



**Recent References (2017-Present) on the Intrathecal Administration of Agents
Using ALZET® Osmotic Pumps**

Q10599: L. Di Cesare Mannelli, *et al.* Neuronal Alarmin IL-1 α Evokes Astrocyte-Mediated Protective Signals: Effectiveness in Chemotherapy-Induced Neuropathic Pain. *Neurobiology of Disease* 2022;168(105716

Agents: Interleukin-1 α **Vehicle:** Saline; **Route:** CSF/CNS (intrathecal); **Species:** Rat; **Pump:** 1002; **Duration:** 10 days;
ALZET Comments: Dose (0.25 mL/h); Controls received mp w/ vehicle; animal info (Male; Weighed about 200-250 g); behavioral testing (Paw pressure test; Cold plate test); immunology;

Q10460: C. De Luca, *et al.* Matrix metalloproteinases, purinergic signaling, and epigenetics: hubs in the spinal neuroglial network following peripheral nerve injury. *Histochemistry and Cell Biology* 2022;157(5):557-567

Agents: GM6001 **Vehicle:** CSF, artificial; **Route:** CSF/CNS (intrathecal, subarachnoid space); **Species:** Rat; **Pump:** 2001; **Duration:** 8 days;
ALZET Comments: Dose: (180 ug/ul, 100 mg/kg/day); Controls received mp w/ vehicle; animal info: Adult (250–300 g); Sprague Dawley rats GM6001 aka (GM); peripheral nerve injury

Q10882: Y. Zhang, *et al.* Extracellular Vesicle-Encapsulated microRNA-23a From Dorsal Root Ganglia Neurons Binds to A20 and Promotes Inflammatory Macrophage Polarization Following Peripheral Nerve Injury. *Aging* 2021;

Agents: Vesicles, extracellular; miR-23a inhibitor, locked nucleic acid based; Oligomer, interfered control **Vehicle:** Saline; **Route:** CSF/CNS (intrathecal); **Species:** Mice; **Pump:** 1007D; **Duration:** 7 days;
ALZET Comments: Dose: (1.4 mg/hr, oligomers 12 pmol/day); Controls received mp w/ vehicle; animal info: male C57BL/6J mice (aged 8 weeks) behavioral testing: Paw withdrawal using Dixon's "up-down" method; polyethylene catheter used;

Q10632: S. H. Oh, *et al.* Sec-O-Glucosylhamaudol Mitigates Inflammatory Processes and Autophagy Via p38/JNK MAPK Signaling in a Rat Neuropathic Pain Model. *Korean Journal of Pain* 2021;34(4):405-416

Agents: Sec-O-glucosylhamaudol **Vehicle:** DMSO; **Route:** CSF/CNS (intrathecal); **Species:** Rat; **Pump:** 1002; **Duration:** 2 weeks;
ALZET Comments: Dose (96 ug/day); Controls received mp w/ vehicle; 70% DMSO used; animal info (Male Sprague Dawley; Pathogen-free; 100-120 g); behavioral testing (Paw withdrawal threshold using von Frey filament; Naloxone challenge test); spinal cord injury;

Q10620: A. Nakano, *et al.* Intrathecal Infusion of Diosgenin during the Chronic Phase of Spinal Cord Injury Ameliorates Motor Function and Axonal Density. *Neurochemical Journal* 2021;15(4):454-461

Agents: Diosgenin **Vehicle:** CSF, artificial; **Route:** CSF/CNS (intrathecal); **Species:** Mice; **Pump:** 1004; **Duration:** 56 days;
ALZET Comments: Dose: (0.1 μ M) ethanol was 0.1% vehicle used Controls received mp w/ vehicle; animal info: Eight-week-old female ddY mice; post op. care: During and after surgery, the mice were placed on a heating pad to maintain their body temperature; behavioral testing: Climbing performance; spinal cord injury; mouse intrathecal catheter used; pumps replaced after 28 days

Q10329: N. Shahsavani, *et al.* Availability of neuregulin-1 β 1 protects neurons in spinal cord injury and against glutamate toxicity through caspase dependent and independent mechanisms. *Experimental Neurology* 2021;345(113817

Agents: Neuregulin-1 β 1 **Vehicle:** BSA; Saline; **Route:** CSF/CNS (intrathecal); **Species:** Rat; **Pump:** 1003D; 2001; **Duration:** 3 days; 7 days;
ALZET Comments: Dose: (1 μ g/day); 0.1% BSA; 0.9% Saline vehicle used; Controls received mp w/ vehicle; animal info: adult female Sprague-Dawley (SD) rats (8–10 weeks, 250 g); Neuregulin-1 β 1 aka (Nrg-1 β 1); spinal cord injury; dependence;

Q10223: Y. Kuthati, *et al.* Teneligliptin Exerts Antinociceptive Effects in Rat Model of Partial Sciatic Nerve Transection Induced Neuropathic Pain. *Antioxidants (Basel)* 2021;10(9):

Agents: Teneligliptin **Vehicle:** DMSO; **Route:** CSF/CNS (intrathecal); **Species:** Rat; **Pump:** 2001; **Duration:** 7 days;
ALZET Comments: Dose: (5 ug/1 uL/h); Controls received mp w/ vehicle; animal info: Male Wistar rats; behavioral testing; Behavior Test for Tactile Allodynia; Behavior Test for Thermal Hyperalgesia; Teneligliptin is a dipeptidyl peptidase-4 inhibitor



