Institute of Cognitive Science Newsletter - Spring 2017

New Grant Studies Effects of High-Potency Marijuana, "Dabbing"

As Colorado leads the way in the United States for pushing the boundaries of legalized marijuana consumption, there are still many unknowns. A new grant at the Institute of Cognitive Science aims to shed some light on high-potency types of cannabis.

Dr. Cinnamon Bidwell, an Assistant Research Professor at ICS, is the lead investigator on a three-year grant from the Colorado Department of Public Health and Environment. The project will look at how both consumers and public health are affected by high-potency forms of marijuana available since the legalization of cannabis in Colorado.

"There is no data on these products which are legally available in our state. We developed this innovative design to be able to test the effects of things people can legally do… in the context of a research study, nobody has assessed how intoxicating they are, or the effects on these public health behaviors [such as driving], which is a problem" explained Bidwell.

Dr. Bidwell, along with co-investigators Drs. **Angela Bryan** and **Kent Hutchinson** from the Department of Psychology and Neuroscience, will be studying people who use high-potency forms of marijuana with behaviors such as "dabbing." Dr. Bidwell notes that "dabbing is a slang term, but it's the only term we know for these new high-potency concentrates. They're basically extracted cannabis that are almost pure THC. So the THC levels can be as high as 95 percent, and dabbing is the term for using these high-potency concentrates...it's not a science term." The state of Colorado currently defines dabbing as "inhalation of a dose of marijuana concentrate that is heated on a hot surface and then inhaled through use of a special apparatus; concentrates are made by extracting THC and other

This van is being used as a mobile laboratory for cannabis research.

cannabinoids using a solvent like butane or carbon dioxide, resulting in sticky oils."

One aspect researchers will examine are the intoxication effects of high-potency use on individuals. Dr. Bidwell explains researchers will look at variables such as, "how high do blood levels get, and what are the subjective effects of experiencing intoxication off of these high-potency products."

To examine the effect on public health, researchers will look at how high-potency marijuana use affects activities like driving and the underlying cognitive processes relevant to driving, such as selective attention, divided attention, working memory, and planning.

The study uses a novel observational technique to collect data, made possible by a special mobile pharmacology laboratory that can meet study participants where they live. Rather than give study subjects a certain amount of drugs in a lab setting, researchers visit subjects at their homes right after participants have consumed marijuana concentrates, to take blood and test cognition. "They're doing what they would in their normal life, and then we are recording that and getting pharmacological drug exposure levels and other validated assessments," explained Bidwell. This allows researchers to gather data based on people's normal patterns of use without ever touching any drugs, and without being present when drugs are consumed.

Sales in Colorado for marijuana concentrates have dramatically increased over the past few years. As marijuana concentrates and "dabbing" become more popular, understanding their effects on individuals and the public is more important than ever. Dr. Bidwell and her co-investigators hope to begin to fill this knowledge gap.

From the Director of the Institute

Dear Colleagues,

What a year! With the seemingly endless reporting on turmoil and dysfunction taking place at the national and international levels, it is worth taking the time to reflect on how lucky we are to have such wonderful colleagues and students to work with here at ICS, and to appreciate our Institute's long and stable history of collegiality and conviviality. I deeply appreciate the enthusiasm with which many of you pitched in to support our new initiatives this year.

As I mentioned in the fall letter, one of our biggest challenges is figuring out how to work together in new ways to further advance our interdisciplinary research and training mission. I'd like to share with you several areas where we are making excellent progress.

First, to advance our training mission, Associate Director Donna Caccamise and Prof. Michael Eisenberg have been working hard to develop our first online course: a revamped and updated version of our long-running undergraduate Introduction to Cognitive Science course. Prof. Eisenberg put together a preliminary course outline which generated a very lively discussion at the last faculty meeting! Mike and Donna will continue to refine this over the summer and we will be requesting your feedback at various points in the process to make sure that we are reflecting the breadth of interdisciplinary perspectives across the Institute. If all goes according to plan, this course will be offered in spring or summer of 2018 and will be the first course offered under the COGS call sign. In addition to introducing students to cognitive science, this course is also structured to introduce students to the interesting research taking place in our Institute. So, don't be surprised if we contact you for advice and help on how to best represent your research!

