References on the Administration of Agents to Nerves Using ALZET® Osmotic Pumps


ALZET Comments: Curcumin; Saline; CSF/CNS (Sciatic nerve); Rat; 2004; 4 weeks; Dose (0.2mg/day); 0.9% saline used; post op. care (buprenorphine 0.05 mg/kg); behavioral testing (Von Frey’s filament test, SSI test, beam walking test); neurodegenerative (nerve regeneration);


ALZET Comments: Tetrodotoxin; Saline; CSF/CNS (left sciatic nerve); Rat; 2ML4; 2ML2; 20 days; Dose (10.2 ug/day); animal info (Adult male Wistar, 400–600 g); neurodegenerative (Skeletal muscles); Pump connected with a silicone tubing to a custom-made silicone cuff (9 mm length, 1.4/5.0 mm ID/OD) placed around the nerve;


ALZET Comments: Ouabain; CSF/CNS (sciatic nerve); mice; 1004; 4 weeks; animal info (male, Thy1- YFP tg, 8-10 weeks old); post op. care (heater until mice could move freely); behavioral testing (hind paw withdrawal); Used ALZET catheter to infuse to sciatic stump; see diagram (pg 2098);


ALZET Comments: Tetrodotoxin; Saline; CSF/CNS (peroneal nerve); Rat; 2002; 14 days; Dose (350mg/ml); 0.9% saline used; Controls received mp w/ vehicle; animal info (Male Wistar rats weighing between 350 –450 g); delivery tubes were channeled to a silicone rubber cuff that was carefully placed around the common peroneal nerve of the left hind limb (Fig.1);

Q4655: J. G. Yan, et al. CALCITONIN PUMP IMPROVES NERVE REGENERATION AFTER TRANSECTION INJURY AND REPAIR. MUSCLE & NERVE 2015;51(229-234

ALZET Comments: Calcitonin; Water, distilled sterile; CSF/CNS (sciatic nerve); Rat; 2006; 12 weeks; Animal info (Sprague Dawley, 250-300g, 3 months old); half-life (p.233); long-term study; “To achieve a continuous and gradual mode of delivery, a mini-osmotic pump was delivered to deliver medication at a constant 0.15 ul/h” pg 233; ”Calcitonin has short absorption and elimination half-lives of 10–15 minutes and 50–80 minutes, respectively; however, using an osmotic pump allows for gradual and prolonged release.” pg233; pg230 diagram of pump implantation;


ALZET Comments: Bupivacaine; clonidine; dexamethasone; Saline; CSF/CNS (sciatic nerve); Rat; 2ML1; 7 days; Controls received mp w/ vehicle; animal info (male, albino, CD[SD]); no stress (see pg. 192); post op. care (IM butorphanol tartrate 0.05 mg/kg, ceftiofur sodium 5 mg/kg); stability verified by (pg. 195); used polyurethane catheter 0.5mm ID 0.9 mmOD; pumps removed after 1 week; dose (66.6 ug/mL);


ALZET Comments: Nerve growth factor, human B-; PBS; CSF/CNS (inferior alveolar nerve); Dog (beagle); 2ML2; 6 weeks; Controls received mp w/ vehicle; animal info (male, beagle, 18 weeks old, 10-12 kg); good methods (picture of implant pg 413); Multiple pumps per animal (2; one pump delivered NGF other delivered PBS); used rat jugular catheter, 15 cm long; pump body placed into retromandibular area; long-term study;

ALZET Comments: Lactate; hydroxycinnamic acid, alpha-cyano-4; Saline; CSF/CNS (sciatic nerve); Mice (transgenic); 1004; 4 weeks; Controls received mp w/ vehicle; animal info ([B6.Cg-Tg (thy1-YFP)16Jrs/J, Nax -/-, 8-15 weeks old); behavioral testing (von frey filaments, neurometer analysis); alpha-cyano-4 hydroxycinnamic acid aka CIN; used catheter tubing #7701 to attach pump to silicone tubing sutured to nerve stump; schematic of surgery on pg.725, figure 3A.;


