TECH 2000 3T MRI RESEARCH FACILITY

3T MR Research Program

Center for MR Research

University of Illinois at Chicago

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3T MRI Facility Updates

By Mike Flannery.

MRI Safety update

The 3T MR Research program would like to inform the user groups of a potentially overlooked MR safety hazard related to the masks that a subject may be wearing during their exam due to the COVID-19 pandemic.
Recently, the FDA received an injury report for a patient who was wearing a face mask with metal during a 3 Tesla MRI scan of the neck. The report describes burns to the patient's face consistent with the shape of the face mask.
Some manufacturer's masks incorporate metallic fibers (such as copper or silver) and/or metallic nanoparticles in an effort to enhance antimicrobial properties. These "multipurpose fabrics" that contain silver microfibers (SMF) or other metallic fibers pose a burn risk to the subject as a result of radio-frequency (RF) induced heating of these materials while being scanned.

In addition to the bendable metal nose strip which allows for making a tight seal around the subject's nose, some masks may also contain metallic staples as fasteners for the ear loops. These also pose a hazard due to RF heating or possible translational and rotational forces that the static magnetic field could exert upon them.
The MR Center would ask that you incorporate these additional safety red flags into your safety screening process and continue to provide masks free of any metal or metallic fabrics to your subjects on the day of their exam.

Research at UIC

The 3T MR Research Program would like to introduce some of the Principal Investigators and their ongoing and new MR research projects supported by the MR Center. We would like to take the opportunity to thank each user group for their contributions, dedication, and collaborations in making the 3T MR Research Program an integral part of cutting-edge research being conducted here at UIC.

Olu Ajilore, MD, PhD

Dr. Ajilore is an Associate Professor in the Department of Psychiatry at UIC. Dr. Ajilore's research goal is to understand the pathophysiology of major depressive disorder in the context of medical co-morbidities and late life using novel magnetic resonance imaging techniques. His group focuses on using structural and functional brain connectivity to study the brain as a network.
"Unobtrusive Monitoring of Affective Symptoms and Cognition using Keyboard Dynamics (UnMASCK)" and "Recurrence Markers, Cognitive Burden, and Neurobiological Homeostasis in Depression (REMBRANDT)"
The current neuroimaging projects from the CoNeCT lab at UIC are NIMH-funded studies called REMBRANDT and UnMASCK. REMBRANDT (Recurrence

markers, cognitive burden, and neurobiological homeostasis in late-life depression) examines markers of relapse in late-life depression. Depression is a recurrent illness and even with successful antidepressant treatment, older adults with late-life depression are at high risk of recurrence. However, neurobiological processes that contribute to vulnerability to recurrence are poorly understood, limiting our ability to target mechanisms in prevention studies. The current study will elucidate neurobiological contributors to recurrence, examine the interrelationship between recurrence and cognitive decline, and provide data on the predictive utility of clinical monitoring in older adults using mobile cognitive assessment, ecological momentary assessment, and neuroimaging in a longitudinal design.

UnMASCK (Unobtrusive Monitoring of Affective Symptoms and Cognition using Keyboard Dynamics) proposes to use smartphone-based technology, called BiAffect, to monitor cognitive dysfunction in patients with mood disorders by linking brain network changes with predicted worsening of mood symptoms. The proposed study will provide evidence for using smartphone-based passive sensing as a cost-effective way to predict illness course and treatment response.

Natania Crane, PhD

Dr. Natania Crane is a Visiting Assistant Professor of Psychiatry and the Associate Director of the UIC Recovery Clinic. She is a Licensed Clinical Psychologist. Her research utilizes multiple methods (i.e., fMRI, EEG, cognitive, clinical, and self-report measures) to examine the brain and behavioral risk factors and consequences of Substance Use Disorders, especially Cannabis Use Disorder.

"Brain-Behavior Markers of Reward and Cannabis Abuse Risk in Young Adults"

Problematic cannabis use is common and leads to enormous personal and societal burden; thus, there is an urgent need to understand who is vulnerable, and why, in order to facilitate prevention and treatment. Dr. Natania Crane's NIDA-funded K23 study, "Brain-Behavior Markers of Reward and Cannabis Abuse Risk in Young Adults" will combine neural (fMRI, EEG) and behavioral measures with acute drug administration to better understand the neural mechanisms underlying the rewarding, reinforcing properties of cannabis. This work will ultimately contribute to a deeper understanding of brain and behavioral risk factors underlying problematic cannabis use and promote the development of targeted, prevention and intervention efforts for this population.