Second, to advance our research mission, we will be holding a few "roadmapping" workshops this summer to outline strategic areas for future interdisciplinary cognitive science research. We hope to bring interesting cross sections of people together to spark new ideas, generate new partnerships and teams, and ideally, lead to competitive new funding lines. The first one is taking place on May 11 and will focus on cognitive neuroscience and related topics. Prof. Marie Banich and I will be leading this workshop. Another workshop on "human sensing and augmentation" will be convened at a later date. One thing we hope to learn is what support you need to participate in ambitious interdisciplinary research: financial, writing, administrative, morale, etc. We really don't know how best to organize ourselves in this regard and this will take iterative cycles of experimentation and reflection.

Third, I'd like to thank our Executive Committee for helping us to reinvent our merit review criteria and processes this year to better reflect our unique interdisciplinary mission. They generously donated their time and energy to discuss our mission, the creative ways that faculty can support it, and criteria that we can use to assess contributions towards our mission. This process is a very important step towards building a shared understanding of what we want to accomplish together.

Last, and definitely not least, I would like to thank our staff and our donors. Yes, you read that right: our donors! Our staff have worked hard this year to devise new ways for us to work effectively with the newly revamped Development Office. We conducted our first "mini campaign" this year to raise additional funds to support graduate student research and other things. We have many friends in the Boulder community and larger environs that support us. And, I am particularly pleased to let you know that our alumni - former Joint PhDs, certificate holders, and GRAs - also stepped in to support the current generation. Their generosity is another reminder of how fortunate we are to work with such a marvelous community of scholars.

Cheers,

Tammy Sumner

Wager Lab to Study Therapeutic Value of Physician Interaction

The Wager lab will soon start a study for a new grant from the Foundation for the Science of the Therapeutic Encounter. Recent clinical studies suggest that the benefit of steroid injections in relieving back pain are not due to the steroid injection, but to the therapeutic encounter between patient and physician. Effects of the therapeutic encounter itself have never been studied in this context. One ethical and clinically impactful way to study this is to deliver an "open-label" placebo treatment—in this case, a placebo treatment that patients know is a placebo, but is delivered in the context of a supportive physician-patient interaction. Accordingly, the Wager lab aims to provide the first assessment of the efficacy of a non-deceptive, "open-label" placebo treatment for back pain on clinical outcomes and corresponding brain measures of pain.

This study will provide measures of placebo effects on both clinical pain outcomes and biological measures of pain neurophysiology. Together, clinical and biological measures can impact how the medical community conceives of and implements treatments for pain.

Banich Lab to Study Working Memory

Dr. Marie Banich on her lab's latest work: The objective of this project is to understand the neural mechanisms that allow us to manipulate information that we are currently keeping in mind. For the last half century, it has been known that we have a limited capacity to maintain information in mind at any given time, typically considered to be about 7 items. This capacity is often referred to as working memory. Surprisingly, what is not known, however, is how we remove information from working memory, so as to either allow other items in or to clear it entirely. Understanding how information is removed from working memory, and which brain systems allow one to do so, is important not only from the perspective of obtaining a better understanding of how the brain influences the way we think, but also because such an understanding has important implications for psychological disorders.

Many psychological disorders are characterized by an inability to remove certain types of information from working memory. For example, individuals with obsessive-compulsive disorder have difficulty not thinking about what harm might befall them or others, and individuals with depression have difficulty not ruminating on negative ideas and feelings. One of the reasons that it has been so hard to understand how information is removed from working memory is the large challenge involved in determining what a person might be thinking of at a particular point in time, and/or knowing whether indeed thoughts have been cleared from working memory.