Q10113: P. Bonilla, *et al.* Human-Induced Neural and Mesenchymal Stem Cell Therapy Combined with a Curcumin Nanoconjugate as a Spinal Cord Injury Treatment. *International Journal of Molecular Sciences* 2021;22(11):

Agents: Polyacetal-curcumin nanoconjugate **Vehicle:** Saline; **Route:** CSF/CNS (intrathecal); **Species:** Rat; **Pump:** 1007D; **Duration:** 7 days;

ALZET Comments: Saline 0.9% vehicle used; Controls received mp w/ vehicle; animal info: Female Sprague–Dawley weighing 300g; post op. care: buprenorphine; behavioral testing: open-field BBB locomotor scale and video-based system for automated gait analysis; PA-C aka polyacetal-curcumin nonconjugate; spinal cord injury

Q10261: B. S. Moon, *et al.* Epigenetic modulator inhibition overcomes temozolomide chemoresistance and antagonizes tumor recurrence of glioblastoma. *Journal of Clinical Investigation* 2020;130(11):5782-5799

Agents: Temozolomide; Pyr-Pam **Vehicle:** Saline; **Route:** CSF/CNS (intrathecal); **Species:** Mice; **Pump:** 1004; **Duration:** 26 days;

ALZET Comments: Dose: TMZ (100 µL at 32.5 mg/mL); Pyr-Pam (100 µL at 7 mg/mL); Controls received mp w/ vehicle; animal info: immunocompromised (NSG) mice; Temozolomide aka (TMZ); Pyriminium pamoate aka (Pyr-Pam); (Brain Infusion Kit 3, 1–3 mm); Alzet used; Brain coordinates ((coordinates: 2 mm anterior and 3 mm to the right of bregma at a depth of 3 mm); dental cement used; (sterile bone wax)cancer (Glioblastoma multiforme); incorrectly labelled pump as Model 1004D

Q8644: J. Li, *et al.* Prolonged Use of NMDAR Antagonist Develops Analgesic Tolerance in Neuropathic Pain via Nitric Oxide Reduction-Induced GABAergic Disinhibition. *Neurotherapeutics* 2020;17(3):1016-1030

Agents: MK801; TrkB-Fc **Vehicle:** Saline; **Route:** CSF/CNS (Intrathecal); **Species:** Mice; Rat; **Pump:** 1004; 2ML4; **Duration:** 11 days;

ALZET Comments: Dose (5 ug/day MK801; 0.2 ug/day TrkB-Fc); Controls received mp w/ vehicle; animal info (Adult male Sprague-Dawley rats, 250–300 g; Adult male mice, 6 to 7 weeks old); behavioral testing (Mechanical Nociception Assays; Thermal Nociception Assays); MK801 aka N-methyl-D-aspartate receptor antagonist; spinal cord injury;

Q8593: Y. Kamata, *et al.* Paclitaxel Induces Upregulation of Transient Receptor Potential Vanilloid 1 Expression in the Rat Spinal Cord. *International Journal of Molecular Sciences* 2020;21(12):

Agents: siRNA; TRPV1 **Vehicle:** CSF, artificial; **Route:** CSF/CNS (intrathecal); **Species:** Rat; **Pump:** Not stated; **Duration:** 3 days; **ALZET Comments:** Dose (0.5 nmol/µL/h); Controls received mp w/ vehicle; animal info (Male Wistar rats weighing 250 to 320 g); behavioral testing (Mechanical or Thermal Stimulation); dependence;

Q10141: T. Chen, *et al.* Astrocyte-microglia interaction drives evolving neuromyelitis optica lesion. *Journal of Clinical Investigation* 2020;130(8):4025-4038

Agents: Immunoglobulin G, human; Immunoglobulin G, mouse **Vehicle:** Not Stated; **Route:** CNS/CSF (intrathecal); **Species:** Mice; **Pump:** Not Stated; **Duration:** 5, 7 days;

ALZET Comments: Dose IgG (1.0–10 µg/day); Controls received mp w/ vehicle; animal info (C57BL/6J, Cx3cr1) Female, (6–8 weeks old); behavioral testing (Rotarod performance test); Immunoglobulin G aka (IgG); immunology;

Q8413: I. J. Chen, *et al.* The Circadian Hormone Melatonin Inhibits Morphine-Induced Tolerance and Inflammation via the Activation of Antioxidative Enzymes. *Antioxidants (Basel)* 2020;9(9):

Agents: Morphine **Vehicle:** DMSO; Saline; **Route:** CSF/CNS (intrathecal); **Species:** Rat; **Pump:** Not stated; **Duration:** 10 days; **ALZET Comments:** 0.9% Saline used; Controls received mp w/ vehicle; animal info (adult male wistar rats, 300–350 g); behavioral testing (Nociceptive Test); dependence;

Q6999: S. J. Shiue, *et al.* Mesenchymal stem cell exosomes as a cell-free therapy for nerve injury-induced pain in rats. *Pain* 2019;160(1):210-223

Agents: Exosomes, human umbilical cord mesenchymal stem cell **Vehicle:** Saline; **Route:** CSF/CNS (intrathecal); **Species:** Rat; **Pump:** 2001; **Duration:** 7 days;

ALZET Comments: Dose (1.2 mg/mL/ hr); Controls received mp w/ vehicle; animal info (Male Sprague–Dawley rats, 200 to 250 g); Therapeutic indication (neuropathic pain);



