

Biology Seminar

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How does the brain know it's cold?



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Mammals maintain stable body temperature largely independent of the temperature of their environment and even small deviations from optimal internal temperature can threaten their survival. Thermoregulation critically depends on the ability to sense deep body temperature by the intrinsically warm and cold-sensitive neurons in the preoptic area of the hypothalamus (POA). However, the precise physiological roles of the temperature-sensitive POA neurons and the molecular mechanisms responsible for their temperature sensitivity are

poorly understood. To address these gaps, we developed an approach based on function-specific differential transcriptomics of mouse POA neurons and identified the CNGA3 ion channel as the putative cold sensor in the mammalian brain.

Unlike mice, hibernating mammals such as thirteen-lined ground squirrels can enter a prolonged state of torpor, characterized by a dramatic drop in the regulated level of body temperature, but its mechanisms remain poorly understood. We hypothesized that torpor may be facilitated by reduced cold sensitivity of the POA neurons in squirrels. Consistent with this hypothesis, we found that squirrels have a reduced number of cold-sensitive POA neurons compared to mice. Furthermore, we discovered that in contrast to its mouse ortholog, squirrel CNGA3 is cold-insensitive, which may explain the reduction in POA cold sensitivity and facilitate torpor.