ALZET Comments: CAY10441; PBS; DMSO; CSF/CNS (sciatic nerve); Mice; 1007D; 4 days; 7 days; Controls received mp w/ vehicle; animal info (C57BL6N or IP receptor KO mice); 1% DMSO used; behavioral testing (paw withdrawal latency); immunology; sciatic nerve injury; used RenaSil tube attached to PE-60, and fixed by Stabiloblast 2-component glue; pumps primed in 37C saline; pumps implanted subcutaneously and fixed with 6-0 Prolene suture to muscle; CAY10441 is an IP receptor antagonist.;


ALZET Comments: Pregabalin; Saline; CSF/CNS (sciatic nerve); Rat; 2ML1; 7 days; Controls received mp w/ vehicle; animal info (male, Sprague Dawley, 8-9 weeks old); behavioral testing (Hargreaves' radiant heat testing, guarding behavior, incapacitation testing); pump and catheter secured using 4-0 silk suture; sciatic nerve injury.;


ALZET Comments: Nifedipine; calcitonin; CSF/CNS (sciatic nerve); Rat; 2006; 4 weeks; Controls received mp w/ saline or sham only; animal info (3 month old, male, Sprague-Dawley 250-300g); functionality of mp verified by decrease in calcium levels; peptides; Picture of MP p56, Fig1A. MP Pump setup p56, Fig1B.;


ALZET Comments: Albumin; Saline, sterile; CSF/CNS (pudendal nerve); Rat; 1007D; 2002; 1, 2 weeks; Animal info (Sprague Dawley, female, virgin, 200-225 g); bilateral cannula used; "localized continuous neurotrophin supplementation has been most effective at promoting nerve regeneration and provided the rationale behind utilizing miniature osmotic pumps in this study." pg 86; bilateral infusion.;


ALZET Comments: Antibody, Fibroblast growth factor-2, mouse, monoclonal; CSF/CNS (sciatic nerve); Rat; 2002; Animal info (male, Lister Hooded, 3 mo old).
ALZET®
Bibliography

ALZET Comments: Endothelin-1; CSF/CNS (optic nerve, perineural region); Rabbit; 2, 4, 8 weeks; Animal info (New Zealand, 2.5-3.5 kg); long-term study; PE tubing used.

ALZET Comments: Tetrodotoxin; CSF/CNS (sciatic nerve); Rat; 2ML4; Animal info (AO strain, 200-400 g, Harlan); fig 1, schematic of pump and placement of conduction block.

Q2413: D. I. Carrasco, et al. Motor terminal degeneration unaffected by activity changes in SOD1(G93A) mice; a possible role for glycolysis. NEUROBIOLOGY OF DISEASE 2012;48(1):132-140
ALZET Comments: Tetrodotoxin; dexamethasone; CSF/CNS (sciatic nerve); Mice; 2002; Animal info (SOD1 G93A); good methods, pg 133.

ALZET Comments: Tetrodotoxin; CSF/CNS (sciatic nerve); Mice; 7-8 days; Animal info (Rab3a +/−, male, female, 2.5-3.5 mo old, C57BL/6J); silastic cuff used.

ALZET Comments: Tetrodotoxin; NaCl; CSF/CNS (sciatic nerve); Mice; 1002; Animal info (unaffected litter mates of ClCn1adr-mto2J, 2-4 mo old); catheter tubing was filled with saline so that "after surgery the foot muscles were not paralyzed" pg 2353.

ALZET Comments: Fibroblast growth factor, basic; albumin, human; Ringer lactate solution; CSF/CNS (facial nerve anastomosis); Rat; 2002; 14 days; Controls received mp w/ sodium heparin, human albumin in Ringer lactate solution; animal info (male, Wistar, adult); functionality of mp verified by residual volume; good methods, pg 499; stress/adverse reaction: (see pg. 501) "neuroma at the anastomosis", "hemoatoma at the surgical incision"; tissue perfusion (epineural anastomosis); vinyl catheter used; "We chose to use minipumps because this method allows better control of the quantity of bFGF delivered at the target site and is compatible with standard facial nerve surgical techniques. Furthermore, the isolate reservoir of the minipumps prevents the contact of the study drug with substances that could inactivate it" pg 502.

