



**Recent References (2018-Present) on the Administration of Agents
Using Multiple ALZET® Osmotic Pumps in a Single Animal**

ALZET pumps are capable of being implanted in animals as small as mice or neonatal rats to very large animals such as cattle. Regardless of animal size, occasionally there is the need to deliver a higher concentration of compound than a single pump will allow. Implanting multiple pumps in a single animal of sufficient size is an acceptable method to achieve higher concentrations of drug delivery.

Additionally, multiple pumps may be implanted if there is a need to deliver compounds to multiple locations using two catheters. The table below contains citations, which used multiple pumps in popular animal models. To see our minimum animal size estimates for multiple pump implantations see the following webpage:

http://www.alzet.com/resources/technical_tips.html#ImpMultPump

Animal	# of Pumps	Reference
Mice	3	<i>P5997</i> Kuroiwa M, et al. Continuous versus intermittent administration of human endostatin in xenografted human neuroblastoma. <i>J Pediatr Surg</i> 2003; 38(10):1499-1505. "The set of 3 osmotic pumps was retained successfully in the subcutaneous tissue of the treated and control animals throughout the experiment, no decrease in body weight was observed in either group." (p. 1501).
Rat	4	<i>P0432</i> Khan SR, et al. Experimental induction of crystalluria in rats using mini-osmotic pumps. <i>Urol Res</i> 1983; 11(5):199-205
Cat	4	<i>P9788</i> N. Ginovart, et al. D ₂ -Receptor Upregulation is Dependent upon Temporal Course of D ₂ -Occupancy: A Longitudinal [¹¹ C]-Raclopride PET Study in Cats. <i>Neuropsychopharmacology</i> 2009;34(3):662-671
Dog	4	<i>P7118</i> Gilberto DB, et al. Use of three infusion pumps for postoperative administration of buprenorphine or morphine in dogs. <i>JAVMA</i> 2002; 220(11):1655-1660
Monkey	4	<i>P2211</i> Tarantal AF, et al. Pre and postnatal treatment of the rhesus macaque (<i>Macaca mulatta</i>) with azidothymidine: I. fetal studies. <i>Pediatr Aids HIV Infection: Fetus to Adolescent</i> 1994; 5(1):10-19
Rabbit	4	<i>P7178</i> Cellini C, et al. Effect of epidermal growth factor infusion on fetal rabbit intrauterine growth retardation and small intestinal development. <i>J Pediatr Surg</i> 2004; 39(6):891-897
Cattle	4	<i>P3546</i> Roh S-G, et al. Characteristics of growth hormone secretion responsiveness to growth hormone-releasing peptide-2 (GHRP-2 or KP102) in calves. <i>Endocrine J</i> 1996; 43(3):291-298
Pig	12	<i>P1697</i> Mukai S, et al. Changes in plasma gonadotropins, ovarian steroids and inhibin concentrations in gilts following progesterone treatment with implantable osmotic pumps. <i>Anim Reprod Sci</i> 1989; 20:287-297



