LIBR

Laureate Institute for Brain Research

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Scientific
Report
2020

LIBR

Laureate Institute for Brain Research

Improving Mental Health Through Neuroscience

IMPROVING MENTAL HEALTH THROUGH NEUROSCIENCE

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LIBR

The Laureate Institute for Brain Research (LIBR) facilities consist of 27,000 square feet of space in a building that is attached to the Laureate Psychiatric Clinic and Hospital. The neuroimaging and laboratory facilities at LIBR are entirely dedicated to research. They include two MRI scanner bays and a control room, two video-teleconferencing-enabled group meeting sites, several medical examination and research subject prep rooms, the computing facility and ample office space for the investigators.

Details of LIBR facilities:

LIBR occupies 27,000 square feet of space designed for neuropsychiatric and neuroscience research on the campus of the Laureate Psychiatric Clinic and Hospital (LPCH) at Saint Francis Hospital.

- 42 offices, including three large shared offices for students and volunteers
- 5 conference rooms
- 2 MRI bays and adjoining control rooms
- 3 psychophysiology testing rooms
- 2 behavioral observation rooms
- 2 medical/blood draw rooms
- 1 mock scanner room
- 1 neuropsychological testing room
- 1 transcranial magnetic stimulation (TMS) room
- 2 float rooms

The Laureate Institute for Brain Research (LIBR) continues to grow and have scientific impact. Researchers from LIBR published over 107 scientific manuscripts in 2020, a 180% increase. We also continue to seek extramural support from governmental agencies. This highly competitive process requires multiple tries and persistence.

Unquestionably, this has been a difficult year in many respects. The impact of COVID-19 has been profound on staff, research participants and operations. We made the decision to close the Institute to in-person data collection between late March and the middle of May. Since that time, we have begun to re-establish our experiments and have been quite successful in following up with our participants for our ongoing studies. Despite these challenges, LIBR's scientific productivity has been outstanding. LIBR investigators and affiliated investigators published 107 scientific manuscripts in 2020, which is a 180% increase from 58 publications in 2019. Moreover, the principal investigators and associate investigators have applied for 15 major extramural grants, another doubling of effort compared to 2019. Most notably, Dr. Robin Aupperle received her first R01 grant notice of award in the summer of this year. In addition, we are awaiting the notice of award for Dr. Jennifer Stewart for her R01. What is important, however, is that all of the investigators have been competitive and persistent in applying for extramural funds. The ultimate goal remains for the team at LIBR to use neuroscience-based approaches to develop better tools for the assessment, prognosis, and diagnosis of mental health conditions and to improve treatments for these illnesses.

Martin Paulus, M.D.
Scientific Director and President
LIBR

Scientific Accomplishments: In addition to the enormous productivity of LIBR investigators, there are several notable accomplishments. Dr. Jonathan Savitz and his postdoctoral fellow Dr. Haixia Zheng have been working to discover brain-imaging related evidence for the role of cytomegaloviruses (CMV) on the development or maintenance of depression. In a recent publication they report that brains of individuals with a history of CMV and depression had a unique structural brain signature that may hint at the effect of CMV in the brain contributing to depression. Although there is a lot more work to do, if true, this discovery could provide a completely new approach to treating some individuals with depressive disorders. At the same time, Dr. Savitz and his team have been accumulating evidence that kynurenine, an amino acid metabolite, could be a molecular marker of depression disease state. Danielle DeVille, a graduate student in Dr. Khalsa's group, found that individuals who

are at risk for suicide may not experience their body as sensitively, possibly a risk marker that needs to be evaluated further. Finally, Dr. Aupperle and several LIBR investigators were involved in creating the Tulsa Life Chart, which is a web-based, structured approach for obtaining and graphically representing historical information on psychosocial and mental health events. The Tulsa Life Chart can be used to map out the course of mental health problems over time, which has been difficult to do but is important for both prognosis and management of these diseases.

Adolescent Brain Cognitive Development (ABCD)
Florence Breslin continues to lead the study and the four-year follow-up visits began in September. LIBR ABCD exceeds expectations for retention with 99.11% of follow-up visits complete! LIBR was awarded a seven-year renewal of the ABCD grant to continue our work with the Tulsa families and received one of the best scores from NIDA. LIBR, unprecedentedly, had an extremely positive grant review. We continue research into the effects of in screen media on development and have started to incorporate evaluations into the mental health of participants. Specifically, we found that – contrary to what is commonly assumed – an increase in screen media activity did not necessarily reduce other recreational activities in these youth.

The Center for Neuroscience-based Mental Health Assessment and Prediction (NeuroMAP)
The LIBR Centers of Biomedical Research Excellence (CoBRE) award focuses on the identification of objective biomarkers for mood and anxiety. The infrastructure established by this grant provides us the opportunity to train young investigators toward independent funding from the National Institute of Health and additional granting agencies. The core services led by **Dr. Jerzy Bodurka**, **Dr. Kent Teague** (OU), and **Dr. Brett McKinney** (TU) include standardized neuroimaging acquisition and processing pipelines, blood biomarker pipelines and statistical analyses. This year we are working to add new junior investigators to be part of NeuroMAP. Dr. Maria Ironside joined us in the fall and is focusing on the degree to which sensitivity to threat contributes to anxious depression. Her goal is to identify interventions such as transcranial direct current stimulation that can specifically reduce anxiety in depressed individuals. The first group of investigators have done extremely well and are poised to be funded by the National Institutes of Health for the continuation of their projects.

Jonathan Savitz, Ph.D., submitted several major NIH grants this year and has received encouraging feedback suggesting that he will be funded in 2021. He has received significant visibility in the field as both an expert in the influence of the kynurenine metabolism in psychiatric disorders and for his studies on how the immune system is affected in depression. He published 15 peer-reviewed manuscripts in 2020 and continues to be a major leader in the discovery of biomarkers for different stages of depression. He has recruited a fantastic group of postdoctoral fellows, Drs. Leandra Figueroa-Hall, Haixia Zheng, and Bart Ford, who are working on different aspects of inflammatory changes in depression, an important area for both diagnostic and treatment targets to find better ways of dealing with depression.

Jerzy Bodurka, Ph.D., our Chief Technology Officer, authored or co-authored 19 publications in 2020 and continues to advance our imaging facility by providing state-of-the-art magnetic resonance imaging technology. Most recently, he has established a way of directly measuring myelin, a major component of the white matter of the brain that is important for the connection between different brain processing areas. The goal is to determine whether subtle changes in myelin may provide early indicators of disease progression in depression and possibly substance use disorder. He is also working toward an extension for a standard MRI system that will enable clinicians to use real-time functional magnetic resonance imaging to improve depressive symptoms. This work could lead to the first "product" actually developed at LIBR, which would be a major milestone for the Institute.

Robin Aupperle, Ph.D., received a major grant from the National Institute of Mental Health this year to study neuroscience-informed behavioral intervention in mood and anxiety disorders. She authored or co-authored 11 publications in 2020 and made some significant advances by showing that behavioral treatments result in neurochemical changes that could lead to an approach for testing whether patients with depression have received sufficient treatment to prevent recurrence in the future. Dr. Aupperle supervises an outstandingly productive group of graduate students, Kelly Cosgrove, Danielle DeVille, and Tim McDermott, who have been extremely productive and who have received grants to support their work. In collaboration with Dr. Kirlic, Dr. Aupperle developed a behavioral intervention to increase resilience for healthcare workers during the time of COVID-19.
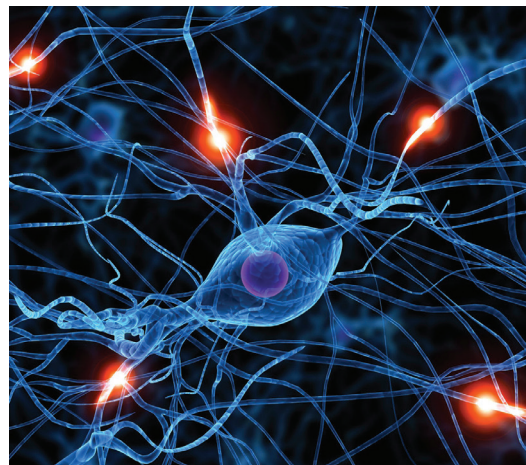
Sahib Khalsa, M.D., Ph.D., our Director of Clinical Operations, who oversees the clinical assessments and has been invaluable during this difficult time, authored or co-authored 13 publications in 2020. His group has been focused on deepening our understanding of how interoception, i.e., the processing of information coming from the body, helps or interferes with mental health. He has teamed up with our associate investigator, Dr. Ryan Smith, to develop a mathematical approach to more precisely quantify the dysfunctions of interoceptive processing in mood and anxiety disorders. In addition, he has taken over the Floatation Clinic and is currently supervising an exciting study that examines whether floatation could be useful for individuals with anorexia nervosa.

Jenny Stewart, Ph.D., has been an outstanding leader in training the next generation of LIBR investigators. She conducted a class for postdoctoral fellows focused on helping to submit career development award proposals to the National Institutes of Health. As a consequence, we have submitted more of these types of proposals than ever before. In addition, she has been very productive and authored or co-authored 22 publications in 2020. Dr. Stewart has also received an outstanding score on her R01 grant submission and is expected to receive the notice of award in 2021. This project is focused on understanding how the brain changes as a consequence of abstinence in individuals who have been using opioids. This work is important because we know virtually nothing on how the brain heals from opiate addiction, which is among the most pressing public health problems of our time.

Salvador M. Guinjoan, M.D., Ph.D., joined us in September as a new principal investigator. He comes to us from Buenos Aires, Argentina, where he was the Chief of Psychiatry, FLENI Foundation, and Associate Professor of Psychiatry and Mental Health, University of Buenos Aires School of Medicine. He has been interested in treatment-resistant depression and – most recently – has started to work on the neuroscience underlying rumination in depression. Rumination, i.e., the incessant thinking about negative events that are related to oneself, is an important feature of severe depression that makes individuals less likely to respond to treatment. Dr. Guinjoan will focus on developing new ways of assessing the brain bases of rumination and develop novel interventions to improve the condition of those who suffer from depression with intense rumination.

Associate Investigators
These investigators are the rising stars at LIBR and assure that we will continue to have thriving research for the foreseeable future. We were fortunate to bring two new associate investigators onboard in 2020.

Hamed Ekhtiari, M.D., Ph.D., continues to work on using neuroscience-based training of individuals with substance use problems to enhance abstinence. Moreover, he completed an experimental medicine study focused on using transcranial direct current stimulation to attenuate craving in individuals with methamphetamine use disorder. He has been very productive and authored or co-authored 12 publications in 2020. He has also submitted his first large grant application, which received an encouraging assessment. Dr. Ekhtiari is increasingly being recognized by leaders in the addiction field as an up-and-coming researcher and educator. He has worked with several senior investigators to develop better standards for the assessment of craving, the performance of neuromodulation to attenuate substance use symptoms, and the role of cognition in substance use disorder.

Namik Kirlic, Ph.D., is focused on developing interventions that will help youth with mood and anxiety disorders and those at risk for these disorders cope better with the challenges that are common for this age group. He has authored or co-authored five publications in 2020. His work complements that of the other investigators at LIBR because he focuses on an age group that has recently received national attention for the stunning rise of anxiety and depression. It is now recognized that teenagers are reporting unprecedented levels of depression and suicidal ideation, which has caught the attention of the National Institute of Mental Health and which has become a national priority. Dr. Kirlic is using mindfulness and real-time functional magnetic resonance imaging neurofeedback to identify how to modify the intervention to make it most effective.

Ryan Smith, Ph.D., is focused on developing computational approaches to better quantify the dysfunctions in individuals with mood and anxiety disorders. In particular, he is working on new ways of assessing individuals when they are under distress to determine what processes go awry in depressed and anxious people and how they are contributing to continued problems with mood and anxiety. This work is highly innovative and could be a game changer when it comes to assessing these dysfunctions using mobile technology. He has been extremely productive and authored or co-authored 11 publications in 2020.

Evan White, Ph.D., was recently awarded a K99 grant to explore cultural protective factors among American Indians from a neuroscientific perspective. His work focuses on the cultural factors that affect outcomes and treatment responses in individuals with mood and anxiety disorders. In particular, he has focused on the contribution of Native American acculturation to booster resilience to mental health conditions. To that end, he is developing a novel neuroscience-based approach to measuring the cultural influences on how we process emotions. He authored or co-authored nine publications in 2020.

Maria Ironside, Ph.D., joined LIBR as an associate investigator after completing her postdoctoral fellowship with Dr. Diego Pizzagalli at the Center for Depression, Anxiety and Stress Research at McLean Hospital in Boston. Dr. Ironside is interested in the role of sensitivity to threat in modulating the levels of anxiety that individuals experience when they are depressed. She is using transcranial direct current stimulation to modulate this sensitivity to possibly reduce anxiety and – as a consequence – improve depression. She has also joined the new group of CoBRE investigators and will begin her project in early 2021.

In summary, given the challenges that the Institute has faced in 2020, the investigators have shown remarkable resilience and productivity. As LIBR grows to become an established force in the research community, we are also being vigilant in keeping our eyes on how the results we are generating can be put to use to improve the conditions of those suffering from mental health problems. This focus is a unique aspect of LIBR and differentiates the Institute from the typical academic institution. Our proposed study of real-time functional magnetic resonance imaging neurofeedback as a treatment for depression is a good example of this type of effort. To make evidence-based, robust progress to improve mental health takes years of effort, but we are well along the way.

2020 AWARDS

RACHEL LAPIDUS was selected for an oral presentation on "Augmented Interoceptive Exposure Training For Food-Related Fear in Anorexia Nervosa: a Proof-of-Concept Study" at the virtual *Intentional Conference on Eating Disorders* in Sydney, Australia.

DR. CHRISTINA RALPH-NEARMAN was selected as the recipient of the Body Image & Prevention SIG Early Career Abstract Award for "Visual Mapping of Body Image Disturbance in Anorexia Nervosa Reveals Objective Markers of Illness Severity" at the virtual *Intentional Conference on Eating Disorders* in Sydney, Australia.

DR. SAHIB KHALSA was invited to join the editorial board of *Biological Psychology*, a journal that features important work on the biological aspects of psychological states and processes.

LIBR MISSION

A clinical neuroscience research institute that recognizes the dignity of each person, and leverages leading talent and technology to discover the causes of and cures for disorders of mood, anxiety, eating, and memory.

SPECIFIC AIMS

Bring to bear a multidisciplinary research program aimed at illuminating the pathophysiology of neuropsychiatric disorders.

Develop novel therapeutics, cures and preventions to improve the well-being of persons who suffer from or are at risk for developing neuropsychiatric disorders.

Foster collaboration among scientists, clinicians and institutions engaged in research that enhances wellness and alleviates suffering from neuropsychiatric disorders.

HISTORY

LIBR opened on May 1, 2009, and currently houses a multidisciplinary team of scientists and clinical research staff who apply neuroimaging, genetic, pharmacological and neuropsychological tools to investigate the biology of neuropsychiatric disorders. Founded by The William K. Warren Foundation, LIBR's purpose is to conduct studies aimed at developing more effective treatments and prevention strategies for these disorders. The studies are led by scientists from diverse backgrounds, including physics, cognitive neuroscience, psychology, psychiatry, developmental neuroscience, computer science and genetics.

