

NMDA Mediated Contextual Conditioning Changes miRNA Expression.

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Public Summary:

We measured the expression of 187 miRNAs using quantitative real time PCR in the hippocampal CA1 region of contextually conditioned mice and cultured embryonic rat hippocampal neurons after neuronal stimulation with either NMDA or bicuculline. Many of the changes in miRNA expression after these three types of stimulation were similar. Surprisingly, the expression level of half of the 187 measured miRNAs was changed in response to contextual conditioning in an NMDA receptor-dependent manner. Genes that control miRNA biogenesis and components of the RISC also exhibited activity induced expression changes and are likely to contribute to the widespread changes in the miRNA profile. The widespread changes in miRNA expression are consistent with the finding that genes up-regulated by contextual conditioning have longer 3' UTRs and more predicted binding sites for miRNAs. Among the miRNAs that changed their expression after contextual conditioning, several inhibit inhibitors of the mTOR pathway. These findings point to a role for miRNAs in learning and memory that includes mTOR-dependent modulation of protein synthesis.

Scientific Abstract:

We measured the expression of 187 miRNAs using quantitative real time PCR in the hippocampal CA1 region of contextually conditioned mice and cultured embryonic rat hippocampal neurons after neuronal stimulation with either NMDA or bicuculline. Many of the changes in miRNA expression after these three types of stimulation were similar. Surprisingly, the expression level of half of the 187 measured miRNAs was changed in response to contextual conditioning in an NMDA receptor-dependent manner. Genes that control miRNA biogenesis and components of the RISC also exhibited activity induced expression changes and are likely to contribute to the widespread changes in the miRNA profile. The widespread changes in miRNA expression are consistent with the finding that genes up-regulated by contextual conditioning have longer 3' UTRs and more predicted binding sites for miRNAs. Among the miRNAs that changed their expression after contextual conditioning, several inhibit inhibitors of the mTOR pathway. These findings point to a role for miRNAs in learning and memory that includes mTOR-dependent modulation of protein synthesis.

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