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- Q11323:** N. Kajitani, *et al.* G protein-biased LPAR1 agonism of prototypic antidepressants: Implication in the identification of novel therapeutic target for depression. *Neuropsychopharmacology* 2024;49(3):561-572
Agents: Lysophosphatidic acid; OMPT **Vehicle:** PBS; **Route:** CSF/CNS (hippocampus); **Species:** Mice; **Strain:** C57BL/6J; LPAR1-heterozygous; **Pump:** 1004; **Duration:** 2 weeks;
ALZET Comments: dose-response (see graphs on pg 8); controls received mp w/ vehicle; animal info (Male; 7-8 weeks old); post op. care: penicillin G, carprofen; brain coordinates (-2.2 mm posterior to bregma, 1.5 mm lateral to midline, -2 mm ventral to skull surface); bilateral cannula used; behavioral testing (Swim test; Open field test); multiple pumps (2) per animal; "...long-term infusion of mouse hippocampus with the potent G protein-biased LPAR agonist OMPT, but not the non-biased agonist LPA, induced antidepressant-like behavior, indicating that G protein-biased agonism might be necessary for the antidepressant-like effects."
- Q11211:** L. E. Stevens, *et al.* JAK-STAT Signaling in Inflammatory Breast Cancer Enables Chemotherapy-Resistant Cell States. *Cancer Res* 2023;83(2):264-284
Agents: Ruxolitinib **Vehicle:** N,N-dimethylacetamide; propylene glycol; **Route:** SC; **Species:** Mice; **Strain:** NOD.Cg-Prkdcscidll2rgtm1Sug/JicTac **Pump:** 1004; **Duration:** Not Stated;
ALZET Comments: Dose (60 mg/kg/day); 60% propylene glycol used; 40% N,N-dimethylacetamide used; animal info: 6-week-old female; Multiple pumps per animal (2); cancer (Breast);
- Q11257:** M. Ceanga, *et al.* Human NMDAR autoantibodies disrupt excitatory-inhibitory balance, leading to hippocampal network hypersynchrony. *Cell Reports* 2023;42(10):113166
Agents: NMDAR-antibody, human monoclonal; control-antibody **Vehicle:** Not Stated; **Route:** SC; **Species:** Mice; **Strain:** C57BL/6J; **Pump:** 1002; **Duration:** 14 days;
ALZET Comments: animal info: male, 16-weeks old 25-30g; brain coordinates: 0.2 mm posterior and ±1.00 mm lateral from bregma, depth 2.2 mm); bilateral cannula used; multiple pumps per mice (2)
- Q10560:** B. Joubert, *et al.* Human CASPR2 Antibodies Reversibly Alter Memory and the CASPR2 Protein Complex. *Annals of Neurology* 2022;91(6):801-813
Agents: CSF **Vehicle:** Not Stated; **Route:** CSF/CNS (lateral ventricle); **Species:** Mice; **Strain:** C57BL6/J; **Pump:** 1002; **Duration:** Not Stated;
ALZET Comments: animal info (; Male; 55 total; 8-10 weeks old; Weighed 25-30 g); behavioral testing (Novel object location; Locomotor activity; Sucrose preference; Open field; Rotarod test); multiple pumps per animal (2); bilateral catheters used; brain coordinates: (0.02 mm anterior and 1.00 mm lateral from bregma, depth 0.22 mm); cannula placement verified via methylene blue; dental cement used
- Q10498:** M. Blanes-Garcia, *et al.* Using Osmotic Pumps to Induce the Production of Gametes in Male and Female European Eels. *Animals (Basel)* 2022;12(3):
Agents: Chorionic gonadotropin hormone, recombinant human; Pituitary extract, carp **Vehicle:** Saline; **Route:** IP; **Species:** Fish (eel); **Strain:** Not Stated; **Pump:** 1004; 2006; 2ML4; **Duration:** 5 weeks; 10 weeks;
ALZET Comments: Dose: HCG (13 IU/uL); CPE (1.05 uL); 90% saline vehicle used; animal info: European eels Male eels (mean body weight = 126.7 +/- 17.9 g), Female eels (mean body weight = 771 +/- 123.8 g); Multiple pumps per animal (3);
- Q10218:** I. Kopaliani, *et al.* Overexpression of dimethylarginine dimethylaminohydrolase 1 protects from angiotensin II-induced cardiac hypertrophy and vascular remodeling. *American Journal of Physiology and Heart Circulatory Physiology* 2021;321(5):H825-H838
Agents: Ang II **Vehicle:** NaCl; **Route:** SC; **Species:** Mice; **Strain:** DDAH1; DDAH1 TG; wild-type; **Pump:** 1002; 1004; **Duration:** 2 weeks; 4 weeks;
ALZET Comments: Dose: (0.75 mg/kg/day); (1.5 mg/kg/day); 0.9% NaCl vehicle used; Controls received mp w/ vehicle; animal info: 12-wk-old male transgenic) and wild-type male littermates (8, 20-22); Multiple pumps per animal (2 different pump model used); Blood pressure measured via: tail cuff; cardiovascular;



