Bimodal effect of glycine on frog spinal motoneurones

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Glycine has been shown to have variable effects on the polarity of amphibian motoneurones as recorded from ventral roots of the isolated hemisected spinal cord (Tebecis & Phillis, 1969; Barker & Nicoll, 1973). In the present experiments regenerative activity in isolated frog hemicords was blocked with procaine which allowed the direct effect of glycine on the polarity of motoneurones to be measured. In such preparations it was found that glycine evoked either hyperpolarization or depolarization depending on the composition of the Ringer solution bathing the cord.

The standard Ringer solution contained (mM):– NaCl, 111; KCl, 2; $CaCl_2$, 2; Tris base, 10; glucose, 12; procaine HCl, 1; adjusted to pH 7.9 with HCl. With this solution, glycine (0.25-2 mM) regularly produced depolarization. Chloride-deficient Ringer ($NaMeSO_4$, 111 mM; $KMeSO_4$, 2 mM; $CaSO_4$, 2 mM) enhanced the depolarization caused by glycine. However, in potassium deficient (KCl, 0.5 mM) and sodium deficient (NaCl, 22 mM; choline chloride, 88 mM) Ringer solutions the depolarization caused by glycine was diminished and hyperpolarization often occurred.

Glycine also produced hyperpolarization when tested in the presence of a depolarizing concentration of L-glutamate (0.2-0.5 mM). The reversal of the response to glycine produced by L-glutamate could not have been due to depolarization alone because similar depolarizations produced by potassium chloride (4-10 mM, total KCl) did not cause glycine to hyperpolarize.

Strychnine (50 μM) increased glycine-induced depolarizations and converted glycine-induced hyperpolarizations into depolarizations.

Thus it appears that glycine has a strychnine-sensitive hyperpolarizing action and also a depolarizing action which may be mediated by different receptors on the motoneurone. It is probable that the hyperpolarizing receptor is activated by β-alanine and taurine in addition to glycine because these amino acids also have hyperpolarizing actions which are blocked by strychnine.

References

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Extracellular and intracellular effects of procion brilliant red H3BN on mammalian muscle fibres

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The interpretation of the physiological and pharmacological properties of muscles from animals suffering from the degenerative diseases of muscle is hindered by the occurrence of severely damaged and normal fibres within the same muscle. One approach to overcoming this obstacle would be to mark individual fibres with a stable dye during an experiment and subsequently to isolate these fibres for morphological and histochemical examination.

The Procion dyes (Stead, 1973), and particularly Procion Yellow, have been widely used for marking nerve cell processes, but not extrafusal muscle fibres. Procion dyes are known to bind to cellular protein (Flanagan, Hesketh & Chung, 1974) but the possibility that they may alter the physiological characteristics of the exposed or injected cells has not been examined. It has, however, been suggested that Procion Yellow has local anaesthetic properties (Payton, 1970).

We have examined the effects of extracellular and intracellular Procion dyes on some properties of mammalian muscle. Procion Yellow MX4R, Procion Navy Blue H3R and Procion Brilliant Red H3BN have all been tested, but only Procion Brilliant Red was found to be routinely suitable for intracellular injection.

Experiments were carried out on isolated extensor digitorum longus, soleus and diaphragm muscles of normal rats and mice. The muscles were maintained *in vitro* at room temperature. The