



Psychology News

Richie Davidson on Contemplative Neuroscience

When Richie Davidson was in graduate school at Harvard, neuroscience was not the field we know today. In the early 1970s, no one was using fMRI to map the neural pathways of emotions. The term “neuroplasticity” had not yet been coined, and scientists generally believed that the neural circuitry of the adult brain was unchangeable. Researchers were not interested in studying meditation, let alone observing monks while they practiced.

Richie Davidson was instrumental in changing all of that. Now the William James and Vilas Professor of Psychology and Psychiatry at the University of Wisconsin-Madison, he has garnered awards that reflect how significantly he influenced the field of psychology—from the esteemed Distinguished Scientific Contribution Award from the American Psychological Association to being named as one of the 100 most influential people in the world by Time magazine. His work focuses on the connection between emotions and brain activity, known as affective neuroscience. He has also pioneered contemplative neuroscience: research on how contemplative traditions such as meditation can structurally change the brain.



Professor Davidson at our department colloquium in December

This past December, our department was fortunate enough to sponsor three talks at CU by Professor Davidson. At a department colloquium and then at a neuroscience seminar talk the following day, he discussed affect and well-being from an affective and contemplative neuroscience perspective. He emphasized the variability of each individual’s emotions, which he called ‘affective style,’ and noted that part of his work has been to identify and objectively measure the neural circuits related to various affective styles. He went on to discuss neuroplasticity, the ability of the brain

to change its structure and function. Reviewing his own extensive research as well as others’ work on the subject, he supported the view that brain patterns related to affective style are not immutable and can be transformed through mental training such as meditation.

At his final talk, a public event held at CU’s Macky Auditorium entitled “Well-Being is a Skill,” he explained further how mental training can be used to cultivate happiness, creativity and productivity.

Professor Davidson, a long-time meditator, is known for his ongoing friendship with the Dalai Lama. At the public event at Macky, he talked about the Dalai Lama’s influence on his work after their meeting in Dharamsala, India, in 1992, recounting this comment from the Dalai Lama that opened his eyes to future research: “We’ve been using tools of modern neuroscience to study qualities like fear, anxiety and depression. Why can’t we use those same tools to study kindness and compassion?” Professor Davidson made a commitment to the Dalai Lama on that day to do everything he could to put the study of compassion and kindness at the forefront of his neuroscience research.

(Continued on page 3)

Table of Contents

Message from the Chair	2
Research News	4
Faculty News	5
Undergraduate Research	6
Alumni Book Review	6
Alumni Spotlight	7
Donate to the Department	Back Cover

Message from the Chair



The beginning of a new year is for many a time of new commitments, new starts, new *practices*. One such practice, characterized by Professor Richard Davidson's research, is meditation. And it sounds quite simple: engaging in this practice has a profound and positive impact on the brain.

And what if it were that simple?

As you will see in the Department of Psychology and Neuroscience Spring 2015 newsletter, there is a great deal of data supporting the premise that our thoughts and actions (i.e., what we practice), *can* and *do* change the brain. Much of this work is done in our department, while much is done by colleagues and collaborators at other institutions. Regardless of where the work is done, a common theme is the many positive means by which to change the brain and in turn, change lives. Professor Davidson's work at the University of Wisconsin-Madison has shown where and how the brain is changed by meditation.

Here at CU, our own Professor Wager has shown how belief, in and of itself, has a potent influence on the brain. Professors Dimidjian, Arch and Gruber all have unique and important research showing that well-being and health can be improved through our actions and emotions. In my laboratory (CAIRR/Clinical Assessment of Injury, Recovery and Resilience), we study the effects of acupressure on perceived stress, relaxation and cognition. This has been studied in many populations including civilians, Veterans, athletes and those with acquired brain injury

(stroke or traumatic brain injury). Thus far it appears that stimulation at acupressure points on the body has many benefits, including enhanced relaxation, reduced stress and improved memory. This from a *practice* that involves light touch using the fingertips at designated regions on the body.

Here is an example that you can try. Place your right index and middle fingers just underneath the ridge of your right collarbone about an inch or so lateral to the middle of your chest. Do the same with your left hand under your left collarbone. With the tips of your fingers you may feel a "pulse" that is much like the cardiac pulse. Keep your fingers in place until you feel the pulse on both sides, and then a bit longer until you feel the pulse become synchronized across the two sides. Notice whether there is a change in your breathing, relaxation state or sense of stress.

