Cell Transplantation Strategies to Repair the Injured Spinal Cord

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The transplantation of peripheral myelin-forming cells such as olfactory ensheathing cells or Schwann cells can both encourage CNS axonal regeneration and form myelin. Peripheral myelin-forming cells derived from human sural nerve or "humanized" transgenic pigs may provide a valuable source of tissue for a cell-based therapy in multiple sclerosis and spinal cord injured patients. However, it is essential to show that these transplanted cells can regenerate and remyelinate axons in adult CNS and improve axonal conduction. Adult human OECs and SCs and those derived from humanized transgenic pigs were isolated and cyropreserved. Suspensions of reconstituted cells were transplanted into one of two model systems in the rat, 1) the x-irradiation/ethidium bromide lesioned dorsal columns of immuno-suppressed Wistar rat or 2) a mechanically transected dorsal column lesion. After 3-5 weeks in the first model system extensive remyelination with a typical Schwann cell pattern was observed in the lesion zone. In the second lesion (transection) numerous axons regenerated across the lesion for over 1.5 cm. The dorsal columns were removed and maintained in an *in vitro* recording chamber; the conduction properties were studied using field potential and intra-axonal recording techniques. The transplanted dorsal columns displayed improved conduction velocity and frequency-response properties, and action potentials conducted a greater distance into the lesion. These data support the conclusion that transplantation of either human peripheral myelin-forming cells or humanized transgenic pig cells results in functional regeneration and remyelination injured dorsal columns of the rat spinal cord, which is an important prerequisite for future consideration of these cells for a cell based therapy in humans.

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