Q7660: M. P. Schneider, *et al.* Anti-Nogo-A Antibodies As a Potential Causal Therapy for Lower Urinary Tract Dysfunction after Spinal Cord Injury. *J Neurosci* 2019;39(21):4066-4076

Agents: Antibody, anti-Nogo-A **Route:** CSF/CNS (intrathecal); **Species:** Rat; **Pump:** 2ML2; **Duration:** 14 days;

ALZET Comments: Dose (5 µl/h, 3 mg of antibody/ml); Controls received mp w/ inactive control antibody; animal info (4+/-1 months, female, Lewis, 210+/-20g); spinal cord injury; Pump and catheter were removed 15–16 d after implantation under 5% isoflurane; Therapeutic indication (reduction of the impairment of several key urodynamic functions such as recovery of the physiological EUS function during voiding after induced SCI);

Q7679: P. Liu, *et al.* Inhibitory effect of hyaluronidase-4 in a rat spinal cord hemisection model. *Cancer Translational Medicine* 2019;5(1):10-16

Agents: Antibody, anti-Hyal-4; IgG; **Route:** CSF/CNS (intrathecal); **Species:** Rat; **Pump:** 1004; **Duration:** 4 weeks;

ALZET Comments: animal info (Female Sprague–Dawley (SD) rats); spinal cord injury;

Q10237: W. Lin, *et al.* NMDAR and JNK Activation in the Spinal Trigeminal Nucleus Caudalis Contributes to Masseter Hyperalgesia Induced by Stress. *Frontiers in Cellular Neuroscience* 2019;13(495)

Agents: SP600125 **Vehicle:** Saline; **Route:** CSF/CNS (intrathecal); **Species:** Rat; **Pump:** Not Stated; **Duration:** 11 days;

ALZET Comments: Dose: SP600125 (1 mg/ml); 0.9% Saline vehicle used; Controls received mp w/ vehicle; animal info: Adult male Sprague–Dawley rats (180–220 g); behavioral testing: open-field test and elevated plus maze test;

Q7622: S. Kokubu, *et al.* Characterization of Analgesic Actions of the Chronic Intrathecal Infusion of H-Dmt-D-Arg-Phe-Lys-NH₂ in Rat. *Neuromodulation* 2019;

Agents: DMT-DALDA; morphine sulfate **Vehicle:** Saline; **Route:** CSF/CNS (intrathecal); **Species:** Rat; **Pump:** 2001, 2002; **Duration:** 7 days, 14 days;

ALZET Comments: Dose ((DMT-DALDA 0.3, 1, 3, or 10 pmol/µL/hour), (MS 37.5 nmol/hour)); dose-response (Figure 1a graph on page 4); Controls received mp w/ vehicle; animal info (adult, male, Sprague-Dawley, 225–300g); behavioral testing (Hargreaves-type hind paw thermal stimulator, formalin-induced flinching); DMT-DALDA (H-Dmt-D-Arg-Phe-Lys-NH₂; Dmt = 2',6'-dimethyltyrosine) is a dermorphin analogue and selective mu opioid agonist; dependence; good methods (surgical techniques and pump/catheter implantation on p.2);

Q8039: H. J. Huang, *et al.* MGCD0103, a selective histone deacetylase inhibitor, coameliorates oligomeric Abeta_{25–35} -induced anxiety and cognitive deficits in a mouse model. *CNS Neurosci Ther* 2019;25(2):175-186

Agents: MGCD0103 **Vehicle:** Not Stated; **Route:** CSF/CNS (Intrathecal); **Species:** Mice; **Pump:** Not stated; **Duration:** 4 weeks;

ALZET Comments: Dose (30 or 60 nmol/day); animal info (C57BL/6J); Selective histone deacetylase inhibitor aka MGCD0103 ; enzyme inhibitor (selective histone deacetylase inhibitor); neurodegenerative (Alzheimer's Disease);

Q7286: X. J. Feng, *et al.* Nerve injury elevates functional Cav3.2 channels in superficial spinal dorsal horn. *Mol Pain* 2019;15(1744806919836569

Agents: Nickel Chloride; TTA-A2 **Route:** CSF/CNS (Intrathecal); **Species:** Rat; **Pump:** 1002; **Duration:** 14 days;

ALZET Comments: Dose (TTA-A2, 0.35 ug/h, Nickel Chloride, 0.5 ug/h); Controls received mp w/ Saline; animal info (Sprague-Dawley rats, 150–250 g); TTA-A2 aka

[(2-(4-cyclopropylphenyl)-N-((1R)-1-{5-[(2,2,2-trifluoroethyl)oxo]-pyridin-2-yl)ethyl)acetamide]; Brain coordinates (rostrally about 2 cm); Catheter placement verified via tail-flick response; spinal nerve ligation;

Q7987: S. Dyck, *et al.* LAR and PTPsigma receptors are negative regulators of oligodendrogenesis and oligodendrocyte integrity in spinal cord injury. *Glia* 2019;67(1):125-145

Agents: peptide, intracellular LAR; peptide, intracellular sigma **Vehicle:** saline, BSA buffered; **Route:** CSF/CNS (intrathecal);

Species: Rat; **Pump:** 2001D, 1003D, 2001, 2002, and 2004; **Duration:** 1, 3, 5, 7, 14, 28 days;