The goal of this project is to leverage brain-imaging techniques to overcome this problem. Recent techniques drawn from computer science allow one to characterize the pattern of brain activity associated with particular items (e.g., apples, pears, grapes, melons) or particular categories of items (fruit, tools, faces, buildings). The project will utilize such methods to verify, via a pattern of brain activity, on which occasions individuals have either cleared their mind of certain items, or replaced them with other thoughts (e.g., switched from thinking about an apple to thinking about a pear, switched from thinking about an apple to thinking about a hammer). Then, the study will test the hypothesis that a certain set of brain regions in the prefrontal cortex plays a central role in successfully changing the nature of the information held in working memory.

Neural Signature for Fibromyalgia May Aid Diagnosis, Treatment

(Adapted from CU Boulder Today)

University of Colorado Boulder researchers have discovered a brain signature that identifies fibromyalgia sufferers with 93 percent accuracy, a potential breakthrough for future clinical diagnosis and treatment of the highly prevalent condition.

Fibromyalgia is commonly defined as chronic widespread musculoskeletal pain accompanied by symptoms such as fatigue, anxiety and mood disorders. The Centers for Disease Control and Prevention (CDC) estimates that fibromyalgia affects more than five million adults annually in the U.S., with significantly higher occurrence rates in women than in men.

Historically, fibromyalgia has been difficult to diagnose and treat due to a lack of a well-categorized tissue pathology and symptoms that overlap with other common chronic illnesses.

CU Boulder researchers used functional MRI scans (fMRI) to study brain activity in a group of 37 fibromyalgia patients and 35 control patients as they were exposed to a variety of non-painful visual, auditory and tactile cues as well as painful pressure.

The multisensory testing allowed the researchers to identify a series of three sub-markers, or neurological patterns, that correlated with the hypersensitivity to pain that characterizes fibromyalgia.

"The novelty of this study is that it provides potential neuroimaging-based tools that can be used with new patients to inform about the degree of certain neural pathology underlying their pain symptoms," said **Marina López-Solà**, a post-doctoral researcher at the Institute of Cognitive Science and lead author of the new study. "The set of tools may be helpful to identify patient subtypes, which may be important for adjusting treatment selection on an individualized basis."

The findings were recently published in the journal PAIN, published by the International Association for the Study of Pain.

"Though many pain specialists have established clinical procedures for diagnosing fibromyalgia, the clinical label does not explain what is happening neurologically and it does not reflect the full individuality of patients' suffering," said **Tor Wager**, director of the Cognitive and Affective Control Laboratory. "The potential for brain measures like the ones we developed here is that they can tell us something about the particular brain abnormalities that drive an individual's suffering. That can help us both recognize fibromyalgia for what it is – a disorder of the central nervous system – and treat it more effectively."

If replicated and expanded upon in future studies, the results could eventually provide a neurological road map to brain activity that would inform diagnosis and therapeutic interventions for fibromyalgia.

