IMPROVING MENTAL HEALTH THROUGH NEUROSCIENCE
# Table of Contents

- Letter from the President ............................................. 4
- About LIBR ............................................................. 9
- Areas of Research ..................................................... 10
- Leadership ................................................................. 11
- LIBR by the Numbers .................................................. 12
- Funding Sources ....................................................... 13
- Awards ...................................................................... 14
- T-1000 Study .............................................................. 14
- ABCD Study ............................................................... 15
- Interoception Summit ................................................... 16
- Float Clinic and Research Center .................................. 18
- EEG-fMRI Facility ..................................................... 19
- Clinical Collaborators .................................................. 20
- WKW Speakers ........................................................... 21
- Visiting Scientists ...................................................... 22
- In the News ................................................................ 23
- Principal Investigators .................................................. 26
- Ongoing Studies .......................................................... 44
- 2018 Publications ....................................................... 46
- LIBR Staff ................................................................... 47
The Laureate Institute for Brain Research (LIBR) facilities consist of 28,000 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 patient prep rooms, the computing facility and ample office space for the investigators.
Details of LIBR facilities:
- 42 offices, including 3 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
As part of our analysis strategy, we have decided to conduct exploratory analyses using the first 500 individuals, and to use the second 500 to determine whether our exploratory results can be replicated. This is part of our effort to make scientific findings more reliable and robust. During 2018, we focused on using brain imaging data to calculate what is referred to as brain age, which links the structural and functional characteristics of the brain to the biological age of the individual. Henry Yeh, Rayus Kuplicki and others have made some important contributions to refine this calculation, and we found that the brain of an individual actually can undergo dynamic changes of this variable. For example, one of our graduate students, Trang Le, found that a single dose of ibuprofen makes the brain look younger by about one year.

The T-1000 data are beginning to be used by our principal investigators to try to solve important problems. For example, Jonathan Savitz found that some individuals with depression have an increased rate of cytomegalovirus antibody, which may indicate that they have experienced...
an inflammatory response. Obada Al Zoubi has used the EEG data to investigate how brain states change and whether these EEG brain states can be related to levels of depression. These are just a few examples showing how this data set will be of immense value in understanding the physiological processes that contribute to mood and anxiety disorders. Importantly, the follow-up data of the T-1000 will be critical to establish whether these physiological parameters can be used as clinical predictors.

Florence Breslin has been heading the Adolescent Brain Cognitive Development (ABCD) study, which also hit a major milestone in 2018 by completing enrollment of 11,874 9- to 10-year-old participants and their parents. Florence also played a critical role in contributing to our first publication with the publicly released data set of 4,523 youth. In this publication, we showed that brain characteristics are related to the degree to which children engage in screen media activity. In particular, brain areas that are related to processing visual input and motor behavior are slightly more mature in kids that engage in more of this type of activity. We are currently exploring other relationships between screen media activity and psychological health. This is certainly just the beginning of what will be an exciting possibility to discover insights on how the brain matures and the influence of activities that are important for youngsters on this maturation process. In addition, we want to determine whether these factors contribute to mental health problems and whether changes in the brain related to screen media activity contribute to these problems.

We completed the first year of our Center of Biomedical Research Excellence (CoBRE) award, which focuses on the identification of objective biomarkers for mood and anxiety. This infrastructure grant provides us with the opportunity to train young investigators towards independence—to receive competitive grants from NIH. During the first year, Jerzy Bodurka, Kent Teague (OU) and Brett McKinney (TU) were able to set up the core services for the investigators, which include standard neuroimaging acquisition and processing pipelines, blood biomarker pipelines and statistical analyses. The investigators of CoBRE have made significant progress towards funding: Jonathan Savitz received an R21 award from the National Institute for Mental Health and Justin Feinstein obtained an R34
grant from the National Center for Complementary and Integrative Health. During this year we also conducted our first external advisory board meeting, which was focused on establishing focused timelines for the submission of future grants. Lastly, we made pilot project grants available to young emerging investigators from LIBR and from the University of Oklahoma.

The LIBR Principal Investigators continue to be highly productive and have made significant progress in their respective area of research. Jonathan Savitz has shown clearly that there is a connection between Cytomegalovirus, early childhood trauma and depression. These insights are critically important to help identify individuals with depression who might benefit from a different treatment approach. One possibility is that the body’s response to a persistent virus might lead to ongoing inflammation of the brain, which—in turn—put individuals at risk for depression. Jerzy Bodurka has made significant progress in using real-time functional magnetic resonance imaging as a therapeutic tool. He now has evidence that this type of intervention may not only work for depression, but may also have benefits for post-traumatic stress disorder. Moreover, in collaboration with Amanda Morris, he has developed a robust environment for hyperscanning of parents with their offspring. Using both MRI scanners he is able to show—in real-time—patterns of brain activation of one participant to the other. This setup makes it possible to study parent-child interactions in a way that it has never been studied before. Justin Feinstein has shown that an acute exposure to the floatation environment profoundly reduces levels of anxiety in individuals with anxiety disorder. Although the mechanism is still unclear, this finding provides a strong basis for future interventional studies that are aimed at both understanding how floatation works and determining what type of floatation works best for which individual with a mental health condition. Robin Aupperle completed a major intervention of first year college students and was able to show that a relatively simple and easily scalable treatment significantly reduces depression in these students. This insight has important public health relevance because as many as 1-in-3 students experiences significant anxiety or depression during the first year in college that is sufficiently severe that it interferes with academic performance. Sahib Khalsa
has conducted several physiological challenge studies to provide an interoceptive stress-EKG for psychiatric populations. He has been able to show that an infusion of isoproterenol, which stimulates the fight/flight system, also profoundly modulates the insular cortex, which has been considered the central hub for interoception, i.e., the processing of body-relevant information to drive behavior. The next step will be to determine how this stress-EKG is altered in individuals with eating or anxiety disorders. The long-term goal is to develop objective procedures that can help a provider monitor risk for recurrence or treatment response. Yoon-Hee Cha has been working on modulating the cerebellum in anxious individuals to begin to identify novel brain targets for neuromodulation of anxiety. It has been increasingly recognized that the cerebellum, which used to be thought of as modulating how people navigate in the world, is also critically important for modulating emotion. As a new Principal Investigator, Jennifer Stewart focuses on the neurobiology of addiction in general and addiction recovery in particular. She is examining the T-1000 brain scans for the possibility of helping to quantify addiction severity. In addition, she has been looking at how EEG and fMRI could be used together to provide a more accurate assessment about how the brain has been affected by drugs.

As LIBR grows and as the institute is fostering young emerging research talent, we have now added two Associate Investigators who are developing their own program of research. Hamed Ekhtiari has been working on using neuroscience-based education of individuals with substance use problems to enhance abstinence. This work is based on translating complex neuroscience constructs into easy-to-understand cartoons. His work has received international attention and his cartoons have been translated into over 15 languages. This approach was recognized by the Oklahoma Center for the Advancement of Science and Technology with a two-year grant to develop this approach as an intervention for individuals with substance-use disorders. Moreover, he has been working with the LIBR team to use transcranial direct and alternate current stimulation to help substance
users overcome their cravings. Namik Kirlic, another Associate Investigator, who completed his training at LIBR and returned as a postdoctoral fellow, is interested in using mindfulness-based interventions in teens who have experienced adverse life events growing up. In addition, he has been working on determining whether fear learning can be used as a useful biological marker for individuals with anxiety disorder. He has found that unlearning of fear-related experiences involves the same brain systems that are also important for interoception. The combination of sophisticated brain imaging and behavioral intervention focused on trauma-related problems with mental health will have significant impact and will be highly relevant for people in Oklahoma.