ALZET Comments: Dose ((ILP 10 µg/day), (ISP 10 µg/day)); 0.1% BSA in saline used; Controls received mp w/ vehicle; animal info (female, Sprague-Dawley, 250g); ILP (NH₂-GRKKRRQRRRCDLADNIERLKKANDGLKFSQEYESI-NH₂) and ISP (NH₂-GRKKRRQRRRCDMAEHMERLKKANDSLKLSQEYESI-NH₂) are peptides against LAR and PTPsigma; enzyme inhibitor (LAR and PTPsigma receptor); peptides; spinal cord injury; Therapeutic indication (inhibition of PTPsigma and LAR receptors promotes oligodendrogenesis by endogenous precursor cells, attenuates caspase 3-mediated cell death in mature oligodendrocytes, and preserves myelin);



Q7272: F. Bai, *et al.* Spinal Cord Glycine Transporter 2 Mediates Bilateral ST35 Acupoints Sensitization in Rats with Knee Osteoarthritis. Evidence-Based Complementary and Alternative Medicine 2019;2019(7493286

Agents: Glycine **Vehicle:** Saline; **Route:** CSF/CNS (Intrathecal); **Species:** Rat; **Pump:** 2002; **Duration:** 14 Days;
ALZET Comments: Dose (0.1 umol/h); Controls received mp w/ vehicle; animal info (Male Sprague-Dawley rats, 200-250 g); behavioral testing (PWMT test);

Q7942: G. L. Austin, *et al.* Central Nervous System Delivery and Biodistribution Analysis of an Antibody-Enzyme Fusion for the Treatment of Lafora Disease. Mol Pharm 2019;16(9):3791-3801

Agents: Fusion protein, VAL-0417; amylase, recombinant pancreatic **Vehicle:** PBS; **Route:** CSF/CNS (lateral ventricle); CSF/CNS (intrathecal); **Species:** Mice; **Pump:** Not stated; **Duration:** 14, 28 days;

ALZET Comments: Dose ((VAL-0417 0.08 mg/day), (amylase 0.04 mg/day)); Controls received mp w/ vehicle; animal info (WT or Epm2a(-/-)); VAL-0417 is an antibody–enzyme fusion protein; neurodegenerative (Lafora disease); generation of antibody-enzyme fusion protein on p.3792;

Q7163: Y. Zhang, *et al.* Combination Treatment of C16 Peptide and Angiopoietin-1 Alleviates Neuromyelitis Optica in an Experimental Model. Mediators Inflamm 2018;2018(4187347

Agents: Antibody, NMO-IgG; Complement, human **Vehicle:** Not Stated; **Route:** CSF/CNS (intrathecal); CSF/CNS (lateral ventricle); **Species:** Rat; **Pump:** 1003D; **Duration:** 3 days;

ALZET Comments: Dose (10 µg NMO-IgG and 50 µL (5µg/µL) human complement); NMO aka Neuromyelitis optica;

Q7542: Q. Wu, *et al.* Human menstrual blood-derived stem cells promote functional recovery in a rat spinal cord hemisection model. Cell Death & Disease 2018;9(9):882

Agents: TrkB-IgG; immunoglobulin G, human **Vehicle:** PBS; **Route:** CSF/CNS (intrathecal); **Species:** Rat; **Pump:** 2002; **Duration:** 4 weeks;

ALZET Comments: Dose (3 µg/day); Controls received mp w/ vehicle; animal info (adult, female, Sprague-Dawley, 220-250g); behavioral testing (BBB locomotion scale); pumps replaced at 3 weeks; enzyme inhibitor (BDNF-TrkB signaling); spinal cord injury;

Q7319: Q. Wang, *et al.* Danhong Injection Alleviates Mechanical Allodynia via Inhibiting ERK1/2 Activation and Elevates BDNF Level in Sciatic Nerve in Diabetic Rat. Evidence-Based Complementary and Alternative Medicine 2018;2018(5798453

Agents: U0126 **Vehicle:** DMSO; CSF, artificial; **Route:** CSF/CNS (intrathecal); **Species:** Rat; **Pump:** 1007D; **Duration:** 1 week;

ALZET Comments: Dose (0.5 ug/ul/hr); 10% DMSO used; Controls received mp w/ vehicle; animal info (Male, Sprague-Dawley, 180-200 g); behavioral testing (Stimulus test); U0216 is a Mitogen-activated protein kinase (MAPK) kinase 1/2 inhibitor; enzyme inhibitor (Mitogen-activated protein kinase); Intrathecal catheters were inserted into subarachnoid spaces through atlantooccipital membrane; diabetes;

Q7304: K. Stockstill, *et al.* Dysregulation of sphingolipid metabolism contributes to bortezomib-induced neuropathic pain. J Exp Med 2018;215(5):1301-1313

Agents: FTY720, ponesimod, NIBR14 **Vehicle:** Saline; **Route:** CSF/CNS (intrathecal; L5/L6 lumbar); **Species:** Rat, Mice; **Pump:** 2001; **Duration:** 6 days;

ALZET Comments: 5% Tween 80, 5% ethanol, saline used; Controls received mp w/ vehicle; animal info (Male, Sprague Dawley rats, 200–220 g); animal info (Male, Sprague Dawley rats, 200–220 g); FTY720 AKA fingolimod; Ponesimod AKA ACT-128800; NIBR14 is a methyl ester pro-drug; FTY720 AKA fingolimod; Ponesimod AKA ACT-128800; NIBR14 is a methyl ester pro-drug;

Q7052: I. Rossetti, *et al.* Calcitonin gene-related peptide decreases IL-1beta, IL-6 as well as Ym1, Arg1, CD163 expression in a brain tissue context-dependent manner while ameliorating experimental autoimmune encephalomyelitis. J Neuroimmunol 2018;323(94-104