Remember, practicing a practice can lead to positive change in mind and body.

Wishing you all of the best for whatever you chose to practice in 2015.

Keep it simple.

Make a change.

Your brain will thank you for it.

—Theresa D. Hernández

The alumni newsletter for the Department of Psychology and Neuroscience
is published biannually and distributed to all alumni.

Editorial Staff

Managing Editor: Alicia Segal

Editors: Theresa D. Hernández, Jon Roberts,
Alicia Segal, Michael Wertheimer

Staff Writers: Kate Bell, Alicia Segal

Photographers: Kate Bell, Ernie Mross

Credits

Technical Support: Ernie Mross, Jon Roberts

Printing: Dynamic Designs Printing

E-mail: psychology.news@colorado.edu

Richie Davidson on Contemplative Neuroscience (continued from page 1)

Professor Davidson went on in his career to examine the neural aspects of meditation, including studies that recorded the brain activity of Buddhist monks in meditation, to understand the effects of that practice on neural circuitry. His studies have shown, among other things, that the brains of long-term meditators are different from those of non-meditators and that such practices can be used to positively transform

the brain. Professor Davidson is the founder and chair of the Center for Investigating Healthy Minds in Madison. The Center studies the role that mindfulness, kindness, compassion and forgiveness can play in mental and physical health and childhood education. For more information about the Center and this research see www.investigatinghealthyminds.org.

The public talk at CU also spotlighted related research being done by faculty in our department, with Professor Tor Wager and Associate Professor Sona Dimidjian presenting some of their own work. Professor Wager, a leader in the field of brain-body medicine, talked about his research on the power of belief. His studies of placebo effects have shown that belief in a treatment can influence pain-related activity in the brain, causing the brain to release opioids associated with pain relief and motivation. Professor Wager also mentioned multiple researchers in our department who are doing important work in the area of well-being, including topics such as resilience, healthy behaviors, healthy social interactions, and pain relief.

Professor Dimidjian, who made her own trek to Dharamsala in 2013 to meet the Dalai Lama, discussed her research on the treatment and prevention of depression, especially related to the well-being of women during pregnancy and postpartum. Her studies have shown that practices of mindfulness, cognitive behavioral therapy and yoga can help this population develop skills to prevent depression. In addition to presenting her own work, Professor Dimidjian talked about faculty members in our department who are pioneering research relevant to well-being. Our chair, Professor Theresa Hernández, along with Veterans Helping Veterans Now, studies the use of a daily self-care practice of acupressure to lessen symptoms of traumatic brain injury in Veterans. Assistant Professor Joanna Arch



Professor Dimidjian meeting with the Dalai Lama in 2013

studies well-being among cancer survivors. She's been developing and testing mindfulness and acceptance-based group therapy to reduce depression and anxiety and to increase life meaning and vitality for survivors. Assistant Professor June Gruber has been exploring the nature of positive emotion function and dysfunction and recently conducted a study examining the construct of emodiversity—that

the richness of one's own diverse experience has important implications for physical and emotional health.

Alison Vaccaro, a psychology undergraduate who attended the public talk, was exhilarated by the event. "This was really exciting and fascinating because I've been learning about mindfulness-based therapy in my psychology class," she says. "I may go into education so it's exciting to know that something like this is being worked on to help in a classroom setting."

Yoni Ashar, a third-year psychology graduate student mentored by Professors Dimidjian and Wager, shares Alison's enthusiasm. He says that several years ago, one of Professor Davidson's talks had a life-changing effect on him. While living in Israel, he happened to hear Professor Davidson at a public event. "I was working in a completely different field as a software developer and stumbled into a public talk that he gave. I was so inspired by that talk that I decided to leave my job and enter this line of work. He was my direct inspiration."

Yoni now studies compassion meditation (a contemplative practice designed to increase compassion for the suffering of others) as a way of training behavior. One of his studies focused on why we help other people and whether a compassionate response can be trained. His research showed that compassion meditation increases compassionate responding and helping behaviors. Yoni finds this work so compelling because he sees it as the intersection of science and spiritual practice. "This intersection gives us a way to understand and study how these practices can shape our lives beyond just anecdotal evidence. It helps us to answer important questions about these practices. Who are they good for? What is the best way to engage in them? How do different practices compare on a brain level? Science allows us to answer questions that we otherwise would be unable to answer." —*Alivia Segal*

