AXOPLASMIC FLOW AND REGENERATION

by

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Contents

SUMMARY

After spinal and sciatic nerve crush there is a large increase in ACHE just proximal to the crush. This is due to a local damming with a reverse flow of axoplasm back towards the cell body which is restricted to the region just proximal to the injury and is the same with a spinal nerve crush as with a more distally placed sciatic nerve crush.

Spinal nerve crush also produces an ACHE increase in the remaining more proximal region of the ventral root which is temporally coincident with the damming just proximal to the crush, although less marked. This is interpreted as a backing up of ACHE which is reflected all the way up the short expanse of root between the cell body and the crush site. The most proximal segment gives witness to the fact that there is during this time a decrease in cell body ACHE synthesis which eventually produces an ACHE decrease in all regions of the root proximal to the crush.

The lack of the early ACHE increase in the more proximal regions of the sciatic after sciatic nerve crush is explained by the backing up of axoplasm occurring over a longer expanse of axon, the ACHE increase thus being very small and unnoticed.

The above data indicate that there must be a rapid flow of membrane bound enzymes such as ACHE from the cell body down towards the synaptic ending. The rapid flow rate accounts for the inability to detect a P-D decline of ACHE in the nerve after crush as the cell body synthesis of ACHE falls to low levels.

Following the damming of ACHE there is a decrease to low levels which remains for an extended period of time, after which there is a slow

recovery as the axons reinnervate the muscles. The recovery of ACHE activity is more than 10 times slower than the decline seen after crush injury.

AP and BG increase markedly in the region just proximal to the spinal or sciatic nerve crush. This reflects besides damming an increased Schwann cell synthesis of such lytic enzymes in order to break down the myelin and axonal debris. This helps insure a clear path for axonal regeneration.