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Mapping Noxious-Stimulus Evoked Activity in Dorsal Root Ganglia and in the Spinal Cord with Glycogen Phosphorylase Histochemistry

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13. Mapping noxious-stimulus evoked activity in dorsal root ganglia and in the spinal cord with glycogen phosphorylase histochemistry

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It is possible to distinguish histochemically the relative amounts of the active and inactive forms of glycogen phosphorylase in the spinal cord (Chong & Woolf 1984). Both primary afferent cell bodies in dorsal root ganglia and the cells of the spinal cord normally maintain most of their glycogen phosphorylase in the inactive *b* form. Noxious mechanical thermal and chemical stimuli result, however, in an increase in the proportion of active glycogen phosphorylase *a* in the dorsal horn. Innocuous stimuli, in contrast, fail to modify the level of glycogen phosphorylase activity in the spinal cord. Stimulation of the sciatic nerve at a strength that activates unmyelinated afferents produces a pattern of activity change in the spinal cord which closely resembles that found with noxious stimuli while A-fibre stimulation has no demonstrable effect. The increase in glycogen phosphorylase activity can be demonstrated within 5 min of sciatic nerve stimulation and the pattern and level of the activity changes are suppressed by barbiturate anaesthesia.

Exactly which cells are responsible for the change in glycogen phosphorylase activity and the mechanisms involved, are not certain. The finding that the number of small diameter primary afferent neurons in dorsal root ganglia with the active form of glycogen phosphorylase increases after noxious stimulation or C-fibre stimulation indicates that neurons do have the capacity to increase their glycogenolytic activity with increases in their electrical activity.

As the conversion of the *b* form of glycogen phosphorylase to the active '*a*' form is mediated by the enzyme phosphorylase *b* kinase, which in turn is activated by calcium of cyclic AMP, it is possible that it is the influx of Ca^{2+} with activity that produces the changes found histochemically. This hypothesis is supported by the discovery that axotomized motorneurons which begin to develop calcium dendritic spikes, also have very high levels of glycogen phosphorylase *a* (Woolf *et al.* 1984).

References

Chong, M. S. & Woolf, C. J. 1984 *J. Physiol., Lond.* **349**, 37*P*.
Woolf, C. J., Chong, M. S. & Ainsworth, A. 1984 *Neuroscience.* (In the press.)