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ORAL PRESENTATION

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Cellular temperature compensation of sensory receptor neuron responses

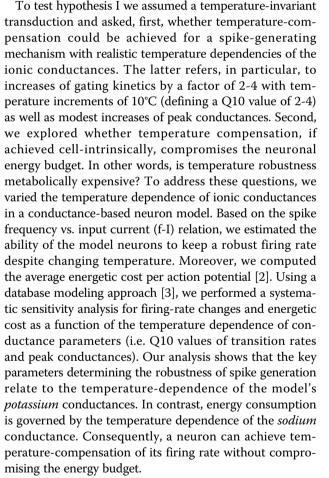
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Temperature is known to modulate ion channel kinetics and hence also action-potential generation. This poses a challenge for neural systems that need to retain their functionality also under conditions of varying temperature. Multiple strategies to counterbalance the effects of environmental temperature changes exist: mammals keep their body temperature approximately constant, while poikilothermic species need to implement temperature-compensation at the behavioral, systems, or cellular level. While mechanisms of behavioral and systems level have been identified [1], cellular mechanisms of temperaturecompensation as well as their associated metabolic cost remain largely unknown.

We investigated the effect of temperature on auditory processing in the grasshopper. We recorded intracellular responses of auditory receptor neurons to auditory broad-band noise stimuli at different intensities at two distinct behaviorally relevant temperatures. Interestingly, we found that changes in temperature did not have large effects on sound-intensity coding in receptor neurons. These neurons constitute the input layer of a feedforward network and hence do not receive network input. We concluded that the observed temperature robustness of receptor-neuron responses must arise from *intrinsic*, network unrelated effects.

In general, the receptor-neuron response is shaped by two processing steps: mechanosensory transduction and spike generation. Both can contribute to temperature compensation. Either both transduction and spike generation are compensated (hypothesis I), or alternatively, their temperature dependencies can cancel each other (hypothesis II).



To constrain hypothesis II, we used the experimentally observed f-I curves in an objective function and inferred the corresponding transduction process for each spike generation in our sensitivity analysis. Our results predict that thermosensitive Transient Receptor Potential (TRP) channels have a role in mechanosensory transduction at



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the grasshopper tympanum, and therefore motivate further experiments.

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References

- Robertson RM, Money TG: Temperature and neuronal circuit function: compensation, tuning and tolerance. *Curr Opin Neurobiol* 2012, 22:724-734.
- Hasenstaub A, Otte S, Callaway E, Sejnowski TJ: Metabolic cost as a unifying principle governing neuronal biophysics. PNAS 2010, 107:12329-12334.
- Prinz AA, Billimoria CP, Marder E: Alternative to Hand-Tuning Conductance-Based Models: Construction and Analysis of Databases of Model Neurons. J Neurophysiol 2003, 90: 3998-4015.

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