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The transport number of noradrenaline as a function of pH

A recent paper by Bevan, Bradshaw & others (1973) has expressed the view, supported by a theoretical calculation, that the transport number of noradrenaline in a solution at pH 5.0 is lower than that at pH 3.1, because of the addition of sodium and hydroxyl ions to the noradrenaline solution during the process of pH adjustment from 3.1 to 5.0. It appears that the authors have overlooked the consideration that because pH 5.0 is still in the acid range, there will be virtually no excess or free hydroxyl ions. Instead, all the added hydroxyl ions (from NaOH) will combine with the removed (buffered) hydrogen ions to form water. A number of sodium ions will be added to the noradrenaline solution equivalent to the number of hydrogen ions removed. This means that some hydrogen ions are replaced by much less mobile sodium ions when the noradrenaline solution is raised from pH 3.1 to 5.0, which would tend to increase the fraction of current carried by noradrenaline ions. In this pH range there is little change in percent of noradrenaline in the cationic form (Frederickson, Jordan & Phillis, 1972). Thus the transport number of noradrenaline at pH 5.0 should be the same or greater than the transport number of noradrenaline at pH 3.0.

The literature is of little use in deciding this issue because of the very wide range and overlap of values of transport numbers for noradrenaline ejection from micropipettes determined empirically (see below).

Source	pH	Concentration of noradrenaline	Transport number
Bradley & Candy (1970)	5.5	1% ($\approx 0.05M$)	0.09 (average)
Krnjević & others (1963)	not stated	10% ($\approx 0.5M$)	0.19 (average)
Hoffer & others (1971)	3-4	1.7M	0.34, 0.37, 0-0.07, 0-0.02*
	not stated	0.5M	0.05-0.30 (range)

*Values for four different pipettes

In our own experience, using solutions of (-)-noradrenaline bitartrate (Sigma, 0.2M) at pH values of 4.5, 5.0, 5.5, 6.0, 7.4, there is little difference between the distribution of effects (i.e. percentage of cortical cells depressed) or depressive potency of noradrenaline.

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