[GRADUATE STUDENT *Spotlight*]

REVEALING HOW THE BODY HELPS TO SHAPE EMOTIONS

Ever since the functions of the autonomic nervous system were discovered, researchers have recognized that the peripheral nervous system plays a role in feelings and behavior. Organisms utilize sympathetic and parasympathetic branches to generate and regulate physiological arousal as they react with the threats, challenges, and triumphs in their surroundings. Hormones, such as glucocorticoids like cortisol, also assist in these peripheral responses to the environment.

"However, there are still a lot of things we don't know about how the body's current state may shape our subjective feelings," explains Jennifer MacCormack, a fifth year graduate student in Social Psychology. She first became interested in how the body might matter for emotions and social cognition as an undergraduate. Working in a laboratory that studied how parents teach children about emotions, MacCormack noticed that some parents talked about bodily sensations while explaining their feelings and wondered if parental knowledge of the physical phenomenon of emotions might predict their children's socioemotional competence. She tested this theory for her honors thesis and discovered that these parents' children were better at regulating their emotions, were more empathetic and sociable, and exhibited fewer internalizing and externalizing behaviors in academic settings. MacCormack says, "I was shocked by how much we still don't know about individual or developmental differences in body awareness for emotion. I decided to research exactly how the body can be a powerful force in shaping people's emotional experiences and outcomes."

Since coming to Carolina, MacCormack has built a research program centered around how the body's state – autonomic responses to stress, hunger, or illness as well as the aging of the peripheral nervous system – can shape people's emotional experiences and, in turn, how internal body awareness moderates these effects. One thread of her research examines interoceptive ability, the perception of internal visceral changes, such as noticing an increase in heart rate. Research indicates that some people are more objectively accurate at detecting their internal bodily changes. "I'm particularly curious about how interoception might interact with autonomic reactivity and how it drives individual difference in emotion," says MacCormack. In a recent study examining 100 young adults, ages 17-24, MacCormack measured electrocardiography, impedance cardiography, and blood pressure while participants undertook a stressful task, which elicited autonomic reactions and negative emotions. Although analysis is still in progress, MacCormack expects that autonomic reactivity will predict the intensity of the self-reported emotions during the task and that interoceptive ability should moderate this intensity.

Everyday changes that everyone experiences, such as hunger, fatigue, and inflammation, can feed into our peripheral and central nervous systems to impact emotions. Correlational research has shown that hungry individuals are more likely to be aggressive, like the pop culture idea of feeling "hangry," however, there is no direct evidence that hunger shifts people's emotions. Over three studies, MacCormack discovered that hunger can impact how people are feeling and construing the world around them, but with two caveats: what context people in and how aware they are of these feelings. Hungry people who weren't thinking about their emotions were more likely to report feeling hateful, stressed, and other high arousal negative emotions in a frustrating situation compared to hungry people who had been primed to think about their emotions. "It really seems to be something about hunger that amps up negativity when elicited by an unpleasant or negative situation," says MacCormack. "I found that hunger really only seems to feed into people's emotions when they are unaware of their feelings, which is particularly interesting because it suggests we may have some control over how these body states drive our emotions and resultant behaviors."

MacCormack is also curious about how aging of the peripheral nervous system sensitivity and function can affect how the brain represents emotions and shapes older adults' emotional lives and well-being. Funded by a National Institute of Aging fellowship, she plans to use functional magnetic resonance imaging (fMRI) to test if limbic and paralimbic regions in the brain will be less activated or functionally connected during older adults' emotions relative to younger ones. By having participants complete emotion induction tasks in the fMRI scanner, MacCormack will be able to assess age differences in functional activity and connectivity in the brain during emotions. "I always wonder how the things I'm studying might vary or change at different stages of life. Aging naturally provides a glimpse into the underlying mechanisms of a construct, as you watch that phenomenon change over time," explains MacCormack. "This work could be informative where older adults' emotions are at play, including mood disorders, financial and health decisions, and their relationships with loved ones and caregivers."

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— JENNIFER MACCORMACK