Q9530: F. Wang, *et al.* Soluble (pro)renin receptor treats metabolic syndrome in mice with diet-induced obesity via interaction with PPARgamma. *JCI Insight* 2020;5(7):

Agents: Renin receptor, human recombinant soluble; PF429242 **Vehicle:** Not Stated; **Route:** IV (external jugular);

Species: Mice; **Strain:** DIO C57/BL6; **Pump:** 1002; **Duration:** 2 weeks;

ALZET Comments: Dose (30 ug/kg/d); Controls received mp w/ vehicle; animal info (Male 36-week-old mice); Multiple pumps per animal (2 pumps); human recombinant soluble renin receptor aka sPRR, PF429242 aka PF; dependence;

Q10062: J. Savidan, *et al.* Cutaneous Inputs to Dorsal Column Nuclei in Adult Macaque Monkeys Subjected to Unilateral Lesion of the Primary Motor Cortex or of the Cervical Spinal Cord and Treatments Promoting Axonal Growth. *Neuroscience Insights* 2020;15(2633105520973991

Agents: Antibody, anti Nogo-A monoclonal 11C7; Brain-derived neurotrophic factor **Vehicle:** Not Stated;

Route: CSF/CNS (spinal cord); **Species:** Monkey; **Strain:** Macaca fascicularis; **Pump:** 2ML2; **Duration:** 4 weeks;

ALZET Comments: Dose (14.8 mg anti Nogo-A monoclonal antibody 11C7; 1.4 mg Brain-derived neurotrophic factor); animal info (adult monkeys, 3.0 to 5.6 kg, 4 to 6 years old); Multiple pumps per animal (2 pumps); spinal cord injury;

Q9432: H. M. Rodgers, *et al.* Dopamine D1 or D3 receptor modulators prevent morphine tolerance and reduce opioid withdrawal symptoms. *Pharmacology, Biochemistry and Behavior* 2020;194(172935

Agents: Morphine; SCH 39166; Pramipexole **Vehicle:** Saline; **Route:** SC; **Species:** Rat; **Strain:** Long- Evans; **Pump:** 1002; 2002; **Duration:** 14 days;

ALZET Comments: Dose (2 mg/kg); Controls received mp w/ vehicle; animal info (female, rats, weighing 200–225 g); behavioral testing (Withdrawal testing); Multiple pumps per animal (2 or 3); dependence;

Q8910: N. Nishida, *et al.* High Salt Intake Worsens Aortic Dissection in Mice: Involvement of IL (Interleukin)-17A-Dependent ECM (Extracellular Matrix) Metabolism. *Arteriosclerosis, Thrombosis, and Vascular Biology* 2020;40(1):189-205

Agents: Aminopropionitrile, B-; Angiotensin II **Vehicle:** Not Stated; **Route:** Not Stated; **Species:** Mice; **Strain:** Not Stated; **Pump:** 1002; **Duration:** 14 days;

ALZET Comments: Dose (150 mg/kg/day Aminopropionitrile, B-; 1000 ng/kg/min Angiotensin II); animal info (male mice, 11 to 14 weeks old); Multiple pumps per animal (2); B-Aminopropionitrile aka BAPN, Angiotensin II aka Ang II; cardiovascular;

Q8906: S. Nardai, *et al.* N,N-dimethyltryptamine reduces infarct size and improves functional recovery following transient focal brain ischemia in rats. *Experimental Neurology* 2020;327(113245

Agents: Tryptamine, N,N-dimethyl-; 1-(3,4-Dichlorophenethyl)-4-methyl- piperazine dihydrochloride **Vehicle:** Ethanol, Saline; **Route:** IP; **Species:** Rat; **Strain:** Wistar; **Pump:** Not Stated; **Duration:** 24 hours;

ALZET Comments: Dose (2 mg/kg/hr); 70% Ethanol used; Controls received mp w/ vehicle; animal info (male rats, 280 ± 20 g body weight); behavioral testing (staircase method); Multiple pumps per animal (2 pumps); dependence;

