**Iron-conjugated nanoparticles for the local delivery of neurotrophic factors.**

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Improvement of neural repair can benefit from the local of neurotrophic factor (NTFs). Unfortunately, the bioactivity of free NTFs is short. Therefore, we tested the possibility of stabilize NTFs with the conjugation to iron oxide nanoparticles (IONP). IONP have been used, *in* *vitro,* as a method of vehicling and releasing growth factors for stimulating axonal growth and the differentiation of glial cells, *in vivo*, in preliminary experiments to test the effect of conjugated NTFs on regeneration of the rat sciatic nerve after a sever segment loss.

In vitro, adult and neonatal rat sensory dorsal root ganglion neurons as well as the PC-12 cell sympathetic culture model system revealed a greater response in terms of stability and effect size when treated with factors conjugated to IONP. Experiments demonstrated that IONP-NTFs, after a two week-preincubation period, have a long-term bioactivity, even superior to free NTFs, as demonstrated by the maintenance of neurite outgrowth activity which was still significantly increased over control conditions, while engineered NTF-cell proved to be less effective in the induction of sensory neurite outgrowth, but demonstrated an increased bioactivity in the PC-12 cell culture system.

*In vivo,* an experimental model for producing a peripheral nerve injury with massive nerve defect was used in female Wistar rats, which were then divided into experimental groups according to the type of implant. Interestingly, the functional and morphometrical analysis of regenerated nerves revealed that, after five months from the surgery, animals in which the lesion was repaired by the device enriched with IONP-NTF a greater recovery was observed, if compared controls.

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