Research News

Adapting to Daily Hassles and Traumatic Events *by Professor Serge Campeau*

Day in and day out, we encounter situations that challenge our physiological and psychological well-being. These situations have been defined under the general concept of “stress” nearly a hundred years ago in classic studies by Walter Canon and Hans Selye. Fortunately, all organisms, including humans, have evolved elaborate systems to respond to stress very effectively. For example, when we increase the demands on the body during vigorous physical activity (e.g., jogging, running, swimming, etc.), the body automatically responds in various specific ways to meet the increased physiologic demands, including the increases in breathing and heart rate that we are all too familiar with, together with multiple additional metabolic, autonomic and endocrine responses that we are not readily aware of. Interestingly, most of these responses can be evoked by stimuli that are primarily characterized as “psychological” in humans, requiring complex interpretations and analyses by the nervous system that often necessitate memories of past experiences.



Under most stress situations, our built-in automatic responses are highly effective in meeting environmental demands. However, multiple epidemiological studies suggest that several illnesses including, but not limited to, cardiovascular diseases, diabetes, various forms of cancers, and a number of psychiatric disorders, are highly associated with repeated or chronic exposure to stress. Importantly, responses evoked by stress can be prevented during chronic stress, especially when the same stress situation is encountered again and again, which is defined as “stress habituation.” Interestingly, studies in various psychiatric patient populations suggest that habituation to stress is abnormal and may be responsible for the appearance or maintenance of their symptoms. My research program attempts to shed light on putative brain systems that contribute to this vital adaptive function, through the use of animal models of stress habituation. Our most recent studies suggest that a region in the older part of the brain, the posterior hypothalamic area, is critically associated with stress habituation and may be part of a key system that can significantly decrease the impact of later challenges (stress resilience). Overall, this research provides new insights into how the brain responds to stress and new brain targets of interest associated with stress-related disorders.

Learning and Knowledge Representation *by Assistant Professor Matt Jones*



The goal of my research is to develop a mathematical and computational understanding of cognition. My interest is in the computational challenges faced by any intelligent agent (human or otherwise) in learning to behave in an environment that is uncertain, dynamic, and richly structured according to unknown principles or regularities. My approach thus draws on methods from machine learning, including control theory, kernel methods, and statistical inference. I use these tools to develop models of cognitive processing, which I test against human behavioral data collected in my laboratory. In some cases the models are also informed by and tested against neural data.

My primary psychological interests lie in learning and representation. Cognitive science has several mature models of learning that explain many aspects of human behavior and that show impressive performance in artificial agents. However, their performance and match to human data both depend critically on the representation on which the learning algorithms are assumed to operate. Representation can be thought of as how information is encoded, the brain’s internal model of stimuli or events that captures principles of organization in the world. Much of the power of human intelligence—and many of the most important open questions in cognitive science—lies in how people learn new representations or adapt their representations to suit the task at hand. There is thus an intimate connection between learning and representation, which motivates my primary research questions: *Representation learning*: How do people develop or construct new representations that exploit structure in the task environment? *Representational flexibility*: How does a person adapt or select among previously learned representations to solve a given task efficiently? *Assessing representation*: How can we as experimenters determine what representation a subject is using in a given task?

I study these questions in a wide range of domains, showing how shared theoretical principles can inform diverse forms of cognitive function, including basic perception, motor control, sequence learning, decision-making, concept learning, and abstract reasoning. In the long term I hope this research will help lead to better educational and training methods, and possibly contribute to development of artificially intelligent systems.

Faculty News



In September 2014, **Professor Yuko Munakata** was named a winner in the Best Digital Data Management Plans and Practices Competition, Life Sciences category, sponsored by CU-Boulder's Office of the Vice Chancellor for Research. Also, in November 2014, Professor Munakata was a plenary speaker at a Science of Learning workshop in Fort Worth, Texas. Her talk was entitled, "Developing Inhibitory Control."



Professor Marie Banich was named the editor of The Psychonomic Society journal *Cognitive, Affective, & Behavioral Neuroscience*. She started her four-year term in January 2015. To read more, see www.psychonomic.org/new-editors.

Senior Instructor David Allen was included by ASSETT (CU's Arts and Sciences Support of Education Through Technology) in their web series highlighting best practices in teaching large introductory level courses. This series consists of short video clips and examples of effective teaching methodologies. Dr. Allen's videotaped interview is available through the ASSETT website (<http://asset.colorado.edu>).



