Dietary polyphenols enhance optogenetic recall of fear memory in hippocampal dentate gyrus granule neuron subpopulations

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Dietary polyphenols have been investigated for their role in promoting memory in model systems of stress, but little is known about select subpopulations of neurons that are influenced by polyphenols to improve memory performance. Granule neurons in the hippocampal dentate gyrus are vulnerable to stressors that impair the functioning of contextual memory and can be influenced by dietary polyphenols. We utilized a c-fos-tTA/TRE-ChR2 optogenetics model in which neurons activated during fear learning are labeled with ChR2-mCherry and can be optically reactivated in a different context to recapitulate the behavioral output of a related memory. Treatment with dietary polyphenols increased fear memory recall and ChR2-mCherry expression in dentate gyrus neurons in the same animal, suggesting that dietary polyphenols promote recruitment of neurons to a fear memory engram. We show that dietary polyphenols promote memory function and offer a general method to map cellular subpopulations influenced by dietary polyphenols, in part through the mechanism of c-Fos expression enhancement.