ALZET Comments: Angiotensin II; CSF/CNS (sciatic nerve); Rat; 2004; 12 weeks; Controls received mp w/ PBS; Animal info (male, Wistar, 250-300 g); peptides; long-term study; good methods, pg 960; no stress (see pg. 961) "All animals from both groups survived the surgery without complications"; pump connected to silicone tube that was connected to a piece of Gelfoam; Fig. 1, schematic of pump, tube, and gelfoam. pg 960.

ALZET Comments: Tetrodotoxin; Saline; CSF/CNS (sciatic nerve); Rat; 2002; 2ML4; Animal info (adult, male, Wistar, 180-350 g).

ALZET Comments: Insulin-like growth factor-I, recomb. human; CSF/CNS (tibial nerve); Rat; 2004; 12 weeks; Controls received mp w/ saline; long-term study; pumps replaced after 6 weeks; animal info (Fischer 344 x Brown Norway, Sprague Dawley; 8 months old, 24 months old); diagram of pump with custom-made T-tube.
**ALZET Comments:** Endothelin-1; CSF/CNS (optic nerve); Rat; 2004; 28 days; Post op. care (buprenorphine); animal info (adult, male, Brown Norway, 250-300g); fellow eye served as untreated control; silastic tubing used; brain tissue distribution.

**ALZET Comments:** Gallamine triethiodide; tubocurarine; atropine; suramin; CSF/CNS (sciatic nerve); Rat; 2ML4; 2-4 weeks; Controls received mp w/saline; animal info (female, adult, Sprague Dawley, 200-220 g); schematic illustration of pump with silastic catheter, Fig 1b.

**ALZET Comments:** Nerve growth factor; glial-derived neurotrophic factor; Saline; CSF/CNS (sciatic nerve); Mice (transgenic); 1004; 4 weeks; Controls received mp w/vehicle; half-life (p. 308) "short"; animal info (10 wks old, 20 g., Thy1-YFP); image of pump pg. 309; schematic of drug delivery system with pump+silicone, fig. 1); "Because of the short biological half-life of neurotrophic factors, a delivery system that protects the protein and slowly releases it locally over a prolonged period of time is required." pg. 308; tissue perfusion (sciatic nerve).

**ALZET Comments:** Cycloheximide; puromycin; Saline; CSF/CNS (sciatic nerve); Rat; 2002; 14 days; Animal info (adult, male, Sprague-Dawley, 250-300 g).

**ALZET Comments:** Alkaline phosphatase tag; eTEM-AP, recomb.; CSF/CNS (sciatic nerve); Rat; 1002; 2 weeks; Controls received mp w/alkaline phosphatase tag; animal info (adult, male, Sprague-Dawley, 150-300 g); peptides.

**ALZET Comments:** Interleukin-1, beta; CSF/CNS (sciatic nerve); Rat; 2002; 2 weeks; Controls received mp w/PBS; animal info (female, Wistar, 180-220 g., sciatic nerve injury); behavioral testing (motor function, toe spreading test, sensory function).

**ALZET Comments:** Brain-derived neurotrophic factor, recomb. human; CSF/CNS (sciatic nerve); Rat; 1007D; 7 days; Controls received mp w/PBS; comparison of foot pad injections vs. mp; peptides; animal info (female, Sprague Dawley, 8-10 wks old, SCI); behavioral testing (hind limb motor function); spinal cord injury.

**ALZET Comments:** Cyclopamine; Cyclodextrin, 2-hydroxypropyl-β-; CSF/CNS (sciatic nerve); Rat; 2001; 1 week; Controls received mp w/vehicle to contralateral side; multiple pumps per animal (2); animal info (male, Wistar, 7 wks old, 200-250 g., sciatic nerve injury); 45% cyclodextrin used.

**ALZET Comments:** Tetrodotoxin; Saline; CSF/CNS (sciatic nerve); Rat; 2002; 12 days; Animal info (male, Wistar, 300-350 g., soleus nerve crushed); silicone cuff placed around the sciatic nerve connected to mp by catheter.

ALZET Comments: Tetrodotoxin; tetraethylammonium chloride; pyridine, 4-amino-; CSF, artificial; CSF/CNS (sciatic nerve); Rat; 2001; 7 days; Controls received mp w/ vehicle, or contralateral uninjured nerve; targeted delivery (axotomy); animal info (female, Sprague-Dawley, 80-100g.; sciatic nerve ligation/traansection); mp primed 4 hrs in 37 celsius saline; chronic pain model.