Agents: Calcitonin gene-related peptide **Vehicle:** CSF, artificial; **Route:** CSF/CNS (intrathecal); **Species:** Mice; **Pump:** 2002; **Duration:** 2 weeks;

ALZET Comments: Controls received mp w/ vehicle; animal info (7-8 week old C57BL/6 female mice); peptides;



- Q7264:** C. Rivat, *et al.* Inhibition of neuronal FLT3 receptor tyrosine kinase alleviates peripheral neuropathic pain in mice. *Nat Commun* 2018;9(1):1042
Agents: RNA, small interfering (Flt3, scrambled) **Vehicle:** Not Stated; **Route:** CSF/CNS(Intrathecal); **Species:** Mice; **Pump:** 1002; **Duration:** 6 days;
ALZET Comments: Dose (12.53 ng/ml); animal info (C57BL/6 naive mice, Flt3KO mice 25–30 g.); behavioral testing (reflexive tail flick); spinal cord injury; stress/adverse reaction: (see pg. 10);
- Q7263:** L. Riemann, *et al.* Transplantation of Neural Precursor Cells Attenuates Chronic Immune Environment in Cervical Spinal Cord Injury. *Front Neurol* 2018;9(428)
Agents: Platelet-Derived Growth Factor, Epidermal Growth Factor, Basic Fibroblast Growth Factor **Vehicle:** Platelet-Derived Growth Factor, Epidermal Growth Factor, Basic Fibroblast Growth Factor; **Route:** CSF/CNS(Intrathecal); **Species:** Rat; **Pump:** 1007D; **Duration:** 7 days;
ALZET Comments: Dose (PDGF-AA, 1 µg/100 µL; EGF, 3 µg/100 µL; bFGF, 3 µg/100mL); 0.1% rat serum albumin used; animal info (female Wistar rats 250 g); post op. care (moxifloxacin, buprenorphine); spinal cord injury;
- Q8126:** L. Micheli, *et al.* Involvement of the N/OFFQ-NOP system in rat morphine antinociceptive tolerance: Are astrocytes the crossroad? *Eur J Pharmacol* 2018;823(79-86)
Agents: Nociceptin/orphanin FQ; Morphine **Vehicle:** Not stated; **Route:** CSF/CNS (intrathecal); **Species:** Rat; **Pump:** 1002; **Duration:** 10 days;
ALZET Comments: Dose (1 and 3 nmol/h); animal info (Male, Sprague-Dawley, Wistar,); behavioral testing (Paw Pressure Test, Rota-rod Test); Nociceptin/orphanin FQ aka (N/OFFQ) ; dependence;
- Q6913:** Michael Mousseau, *et al.* Microglial pannexin-1 channel activation is a spinal determinant of joint pain. *Science Advances* 2018;4(8):
Agents: A740003; mimetic peptide inhibitor of Panx1; 10panx; scrpanx; Mac1-saporin; Saporin **Vehicle:** Not Stated; **Route:** CSF/CNS (intrathecal); **Species:** Rat; **Pump:** Not Stated; **Duration:** 7 days;
ALZET Comments: animal info (adult male Sprague-Dawley rats); enzyme inhibitor (P2X7R antagonist A740003); Therapeutic indication (arthritis);
- Q7202:** W. Liu, *et al.* Dextran-based biodegradable nanoparticles: an alternative and convenient strategy for treatment of traumatic spinal cord injury. *Int J Nanomedicine* 2018;13(4121-4132)
Agents: Taxol **Vehicle:** Cremophor EL; **Route:** CSF/CNS (Intrathecal); **Species:** Rat; **Pump:** 2004; **Duration:** 7 days;
ALZET Comments: Dose (256 ng/day); animal info (Sprague Dawley rats); behavioral testing (Locomotor capacity, BBB open field 21 point scale); ALZET rat intrathecal catheter used; spinal cord injury; stress/adverse reaction: (see pg. 4130);
- Q7216:** G. Li, *et al.* MiR-103 alleviates autophagy and apoptosis by regulating SOX2 in LPS-injured PC12 cells and SCI rats. *Iran J Basic Med Sci* 2018;21(3):292-300
Agents: miR-103 agomir **Vehicle:** Saline; **Route:** CSF/CNS (intrathecal); **Species:** Rat; **Pump:** 1003D; **Duration:** 3 days;
ALZET Comments: Dose (1 ul/hr/day); Controls received mp w/ vehicle; animal info (Male, Sprague-Dawley, 180-220 g); post op. care (Penicillin G); spinal cord injury;
- Q7026:** P. M. Grace, *et al.* Protraction of neuropathic pain by morphine is mediated by spinal damage associated molecular patterns (DAMPs) in male rats. *Brain, Behavior, and Immunity* 2018;72(45-50)
Agents: naloxone; A438079; YVAD-cmk, Ac- **Vehicle:** Not Stated; **Route:** CSF/CNS (intrathecal); **Species:** Rat; **Pump:** 2001; **ALZET Comments:** Dose (naloxone: 60 ug/h; A438079: 30 ng/h; ac-YVAD-cmk: 1 ug/h); animal info (10-12 week old male Fischer 344 rats); enzyme inhibitor (caspase-1);
- Q7141:** N. Geribaldi-Doldan, *et al.* Specific inhibition of ADAM17/TACE promotes neurogenesis in the injured motor cortex. *Cell Death & Disease* 2018;9(9):862
Agents: GM6001(N-[(2R)-2-(hydroxami-docarbonylmethyl)-4-methylpentanoyl]-L-tryptophan methylamide) **Vehicle:** DMSO, PBS; **Route:** CSF/CNS (intrathecal); **Species:** Mice; **Pump:** 1002, 1004; **Duration:** 14 days, 28 days;
ALZET Comments: Dose (50-µM); 0.4% DMSO used; Controls received mp w/ vehicle; Controls received mp w/ vehicle; GM6001 is N-[(2R)-2-(hydroxami-docarbonylmethyl)-4-methylpentanoyl]-L-tryptophan methylamide; ALZET brain infusion kit II