"This is a helpful first step that builds off of other important previous work and is a natural step in the evolution of our understanding of fibromyalgia as a brain disorder" said López-Solà.
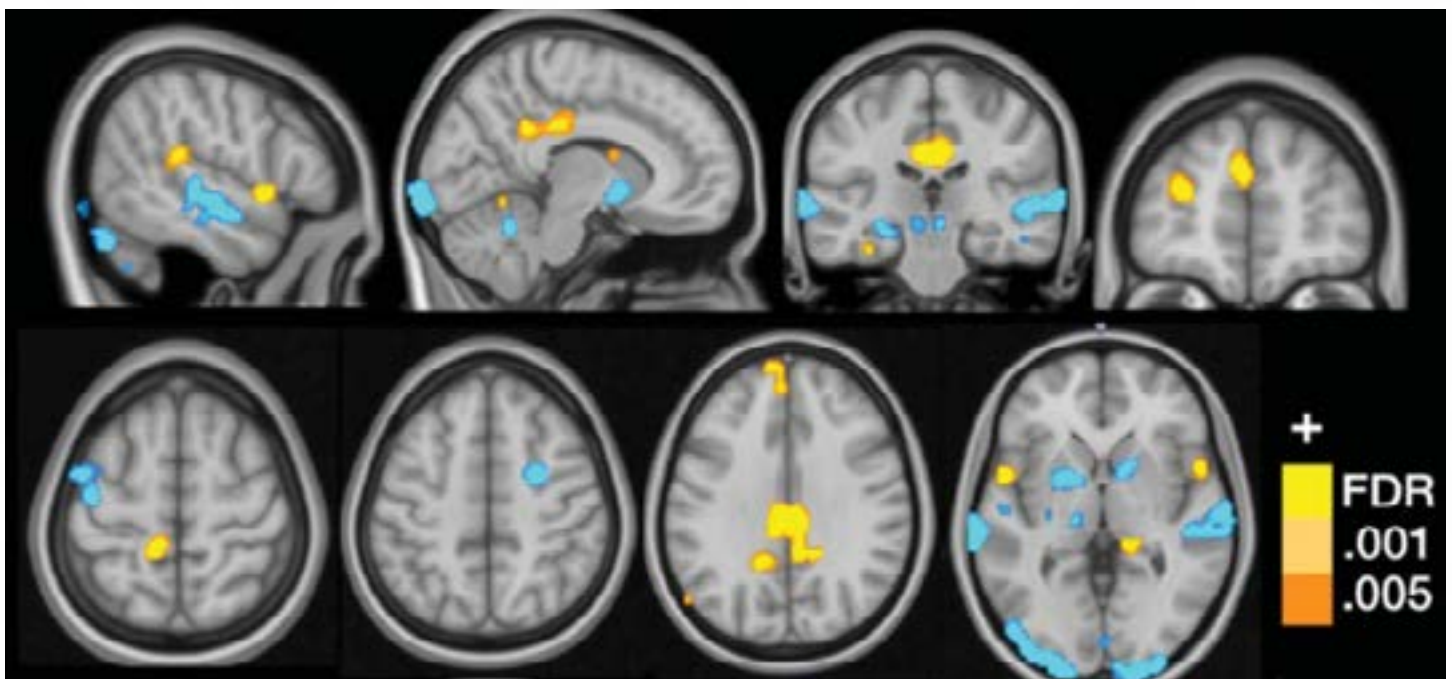
An MRI image showing the multivariate brain pattern that predicts fibromyalgia status on the basis of brain activation during multisensory stimulation.

ICS Promotes Catherine Latzer

The Institute is happy to announce that ICS staff member Catherine Latzer has been promoted to Grant Accounting and Payroll Operations Manager. Cat has worked for CU Boulder for 15 years, 10 of which were for the Institute. She also recently passed the exam to become a Certified Research Administrator. Please join us in congratulating Cat!

Darya Zabelina to Study Creativity and Dementia

ICS Research Associate Dr. Darya Zabelina was awarded an Endeavor Fellowship from the Australian government to conduct research at the University of Sydney examining imagination and creativity with the onset of dementia.

Dr. Zabelina has also accepted a tenure-track position in the department of Psychological Science at the University of Arkansas starting this fall.

Daniel Szafir Named on Forbes "30 Under 30"

ICS Fellow Dr. Daniel Szafir was named on the Forbes Science "30 Under 30" list for 2017.

Dr. Szafir is an Assistant Professor with the ATLAS Institute and the Computer Science Department. His work focuses on human-robot interaction (HRI) and human-computer interaction (HCI). He studies the design and use of robots and related novel technologies, including brain-computer interfaces and virtual reality, with the goal of improving usability and outcomes such as learning and collaboration.

New ICS Fellows

The Institute welcomed the following new Fellows in 2017, and looks forward to our collaborations:

Iskra Fileva
Assistant Professor
Philosophy

Research interests include the connections and tensions between conscious and unconscious motivation, the links between rational and psychological explanations of action, the influence of character and personality traits on reasons for action, and the boundary between irrationality and mental disorder.

