ALZET®
Bibliography

Recent References (2016-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

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<th>Animal</th>
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<td>Dog</td>
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<td>P7118 Gilberto DB, et al. Use of three infusion pumps for postoperative administration of buprenorphine or morphine in dogs. JAVMA 2002; 220(11):1655-1660</td>
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Recent References (2016-Present) on the Administration of Agents Using Multiple ALZET® Osmotic Pumps in a Single Animal


**Agents:** Angiotensin II  
**Vehicle:** NaCl  
**Route:** SC  
**Species:** Mice  
**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 DDAH1 transgenic (DDAH1 TG) and wild-type male (WT) littermates (8, 20–22); All mice had C57BL/6J genetic background; Multiple pumps per animal (2 different pump model used); Blood pressure measured via: tail cuff; Angiotensin II aka (Ang II)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  
**Pump:** 1002  
**Duration:** 2 weeks  

**ALZET Comments:** Dose (30 ug/kg/d); Controls received mp w/ vehicle; animal info (Male 36-week-old DIO C57/BL6 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  
**Species:** Monkey  
**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); Brain-derived neurotrophic factor aka BDNF; 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  
**Pump:** 1002; 2002  
**Duration:** 14 days  

**ALZET Comments:** Dose (2 mg/kg); Controls received mp w/ vehicle; animal info (female, Long- Evans 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  
**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  
**Pump:** Not Stated  
**Duration:** 24 hours  

**ALZET Comments:** Dose (2 mg/kg/hr); 70% Ethanol used; Controls received mp w/ vehicle; animal info (male Wistar rats, 280 ± 20 g body weight); behavioral testing (staircase method); Multiple pumps per animal (2 pumps); N,N-dimethyl-tryptamine aka DMT; dependence;
**Agents:** Beta-hydroxybutyrate  
**Vehicle:** PBS;  
**Route:** CSF/CNS (frontal cortex);  
**Species:** Rat;  
**Pump:** 2006;  
**Duration:** 21 days;  
**ALZET Comments:** Dose (80 mg/mL); Controls received mp w/ vehicle; animal info (Male Sprague-Dawley rats, 7-8 weeks of age); 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  
**Duration:** 2, 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 Sprague-Dawley rats weighing 250–350 g); Multiple pumps per animal (2 pumps); dependence;

**Agents:** Aminopropionitrile, B-; Angiotensin II  
**Vehicle:** Not stated;  
**Route:** SC;  
**Species:** Mice;  
**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;

**Agents:** NMDAR-CSF  
**Vehicle:** CSF;  
**Route:** CNS/CSF (lateral ventricle);  
**Species:** Mice;  
**Pump:** Not stated;  
**Duration:** 14 days;  
**ALZET Comments:** Controls received mp w/ vehicle; animal info (male C57BL/6J 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;

**Agents:** Protein arginine methyltransferase 3 inhibitor  
**Vehicle:** DMSO;  
**Route:** SC;  
**Species:** Mice;  
**Pump:** 2002;  
**Duration:** 2, 4, or 6 weeks;  
**ALZET Comments:** Dose (20 mg/kg/day); animal info (8 weeks old, C57BL/6J 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); PRMT3 is an enzyme inhibitor (Protein arginine methyltransferase 3 inhibitor);

**Agents:** Angiotensin II; B-aminopropionitrile  
**Vehicle:** Saline;  
**Route:** SC;  
**Species:** Mice;  
**Pump:** 1002;  
**Duration:** 1, 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 C57BL/6J mice (10–12 weeks; 25–30 g)); Multiple pumps per animal (2); B-aminopropionitrile is an enzyme inhibitor (lysyl oxidase inhibitor); cardiovascular;

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

**ALZET Comments:**
- Dose ((O-1602 4 μg/kg/day), (LPS 0.2 mg/kg/day));
- Controls received mp w/ vehicle; animal info (12-15 weeks, male and female, C57BL/6 and GPR55−/−);
- 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);


**Agents:** Quinic acid
**Vehicle:** Saline
**Route:** SC
**Species:** Mice
**Pump:** Not stated
**Duration:** 12 weeks;

**ALZET Comments:**
- Dose (75 mg/kg/day);
- Controls received mp w/ vehicle; animal info (12 weeks old, Male, C57BL/6N);
- Pumps replaced every ? weeks;
- Multiple pumps per animal (2);
- Long-term study;
- Quinic acid aka QA ;


**Agents:** (R)-DOI
**Vehicle:** Saline
**Route:** SC
**Species:** Mice
**Pump:** 2006
**Duration:** 8 weeks;

**ALZET Comments:**
- Dose (2.4 mg);
- Controls received mp w/ vehicle; animal info (8-10 weeks, Male, C57BL/6J and C1QTNF1 KO, 25+/-2g);
- 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
**Pump:** 2ML2
**Duration:** 14 days;

**ALZET Comments:**
- Controls received mp w/ vehicle; animal info (New Zealand, female);
- Multiple pumps per animal (2);
- Resultant plasma level ((100 and 150 ng/mL));
- Cardiovascular;


**Agents:** Angiotensin II; Tumor necrosis factor related protein 1, C1q, human recombinant
**Vehicle:** Saline
**Route:** SC
**Species:** Mice
**Pump:** Not Stated
**Duration:** 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, C57BL/6J and C1QTNF1 KO, 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;


**Agents:** angiotensin II; INO-1001
**Vehicle:** Not Stated
**Route:** SC
**Species:** Mice
**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, C57BLKS/J and C57BLKS/J-leprdb/leprdb);
- 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.).