The goal for LIBR is to generate impactful research (knowledge) that makes a difference in mental health. That is, the principal product of LIBR is knowledge building. In order for knowledge to be impactful, it needs to change behavior of the stakeholders and, as a consequence, improve the quality of life of the mentally ill. This change in behavior could be applying a new treatment, providing information to the patient that affects their behavior to improve outcomes, changing the strategy of treatment based on novel assessments or providing information about likely outcomes in the future. A critical task in creating impactful knowledge at LIBR is to shorten the gap of time between the acquisition of knowledge and the implementation in clinical practice. This gap of time will be greater if production of knowledge focuses on basic processes underlying the pathophysiology of the disorder as opposed to changing behavior. Therefore, we need to be mindful of creating knowledge that will affect mental health in the short-term as well as the long-term.

THERE IS A NEED FOR:

1
Earlier detection of the development and/or exacerbation of mental health conditions, e.g., early but not late stages of mood disorder may be treatable with an anti-inflammatory agent

2
Sensitive and specific tests for severity of mental health conditions, e.g., predicting relapse may allow the clinician to intervene earlier

3
Earlier and sensitive detectors of treatment effects of interventions for mental health conditions, e.g., rather than waiting four to six weeks for an antidepressant to show significant effects, early changes may help select treatments that work faster

4
Detection of the emergence of side effects

5
More effective interventions for anxiety, depression and substance disorders

BEHAVIORAL PROCESSES
This research theme focuses on identifying the physiological bases for drives and behaviors that contribute to the development, maintenance or recovery from neuropsychiatric dysfunction to improve the assessment and treatment of mental and physical health.

NEUROIMAGING
This research theme focuses on the existing and emerging tools and techniques in multimodal imaging.

NEUROMODULATION
This research theme focuses on real-time feedback modalities and non-invasive brain stimulation to change dysfunctional processes in psychiatric populations.

PSYCHOPHYSIOLOGY
This research theme focuses on the use of physiological measures to examine the connection between body and brain.

BIOASSAYS
This research theme focuses on the use of biochemical measures, ranging from inflammatory markers to microbiome assessments to genetics.
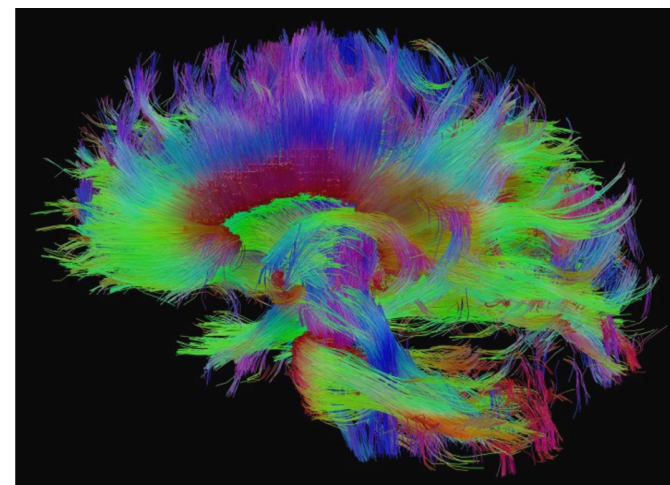
LIBR LEADERSHIP

Martin Paulus, M.D.
Scientific Director and President

Tom Cooper, MBA
Chief Executive Officer

Colleen McCallum, MBA
Chief Operating Officer

Jerzy Bodurka, Ph.D.
Chief Technology Officer

107 journal article publications by LIBR investigators

3,309 inquiries for study participation

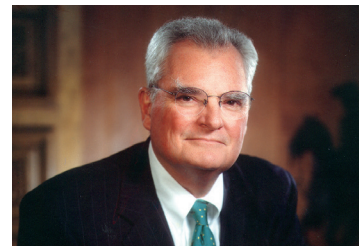**1,356** participants enrolled across all studies

12 active grants and clinical trials

183 participants enrolled in their first MRI study

4 new externally funded grants

$2.9 million in external grant funding

8 post-doctoral fellows

6 distinguished speakers for The William K. Warren, Jr. Frontiers in Neuroscience 2020 lecture series

8 principal investigators

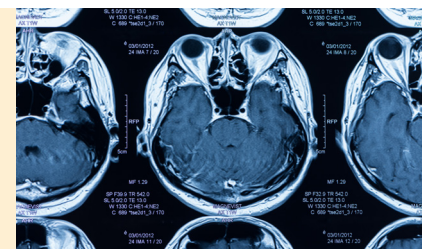**100+** poster presentations and talks at conferences and universities

5 staff scientists

5 associate adjunct investigators

60+ collaborative institutions

7 graduate students

725 Magnetic Resonance Imaging (MRI) scanning sessions

2020 FUNDING SOURCES

ACTIVE AND AWARDED GRANTS

National Institute of Drug Abuse (NIDA)
Adolescent Brain Cognitive Development (ABCD) Study
04/15/2020 – 03/31/2027
PI: Martin Paulus, M.D.

3/6 Planning for the HEALthy Early Development Study
09/30/2019 – 09/30/2021
PI: Jerzy Bodurka, Ph.D.

National Institute of Mental Health (NIMH)
*Approach-Avoidance Conflict:
A Multi-Level Predictor for Exposure Therapy Response*
04/12/2016 – 03/31/2021
PI: Robin Aupperle, Ph.D.

Neural Basis of Meal Related Interoceptive Dysfunction in Anorexia Nervosa
05/01/2017 – 03/31/2022
PI: Sahib Khalsa, M.D., Ph.D.

Acute Modulation of Neural Circuitry Regulating Immune Function in Depression
08/01/2018 – 07/31/2021
PI: Jonathan Savitz, Ph.D.

*An Approach-Avoidance, Computational Framework for
Predicting Behavioral Therapy Outcome in Anxiety and Depression*
07/01/2020 – 06/30/2025
PI: Robin Aupperle, Ph.D.

National Institute of General Medical Sciences (NIGMS)
*The Center for Neuroscience-based Mental Health
Assessment and Prediction (NeuroMAP)*
09/15/2017 – 06/30/2022
PI: Martin Paulus, M.D.

National Center for Complementary & Integrative Health
*Investigating Flotation-REST as a Novel Technique
for Reducing Anxiety and Depression*
09/25/2018 – 07/31/2021
PI: Sahib Khalsa, M.D., Ph.D.

National Institute on Minority Health and Health Disparities
Neuroscientific Exploration of Cultural Protective Factors in American Indians
12/27/2020 – 11/30/2022
PI: Evan White, Ph.D.

Brain and Behavior Research Foundation (formerly NARSAD)
*Examining the Utility of Frontoparietal Synchronization
to Modulate Drug Craving to Enhance Self-Control to Cue
Induced Cravings in Individuals with Opioid Use Disorder*
01/15/19 – 01/14/21
PI: Hamed Ekhtiari, M.D., Ph.D.

Oklahoma Center for the Advancement of Science and Technology (OCAST)
*Neurocognitive Empowerment for Addiction Treatment (NEAT):
A Randomized Controlled Trial for Opioid Addiction*
07/01/18 – 07/17/21
PI: Hamed Ekhtiari, M.D., Ph.D.

Presbyterian Health Foundation (PHF)
Structural and Functional Markers of Injury in Cervical Spinal Compression
07/01/2020 – 06/30/2021
PI: Jerzy Bodurka, Ph.D.

2020 DONORS

- Marie Elise Howard Fund
- The William K. Warren Foundation
- John J. King, Jr.
- Saxifrage Summit Partnership, LTD c/o John J. King, Jr.
- Christopher W. King
- CWK Ventures, LLC c/o Christopher W. King
- Judith King
- J. Falcon, LTC c/o Judith King
- Margaret King Kelley
- Overall Five, LTD c/o Margaret King Kelley
- Constance King Cowett
- DWK Legacy, LTD c/o Constance King Cowett
- Natalie Bryant
- W. Kelly Vandever Revocable Trust
- William K. Warren, Jr., LLC
- Stephen K. Warren
- Mr. & Mrs. Fred McNeer
- Float Conference c/o Jocelyn Jester
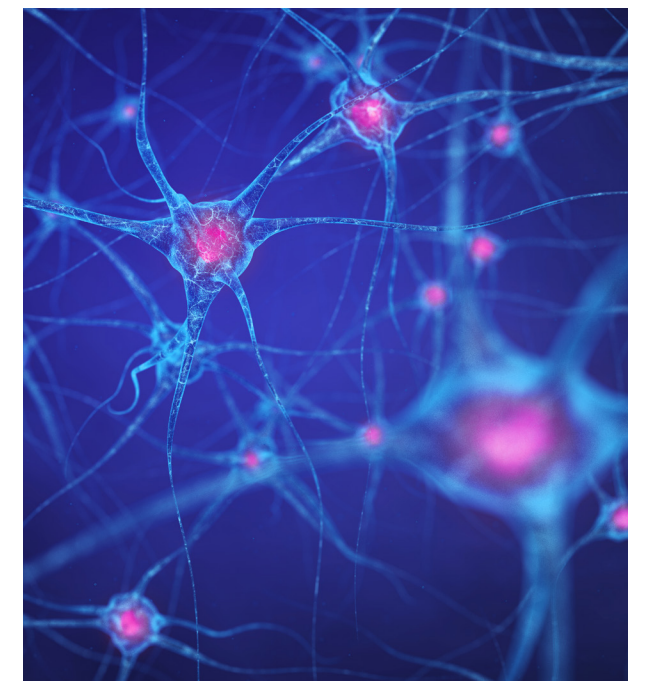
ABCD STUDY

The Adolescent Brain Cognitive Development (ABCD) study was awarded a seven-year continuation U01 grant from the National Institute on Drug Abuse (NIDA) in March 2020. Along with our study renewal, we added Dr. Robin Aupperle to our study team as Multi-PI with Dr. Paulus and were excited to watch our team grow.

Then, along with the rest of the world, ABCD was dramatically affected by the COVID-19 pandemic. Through diligent

Adolescent Brain Cognitive Development
Teen Brains. Today's Science. Brighter Future.

work of the ABCD staff, in coordination with the Coordinating Center at UC-San Diego, we were able to quickly adjust to remote data collection at the end of March and reopened for in-person scanning in July. In November, the LIBR site completed the 2nd annual assessment with 97% retention and began the 4th annual assessment. The national ABCD has continued its dedication to open science and in November the ABCD 3.0 data set was released at the NIMH Data Archive. The data release contains the complete data sets for the baseline, 6-month, 1-year, 18-month assessments and partial data for 2-year and 30-month assessments. The ABCD consortium, along with scientists from all over the world have begun examining the data, available at ABCD Publications. The LIBR group has continued to contribute to this literature including recent publications that have been shared by mainstream media, such as a *U.S. News and World Report* article, "Study: Family Factors Are Tied to Suicide Thoughts and Attempts in Children" and LIBR ABCD's participation in the ARTE documentary "Screen Generation: A Sick Generation?"

The LIBR ABCD team is hopeful we can reinstitute our annual ABCD night in Summer/Fall 2021 where our team will share updates on our exciting results to all the participating families while the subjects enjoy some food and fun.

T-1000 STUDY

Tulsa 1000 Study
The Tulsa 1000 (T-1000) study, the largest study at LIBR, began in January 2015 and completed baseline enrollment of all 1000 participants in 2018. Participants with disorders of mood and anxiety, eating and substance

use completed over 24 hours of baseline testing including clinical interviews and behavioral and neuroimaging assessments of emotion, cognition, reward and interoception. Longitudinal assessments were conducted with one-hour follow-up interviews at three, six and nine months and an eight-hour follow-up session at the one-year completion mark. Yearly follow-up assessments continued throughout 2020. The goal for this study is to determine whether neuroscience-based measures can be used to predict outcomes in patients with mental illness. In particular, we are trying to determine what factors best predict who will respond well to a particular treatment. **The study is a definitive step toward developing a science-based personalized medicine approach in mental health.**

To date, over 20 papers have been published by the T-1000 project authors and their collaborators. An additional five were under review at the end of 2020. Data analysis of the T-1000 variables is ongoing, with over 65 individual scientific papers in progress for publication. Publications thus far have covered the topics of: the relationship between gray matter volume and childhood trauma; the development of automatic pipelines for pre-processing EEG-fMRI data; EEG microstates as an electrophysiological signature of BOLD resting state networks and characterization of abnormalities in mood and affective disorders; the prediction of brain age from EEG signals using a machine learning approach and the relationship to chronological age; the effect of neighborhood factors on brain structure and function; how body characteristics predict motion in the scanner; how early life stress and adult cytomegalovirus infection are related in mood and anxiety disorders; how processing of body signals differs in individuals with opioid and stimulant use disorders; a potential fMRI based biomarker for substance use disorder; interoceptive responses in suicide attempters; and reward activation with cannabis use in anxious and depressed individuals.

The "Tulsa 1000 Investigators" include the following contributors: Robin Aupperle, Ph.D., Jerzy Bodurka, Ph.D., Sahib S. Khalsa, M.D., Ph.D., Rayus Kuplicki, Ph.D., Martin P. Paulus, M.D., Jonathan Savitz, Ph.D., Jennifer Stewart, Ph.D., and Teresa A. Victor, Ph.D.

In addition to publications, bi-weekly discussions of data analysis pathways and scientific findings with the principal investigators, associate investigators, staff scientists, and post-doctoral fellows offer opportunities for new ideas to explore as we work toward developing a personalized treatment approach through the knowledge gained with this comprehensive dataset.

EEG-FMRI FACILITY: 2020

Established in July 2009 and in research operation since June 2010, the MRI and EEG facility provides advanced state-of-the-art structural, diffusion, perfusion and quantitative MRI, functional MRI (fMRI), and electroencephalography (EEG) neuroimaging capabilities. These advanced research capabilities allow for non-invasive measurement,

quantification, modulation, and study of the human central nervous system (both healthy and diseased) with a primary focus on brain structure and functions, as well as on advanced neuroimaging of the human cervical spinal cord.

The facility provides all the latest technology, tools and resources necessary to conduct and support brain neuroimaging studies focused on advancing clinical research to discover causes of and cures and novel interventions for mood, anxiety, eating, and memory disorders.

Both MRI scanners are fully dedicated to research and provide a state-of-the-art advanced capacity for the latest ultra-fast and accelerated imaging and visualization of the human brain structure as well as measurement and monitoring of brain activity. LIBR's main research approach, to study brain function, is a combination of simultaneous EEG and fMRI, which provide a unique capacity to capture

and measure brain activity at high spatial and temporal resolution.

Each MRI scanner is also equipped with 128-channel high density EEG and wide arrays of MRI phased array coils for imaging the brain and spinal cord. In addition, a custom-made real-time MRI system allows for the management of large amounts of neuroimaging data, real-time fMRI (rtfMRI), real-time integration of physiological data (respiration, pulse oximetry or ECG waveforms) and EEG data simultaneously acquired with fMRI, as well as neurofeedback (rtfMRI-nf) experiments to modulate and influence brain activity during subject scanning. Both scanners are also synchronized and integrated with other imaging and stimulation modalities to conduct multimodal simultaneous EEG and

fMRI, simultaneous transcranial direct or alternating current stimulation (tDCS/tACS) during fMRI and hyperscanning experiments where two or more subjects' EEG and/or fMRI responses and their interactions are measured simultaneously. This advanced combination and customization of state-of-the-art MRI, RF coils, and EEG and brain stimulation technologies, along with custom-developed software solutions and a wide range of auxiliary computerized equipment, offer a unique potential for conducting advanced brain research.

The LIBR MRI-EEG facility makes it possible to conduct massive clinical human research at the Institute and provides support to collaborative neuroimaging research with researchers from local academic institutions. In addition, in the state of Oklahoma, the LIBR MRI-EEG facility is the only facility that maintains this unique technology and know-how to conduct advanced non-invasive neuroscience research for studying the human brain as well as brain development in health and disease.

