Institute of Cognitive Science Newsletter - Spring 2016

Can You Teach Compassion?

ICS Faculty Dr. Tor Wager and Psychology and Nueroscience Faculty Dr. Sona Dimidjian were Co-PIs on an ICS grant exploring compassion. We sat down with graduate student Yoni Ashar, who worked extensively on the grant, to discuss the research conducted.

The premise of the research was to discover if compassion is a skill that a person can acquire, and whether someone could be trained to feel compassion in the same way they could be taught to play guitar. The team also wanted to learn what is happening in participants' brains as they become more compassionate. When examining compassion, the research focused not only on how people felt, but whether or not they were compelled to action by those feelings. Ashar commented that "modern science is currently well poised to determine if the effects of meditation on compassion derive from a placebo effect or from another mechanism in the brain."

Initially, the team ran an online experiment to develop a model to predict how compassionate feelings related to compassionate behavior. Participants read biographies of people going through hard times, were asked to rate their feelings about the person in the biography, and then asked how much of their payment for completing the study would they like to donate. Researchers then developed a model predicting, based on participants reported feelings, how much of their study earning the participants would donate. The model was successful and predicted donations were off by an average of only 13 cents, out of $1 total possible donation.

To develop a program to teach compassion the team worked with Dr. Roshi Joan Halifax, a Buddhist teacher, Zen priest, and founder of the Upaya Institute and Zen Center in Santa Fe, New Mexico. The technique, called Compassion Meditation, has its roots in the Buddhist tradition. Anecdotal research had suggested meditation could increase compassion, so researchers drew from Halifax's knowledge of thousands of years of Buddhist meditation practices to design a daily, four-week long meditation program hosted through a smart-phone app.

To determine if the Compassion Meditation Program could affect behavior, researchers ran a randomized controlled study of people with no meditation background. Over the four weeks of the meditation program completed by participants, researchers saw about a 75 percent compliance rate. One control group was given a nasal spray to be administered daily, which they were told was oxytocin but was actually saline, in order to see if the placebo effect was affecting compassion. Another control group was asked to listen to biographies of people going through hard times, to measure if merely being exposed to other people's suffering would increase compassion without meditation. All participants underwent fMRI brain scans before and after the interventions, and were asked to complete charitable donation tasks in a laboratory setting, such as being requested to donate a portion of their participant payment to a charity. The research conducted showed that the group practicing Compassion Meditation increased both feelings of compassion and charitable behavior over those of the control groups. Additionally, following the intervention, the Compassion Meditation group had increased fMRI activity in the basal forebrain while listening to stories of suffering others, relative to control groups. The basal forebrain is strongly related to emotion and motivation, and these results suggest that Compassion Meditation can change the emotional and motivational value of suffering others.

Several other studies were conducted during the life of the grant. One looked at neural markers of empathetic care, looking for patterns of whole brain activity which track the intensity of feelings of care and distress. The study found relatively successful markers of "care" in the ventromedial prefrontal cortex and ventral striatum, areas of the brain linked to reward and value, and markers of "distress' in regions of the brain associated with mirroring, or sharing another person's experience.

Researchers on the grant include Dr. Tor Wager, Dr. Sona Dimidjian, Dr. Jessica Andrews-Hanna, Dr. Tal Yarkoni, and graduate student Yoni Ashar. While some results are still awaiting publication, several have already been released:

Ashar, Y. K., Andrews-Hanna, J. R., Yarkoni, T., Sills, J., Halifax, J., Dimidjian, S., Wager, T. D. (2016) Effects of compassion meditation on a psychological model of charitable donation. *Emotion*.

Ashar, Y. K., Andrews-Hanna, J. R., Dimidjian, S., Wager, T. D. (in press) Towards a neuroscience of compassion: A brain systems-based model and research agenda. In: Greene, J. (Ed.), *Positive Neuroscience Handbook*. Oxford University Press.