Q7137: K. Fujita, *et al.* Targeting Tyro3 ameliorates a model of PGRN-mutant FTLT-TDP via tau-mediated synaptic pathology. *Nat Commun* 2018;9(1):433

Agents: G66976 **Vehicle:** PBS; **Route:** CSF/CNS (intrathecal); **Species:** Mouse; **Pump:** 2006; **Duration:** 2 weeks;

ALZET Comments: Dose (0.15 μ l/h); animal info (PGRN-KI and C57BL/6J, 10-12 weeks old); behavioral testing (Morris water maze test, Fear-conditioning test, Probe test, Rotarod test, Open-field test, Light-dark box test); enzyme inhibitor (PKC inhibitor); gene therapy;

Q7031: M. Fregosi, *et al.* Changes of motor corticobulbar projections following different lesion types affecting the central nervous system in adult macaque monkeys. *European Journal of Neuroscience* 2018;48(4):2050-2070

Agents: Antibody, anti-Nogo-A **Vehicle:** Not Stated; **Route:** CSF/CNS (Intrathecal), SC; **Species:** Monkey (Macaca fascicularis); **Pump:** 2ML2; **Duration:** 4 weeks;

ALZET Comments: Dose (3 mg/ml); One pump administered the treatment intrathecally to the cervical spinal cord, whereas the other pump delivered the antibody close to the lesioned site in M1 below the dura; Multiple pumps per animal (2);

Q7131: S. Dyck, *et al.* Perturbing chondroitin sulfate proteoglycan signaling through LAR and PTPsigma receptors promotes a beneficial inflammatory response following spinal cord injury. *J Neuroinflammation* 2018;15(1):90

Agents: Intracellular leukocyte common antigen-related peptide (ILP), Intracellular sigma peptide (ISP), TAT- conjugated peptides **Vehicle:** Saline; **Route:** CSF/CNS (intrathecal); **Species:** Rat; **Pump:** 2001D, 1003D, 2001, 2002, 2004; **Duration:** 1, 3, 5, 7, or 14 days;

ALZET Comments: Dose (10 μ g/day); Controls received mp w/ vehicle; animal info (Sprague-Dawley, adult, female, 250 g); animal info (Sprague-Dawley, adult, female, 250 g); spinal cord injury;

Q3539: Y. C. Cheng, *et al.* Melatonin regulation of transcription in the reversal of morphine tolerance: Microarray analysis of differential gene expression. *Int J Mol Med* 2018;

Agents: Morphine **Vehicle:** Saline; **Route:** CSF/CNS (intrathecal); **Species:** Rat; **Pump:** Not Stated; **Duration:** 7 days;

ALZET Comments: Dose (15 μ g/h); Controls received mp w/ vehicle; animal info (27 Male Wistar rats (350-400 g), each rat (with 12 weeks of age)); neurodegenerative ();

Q7097: A. Alastrue-Agudo, *et al.* FM19G11 and Ependymal Progenitor/Stem Cell Combinatory Treatment Enhances Neuronal Preservation and Oligodendrogenesis after Severe Spinal Cord Injury. *Int J Mol Sci* 2018;19(1):

Agents: FM19G11 **Vehicle:** DMSO; **Route:** CSF/CNS (intrathecal); **Species:** Rat; **Pump:** 1007D; **Duration:** 3 days;

ALZET Comments: Controls received mp w/ vehicle; animal info (2-month-old Sprague Dawley rats weighing ~200 g); FM19G11 is an inhibitor of Hypoxia inducible factor- α protein expression; spinal cord injury;

Q9467: Methods for Assessing Serpins as Neuroprotective Therapeutics. *Methods in Molecular Biology* 2018;

Agents: Dexamethasone **Vehicle:** Saline; **Route:** CSF/CNS (Intrathecal); **Species:** Rat; **Pump:** 2ML4, 2ML2, 2ML1; **Duration:** 2 w

ALZET Comments: Dose (2.5-10 mL/h); animal info (Long Evans, Male, 16 week old rat, 370-420 g); spinal cord injury;

Q6332: J. Zhang, *et al.* Prevention and reversal of latent sensitization of dorsal horn neurons by glial blockers in a model of low back pain in male rats. *J Neurophysiol* 2017;118(4):2059-2069

Agents: Minocycline, fluorocitrate **Vehicle:** PBS, artificial cerebrospinal fluid; **Route:** CSF/CNS (intrathecal); **Species:** Rat; **Pump:** 2002; **Duration:** 6 days, 3 days;

ALZET Comments: Dose (200 μ g/day); Controls received mp w/ vehicle; animal info (adult male Sprague-Dawley rats);

Q5911: X. Wang, *et al.* Threshold Effect of G9a/Glp on Peripheral Nerve Injury Induced Hypersensitivity. *Mol Pain* 2017;13(1744806917729305