The MRI-EEG facility was created from the bottom up and is overseen by Jerzy Bodurka, Ph.D., an expert in MRI/EEG-fMRI/real-time fMRI. It is also staffed by two staff scientists: Vadim Zotev, Ph.D. (physics), an expert in MRI, simultaneous EEG & fMRI, and fMRI data analysis and Masaya Misaki, Ph.D. (computational neuroscience), an expert in structural MRI, quantitative MRI image, real-time fMRI processing as well as fMRI decoding and multivariate multimodal fMRI/EEG data analysis. Other staff include two full-time MRI technologists (Julie Owen, Julie DiCarlo), a part-time MRI technologist (Leslie Walker) and computer programmer support (Jared Smith).

RACISM AND SCIENCE: A CALL FOR ACTION

Martin P. Paulus, M.D.
Scientific Director and President
Laureate Institute for Brain Research

Over the past year, we have experienced repeated events that are painful to watch, and that cannot be condoned with silence. It is all too obvious that people who look like me hurt people who do not look like me with the tacit assumption that there is no retribution. These events make me feel ashamed and guilty, feelings that are painful to be with and that my brain would prefer to suppress. These events have made me aware that there are many people who are struggling on a daily basis and are facing bodily harm, oppression, injustice, and disrespect. Violence against Black people has brought this struggle into focus, but these events are not limited to Blacks alone. There is an unfortunate history of violence and injustice against American Indian, Asian American, Hispanic American, and other minorities. Moreover, this struggle extends to one's sexual orientations or one's belief systems in contrast with the mainstream. One common element is the intolerance of what is different and the anger, aggression, and hate that emerges from this intolerance.

In science, we aim to observe, experiment, and draw conclusions from the facts. However, science does not happen in a vacuum. It is done by people and – when it involves the human condition – it focuses on people. We have to ask ourselves, have the events that occurred on our streets also occurred in more subtle ways in our laboratories? Have people that look like me hurt people that do not look like me? The answer is yes, and this admission demands further evaluation.

First, given certain circumstances, we are all capable of biased or racist thoughts, feelings, and actions. This is the source of pain experienced by those who see people of their group hurting those that are not part of their group. **Second,** we have to make an ongoing effort to openly work with these sentiments and to arrive at choices that will reduce the chance that we will hurt people who are different from us in the future. **Third,** we have to provide an opportunity for those who are the target of these injustices. However, that also means we have to learn about their struggle, understand the particulars of the pain they are experiencing, and develop paths that will reduce those painful events within the context of science in the future. **Fourth,** curiosity and understanding have to win over ignorance and intolerance. We need to learn about our differences, understand how they influence our feelings, thoughts, and actions, and develop better explanations of the human conditions that we are interested in.

Outrage and anger over the events on our streets, laboratories, and other public or private places are not enough. It may even be a cage that will not allow us to understand why we are inflicting pain on others and how this increases all human suffering. Instead, open engagement with respect, interest, and love will help to develop the understanding that can be used to build new systems to reduce the pain of those in the minority. The situation is serious and calls for urgent and sustained engagement in finding new solutions. Scientists are problem solvers; we need to be thinking about our contribution to finding solutions to overcoming intolerance, anger, and aggression on the one hand and discover ways of healing the pain of those that have been the target of racism. We must work to build each other up and empower minorities in science rather than tearing people down.

To that end, we have started a workgroup that consists of individuals who work at LIBR to enhance the recognition that race and ethnicity play an important role to improve our scientific approach to solving mental health problems:

AIM 1: Increase the consideration of race/ethnicity when developing research questions, analysis plans, and assessments (e.g., including biological, sociocultural, economic variables).

GOALS:
- Increase investigator and staff understanding and comfort level with research on race and ethnicity concerning neuroscience and mental/physical health.
- Increase understanding and sensitivity to issues of race/ethnicity in the conduct of research.

ACTIONS:
- Establish a "Diversity in Mental Health and Neuroscience Research" lecture series for which we invite experts in related areas of research to present their work.
- Establish a training seminar or reading group for all LIBR staff/faculty concerning issues of culture and diversity in the conduct of research.
- Establish a community advisory board with standing and/or rotating membership to inform how we can make our research more relevant to individuals from diverse racial and ethnic backgrounds.

AIM 2: Increase the representation of underrepresented minorities in the neuroscience and mental health research workforce.

GOALS:
- Increase representation of researchers from underrepresented minorities on our invited speaker lineup (WKW, Brown bags, Visiting Scientists).
- Increase recruitment of underrepresented minorities at all levels of employment and training (research assistants, students, staff scientists, investigators).

ACTIONS:
- Ensure that advertisements for new positions are sent to universities and organizations with diverse students/members.
- Establish summer research opportunities for undergraduate and graduate students from underrepresented minorities.

AIM 3: Enhance outreach efforts to and partnership with communities and organizations with diverse race/ethnicity representation.

GOALS:
- Increase our understanding of how we can optimize our research to better answer questions of relevance to individuals from diverse race/ethnicity backgrounds.
- Increase recruitment of participants from diverse race/ethnicity backgrounds.

ACTIONS:
- Organize regular opportunities for LIBR employees to volunteer together with Tulsa communities and organizations.
- Identify organizations and clinics that we can partner with to support the recruitment of participants from diverse race/ethnicity backgrounds.

Notable accomplishments from the newly established LIBR Diversity and Inclusion Workgroup include:

1. Scheduling and completing Institute-wide training related to diversity and inclusion
2. Establishing a quarterly seminar series dedicated to Diversity in Neuroscience
3. The creation of a lending library of books related to issues of diversity and racism
4. Establishment of a post-baccalaureate diversity fellowship to begin in 2021
5. Development of a plan for involvement in the OSU American Indian Summer Research Program
6. Creation of a participant feedback survey to enable us going forward to assess the quality of participant experiences at LIBR
7. Introduction of a monthly reading/discussion group beginning in 2021
8. Organization of the Women in Recovery holiday gift drive

From Dr. Robin Aupperle, chair of the Diversity and Inclusion Workgroup: "I think it will be important for us to remember that this work is not a sprint…and it is not even a marathon. It is a career/lifelong journey to improve inclusion of diverse and underrepresented people in all areas of science (and increase our understanding of issues of diversity on mental health and neuroscience specifically). And in turn, to improve the quality and impact of the science itself. As we institute programs that will be maintained far into the future, we will hopefully contribute to lasting change that will seep into the culture of LIBR."

# BRAIN AWARENESS FOR ADDICTION RECOVERY INITIATIVE (BARI)

LIBR'S BRAIN AWARENESS MATERIALS WERE TRANSLATED INTO JAPANESE, TURKISH, RUSSIAN, FRENCH, SPANISH AND HUNGARIAN IN 2020 AND ARE NOW AVAILABLE IN 18 LANGUAGES

Brain Awareness for Addiction Recovery Initiative (BARI) started at LIBR to help people who suffer from substance use disorders and their families have a better understanding about how the brain could be affected by drug addiction and how they can help the brain in the process of recovery. Drs. Hamed Ekhtiari, Martin Paulus, and Robin Aupperle developed a cartooned, neuroscience-informed psychoeducation (NIPE) package for BARI. NIPE incorporates neuroscience content targeting negative valence (e.g., anxiety and loss), positive valence (e.g., reward), cognitive systems (e.g., attention, executive control, and working memory), social processes (e.g., affiliation), and arousal/modulatory systems (e.g., sleep–wake). NIPE uses cartoons and affiliated text to promote insight and metacognitive awareness and increase motivation for brain recovery. Some of the NIPE messages are organized in three posters in two different versions for male and female audiences. NIPE posters have been translated and culturally adopted by local scientists in 18 languages in five continents so far.

NIPE materials are organized into a structured psychoeducation package for four sessions called "Brain Healing First Aid." NIPE materials are also incorporated into a larger brain training/rehabilitation program for substance use disorders in 14 sessions (Neurocognitive Empowerment for Addiction Treatment (NEAT) or simply Brain Gym for Recovery). In a trial funded by Oklahoma Center for Advancement of Science and Technology (OCAST), NEAT is being implemented to promote the recovery process in Tulsa. Furthermore, BARI plans to develop new brain awareness activities/materials to promote brain recovery for other psychiatric disorders such as mood and anxiety disorders.

In 2020, during the COVID-19 pandemic, two new posters were added to the BARI series to cover the emerging needs of addiction treatment centers to help their patients to cope with the stress and anxiety associated with the pandemic.
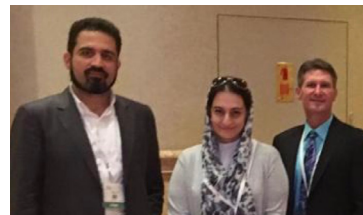
TRAINING AND MENTORING
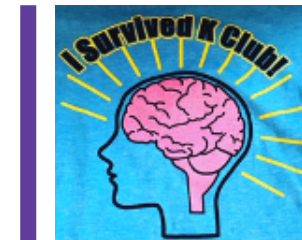
K Club. Dr. Jennifer Stewart created a 13-week "K Club" course to train LIBR Post-Doctoral Researchers how to write National Institutes of Health K-level Career Development grant applications. This course consisted of one-hour per week virtual lectures and discussion followed by weekly homework assignments. These assignments involved writing and then peer-reviewing each of 20+ sections of the K application and revising based on Dr. Stewart's and their peers' feedback. Of the six Post-Docs completing the course, four submitted K applications in 10/2020 and two submitted a K application in 02/2021.

Dr. Leandra Figueroa Hall, Ph.D.
K99/R00 Grant Title:
"In vivo inflammatory challenge to elucidate the role of the toll-like receptor 4 pathway in depression"
Primary Mentor: Jonathan Savitz

Dr. Kara Kerr, Ph.D.
K23 Grant Title:
"Parent-adolescent dyadic neurofeedback for enhancing emotion regulation"
Primary Mentor: Jerzy Bodurka

Dr. Philip Spechler, Ph.D
K99/R00 Grant Title:
"Estimating the psychosocial and biobehavioral causes and effects of cannabis use on children in the ABCD study via causal inference methods"
Primary Mentor: Martin Paulus

Dr. Aki Tsuchiyagaito, Ph.D.
K99/R00 Grant Title:
"Modulating rumination related brain connectivity in depression with neurofeedback"
**Primary Mentor:** Jerzy Bodurka

CoBRE NeuroMAP Pilot Grants. Four LIBR scientists worked with Dr. Stewart to successfully write, submit, and earn funding for LIBR Neuromap pilot grants funded by the National Institute of General Medical Sciences. These grants provide funding for one to two years for development of innovative study protocols and novel secondary data analysis projects at LIBR.

Dr. Kaiping Burrows, Ph.D.
CoBRE Pilot Title:
"Plasma brain-derived exosome microRNA assessment of major depressive disorder inflammatory subtypes"
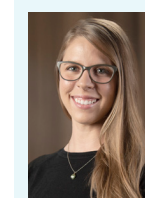
Dr. Janna Colaizzi, Ph.D.
CoBRE Pilot Title:
"Enhancing assessment of externalizing disorders through sign- and goal-tracking behaviors"

Dr. Kara Kerr, Ph.D.
CoBRE Pilot Title:
"Parent-adolescent training on neurofeedback and synchrony"

Dr. Haixia Zheng, Ph.D.
CoBRE Pilot Title:
"Inflammation and neurobehavioral metrics of interoceptive processing in depression"

Monthly Postdoc Meetings. Dr. Stewart organized monthly career development meetings focusing on the following topics: (1) an overview of various grant mechanisms for which they may be eligible; (2) documents needed for Assistant Professor job applications; (3) discussion of each Postdoc's short- and long-term career goals; (4) practice job talks for Postdocs who were currently on the job market; (5) Q+A sessions about the job interview process; and (6) Q+A sessions with LIBR Associate Investigators about career transitions and development.

LIBR works closely with several clinical entities in Tulsa to recruit new participants to LIBR research studies.

Family and Children's Services (FCS)

Family and Children's Services is devoted to helping families in crisis, and serving people struggling with mental illness, addiction and homelessness. They are committed to the families and individuals of the Tulsa area, helping over 110,000 individuals each year, or one in six Tulsans. LIBR has continued our research partnership with the Family and Children's Services program Women in Recovery. The intensive outpatient program is an alternative for women facing long prison sentences for non-violent, drug-related offenses. LIBR regularly shares the results of data collected through this partnership with the goal of increasing graduation rates from the program. This award-winning program is dedicated to changing the lives of women in Oklahoma and giving them the tools to become positive, contributing members of the community.

12 & 12, Inc.

12 & 12 is an award-winning leader in the Tulsa community for addiction treatment and recovery services. Last year, they served over 1,600 clients in Oklahoma. Through LIBR's established collaboration with 12 & 12's Clinical Director, Richard Turnham, individuals with substance use-related problems are recruited to participate in LIBR studies of addiction. This partnership involves collaboration on an OCAST and R01 grant.

Laureate Psychiatric Clinic and Hospital

LIBR has continued to work closely with our neighbors at the Laureate Psychiatric Clinic and Hospital. Through a "universal consent" process, LIBR is able to reach out to Laureate patients to inquire about their interest in participating in research. LIBR has extended the partnership to include monthly informational sessions on research studies with participants in the Intensive Outpatient Programs to recruit individuals with substance use and mental health disorders in the Tulsa area.

January 7
Christopher Lowry, Ph.D.

Infrared Whole-Body Heating for Treatment of Major Depressive Disorder: Bench to Bedside and Back Again

February 4
Janet Treasure, M.D., Ph.D.

Translational Research in Anorexia; Relevant Results for the Everyday Practice

March 3
Judson Brewer, M.D., Ph.D.

One Simple Ingredient for Habit Change: Awareness

September 3
Carmine Pariante, M.D., Ph.D.

Inflammation in Depression: The New Frontier of Translational Psychiatry

October 6
Jennifer Blackford, Ph.D.

What Causes Anxiety? Building a Reverse Translational Model

November 18
Yael Niv, Ph.D.

Latent Causes, Prediction Errors, and the Organization of Memory

January 21
Janos Zempleni, Ph.D.

Biological Activities of Milk Exosomes and their RNA Cargos Within and Across Species Boundaries

October 28
Meghan Martz, Ph.D.

Reward System Modulation Using Real-Time fMRI Neurofeedback

November 17
Paul Spicer, Ph.D.

An Alternative Approach to Genomic Research in American Indian and Alaska Native Communities

IN THE NEWS 2020

LIBR investigators safely gathered at Southern Hills Country Club in Tulsa for their annual scientific retreat. This event was enjoyed by all as an opportunity to reflect on the past year and enthusiastically plan for the future to fulfill LIBR's mission of improving mental health through neuroscience.


Florence Breslin Presentation at TEDxTysons

"While there is evidence of screen time producing negative consequences, screen time is not solely to blame for many adverse outcomes we see in children and adolescence. As technology continues to rapidly change, scientists are working furiously to understand the role of screen time on our children, but in the meantime, society has leaned more and more on blaming screens for ill effects without supportive evidence. In this talk, Adolescent Brain Cognitive Development (ABCD) study Investigator, Florence Breslin provides an update on the research of screen time's effects on children and discusses where screen time does and does not play a role in different family experiences."

Click here to view the full story.