Katie Burkhouse, PhD

Dr. Burkhouse is an Assistant Professor of Psychiatry and a Clinical Psychologist affiliated with UIC's Pediatric Mood Disorders Clinic. She received her PhD in Clinical Psychology from Binghamton University (SUNY) and completed her Clinical Internship at UIC. Her program of research broadly focuses on identifying behavioral-brain risk phenotypes and preventive interventions for youth depressive disorders. Much of this work focuses on utilizing multiple levels of analysis (i.e., behavioral, EEG, pupil dilation, fMRI) to identify cognitive-affective processing styles involved in the transmission of depression from parents to their offspring.

Families, Affective Neuroscience, and Mood Disorders (FAM Lab, PI Dr. Katie Burkhouse) Research:

Having a parent with a history of major depressive disorder places youth at significantly elevated risk for multiple forms of psychiatric disorders across the lifespan. Given this, there is a need to identify specific mechanisms of risk in order to develop targeted, prevention efforts for this population. Building off of research showing offspring of depressed mothers are characterized by disruptions in emotional reactivity and regulation, we are using functional magnetic resonance imaging (fMRI) to test whether neural regions central to reward and negative social-emotional processing differentiate children of depressed from nondepressed mothers, and if neural activation patterns are similar among depressed mothers and their offspring, representing familial risk markers. We are also following offspring over a period of two years to determine if these brain activation patterns can predict which offspring of depressed mothers develop depression. We believe this work will ultimately contribute to a better understanding of brain and behavioral markers underlying youth depression risk. In a second study, we are examining whether preexisting deficits in neural activation patterns during reward and negative emotion processing can be targeted and modified through a group-based psychosocial prevention program for depressed mothers and their offspring. This project is also examining whether brain activation patterns can predict which offspring of depressed parents will respond to the intervention program. Ultimately, findings from the study have the potential to improve clinical outcomes and optimize limited resources for these high-risk families.

Pauline Maki, PhD

For over 20 years, Dr. Pauline M. Maki has led a program of NIH-funded research focused on the role of sex steroid hormones on cognition, mood, brain function (neuroimaging) and stress responsivity in women. Dr. Maki received her Ph.D. in experimental psychology from the University of Minnesota in 1994. She received post-graduate training at the Johns Hopkins University School of Medicine in the dementias of aging and at the National Institute on Aging in neuroimaging. In 1999, she joined the Intramural Research Program of the National Institute on Aging. In 2002, she joined the faculty at the University of Illinois at Chicago. As of June 2020, Dr. Maki has been named Associate Dean for Faculty Affairs with the University of Illinois College of Medicine.

"Stellate Ganglion Blockade for the Management of Vasomotor Symptoms"

In recent years, there has been growing appreciation in how brain aging differs between men and women. One factor that can influence brain aging differently in the two sexes is reproductive aging. All women who live into late life will transition through the menopause. In addition to the hormonal changes that all women experience as they transition through this life stage, women can experience a variety of menopausal symptoms, the most common of which is the hot flash. Although seemingly benign and time-limited, hot flashes are now known to be associated with markers of cardiovascular disease, and they last more than 10 years after the final menstrual period in 25% of women. Pauline M. Maki, PhD, Professor of Psychiatry, Psychology and OB/GYN at the University of Illinois at Chicago and her team have made new discoveries linking hot flashes to decreases in memory performance and decreases in hippocampal function, as measured by fMRI BOLD signaling in a word encoding task. In work funded by the National Institute on Aging, Maki and her team are examining how a non-hormonal treatment for hot flashes might improve memory and brain function. The treatment is stellate ganglion blockade (SGB), an anesthesia procedure used widely in the field of pain medicine. The ongoing study, conducted by Maki and David Walega, MD Professor of Anesthesiology at Northwestern Feinberg and PI on the clinical trial, will shed new light on a potentially modifiable contributor to cognitive difficulties at midlife. A secondary goal of the study is to determine how sleep disturbances, especially those linked to hot flashes, contribute to cognitive difficulties at this time.

Heide Klumpp, PhD

Dr. Klumpp's main research interest is using a cognitive-affective neuroscience approach to understand anxiety and depression for clinical translation. She uses neuroimaging to delineate brain markers of response to psychotherapy to increase therapeutic success with available treatment and develop more individually tailored, novel interventions. In addition, she translates discoveries from basic neuroscience to enhance therapies for anxiety disorders and depression.