Yarkoni, T., Ashar, Y. K., Wager, T. D. (2015) Interactions between donor Agreeableness and recipient characteristics in predicting charitable donation and positive social evaluation. *PeerJ* 3:e1089

From the Director of the Institute

Dear Colleagues,

For me, writing this last ICS Director's letter is bittersweet. I have so enjoyed the opportunity to lead the Institute for the past 12 years, and stepping back (but not away) will be hard. I am very pleased to look back and think about the things we've managed to accomplish together – a continued strong base of ICS programs, activities, and actively-involved members; the creation of a physical space for ICS researchers, faculty and students at CINC; the establishment of our neuroimaging center; the expansion of our training programs; and the creation of a strong staff and infrastructure to aid in Institute endeavors. And while individuals have come and gone over the years, what I have most appreciated is the intellectual enthusiasm that people here have for Cognitive Science, from the undergrads to the joint Ph.D. students, from our research professors to our tenured faculty. While one can talk about facilities and programs, what makes an intellectual community great are the intangibles – the desire for discovery, an enthusiasm for the exchange of ideas, the willingness to engage in conversation (not confrontation), and the ability to think outside the box. However, what I view perhaps most important for the health of a multi-disciplinary Institute, such as ours, is the ability to bridge across disciplinary boundaries and silos. While I think sometimes that we take this for granted, creating such connections is not all that common within academia. And it takes a special kind of culture and perspective to make it work well, as it does here at ICS. It takes individuals and a community who hold certain values - values that center around treating both ideas and people with respect. To my mind, ICS is successful because we value ideas, and how these ideas can be explored, expanded, and strengthened by a conversation across disciplines. And we value our colleagues. We have taken the time and acquired the discipline to learn to speak with each other in an understandable and comprehensible way, avoiding the jargon of our own area of expertise. We lack an egocentric bias that suggest "we" know the answer and are open to ideas and viewpoints besides our own. And even when our schedules are full and deadlines loom, we come to talks and colloquia to understand the broader scope of Cognitive Science. In many ways, it is because of these underlying, and often unspoken values of the Institute, that I have felt most proud to lead it. And because of these values, I have no concerns about the Institute's future because these values will take it far no matter the circumstances.

I also want to thank all of you who have supported me in my endeavors in the past 12 years, from being an active member of the community, to serving on committees, to spreading the word about ICS, to giving your ideas and thoughts, to attending ICS events or being involved in ICS Programs. I am extremely grateful to the ICS staff, who are an indispensable part of the Institute's success. They have exemplified another set of values – the goal of making ICS a warm and inviting place to visit or do business; the goal of helping scientists and teachers focus on their job without the distractions of the vagaries of an arcane university accounting system, or complicated Federal grant requirements; and the goal of doing their work to the highest standards possible within in a reasonable amount of time.

The saying is "All things must change", but from my perspective that's entirely true. While you'll have new leadership at the helm of ICS next year, I am sure the Institute's values will be a constant foundation for future efforts.

With much gratitude,

Marie

ICS Approved for Research Professor Track

Due to a policy change at CU Boulder, the Institute is now authorized to initiate and use the Research Professor Series for appointments. The Research Professor Series (Assistant Research Professors, Associate Research Professors, and Research Professors) hiring and promotion processes are similar to the tenure-track processes. Individuals hired in the Research Professor Series must have grant funding to support salary, benefits, etc., and are expected to have comparable responsibilities (research, service, etc.) in their formulated workload. For more information visit http://www.colorado.edu/vcr/hr/research-professor-series

The Institute currently has four people who are part of the Research Professor Series:

Cinnamon Bidwell, Assistant Research Professor

Donna Caccamise, Associate Research Professor

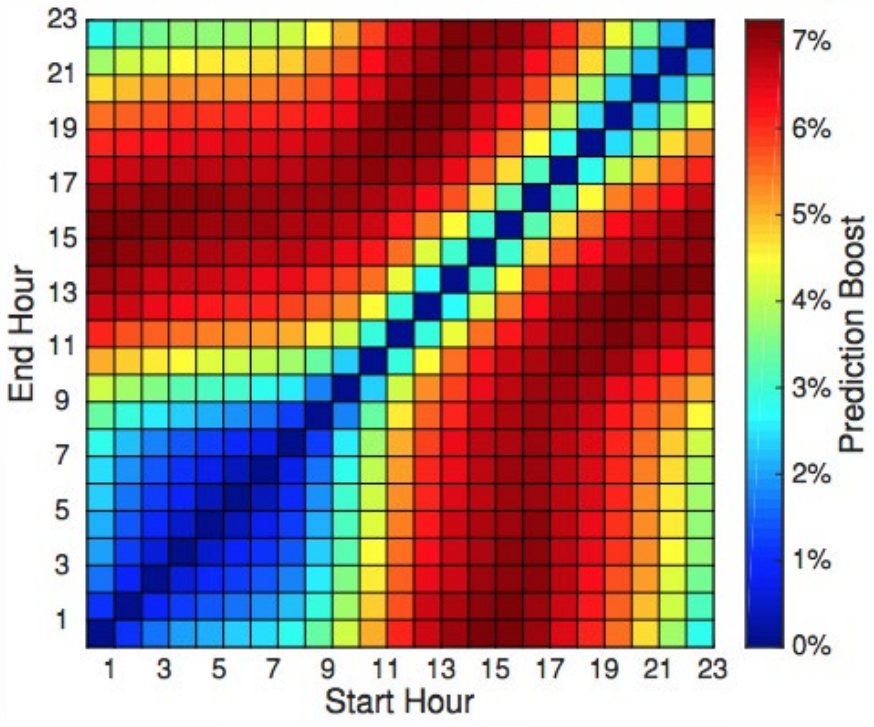
Peter Foltz, Research Professor Adjoint

Sarel Van Vuuren, Associate Research Professor

Improving Music Recommendations

ICS Faculty Mike Mozer served as the PI for a grant sponsored by Samsung. Dr. Mozer, along with Zhaochuan Chen, a recent Physics PhD from CU, and Dana Hughes, a Computer Science PhD student, investigated models that could provide better customized music recommendations using data available on listeners' mobile devices. The models were developed using a large public data set of music selections from a UK audience, pulled from the website "last.fm." The team invented several new algorithms for making predictions that cut across many time scales, from minute-to-minute to month-to-month. Their algorithms efficiently searched for the best way to segment the data. They found that by segmenting the data by time of day and day of week, they could improve predictions significantly. For example, in one experiment they segmented by time of day only and found that splitting the data {12:00p - 6:59p} and {7:00p - 11:59a} improved predictions by 7%. Publications on this work are forthcoming.

Improvement in Prediction Performance from Time-Based Segmentation



ICS Fellow Presentations

Ketz, Nick, O'Reilly, Randall, Curran, Tim. (2016). Paired Associate Encoding Influenced by Entrained Theta Power. Poster session presented at national conference for the Cognitive Neuroscience Society. New York, NY

Stephen Sommer, Leighanna Hinojosa, and Joseph Polman (School of Education & ICS) will be traveling to the International Conference of Learning Sciences (ICLS) in Singapore this June to present a poster titled Utilizing Eye Tracking Technology to Promote Students' Meta-Cognitive Awareness of Visual STEM Literacy. This report is based on work done in collaboration with the CU Science Discovery Program, the Cognitive Development Lab, and the STEM Literacy through Infographics Project. A second iteration of this work will happen again on CU campus this July. Stephen received travel funding through ICS.

This summer, ICS Fellow Rob Rupert will spend one month as a research fellow at the Ruhr-Universität, in Bochum, Germany. He will be working with Prof. Tobias Schlicht on his project "Situated Cognition: Perceiving the World and Understanding Other Minds." Prof. Rupert will also be affiliated with RUB's Center for Mind, Brain, and Cognitive Evolution and the Institute of Philosophy II. In addition, Rupert will spend two months this summer visiting the University of Edinburgh's School of Philosophy, Psychology, and Language Sciences, as a professorial fellow.

David Quigley and Tamara Sumner, along with colleagues in Education and partners at UCAR, will present their ecosystem mapping tool EcoSurvey to educators at the International Society for Technology in Education conference, at the end of June.

David Quigley and Tamara Sumner, along with colleagues in Computer Science, Education, and partners at DePaul University, will present a poster titled "Equity of Learning Opportunities in Chicago City of Learning" at the Educational Data Mining conference June 29 - July 2.

ICS Fellow Publications

Friedman, N. P., Miyake, A., Altamirano, L. J., Corley, R. P., Young, S. E., Rhea, S. A., & Hewitt, J. K. (2016). Stability and change in executive function abilities from late adolescence to early adulthood: A longitudinal twin study. Developmental Psychology, 52, 326-340. PMCID: NIHMS734455.

D.A. Szafir, S. Haroz, M. Gleicher, S. "Franconeri; Four types of ensemble coding in data visualizations". Journal of Vision 2016;16(5):11. doi: 10.1167/16.5.11.

D.A. Szafir, A. Sarikaya, & M. Gleicher. "Lightness Constancy in Surface Visualization." IEEE Transactions on Visualization and Computer Graphics, 2016.