An additional Associate Investigator, Ryan Smith, focuses his main research interests on understanding how conscious and unconscious emotion-related processes are realized within the brain, and in how these processes may be altered in mood and anxiety disorders. His research employs both neuroimaging and computational modeling. A major overarching theme is to characterize differences between mentally healthy and unhealthy individuals with the goal of improving diagnosis and treatment selection within psychiatry and clinical psychology.

Taken together, 2018 has been another productive year for LIBR. We recognize that the suffering of individuals with psychiatric disorders is current and pressing. Therefore, there is a sense of urgency to push the field to apply neuroscience to identify objective markers for disease and to use these tools for innovative treatments. There is light at the end of the tunnel, but we are not there yet.
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 prevention strategies 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, neurology, 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**

**Tom Cooper, MBA**
Chief Executive Officer

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

**Colleen McCallum, MBA**
Chief Operating Officer

**Jerzy Bodurka, Ph.D.**
Chief Technology Officer
LIBR BY THE NUMBERS 2018

<table>
<thead>
<tr>
<th>Category</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Journal article publications by LIBR investigators</td>
<td>66</td>
</tr>
<tr>
<td>Inquiries for study participation</td>
<td>4,749</td>
</tr>
<tr>
<td>Participants enrolled across all studies</td>
<td>2,413</td>
</tr>
<tr>
<td>Active grants and clinical trials</td>
<td>12</td>
</tr>
<tr>
<td>Participants enrolled in their first MRI study</td>
<td>956</td>
</tr>
<tr>
<td>New externally funded grants</td>
<td>6</td>
</tr>
<tr>
<td>In external grant funding</td>
<td>$4.4 million</td>
</tr>
<tr>
<td>Post-doctoral fellows</td>
<td>5</td>
</tr>
<tr>
<td>Principal investigators</td>
<td>7</td>
</tr>
<tr>
<td>Poster presentations and talks at conferences and universities</td>
<td>100+</td>
</tr>
<tr>
<td>Staff scientists</td>
<td>6</td>
</tr>
<tr>
<td>Associate adjunct investigators</td>
<td>2</td>
</tr>
<tr>
<td>Collaborative institutions</td>
<td>55</td>
</tr>
<tr>
<td>Graduate students</td>
<td>10</td>
</tr>
<tr>
<td>Magnetic Resonance Imaging (MRI) scanning sessions</td>
<td>1,855</td>
</tr>
</tbody>
</table>
2018 FUNDING SOURCES

National Institute of Drug Abuse (NIDA)
Adolescent Brain Cognitive Development (ABCD) Study
09/30/2015 – 05/31/2020
P.I.: Martin Paulus, M.D.

National Institute of Mental Health (NIMH)
Neural Basis of Meal Related Interoceptive Dysfunction in Anorexia Nervosa
5/1/2017 – 3/31/2022
P.I.: Sahib Khalsa, M.D., Ph.D.
Approach-Avoidance Conflict: A Multi-Level Predictor for Exposure Therapy Response
4/12/2016 – 3/31/2021
P.I.: Robin Aupperle, Ph.D.
Acute modulation of neural circuitry regulating immune function in depression
08/01/2018 – 07/31/2020
P.I.: Jonathan Savitz, 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
P.I.: Martin Paulus, M.D.
Dyadic Inter-Brain Signaling Project
02/01/2017 – 03/31/2021
P.I.: Jerzy Bodurka, Ph.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
P.I.: Justin Feinstein, Ph.D.

Brain and Behavior Research Foundation (formerly NARSAD)
Examining the Neural Basis of Interoceptive Fear
01/01/2017 – 12/01/2019
P.I.: Justin Feinstein, Ph.D.
Augmented Interoceptive Exposure Training as a New Treatment for Anxiety in Anorexia Nervosa
01/01/2016 – 12/01/2018
P.I.: Sahib Khalsa, M.D., Ph.D.
Efficacy of Influenza Vaccine in Major Depressive Disorder
01/01/2017 – 01/01/2019
P.I.: Jonathan Savitz, Ph.D.
Enhancing Fear Extinction through Cerebellar Neuromodulation
01/15/2017 – 01/14/2019
P.I.: Yoon-Hee Cha, M.D.
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
P.I.: Hamed Ekhtiari, M.D., Ph.D.

National Science Foundation
Innovative, Broadly Accessible Tools for Brain Imaging, Decoding, and Modulation
08/01/2016 – 07/31/2019
P.I.: Yoon-Hee Cha, M.D.

Epsom Salt Council
Measuring Magnesium Absorption in Float
06/15/2015 – 06/15/2018
P.I.: Justin Feinstein, Ph.D.

Springbank Foundation
Transcranial Magnetic Stimulation (TMS) for Spontaneous Mal de Debarquement Syndrome (MdDS)
03/01/2016 – 04/30/2018
P.I.: Yoon-Hee Cha, M.D.
MdDS Balance Disorder Foundation
Development of Biomarkers to Refine Neuroimaging and Neuromodulation to Enhance Treatment Response in MdDS
02/01/18 – 02/01/20
P.I.: Yoon-Hee Cha, M.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
P.I.: Hamed Ekhtiari, M.D., Ph.D.

2018 DONORS
- Marie Elise Howard Fund
- 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
- Natalie Bryant
- W. Kelly Vandever Revocable Trust
- William K. Warren, Jr., LLC.
- Stephen K. Warren, Trust A
- Mr. and Mrs. W. K. Warren, Jr., in memory of Robert C. McNair
- The William K. Warren Foundation
Tulsa 1000 Study
The Tulsa 1000 (T-1000) study, the largest study at LIBR, began in January 2015 and completed baseline enrollment of all 1,000 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 will continue throughout 2019 with one-hour follow-up interviews at 3, 6 and 9 months and an eight-hour follow-up session at the one-year completion mark. 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 towards developing a science-based personalized medicine approach in mental health.

In 2015, LIBR enrolled 164 of the 1,000 participants. In 2016, our recruitment efforts substantially increased and we enrolled 283 more participants. In 2017, another 346 participants completed baseline. Finally, 255 participants rounded out the study of over 1,000 individuals in 2018. Our retention rate for the one-year follow-up session remains high at over 80% retention. By diagnostic category, we enrolled 508 participants with mood and anxiety disorders, 330 with substance-use disorders, 50 with eating disorders and 159 healthy controls for comparison. Our most successful recruitment strategies for mood and anxiety disorders and healthy control participants have been through radio, social media advertisements and word-of-mouth. For substance-use participants, we work primarily with our invaluable community partners at the 12 & 12, Inc., treatment facility and the Women in Recovery Program through Family and Children’s Services, both located in Tulsa, Oklahoma. For participants with eating disorders, we work directly with the Laureate Psychiatric Hospital and Clinic (LPCH) and their outpatient treatment services.