Tam Vu
Assistant Professor
Computer Science

Starting at CU Boulder August 2017. Research interests include pervasive and mobile systems, including context discovery, context-aware wearable devices, security and privacy protection for mobile systems, and mobile-centric network architecture for future Internet.

ICS Travel and Research Student Awards

ICS awarded the following students travel and research awards for Spring 2017:

Dan Corral	Psychology	Research
Leighanna Hinojosa	Education	Travel
HyunJoo Oh	ATLAS	Travel
Shannon McKnight	Psychology	Travel
Conor McNamara	Computer Science	Travel
Rick Parker	Computer Science	Travel
Stephen Sommer	Education	Travel
Adam Young	Psychology	Travel

For more information about ICS Student Awards, visit colorado.edu/ics/graduate-programs/student-travel-research-awards

ICS Student Presentations

Parker, R. (2017, April) How Do You Feel: Affective Expressions from Computer Science Senior Capstone Projects. Presented at Learning and Teaching in Computing and Engineering (LaTiCE) 2017, April 20-23, 2017, Hong Kong. Hong Kong.

Sommer, S., Graville-Smith, C., **Polman, J**., & **Hinojosa, L.** (2016). Iterative curricular design of collaborative infographics for science literacy in informal learning spaces. In C. K. Looi, Polman, J., Cress, U., & Reimann, P.,Transforming learning, empowering learners: The International Conference of the Learning Sciences (ICLS) 2016, Volume 2 (pp. 954-957). Singapore: International Society of the Learning Sciences.

Sommer, S., **Hinojosa, L**., & **Polman, J. L.** (2016). Utilizing eye tracking technology to promote students' metacognitive awareness of visual STEM literacy. In C. K. Looi, Polman, J., Cress, U., & Reimann, P., Transforming learning, empowering learners: The International Conference of the Learning Sciences (ICLS) 2016, Volume 2 (pp. 1231-1232). Singapore: International Society of the Learning Sciences.

Graduate Student Awards

Adam Young was awarded a Beverly Sears Research Grant from the Graduate School. Beverly Sears Graduate Student Grants are competitive awards sponsored by the Graduate School that support the research, scholarship, and creative work of graduate students from all departments on campus.

Jason Zietz was awarded a 2017 Summer Graduate School Fellowship to support his research exploring the intersection of mindfulness, cognitive processes related to empathy, and decision-making, and the design of a new class of "mindful" technologies that encourage pro-environmental decision making. The total value of this award is $6,000, which will be used to provide a summer GRA stipend.

ICS Beyond CU

Dr. Iskra Fileva published an encyclopedia entry titled "The Ontology of Personality," in Virgil Zeigler-Hill and Todd Shackelford, eds., *Encyclopedia of Personality and Individual Differences*.

Dr. Rafael Frongillo is co-organizing the EC 2017 Forecasting Workshop, held on June 27, 2017 at MIT, which will bring together theoreticians, empiricists, and practitioners to discuss the elicitation and aggregation of information for prediction making. http://www.bowaggoner.com/ec-forecasting/

For one week in February and March, **Dr. Alice Healy** had an appointment as a Visiting Scholar at the University of Pennsylvania in Philadelphia, and she presented a talk to their group of memory researchers. She will return as a Visiting Scholar for a second one-week visit in May when she will also be attending and coauthoring a poster at the Context and Episodic Memory Symposium (CEMS) there.

The *Oxford Handbook of Cognitive Science*, edited by Susan E. F. Chipman, was published December, 2016, and included chapters by several ICS Fellows including **Dr. Clayton Lewis**, **Dr. Martha Palmer**, and **Dr. Randy O'Reilly**.

Dr. Keith Lohse accepted a new position as an Assistant Professor in the Department of Health, Kinesiology, and Recreation at the University of Utah, and will start there this August.