D.A. Szafir, D. Stuffer, Y. Sohail, & M. Gleicher. "TextDNA: Visualizing Word Usage Patterns with Configurable Colorfields." Computer Graphics Forum. 35 (3), 2016. (In the Proceedings of the 2016 Eurographics/IEEE Conference on Visualization)

ICS Fellow Grants

ICS Fellow Danielle Albers Szafir received the following grant: "FieldView: Using Mobile Devices to Blend Data Collection and Analysis for Field Research," CU Innovative Seed

ICS Student Achievements

David Quigley, a graduate student in ICS and CS, received the CS Department 2015 Outstanding Service Award for his contributions to the department, ICS, the College of Engineering, and the Boulder community.

Sam Severance, a Joint PhD candidate in ICS and Education, has accepted a Postdoctoral Researcher position at Michigan State University within the CREATE for STEM Institute. CREATE for STEM Institute is a collaboration between the colleges of Education, Natural Science, and Engineering at Michigan State University. The Institute seeks to improve teaching and learning in the STEM disciplines for students from grades K-16 through research and development efforts. Sam's postdoctoral advisor will be Professor Joe Krajcik, the director of the CREATE for STEM Institute. Professor Krajcik is a national leader in STEM education and co-author of the Next Generation Science Standards.

In January, Katherine Goodman, a December 2015 ICS certificate / ATLAS PhD graduate, became an assistant professor at University of Colorado Denver's Inworks initiative. Inworks is a rapid prototyping and design space, where she will be able to continue her research in the ways unusual educational experiences expand students' perception.

ICS Student Presentations

Nickerson, H., Brand, C., & Repenning, A. (2015). Grounding computational thinking skill acquisition through contextualized instruction. In Proceedings of the Eleventh International Computing Education Research Conference (ICER) (pp. 207-216). New York: ACM Press.

Nickerson, H., Bush, J., & Endo, Y. C. (2016). We have questions: Pedagogical, technical, and procedural assistance requests in a large computational thinking curriculum research project (poster). In Proceedings of the 47th ACM Technical Symposium on Computing Science Education (SIGCSE) (p. 692). New York: ACM Press.

Inquiry Hub, an ICS Collaboration

This Spring, work from the Inquiry Hub project (an ICS, School of Education, Denver Public Schools, and UCAR collaboration led by ICS Faculty Tamara Sumner), was featured in multiple workshops led by Bill Penuel, Katie Van Horne, Tiffany Clark, and University of Washington collaborators at two annual educator conferences: The Council of State Science Supervisors (CSSS) and the National Science Teacher Association (NSTA). CSSS is the professional association for the leaders of science in state departments of education, and NSTA is the largest organization of science teachers worldwide, with more than 57,000 members.

The workshops highlighted curriculum co-design processes generated from the project, for example, how to select a scientific phenomena or engineering design challenge to anchor a sequence of lessons: http://www.ngssphenomena.com/how-to-use-phenomena/

Work was also shared on how to design three-dimensional (3D) assessments to assess 3D student learning, that is, learning through the integration of science and engineering practices, crosscutting concepts, and disciplinary core ideas. The collective set of resources from those workshops are available through the Research + Practice Collaboratory on the STEM Teaching Tools website: http://stemteachingtools.org/news/2016/short-course-how-to-develop-3d-formative-assessments-for-the-science-classroom

RESEARCH + PRACTICE COLLABORATORY

ICS Travel Student Awards Spring 2016

ICS awarded the following students travel awards for Spring 2016:

Nicole Beckage	Computer Science
James Foster	Psychology
Nick Ketz	Psychology
David Quigley	Computer Science
Marianne Reddan	Psychology
Brett Roads	Computer Science
Stephen Sommer	Education

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

ICS Certifications

December 2015

Undergraduate Certificate

Kimberly Donovan – SLHS

Melissa Smithson – Linguistics and Anthropology

Graduate Certificate

Katherine Goodman – Engineering and ATLAS

May 2016

Undergraduate Certificate

Eric Badovinatz – Philosophy and Linguistics

Katie Braun – SLHS

Elizabeth Gangware – SLHS

Dana Green – Linguistics

Chelsey Hill – SLHS

Jared Jolton – Psychology and Neuroscience

Emily Nightengale – SLHS

Colleen O'Connor – SLHS

Annika Wigert – SLHS

Graduate Certificate

Allison Langley – Linguistics

Human Language Technology Certificate

Allison Langley – Linguistics

Audrey Farber – Linguistics

Joint PhD

Steve Duman – Linguistics and Cognitive Science

Steve is pursuing a position as a User Experience Researcher, and will continue to run his NSF-funded company, Inherent Games, where they make language-learning apps for mobile devices.

