# ABSTRACT


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| Title: | Examining bone morphogenic protein (BMP) as a dynamic membrane voltage sensor at the Drosophila neuromuscular junction |
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| Year: | 2023 |



Synaptic activity is the basis of neural communication and functions. Changes in a neuron's electrochemical environment can affect synaptic function and morphology. This can be linked to secondary changes in neural network structure and plasticity, which are crucial for maintaining adaptive neural functioning. However, possible molecular mechanisms by which neurons recognize, respond, and adapt to acute changes in membrane voltage to maintain electrical homeostasis have not been fully elucidated. Bone morphogenic protein (BMP) signaling is a pathway of interest, as it relays information regarding postsynaptic neuronal activity to the respective presynaptic neurons to modulate synaptic development and function. Previous work has suggested that pMad, the effector molecule of BMP signaling, may function as a sensor for changes in membrane voltage. Before investigating which types of voltage changes may affect BMP signaling, methods for successfully changing membrane excitability must first be explored. To do so, potassium ion channel (Kir2.1 and ShakerDN) or ionotropic glutamate receptor (GluRIIA) expression in muscles was altered using a Drosophila melanogaster model and basic genetics. Intracellular electrophysiological recordings of miniature excitatory junction potentials (mEJPs)—the cell's spontaneous, brief depolarizations in response to the release of a single vesicle of excitatory neurotransmitters—were performed and analyzed using Python programming language. Comparisons of the amplitudes and frequencies of mEJPs from experimental crosses to those of wild-type controls revealed a significant increase in mEJP frequency in GluRIIA mutants and a significant decrease in mEJP amplitude in Kir2.1 mutants. Synaptic pMad quantities were assessed from dissected and immuno-stained Drosophila body wall muscles after confocal imaging. The mean intensity of pMad in Kir2.1 mutants was significantly reduced but no change was found in pMad accumulation at the GluRIIA NMJ, indicating that pMad may function as a glutamate-independent membrane voltage sensor.