Q8563: N. Kajitani, *et al.* Prefrontal cortex infusion of beta-hydroxybutyrate, an endogenous NLRP3 inflammasome inhibitor, produces antidepressant-like effects in a rodent model of depression. *Neuropsychopharmacology Reports* 2020;40(2):157-165

Agents: Beta-hydroxybutyrate **Vehicle:** PBS; **Route:** CSF/CNS (frontal cortex); **Species:** Rat; **Strain:** Sprague-Dawley; **Pump:** 2006; **Duration:** 21 days;

ALZET Comments: Dose (80 mg/mL); Controls received mp w/ vehicle; animal info (Male rats, 7-8 weeks of age); post op. care: Antibacterial penicillin G; Analgesic carprofen; behavioral testing (forced swim test; open field test); Multiple pumps per animal (2 pumps); Beta-hydroxybutyrate aka BHB; Brain coordinates (coordinates: anteroposterior + 3.2 mm, dorsolateral ± 0.6 mm from bregma, ventral 4.0 mm from the skull surface); bilateral cannula used; neurodegenerative (Depression);



Q8863: J. L. Jiang, *et al.* Triple reuptake inhibition of serotonin, norepinephrine, and dopamine increases the tonic activation of alpha2-adrenoceptors in the rat hippocampus and dopamine levels in the nucleus accumbens. *Progress in Neuropsychopharmacology & Biological Psychiatry* 2020;103(109987)

Agents: Nomifensine; Escitalopram **Vehicle:** 2-Hydroxypropyl-B-cyclodextrin; **Route:** SC; **Species:** Rat;

Strain: Sprague-Dawley; **Pump:** Not Stated; **Duration:** 2 days; 14 days;

ALZET Comments: Dose (5 mg/kg/day Nomifensine; 10 mg/kg/day Escitalopram); 20% 2-Hydroxypropyl-B-Cyclodextrin used; Controls received mp w/ vehicle; animal info (Adult male rats weighing 250–350 g); Multiple pumps per animal (2 pumps); dependence;

Q8539: S. Hirakata, *et al.* Genetic Deletion of Socs3 in Smooth Muscle Cells Ameliorates Aortic Dissection in Mice. *JACC Basic Translational Science* 2020;5(2):126-144

Agents: Aminopropionitrile, B-; Angiotensin II **Vehicle:** Not stated; **Route:** SC; **Species:** Mice; **Strain:** Not Stated; **Pump:** 1002; **Duration:** 14 days;

ALZET Comments: Dose (150 mg/kg/day BAPN, 1000 ng/kg/min AngII); animal info (Male mice of 11 to 14 weeks of age); Multiple pumps per animal (2 pumps); B-aminopropionitrile aka BAPN, Angiotensin II aka AngII; cardiovascular;

Q8508: G. Gomez-Correa, *et al.* Chronic Bumetanide Infusion Alters Young Neuron Morphology in the Dentate Gyrus Without Affecting Contextual Fear Memory. *Frontiers in Neuroscience* 2020;14(514)

Agents: Bumetanide **Vehicle:** Propylene; Glycol; **Route:** CSF/CNS (lateral ventricle); **Species:** Rat; **Strain:** Wistar; **Pump:** 2002; **Duration:** 28 days;

ALZET Comments: Dose (0.4 mg/kg/day); Controls received mp w/ vehicle; animal info (male Wistar rats (250–350 g)); Multiple pumps per animal (2 pumps); ALZET brain infusion kit used; Brain coordinates (AP –1.4 mm; ML –2.0 mm); dependence;

Q8402: M. Carceles-Cordon, *et al.* NMDAR Antibodies Alter Dopamine Receptors and Cause Psychotic Behavior in Mice. *Ann Neurol* 2020;88(3):603-613

Agents: NMDAR-CSF **Vehicle:** CSF; **Route:** CSF/CNS (lateral ventricle); **Species:** Mice; **Strain:** C57BL/6J; **Pump:** Not stated; **Duration:** 14 days;

ALZET Comments: Controls received mp w/ vehicle; animal info (male mice, 8 to 10 weeks old (25–30g)); behavioral testing (prepulse inhibition of the acoustic startle reflex; novel object location; general locomotor activity); Multiple pumps per animal (2 pumps); NMDAR aka anti-N-methyl-D-aspartate receptor; dependence;