Drs. Sahib Khalsa and Robin Aupperle appeared on *Good Day Tulsa* to discuss a mobile health application developed during the four-year Tulsa 1000 study at LIBR. The Tulsa Life Chart (TLC), uses information provided during a survey to create a web-based graphic representation of an individual's life history to make it easier for clinicians to effectively diagnose and provide treatment for medical and mental health conditions.
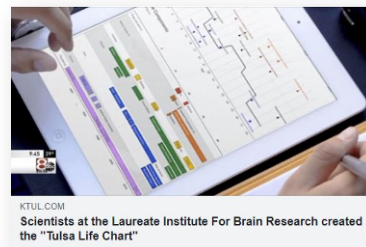
KTUL.COM
Scientists at the Laureate Institute For Brain Research created the "Tulsa Life Chart"

Click here to view the full story.
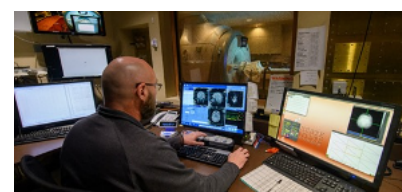
TU, LIBR Partnership at the Forefront of Mental Health Research

"The Laureate Institute for Brain Research opened its doors 10 years ago to address one of Oklahoma's worst health factors, mental health. As scientists and researchers discover the ways in which a person's mental health is directly linked to their overall physical condition, LIBR, in collaboration with The University of Tulsa, is using new neuroscience tools and resources to answer old questions about Oklahoma's health crisis."

Click here to view the full story.

TRAUMA & ITS EFFECTS
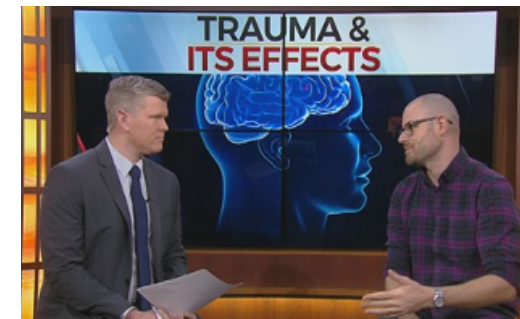
Dr. Namik Kirlic appeared on KOTV - News On 6

Dr. Kirlic discussed a new study in his lab focusing on early childhood trauma and how it affects individuals later in life.

Click here to view the full story.

Dr. Justin Feinstein, Director of the Float Clinic & Research Center, spoke about research studies conducted at LIBR on the effects of floating on the body and brain at the #TEDxSalem event on Friday, January 4th, 2020.

Click here to view the full story.

The laboratory of Dr. Sahib Khalsa has made several advances:

1. Authored or co-authored 18 publications in 2020.

2. Contributed two senior author papers in *Trends in Neurosciences*, one of the top journals in neuroscience. The papers, one of which was co-authored with Martin Paulus, are part a special issue on interoception stemming from participation in a 2019 conference on interoception organized by the National Institute of Health entitled "The Science of Interoception and its Roles in Nervous System Disorders." The meeting brought the scientific debate on interoception that was started by the LIBR Interoception Summit to a broader audience of animal and human researchers from all over the world.

3. Drawing from the Tulsa 1000 study dataset, he contributed five senior author papers. These papers showed that blunted interoception is associated with suicide attempting, that individuals with mood, anxiety and substance use disorders show an insensitivity to changes in interoceptive state, and that individuals with eating disorders exhibit a heightened sensitivity to respiratory sensations during changes in interoceptive state. In collaboration with Robin Aupperle, he described the initial development of the Tulsa Life Chart, an interactive digital tool facilitating the efficient communication of historical life information that would be useful for clinicians, patients, and family members during mental health treatment.

4. He published the first study of floatation therapy in eating disorders, a clinical trial demonstrating that floating is safe for individuals with anorexia nervosa.

5. He participated in a workgroup on defining the research agenda for functional neurological disorder (FND), a neuropsychiatric condition which manifests in the abnormal perception of motor or sensory function, resulting in a paper as part of a special issue on FND.

6. He was invited to join the editorial board of *Biological Psychology*, a journal that features important work on the biological aspects of psychological states and processes.

7. Finally, he was promoted to Associate Professor with tenure in the Oxley College of Health Sciences at the University of Tulsa, and transitioned to a new role as Director of Clinical Operations at LIBR, which has included additional responsibilities in coordinating the safety and well-being of the LIBR staff and participants in the Covid-19 era.

NIMH Director's Innovation Speaker Series 2020-2021

Dr. Martin Paulus presented a lecture at the prestigious NIMH Director's Innovation Speaker Series on November 12th, 2020 on "Decision-Making and Computational Psychiatry: An Explanatory and Pragmatic Perspective."

Click here to view the virtual presentation and discussion.

Vanderbilt University received $20 million from The William K. Warren Foundation, located in Tulsa, Oklahoma, to establish the Warren Center for Neuroscience Drug Discovery to support pharmaceutical breakthroughs that prevent serious brain disorders, like Alzheimer's, schizophrenia and Parkinson's disease.

The William K. Warren Foundation established Oklahoma's largest healthcare provider, the Saint Francis Health System, and the Laureate Institute for Brain Research in Tulsa.

Click here to view the full story.

CNN featured ongoing float research at LIBR about the benefits of floatation on the mind and body

Click here to view the full story.

Trends in Neurosciences
The Neuroscience of Interoception
CellPress
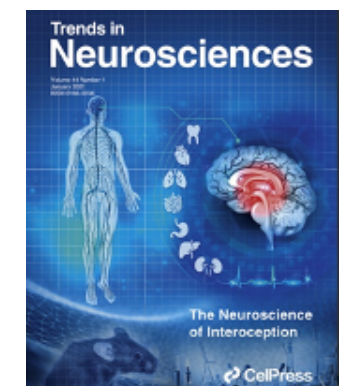
Tim Collins continues to manage the assessment team. He has worked with the team to ensure that, despite the challenges faced in 2020, LIBR has been able to continue to recruit and assess participants for all studies.

THE ASSESSMENT TEAM FOCUSES ON THREE MAIN OBJECTIVES:

1. Recruit participants living in the northeastern Oklahoma region using a multi-pronged approach, including digital and radio advertising, direct on-site facility recruitment, direct recruitment at the Laureate Psychiatric Clinic and Hospital, and in-person activity-based recruitment.

2. Clinically assess participants. Masters-educated interviewers (licensed therapists or licensed social workers) complete diagnostic interviews to determine DSM-5 diagnoses for each participant. Additionally, interviewers discuss current and past suicidal thinking and/or attempts of self-harm with each person. The team completes clinical interviews with adults and teens.

3. Medically assess participants. The medical team (registered nurses and medical technicians) complete comprehensive interviews to determine the history of chronic, recent, and current medical conditions. The team also collects biological samples including CRP and A1c in addition to completing standard medical assessments.

The assessment team also completes COVID-19 testing, clinical interviews, ratings, blood collections, and assists participants in completing study-directed tasks for multiple LIBR studies for the following investigators: Drs. Paulus, Bodurka, Aupperle, Khalsa, Stewart, Savitz, Smith, Ekhtiari, and Kirlic.

THE ASSESSMENT TEAM, OVER THE PAST FIVE YEARS, HAS COMPLETED:

- Number of phone screens: **17,718**

- Number of screening interviews: **5,676**

- Number of blood collections: **3,073**

- Number of COVID POC tests (2020): **750**

ASSESSMENT TEAM SPOTLIGHT:
DARA CRITTENDEN

How did you come to work at LIBR?

I transferred to LIBR after working in the Laureate Eating Disorder program as a psychiatric technician and in their admissions department performing intake evaluations. A good friend of mine worked here at LIBR, and told me of an opening on the assessment team and she thought I would enjoy it. After seven years of working here, I am still just as excited to be part of an organization that is working toward positive change and improvement for mental health outcomes. I have contributed to over a dozen studies during my time here, including the longitudinal Tulsa 1000 study, Neosync, and CoBRE Core.

What do you enjoy about your job at LIBR?

My favorite thing about my job is seeing so many participants feel good about making a contribution to LIBR's research. I always try to make their time at LIBR an enjoyable and worthwhile experience. As a part of the assessment team, I love the variety my job offers, from working with multiple labs, to conducting screening interviews and clinical ratings, to running cognitive tasks and participant recruitment.

If you are interested in participating in any of the studies below, or would like to be considered for future studies, please call our assessment team at **918-502-5100** or email **info@laureateinstitute.org**.

President
Robin Leora Aupperle

Robin was born and raised on her parents' cattle ranches outside of Newkirk, OK, a small town of approximately 2,000 people. She attended Oklahoma State University (OSU) in Stillwater, OK for her undergraduate education. After considering careers in mathematics, journalism, law, and medicine, she decided that psychology offered a career where she could bring everything she loved about those other careers together – including analytics, writing, and understanding and helping other people. Her first ventures into research as an undergraduate student included (1) working with Dr. William Beatty at the University of Oklahoma on a project examining the utility of different neuropsychological testing batteries in assessing cognitive function for individuals with Multiple Sclerosis, and (2) examining relationships between parenting and attachment styles in Dr. Maureen Sullivan's laboratory at OSU. She continued on to pursue her Ph.D. in Clinical Psychology at the University of Kansas. She started out working with mentor Dr. Doug Denney and for her Master's thesis, examined the relationship between depressive symptoms and both dietary intake and red blood cell levels of fatty acids (e.g., omega-3 fatty acids) for individuals with Multiple Sclerosis (Aupperle et al., 2008, *Journal of Behavioral Medicine*).

During Robin's second year of graduate training, she started working as a psychometrician at the Hoglund Brain Imaging Center and became fascinated by how neuroimaging could be used to better understand mental health. She became particularly intrigued by this field of research when the paper "Change the mind and you change the brain: effects of cognitive-behavioral therapy on the neural correlates of spider phobia" by Dr. Vincent Paquette was published in 2003, during Robin's second year of graduate school. While the idea that changes in thinking and behaviors and one's emotional experience relate to changes in brain function is now taken for granted – this fact had a profound impact on scientific perspectives at the time. This article and other readings (such as the book, "The Neuroscience of Psychotherapy" by Dr. Luis

Cozolino) also had a profound impact on Robin's career trajectory. She became focused on the intriguing idea that neuroscience could help inform and enhance psychotherapy outcomes.

To help her pursue research consistent with her burgeoning interests in the neuroscience of mental health treatment, she switched to Dr. Cary Savage's laboratory for her dissertation project. This project focused on using functional MRI to examine the neural mechanisms underpinning D-cycloserine effects, which had been found to enhance fear extinction in animals and exposure therapy in humans, for individuals with specific (spider) phobia (Aupperle et al., 2009, *CNS Spectrums*). One finding from this study highlighted the potential effects of DCS on activation within the anterior insula (rather than amygdala or hippocampus as originally hypothesized). Drs. Martin Paulus and Murray Stein at University of California, San Diego (UCSD) had recently published the paper "An insular view of anxiety" (2006) in which they highlighted the potential importance of the anterior insula for integrating internal bodily signals with cognitive and emotional processing and to process differences in expected and observed states. She developed the goal of wanting to work in Dr. Stein and Paulus' laboratories for her postdoctoral training. Luckily, she was able to match for her clinical training internship at UCSD and the San Diego VA in 2008, where she obtained valuable clinical experience in neuropsychological assessments (partly under Dean Delis, Ph.D.), cognitive rehabilitation (with Amy Jak, Ph.D.), and empirically-based treatment of posttraumatic stress disorders (PTSD: under Steven Thorp, Ph.D., Sonya Norman, Ph.D., and Ariel Lang, Ph.D.).

In 2009, Robin was awarded the VA MIRECC postdoctoral fellowship, which funded her work in Drs. Paulus and Stein's laboratories. As part of her fellowship, Robin published papers based on ongoing work in her mentor's laboratories, including work examining relationships between emotional and neuropsychological functioning in PTSD (Aupperle et al., 2012a, 2012b) and predictors and mechanisms of CBT for PTSD (Aupperle et al., 2013). Soon after starting her fellowship, Robin approached her mentors with the idea of creating an approach-avoidance conflict paradigm for use in human neuroimaging, based on animal tasks. This idea was developed based on her clinical experiences, observing how much patients would often sacrifice (e.g., in terms of work, family, social rewards) to avoid potential negative affective outcomes (e.g., fear of driving on highways, risking embarrassment, etc.). She felt that the decisions made by these patients may not be solely driven by threat reactivity and that examining the decision-making process itself could potentially be important. Luckily, her mentors agreed

and supported her development of the conflict task that Dr. Aupperle has used ever since (e.g. Aupperle et al., 2011, 2015; Kirlic et al., 2017; Smith et al., 2020) and which provides the foundation for her current NIMH-funded projects.

After completing postdoctoral training, Robin accepted a tenure-track faculty position at the University of Missouri-Kansas City (UMKC) in 2011. She taught undergraduate and graduate students in biological aspects of psychology and provided clinical supervision to clinical psychology graduate students during their first year of practicum. Her research focused on extending our understanding of neural mechanisms underlying neuropsychological functioning in combat-related PTSD (e.g., Aupperle et al, 2016; Clausen et al., 2017) and examining the potential benefit of computer-based executive function training for this population (Clausen et al., 2019). Dr. Paulus called in 2013 to share that he would be moving to the Laureate Institute for Brain Research (LIBR) as the new Scientific Director and asked if she would have an interest in joining the Institute as well. Robin was ecstatic to move back to her home state to continue progressing her research and her career.

Robin officially joined LIBR in August 2014. When she arrived, she quickly became involved in helping design and launch the Tulsa 1000 study. Within a year of starting, she was awarded a K23 career development award (K23MH108707) to examine the potential utility of approach-avoidance conflict in predicting response to exposure-based therapy (compared to behavioral activation therapy) for generalized anxiety disorder (GAD). Preliminary data from this project and the Tulsa 1000 was used as the basis for Robin's first R01 application, which

was awarded in 2020 (R01MH123691). This new project is conducted in collaboration with Dr. Ryan Smith at LIBR and focuses on examining approach-avoidance conflict from a computational perspective to identify predictors of therapy response for comorbid anxiety/depression. During her five years thus far at LIBR, she has also conducted research focused on: (1) developing and testing the efficacy for a brief resilience-based intervention for first year college students (Akeman et al., 2018), (2) development of a graphical, interactive life chart interview and application for representing patient's psychosocial history (Aupperle et al., 2020), (3) examining the potential benefit of a cognitive rehabilitation intervention for improving outcomes for substance use populations (collaboration with Dr. Ekhtiari), (4) examining test-retest reliability of fMRI paradigms to inform clinical utility (e.g., McDermott et al., 2020) and (5) examining neural correlates of positive future thinking in relation to suicide risk.

In addition to the NIMH-funded K23 and R01 awards, Robin has also served as an investigator on the NIGMS-funded CoBRE award (PI: Paulus) and recently became a site Co-PI of the multisite NIH-funded Adeolescent Brain and Cognitive Development (ABCD) study (site PI: Paulus). She has also served as a mentor for two funded predoctoral F31 awards (for students Tim McDermott and Kelly Cosgrove) and an American Psychological Foundation (APF) dissertation grant (student Danielle DeVille).

With the help of mentors and the support of LIBR, Robin has been able to pursue exactly what she became passionate about in graduate school – how to utilize neuroscience to better understand and improve psychotherapeutic interventions. While science is in its nature incremental, she is hopeful that through her collaborations with the amazing team of scientists at LIBR, her ongoing and future work will lead toward new perspectives on mental health treatment.

Robin Aupperle, Ph.D.

Principal Investigator
Laureate Institute for Brain Research

Assistant Professor
University of Tulsa

Email: raupperle@laureateinstitute.org
Phone: 918-502-5744

Dr. Aupperle's research focuses on using neurocognitive methods to enhance our understanding of anxiety, depression, and trauma. She is particularly interested in:

1 The intersect between cognitive and emotional processing and how this may relate to the development and maintenance of anxiety, depression, and trauma-related symptoms.