INC News Update

INC has been busy this winter and spring preparing for a major upgrade to the MRI scanner. The INC facility is closed to data collection from April 19-May 31 as the scanner system is stripped down to its magnet and then updated with a range of new components that will enhance data quality as well as ensure the scanner technology keeps pace with cutting edge data acquisition methods. You can follow the upgrade progress with pictures on the INC's Facebook page (see below).

Prior to the upgrade, researchers completed a number of studies but even more studies will continue after the upgrade. INC investigators have been very successful recently in funding intervention and longitudinal studies, in which participants undergo multiple scan sessions either before and after an intervention of some sort or on a regular basis to track developmental changes in the brain. Current intervention studies underway at the INC include exploring the effects of exercise on susceptibility to mental illness in adolescents, the effects of different types of exercise on age-related declines in cognitive function and brain connectivity, the effects of mindfulness mental health, and the effects of neutraceuticals (food supplements) on age-related changes in cognitive function and brain connectivity. A number of INC-supported studies of children and adolescents continue to study the developing brain including the Adolescent Brain Cognitive Development (ABCD) study, a large, multi-site study starting this summer which will explore the effects of substance use on the developing brain.

INC continues to expand its outreach into the larger Colorado community with neuroscience lessons for K-12 classrooms, talks for the public and a professional development workshop for K-12 teachers (in partnership with CU Teach). From March 14-20 2016, the INC participated in the Dana Foundation's Brain Awareness Week by hosting talks and events around the CU Boulder campus to increase public awareness of brain research. Next year the INC will host a Brain Bee to better engage Colorado high school students in neuroscience research. Stay up to date on the latest INC research, events and research opportunities via the new INC website and social media channels:

On the web: www.colorado.edu/mri

Facebook: www.facebook.com/CUBoulderMRI

Twitter: twitter.com/CUBoulderMRI

Rocky Mountain Psychological Association Conference

The 86th Annual Convention of the Rocky Mountain Psychological Association was held in Denver April 14-16. On Saturday, April 16, the convention included the invited Ellis-Battig Memory Symposium, and this year the symposium was devoted to a summary of research conducted at the CU Center for Research on Training, which is an ICS Center. The symposium title was "Studies from the Center for Research on Training, University of Colorado Boulder," and the Moderator of the symposium was Aaron Richmond, Metropolitan State University of Denver.

The following are the five invited talks (with titles, authors, and abstracts) that comprised this symposium:

(1) The Bat-and-ball Problem: Confidence and Answer Fluency

Lesley G. Hathorn, Metropolitan State University of Denver
Alice F. Healy, University of Colorado Boulder

In 2 experiments, a positive correlation was found between answer fluency (how quickly the answer comes to mind) and confidence in the answer to the bat-and-ball problem, regardless of answer accuracy. Most participants who responded with the incorrect biased (intuitive) answer provided a high level of confidence in their response.

(2) Predicting Pronunciation Variability: Implicit Learning of Words in Contexts

William D. Raymond, Esther L. Brown, and Alice F. Healy
University of Colorado Boulder

Knowledge of language reflects implicit learning from experience of distributional probabilities of linguistic units. We report on studies relating the learned contextual likelihoods of words to word pronunciation variability originating in articulatory approximations. Contextual experience is thus implicated as a source of synchronic variability and diachronic change in the lexicon.

(3) Comparative Experience is Not Enough: Challenges For Eliciting Awareness of the Testing Effect

Adam P. Young, Alice F. Healy, Matt Jones, and Tim Curran
University of Colorado Boulder

Students are largely unaware of the benefits of self-testing. In 2 experiments students experienced both restudy and self-testing strategies in close succession. However, they largely failed to detect and capitalize upon the benefits of self-testing. These results highlight the difficulty facing teachers in eliciting appreciation of the testing effect.

(4) Training Data Entry: Specificity and Generalizability of Perceptual and Motor Processes

Vivian I. Schneider, Alice F. Healy,
University of Colorado Boulder
James A. Kole, University of Northern Colorado
Immanuel Barshi, NASA Ames Research Center

Subjects were trained on a standard data entry task and then tested on the standard task as well as on two task variants, which changed either the perceptual or the motor requirements. Surprisingly, despite the assumed orthogonal relationship between specificity and generalizability of training, evidence was found for both outcomes.

(5) Do EReaders Aid Vocabulary Acquisition in Middle School Language Arts?

