World Wide

NeuRise

Talks by rising stars of neuroscience

How does the metabolically-expensive mammalian brain adapt to food scarcity?

Zahid Padamsey - Rochefort Lab
(University of Edinburgh)

Information processing is energetically expensive. In the mammalian brain, it is unclear how information coding and energy usage are regulated during food scarcity. I addressed this in the visual cortex of awake mice using whole-cell recordings and two-photon imaging to monitor layer 2/3 neuronal activity and ATP usage. I found that food restriction reduced synaptic ATP usage by 29% through a decrease in AMPA receptor conductance. Neuronal excitability was nonetheless preserved by a compensatory increase in input resistance and a depolarized resting membrane potential. Consequently, neurons spiked at similar rates as controls, but spent less ATP on underlying excitatory currents. This energy-saving strategy had a cost since it amplified the variability of visually-evoked subthreshold responses, leading to a 32% broadening in orientation tuning and impaired fine visual discrimination. This reduction in coding precision was associated with reduced levels of the fat mass-regulated hormone leptin and was restored by exogenous leptin supplementation. These findings reveal novel mechanisms that dynamically regulate energy usage and coding precision in neocortex.

Event link:
https://www.crowdcast.io/e/wwneurise/