radioisotopic (Daly, 1972; McIlwain, 1974) studies. Thus the post-stimulation increase in synaptosomal cyclic AMP can most readily be seen as migration of the nucleotide, by intracellular or extracellular routes, from those localized sites, although there is also a possibility of adenosine as intermediate. Independently of route, the delayed increase in nerve-terminal cyclic AMP is significant in interpreting slow changes in potential and cell-firing which follow excitation in cerebral systems (McIlwain, 1976).

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The Effect of Amino Acids on Ouabain-Induced [45Ca]Calcium Ion Uptake into Slices of Rat Cerebral Cortex

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Taurine may interact with calcium in heart (Welty et al., 1976), muscle (Huxtable & Bressler, 1973) and brain (Kaczmarek & Adey, 1974). Izumi et al. (1975) have shown that the anti-convulsant effect of taurine, against seizures induced by pentylenetetrazole, was abolished by prior treatment with EDTA, whereas that of γ-aminobutyric acid was unaffected. Taurine has also been shown to be the most potent naturally occurring amino acid antagonist of seizures induced by ouabain (Barbeau et al., 1976). Ouabain stimulates 45Ca2+ uptake into slices of rat cerebral cortex in vitro, and the effects of amino acids on this stimulation were therefore examined.

The uptake of 45Ca2+ into 0.1 mm (i.e. 0.1 mm × 0.1 mm × 2 mm) and 0.4 mm (0.4 mm × 0.4 mm × 2 mm) slices of rat cerebral cortex was measured in the manner described previously (Riddall, 1977). Slices were preincubated at 37°C for 15 or 30 min in the presence of amino acids, and portions (equivalent to 20 mg wet wt.) of this suspension were transferred to Tyrode medium containing 0.1 mM-ouabain, the amino acid under test and 1.78 μM-45Ca2+ (0.1 μCi/ml). Flasks were incubated for various times and uptake was terminated by the addition of 1 ml of quench solution (24 mM-EGTA/Tris/72 μM-Ruthenium Red in Tyrode medium). The suspension was immediately filtered under vacuum, washed and the resulting tissue sample was digested and counted for radioactivity by the method of Dent & Johnson (1974).

Ouabain (0.1 mM) stimulated 45Ca2+ uptake into both 0.1 mm and 0.4 mm slices, and increased the asymptotic uptake values for basal flux by 197% and 240% respectively (Table 1). Of the amino acids tested only taurine inhibited 45Ca2+ uptake, induced by 0.1 mM-ouabain, into 0.4 mm slices (Table 1). In 0.1 mm slices, however, glycine (50 mM) and β-alanine (50 mM) exerted an inhibitory effect on 45Ca2+ uptake stimulated by 0.1 mM-ouabain, but these effects were far less marked than those of taurine (Table 1).
Table 1. Effect of amino acids on ouabain-stimulated $^{45}$Ca$^{2+}$ uptake into slices of rat cerebral cortex

Slices were preincubated with amino acid for 30 min at 37°C. Portions of this slice suspension (equivalent to 20 mg wet wt.) were transferred to Tyrode medium containing 0.1 mM-ouabain, amino acid and 1.78 mM-$^{45}$Ca$^{2+}$ (0.1 μCi/ml). Incubations were continued for 10, 20, 40 and 60 min and the asymptotic uptake values were computed from three such experiments; each time point was measured in triplicate. *P<0.01 when compared with ouabain; †P<0.05 when compared with ouabain.

Asymptotic uptake values (±S.E.M.)
(μmol of Ca$^{2+}$ accumulated/g wet wt. of cortex)

<table>
<thead>
<tr>
<th>Slice size (mm)</th>
<th>0.1</th>
<th>0.4</th>
</tr>
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<tbody>
<tr>
<td>Basal</td>
<td>2.18±0.16*</td>
<td>4.46±0.26*</td>
</tr>
<tr>
<td>Ouabain (0.1 mm)</td>
<td>4.10±0.44</td>
<td>10.69±0.82</td>
</tr>
<tr>
<td>Ouabain (0.1 mm)+taurine (10 μM)</td>
<td>2.47±0.26†</td>
<td>10.60±0.95</td>
</tr>
<tr>
<td>Ouabain (0.1 mm)+taurine (25 μM)</td>
<td>2.28±0.2*</td>
<td>6.17±0.36*</td>
</tr>
<tr>
<td>Ouabain (0.1 mm)+taurine (50 μM)</td>
<td>2.04±0.2*</td>
<td>6.42±0.34*</td>
</tr>
<tr>
<td>Ouabain (0.1 mm)+γ-aminobutyric acid (50 μM)</td>
<td>3.13±0.27</td>
<td>10.58±1.58</td>
</tr>
<tr>
<td>Ouabain (0.1 mm)+β-alanine (50 μM)</td>
<td>2.78±0.43</td>
<td>10.29±0.17</td>
</tr>
<tr>
<td>Ouabain (0.1 mm)+glycine (50 μM)</td>
<td>2.66±0.23†</td>
<td>8.23±0.71</td>
</tr>
</tbody>
</table>

These results may therefore provide a biochemical basis for the role of taurine in the modulation of nervous function.


The Role of Trehalose in the Nutrition of the Locust Nervous System

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In the haemolymph of the locust (Schistocerca gregaria) the predominant carbohydrate is trehalose, with glucose present in much lower concentration. The actual concentrations in resting adult locusts in a colony maintained on a diet of bran were 54 and 4 μM, respectively. If the nervous system of the locust is as dependent on carbohydrate as is that of the mammal, then it would be expected that trehalose would constitute an important energy source for that tissue. During flight, however, the concentration of trehalose falls quite dramatically within 1 h (Mayer & Candy, 1969). Thus the contribution from trehalose might change depending on the physiological circumstances.

Trehalose is metabolized by being hydrolysed to two molecules of glucose by the enzyme trehalase. The glucose thus formed within the tissues would compete with the glucose from the haemolymph for hexokinase.