2 How knowledge from neuroscientific research may be used to enhance treatment and prevention efforts.

In regard to the former, she has conducted research related to neuropsychological correlates of trauma and posttraumatic stress disorder (PTSD) and has developed translational exploratory and decision-making tasks to better understand behavioral, physiological, and neural correlates of anxiety and depression. In regard to the latter, she has been involved in research investigating behavioral and neural mechanisms and predictors of current pharmacologic and behavioral treatments for anxiety, depression, and trauma-related disorders. She is also actively involved in identifying strategies to optimize psychological well-being for college students and examining novel interventions for trauma-related and substance use disorders.

Dr. Aupperle was born and raised in rural Oklahoma and obtained her bachelor's degree in psychology from Oklahoma State University. She received her master's and doctoral education in clinical health psychology at the University of Kansas, under the mentorship of Cary Savage, Ph.D. and Douglas Denney, Ph.D. Her graduate research and clinical education focused on neuropsychology, neuroimaging, and anxiety disorders. She then continued out west to complete clinical internship at the VA San Diego Healthcare System, during which her training focused on clinical neuropsychology, cognitive rehabilitation, and treatment of posttraumatic stress disorder (PTSD).

Dr. Aupperle remained in San Diego to complete a postdoctoral fellowship under the mentorship of Drs. Martin Paulus and Murray Stein, conducting research related to neural substrates of anxiety disorders and PTSD, with a particular emphasis on decision-making processes and treatment. She moved to Kansas City to join the University of Missouri – Kansas City (UMKC) Department of Psychology as Assistant Professor in August 2011. In August 2014, Dr. Aupperle joined the Laureate Institute for Brain Research (LIBR) in Tulsa, OK, as Assistant Professor.

Dr. Aupperle's lab had a very successful year, despite the challenges of 2020. Dr. Aupperle was awarded an NIMH R01 grant for a study focused on using a computational perspective of approach-avoidance conflict processing to identify predictors of behavioral therapy response for comorbid depression and anxiety. In addition, all three graduate students received awards for their dissertation projects. Tim McDermott received an NIMH F31 award for his dissertation focused on dorsolateral prefrontal cortex (dlPFC) fMRI-based neurofeedback. Kelly Cosgrove received an NIMH F31 award for her dissertation focused on social and neural connectivity in relation to neurodevelopmental symptoms within the Adolescent Brain and Cognitive Development (ABCD) study. Lastly, Danielle DeVille received an award from the American Psychological Foundation (APF) for her dissertation focused on using machine learning to identify psychosocial predictors of suicidal ideation and attempts reported by participants in the ABCD study. Jessica Santiago, the previous LIBR research therapist, left to begin her doctoral education at Oklahoma State University (OSU). Evan White transitioned from postdoctoral fellow to Associate Investigator at LIBR. Elisabeth Akeman transitioned from study coordinator to research therapist, after completing her master's degree in counseling at OSU. Mallory Cannon was hired as the new study coordinator for the laboratory. James Touthang continues to support software development, programming, data analysis, and numerous technical needs within Dr. Aupperle's laboratory and other laboratories at LIBR.

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SELECTED PUBLICATIONS

Aupperle, R.L., McDermott, T.J., White, E., Kirlic, N. (in press). The Neuropsychology of Anxiety: An Approach-Avoidance Decision Making Framework. Invited Chapter In G. Brown, B. Crosson, K. Haaland, & T. King (Eds.), APA Handbook of Neuropsychology.

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Dr. Bodurka's research focuses on three main areas:

1 **Non-invasive multimodal neuroimaging method development and applications for studying brain function, including: structural, quantitative and functional MRI (fMRI), real-time fMRI with neurofeedback, multimodal simultaneous electroencephalography (EEG) and fMRI brain imaging, real-time integration of fMRI and EEG data, simultaneous EEG and fMRI neurofeedback, EEG and fMRI hyperscanning.**

2 **Novel non-invasive brain neuromodulation and neuroenhancement approaches to better understand brain emotion regulation and social interactions in major depressive disorder (MDD) and post-traumatic stress disorder (PTSD). Dr. Bodurka's research has shown that the use of real-time fMRI neurofeedback during recall of positive emotions in patients with depression can normalize the neural activity of the amygdala and result in significant depression symptom relief. His most recent work in the laboratory established a data-driven discovery framework that identified brain targets for non-invasive brain modulation, which aims to break ruminative thoughts in depression.**

3 **Translational approaches through precise clinical neuroscience to: i) discover and research novel therapeutic strategies to improve treatment strategies by training and helping to recover healthy function of brain networks; ii) and to improve psychotherapy by determining the neural features of socially interacting individuals in MDD and PTSD.**
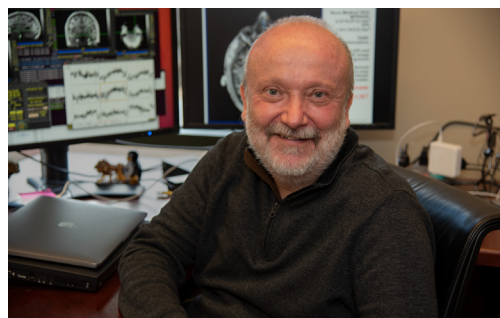
SCIENTIFIC BACKGROUND

Dr. Bodurka has broad expertise in Nuclear Magnetic Resonance (NMR) and Magnetic Resonance Imaging (MRI) physics. He received his doctorate degree in physics from the University of Nicolaus Copernicus in Torun, Poland and completed part of his postdoctoral training in NMR at the Department of Chemistry at Free University in Berlin, Germany. As a postdoctoral fellow at the Medical College of Wisconsin, he received training in MRI technology and functional MRI (fMRI). As a Staff Scientist at the functional MRI Facility of the National Institute for Mental Health (NIMH) and the National Institute of Neurological Disorders and Stroke (NINDS) at the National Institutes of Health (NIH), he was responsible for providing a state-of-the-art imaging environment for conducting advanced MRI and fMRI research. In 2007, for his development of a Scalable Multi-Channel MRI Data Acquisition System, he received the NIH's Director Award for Advancements in MRI Parallel Imaging Technology. The advancements in MRI receiver and multi-element coil technologies allowed for major improvements in the MRI signal-to-noise ratio and pushed spatial and temporal limits for both functional and anatomical imaging. He also developed an advanced real-time software set-up, allowing for the conduction of real-time fMRI with neurofeedback.

In 2009, Dr. Bodurka joined the newly established Laureate Institute for Brain Research (LIBR) to create a state-of-the-art MRI/fMRI/EEG neuroimaging facility and to establish a multimodal brain neuroimaging program. The program's purpose is to advance clinical research focused on mental disorders, with a broad research goal of advancing our understanding and characterization of brain abnormalities due to mental illness.

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SELECTED PUBLICATIONS

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Dr. Ekhtiari's main research interests include:

Using brain imaging to inform new treatments for drug addiction with:

1 Brain Stimulation (e.g., transcranial electrical/magnetic stimulation)

2 Cognitive Interventions (e.g., brain rehabilitation using mental exercises)

ONGOING RESEARCH PROJECTS IN 2020:

- Clinical Trial (ClinicalTrials.gov Identifier: NCT03907644): Frontoparietal Synchronization to Modulate Drug Craving in Opioid Use Disorder (Recruiting) (NARSAD Young Investigator Award)

- Clinical Trial (ClinicalTrials.gov Identifier: NCT03922646): Neurocognitive Empowerment for Addiction Treatment (NEAT) in Opioid Use Disorder and Amphetamine Use Disorder (Recruiting) (OCAST funded)

- Experimental Trial: Closed-Loop Online fMRI tACS Neurofeedback to Individually Maximize Connectivity within Executive Control Network with Active Searching for Optimized Stimulation Parameters (LIBR funded)

New LIBR Closed-Loop Online Brain Stimulation (tACS) and Brain Imaging System: This Set Up is Being Tested to Maximize Connectivity within the Executive Control Network with Active Searching for Optimized Stimulation Parameters during Imaging

SCIENTIFIC BACKGROUND

Dr. Ekhtiari attended Tehran University of Medical Sciences (TUMS), the most-distinguished medical school in Iran, as a medical student after passing the highly competitive national university entrance exam with a rank of 11 out of over 350,000 participants. Facing daily challenges of people with substance use disorder (SUD) in Tehran, he became interested in the neuroscience of cognitive disorders associated with SUDs. He received his first small grant as a medical student in this field in 2000, and published his first paper on the "role of prefrontal cortex in risky decision making" in 2001. He graduated from medical school with honors in 2004 with a dissertation on risky decision-making and impulsivity. Immediately, he started work at the Iranian National Center for Addiction Studies (INCAS) in 2004 in one of the least affluent neighborhoods in Tehran and launched a neurocognitive lab there in 2005. He also started a research program at the Institute for Cognitive Science Studies (ICSS) in Tehran in 2010 called the Translational Neuroscience Program. He enrolled in a Ph.D. program in neuroimaging at TUMS in 2011 and did his thesis project on the neural basis of response inhibition using fMRI. Then, he moved to the U.S. for a postdoctoral position with Dr. Martin Paulus at the Laureate Institute for Brain Research (LIBR). He was promoted to associate investigator at LIBR in January 2018.

Dr. Ekhtiari started to work in the field of transcranial brain stimulation with an awarded short-term fellowship at Harvard University in 2009. Afterward, while contributing to different studies using fMRI and brain stimulation, he realized many potentials in this field for understanding causal mechanisms involved in SUD to design therapeutic interventions. In 2014, he published one of the first pieces of evidence on the potential hopes for modulation of drug craving among methamphetamine users with transcranial direct current stimulation (tDCS). His joint review paper on non-invasive brain stimulation and its challenges was published in the *Neuron* in 2015. In early 2018, he published his preliminary results for the first combined tDCS fMRI study among people with SUD. He completed his first randomized controlled clinical trial in methamphetamine users at LIBR as a PI with tDCS fMRI in January 2019 (NCT03382379). In late 2018, he received the NARSAD young investigator award on "examining the utility of fronto-parietal synchronization (FPS) to enhance self-control to cue induced cravings in individuals with opioid use disorders." He hopes to extend his activities with transcranial electrical and magnetic stimulation (TES/TMS) technologies using fMRI as a biomarker for prediction and monitoring among people with mental health disorders.

Dr. Ekhtiari has also focused intently on the development of cognitive training and rehabilitation programs for people with SUDs. He has recently written a chapter for the world-renowned textbook *Neuropsychological Rehabilitation: The International Handbook* on brain rehabilitation for psychiatric disorders with specific sections focused on SUDs. In 2014, he conducted his first clinical trial of neurocognitive rehabilitation for people with SUDs, using a package termed "NEuroCOgnitive Rehabilitation for Disease of Addiction" (NECOREDA) in a collaboration with Mehmet Sofuoglu, Yale University. Results from this study were published in 2017. Based on his background in the field, in collaboration with Drs. Robin Aupperle and Martin Paulus, he recently developed a new package with more in-depth neuroscience informed interventions called "Neurocognitive Empowerment for Addiction Treatment" (NEAT). In July 2018, he received a three-year grant from the Oklahoma Center for Advancement of Science and Technology (OCAST) to run a randomized clinical trial among people with opioid-use disorder with NEAT as PI. Dr. Ekhtiari has already recruited half of the subjects for this trial by the end of 2019. He is planning to extend the idea of brain rehabilitation in drug addiction based on the experiences in this trial.
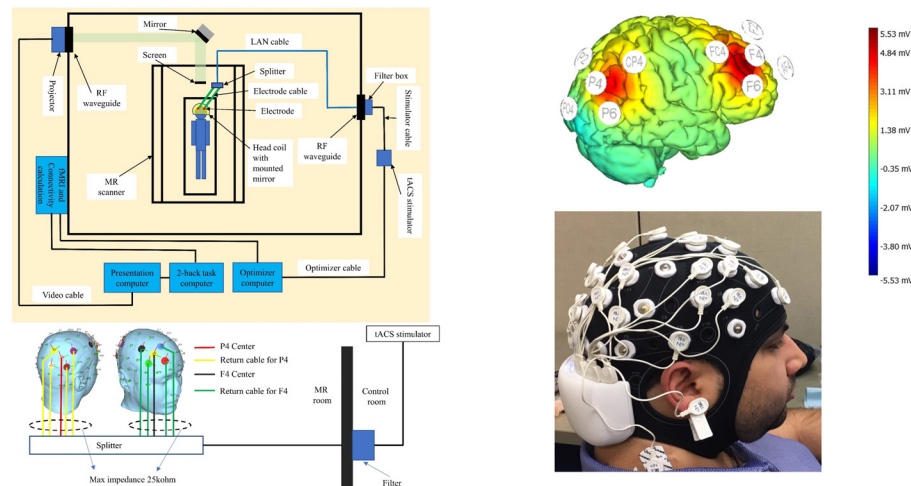
SELECTED PUBLICATIONS

Domain I: Addiction Neuroimaging
Ekhtiari, H., Kuplicki, R., Aupperle, R., & Paulus, M. P. (2020). It is Never as Good the Second Time Around: Brain Areas Involved in Salience Processing Habituate During Repeated Drug Cue Exposure in Methamphetamine and Opioid Users. bioRxiv. Under review in Neuroimage

Ekhtiari, H., Kuplicki, R., Pruthi, A., & Paulus, M. (2020). Methamphetamine and Opioid Cue Database (MOCD): development and validation. Drug Alcohol Depend, 107941.

Ekhtiari, H., Zare-Bidoky, M., Sangchooli, A., Janes, A. C., Kaufman, M. J., Oliver, J., . . . Zilverstand, A. (2020). A Methodological Checklist for fMRI Drug Cue Reactivity Studies: Development and Expert Consensus. medRxiv, under review in Nature Protocols.

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Moradi, M., Ekhtiari, H., Victor, T. A., Paulus, M., & Kuplicki, R. (2020). Image-Derived Phenotyping Informed by Independent Component Analysis—An Atlas-Based Approach. Frontiers in neuroscience, 14, 118.

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Domain II: Brain Stimulation for Addiction Treatment
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Esmaeilpour, Z., Shereen, A. D., Ghobadi-Azbari, P., Datta, A., Woods, A. J., Ironside, M., . . . Ekhtiari, H. (2020). Methodology for tDCS integration with fMRI. Human Brain Mapping, 41(7), 1950-1967.

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Martinotti, G., Pettorruso, M., Montemitro, C., Ekhtiari, H., Hanlon, C. A., Spagnolo, P. A., . . . Di Giannantonio, M. (2020). Repetitive Transcranial Magnetic Stimulation in Addiction Non-Invasive Brain Stimulation in Psychiatry and Clinical Neurosciences (pp. 135-160): Springer, Cham.

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Valyan, A., Ekhtiari, H., Smith, R., & Paulus, M. P. (2020). Decision-making deficits in substance use disorders: cognitive functions, assessment paradigms, and levels of evidence, Cognition and Addiction (pp. 25-61): Academic Press.

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Domain IV: Addiction Medicine including Studies on COVID-19 Pandemic
Ekhtiari, H., Noroozi, A., Farhoudian, A., Radfar, S. R., Hajebi, A., Sefatian, S., . . . Rahimi-Movaghar, A. (2020). The evolution of addiction treatment and harm reduction programs in Iran: a chaotic response or a synergistic diversity? Addiction, 115(7), 1395-1403.

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Farhoudian, A., Baldacchino, A., Clark, N., Gerra, G., Ekhtiari, H., Dom, G., . . . Demasi, M. (2020). COVID-19 and substance use disorders: recommendations to a comprehensive healthcare response. An international society of addiction medicine (ISAM) practice and policy interest group position paper. Basic & Clinical Neuroscience, 11(2), 129-146.