Professor Bob Spencer and **Associate Professor Sona Dimidjian** received College Scholar Awards for 2015-16 from CU's College of Arts and Sciences. These awards, chosen by Arts and Sciences College Professors of Distinction, enable professors to pursue full-time research for one semester. Professor Spencer studies the neurobiology of psychological stress and its interaction with circadian control of prefrontal cortex brain function. Professor Dimidjian's research addresses the treatment and prevention of depression, with a particular focus on the mental health of women during pregnancy and postpartum.



Associate Professor Josh Correll received one of the CU-Boulder Provost's 2014 Faculty Achievement Awards. This award is "presented annually to selected faculty who have offered recent significant publication or creative contributions in their academic fields."



New Faculty



August 2014—**Assistant Professor McKell Carter**, cognitive psychology; PhD 2006, California Institute of Technology. He was previously a senior research associate at the Center for Cognitive Neuroscience at Duke University. His research applies computational methods to understanding the social aspects of decision making and the neural structures that support them.

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CRJP Reunion



The group of researchers who originally formed CU's Center for Research on Judgement and Policy (CRJP) in 1976 wanted to promote interdisciplinary interaction and collaboration among researchers of human judgment, particularly related to public policy. CRJP continues this task under the directorship of Professor Leaf Van Boven. The original members of the Center reunited for an informal lunch in honor of the 98th birthday of Professor Ken Hammond (seated in the picture above). Other founding members are, standing from left to right, Professor Gary McClelland, Professor Jeryl Mumpower, and Professor Tom Stewart.

Undergraduate Research: Talia Scott

Talia Scott is a young scientist who completed a double major in Neuroscience and in Molecular, Cellular and Developmental Biology in December 2014. After graduating, Talia felt compelled to develop her research skills and committed to improving the lives of those suffering from mental illness.

Talia's interest in research was piqued her freshman year when she enrolled in an honors class entitled Philosophy and Psychology in which she read many neuroscience-based research papers. "I became curious and figured that research would be a way to satisfy my curiosity," she says.

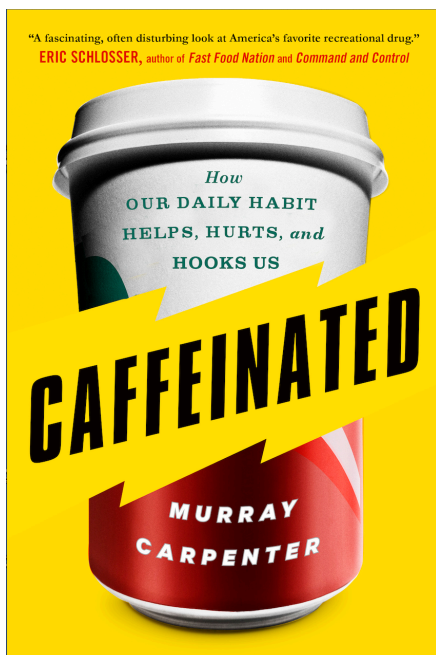
Volunteering in Assistant Professor Ryan Bachtell's lab provided Talia with hands-on research experience and led to her senior year honors project entitled "The Effects of Adolescent Caffeine Consumption on Anxiety and Stress Behavior in Adulthood." Talia was interested in assessing how early life drug exposure affects the way the brain responds to psychological challenges in adulthood. In her research, she observed how caffeine consumption in an adolescent rodent population influenced the activity of different brain regions involved in anxiety and stress responsiveness. The results of her research indicate that caffeine consumption in adolescent rodents has long-lasting effects on the brain to increase anxiety when the rodents become adults and are no longer consuming caffeine.

Talia's experience in the Bachtell Lab broadened her curiosity and influenced her exploration into research involving human subjects. To gain experience prior to attending medical school, she now works as a research assistant in Assistant Professor Vijay Mittal's ADAPT (Adolescent Development and Preventive Treatment) Lab in the Department of Psychology and Neuroscience. The research focus of ADAPT is to develop an early identification program aimed at examining markers of susceptibility for the onset and course of serious mental illness, such as schizophrenia. With the eagerness of an inspired scientist, Talia affirms, "My goals are to earn an MD-PhD dual degree and to work in a research hospital." –Kate Bell



Book Review

Caffeinated – A New Book by Alumnus Murray Carpenter



Caffeinated: How Our Daily Habit Helps, Hurts, and Hooks Us, a new book by alumnus Murray Carpenter (class of '85), is an enjoyable, informative read. The breadth of the subject matter covered in this book (history, politics, biochemistry, physiology, marketing, cognitive science, and more) is mind-boggling; the author touches on an astounding range of topics, all with grace, a fetching sense of humor, and sometimes gut-wrenching candor. The basic question of the extent to which caffeine, a drug used extensively by billions of people all around the globe, is beneficial or harmful, is addressed in the most detailed and variegated way. But the author wisely ends the book without a clear-cut answer, leaving final decisions up to the reader.