Data analysis of the T-1000 variables is ongoing, with over 40 individual scientific papers in progress for publication. Bi-weekly discussions of data analysis pathways and scientific findings with the principal investigators, associate investigators, staff scientists and postdoctoral fellows offer opportunities for new ideas to explore as we work towards developing a personalized treatment approach through the knowledge gained with this comprehensive data set.

R34 Awarded to Dr. Justin Feinstein
Congratulations to Dr. Justin Feinstein for receiving an R34 Award from the National Institute for Complementary and Integrative Health for his research project; Investigating flotation-REST as a novel technique for reducing anxiety and depression. This grant allows Dr. Feinstein to perform early phase clinical trial testing on the feasibility, tolerability and safety of using flotation-REST (reduced environmental stimulation therapy) in patients with anxiety and depression.

R21 Awarded to Dr. Jonathan Savitz
Congratulations to Dr. Jonathan Savitz for receiving an R21 Award from the National Institute for of Mental Health for his research project titled: Acute modulation of neural circuitry regulating immune function in depression. This grant allows Dr. Savitz to take a step towards identifying immune markers of treatment response and prognosis, and characterize the immune changes that occur in subjects who are able to regain medial temporal lobe plasticity/function and identify biomarkers of therapeutic brain changes.

OCAST Award Given to Dr. Hamed Ekhtiari
Congratulations to Dr. Hamed Ekhtiari for receiving and OCAST award from the Oklahoma Center for the Advancement of Science and Technology for his research project titled: Neurocognitive Empowerment for Addiction Treatment (NEAT): A Randomized Controlled Trial for Opioid Addiction. This grant allows Dr. Ekhtiari to characterize initial clinical efficacy for an intervention targeting neurocognitive deficits in persons with opioid-use disorder by enhancing awareness and use of neurocognitive skills in the context of substance use recovery.
The Adolescent Brain Cognitive Development (ABCD) study completed recruitment of 743 subjects from the Tulsa area in October 2018. This was an increase from the original goal of 525 subjects. The entire ABCD study enrolled 11,877 subjects across the country. LIBR is excited to remain at the top of the consortium, and in August of 2018 was awarded a demographic supplemental NIH grant to recruit under-represented populations. Through the hard work of our ABCD team, the LIBR site has a 99.45 percent retention rate and follow-up data collection is ongoing.

The first annual data set for ABCD was released in March 2018, and our group was one of the first to publish on the data, with our NeuroImage paper “Screen media activity and brain structure in youth: Evidence for diverse structural correlation networks from the ABCD study,” led by Dr. Martin Paulus. This paper garnered a lot of attention and data from the paper was shown during the 60 Minutes segment “Ground breaking study examines screen time on kids” on December 9, 2018. Subsequently, Dr. Paulus and study investigator, Florence Breslin, have had several interviews published in various outlets, including the Oklahoma Magazine February 2019 issue, TulsaKids Magazine February 2019 issue and Mashable.com. The Mashable.com article was entitled “Screen time can affect kids, but the data is hard to measure. Here’s why.” (mashable.com/article/how-much-screen-time-is-too-much/#lT9U46wlvPqE).

The LIBR ABCD team is excited for our annual ABCD night on April 25, 2019, where Dr. Paulus will speak and share updates on our exciting results to all the participating families while the subjects enjoy food and fun.
2018 Update

The Interoception Summit was the first of its kind—organized by LIBR with the generous support of The William K. Warren Foundation in 2016, the meeting united a multidisciplinary group of leading scientists and thought leaders with the goal of accelerating research in interoception research, and ultimately, improving mental health outcomes. The conference proceedings were formalized into a consensus statement (i.e., a white paper) that serves as an authoritative reference for other scientists and funding agencies. A special issue on the theme of mental health accompanied the white paper, which was officially published in the journal Biological Psychiatry: Cognitive Neuroscience and Neuroimaging in 2018. The guest editors for the issue were Drs. Sahib Khalsa, Justin Feinstein, W. Kyle Simmons and Martin Paulus.

NIH INTEROCEPTION MEETING

Recognizing the importance of interoception to our understanding of health, the National Institutes of Health will be hosting a two-day workshop in April 2019 focused on interoception. The workshop is part of the NIH Blueprint series, which often establish the state-of-the-art knowledge in a particular area, and can serve as a foundation for future funding opportunities. Many speakers from the original interoception summit were invited to participate, including Martin P. Paulus, W. Kyle Simmons and Sahib Khalsa.

White paper

The Center for Neuroscience-based Mental Health Assessment and Prediction (NeuroMAP)

In 2017, the Laureate Institute for Brain Research was awarded an $11.3 million CoBRE grant from the National Institutes of Health (NIH) to help researchers predict and treat mood and anxiety disorders.

As a result, NeuroMAP was formed and includes collaborative efforts from University of Tulsa and the University of Oklahoma.

NeuroMAP provides scientific, operational and educational infrastructure for innovative neuroscience-based research to use individual differences on several biological levels together with sophisticated statistical approaches to generate clinically meaningful predictions of risk and outcomes for mood, anxiety and eating disorders.

NeuroMAP Includes:
- A Research Core of established biomedical research scientists with expertise in mental health, imaging, research laboratories, relevant peer-reviewed funding, and demonstrated leadership and mentoring experience.
- A dedicated mentor and development plan for each junior investigator to transition into independently funded investigators who obtain grant support from National Institutes of Health and other funding sources.
- Research projects each supervised by a single junior investigator that stand alone but share a common thematic scientific focus.

The Individual Research Projects Include:

**PROJECT 1:**
Cerebellar Neuromodulation to Enhance Fear Extinction

**PROJECT 2:**
Predicting Response to Exposure Therapy Using a Carbon Dioxide Challenge in Patients with High Levels of Anxiety Sensitivity

**PROJECT 4:**
Response to Inflammatory Challenge in Major Depressive Disorder

**PROJECT 5:**
Neural Basis of Interoceptive Dysfunction and Anxiety in Anorexia Nervosa

Progress in Year Two

Recruitment of research participants is ahead of schedule with NeuroMAP projects having met targets for year two with a majority surpassing year three recruitment goals. This is important because it allows investigators to more quickly collect and analyze their data and find results.

As part of the CoBRE grant’s commitment to training and development of investigators, a variety of educational opportunities were offered in 2018. Some examples are below.
- A two-day Grant Workshop was held as an intensive grant development program, where researchers transformed a research question into a grant application.
- The External and Internal Advisory Committees met in April for a full-day review and assessment of progress. The Committees provided valuable feedback that will help shape the direction of NeuroMAP.

**Internal Advisory Committee**
- Beverly Greenwood-Van Meerveld, Ph.D.
- Darrin Akins, Ph.D.
- Judith James, M.D., Ph.D.
- James Sluss, Ph.D.

**External Advisory Committee**
- Charles Nemeroff, M.D., Ph.D.
- Mary Phillips, Ph.D.
- Leanne Williams, Ph.D.

**Oklahoma State University**
- Beverly Greenwood-Van Meerveld, Ph.D.
- Darrin Akins, Ph.D.
- Judith James, M.D., Ph.D.
- James Sluss, Ph.D.