Farhoudian, A., Radfar, S. R., Ardabili, H. M., Rafei, P., Ebrahimy, M., Zonoozi, A. K., . . . Kouimtsidis, C., Ekhtiari, H. (2020). A global survey on changes in the supply, price and use of illicit drugs and alcohol, and related complications during the 2020 COVID-19 pandemic. medRxiv

Radfar, S. R., De Jong, C. A., Farhoudian, A., Ebrahimi, M., Rafei, P., Vahidi, M., . . . Ekhtiari, H., Massah, O. (2020). Reorganization of Substance Use Treatment and Harm Reduction Services during the COVID-19 Pandemic: A Global Survey. medRxiv.

International Collaborative Leadership
Dr. Ekhtiari is contributing to 4 International Virtual Collaborative Networks for Neuroscience (ViCoNs) as co-chair or director. These ViCoNs are designed to promote methodological rigor, transparency, reproducibility and collaboration to ultimately increase the quality of the scientific activities and outcomes.

1. ENIGMA Addiction Cue Reactivity Initiative (ACRI)
2. International Network of tES/TMS Trials for Addiction Medicine (INTAM)
3. International Network of tES-fMRI (INTF)
4. Neuroscience Interest Group (NIG) of the International Society of Addiction Medicine (ISAM)

Further details about these ViCoNs could be found on Dr Ekhtiari's page at LIBR website.

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Dr. Feinstein's three main research areas are to:

1 Develop floatation as a tool for reducing stress and enhancing well-being in individuals who suffer from anxiety.

2 Use functional neuroimaging and the lesion method to help determine the causal source of anxiety in the human brain.

3 Study how the brain dynamically maps the internal world of our body, determine how these maps are dysregulated in conditions of anxiety, and whether floatation therapy can help regulate these disturbances, allowing patients to reshape their internal experience.

Dr. Justin Feinstein joined the faculty of the Laureate Institute for Brain Research in December of 2013 after completing his Ph.D. in clinical neuropsychology at the University of Iowa, and his postdoctoral fellowship at the California Institute of Technology. He earned his undergraduate degree in cognitive neuroscience at the University of California – San Diego. His clinical internship occurred at the San Diego VA hospital and focused on the treatment of veterans with PTSD using Prolonged Exposure therapy.

Dr. Feinstein's research utilizes the lesion method and functional neuroimaging to explore how the human brain produces primal states of emotion, with an emphasis on the neuroscience of fear and treatments that alleviate anxiety. His laboratory is interested in understanding the intimate connection between the body and the brain, and developing new technologies to help bring this connection to the forefront of awareness. To this end, he is exploring several new approaches that can selectively enhance "interoceptive awareness," in order to help patients with anxiety establish a healthier balance between their body and brain.

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SELECTED PUBLICATIONS

Feinstein, J.S., Khalsa, S.S., Yeh, H., Al Zoubi, O., Arevian, A.C., Wohlrab, C., Pantino, M.K., Cartmell, L.J., Simmons, W.K., Stein, M.B., Paulus, M.P. (2018). The elicitation of relaxation and interoceptive awareness using floatation therapy in individuals with high anxiety sensitivity. Biological Psychiatry: Cognitive Neuroscience and Neuroimaging, 3, 555-562.

Feinstein, J.S., Khalsa, S.S., Yeh, H., Wohlrab, C., Simmons, W.K., Stein, M.B., Paulus, M.P. (2018). Examining the short-term anxiolytic and antidepressant effect of Floatation-REST. PLoS ONE, 13, e0190292.

Feinstein, J.S., Khalsa, S.S., Salomons, T.V., Prkachin, K.M., Frey-Law, L.A., Lee, J.E., Tranel, D., Rudrauf, D. (2016). Preserved emotional awareness of pain in a patient with extensive bilateral damage to the insula, anterior cingulate, and amygdala. Brain Structure and Function, 221:1499-1511.

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After graduating as an Argentine Navy reserve ensign, **Dr. Guinjoan** earned an M.D. from the University of Buenos Aires ("U.B.A") in 1992, and a Ph.D. from the U.B.A. Dept. of Physiology in 1997. He trained as a psychiatrist at the Sheppard Pratt Hospital/University of Maryland program from 1995 to 1999, where he was also a chief resident, and obtained certification in the specialty of Psychiatry from the American Board of Psychiatry and Neurology. He returned to Argentina in 1999, where he developed an academic career in psychiatry as Associate Professor of Psychiatry at the U.B.A., Principal Investigator of the Argentine National Council of Scientific and Technological Research (CONICET), and Chief of Psychiatry at the Fleni Foundation Hospital (a U.B.A. teaching unit), before joining LIBR in 2020.

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Sánchez SM, Duarte-Abritta B, Abulafia C, De Pino G, Bocaccio H, Castro MN, Sevlever GE, Fonzo GA, Nemeroff CB, Gustafson DR, Guinjoan SM, Villarreal MF (2020): White matter fiber density abnormalities in cognitively normal adults at risk for late-onset Alzheimer's disease. J Psychiatr Res 122:79-87.

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Axelrud LK, Sato JR, Santoro ML, Talarico F, Pine DS, Rohde LA, Zugman A, Junior EA, Bressan RA, Grassi-Oliveira R, Pan PM, Hoffmann MS, Simioni AR, Guinjoan SM, Hakonarson H, Brietzke E, Gadelha A, Pellegrino da Silva R, Hoexter MQ, Miguel EC, Belangero SI, Salum GA (2019): Genetic risk for Alzheimer's disease and functional brain connectivity in children and adolescents. Neurobiol Aging 82:10-17.

Crossley NA, Alliende LM, Ossandon T, Castañeda CP, González-Valderrama A, Undurraga J, Castro M, Guinjoan SM, Díaz-Zuluaga AM, Pineda-Zapata JA, López-Jaramillo C, Reyes-Madrigal F, León-Ortíz P, de la Fuente-Sandoval C, Czepielewski LS, Gama CS, Zugman A, Gadelha A, Jackowski A, Bressan R (2019): Imaging Social and Environmental Factors as Modulators of Brain Dysfunction: Time to Focus on Developing Non-Western Societies. Biol Psychiatry Cogn Neurosci Neuroimaging 4(1):8-15.

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Curiel RE, Loewenstein DA, Rosselli M, Penate A, Greig-Custo MT, Bauer RM, Guinjoan SM, Hanson KS, Li C, Lizarraga G, Barker WW, Torres V, DeKosky S, Adjouadi M, Duara R (2018): Semantic Intrusions and Failure to Recover From Semantic Interference in Mild Cognitive Impairment: Relationship to Amyloid and Cortical Thickness. Curr Alzheimer Res 15(9):848-855.

Duarte-Abritta B, Villarreal MF, Abulafia C, Loewenstein D, Curiel Cid RE, Castro MN, Surace E, Sánchez SM, Vigo DE, Vázquez S, Nemeroff CB, Sevlever G, Guinjoan SM (2018): Cortical thickness, brain metabolic activity, and in vivo amyloid deposition in asymptomatic, middle-aged offspring of patients with late-onset Alzheimer's disease. J Psychiatr Res 107:11-18.

Abulafia C, Duarte-Abritta B, Villarreal MF, Ladrón-de-Guevara MS, García C, Sequeyra G, Sevlever G, Fiorentini L, Bär KJ, Gustafson DR, Vigo DE, Guinjoan SM (2017): Relationship between cognitive and sleep-wake variables in asymptomatic offspring of patients with late-onset Alzheimer's Disease. Front Aging Neurosci 9:93.

Sánchez SM, Abulafia C, Duarte-Abritta B, de Guevara MSL, Castro MN, Drucaroff L, Sevlever G, Nemeroff CB, Vigo DE, Loewenstein DA, Villarreal MF, Guinjoan SM (2017): Failure to recover from proactive semantic interference and abnormal limbic connectivity in asymptomatic, middle-aged offspring of patients with late-onset Alzheimer's Disease. J Alzheimers Dis 60(3):1183-1193.

Recently incorporated to LIBR, Dr. Guinjoan works on the application of knowledge on basic mental and behavioral processes to developing diagnostic and therapeutic tools for the mood disorders. Working on the T1000 study, he is helping to detect clinical and biological predictors of adverse outcomes in persons who suffer from major depression. He specifically focuses on three main research questions:

1 Does rumination convey risk for adverse outcomes in mood disorders on its own?

2 Are inflammatory mediators previously associated to depression expressed in specific clusters of symptoms? Do they contribute to risk of suicide?

3 Which are the brain circuits whose abnormalities are ultimately expressed as adverse outcomes in depression? Is it possible to modulate such circuits' activity to improve depression symptoms?

Maria Ironside, Ph.D.

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Dr. Ironside's main interests include understanding the mechanisms of action of non-invasive neuromodulation as a treatment for psychiatric disorders. Dr. Ironside uses behavioral and neuroimaging measures to investigate acute effects of transcranial direct current stimulation with a view to establishing potential biomarkers of treatment response. The goal of this research program is to inform patient selection for future clinical trials and, ultimately, treatment selection in the clinic.

RESEARCH PROGRAM HIGHLIGHTS

Main Questions

Can we modulate threat sensitivity using neuromodulation to increase top-down control of threat responses? Can we protect against the effects of stress by increasing top-down control? Is threat sensitivity the mechanism by which prefrontal neuromodulation reduces anxious or depressive symptoms?

Approach

The acute effects of neuromodulation are probed using behavioral and neuroimaging measurements designed to capture threat sensitivity and stress response.

Future Directions

More objective measures such as startle response, eye tracking and stress hormones will be investigated in upcoming projects, to allow additional levels of measurement that could have predictive utility. Ultimately, these measures would be used in a clinical trial of neuromodulation for anxious depression.

SCIENTIFIC BACKGROUND

Dr. Ironside received her Bachelor's degree from Trinity College Dublin in 2004. After some time working in the public sector in London she subsequently completed two Master's degrees in Cognitive and Decision Sciences and Cognitive Neuroscience at University College London and Birkbeck. It was there that she began working with neuromodulation under the supervision of Dr. Vincent Walsh at the Institute of Cognitive Neuroscience. She then completed her doctorate in Psychiatry at the University of Oxford under the supervision of Dr. Catherine Harmer (Dept. Psychiatry) and Dr. Jacinta O'Shea (Nuffield Dept of Clinical Neurosciences). Her doctoral work applied neuromodulation to models of acute effects typically used in psychopharmacology, using behavioral and functional imaging measures and has been published in Biological Psychiatry and JAMA Psychiatry.

Dr. Ironside next completed a postdoctoral fellowship at McLean Hospital/ Harvard Medical School, under the mentorship of Dr. Diego Pizzagalli. During this fellowship she led two large clinical multimodal neuroimaging studies in major depression, examining sex differences and effects of stress in current and remitted depression. During this time she also worked on a cross-species investigation of approach-avoidance-conflict in major depressive disorder, in collaboration with Ann Graybiel's non-human primate lab at MIT. In 2018 Dr. Ironside was awarded a Rappaport Mental Health Award to continue her neuromodulation work in patients and was promoted to Instructor/Assistant Neuroscientist by Harvard Medical School/McLean.

Dr. Ironside recently made the move to LIBR, to start a position as an Associate Investigator. She is continuing her work on the acute mechanisms of prefrontal neuromodulation with a view to carrying out mechanistic clinical trials of neuromodulation treatment in psychiatry.

SELECTED PUBLICATIONS IN 2020:

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Ironside, M., Admon, R., Maddox, S. A., Mehta, M., Douglas, S., Olson, D. P., & Pizzagalli, D. A. (2019). Inflammation and depressive phenotypes: evidence from medical records from over 12 000 patients and brain morphology. Psychological Medicine, 1-9

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Ironside, M., & Perlo, S. (2018). Transcranial Direct Current Stimulation for the Treatment of Depression: a Review of the Candidate Mechanisms of Action. Current Behavioral Neuroscience Reports, 5(1), 26-35

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Dr. Khalsa's laboratory studies the brain-body connection. Our research explores three main questions:

1 How does the nervous system influence the way we perceive our inner body?

2 Does dysfunctional cross talk between the body and brain influence the expression of psychiatric and cardiovascular illnesses?

**3** How can we develop new treatments that re-establish a functional dialogue between the body and brain?

SCIENTIFIC BACKGROUND

Dr. Khalsa received a bachelor's degree in psychology from SUNY Stony Brook in 2002. He graduated from the Medical Scientist Training Program at the University of Iowa, receiving M.D. and Ph.D. (neuroscience) degrees in 2009. He completed his residency training in Psychiatry at UCLA in 2013, serving as the program Chief Resident and Chief Resident in the UCLA Anxiety Disorders Clinic, subsequently joining the department as a faculty member in the Division of Adult Psychiatry at UCLA, and becoming an Assistant Professor in Residence. In 2015 Dr. Khalsa joined LIBR as the Director of Clinical Studies, and as an Assistant Professor (tenure track) at the University of Tulsa.

Dr. Khalsa's research investigates the role of interoception in mental health, with a focus on understanding how changes in the internal physiological state influence body perception and the functioning of the human nervous system. His studies utilize a variety of approaches to probe interoception and body image including pharmacological and non-pharmacological techniques, functional brain imaging and electroencephalography, computational modeling, and digital psychiatry. Central aims of this work are to discover modifiable neuroscience-based treatment targets for psychiatric disorders, to develop novel tests to identify these treatment targets in individual patients, and to design novel neuroscience-based therapies capable of ameliorating the symptoms and signs of mental illness.
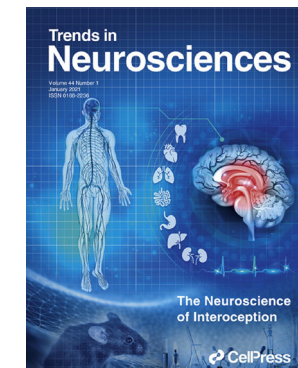
Dr. Khalsa's clinical expertise focuses on the assessment and treatment of anxiety disorders. Dr. Khalsa previously served as Associate Director of the UCLA Anxiety Disorders Clinic, supervising resident physicians in the treatment of anxiety disorders, and was an attending psychiatrist in the UCLA OCD Intensive Outpatient Program. As founding Director of the Healthy Hearts Behavioral Medicine Program, an interdisciplinary endeavor started with the UCLA Cardiac Arrhythmia Center, he specialized in treating anxiety and mood disorders in individuals with cardiac arrhythmias. Current clinical activities include conducting case conferences with the Laureate Psychiatric Hospital and Clinic and psychoeducation groups with inpatients from the Laureate Eating Disorders Program.

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Smith R, Khalsa SS, Paulus MP. An active inference approach to dissecting reasons for non-adherence to antidepressants. Biological Psychiatry CNNI 2019. Dec 5. pii: S2451-9022(19)30309-X.

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Berntson GG, Khalsa SS. Neural circuits of interoception. Trends in Neurosciences (in press).

Petzschner FH, Garfinkel SN, Paulus MP, Koch C, Khalsa SS. Computational models of interoception and body regulation. Trends in Neurosciences (in press).

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Dr. Kirlic's laboratory focuses on improving our understanding of the broad consequences of early life adversity, and what preventative interventions may mitigate the risk for psychiatric and medical illness in this population. His research explores the following questions:

1 Can we identify adaptive versus maladaptive patterns of responses to early life adversity, and establish whether these predict resilience or vulnerability, respectively, over time?

2 By using novel interventions, can we target the neurobiological and psychosocial systems disrupted by early life adversity, thereby improving the short-term and long-term outcomes?

