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Immunohistochemical differences in the cholinergic system of two mice strains (DBA/2J and C57/BL6J)

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The two inbred mice strains DBA/2J and C57/BL6J are well known to neurobiologists for their marked genotype-dependent differences for phenotypes related to brain dopamine and opioid functioning. Under normal and experimental conditions they display different and often opposite behaviors and even respond differently to drug abuse treatment. The cholinergic-dopaminergic systems interactions are opposite in the two strains. Our previous study disclosed differences in the immunohistochemical organization of the dopaminergic system of DBA and C57. The hypothesis that genetically determined behavioral differences between the inbred mice strains may be also related to differences in acetylcholine presence in certain regions of the brain, has been tested. Therefore, a morphological study of brain cholinergic organization of these strains was performed by using choline acetyltransferase (ChAT) immunohistochemistry. ChAT, the synthetic enzyme of acetylcholine, has been widely used as a specific marker for cholinergic neurons. A new antiserum specifically recognizing the isoform of ChAT widely present in the central nervous system and named as ChAT of the common type (cChAT), has been applied. Cross-sectional areas of selected brain regions were analyzed and show clearly that cell density in cChAT-immunostained sections was lower in C57 mice in some specific forebrain areas. C57 mice represent a valuable model for studying the influence of genetic factors on central nervous system cholinergic mechanisms and the effects of genetically determined cholinergic deficiency on behavior and learning. These results are interpreted as being in agreement with previous reports on correlations between learning ability or locomotors activity and regional activities of cerebral cholinergic system of these inbred strains. Our findings indicated that the distinct genotype-dependent behavioral characteristic displayed by the two mice strains may have a documentable morphological basis. In addition demonstration of strain-specific differences in the organization of forebrain cholinergic system may have some important clinical implications in neurological diseases.