  Material Science & Engineering  College of Engineering  Detection & Data

NEW FACULTY AFFILIATES
Chen Gu, PhD | Biological Chemistry & Pharmacology
Paola Malerba, PhD | Nationwide Children’s Hospital
Andrew Sas, MD, PhD | Neurology
Philip Yuhas, OD, PhD | Optometry
Min Zhou PhD | Neuroscience

Recruiting Faculty
2 NEW FACULTY HIRES
5 NEW FACULTY AFFILIATES

Grants & Fellowships
$125K PILOT AWARDS
$60K PROJECT PERSONNEL
$12K SURF AWARDS
$10K EQUIPMENT AWARDS

Seminars, Workshops & Symposia
15 NT RIPS SEMINARS
12 NEURO NIGHTS
90 RESEARCH DAY ATTENDEES
30 BRAIN HEALTH HACKERS
2 GRAND ROUNDS
FUTURE RESPONSES

PILOT AWARDS
In March 2020, CBI paused all ongoing pilot projects with extensions granted through Summer 2021. Additionally, due to potential impacts on University funding, CBI cancelled new pilot awards for Spring 2020. However, the interactions between COVID-19 and brain injury, including stroke risk and environmental challenges, have created opportunities to study infection risk and consequences in the context of neurotrauma. CBI will fund interdisciplinary projects related to infection and injury in future pilot award cycles.

VIRTUAL ACTIVITIES
As we zoomed to working remotely, CBI relaunched the NT-RIPS and Grand Rounds series in virtual format to continue connecting the research and clinical communities. CBI also refocused the NeuroNights series to address social isolation by creating Social Nights for group discussion, and tripling the number of sessions per month. Finally, CBI's Research Day symposium was converted to a virtual-only meeting, featuring video poster presentations and several networking sessions.

SOCIAL MEDIA
CBI’s marketing and communications approach was enhanced by Twitter and YouTube channels to continue engaging with science communicators, colleagues, and survivors. Over the next fiscal year, CBI will continue to create and share research findings, successes, and educational content.

CHALLENGES
FUNDING
With expected changes to federal and state budgets, the CBI program and faculty have faced and will continue to face changes in the funding environment. Most CBI faculty pursue federal funding, and the impacts to near and medium term sustainability are uncertain.

RESEARCH & EVENT LIMITATIONS
As we resume research on campus, CBI faculty report continuing challenges to accessing shared resources, trainee support at both graduate and undergraduate levels, and significant delays in recruitment of human subjects for their experiments. Events including CBI Research Day and Brain Injury Awareness 5K could not be held and were postponed.

TREATMENT & EDUCATION
Survivors of moderate to severe brain injury who are admitted to inpatient rehabilitation require family support upon discharge. However, due to hospital visitor policies, family caregivers are not receiving critical information on symptoms, behavior change, and how to access resources.

PHYSICAL & SOCIAL EFFECTS
Stress and anxiety are particularly problematic for the health of brain injury survivors, as this can exacerbate symptoms and increase risk of long-term neurodegeneration. Additionally, active social engagement is an important wellness strategy for injury survivors, and social isolation can further challenge recovery and healthy living.

PANDEMIC

RESPONSES

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FUTURE

PROJECTS & INVESTMENTS

TRANSLATIONAL RESEARCH INFRASTRUCTURE
CBI is developing a statewide voluntary registry and a TBI biobank in alignment with Arts & Sciences and Wexner Medical Center priorities. These efforts and others will provide better access for researchers to patients and improve data sharing. Goals include recruiting 200 registrants through FY2022 and 100 biobank participants through FY2023.

LEVERAGING FACULTY CLUSTERS
Building on the early successes of our faculty and program, CBI will ramp up strategic development of aligned faculty research projects to compete for prestigious center and training grants. Potential areas include neuroimmunology, treatment of mild TBI, domestic violence, biosensors, and neurodevelopment. We aim to capture multiple grants by FY2025.

POLICY RESEARCH
CBI and the Ohio Brain Injury Program are collaborating to develop research partnerships and projects that will address disproportionately low state funding for brain injury services and resources in the State of Ohio. In FY2021, CBI will begin connecting faculty affiliates with state agency leaders and experts in public health, law, and public policy, to begin translational projects in health services and outcomes research. Successful efforts should result in State funding of $1+ million by FY2024.

PROFESSIONAL EDUCATION
CBI will develop education programs to better address limited training in brain injury topics, particularly in the existing and incoming medical and health professionals. CBI will support formal mentorship of research faculty across colleges to improve the skillsets critical for success in interdisciplinary research. Faculty, staff, and trainee engagement will be a primary metric.

CHALLENGES TO ADDRESS

FACULTY CAREER DEVELOPMENT
Discovery Themes faculty are jointly hired and supported by tenure-initiating departments and CBI. As these faculty progress in their careers, their service and contributions to CBI do not receive adequate recognition in the promotion and tenure process. Similarly, course buyout requirements do not reflect the joint salary support structure. CBI is working with university leadership and individual department chairs to remove or reduce these barriers to Discovery Themes’ hires success.

RESEARCH RECRUITMENT
Concussion, or mild traumatic brain injury (mTBI), survivors are prevalent in the Ohio and Columbus area populations, but many do not initially seek or receive services. In order to effectively recruit subjects with mTBI, CBI is working with Wexner Medical Center clinicians to create clinics and support services that complement current efforts to register, educate, and meet with survivors and caregivers.

PHYSICAL SPACE
We have unique and innovative ways for our groups to engage, interact and collaborate. However, connected research labs and office space that house interdisciplinary CBI working groups is ideal. We are working with university leadership to identify shared spaces to become a more physical – rather than virtual – institute.
Acknowledgements

This report was compiled by the CBI Program Staff: Kedar Hiremath, Julie Hannahs, Jenna McCloskey & Jonathan Godbout.

Images provided by:

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Brain Injury Association of America

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