Dr. Rob Rupert will spend May-July, 2017, as a Research Fellow at the Center for Mind, Brain, and Cognitive Evolution at the Ruhr-Universität in Bochum, Germany.

ICS Fellow Awards

Dr. Phillip Gilley and Dr. Kristin Uhler were featured at the Academy of Audiology AudiologyNow conference in the Academy Research Conference on Pediatrics: Advancements in Assessment and Rehabilitation April 5, 2017.

Dr. Jennifer Jacobs received the Association of Teacher Educators' 2017 Distinguished Research in Teacher Education Award.

Dr. Danielle Szafir received a NSF CISE Research Initiation Initiative grant for $174,855 to study "Data-Driven Automation of Color Encodings For Data Visualization.

ICS Fellow Publications

Ashar, Y. K., Chang, L. J., **Wager, T. D**. (in press) Brain and psychological mechanisms of the placebo effect: An affective appraisal account. Annual Reviews Clinical Psychology.

Ashar, Y. K., Chang, L. J., **Wager, T. D.** (2017) Brain and psychological mechanisms of the placebo effect: An affective appraisal account. Annual Reviews Clinical Psychology.

Benca, C. E., Derringer, J. L., Corley, R. P., Young, S. E., Keller, M. C., Hewitt, J. K., & **Friedman, N. P.** (2017). Predicting cognitive executive functioning with polygenic risk scores for psychiatric disorders. *Behavior Genetics, 47*, 11-24.

Bidwell, L. C., Gray, J. C., Weafer, J., Palmer, A., de Wit, H., & MacKillop, J. Genetic Influences on ADHD Symptom Dimensions: Examination of A Priori Candidates, Genome-wide Variation, and SNP Heritability. (2017). *American Journal of Medical Genetics, Part B.*

Bidwell, L. C., Marceau, K., Brick, L., Karoly, H. C., Palmer R. H. C., Todorov, A., Heath, A. C., & Knopik, V. S. (2017). Prenatal exposure effects on early adolescent substance use: A genetically-informed Bayesian approach. *Journal of Studies on Alcohol and Drugs.*

Cowell, A., **Ramsberger, G.**, **Menn, L.** 2017. Dementia and grammar in a polysynthetic language: An Arapaho case study. Language, vol. 93, 1: 97-120. Project MUSE, muse.jhu.edu/article/650308.

El Masri, Y., Ferrara, S., **Foltz, P. W.**, & Baird, J. (2016). Predicting item difficulty of science National Curriculum tests: The case of Key Stage 2 assessments. *The Curriculum Journal.* DOI: 10.1080/09585176.2016.1232201

Elvevåg, B., **Foltz, P. W.**, Rosenstein, M., Ferrer I Cancho, R. De Deyn, S., Mizraji, E., & Cohen, A. (In press). Thoughts about disordered thinking: Measuring and quantifying the laws of order and disorder. *Schizophrenia Bulletin.*

Fileva, I. (Forthcoming) Historical Inaccuracy in Fiction. *American Philosophical Quarterly*.

Foltz, P. W. & Rosenstein, M. (2017). Data mining large scale formative writing. In G. Siemens and C. Lang (Eds.), *Handbook of Learning Analytics and Educational Data Mining.*

Friedman, N. P. (2016). Research on individual differences in executive functions: Implications for the bilingual advantage hypothesis. *Linguistic Approaches to Bilingualism, 6*, 535-548.

Friedman, N. P., & Miyake, A. (2017). Unity and diversity of executive functions: Individual differences as a window on cognitive structure. *Cortex, 86,* 186-204.

Gilley, P. M., Uhler, K., Watson, K., & **Yoshinaga-Itano, C.** (2017). Spectral-temporal EEG dynamics of speech discrimination processing in infants during sleep. *BMC Neuroscience, 18*(1). doi:10.1186/s12868-017-0353-4

Goldin, I., Narciss, S., **Foltz, P. W.**, & Bauer, M. (2017) New directions in formative feedback in interactive learning environments. I*nternational Journal of Artificial Intelligence and Education.* doi:10.1007/s40593-016-0135-7

Gustavson, D. E., Stallings, M. C., Corley, R. P., Miyake, A., Hewitt, J. K., & **Friedman, N. P.** (2017). Executive functions and substance use: Relations in late adolescence and early adulthood. *Journal of Abnormal Psychology, 126*, 257-270.