**Oklahoma State University**
- Charles Nemeroff, M.D., Ph.D.
- Mary Phillips, Ph.D.
- Leanne Williams, Ph.D.
The Laureate Institute for Brain Research is home to the world’s first research laboratory investigating the effects of floatation therapy on both the body and the brain, as well as exploring its potential as a therapeutic treatment for promoting mental health and healing in patients who suffer from anxiety and other forms of mental illness.

Floatation therapy allows the nervous system to naturally enter a relaxed physiological state by reducing stimulation from the external environment. In a world of 24/7 connectivity, the float experience helps an individual disconnect from this constant stream of stimulation. All visual, auditory, thermal, tactile and proprioceptive input is minimized in our specially designed circular pools. Moreover, each pool is saturated with 2,000 pounds of Epsom salt, allowing individuals to effortlessly float in a bed of water that is denser than the Dead Sea.

The FCRC is directed by Dr. Justin Feinstein and is now in its fourth year of operation. Based on initial studies, the float environment appears to rapidly reduce levels of stress throughout the nervous system, allowing one’s brain and body to enter a deep state of relaxation. This past year, the FCRC published the first float study to measure blood pressure during the float itself, documenting significant reductions in blood pressure (10 to 15 points). We have also developed other wireless and waterproof sensors to measure neural and physiological changes during the float itself, including heart rate, respiration, movement and frontal EEG brain waves. The lab has also completed the first brain imaging study examining the effects of floating on the brain.

Building from this base of knowledge, the FCRC has completed its first set of clinical studies examining the effects of floatation therapy in individuals who have been chronically suffering from high levels of anxiety and stress, including patients with PTSD, panic disorder, generalized anxiety disorder, major depression and anorexia nervosa. Across two different trials that were published in 2018, an open label trial and a randomized controlled trial, the initial data has shown very promising short-term effects in these patient populations, with a single float session able to provide significant reductions in stress and anxiety, improving both mood and well-being. We are now tracking the time course of these effects as well as studying whether there is evidence for long-term benefit following repeated practice. As part of this program of research, the FCRC was recently awarded an R34 grant from the National Center for Complementary and Integrative Health at the National Institutes of Health. This unique program of research is just beginning, so please stay tuned as we learn more about how floatation therapy works, and how it can help those who suffer from anxiety, PTSD, depression, anorexia nervosa, and other forms of mental illness.
Established in July 2009 and in research operation since June 2010, the MRI and EEG facility provides advanced, state-of-art structural, diffusion and perfusion MRI, functional MRI (fMRI), and electroencephalography (EEG) neuroimaging capabilities to non-invasively measure, quantify, modulate, and study normal and abnormal human brain structure and functions.

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

Both recently upgraded MRI scanners are fully dedicated to research and provide state-of-the-art advanced capacity for the latest ultra-fast and accelerated imaging and visualizing human brain structure. The scanners also measure and monitor brain activity. LIBR’s main research approach to study brain function is a combination of simultaneous EEG and fMRI, which provides a unique capacity to capture and measure brain activity at high spatial and temporal resolution.

Each MRI scanner is also equipped with a custom-made real-time scanner system, allowing 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, and neurofeedback (rtfMRI-nf) experiments to modulate and influence brain activity during subject scanning. Both scanners are also synchronized and integrated to conduct multimodal simultaneous EEG and fMRI 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 technologies, along with custom-developed software solutions and a wide range of auxiliary computerized equipment, offer unique potential for conducting advanced brain research.

In the state of Oklahoma, the LIBR MRI-EEG facility is the only facility that provides this unique technology and know-how to conduct advanced non-invasive neuroscience research for studying the human brain.

The MRI facility was created and is overseen by Jerzy Bodurka, Ph.D., an expert in MRI/EEG-fMRI/real-time fMRI. It is also staffed by three staff scientists: Vadim Zotev, Ph.D. (physics), an expert in MRI, simultaneous EEG and fMRI, and fMRI data analysis; Qingfei Luo, Ph.D. (physics) an expert in EEG and fMRI, and quantitative MRI (arterial spin labeling); and Masaya Misaki, Ph.D. (computational neuroscience), an expert in structural MRI image, real-time fMRI processing as well as fMRI decoding and multivariate multimodal fMRI/EEG data analysis. Other staff include four MRI technologists (Julie Owen, Bill Alden, Julie DiCarlo and Greg Hammond), and a computer programmer support (Jared Smith).
LIBR works closely with several clinical entities in Tulsa to recruit new participants to LIBR research studies.

**Family and Children 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. As part of LIBR’s collaboration, a LIBR assessment team member is stationed at FCS and regularly recruits individuals to participate in LIBR studies. 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. 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.

**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.
<table>
<thead>
<tr>
<th>Date</th>
<th>Speaker</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>February 6</td>
<td>Mark Hyman Rapaport, M.D.</td>
<td>The Impact of Peripheral Inflammation on Mood: the Mind and the Body are Connected</td>
</tr>
<tr>
<td>February 20</td>
<td>Joshua Gordon, M.D., Ph.D.</td>
<td>Challenges and Opportunities in Mental Health Research</td>
</tr>
<tr>
<td>March 6</td>
<td>Joanna Steinglass, M.D.</td>
<td>Neurobiology of the Persistence of Anorexia Nervosa: Why So Stuck?</td>
</tr>
<tr>
<td>April 3</td>
<td>Charles Raison, M.D.</td>
<td>Evolution Comes to the Clinic: Relevance of Ancient Practices for 21st Century Mental Health</td>
</tr>
<tr>
<td>June 19</td>
<td>Jordan Smoller, M.D., ScD.</td>
<td>Psychiatric Genomics and Phenomics</td>
</tr>
<tr>
<td>September 26</td>
<td>Kevin LaBar, Ph.D.</td>
<td>An Information Mapping Approach to Emotion Representation in the Brain</td>
</tr>
<tr>
<td>October 30</td>
<td>Deanna Barch, Ph.D.</td>
<td>Early Emergence of Depression: Understanding Risk Factors and Treatment</td>
</tr>
<tr>
<td>November 6</td>
<td>David Barlow, Ph.D.</td>
<td>Transdiagnostic Approaches to Treating Neuroticism and Somatic Anxiety in Emotional Disorders</td>
</tr>
<tr>
<td>December 19</td>
<td>Barbara Parry, M.D.</td>
<td>Chronobiology of Women’s Mood Disorders</td>
</tr>
</tbody>
</table>
LIBR welcomed several visiting scientists to our institute in 2018.