ALZET Comments: Bone morphogenetic protein-2; Saline; CSF/CNS (facial nerve); Rabbit; 2ML4; 10 days; Controls received mp w/ vehicle; animal info (New Zealand, 1.6-2.3 kg); total daily infused volume incorrect; tissue perfusion (facial nerve).


ALZET Comments: Tetrodotoxin; Ringer’s solution; CSF/CNS (sciatic nerve); Frog (rana pipiens); 2001; 1 week; Pump implanted SC in the back with catheter guided to the sciatic nerve.


ALZET Comments: Adenosine triphosphate-gamma-S; adenosine triphosphate, 2’, 3’-O-(benzoyl-4-benzoyl)-; adenosine triphosphate, oxidized; dye, brilliant blue G; Saline; PBS, sterile; CSF/CNS (optic nerve); Rabbit; 1003D; 3 days; Controls received mp w/ vehicle; neurodegenerative (multiple sclerosis).


ALZET Comments: Glutathione S-transferase; glutathione S-transferase-Nogo-66; CSF/CNS (sciatic nerve); Rat; 2002; 14 days; Controls received mp w/ GST or no treatment; peptides; animal info (male, Sprague Dawley, 240-260g., Sciatic nerve transection); pain; silicon tube used.


ALZET Comments: WIN-55212-2 mesylate salt; SR141716A; SR144528; Saline; tween 20; albumin, rat serum; DMSO; CSF/CNS (sciatic nerve); Rat; 2001; 6, 7 days; Controls received mp w/ vehicle; functionality of mp verified after removal, as well as mp/catheter connection, catheter patency and position; dose-response (fig. 3); animal info (male, Wistar, 250-300 g, partial ligation injury); 4% DMSO; 14.5 % DMSO.


ALZET Comments: Brain-derived neurotrophic factor; Saline; CSF/CNS (sciatic nerve); Rat; 2002; 14 days; Controls received mp w/ vehicle; tissue perfusion (sciatic nerve graft); replacement therapy (axotomy); no stress (see pg. 1270); stress/adverse reaction: (see pg. 1270) "one pump was extruded"; animal info (male, Wistar, 200-250g.); pg. 1269, fig A shows image of pump implantation and cannulae location.


ALZET Comments: Tetrodotoxin; Saline; CSF/CNS (sciatic nerve); Rat; 2002; 2ML4; 14-21 days; Controls received no treatment; animal info (male, Wistar, 180-400g); silicone nerve cuff used.

ALZET Comments: Endothelin-1; CSF/CNS (optic nerve); Monkey (Rhesus); 2004; 8 months; Controls received mp w/ vehicle; long-term study; pumps replaced every 4 weeks; peptides; animal info (young, male, Rhesus); glaucoma.

ALZET Comments: Tetrodotoxin; Penicillin G potassium; gentamicin sulfate; CSF/CNS (posterior tibial nerve); Rat; 2004; 4, 8 weeks; Controls received mp w/ saline; long-term study; pumps replaced after 28 days; no stress (see pg. 52); animal info (female, Wistar, 270-380 g, MG nerve crush; used silastic nerve cuff.

P7988: X. Y. Wang, et al. Prolongation of evoked and spontaneous synaptic currents at the neuromuscular junction after activity blockade is caused by the upregulation of fetal acetylcholine receptors. Journal of Neuroscience 2006;26(35):8983-8987
ALZET Comments: Tetrodotoxin; Saline; CSF/CNS (sciatic nerve); Mice; 2002; 2 weeks; Controls received mp w/ vehicle; animal info (2-4 months old); silastic nerve cuff; tissue perfusion (sciatic nerve).

ALZET Comments: Tetrodotoxin; Saline; CSF/CNS (sciatic nerve); Rat; 2001; 7 days; Controls received mp w/ vehicle; animal info (male, wistar, 200-250 g); nerve injury; silicone tubing (0.64 mm I.D., 1.19 mm O.D.); "implanting a silicone cuff on injured sciatic nerve was extremely difficult to do without further damaging the nerve." hence instead of a cuff we surrounded the nerve with two soft pieces of silicone formed by cutting a slit in the end of silicone tubing. P. 245; behavioral testing.