Overstreet, M. F., **Healy, A. F.**, & Neath, I. (2017). Further differentiating item and order information in semantic memory: students' recall of words from the "CU Fight Song," Harry Potter book titles, and Scooby Doo theme song. *Memory*, 25, 69-83.

Vergara, D., **Bidwell, L. C.**, **Hutchison, K. E.**, & Kane, N. (2017). Compromised external validity: Cannabis from federal sources does not reflect the diversity and potency available in state-regulated markets. *Scientific Reports.*

ICS Fellow Presentations

Chen, W., **Palmer, M.** (2017). `Unsupervised AMR-Dependency Parse Alignment'', In Proceedings of the European Chapter of the Association of Computational Linguistics (EACL) 2017, Valencia, Spain.

Fileva, I. (2017, May). Reflection without Empathy: The Case of Psychopathy," Invited talk presented at the Stanford University Philosophy Department, Stanford, CA.

Foltz, P. W. (2017, March). Automated feedback in large-scale formative writing: Lessons learned and best practices. Keynote address presented at the Learning Analytics and Knowledge LAK2017 Writing Analytics Literacy, Bridging Research to Practice Workshop. Vancouver, BC.

Healy, A. F. (2017, February). How to train knowledge and skills for peak performance. Invited address presented at Learning & the Brain Conference: The Science of Student Learning, San Francisco, CA.

Ketels, S. L., **Healy, A. F.**, **Jones, M.**, Guhl, M., & Sasnett-Martichuski, D. K. (2017, February). Peer learning can impede student understanding. Paper presented at the First Mini-Annual Interdisciplinary Conference, Jackson, WY.

INC
Intermountain Neuroimaging Consortium

INC News Update

After celebrating its 5th anniversary last fall, the INC had a busy winter with INC investigators running both continuing and new studies on a range of topics, including:

- The brain systems underlying different cognitive processes that contribute to working memory

- How a relapse prevention program changes the brains of people recovering from alcoholism

- The brain regions and networks underlying the construct of imagination

- How cognitive pain regulation influences different components of pain

- Whether brain structure and function in old age are affected by chronic marijuana use

- How the brain develops from childhood through adolescence and how environmental factors may influence that process

- How mindfulness and cognitive therapy change brain structure and function in women with depression

- How different types of exercise influence age-related changes in brain structure and function

- The neural predictors of executive control abilities

The INC has continued to expand its outreach work this year with tours of the facility for K-12 and college students, and K-12 classroom and after-school lessons. If you would like to visit our facility or learn more about the INC, please visit our website or contact the INC's Executive Director, Dr. Marie Banich (Marie.Banich@Colorado.edu), or Dr. Nicole Speer, INC Director of Operations (Nicole.Speer@Colorado.edu).

Stay up to date with the INC online:
www.colorado.edu/mri
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ICS Certifications
Spring 2017
Undergraduate Certificate

Bethany Baker — SLHS

Angela Brickman — SLHS

Kelsey Conlan — SLHS

Benjamin Galassi — Psychology and Neuroscience

Lucas Hayne — Psychology and Neuroscience

Annaliese Miller — SLHS

Alyssa Roseman — Psychology and Neuroscience

Graduate Certificate

Leighanna Hinojosa — Education

Megan Rose Meyer — Linguistics

Abhijit Suresh — Computer Science

Human Language Technology Certificate

Lin Yuan — Linguistics

Jeannette Pepin — Computer Science

Geoffery Sutcliffe — Computer Science

Sepideh Vosoughian — Linguistics

Thank You ICS Donors!

ICS would like to thank the following donors for their generous contributions to the Institute:

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