Anatomy and chemo-architectonics of the neural structures involved in the early stages of somato-sensory processing

We assessed the changes in a variety of molecular features of the target territories in the central nervous system (spinal cord, brain stem and sensory cortex) consequent to the implant and eventual nerve regeneration through it. We found that permanent transection of nerves, keeping them from regenerating, produces detectable changes in the molecular markers used in some or all of the target regions, specifically in those subregions representing the territory affected by the denervation. Most changes consisted in down-regulation or lower expression of the marker, but exceptions occurred, as is the case of over-expression of parvalbumin in the deafferented DCN, which built up with survival time. When transected nerves regenerated successfully through the sieve electrode most, but not all, of the changes were reverted -or did not occur altogether-. There seems to exist a direct relationship between the actual number of regenerating sensory fibres through the electrode and the expression of some markers in the target regions.

This relationship is probably complex, because it likely depends on the relative regenerative success of each kind of fibre subpopulation. An additional relevant conclusion was that the number of motoneurons in the ventral horn of the rat spinal cord never regained a normal structure, as revealed by Nissl (fewer motoneuron bodies) and AChE and ChAT (lower staining of cholinceptive/cholinergic and cholinergic markers, respectively), indicating less than optimal motor recovery. Finally, very long postimplantation survival times in cats showed fairly normal patterns of molecular expression at "early" stations of sensory processing, but various degrees of disorganization or down-regulation of the same markers in the somatosensory cortex, suggesting that regenerating failed to bring about nearly-complete recovery of the reorganized cortex: PV, CB or SS immunostaining was apparently normal in the neurons and neuropil of the dorsal horn of the spinal cord and the DCN, in rats and cats, after regeneration. In contrast, these three markers displayed various degrees of disorganization or down-regulation in the somatosensory cortex.