Agents: Not Stated **Vehicle:** Not Stated; **Route:** CSF/CNS (intrathecal); **Species:** Mice; **Pump:** Not Stated;

ALZET Comments: animal info (male, C57BL6, 20-25g, 7-9 weeks old); post op. care (10000 IU sodium penicillin IM);

Q6270: A. S. Wahl, *et al.* Optogenetically stimulating intact rat corticospinal tract post-stroke restores motor control through regionalized functional circuit formation. *Nat Commun* 2017;8(1):1187

Agents: Antibody, anti-Nogo-A **Route:** CSF/CNS (intrathecal); **Species:** Rat; **Pump:** 2ML2; **Duration:** 2 weeks;

ALZET Comments: animal info (adult female Long-Evans rats); post op. care (animals received analgesics and antibiotics);



Q5992: H. Suzuki, *et al.* Neural stem cell mediated recovery is enhanced by Chondroitinase ABC pretreatment in chronic cervical spinal cord injury. PLoS One 2017;12(8):e0182339

Agents: Chondroitinase AB **Vehicle:** CSF, artificial; **Route:** CSF/CNS (intrathecal); **Species:** Mice; **Pump:** 1007D; **Duration:** 7 days;

ALZET Comments: Controls received mp w/ vehicle; animal info (female, 15-20g); spinal cord injury; Therapeutic indication (Spinal cord injury); Dose (2.64 mU/mL);

Q6181: R. Simeoli, *et al.* Exosomal cargo including microRNA regulates sensory neuron to macrophage communication after nerve trauma. Nat Commun 2017;8(1):1778

Agents: miR-21-5p antagomir **Vehicle:** in vivo transfection reagent; **Route:** SC; CSF/CNS (intrathecal); **Species:** Mice; **Pump:** 1007D; **Duration:** 7 days;

ALZET Comments: Dose (12 pmol/day); Controls received mp w/ vehicle and scrambled oligomer; functionality of mp verified (Catheter and pump were checked at the end of treatment to ascertain efficient delivery) ; spinal cord injury;

Q5981: S. Shen, *et al.* Regulation of transient receptor potential cation channel subfamily V1 protein synthesis by the phosphoinositide 3-kinase/Akt pathway in colonic hypersensitivity. Experimental Neurology 2017;295(104-115

Agents: LY294002 **Vehicle:** DMSO, Saline; **Route:** CSF/CNS (intrathecal); **Species:** Rat; **Pump:** 2001; **Duration:** Not Stated;

ALZET Comments: Controls received mp w/ vehicle; animal info (Sprague-dawley, 200g); enzyme inhibitor (PI3K); Dose (2.4 ug/rat/day or 90 ug/kg/body weight);

Q5891: K. T. Santhosh, *et al.* Design and optimization of PLGA microparticles for controlled and local delivery of Neuregulin-1 in traumatic spinal cord injury. J Control Release 2017;261(147-162

Agents: Neuregulin-1, human recombinant **Vehicle:** CSF, artificial; BSA; **Route:** CSF/CNS (intrathecal); **Species:** Rat; **Pump:** 1003D; 2001; 2002; 2004; **Duration:** 3 days, 7 days, 14 days, 28 days;

ALZET Comments: Controls received mp w/ vehicle; animal info (female, Sprague Dawley, 250g); Dose (500ng/day); 1% BSA used; comparison of microparticles vs mp; spinal cord injury; peptides; Dose (500ng/day); Comparison of PLGA Microparticles with ALZET pumps;

Q6755: U. N. Ramirez-Jarquin, *et al.* Chronic GABAergic blockade in the spinal cord in vivo induces motor alterations and neurodegeneration. Neuropharmacology 2017;117(85-92

Agents: AMPA; CNQX; MK801; bicuculline methbromide; strychnine **Vehicle:** Ringer's solution; **Route:** CSF/CNS (intrathecal); **Species:** Rat; **Pump:** 2004; **Duration:** 16 days;

ALZET Comments: Dose (bicuculline methbromide 5, 10 or 17.5 mM; strychnine 20 mM; Bic 10 mM + CNQX 1 mM; Bic10 mM + MK801 14 mM; AMPA 3.8 mM; and AMPA 3.8 mM + Bic 10 mM.); Controls received mp w/ vehicle; animal info (adult Wistar male rats (270-300 g).); cyanoacrylate adhesive;

Q5884: U. N. Ramirez-Jarquin, *et al.* Chronic infusion of SOD1(G93A) astrocyte-secreted factors induces spinal motoneuron degeneration and neuromuscular dysfunction in healthy rats. J Cell Physiol 2017;232(10):2610-2615

Agents: ACM-hG93A **Vehicle:** Not Stated; **Route:** CSF/CNS (intrathecal); **Species:** Rat; **Pump:** 2004; **Duration:** 16 days;

ALZET Comments: animal info (male, Wistar, 270-300g, adult); neurodegenerative (amyotrophic lateral sclerosis); post op. care (IM penicillin); behavioral testing (rotarod test; paw grip endurance); Pumps primed in 37C saline for 28 hours; used wound clips;

Q6600: C. Mazur, *et al.* Development of a simple, rapid, and robust intrathecal catheterization method in the rat. J Neurosci Methods 2017;280(36-46

Agents: Oligonucleotide, antisense **Vehicle:** Not Stated; **Route:** CSF/CNS (intrathecal); **Species:** Rat; **Pump:** Not Stated; **Duration:** Not Stated;

ALZET Comments: animal info (Sixteen male Sprague-Dawley rats); Publication describes the development of a rapid and robust intrathecal catheterization method for the testing of putative ASO therapeutics for diseases of the CNS.



