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Extracellular Brain Glucose Levels Reflect Local Neuronal Activity: A Microdialysis Study in Awake, Freely Moving Rats

activity and extracellular glucose levels, as well as the effects of general anaesthesia. The changes in extracellular glucose content observed under these conditions are discussed with respect to the local coupling be-

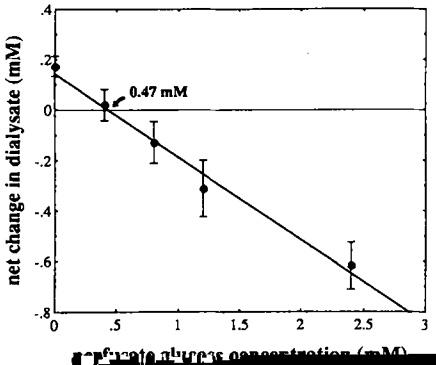
Probe construction

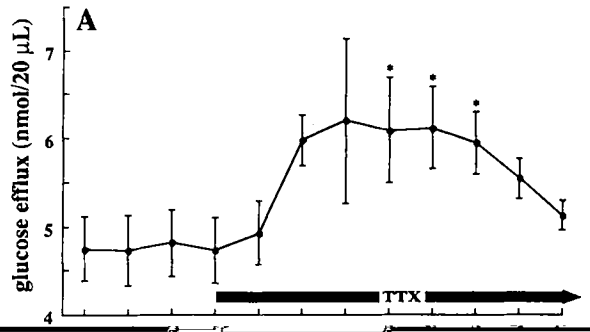
The microdialysis probes were of concentric design, constructed by inserting a plastic-coated silica tube (VS170/110; Scientific Glass Engineering) into a polyacrylonitrile

culating the perfusate concentration where no net influx or efflux would occur.

Drugs

TTX and veratridine were dissolved in artificial CSF and applied locally through the probe, at concentrations of 1 and 50 μM, respectively. Neither drug interfered with glucose detection at these concentrations. Chloral hydrate was administered at a dose of 500 mg/kg i.p. as a 10% (wt/wt) solution in water. Anaesthetized animals were maintained at 37°C by means of a heating pad, as described for the surgery, and the depth of anaesthesia was monitored by periodic testing of the hind limb withdrawal reflex.





nique for directly determining the extracellular glucose concentration in the awake and unrestrained rat. This gave an estimate of 0.47 m*M* for the ECF glucose concentration in the striatum.

To compare this value with other estimates, it was important to confirm that the dialysis probe was sampling from normal brain tissue. Disturbances in glucose metabolism have been found immediately following the implantation of microdialysis probes. However, within 2 h the BBB has resealed (Edvinsson et al., 1971; Benveniste and Hüttemeier, 1990), and at

The probe design used in the present experiments [redacted] Glucose levels vary with drug-induced neuronal [redacted]

Lönnroth P., Jansson P.-A., and Smith U. (1987) A microdialysis method allowing characterization of intercellular water space in humans. *Am. J. Physiol.* **253,** E228–E231.

Lund-Andersen H. (1979) Transport of glucose from blood to brain. *Physiol. Rev.* **59,** 305–352.

Morton D. B. and Griffiths P. H. M. (1985) Guidelines on the recognition of pain, distress and discomfort in experimental animals and a hypothesis for assessment. *Vet. Rec.* **116,** 431–436.

Osborne R. G., O'Connor W. T., Kehr J., and Ungerstedt U. (1991) utilization and transport and cortical function in chronic vs. acute hypoglycemia. *J. Neurochem.* **53,** 789–792.

Robinson P. J. and Rapaport S. I. (1986) Glucose transport and metabolism in the brain. *Am. J. Physiol.* **250,** R127–R136.

Siesjö B. K. (1978) *Brain Energy Metabolism.* John Wiley and Sons, Chichester.

Sokoloff L. (1981) Relationship among local functional activity, energy metabolism, and blood flow in the central nervous system. *FASEB J.* **40,** 2311–2316.