Q6780: Y. Izawa-Ishizawa, *et al.* Development of a novel aortic dissection mouse model and evaluation of drug efficacy using in-vivo assays and database analyses. *J Hypertens* 2019;37(1):73-83

Agents: Angiotensin II; B-aminopropionitrile **Vehicle:** Saline; **Route:** SC; **Species:** Mice; **Strain:** C57BL/6J; **Pump:** 1002;

Duration: 1 week; 6 weeks;

ALZET Comments: Dose (Angiotensin II (1000 ng/kg per day); B-aminopropionitrile (150 mg/kg/day)); Controls received mp w/ vehicle; animal info (Male mice (10–12 weeks; 25–30 g)); Multiple pumps per animal (2); B-aminopropionitrile is an enzyme inhibitor (lysyl oxidase inhibitor); cardiovascular;

Q7584: J. D. Hill, *et al.* Activation of GPR55 induces neuroprotection of hippocampal neurogenesis and immune responses of neural stem cells following chronic, systemic inflammation. *Brain, Behavior, and Immunity* 2019;76(165-181)

Agents: O-1602; LPS **Vehicle:** CSF, Artificial; saline; **Route:** CSF/CNS (hippocampus); SC; **Species:** Mice; **Strain:** C57BL/6; GPR55–/–; **Pump:** 1002; **Duration:** 14 days;

ALZET Comments: Dose ((O-1602 4 µg/kg/day), (LPS 0.2 mg/kg/day)); O-1602 diluted in 100% EtOH before diluted in ACSF to 0.05% EtOH used; Controls received mp w/ vehicle; animal info (12-15 weeks, male and female,); Multiple pumps per animal (2); O-1602 is an analog of cannabidiol and a potent GPR55 agonist. LPS (lipopolysaccharide) initiates pathological neuroinflammation; ALZET brain infusion kit 3 used; Full compound name of O-1602 is 5-Methyl-4-[(1R,6R)-3-methyl-6-(1-cyclohexen-1-yl)-1,3-benzene-diol]; Therapeutic indication (LPS-induced dysregulation of hippocampal neurogenesis);



Q8033: E. Heikkilä, *et al.* The plant product quinic acid activates Ca²⁺ -dependent mitochondrial function and promotes insulin secretion from pancreatic beta cells. *Br J Pharmacol* 2019;176(17):3250-3263

Agents: Quinic acid **Vehicle:** Saline; **Route:** SC; **Species:** Mice; **Strain:** C57BL/6N; **Pump:** Not stated; **Duration:** 12 weeks; **ALZET Comments:** Dose (75 mg/kg/day); Controls received mp w/ vehicle; animal info (12 weeks old, Male,); pumps replaced every ? weeks; Multiple pumps per animal (); long-term study; Quinic acid aka QA ; dependence;

Q9767: T. W. Flanagan, *et al.* Activation of 5-HT₂ Receptors Reduces Inflammation in Vascular Tissue and Cholesterol Levels in High-Fat Diet-Fed Apolipoprotein E Knockout Mice. *Scientific Reports* 2019;9(1):13444

Agents: (R)-DOI **Vehicle:** Saline; **Route:** SC; **Species:** Mice; **Strain:** ApoE -/-; **Pump:** 2006; **Duration:** 8 weeks; **ALZET Comments:** Dose (2.4 mg); Controls received mp w/ vehicle; animal info (, Male, 20.6- 21.0 g); Multiple pumps per animal (2); (R)-DOI aka (R)-2,5-dimethoxy-4-iodoamphetamine aka 5-HT₂ receptor selective agonist ; cardiovascular;

Q7398: M. Biet, *et al.* In utero exposure to nicotine abolishes the postnatal response of the cardiac sodium current to isoproterenol in newborn rabbit atrium. *Heart Rhythm* 2019;16(4):494-501