<table>
<thead>
<tr>
<th>Date</th>
<th>Name</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>January 29</td>
<td>Erik Benau, Graduate Student</td>
<td>The Body on the Brain: Embodied Concepts, Personal Relevance and Interoceptive Abilities Modulate Electrophysiological Indices of Attention and Emotion</td>
</tr>
<tr>
<td>March 13</td>
<td>Aislinn Williams, M.D., Ph.D.</td>
<td>Investigating the Cellular and Molecular Mechanisms of Psychiatric Disease Risk</td>
</tr>
<tr>
<td>March 27</td>
<td>Wan-Ling Tseng, Ph.D.</td>
<td>Childhood Irritability: A Developmental Neuroscience Perspective</td>
</tr>
<tr>
<td>March 30</td>
<td>John Coetzee, Ph.D. Candidate</td>
<td>Dissociating Language and Deductive Reasoning</td>
</tr>
<tr>
<td>May 14</td>
<td>Lawrence Frank, Ph.D.</td>
<td>CORT-JESTER: Cortical Joint Estimation Using Entropy Regularization</td>
</tr>
<tr>
<td>May 30</td>
<td>Jony Sheynin, Ph.D.</td>
<td>Avoidance Behavior in Humans: Behavioral, Computational and Imaging Perspectives</td>
</tr>
<tr>
<td>June 8</td>
<td>Gregory Fonzo, Ph.D.</td>
<td>Using Imaging to Guide Treatment Biomarker and Target Discovery in Affective Disorders</td>
</tr>
<tr>
<td>July 23</td>
<td>Ryan Smith, Ph.D.</td>
<td>The Neural Basis of Hierarchical Emotion Processing and Emotional Awareness: Clinical Relevance and Opportunities for Computational Modeling</td>
</tr>
<tr>
<td>August 15</td>
<td>Henning Tiemeier, M.D., Ph.D.</td>
<td>Modifiable Risk Factors for Neurodevelopmental Problems: The Generation R Study</td>
</tr>
<tr>
<td>August 28</td>
<td>Alejandro Meruelo, M.D., Ph.D.</td>
<td>Adolescent Markers of Academic Performance, Depression, and the Impact of Substance Use</td>
</tr>
<tr>
<td>September 5</td>
<td>Katrin Preller, Ph.D.</td>
<td>Psilocybin and LSD-Induced States: Behavioral and Neuroimaging Studies in Humans</td>
</tr>
<tr>
<td>September 10</td>
<td>Bruno Averbeck, Ph.D.</td>
<td>Motivational Neural Systems Underlying Reinforcement Learning</td>
</tr>
<tr>
<td>November 8</td>
<td>Michael Nitsche</td>
<td>Physiology and Functional Effects of Transcranial Electric Stimulation</td>
</tr>
<tr>
<td>November 14</td>
<td>Zachary Stowe</td>
<td>Perinatal Mental Illness: The First Adverse Life Event</td>
</tr>
</tbody>
</table>

A regulatory battle for control ensues in the central nervous system following a mismatch between the current physiological state of an organism as mapped in viscerosensory brain regions, and the predicted body state as computed in visceromotor control regions. The discrepancy between the predicted and current body state (i.e., the ‘somatic error’) signals a need for corrective action, motivating changes in both cognition and behavior. Here, we argue that anxiety disorders are fundamentally driven by somatic errors that fail to be adaptively regulated, leaving the organism in a state of dissonance where the predicted body state is perpetually out of line with the current body state. Repeated failures to quell somatic error can result in long-term changes to interoceptive circuitry within the brain. This chapter explores the neuropsychiatric sequelae that can emerge following chronic allostatic dysregulation of somatic errors, and discusses novel therapies that might help to correct this dysregulation.

---

National News Coverage on Floatation by CBS This Morning

An interview with Dr. Justin Feinstein and visit to the LIBR Float Clinic and Research Center was featured on CBS This Morning with co-host John Dickerson. He spoke with Dr. Feinstein about the floatation process and detailed his own personal experience. As part of CBS This Morning’s “Pay Attention” series, the goal was to look at how to retrain our focus and recapture our attention under the bombardment of technology and information that distract us. They looked at ways people are trying to short-circuit the noise, help with mental focus and learn about the impact of floating on mental health disorders.
Feinstein Laboratory Publishes Float Study in PLoS One

The first float study ever conducted in patients suffering from both anxiety and depression was conducted at LIBR and published in PLoS One. Dr. Justin Feinstein and colleagues showed that 1 hour of float therapy can provide significant short-term relief from symptoms of stress and anxiety, leaving patients in a peaceful and serene mental state. While the current study examined only the short-term effects of floating, studies are currently underway to evaluate the long-term benefits of floating after repeated practice.

Dr. Joshua Gordon, Director of the National Institute of Mental Health, Visits LIBR

In February, LIBR welcomed Dr. Joshua Gordon, Directory of the National Institute of Mental Health, to lead a discussion at the William K. Warren, Jr. Frontiers in Neuroscience Conferences on the Challenges and Opportunities in Mental Health Research.

Brain research and the healthy mind

Tulsa Lifestyle asked Dr. Martin Paulus questions on how people can stay mentally healthy and why it is important to understand mood and anxiety at an early age.

Groundbreaking study examines effects of screen time on kids.

An interview with Drs. Martin Paulus and Gaya Dowling aired on 60 Minutes, Sunday, December 9th at 7pm EST on CBS. They discussed findings from the Adolescent Brain Cognitive Development (ABCD) study.

Study Suggests Not All Screen Time is Created Equal – February Tulsa Kids Magazine

“Screens. They’re the bane of every parent’s existence, or at least a significant point of contention. Regulating the use of computers, phones and video games can seem like, and often is, a constant battle. In addition, parents worry that all this digital consumption could have a negative impact on their child’s health and wellbeing. Fortunately for those of us raising kids in a digital world, scientists at Tulsa’s Laureate Institute for Brain Research (LIBR) have been hard at work investigating these very issues. Preliminary data is in, and the initial findings might surprise you.”
People to Watch: Dr. Martin Paulus is helping to put Tulsa on map for brain research

In January, Tulsa World published an article on Dr. Martin Paulus in their “People to Watch 2018” feature. The article discussed how LIBR’s involvement in the National Institute of Health’s Adolescent Brain Cognitive Development Study, or ABCD, has put Tulsa on the map for brain research. “I thought, ‘This is a place where I could do something to really make a difference,’” he said. “At the end of my career, I could say, ‘I had something to do with this.’” The largest study of its kind ever attempted, LIBR and other sites will follow 10,000 adolescents over the next decade, from the ages of 9 and 10 to 19 and 20.

Social Media Toxins – January Oklahoma Magazine

“Whether social media and excessive screen time create mental illness is murky. Many factors contribute to poor mental health, and researchers at the Laureate Institute for Brain Research in Tulsa aim to find answers.”

NPR: A Look At Social Media Finds Some Possible Benefits For Kids

One of the first studies to emerge from the NIH Adolescent Brain Cognitive Development (ABCD) longitudinal study focuses on screen time and social media. Researchers found that for 9- and 10-year-old children taking part in a study of brain development, greater social media use, such as scrolling through Instagram and texting, was associated with some positive effects, including increased physical activity, less family conflict and fewer sleep problems.

Brain Healing First Aid

Drs. Hamed Ekhtiari and Robin Aupperle presented ideas for psychoeducation and brain rehabilitation for individuals with substance use disorders. Originally presented at the Zarrow Mental Health Symposium on October 5, 2018.

2018 Zarrow Mental Health Symposium: “Innovations in Mental Health”

The 2018 Zarrow Mental Health Symposium featuring “Innovations in Mental Health” at the Cox Business Center in Tulsa, OK highlighted the research of many of our LIBR investigators. Congratulations to all of the speakers at this influential annual event!