Dr. Kirlic's research is currently funded by LIBR and the National Institute for General Medical Sciences (NIGMS).

SCIENTIFIC BACKGROUND

Dr. Kirlic was born and raised in Bosnia-Herzegovina. He earned his B.A. in Psychology from Middlebury College in Vermont in 2005, where under mentorship of Dr. Adela Langrock his senior thesis focused on the cumulative effects of perceived war- and post-war stress on current psychological functioning. Following his undergraduate studies, he spent two years in the laboratory of Drs. Hans Breiter and Anne Blood at the Massachusetts General Hospital managing studies on addiction and movement disorder and learning neuroimaging methods and technology.

Taking leap of faith, he moved to Tulsa, Oklahoma in 2010 to pursue a Ph.D. in clinical psychology at the University of Tulsa and Laureate Institute for Brain Research (LIBR). Under mentorship of Drs. Elana Newman and Ruben Alvarez, Dr. Kirlic focused on individual differences in neural responses to predictable and unpredictable threats, effects of prenatal drug exposure and postnatal adversity on biological stress responses in children, and effectiveness of interventions for youth survivors of natural disasters and war. His clinical practice in graduate school, as well as during his clinical residency at the University of New Mexico Hospitals and New Mexico VA, centered on the assessment and evidence-based treatment of mood, anxiety, and emotion dysregulation disorders.

Dr. Kirlic returned to Tulsa for his postdoctoral fellowship at LIBR in 2016. Under mentorship of Dr. Robin Aupperle, he trained in the use of translational behavioral and neuroimaging methods to identify reliable predictors of resilience and treatment responses. Additionally, he had an active role in the delivery of the related evidence-based interventions.

In January of 2019, Dr. Kirlic became an Associate Investigator at LIBR. His current research focuses on consequences of early life adversity, preventative interventions, and multi-system responses during aversive conditions.

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Jordan Hoffmeister, M.A.
Graduate Student Volunteer

SELECTED PUBLICATIONS IN 2019:

Cohen, Z. P., Cosgrove, K. T., Akeman, E, Coffey, S., Teague, K., Hays-Grudo, J., Paulus, M. P., Aupperle, R. L, & Kirlic, N. (2020). The effects of mindfulness-based stress intervention on neurobiological and symptom measures in adolescents with early life stress: A feasibility randomized controlled trial. Preprint: https://doi.org/10.31219/osf.io/b5pyr.

Cohen, Z. P., Cosgrove, K. T., DeVille, D. C., Akeman, E., White, E. J., Stewart, J. L., Singh, M. K., Aupperle, R. L., Paulus, M. P., & Kirlic, N. (2020). The impact of COVID-19 on adolescent mental health: Preliminary findings from a longitudinal sample of healthy and at-risk adolescents. Preprint: https://doi.org/10.31219/osf.io/rka2n.

Kirlic, N., Akeman, C. E., Deville, D., Yeh, H. W., Cosgrove, K., McDermott, T. J., Touthang, J., Clausen, A. N., Paulus, M. P., & Aupperle, R. L., (2020). I'm still standing: a machine learning analysis of risk and protective factors of suicidality in college students. Preprint: https://doi.org/10.31219/osf.io/zx352.

Kirlic, N., Colaizzi, J., Cosgrove, K. T., Cohen, Z., Yeh, H., Breslin, F., … Paulus, M. P. (2020). Modifiable factors influencing youth cognitive functioning: Evidence from the ABCD study. Preprint: https://doi.org/10.31219/osf.io/ebf3r.

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Kirlic, N., Cohen, Z. P., & Singh, M. K. (2020). Is There an Ace Up Our Sleeve? A Review of Interventions and Strategies for Addressing Behavioral and Neurobiological Effects of Adverse Childhood Experiences for Youth. Adversity and Resilience Science: Journal of Research and Practice.

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RESEARCH COLLABORATORS

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Dr. Paulus' research focuses on three main areas:

1 To use a neuroscience-based approach for:

   a. objective markers for psychiatric disorders

   b. better disease models

   c. better access to efficacious treatments

   d. brain-based and more effective interventions

2 To use computational approaches in order to move from one-size-fits-all toward precision psychiatry

3 To develop prevention strategies for psychiatric disorders

SCIENTIFIC BACKGROUND

Dr. Paulus studied Medicine at the Johannes Gutenberg University in Mainz from 1979-1985. He received a postdoctoral fellowship from the Deutsche Forschungsgemeinschaft (German Research Foundation) in 1986 to study the effects of calcium antagonists on animal models of mania at the University of California San Diego (UCSD). In 1993, Dr. Paulus left UCSD to resume his medical training and completed his internship at the Long Island Jewish Medical Center/Zucker Hillside Hospital on Long Island, NY. In 1994, he rejoined the Department of Psychiatry at UCSD as a psychiatric resident. Dr. Paulus completed his residency in psychiatry in 1997. At that time, he joined the Department of Psychiatry at UCSD as an Assistant Professor and became a staff psychiatrist at the Veterans Affairs San Diego Health Care System (VASDHS). In May 2014, Dr. Paulus joined the Laureate Institute for Brain Research (LIBR) in Tulsa, OK, as the Scientific Director and President.

Dr. Paulus has published over 400 peer-reviewed publications (some in top-tier journals like Science, Nature Reviews Neuroscience, PNAS, JAMA Psychiatry, Lancet Psychiatry, Biological Psychiatry, Neuropsychopharmacology, and the American Journal of Psychiatry). Dr. Paulus received the UCSD Lew Judd young investigator award, the NAMI young investigator award, and the NIMH Outstanding Resident Award. He is the Deputy Editor of JAMA Psychiatry, a Series Editor for Current Topics in Behavioral Neuroscience and is on several editorial boards of top-tier psychiatric journals. He has served on numerous NIH and International Study Sections. LIBR's strategic goals are: (1) To identify, characterize and develop Targetable, Disease Modifying Processes in Mental Health. (2) To develop neuroscience-based interventions to improve Mental Health. Dr. Paulus' research focuses on pragmatic academic psychiatry, i.e., that is how to use neuroscience-based measurements to identify modifiable treatment targets and to generate predictions that can be useful for clinicians. Moreover, Dr. Paulus is interested in whether computational approaches can be useful to better develop explanatory basis for psychiatric disorders that can be submitted to rigorous scientific examination.

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Depression is the most devastating mental health problem on the planet, yet we know very little about the underlying disease process. Our lab is examining whether inflammation of the brain is one cause of depression. In particular, we are using blood-based inflammatory and immune markers and experimental medicine designs to examine how inflammatory processes affect the healthy and diseased brain. Ultimately, this research can help to identify new treatments for depression that are based on modifying the inflammatory process. Three major ongoing projects are as follows:

1 Just as a cardiac stress test can be used to identify abnormalities of the heart that are not visible at rest, so too can "stressing" the immune system enable us to detect hidden factors that may lead to maladaptive immune responses. We use low-dose endotoxin, part of the cell wall of gram-negative bacteria, to "trick" the immune system into launching a transient inflammatory response. To our knowledge, we are the first group in the world to perform an endotoxin challenge on depressed volunteers. Knowledge gained from this study will help us understand the mechanisms through which an inflammatory stimulus alters brain activity in a way that makes some people vulnerable to developing depression in the setting of inflammation.

2 Herpesvirus infections in healthy adults were traditionally considered to be harmless but there is emerging evidence that these viruses may not be completely benign. Herpesviruses lie dormant until they are reactivated by physical or psychological stressors. Conceivably, this periodic viral replication may trigger inflammatory responses that lead to depression. We are testing this hypothesis by following volunteers over the course of several months in order to evaluate whether fluctuations in stress and mood co-occur with changes in viral activity. This research may lead to the initiation of a clinical trial to test whether anti-viral agents have therapeutic benefits in depression.

3 The balance of kynurenine pathway metabolism has been shown to be altered in depression such that an excess of neurotoxic kynurenines is produced. These metabolites damage neuronal cells and impair synaptic plasticity (changes in the junctions between neurons that allow them to communicate). Real time neurofeedback of the amygdala is a promising treatment for depression that likely works in part by altering the connections between neuronal cells. This study tests whether people with higher levels of neurotoxic kynurenine metabolites will be less likely to respond to neurofeedback. The research may help us develop a blood biomarker to determine who should receive this type of treatment.

Dr. Savitz received an undergraduate degree (B.S.) in psychology and genetics from the University of the Witwatersrand in Johannesburg, performed further graduate work in neuropsychology, including a clinical internship, and then completed a Ph.D. on the genetics of bipolar disorder at the University of Cape Town in 2006. He subsequently completed a postdoctoral fellowship at the National Institutes of Health and is currently a Principal Investigator at the Laureate Institute for Brain Research and an Associate Professor at The University of Tulsa. Dr. Savitz has published over 60 first or senior author scientific papers and has been the PI on three NIH grants. He served previously as an associate editor of the journal *Neuroscience Letters* and is an editorial board member of *Brain, Behavior, and Immunity*, *Psychoneuroendocrinology*, and *International Journal of Molecular Sciences*. He has served as a reviewer for numerous European and American grant agencies, including the MESH and NPAS study sections of the NIH.

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Dr. Smith's main research interests include understanding how emotion and decision-making processes are realized within the brain, and how these processes may be altered in mood and anxiety disorders. The primary research methods Dr. Smith employs in his research are neuroimaging and computational modeling. A major overarching focus is to characterize differences between mentally healthy and unhealthy individuals with the goal of improving diagnosis and treatment selection within psychiatry and clinical psychology.

RESEARCH PROGRAM HIGHLIGHTS

Main Questions

How does the brain generate emotions, and how do we subsequently recognize and become aware of our own emotions? How do interoceptive and emotional mechanisms influence decision-making? Can these processes be understood in terms of the computational processes performed by the brain? How might these computational processes be affected in psychiatric disorders? Could understanding these mechanisms improve treatment?

Approach

Dr. Smith employs several methods aimed at providing multiple levels of description in characterizing emotion-related psychological and biological processes, including self-reported experience, decision-making tasks, behavioral and physiological responses measures, functional neuroimaging, and computational modeling.

Future Directions

Dr. Smith's lab aims to establish: (1) the role of emotional and decision-making processes in psychiatric disorders at a cognitive, computational, and neurobiological level of description, (2) how such processes contribute to the vulnerability to, and the onset and maintenance of psychiatric symptoms, and (3) how characterizing such processes in individual participants might inform more individualized and targeted treatment selection.

Dr. Smith received his Bachelor's degree in the science of Psychology from Arizona State University in 2010. He subsequently completed three graduate degrees from the University of Arizona between 2011 and 2015. This included Master's degrees in Neuroscience and in Philosophy (with a focus on Philosophy of Science and Mind), and a Ph.D. in Psychology (with a Cognitive Neuroscience focus). His graduate work in philosophy focused on the relationship between scientific explanation and understanding and on the relationship between physical and mental processes. This work was done primarily under the supervision of Jenann Ismael, who is a recognized leader in the fields of Philosophy of Cognitive Science and Philosophy of Physics. His graduate work in Neuroscience/Psychology focused on the role of prefrontal cortex in emotion and its pathology in Major Depression, using both structural and functional neuroimaging as well as measurement of heart rate variability. This work was done primarily under the supervision of Dr. Richard Lane, who is both a practicing psychiatrist and a recognized pioneer in studying the brain basis of emotion.

Dr. Smith subsequently completed a three-year postdoctoral fellowship with Dr. W.D. Scott Killgore in the Psychiatry Department within the University of Arizona College of Medicine. During this fellowship he designed and ran a neuroimaging study focused on understanding the ability to hold emotional information within working memory. He also played a primary role in creating an online emotional intelligence training program designed to minimize the development of emotional disorders in military personnel.

Upon completing this postdoctoral fellowship, Dr. Smith accepted an associate investigator position at LIBR, following completion of a four-month visiting fellowship with Dr. Karl Friston at University College London. This fellowship focused on designing computational models of brain function for use in understanding emotions and mechanisms underlying psychopathology.

Dr. Smith has authored 83 publications within peer-reviewed journals and scholarly books, based in part on the work described above. Many of these publications have also made theoretical contributions, proposing neurocognitive and computational models of conscious/unconscious emotion, neurovisceral integration, emotional intelligence, depression, and learning and decision-making mechanisms.

In 2020, Dr. Smith had nine research articles and six book chapters published. He also had two additional journal articles accepted for publication, three manuscripts under review, and five manuscripts in preparation. Dr. Smith presented his research at the International Workshop for Active Inference in September of 2020, and submitted an NIMH grant in November of 2020. He also welcomed a very bright and talented research assistant named Sam Taylor as a new member of his lab.

SELECTED PUBLICATIONS

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Michael Mouttoussis
University College London

Quentin Huys
University College London

W.D. Scott Killgore
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Horst Dieter Steklis
University of Arizona

Edda Bilek
University College London

Jennifer L. Stewart, Ph.D.

Principal Investigator
Associate Director for Training and Mentoring
Laureate Institute for Brain Research

Assistant Professor, University of Tulsa
Department of Community Medicine

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Dr. Stewart employs electroencephalography (EEG) frequency analysis, event related potentials (ERPs), and functional magnetic resonance imaging (fMRI) to identify potential biomarkers of risk for/presence of:

1 **major depressive disorder with and without comorbid anxiety; and**

2 **substance use disorders, with a particular emphasis on cannabis, methamphetamine, and opioids.**

CURRENT PROJECTS INVOLVE:

1 **the use of ERPs to predict therapy outcome in depressed and anxious individuals;**

2 **the use of fMRI to predict and track early abstinence (three months) in individuals with opioid use disorder entering treatment.**

Dr. Stewart earned a B.S. in Psychology from University of California, San Diego in 1998 and her M.A. (2005) and Ph.D. (2008) in Clinical Psychology at the University of Illinois at Urbana-Champaign. Dr. Stewart trained with Drs. Brett Clementz, John Polich, Gregory Miller, Wendy Heller, John Allen, and Martin Paulus on EEG, ERP, and fMRI data collection and analysis, focusing on potential state and trait markers of mood, anxiety, and substance use disorders. Starting in 2014, Dr. Stewart spent four years as an Assistant Professor of Clinical Psychology at the City University of New York (CUNY Queens College/The Graduate Center) where she served as Training Area Coordinator for their APA-accredited Clinical Program. She taught courses on Psychopathology, Introduction to Clinical Psychology, Multivariate Statistics, Clinical Interviewing, and Neuropsychological Assessment. Dr. Stewart joined LIBR in July 2018. She has taken an active role in training and mentoring LIBR staff members in grant writing, manuscript/talk preparation, statistics, and career development.

LAB MEMBERS

Mariah Nacke, B.S.
Research Assistant

SELECTED PUBLICATIONS

Burrows, K., Stewart, J. L., Antonacci, C., Kuplicki, R., Thompson, K., Taylor, A., Teague, K., Paulus, M. P. (2020). Diet is related to depression severity and inflammation in major depressive disorder independent of appetite change. Journal of Affective Disorders, 263, 99-106. https://doi.org/10.1016/j.jad.2019.11.160

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Evan White, Ph.D.

Associate Investigator
Laureate Institute for Brain Research

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Dr. White's laboratory aims to establish and advance neuroscientific understanding of cultural factors that are protective against poor mental health among American Indians utilizing a strength-based framework. A focus this research is implementing multi-modal neuroscience and psychophysiology with a particular emphasis in electroencephalography/ event-related potentials. Our goal is to integrate clinical and cultural neuroscience to identify modifiable factors as candidate treatment targets for mental health intervention and prevention research. Current research aims:

1 Establish functional framework for the protective role of cultural engagement against poor mental health outcomes.

2 Identify neuroscientific signatures of cultural protective factors that may enhance culturally informed prevention and intervention efforts.