- Q5828:** K. Matoba, *et al.* Leptin sustains spontaneous remyelination in the adult central nervous system. *Sci Rep* 2017;7(40397)
Agents: Antibody, leptin neutralizing; leptin, recombinant mouse **Vehicle:** PBS; **Route:** CSF/CNS (intrathecal); **Species:** Mice;
Pump: 1007D, 1002; **Duration:** Not Stated;
ALZET Comments: Controls received mp w/ vehicle; animal info (7-8 weeks old) ; ALZET brain infusion kit used; neurodegenerative (Demyelination); Therapeutic indication (Demyelination); Dose ((12 µg/kg body weight per day, 10 ug/kg of body weight per day);
- Q5832:** C. P. Lin, *et al.* CXCL12/CXCR4 Signaling Contributes to the Pathogenesis of Opioid Tolerance: A Translational Study. *Anesthesia & Analgesia* 2017;124(3):972-979
Agents: CXCL12 **Vehicle:** Saline; **Route:** CSF/CNS (intrathecal); **Species:** Rat; **Pump:** 2001; **Duration:** 5, 6 days;
ALZET Comments: Controls received mp w/ vehicle; animal info (250-275 g); Therapeutic indication (Analgesia, anesthesiology); Dose ((3.6 ng/h x 24 hrs);
- Q5846:** B. V. Ineichen, *et al.* Direct, long-term intrathecal application of therapeutics to the rodent CNS. *Nat Protoc* 2017;12(1):104-131
Agents: Not Stated **Vehicle:** Ringer's solution; **Route:** SC, CSF/CNS (Intrathecal); **Species:** Rat; **Pump:** 2ML2; **Duration:** 1 week - 6 weeks;
ALZET Comments: Controls received mp w/ vehicle; animal info (8-24 weeks old); dose-response; good methods p. 109; no stress; The pump does not interfere with behavioral assessments of animals, but from our experience we recommend a recovery interval of 2–3 d after surgery until behavioral testing is resumed; Therapeutic indication (CNS therapeutics);
- Q6431:** M. Hlavica, *et al.* Intrathecal insulin-like growth factor 1 but not insulin enhances myelin repair in young and aged rats. *Neurosci Lett* 2017;648(41-46)
Agents: Insulin-like Growth Factor 1, insulin **Vehicle:** Acetic acid, Saline, Tween; **Route:** CSF/CNS (intrathecal); **Species:** Rat;
Pump: 2ML2; **Duration:** 21 days;
ALZET Comments: Dose (100 µg/day); 0.1% Tween used; Controls received mp w/ vehicle; animal info (12–14 weeks-old and 12 months-old female Long Evans rats); Insulin-like Growth Factor 1 aka IGF-1;
- Q6043:** V. Hernandez-Torres, *et al.* BDNF effects on functional recovery across motor behaviors after cervical spinal cord injury. *J Neurophysiol* 2017;117(2):537-544
Agents: Brain-derived neurotrophic factor **Vehicle:** CSF, artificial; **Route:** CSF/CNS (intrathecal); **Species:** Rat; **Pump:** 2002;
Duration: 14 days;
ALZET Comments: Controls received mp w/ vehicle; animal info (280-300g); spinal cord injury; Dose (180 ng/day);
- Q5812:** M. Flinspach, *et al.* Insensitivity to pain induced by a potent selective closed-state Nav1.7 inhibitor. *Sci Rep* 2017;7(39662)
Agents: JNJ63955918, Morphine **Vehicle:** Saline; **Route:** CSF/CNS (intrathecal); **Species:** Rat; **Pump:** 2002, 2001; **Duration:** 14 days, 2 weeks;
ALZET Comments: Controls received mp w/ vehicle; animal info (250-300g) behavioral testing (Hargreaves test, hotplate test, tail-flick test, formalin flinching); JNJ63955918 is a tarantula venom-derived peptide (a potent, highly selective, closed-state Nav1.7 blocking peptide) ; Therapeutic indication (Pain, analgesia, electrophysiology);
- Q5759:** Y. Cao, *et al.* Synchrotron radiation micro-CT as a novel tool to evaluate the effect of agomir-210 in a rat spinal cord injury model. *Brain Research* 2017;1655(55-65)
Agents: Agomir-210 **Vehicle:** Saline; **Route:** CSF/CNS (intrathecal); **Species:** Rat; **Pump:** 1002; **Duration:** 3 days;
ALZET Comments: Controls received mp w/ vehicle saline, and Agomir-negative; animal info (180-220 g); spinal cord injury; Therapeutic indication (spinal cord injury);
Dose (agomir-NC (1 µL/h, 20 nmol/ mL) or agomir-210 (1 µL/h, 20 nmol/mL));
- Q5871:** J. E. Aguirre, *et al.* Neonatal immune challenge followed by adult immune challenge induces epigenetic-susceptibility to aggravated visceral hypersensitivity. *Neurogastroenterol Motil* 2017;29(9):
Agents: Garcinol **Vehicle:** DMSO, water; **Route:** CSF/CNS (intrathecal); **Species:** Rat; **Pump:** Not Stated; **Duration:** 7 days;
ALZET Comments: 50% DMSO; Garcinol is a HAT inhibitor; Therapeutic indication (Colon Inflammation); Dose (4 nmol per µL);