Agents: Nicotine **Vehicle:** Saline; **Route:** SC; **Species:** Rabbit; **Strain:** New Zealand; **Pump:** 2ML2; **Duration:** 14 days; **ALZET Comments:** Controls received mp w/ vehicle; animal info (, female); Multiple pumps per animal (2); Resultant plasma level ((100 and 150 ng/mL)); cardiovascular;

Q8783: L. Wu, *et al.* C1QTNF1 attenuates angiotensin II-induced cardiac hypertrophy via activation of the AMPKα pathway. *Free Radical Biology and Medicine* 2018;121(215-230

Agents: Angiotensin II; Tumor necrosis factor related protein 1, C1q, human recombinant **Vehicle:** Saline; **Route:** SC; **Species:** Mice; **Strain:** C57BL/6J; C1QTNF1 KO; **Pump:** 2004; **Duration:** 2, 4 weeks; **ALZET Comments:** Dose ((AngII 1.4 mg/kg/day), (C1QTNF1 0.2 μg/g/day)); Controls received sham surgery; animal info (8-10 weeks, male, , 25+/-2g); Multiple pumps per animal (2); C1QTNF1 is a member of the CTRP superfamily expressed in the myocardium; cardiovascular; recombinant human globular domain of C1QTNF1 used in mp. C1QTNF1 mp implanted 2 weeks after AngII infusion;

Q7840: M. Waldman, *et al.* PARP-1 inhibition protects the diabetic heart through activation of SIRT1-PGC-1α axis. *Experimental Cell Research* 2018;373(1-2):112-118

Agents: Angiotensin II; INO-1001 **Vehicle:** Not Stated; **Route:** SC; **Species:** Mice; **Strain:** C57BLKS/J; C57BLKS/J-leprdb/leprdb; **Pump:** Not Stated; **Duration:** 4 weeks; **ALZET Comments:** Dose ((AngII 1000 ng/kg/min), (INO-1001 5 mg/kg/day)); Controls received no pump; animal info (12-14 weeks, male,); Multiple pumps per animal (2 for AT + INO group); INO-1001 is an enzyme inhibitor (PARP-1); diabetes; Therapeutic indication (PARP-1 inhibition by INO1001 promoted weight loss in the diabetic mice stressed with AT. It attenuated cardiac fibrosis and hypertension in diabetic mice and prevented oxidative stress.);

Q7935: T. Wada, *et al.* Impact of central and peripheral estrogen treatment on anxiety and depression phenotypes in a mouse model of postmenopausal obesity. *PLoS One* 2018;13(12):e0209859

Agents: Estradiol **Vehicle:** CSF, artificial; **Route:** SC; CSF/CNS (lateral ventricle); **Species:** Mice; **Strain:** C57BL/6; **Pump:** 1004; **Duration:** 3 weeks; **ALZET Comments:** Dose ((SC 50 μg/kg/day), (ICV 1 μg/kg/day)); Controls received mp w/ vehicle; animal info (16 weeks, female,); behavioral testing (Open field, Light-dark box, Tail suspension, Forced swim); Multiple pumps per animal (2 for SC group); comparison of SC mp vs ICV mp; ALZET brain infusion kit 3 used; Brain coordinates (0.3 mm posterior to the bregma, 0.9 mm lateral to the central sulcus, 2.5 mm below the skull); replacement therapy (estradiol); Therapeutic indication (mouse model of postmenopausal obesity that exhibited anxiety disorder and depression phenotypes were improved by E2 replacement.);



Q7310: S. Toyama, *et al.* Protective Effect of a Mitochondria-Targeted Peptide against the Development of Chemotherapy-Induced Peripheral Neuropathy in Mice. *ACS Chemical Neuroscience* 2018;9(7):1566-1571

Agents: SS-20 **Vehicle:** Saline; **Route:** SC; **Species:** Mice; **Strain:** BALB/c; **Pump:** 1004; **Duration:** 3 weeks;
ALZET Comments: Dose (5 mg/kg/day, 10 mg/kg/day); Controls received mp w/ vehicle; animal info (Male, mice, 8 weeks old); behavioral testing (von Frey hair test, paw withdrawal); Multiple pumps per animal (2); SS-20 is a mitochondria-targeted peptide;

