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Implication of GluR2 subunit of AMPA receptor in RGS14(414)-mediated memory enhancement

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Ongoing quest for finding treatment against memory loss seen in aging and in many neurological and neurodegenerative diseases, so far has been unsuccessful and memory enhancers are seen as a potential remedy against this brain dysfunction. Recently, we showed that gene corresponding to a protein called regulator of G-protein signaling 14 of 414 amino acids ($RGS14_{414}$) is a robust memory enhancer (Lopez-Aranda et al. 2009: Science). $RGS14_{414}$-treatment in area V2 of visual cortex caused memory enhancement to such extent that it converted short-term object recognition memory (ORM) of 45min into long lasting long-term memory that could be traced even after many months. Now, through targeting of multiple receptors and molecules known to be involved in memory processing, we found that GluR2 subunit of AMPA receptor might be key to memory enhancement in RGS-animals. RGS14-animals showed a progressive increase in GluR2 protein expression while processing an object information which reached to highest level after 60min of object exposure, a time period required for conversion of short-term ORM into long-term memory in our laboratory set up. Normal rats could retain an object information in brain for 45min (short-term) and not for 60min. However, RGS-treated rats are able to retain the same information for 24h or longer (long-term). Therefore, highest expression of GluR2 subunit seen at 60min suggests that this protein might be key in memory enhancement and conversion to long-term memory in RGS-animals. In addition, we will also discuss the implication of Hebbian plasticity and interaction of brain circuits in memory enhancement.

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