Babies’ brains undergo dramatic changes in the womb and during the first months of life, yet not much is known about how the mental health of expectant mothers shapes the brain development of their infants. This gap in knowledge has inspired new research at the Center, which has begun to study the relationship between depression and anxiety symptoms in expectant mothers and how those symptoms are related to their infants’ brain development.

The brain can be thought of as a computer of sorts, with hardware, software and lots of wiring. The brain’s wiring — called “white matter” — forms connections needed for neurons and other signals to move quickly through different areas of the brain. At birth, babies don’t have much white matter, but after birth, white matter development explodes, making the first months after birth a critical time for brain maturation.

Early results from the Center’s research suggest that mental health symptoms of mothers during pregnancy may affect the quality of white matter development in their infants’ brains well after birth. “The most surprising aspect of these studies is that we are beginning to see that brain development doesn’t just happen after birth and that we can influence those very early processes of brain development still in utero,” says Doug Dean, a postdoctoral research associate leading the work. “As a result, we can better understand how the brain develops.”

Dean and scientists on the team are also finding that the areas of the brain where white matter is affected the most — like the superior longitudinal fasciculus, critical for establishing connections with brain regions involved in various cognitive and emotional processes — are the same areas negatively affected by depression and anxiety later in life.

The team hopes to learn whether interventions, including mindfulness-based training, could affect mothers’ symptoms and babies’ brain development. These brain areas have been shown to play a role in negative reactivity, emotional and behavioral difficulties, lower verbal IQ and even physical health problems later in life.

The findings — originally supported by the National Institute of Mental Health — fit into a larger, more comprehensive view of how poverty affects the development of their infants.

When I do analyses on studies at the Center, I apply the best and most rigorous methods and spend a lot of time making sure we know how we’re doing and go beyond typical rules of thumb. I really like to open and look under the hood and understand what’s happening with the data. Pursuing such sensitivity and specificity is necessary and extremely important for me to be able to call my work “science.”

Are we closer to understanding how the brain works? It’s hard to make definitive statements about the brain without being comprehensive — i.e., combining lots of different measurements. Only then, can we really establish the relationships between the brain and high-level behavior. I use techniques from machine learning, statistics and MRI signal processing. I also focus on analyzing diffusion weighted MRI and T1-weighted MRI, which are techniques that offer excellent white and gray matter “fingerprints” in the brain respectively. Modern artificial intelligence is another area that can help make sense of the information we collect.

How has your upbringing shaped you and your collaborators on the cusp of discovering? I’ve done research on a variety of conditions like autism and anxiety, but lately I’ve been collaborating more directly with research groups focused on Alzheimer’s disease. We’re using math and differential geometry to develop and test new prognostic and detection tools. Early detection of the disease is ideal for effective interventions, but this is where simply scanning the brain falls short. Using tools from mathematics gives you specialized microscopes that can find fainter yet persistent correlations, and hopefully detect the disease at an earlier stage.

Consider supporting this research and other projects with a gift to the Center for Healthy Minds. Contact Liz Vanderwerff at liz@hminnovations.org or visit go.wisc.edu/supportCHM.
SCIENCE WITH HEART
Center Director and Founder Richard Davidson was among a panel of experts who issued the first-of-its-kind recommendation that meditation may decrease the risk of heart disease. The recommendation, released by the American Heart Association, was estimated to have reached 409 million people.

MINDFUL POLICING RESEARCH
A new $616,000 grant from the National Institute of Justice delves deeper into the effectiveness of an eight-week mindfulness-based program on police well-being and brings into the fold new collaborators with the UW-Madison Police Department and the Dane County Sheriff’s Office in addition to the Madison Police Department.

MORE RIGOR NEEDED IN MINDFULNESS STUDIES
A recent article from Center collaborator Simon Goldberg puts the spotlight on the need for more rigorous research into mindfulness-based interventions. Analyzing 142 studies between 2000 and 2016, the team noted modest improvements in study design. The paper, published in the journal *PLOS ONE*, is one of several studies at the Center looking at ways to improve the quality of research.

DAVIDSON ELECTED TO NATIONAL ACADEMY OF MEDICINE
Richard Davidson has been elected as a member of the National Academy of Medicine, the premier authority dedicated to the health and medical sciences. The academy awards this honor to the world’s top experts who demonstrate outstanding professional achievements and commitment to service in the field.

supporter spotlight: sara flitner
When Center friend and supporter Sara Flitner first took office as the mayor of Jackson, Wyoming, in 2015, she knew the job would be anything but easy.

“My first year as mayor was the most challenging year of my life. I had a front row seat to the divisiveness, the pain of lots of ‘unseen’ people, the incivility based in fear. The issues were real — lack of housing, a huge economic gap, off the charts teen substance abuse and suicide rates. We’ve all watched the level of dialogue and connection erode in real time as a result of fear, vulnerability in communities and the tragedy of natural disasters. The solution to these vexing problems lies in the science and art of increasing our understanding of our own skills and ways we can use our minds and brains more effectively. The neuroscience contributions of the Center not only armed me with real problem-solving strategies, but they served as a point of entry among constituents who were hijacked by their own emotions.” — Sara Flitner

Sara’s current focus is to help organizations, communities and leaders become more effective in cultivating foundational skills such as self-awareness, empathy and the ability to focus. We’re grateful for Sara’s leadership and are inspired by how Sara and so many others in our community are transforming the world into a kinder, wiser, more compassionate place.