Electrophysiological Signatures of Intrinsic Functional Connectivity Related to rTMS Treatment for Mal de Debarquement Syndrome

The latest published research from Dr. Yoon-Hee Cha’s lab on EEG-rTMS in Mal de Debarquement Syndrome (MdDS) is available to the public via open access on pubmed.com. Learn about this motion perceptual disorder and promising new predictors and indicators of treatment effects.
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 intersection 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 regards to the former, she has conducted research related to neuropsychological correlates of trauma and post-traumatic 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 regards to the latter, she has been involved in research investigating behavioral and neural mechanisms of current pharmacologic and behavioral treatments for anxiety, depression and trauma-related disorders. She is also actively involved in identifying factors that support resilience to college-related stress and strategies to optimize psychological well-being for students.
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 a clinical internship at the VA San Diego Healthcare System, during which her training focused on clinical neuropsychology, cognitive rehabilitation and treatment of post-traumatic 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, Oklahoma, as Assistant Professor.

Dr. Aupperle has ongoing research projects at LIBR investigating neurocognitive and behavioral predictors of treatment response to behavioral activation therapy for depression and exposure therapy for anxiety. In addition, she is taking the lead in LIBR projects investigating predictors of success for females enrolled in a criminal diversion program and factors related to mental health resiliency in college students.

SELECTED PUBLICATIONS


RESEARCH COLLABORATORS

Jim Abelson, M.D., Ph.D.
University of Michigan

Amanda Bruce, Ph.D.
University of Missouri – Kansas City

Evangelia Chrysikou, Ph.D.
Drexel University

Michelle Craik, Ph.D.
University of California – Los Angeles

Amy Jak, Ph.D.
University of California – San Diego

Christopher Martell, Ph.D.
University of Massachusetts – Amherst

Arpi Minassian, Ph.D.
University of California – San Diego

Murray Stein, Ph.D.
University of California – San Diego

Charles Taylor, Ph.D.
University of California – San Diego

Kate Wolitzky-Taylor, Ph.D.
University of California – Los Angeles

Jared Young, Ph.D.
University of California – San Diego

LAB MEMBERS

Elisabeth Akeman
Research Assistant

Alyssa Clinard
Research Volunteer

Kelly Cosgrove
Graduate Student, University of Tulsa

Kyle DeVries
Research Volunteer

Namik Kirlic, Ph.D.
Postdoctoral Fellow

Bailey Mathis
Research Assistant

Timothy McDermott
Graduate Student, University of Tulsa

Jessica Santiago
Research Therapist

Srivats Srinivasan
Research Volunteer

James Touthang
Research Assistant
Dr. Bodurka’s research focuses on three main areas:

1. Non-invasive, multimodal neuroimaging method development and applications for studying brain function including: structural 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.

3. Translational approaches to discover and research novel therapeutic strategies to improve treatments by training and recovering healthy function of brain networks, 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 of Berlin, Germany. As a postdoctoral fellow at Medical College of Wisconsin, he received firm 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) and 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 NIH’s Director Award for Advancements in MRI Parallel Imaging Technology. The advancements in MRI receiver and multi-element coils technologies allowed for major improvements in MRI signal-to-noise ratio, and pushed spatial and temporal limits for both functional and anatomical imaging. He has also developed an advanced real-time software set-up allowing for conducting 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 multimodal brain neuroimaging program with the overall purpose of advancing clinical research focused on mental disorders, with a broad research goal of advancing our understanding and characterization of brain abnormalities due to mental illness.

**SELECTED PUBLICATIONS**


**LAB AND MRI-EEG FACILITY RESEARCH STAFF**

Obada Al Zoubi, M.S., Ph.D.  
Graduate Student  
University of Oklahoma

Qingfei Luo, Ph.D.  
Staff Scientist

Ahmad Mayeli, M.S., Ph.D.  
Graduate Student  
University of Oklahoma

Masaya Misaki, Ph.D.  
Staff Scientist

Beni Mulyana, M.S.  
Graduate Student  
University of Oklahoma

Jared Smith, B.S.  
Research Assistant

Chung-Ki Wong, Ph.D.  
Post doctoral Associate

Aki Tsuchiyagaito Ph.D.  
Post doctoral Associate

Vadim Zotev, Ph.D.  
Staff Scientist

**RESEARCH COLLABORATORS**

Peter Bandettini, Ph.D.  
NIH/NIMH, Bethesda, Maryland

Samuel Chang, Ph.D.  
University of Oklahoma – Tulsa

Matthew Feldner, Ph.D.  
University of Arkansas

Frank Krueger, Ph.D.  
George Mason University

Wenming Luh, Ph.D.  
Cornell University

Amanda Morris, Ph.D.  
Oklahoma State University – Tulsa

Hazem Refai, Ph.D.  
University of Oklahoma – Tulsa

Michael Roy, M.D.  
Uniformed Services University

Kent Teague, Ph.D.  
University of Oklahoma – Tulsa

**INDUSTRY COLLABORATORS**

Patrick Britz, Ph.D.  
Brain Products GmbH, Germany

Scott Hinks, Ph.D.  
GE Healthcare, Waukesha, Wisconsin

Patrick Leden, Ph.D.  
Nova Medical Inc., Wilmington, Massachusetts
Dr. Cha’s main research interests include:

1. Exploring the role of the cerebellum in regulating cerebral networks, especially as it pertains to anxiety and depression.

2. Understanding the connection between motion perception disorders, anxiety and migraine headaches.


4. Developing neuromodulation tools that can be accessible to more patients.
**Dr. Yoon-Hee Cha** is a neurologist with subspecialty training in neurotology. She completed her premedical studies at Stanford University graduating with a degree in biology with honors in 1995. She earned her medical degree from Mayo Medical School in 2001, which included a year of research at the National Institutes of Health through the Howard-Hughes-NIH Research Scholars Program from 1998-1999. In 2002, she completed a preliminary year in internal medicine at the Brigham and Women’s Hospital in Boston, Massachusetts, before going on to complete her neurology residency training at the University of California – San Francisco in 2005—she was also chief resident from 2004-2005. From 2005-2007, she was the neurotology fellow at the University of California – Los Angeles (UCLA), where she trained with Dr. Robert W. Baloh. She worked with Dr. Baloh on the genetics of episodic ataxia and vestibular migraine. At UCLA, she developed her interest in understanding the neurological basis of motion perception, which led to her current work using functional MRI, EEG and neuromodulation techniques such as transcranial magnetic stimulation and transcranial electrical stimulation to probe the biological basis of and treat disorders of motion perception. She joined LIBR in August 2012. Her current work focuses on a group of patients with a disorder of motion entrainment called mal de debarquement syndrome (MdDS) as well as disorders of spatial processing related to anxiety and migraine. Her work has expanded to include studies that explore the role of the cerebellum in mood and anxiety disorders, particularly in its role in fear conditioning and fear extinction. In conjunction with other LIBR investigators, she is studying how vestibular and cerebellar networks can be targeted to modulate cerebral function.