Carolyn J. Buck-Gengler and Alice F. Healy
University of Colorado Boulder

Two classes of middle school students read the same book, but half the students in each class read it with an eReader, and half read the print version. The results suggest that the teacher is more important than the learning tools in determining performance levels on vocabulary and comprehension tests.

In addition, an invited symposium entitled, "Cognition, Technology, and Education," was moderated by James A. Kole, a CU graduate at the University of Northern Colorado. This symposium also reported research from ICS.

The following are the three invited talks (with titles, authors, and abstracts) that comprised this symposium:

(6) The Accessibility Liability: Digital Information Undermines Conceptual Understanding

Shane Schwikert, University of Colorado Boulder
Adrian Ward, University of Texas Austin

In this research, we explore how increasing reliance on digital information in the "Internet Age" affects our knowledge and understanding. We find that digital information (relative to "live" or print-based information) is associated with impaired information processing (or conceptual understanding), even when information storage (memory for information) is unaffected.

(7) The Effects of Note Taking Medium Based on Lecture Format

Lakshmi A. Lalchandani and Alice F. Healy
University of Colorado Boulder

The effect of educational technology is largely unstudied in psychology due to its recent rise in popularity and lack of uniformity in classrooms. The current study investigated the interaction effect between lecture style (aided by technology vs. unaided) and notetaking style (longhand vs. computer vs. no notes).

(8) Uneven Benefits from Clickers in the Statistics Classroom

Shaw L. Ketels, Alice F. Healy, Matt Jones, Diane K. Sasnett-Martichuski, Lakshmi A. Lalchandani, & Mary J. Chapman
University of Colorado Boulder

We manipulated the usage of clickers in four statistics classes, to evaluate two common pedagogical prescriptions for their usage. Performance on exam questions was used as the dependent measure. We found expertise reversal effects: clicker usage manipulations benefited students differentially depending on their course performance and the nature of each question.

Nicole Speer Wins Outreach and Engagement Award

(Adapted from CU Boulder News Center)

The Office for Outreach and Engagement announced that Nicole Speer, Director of Operations for the Intermountain Neuroimaging Consortium, was selected for a special recognition award. The award honors staff members who have demonstrated outstanding professional commitments to and success with community outreach and engagement initiatives. Speer was awarded $1,000 to be applied toward her outreach programs.

Sara Thompson, Dean of the Division of Continuing Education and Vice Provost for Summer Session and Outreach & Engagement, said at an luncheon celebrating Speer and other award recipients, “This recognition underscores the important role our staff play in advancing outreach and engagement initiatives, which are an integral part of our role and mission as a comprehensive, public research university.”

As the Director of Operations, Speer develops, manages and implements outreach programs for the Intermountain Neuroimaging Consortium (INC), a CU-Boulder brain imaging facility that supports neuroscience research related to addiction, pain, emotion, attention, sleep, learning and memory. Outreach efforts include training CU-Boulder undergraduate students to deliver interactive, age-appropriate neuroscience lessons to K-12 students in the Denver/Boulder area. These lessons focus on how students can make healthy lifestyle choices related to exercise and sleep.

National Academies of Practice Inducts Christine Yoshinaga-Itano

(Adapted from NAP Press Release)

The National Academies of Practice elected of Christine Yoshinaga-Itano, PhD, of Boulder, CO as a Distinguished Scholar & Fellow of NAP. Dr. Yoshinaga-Itano was inducted at a gala membership banquet on April 9, 2016 in Baltimore, MD.

Founded in 1981, NAP is an interdisciplinary, nonprofit organization, with membership representing 14 health care professions willing to serve as distinguished advisors to health care policy makers in Congress and elsewhere. Membership in the NAP is an honor extended to those who have excelled in their profession and are dedicated to furthering practice, scholarship and policy in support of interprofessional care. The central purpose of NAP is to advise public policy makers on health care issues using NAP’s unique perspective, that of expert practitioners and scholars joined in interdisciplinary dialogue.

Randy O’Reilly Wins Faculty Award in Research

The Salary Committee for the Department of Psychology and Neuroscience recognized Professor Randy O’Reilly for his outstanding achievements in research. His lab develops computational models of the biological bases of cognition, focusing on interactions between the hippocampus, prefrontal cortex, basal ganglia, and posterior neocortex in learning, memory, attention, vision, and controlled processing. He has published 11 journal articles over the last two years and is Principal Investigator on four research grants totaling over $4 million. He is also a highly engaged research adviser who serves as the primary mentor for two senior research associates, five postdoctoral fellows, and four PhD students.