Dr. White's research is currently funded by the Laureate Institute for Brain Research with support from the National Institute of General Medical Sciences and National Institute of Minority Health and Health Disparities.

In addition to his work with American Indians. Dr. White is interested in employing translational neuroscience and psychophysiological research (especially event-related potentials) to understand development, maintenance, and treatment of anxiety and mood disorders. Currently, he is collaborating with investigators at LIBR to examine concurrent EEG-ERP/fMRI indicators of cognitive processing relevant to mental health disorders.

RESEARCH APPROACH

Main Question
What is the neural instantiation of mental health protection conveyed by cultural engagement among American Indians and how can this inform treatment and prevention of mental disorders?

Approach
We utilize a multi-modal (e.g., neural, physiological, neuropsychological, behavioral, subjective) investigative framework to characterize the protective role of culture at multiple levels of analysis.

Future Directions
Establish a clinical-cultural-neuroscience framework in which mental health intervention and prevention efforts are culturally informed and guided by neuroscience.

SCIENTIFIC BACKGROUND

Dr. White was born and raised in Tulsa, Oklahoma. He is an enrolled member of the Absentee Shawnee Tribe of Oklahoma. He belongs to the Shawnee Chapter of the Native American Church of Oklahoma and the Whiteoak Shawnee Ceremonial Grounds. He received his bachelor's degree in Psychology from Oklahoma State University. He also, completed his master's and doctoral education in clinical psychology at Oklahoma State University under the mentorship of DeMond M. Grant, Ph.D. His graduate research focused on employing psychophysiological techniques, to test predictions from cognitive models of mood and anxiety disorders. His clinical training was generalist clinical science broadly with an emphasis in adult outpatient treatment of anxiety, mood, and trauma-related disorders using evidence-based psychotherapy approaches. He completed his predoctoral clinical internship at the Charleston Consortium (Medical University of South Carolina/ Ralph H. Johnson VA Medical Center) in Charleston South Carolina working closely with his research preceptor Lisa McTeague, Ph.D.

Dr. White joined LIBR in 2019 as a postdoctoral fellow under the mentorship of Dr. Robin Aupperle. During his fellowship his training focused on using translational neuroimaging methodologies to predict treatment response in mood and anxiety disorders. In July 2020 Dr. White became an Associate Investigator at LIBR; the focus of his work is employing clinical cultural neuroscience to improve mental health outcomes among American Indians.
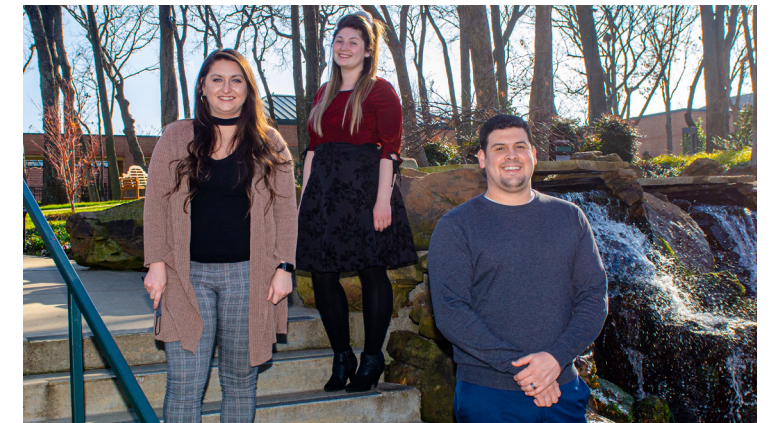
LAB MEMBERS

Mariah Nacke, B.S.

Mara Demuth, M.S.

SELECTED PUBLICATIONS

Aupperle, R.L., McDermott, T.J., White, E.J., & Kirlic, N. (accepted). The neuropsychology of anxiety: An approach-avoidance decision making framework. APA Handbook of Neuropsychology.

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RESEARCH COLLABORATORS

DeMond M. Grant, Ph.D.
Oklahoma State University

Matthew R. Judah, Ph.D.
University of Arkansas

Lisa McTeague, Ph.D.
Medical University of South Carolina

Christopher Sege, Ph.D.
Medical University of South Carolina

Danielle L. Taylor, Ph.D.
Ralph H. Johnson VA Medical Center, Charleston South Carolina

Flyer 1: Are You Depressed?

LIBR — Laureate Institute for Brain Research

Are You Depressed?

Help us understand how the brain functions in individuals with Major Depressive Disorder (MDD)

ABOUT OUR RESEARCH

The Laureate Institute for Brain Research (LIBR) is studying the biological basis of Major Depressive Disorder (MDD).

We conduct research using magnetic resonance imaging (MRI) to make images of the brain.

These images help researchers understand how the brain processes emotion and motivation.

MRI is safe, painless, and involves no radiation.

WE NEED YOU

You are eligible if you are:
• male or female
• currently depressed
• ages 18-55
• not currently taking psychiatric medication

Joining this research study provides you with an opportunity to contribute to the understanding of MDD, which affects millions of Americans.

Compensation is provided.

SYMPTOMS OF MDD MAY INCLUDE:

Sadness
Hopelessness
Depressed mood
Problems sleeping
Difficulty concentrating
Lack of motivation

For more information, please call LIBR at:
918-502-5100

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Visit us online at www.laureateinstitute.org or email info@laureateinstitute.org

Flyer 2: Join a Teen Study

LIBR — Laureate Institute for Brain Research

JOIN A TEEN STUDY

ABOUT OUR RESEARCH

LIBR is a groundbreaking research facility that uses neuroscience to help improve mental health worldwide. We are looking for teenage research participants from the Tulsa area to help us improve our understanding of mental health disorders through the use of magnetic resonance imaging (MRI), behavioral testing and biological markers.

Research at LIBR may help us to:

Improve treatment outcomes.

Understand the role of adverse childhood events in the development of mental health disorders.

Improve community partnerships that lead to the **better mental health care.**

STUDY PARTICIPATION

Studies at LIBR typically include questionnaires and testing on a computer, interviews with a researcher, brain imaging scans and the collection of biological samples. Some studies can be completed in a single visit, while others involve multiple visits.

Participation is always **voluntary** and your information is kept **confidential.**

All study assessments and procedures will be provided free of charge to you. No insurance is necessary. You will be paid for your time spent participating in all studies at LIBR.

WE NEED YOU

Qualified teen research volunteers must be:

• Ages 13-17, male or female

AND

• Free of psychiatric symptoms

OR

• Currently experiencing symptoms of anxiety or depression

• Accompanied by a parent or legal guardian

For more information, please call LIBR at:
918-502-5142

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Visit us online at www.laureateinstitute.org or email info@laureateinstitute.org

Flyer 3: Affected by depression?

Affected by depression? We want to help.

JOIN OUR THERAPY STUDY — **LIBR** Laureate Institute for Brain Research

CALL 918-344-8611

ABOUT OUR RESEARCH

This study aims to explore how effective Behavioral Activation Depression Therapy is in reducing symptoms of depression.

As a participant you will receive 10 weeks of therapy and complete tasks, questionnaires, blood draws, and EEG.

To see what's happening in your brain we will use magnetic resonance imaging (MRI), a very safe technology that takes live images of your brain as it's working.

Compensation will be provided.

ABOUT THE THERAPY

Depressive symptoms can impact our day-to-day behavior. Feeling down or depressed, and tired all of the time can reduce our desire to seek out and enjoy daily activities. The fewer things we enjoy, the more down or depressed we may feel.

Behavioral activation breaks this vicious cycle by providing opportunities and motivation to engage in more pleasurable and rewarding activities. Behavioral activation also helps us tackle those daunting to-do lists by breaking activities down in a manageable and realistic way.

WE NEED YOU

You may be eligible for this study if you are:

• 18 to 55 years old
• male OR female
• depressed

SYMPTOMS OF DEPRESSION

Loss of pleasure in things you used to enjoy, difficulty sleeping, feeling depressed or blue, changes in weight or appetite, difficulty concentrating, decreased energy or fatigue, moving or talking more slowly.

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Visit us online at www.laureateinstitute.org or email neurocatt@libr.net

Flyer 4: Curious about anxiety?

Curious about anxiety?

JOIN OUR STUDY

FIND OUT IF YOU QUALIFY
CALL 918-344-8611

LIBR Laureate Institute for Brain Research

ABOUT OUR RESEARCH

This study aims to explore how anxiety relates to the way we think, feel, and make decisions, as well as how our brain responds to various situations.

As a participant you will complete tasks that trigger parts of your brain involved in decision making and other thought processes.

To see what's happening in your brain, we will use magnetic resonance imaging (MRI), a very safe technology that takes live images of your brain as it's working.

WE NEED YOU

You may be eligible if you are:

• Are 18 to 55 years old
• Are male OR female
• Experience high anxiety

OR

• Do not experience any significant mental health symptoms.

You will be paid for your participation.

SYMPTOMS OF ANXIETY

Fear or distress in social situations, such as public speaking

Fear or distress in performance situations, such as taking tests

Exaggerated or persistent worry about a number of different aspects of life

Panic attacks

Muscle tension

Difficulty sleeping

Irritability

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Visit us online at www.laureateinstitute.org or email neurocatt@libr.net

Flyer 5: Join a Research Study

LIBR — Laureate Institute for Brain Research

JOIN A RESEARCH STUDY
TO IMPROVE MENTAL HEALTH THROUGH NEUROSCIENCE

The Laureate Institute for Brain Research (LIBR) in Tulsa, OK is looking for volunteers to join our treatment studies that aim to personalize mental health care through neuroscience.

Volunteers are needed with and without symptoms of depression and anxiety. You will be paid for your participation. Your information will remain confidential. No insurance is required.

Call for more information: (918) 502-5100
www.laureateinstitute.org | info@libr.net | 6655 South Yale Ave, Tulsa, OK 74136
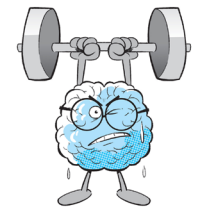
Flyer 6: Stress

STRESS

ABOUT OUR RESEARCH

LIBR is recruiting adolescents for a new research study to better understand how mindfulness training may help teens cope with stress and become more resilient.

We use magnetic resonance imaging (MRI) to take live images of the brain. It's safe, painless, and involves no radiation.

HOW TO PARTICIPATE

You may be eligible if you are:

• 13-17 years of age
• Fluent in English
• Have a parent or legal guardian to give permission for your participation

Compensation will be provided.

PARENTS, PLEASE CONTACT US:
CALL 918-502-5142

LIBR Laureate Institute for Brain Research
6655 South Yale Ave, Tulsa OK 74136
Visit us online at www.laureateinstitute.org or email mindreal@libr.net

Flyer 7: Volunteer for Brain Gym

LIBR — Laureate Institute for Brain Research

Volunteer for Brain Gym for Recovery Project

Neurocognitive Empowerment for Addiction Treatment (NEAT) Project

WHY BRAIN GYM FOR RECOVERY?

• Drug addiction is not only associated with increased mental health symptoms, such as anxiety and depression, but also with brain (neural and cognitive) deficits.

• Cognitive deficits in memory, attention, decision-making, and inhibitory control disturb normal daily functioning and attempts for abstinence, and are associated with worse long-term recovery outcomes.

• Current treatment programs for addiction are mainly focused on abstinence, with the assumption that these brain deficits will subsequently heal. However, these deficits are found to persist even after a long-term abstinence and are thought to contribute to relapse, decreases quality of life, and lack of reintegration into society.

• Brain rehabilitation programs focused on compensatory strategies and training exercises for brain deficits have consistently been found to improve functioning and long-term outcomes for different clinical populations.

• However, there has been a relative lack of research focused on identifying interventions targeting brain deficits in the context of addiction.

BRAIN GYM PARTICIPATION

Brain Gym is composed of 14 sessions of 2 hours classes with novel:

(a) cartoons, brain awareness games and real-life scenarios to ensure it is interactive and engaging,

(b) focus on the role of brain deficits in recovery from addiction and co-occurring mental health disorders, and

(c) incorporation of scientific findings specific to addiction to the brain training and exercise strategies.

Participants will be followed for six months to explore the efficacy of the Brain Gym on cognitive performance, and functional and structural brain changes using magnetic resonance imaging (MRI).

This research study has the potential to identify a novel intervention that can be integrated into addiction treatment programs in Oklahoma and nation-wide to more effectively support recovery from addictions.

You will be paid for your time spent participating in the Brain Gym study.

WE NEED YOU

Qualified research volunteers will:

• Be ages 18-55, male or female
• Have problems with substance use
• Currently in a recovery treatment program

Joining this research study provides you with an opportunity to contribute to an exciting time in mental health research, one that is moving toward personalized care for the millions of people world-wide who suffer from addiction as a brain disease.

For more information, please call LIBR at:
918-502-5100

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Visit us online at www.laureateinstitute.org or email info@laureateinstitute.org

Flyer 8: A MindREaL Study

Mind Full, or Mindful?

A MindREaL Study
Mindfulness for Resilience in Early Life

Are you a teen or the parent of a teen who is interested in learning to become more mindful, concentrate and be more present, and better cope with stress?

LIBR is searching for 13-17 year old volunteers to participate.

Visits involve:
• Completing surveys
• Providing biological samples
• Brain imaging and computer tasks

Compensation will be provided.

ABOUT OUR RESEARCH

The Laureate Institute for Brain Research (LIBR) is conducting research to better understand the relationship between mindfulness training and brain function in teens.

Parents, please contact us:
918-502-5142

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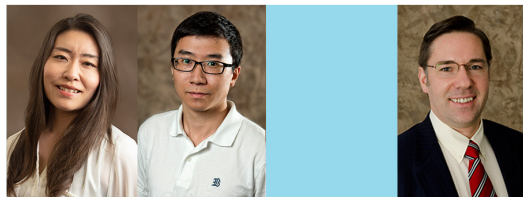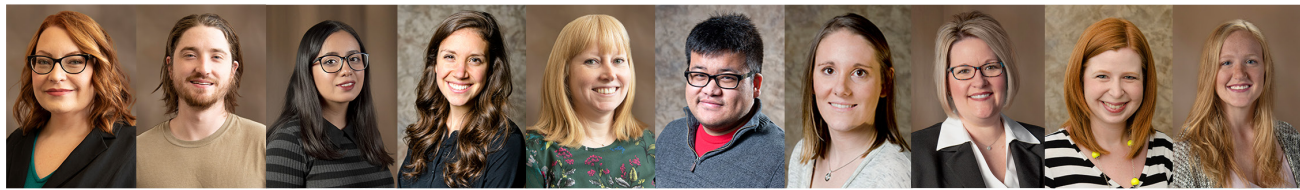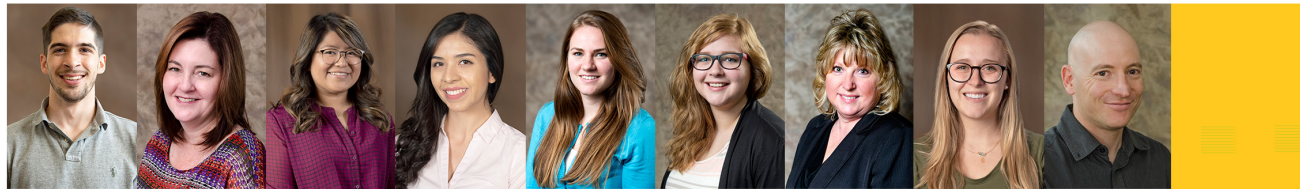
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