Q7864: J. A. Sandgren, *et al.* Arginine vasopressin infusion is sufficient to model clinical features of preeclampsia in mice. *JCI Insight* 2018;3(19):

Agents: Arginine Vasopressin; Conivaptan; Relcovaptan; Tolvaptan **Vehicle:** Saline; DMSO; **Route:** SC; **Species:** Mice; **Strain:** Not Stated; **Pump:** 1002; 1004; 1007D; **Duration:** 1, 2 weeks;
ALZET Comments: Dose ((AVP 24 ng/h), (conivaptan 22 ng/h), (relcovaptan 22 ng/h), (tolvaptan 22 ng/h)); saline or saline with 10% DMSO used; Controls received mp w/ vehicle; Multiple pumps per animal (2 if AVP plus antagonist); conivaptan is a nonselective AVPR1A and AVPR2 antagonist. relcovaptan is an AVPR1A antagonist. tolvaptan is an AVPR2 antagonist; AVP and tolvaptan were reconstituted in saline while relcovaptan was reconstituted in saline with 10% DMSO;

Q7259: I. G. Rajapaksha, *et al.* The small molecule drug diminazene aceturate inhibits liver injury and biliary fibrosis in mice. *Sci Rep* 2018;8(1):10175

Agents: Diminazene aceturate **Vehicle:** Not Stated **Route:** SC **Species:** Mice **Strain:** C57BL/6 **Pump:** Not Stated; **Duration:** 2 w
ALZET Comments: Dose (10mg/kg/day); animal info (6–8 weeks old, male mice); functionality of mp verified by residual volume; Multiple pumps per animal (2 pumps);

Q7755: R. W. Holdcraft, *et al.* A model for determining an effective in vivo dose of transplanted islets based on in vitro insulin secretion. *Xenotransplantation* 2018;25(6):e12443

Agents: Insulin, recomb. human **Vehicle:** Not Stated; **Route:** SC; **Species:** Rat; **Strain:** Not Stated; **Pump:** Not Stated;
Duration: 3-5 days;
ALZET Comments: Dose ((female 1.5-2.0 U/day), (males 3.0-4.5 U/day)); Controls consisted of rats that did not become diabetic during the initial study period; animal info (male and female, BioBreeding diabetes-prone); Multiple pumps per animal (2 if hyperglycemic state observed. see p.4); comparison of macrobead implant vs mp; diabetes; Pilot study for CGM calibration 3-5 days followed by 1 or 3 month study using microbeads.

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*); **Strain:** *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);

Q7104: E. S. Calipari, *et al.* Granulocyte-colony stimulating factor controls neural and behavioral plasticity in response to cocaine. *Nature Communications* 2018;9(1):9

Agents: Antibody, anti-GCSF neutralizing antibody, Immunoglobulin G, pre-immune **Vehicle:** Saline; **Route:** CSF/CNS (nucleus accumbens); **Species:** Mice; **Strain:** C57BL/6 J; **Pump:** 1007D; **Duration:** 7 days;
ALZET Comments: Dose (1 ug/day); animal info (Male, 7 weeks old, 20–25 g); Multiple pumps per animal (2); Brain coordinates (From bregma: anteroposterior, +1.5; mediolateral, + 1.0; dorsoventral, –4.5); bilateral cannula used; The cannulae were permanently fixed to the skull with Loctite adhesive; dependence;

Q10120: E. Brolin, *et al.* Chronic administration of morphine using mini-osmotic pumps affects spatial memory in the male rat. *Pharmacology, Biochemistry and Behavior* 2018;167(1-8)

Agents: Morphine hydrochloride **Vehicle:** DMSO; Saline; **Route:** SC; **Species:** Rat; **Strain:** Sprague Dawley; **Pump:** 2ML4;
Duration: 28 days;
ALZET Comments: Dose (17.5 mg/kg/day); 2% DMSO used; Controls received mp w/ vehicle; animal info (male); 8 wks old; behavioral testing (Tail flick, Morris water maze); Multiple pumps per animal (2); good methods (see pg 5);