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Cocaine and amphetamine regulated transcript, type-2 vesicular glutamate transporter and calbindin co-expression define spiny stellate cells in layer IV of the granular cerebral cortex

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Microarray experiments from our laboratory identified cocaine and amphetamine regulated transcript (CART) as an estrogen-regulated cortical gene. The present studies addressed the anatomical location and functional phenotype of cortical CART neurons using immunohistochemical (IHC) and in situ hybridization (ISH) strategies. IHC and ISH studies localized CART expressing neurons in layer IV throughout the granular cortex of the rat. CART neurons were found to be distinct from GABAergic interneurons expressing glutamic acid decarboxylase-65 mRNA. Out of the Ca-binding proteins calretinin, parvalbumin and calbindin, CART neurons only expressed low levels of calbindin. ISH studies established that the distribution of CART/calbindin neurons was identical with that of VGLUT2 mRNA expressing cells in layer IV. Morphological studies with IHC determined that CART/VGLUT2/calbindin neurons correspond to spiny stellate cells known to establish local efferent cortical connections. Future studies will use electrophysiological tools to address the effects of CART on cortical neuronal functioning and molecular approaches to study the regulation of cortical CART expression under various physiological and pathological conditions.

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