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**“Neural Circuits for Maternal Thermoregulatory  
Behaviors”**

By

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10:00 A.M.

Medical Science Building, H-609 conference room

Join Zoom Presentation:

<https://rutgers.zoom.us/j/96237403376?pwd=k8ExlyovnpV3ZrJdtZa6SZ5E8DrpyL.1>

Meeting ID: 962 3740 3376

Password: 198936

## ABSTRACT

Endothermic organisms developed complex physiological and behavioral adaptations to regulate body temperature. In many species, including mice, additional behaviors emerged in adults to maintain constant body temperature of poikilothermic infants. These thermoregulatory behaviors are an essential part of maternal care, and critical for survival of neonates. Using a mouse model, we characterized adaptations in maternal behavior during either decreases or increases in ambient temperature. Both dams and naïve virgins (female alloparents) shepherd one another towards pups in the nest more in cold temperature (CT) compared to room temperature (RT), thermoneutral temperature (TN), and warm temperature (WT) ( $r = -0.52$ ,  $p = 0.0002$ ). Both maternal caregivers built the largest nests in CT and smallest nests in WT ( $r = -0.76$ ,  $p < 0.0001$ ), and spend more time in nest as the ambient temperature decreases ( $r = -0.56$ ,  $p < 0.0001$ ). Ambient temperature also modulates pup retrieval in virgins, as they fail to retrieve pups the most at WT ( $p = 0.017$ ). To determine if thermosensory mechanisms could contribute to maternal thermoregulatory behavior, we tested maternal care in TRPM8 knockout mice (TRPM8<sup>-/-</sup>) virgins, deficient in both cold and warm perception. We observed that TRPM8<sup>-/-</sup> females have deficits in all maternal thermoregulatory behaviors tested. TRPM8<sup>-/-</sup> virgins did not show significant temperature modulation in most maternal thermoregulatory behaviors tested except, they built larger nests in TN and WT compared to wildtype virgins.

Hypothalamic neurons expressing oxytocin and vasopressin (AVP) play an important role in the initiation and maintenance of maternal behaviors as well as thermoregulatory responses. We find that CT increases expression of a proxy for neural activity, *c-fos*, in PVN-AVP+ neurons ( $p < 0.0001$ ) in wild-type virgins. TRPM8<sup>-/-</sup> virgins had significantly fewer *c-fos* expressing PVN-AVP+ cells in CT ( $p < 0.0001$ ) and in WT ( $p = 0.0009$ ). Using a combination of anterograde trans-synaptic tracing and whole brain activity mapping, we identified several structures downstream of PVN-AVP+ that respond to CT (central amygdala, CeA) or to WT (medial preoptic area, ventromedial hypothalamus). Finally, optogenetic stimulations of PVN-AVP+ terminals in CeA revealed a role of the neural circuitry involving PVN-AVP+ neurons in maternal thermoregulatory behavior.