**SELECTED PUBLICATIONS**


**LAB MEMBERS**

B. Chipper Doudican
Research Assistant

Diamond Urbano
Research Assistant and Lab Manager

**RESEARCH COLLABORATORS**

Walter Besio, Ph.D.
University of Rhode Island

Lei Ding, Ph.D.
University of Oklahoma

Flavio Frolich, Ph.D.
University of North Carolina

Han Yuan, Ph.D.
University of Oklahoma
Dr Ekhtiari’s main research interests include:

Using neuroimaging/neurocognitive markers among people with substance-use disorders to inform development, predict outcome and monitor efficacy of:

1. non-invasive transcranial electrical/magnetic stimulation (TES/TMS); and
2. neurocognitive interventions.
Dr. Ekhtiari went to 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 neighborhood in Tehran and launched a neurocognitive lab there in 2005. He also started a research program at 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 position 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. Afterwards, during contribution in 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.

SELECTED PUBLICATIONS


RESEARCH COLLABORATORS
Ali Farhoudian, M.D.
Neuroimaging and Analysis Group
Tehran University of Medical Sciences
Felipe Fregni, M.D., Ph.D.
Harvard University
Irene Jillson, Ph.D.
Georgetown University
Javad Hatami, Ph.D.
Institute for Cognitive Science Studies
Kaveh Ashenayei, Ph.D.
University of Tulsa
Majid Nili Ahmadabadi, Ph.D.
University of Tehran
Marom Bikson, Ph.D.
City University of New York
Mohammad Ali Oghabian, Ph.D.
University College London
Michael Nitsche, M.D.
Durham University
Mohammad Ali Oghabian, Ph.D.
Tehran University of Medical Sciences
Vincent Walsh, Ph.D.
United Kingdom

Page 33
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.

SELECTED PUBLICATIONS


LAB MEMBERS

Obada Al Zoubi, M.S., Ph.D.
Graduate Student
University of Oklahoma

Laci Cartmell
Research Volunteer
University of Tulsa

Laura Garrison, M.S.
Research Specialist

Cindi Guillory
Research Coordinator

Jessyca Naegele
Research Volunteer
Oklahoma State University

Will Schoenhals, M.S.
Engineering Consultant

RESEARCH COLLABORATORS

Ralph Adolphs, Ph.D.
California Institute of Technology

Jacopo Annese, Ph.D.
The Brain Observatory® and The Institute for Brain and Society, California

Kaveh Ashenayi, Ph.D.
University of Tulsa

Jason Beaman, M.D.
Oklahoma State University

Paul Davenport, Ph.D.
University of Florida

Ricardo Gil-da-Costa, Ph.D.
CEO, Neuroverse

Reine Hurlemann, M.D., Ph.D.
University of Bonn

Andreas von Leupoldt, Ph.D.
Institute for Frontier Areas of Psychology and Mental Health, Germany

William Potter, Ph.D.
University of Tulsa

Hazem Refai, Ph.D.
University of Oklahoma

Victoria Risbrough, Ph.D.
University of California – San Diego

David Rudrauf, Ph.D.
University of Geneva, Switzerland

Murray Stein, M.D.
University of California – San Diego

Daniel Tranel, Ph.D.
University of Iowa

Marc Wittmann, Ph.D.
Institute for Frontier Areas of Psychology and Mental Health, Germany
Dr. Khalsa’s laboratory studies the heart-brain connection. His research explores three main questions:

1. How do we perceive our heartbeat?

2. Is there dysfunctional cross talk between the heart and brain in psychiatric and cardiovascular illnesses?

3. How can we develop new treatments that re-establish a functional dialogue between the body and brain?
Dr. Khalsa received a bachelor’s degree in psychology from The State University of New York – Stony Brook in 2002. He graduated from the medical scientist training program at the University of Iowa, receiving M.D. and Ph.D. degrees in neuroscience in 2009. He completed his residency training in psychiatry at University of California – Los Angeles (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 assistant professor (tenure track) at the University of Tulsa.

Dr. Khalsa’s research investigates how people perceive their heartbeat and overall body image, how the human brain maps cardiac sensation, and whether there is dysfunctional cross talk between the heart and brain in psychiatric and cardiovascular illnesses. To address these questions, his studies have examined the effects of aging, focal brain injury, cardiac dysfunction and meditation practice on awareness of the heartbeat. Current projects examine the neural basis of heart-brain communication in anorexia nervosa and anxiety disorders, the effect of a novel drug on targeting brain function, the utility of a new mobile measure of body image perception in eating disorders, and the potential impact of floatation therapy on body image disturbance and anxiety in anorexia nervosa. These studies aim to ultimately answer the question: “How can we develop new tests and treatments that re-establish a functional dialogue between the body and brain?”

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.

**SELECTED PUBLICATIONS IN 2017-2018**


**LAB MEMBERS**

Danielle DeVille  
Graduate Student  
University of Tulsa

Daniel Guzman  
Graduate Student  
University of Tulsa

Abigail Kimball  
Research Volunteer  
University of Tulsa

Rachel Lapidus  
Graduate Student  
University of Tulsa

Austin Lignieres  
Research Volunteer

Olivia Shadid  
Medical Student  
University of Oklahoma – Tulsa

Megan Sinik  
Research Volunteer  
University of Tulsa

Valerie Upshaw, R.N., B.S.N.  
Clinical Research Coordinator

Alexandra Weindel  
Research Volunteer  
University of Tulsa

**RESEARCH COLLABORATORS**

Ralph Adolphs, Ph.D.  
California Institute of Technology

Olujimi Ajiola, M.D., Ph.D.  
University of California - Los Angeles

Armen Arevian, M.D., Ph.D.  
University of California - Los Angeles

Michelle Craske, Ph.D.  
University of California - Los Angeles

Richard J. Davidson, Ph.D.  
University of Wisconsin-Madison

Jami Feusner, M.D.  
University of California - Los Angeles

Rene Hurlemann, M.D., Ph.D.  
University of Bonn

Mike Keller, Ph.D.  
University of Tulsa

Rajesh Kumar, Ph.D.  
University of California - Los Angeles

Richard Lane, M.D., Ph.D.  
University of Arizona

Scott Moseman, M.D.  
Medical Director  
Laureate Eating Disorders Program

David Rudrauf, Ph.D.  
University of Geneva, Switzerland

Kalyanam Shivkumar, M.D., Ph.D.  
University of California – Los Angeles

Michael Strober, Ph.D.  
University of California – Los Angeles

Daniel Tranel, Ph.D.  
University of Iowa

Danny JJ Wang, Ph.D.  
University of Southern California
Dr. Paulus’ research focuses on three main areas:

1. Using neuroimaging to develop predictive biomarkers for anxiety disorders and addictive disorders.
2. Using computational psychiatry to better quantify the behavioral dysfunctions in individuals with mood, anxiety and addictive disorders.
3. Develop a research pipeline that enable one to translate basic neuroscience discoveries into clinically useful tools.
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 in Long Island, New York. 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, Oklahoma, as the scientific director and president.

