

Marquette University: Biological sciences professor receives NSF grant to study behavioral and physiological reactions to climate fluctuations

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MILWAUKEE — [Dr. Chelsea Cook](#), assistant professor of biological sciences in Marquette University's Klingler College of Arts and Sciences, has received a \$754,826 grant from the National Science Foundation to study the behavioral and physiological response of animals to manage daily and seasonal environmental fluctuations such as temperature changes.

Her project "Balancing Social and Ecological Information to Collectively Manage Dynamic Environments" will identify the mechanisms that honeybees use to sense environmental fluctuations, how their brains change in response to this information, how they communicate this information, and how entire colonies regulate temperature when information changes.

"Animals, whether behaviorally or physiologically, manage daily and seasonal environmental fluctuations, such as temperature changes, by using receptors on their bodies. For social animals, individuals often work together in a group to manage these fluctuations much more effectively, such as through huddling, yet little is known exactly how animals accomplish this," Cook said. "This research will

provide critical knowledge about how complex animal systems manage dynamic environments, identify gene and sensory pathways that mediate effective responses, and generate hypotheses about how animal groups may manage global climate change.”

Cook’s research team will look at honeybees, which must maintain 34°C/93°F in their colony, or risk death of their developing brood. In the summer, honeybees engage in a cooling behavior called “fanning,” where they fan their wings to circulate air to cool the colony. Fanner honeybees utilize both information from their nestmates and information from their ecological environment to collectively thermoregulate.

The fanning response shifts when the social and thermal information changes. Isolated individuals rarely fan, while groups of 10 bees are more likely to fan and fan closer to ideal colony temperatures. The ways in which individuals or groups perceive, integrate or communicate about these changes to behave collectively is unknown. The aims of this project are to study the behaviors on a social, genetic and cellular level, while evaluating colony-level fanning response in a changing environment.

“This grant is a well-deserved honor and an exciting opportunity for Dr. Cook, and we are thrilled for her and the other members of her lab,” said [Dr. Heidi Bostic](#), dean of the Klingler College of Arts and Sciences. “Her research will transform understanding of how organisms collectively manage the dynamic environment around them. This project will also benefit the community through extensive outreach that is an excellent testament to Marquette’s values.”

The project will engage several stakeholders in the community with ambitious initiatives to develop a local prison beekeeping program and provide tangible workforce skills for inmates; introduce underrepresented middle school students and parents to STEM research; and engagement with local beekeeping and ecology

organizations. At Marquette, undergraduate, graduate and postdoctoral scientists will be trained and supported in cutting-edge research and outreach techniques.