Despite its chatty, informal journalistic style this book is a treasure-trove of carefully researched assertions, many of which would appear to be almost scandalous or even libelous if not supported by painstaking investigative reporting and scholarship. Indeed the fast-moving, readable style is highly unusual for a work that is so carefully documented.

This useful compendium deserves to become the standard work to which anyone interested in making decisions about the use of caffeine should turn, whether athlete, physician, regulator, law-maker, teenager, or habitual coffee drinker. It is a scholarly and journalistic tour de force. Our department should be proud one of its graduates has generated such a fine product.

–Professor Emeritus Michael Wertheimer

Alumni Spotlight: Lynn Daniels, Class of '97



Lynn Daniels has come full circle since she completed her psychology degree in 1997. Now a massage therapy instructor with a thriving private practice, she remembers well the long journey that began as a student at CU.

Though she started her education in the early eighties as a pre-med student, she didn't finish until fifteen years later as a psychology major. In between, she got a job in sales and marketing, working her way up the corporate ladder. One day she took a hard look at her place in that fast-paced, high-pressured environment and decided she was on the wrong track. So she returned to school to complete her degree.

With pre-med out of her system, the field of psychology was a more natural fit. After all, her father was a psychiatrist and her mother a psychiatric nurse. When she took psychology classes, she felt exhilarated by the atmosphere of inquiry and questioning. In her final semester, she took a class in health psychology that excited her most of all. This led to a rewarding internship compiling data at CU's former Health Sciences Center.

Interestingly enough, this internship experience precipitated a major career crisis for Lynn. On one hand, she felt inspired to go into health psychology as a researcher. "I took the GRE and was applying to doctoral programs. But I was dragging my feet filling out applications and thinking about so many more years of school," she remembers. "If I'd done this as a young adult, it might have happened. But at age 41, I felt like I just couldn't do it."

Her boyfriend at the time (now her husband) suggested a career in therapeutic massage. As a construction worker whose achy back benefitted greatly from her hands-on work, he knew better than anyone that she would excel in the field. He was right. After researching massage schools and finding a good fit at the renowned Boulder College of Massage Therapy (BCMT), Lynn decided to give it a try after graduating from CU.

"I devoured massage school!" Lynn says. Taking as many electives and advanced trainings as she could, specializing in Shiatsu (a Japanese form of bodywork), Lynn graduated from massage school and went to work as a massage therapist in a hospital—a happy return to her earlier interest in medicine and health psychology. Well known as a gifted practitioner, she was asked to teach at BCMT and also at a local acupuncture school. She's been a massage therapy instructor at various local schools ever since and currently teaches at the Academy of Natural Therapy in Greeley. Lynn also has a flourishing private practice in Brighton that allows her to integrate many aspects of her massage and psychology training.

In her teaching, she often finds herself including principles in her massage classes that she learned as a psychology student. In fact, she remembers her influential psychology courses clearly. In Professor Jerry Rudy's class, Psychology of Learning, she learned the essentials of how to understand and analyze research, skills that she passes on to her students when teaching medical massage. In Behavioral Neuropharmacology, Professor Al Collins challenged her to think for herself and synthesize facts into new theories, something she encourages her own students to do. And Professor Steven Maier's class, Seminar in Critical Thinking in Psychology, continues to resonate with her because of its focus on theories of learned helplessness. "Those theories have greatly helped me in teaching," she says, "particularly right now when I'm teaching many at-risk students

who are Hispanic and single mothers, in addition to students who are in work-release programs from jail. They're people who have had difficult lives. Understanding them from this perspective allows me to bring out their confidence in themselves and the world."

Ever the enthusiastic learner, Lynn is now considering going back for a master's in counseling psychology or education. She hopes to teach at the community college level, believing that this is where massage therapy training is headed. "I love exactly where I'm at," she says. "I don't ever see myself retiring. I can see myself teaching when I'm 85! One of my students in massage school just graduated at the age of 75. I want to be just as open and inquiring at that age, too." —*Alicia Segal*





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