"Transdiagnostic Brain-Behavior Profiling to Enhance Cognitive Behavioral Therapy Response"

Depression and anxiety are prevalent, debilitating psychiatric illnesses. While many benefit from treatment, treatment outcome is variable, and many remain highly symptomatic despite treatment. In keeping with the precision medicine initiative, the overarching goal of neuroimaging projects in Dr. Klumpp's lab is to advance our understanding of the brain pathophysiology of depression and anxiety, identify neural predictors of treatment outcome, and elucidate mechanisms of change. Recent projects show neural activity to threatening faces distinguishes treatment responders from non-responders in depressed or anxious patients following a trial of psychotherapy (Klumpp, H., et al., Psychological Medicine, 2020). We also show brain response to threatening faces across large-scale systems differentiate patients with an anxiety disorder from healthy individuals (Xing, M., et al., Frontiers Psychiatry, 2020), and that amygdala volumetric techniques are an important methodological consideration when evaluating the neurobiology of anxiety (Jayakar, R., et al., Psychiatry Research: Neuroimaging, 2020). Current projects show resting-state neural correlates of repetitive negative thinking (i.e., rumination and worry), a core process in the maintenance of psychopathology, involve affective and default mode networks (Feurer, C., et al., ACNP annual meeting 2020), and prefrontal activity during emotional interference predicts symptom improvement in anxiety and depression following psychotherapy (Klumpp, H., et al., ADAA annual meeting 2021). Preliminary data also indicates trauma exposure impacts neural mechanisms of change in depression and anxiety suggesting trauma history may be a transdiagnostic factor in treatment outcome. This work would not be possible without collaborations with Drs. Ajilore, Burkhouse, Crane, and

Leow; the Center for MR research; NIMH support; and our participants.

Frank Gonzalez, MD, PhD

Dr. Frank Gonzalez provides comprehensive care to couples with infertility and manages hormonal imbalances that affect menstrual function. He is a nationally recognized expert on Polycystic Ovary Syndrome (PCOS), the most common hormonal imbalance in premenopausal women. Dr. González is a formally trained physician-scientist and his lab is an integral part of his translational research program. His research is funded by the National Institutes of Health and is focused on studying the effects of nutrient-induced inflammation in the development of ovarian dysfunction, insulin resistance, β-cell dysfunction and atherogenesis in PCOS.

"**Treating Inflammation in PCOS to Ameliorate Ovarian Dysfunction"**
Polycystic Ovary Syndrome (PCOS) is characterized by hyperandrogenism, ovulatory dysfunction and polycystic ovaries. Insulin resistance is a common feature of PCOS. It is theorized that the resultant hyperinsulinemia is the primary driver of hyperandrogenism in the disorder. However, 30-50% of women with PCOS who are lean do not have insulin resistance. Women with PCOS also exhibit chronic low-grade inflammation. We have shown that in PCOS, lipid ingestion triggers an inflammatory response from circulating mononuclear cells (MNC). In a pilot study, we showed that anti-inflammatory therapy using a well-tolerated salicylate called salsalate, profoundly suppressed this lipid-triggered inflammatory response, normalized basal androgen levels, significantly reduced ovarian androgen secretion, and induced ovulation in lean insulin-sensitive women with PCOS (Am J Physiol Endocrinol Metab 2020, 319:E744-52). Our current NIH R01-funded study is a randomized double-blind placebo-controlled study of 90 women with PCOS. Forty-five subjects with PCOS (15 lean without insulin resistance (IR), 15 lean with IR and 15 obese) undergoing salsalate treatment for 12 weeks will be compared with 45 age- and body-composition-matched control women with PCOS receiving placebo. The overarching hypothesis is that inflammation contributes to ovarian dysfunction, independent of excess adiposity or insulin resistance. There are two specific aims as follows: I. To examine the effect of salsalate administration on the ovarian capacity to secrete androgen and insulin sensitivity in PCOS. II. To examine the effect of salsalate administration on the inflammatory response of mononuclear cells to lipid ingestion in PCOS. Ovarian androgen secretion in response to human chorionic gonadotropin administration, insulin sensitivity during an intravenous glucose tolerance test and ovulation will be evaluated in all subjects before and after salsalate administration. The inflammatory response of MNC to lipid ingestion will also be evaluated before and after treatment by measuring reactive oxygen species, the RNA and protein content of inflammation markers, nuclear factor kB activation and cytokine secretion in culture. Even though subjects in both study groups will be weight-matched using body mass index upon study entry, differences in body fat are anticipated based on a total body DEXA scan and an abdominal MRI that will be performed at baseline in all subjects. These differences will be taken into account for group assignment and data analysis. We anticipate that women with PCOS receiving salsalate will exhibit decreased ovarian androgen secretion and reduced inflammation regardless of degree of adiposity or insulin resistance. Hopefully, our findings will lead to important advances in the therapy of PCOS that will ameliorate androgen excess and by reducing inflammation.