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Energy use & synaptic transmission: A review

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Enormous progress has been made in recent decades in our understanding of synaptic transmission and its use-dependent plasticity. The development of new tools, in particular in molecular genetics, structural biology, electrophysiology, and imaging has led to a detailed understanding of key phenomena, such as the Ca^{2+} triggering of neurotransmitter release and some of the key mechanisms underlying synaptic plasticity. We will review how most brain energy is used on synapses, investigate how pre- and postsynaptic terminals are optimized to maximize information transmission at minimum energy cost, and assess how ATP provision to synapses is regulated to satisfy their energetic needs. We then consider how synapse energy use changes with development and synaptic plasticity, and between awake and sleep states.

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