EXPRESSION AND LOCALIZATION OF INSULIN-RESPONSIVE GLUCOSE TRANSPORTER (GLUT4) IN RAT BRAIN

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Glucose is the major energy source for the brain, and thereby is very important for the maintenance of brain functions. Glucose transport across the cell membrane is mediated by specific transport proteins (GLUT). It has been reported that there are two isoforms of the glucose transporter in the brain, GLUT1 and GLUT3. GLUT1 is predominantly expressed in microvascular endothelium and glial cells, and GLUT3 in neuronal cells. In peripheral tissues, there are three isoforms of glucose transporter in addition to GLUTs1 and 3. Among them GLUT4 is most responsible for the insulin-induced acceleration of glucose transport. Considering recent reports about the existence of insulin in the brain, it is intriguing to investigate GLUT4 in the brain.

In this study, using Northern and Western blot analyses, I demonstrated that GLUT4 actually existed in various regions of the rat brain, especially in the cerebellum. *In situ* hybridization analysis revealed that GLUT4 was expressed in Purkinje's cells and granular cells in the cerebellum, and neuronal cells in the hippocampus, thalamus and medulla oblongata (vestibular nuclei), and also in ependymal cells along the cerebral ventricles. No signal was detected in the cerebral cortex. Thus, GLUT4 is present in certain limited cells in the brain and probably plays a significant role in glucose uptake in these cells.

The GLUT4 level in peripheral tissues is known to change in response to blood insulin and glucose levels. In this study, I confirmed that the GLUT4 level in white adipose tissue indeed decreased greatly in fasted or experimentally induced diabetic rats. However, the GLUT4 level in the brain was little changed in these animals. These results suggest that brain GLUT4 is regulated by a mechanism different from that for peripheral GLUT4.