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Compartmentation of glutamate metabolism observed with glucose / D. D. Clarke, E. Dicker & E.J. Ronan, Chem. Dept. Fordham University, Bronx, N.Y. 10458, U.S.A.

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COMPARTMENTATION OF GLUTAMATE METABOLISM OBSERVED WITH GLUCOSE -[2-^{14}C]. D.D. Clarke, E. Dicker & E.J. Ronan, Chem. Dept. Fordham University, Bronx, N.Y. 10458, U.S.A.

Compartmentation of glutamate metabolism in the central nervous system has been demonstrated in a number of laboratories using a variety of labeled precursors. The labeling of glutamine is much more rapid than would be expected if the total pool of glutamate in brain is the precursor of glutamine. An obvious suggestion for the origin of this compartmentation is that it reflects glial vs. neuronal relationships. Some evidence in support of this idea has been obtained by Rose using separated neuronal vs. neuropil preparations (J. Neurochem. 17, 809 (1970)). Until recently brain was the only tissue which, after the injection of a variety of labeled precursors, exhibited rather distinctly this compartmentation of the glutamate-glutamine system. This is measured by the relative specific activity (RSA) of glutamine (glutamate = 1) being greater than unity well before the specific activity of glutamate reaches a maximum value. Glucose was notable as a precursor which does not give RSA's of glutamine >1 in brain. We have confirmed this observation. However, we wish to report that in the livers and kidneys of mice injected i.p. with [2-^{14}C]-glucose the RSA of glutamine was much greater than unity within two to ten minutes after administration of the labeled precursor. A similar observation viz. that glutamine had RSA's >1 after addition of labeled glucose was made using platelets from humans by Puszkin et al. (J.Lab. Clin. Med. 74, 234 (1970)). It is therefore evident that compartmentation of the glutamate-glutamine system is not unique to brain. The nature of the compartmentation in brain is still distinctly different from that in other tissues. In addition, the relative homogeneity of cell types in liver and platelets make it likely that different cell types, as with neurons and glia, are not necessary for the compartmentation phenomena to exist. Rather this may correlate with the different populations of mitochondria in the brains of rats demonstrated by Neidle et al. (J. Neurochem. 16, 225 (1969)). While the possibility of similar differences in enzyme distribution as found in brain has not been examined in liver, some evidence for the heterogeneity of liver mitochondria as measured by the distribution of other enzymes has been reported by Swick et al. (Biochem. 6, 737 (1967). It is suggested here that differences of cell type are not a necessary condition for the compartmentation of the glutamate-glutamine system to be manifested but we do not wish to state that glial-neuronal relationships are not a factor in the behavior of the glutamate-glutamine system in brain. This work was supported by a grant from the National Institute for Neurological Diseases and Stroke (#07890) NIH.

Glutamate, Glutamine, Glucose, Liver, Brain.