Dr. Paulus has published over 300 scientific papers, has been funded continuously by federal grants since 1997, and is currently the principal investigator on an NIGMS CoBRE grant to develop an infrastructure for young investigators to establish their research careers with NIH competitive funding. Moreover, Dr. Paulus is a co-PI on an ABCD Site U01 grant to test behavior and brain function of approximately 700 children ages 9-10 in the Tulsa area, and to follow these children and their families for the next 10 years. He has served on numerous research panels, study sections and advisory committees. Currently, Dr. Paulus is conducting a large-scale study in Tulsa, the T-1000, to determine whether biological measures can be developed to help a clinician predict patient outcomes. Dr. Paulus is also a member of the Adolescent Brain Cognitive Development (ABCD) study, which aims to determine how the brain changes during the course of adolescence and how these changes put adolescents at risk for substance use.

SELECTED PUBLICATIONS

RESEARCH COLLABORATORS
Gregory Brown, Ph.D.  
University of California – San Diego
Michelle Craske, Ph.D.  
University of California – Los Angeles
Paul Davenport, Ph.D.  
University of Florida
Greg Fonzo, Ph.D.  
Stanford University
James Fowler, Ph.D.  
University of California – San Diego
Lawrence Frank, Ph.D.  
University of California – San Diego
Guilia Galli, Ph.D.  
University College London, United Kingdom
Walter Kaye, M.D.  
University of California – San Diego
Tom T Liu, Ph.D.  
University of California – San Diego
Alan N Simmons, Ph.D.  
University of California – San Diego
Lindsay M. Squeglia, Ph.D.  
Medical University of South Carolina
Murray B Stein, M.D., M.P.H., F.R.C.P.C.  
University of California – San Diego
Susan F Tapert, Ph.D.  
University of California – San Diego
Wesley R Thompson, Ph.D.  
University of California – San Diego
Tony Yang, M.D., Ph.D.  
University of California – San Francisco
Angela Yu, Ph.D.  
University of California – San Diego
Marc Wittmann, Ph.D.  
Institute for Frontier Areas of Psychology and Mental Health, Germany
Dr. Savitz’s work focuses on three main areas:

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.
**SCIENTIFIC BACKGROUND**

**Dr. Savitz** received an undergraduate degree in psychology and genetics from the University of the Witwatersrand in Johannesburg, South Africa, 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. Jonathan has trained with two of the most well-known experts in their respective fields: Wayne Drevets (mood disorders, neuroimaging) and Robert Dantzer (psychoneuroimmunology), and has conducted a number of innovative studies that have addressed important gaps in our knowledge regarding the relationship between genes, immunological function and neuroimaging abnormalities in mood disorders. Dr. Savitz has published over 60 first or senior author scientific papers and has been the PI on three NIH grants. He is an associate editor of the journal, *Neuroscience Letters*, and is an editorial board member of *Heliyon and Brain, Behavior and Immunity*. He has served as a reviewer for numerous European and American grant agencies, including the MESH study section of the NIH.

**LAB MEMBERS**

**Bart Ford**
Graduate Student
University of Tulsa

**Nour El-Sabbagh**
Lab Manager

**SELECTED PUBLICATIONS**


Mechawar, N. and Savitz, J. (2016). Neuropathology of Mood Disorders: Do we see the stigmata of inflammation? Translational Psychiatry. 6, e946


**RESEARCH COLLABORATORS**

Jin Cho, M.D., Ph.D.
University of California – Los Angeles

Robert Dantzer, DVM, PhD.
MD Anderson Cancer Center
University of Texas

Wayne Drevets, M.D.
Janssen Pharmaceuticals

David Goldman, M.D.
National Institute on Alcohol Abuse and Alcoholism

Mike Irwin, M.D.
University of California – Los Angeles

Brett McKinney, Ph.D.
University of Tulsa

Kent Teague, Ph.D.
University of Oklahoma – Tulsa

Bob Yolken, M.D.
Johns Hopkins University
Dr. Stewart employs subjective reports (questionnaires and clinical interviews), behavioral methods, electroencephalography (EEG), event-related potential (ERP) and functional magnetic resonance imaging (fMRI) to investigate how brain patterns linked to cognition, emotion and their interaction intersect with individual differences in substance use, depression and anxiety disorders. People who are suffering from drug addictions, depression and/or anxiety often have difficulties processing emotions and making decisions that are evident in patterns of brain activity and behavior.

**Dr. Stewart’s primary research areas include:**

1. Can we identify brain/behavioral markers of risk for future addiction in young adults who have not yet transitioned to chronic mental health problems?

2. In individuals experiencing chronic addiction, can we identify brain/behavioral markers of short-term and long-term abstinence and recovery?

3. Once viable brain/behavioral markers are identified, these can be used in clinical prevention and early intervention efforts.
Dr. Stewart earned a B.S. in psychology from University of California – San Diego (UCSD) in 1998, where she worked with Dr. Brett Clementz on EEG and eye-tracking studies of schizophrenia and bipolar disorder. Following further EEG and ERP training with Dr. John Polich at the Scripps Research Institute, Dr. Stewart completed her M.A. (2005) and Ph.D. (2008) in clinical psychology at the University of Illinois at Urbana-Champaign working with Drs. Greg Miller and Wendy Heller. Her graduate work used EEG, ERP and fMRI methods to investigate patterns of functional brain asymmetry as a function of approach- versus withdrawal-related anger expression styles (anger-out versus anger-in), taking patterns of comorbid depression and anxiety into account. In her postdoctoral studies, Dr. Stewart evaluated the viability of brain asymmetry as a biomarker of depression risk with Dr. John Allen at the University of Arizona and investigated potential markers of stimulant addiction risk and relapse with Dr. Martin Paulus at UCSD.

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. While at CUNY, she supervised undergraduate and graduate students on EEG/ERP data collection/analysis for studies evaluating biomarkers of depression risk and heavy marijuana use in college students. She taught courses on psychopathology, introduction to clinical psychology, multivariate statistics, clinical interviewing and neuropsychological assessment.

In the past decade, Dr. Stewart has assisted in mentoring and training undergraduates, graduate students, postdoctoral researchers and visiting scientists on clinical assessment measures as well as EEG, ERP and fMRI methodology, data collection/analysis, manuscript writing, talks, poster presentations and grant applications. She is enthusiastic about science and hopes to empower students with the tools to become successful researchers. Dr. Stewart joined LIBR in July 2018.

**SELECTED PUBLICATIONS (2016-Present)**


**RESEARCH COLLABORATORS**

John J.B. Allen, Ph.D.
University of Arizona

Emily A. Jones, Ph.D.
Queens College/The Graduate Center
City University of New York

April C. May, M.A.
University of California – San Diego

Justin Storbeck, Ph.D.
Queens College/The Graduate Center
City University of New York

Susan F Tapert, Ph.D.
University of California – San Diego

Valentina Nikulina, Ph.D.
Queens College/The Graduate Center
City University of New York
Ongoing Studies

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.
JOIN A RESEARCH STUDY
TO IMPROVE MENTAL HEALTH THROUGH NEUROSCIENCE

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

Call for more information: (918) 502-5100
www.laureateinstitute.org | Info@librnet | 6555 South Yale Ave, Tulsa, OK 74135

Libr
Laureate Institute for Brain Research

Improving Mental Health Through Neuroscience

- Postdoctoral positions available
- Projects include behavioral and pharmacological clinical trials, EEG-MRI studies, computational modeling of multilevel data sets
- Interested? Contact careers@laureateinstitute.org