ALZET Comments: Tetrodotoxin; Saline; CSF/CNS (sciatic nerve); Rat; 2002; 8 days; Controls received mp w/ vehicle; animal info (male, Long-Evans, 200 g); silastic tubing cuff.

ALZET Comments: Colchicine; tetrodotoxin; PBS; CSF/CNS (facial nerve); Rat; 2002; 8 days; Controls received mp w/ vehicle; animal info (male, Long-Evans, 200 g); silastic tubing cuff.

ALZET Comments: AG-490; Saline; CSF/CNS (sciatic nerve); Rat; 2004; Controls received mp w/ vehicle; enzyme inhibitor (JAK2); silastic tubing and a gortex nerve cuff used.

ALZET Comments: Antibody, anti-MCP-1/MIA-1a; antibody, anti-IL-1B; immunoglobulin G; CSF/CNS (sciatic nerve); Mice; 1007D; 7 days; Controls received mp w/ IgG; animal info (adult female, BALB/c); tissue perfusion (sciatic nerve); PE tubing + silastic nerve cuff used.

ALZET Comments: Galectin-1, recomb. human oxidized; CSF/CNS (sciatic nerve); Rat; 2ML4; 12 weeks; Controls received mp w/ PBS; dose-response (fig. 1); long-term study; no stress (see pg. 285); peptides; animal info (male, adult, Sprague-Dawley); "No rats showed any toxic effects or reaction to the administration of rh GAL-1/Ox." (p. 285).
ALZET Comments: Colchicine; tetrodotoxin; PBS; CSF/CNS (facial nerve); Rat; 2002; 1,3,8,30,60 days; Controls received mp w/ vehicle; facial palsy; long-term study.

ALZET Comments: Oligonucleotide, antisense; oligonucleotide sense; kainate, dihydro-; aspartic acid, DL-threo-B-benzyloxy-; Saline, sterile; CSF/CNS (optic nerve); Rabbit; 1003D; 3 days; Controls received mp w/ vehicle, or contralateral nerves; antisense (glutamate transporters GLAST + GLT-1); animal info (adult, male, white New Zealand).

ALZET Comments: Fibroblast growth factor, basic; PBS; BSA; CSF/CNS (sciatic nerve); Mice; 1002; 8-10 days; Controls received mp w/ vehicle; functionality of mp verified by residual volume; good methods (p. 1248); nerve infusion schematic (p. 1248).

P6944: K. Motoyoshi, et al. Restoring vocal fold movement after transection and immediate suturing of the recurrent laryngeal nerve with local application of basic fibroblast growth factor: An experimental study in the rat. Laryngoscope 2004;114(7):1247-1252
ALZET Comments: Fibroblast growth factor, basic; PBS; BSA; CSF/CNS (recurrent laryngeal nerve); Rat; 2002; 14 days; Controls received mp w/ vehicle; functionality of mp verified by residual volume; good methods (p. 1248); nerve infusion schematic (p. 1248).

ALZET Comments: Nerve growth factor; ciliary neurotrophic factor; CSF/CNS (peroneal nerve); Rat; 2ML4; 28 days; Controls received mp w/ isotonic saline; peptides; mp primed 24 hours in 37 degrees Celsius saline.

P6610: M. Buffelli, et al. Activity-dependent synaptic competition at mammalian neuromuscular junctions. NEWS IN PHYSIOLOGICAL SCIENCES 2004;19(85-91
ALZET Comments: Tetrodotoxin; CSF/CNS (soleus nerve); Rat; Controls received mp on contralateral side.

ALZET Comments: Endothelin; Saline; acetic acid; CSF/CNS (optic nerve); Monkey; 18 months; Controls received mp w/ vehicle; long-term study; pumps replaced every 6 weeks; no stress (see pg. 1833); peptides; "The osmotic minipumps were well tolerated by the monkeys for the length (1.5 years) of the experiment." The long exposure time was used to "mimic more closely the prolonged human glaucomatous condition." p. 1838; pump model not listed; ischemia.