**Agents:** Estradiol  
**Vehicle:** CSF, artificial  
**Route:** SC, CSF/CNS (lateral ventricle)  
**Species:** Mice  
**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, C57BL/6); 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.);


**Agents:** SS-20  
**Vehicle:** Saline  
**Route:** SC  
**Species:** Mice  
**Pump:** 1004  
**Duration:** 3 weeks  
**ALZET Comments:** Dose (5 mg/kg/day, 10 mg/ kg/day); Controls received mp w/ vehicle; animal info (Male, BALB/c 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  
**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;


**Agents:** Diminazene aceturate  
**Vehicle:** Not Stated  
**Route:** SC  
**Species:** Mice  
**Pump:** Not Stated  
**Duration:** 2 weeks  
**ALZET Comments:** Dose (10mg/kg/day); animal info (6–8 weeks old, male C57BL/6 mice); functionality of mp verified by residual volume; Multiple pumps per animal (2 pumps); Diminazene aceturate aka 4-[2-(4-carbamimidoylphenyl)iminohydrazinyl]benzenecarboximidamide;


**Agents:** Insulin, recomb. human  
**Vehicle:** Not Stated  
**Route:** SC  
**Species:** Rat  
**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. Pump models not stated but duration length listed at 7 or 14 days;


**Agents:** Antibody, anti-Nogo-A  
**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);

**Agents:** Antibody, anti-GCSF neutralizing antibody, Immunoglobulin G, pre-immune

**Vehicle:** Saline; **Route:** CSF/CNS (nucleus accumbens); **Species:** Mice; **Pump:** 1007D; **Duration:** 7 days;

**ALZET Comments:** Dose (1 ug/day); multiple pumps per animal (2); bilateral cannula used; The cannulae were permanently fixed to the skull with Loctite adhesive; dependence;


**Agents:** Morphine hydrochloride

**Vehicle:** DMSO; Saline; **Route:** SC; **Species:** Rat; **Pump:** 2ML4; **Duration:** 28 days;

**ALZET Comments:** Dose (17.5 mg/kg/day); 2% DMSO used; Controls received mp w/ vehicle; animal info (male Sprague Dawley); 8 wks old; behavioral testing (Tail flick, Morris water maze); Multiple pumps per animal (2); good methods (see pg 5);


**Agents:** Angiotensin II; sodium butyrate

**Vehicle:** Not Stated; **Route:** SC; Intrarenal (medulla); **Species:** Rat; **Pump:** 2002; **Duration:** 14 days;

**ALZET Comments:** Controls received mp w/ vehicle; animal info (male, Sprague Dawley, 250-300g); pumps replaced every 12 weeks; Multiple pumps per animal (2); replacement therapy (uniphrectomy); tissue perfusion (renal medulla); cardiovascular; antihypertensive; peptides; Bp measured using radio telemetry (DSI); Dose (Ang II 200 ng/kg/min; NaBu 1 ug/kg/min); good bp comparison curve (pg4);


**Agents:** Leptin

**Vehicle:** Not Stated; **Route:** SC; **Species:** Mice; **Pump:** Not Stated; **Duration:** 24 weeks;

**ALZET Comments:** Dose (5 mg/day; 10 mg/day); Controls received mp w/ vehicle; animal info (10-week-old male ObOb and strain-matched control mice); pumps replaced every 12 weeks; Multiple pumps per animal (2); long-term study;

Q6173: J. S. Medel-Matus, et al. Galanin contributes to monoaminergic dysfunction and to dependent neurobehavioral comorbidities of epilepsy. Experimental Neurology 2017;289(64-72

**Agents:** M40, M871, Galanin receptor antagonists

**Vehicle:** Saline; **Route:** CSF/CNS (raphe nucleus); CSF/CNS (locus coeruleus); **Species:** Rat; **Pump:** 1007D; **Duration:** 3 days;

**ALZET Comments:** Dose (10 nM solution of M40, 30 nM solution of M871); Controls received mp w/ vehicle; animal info (50 day old maleWistar rats); Multiple pumps per animal (2); M40 is a Galanin receptor type 1/2 antagonist; M871 is a preferential GalR2 antagonist; PlasticsOne cannula used (28 GA; length 6.5 mm for RN, 8.0 mm for LC); bilateral cannula used for LC infusion with 2 pumps; Therapeutic indication (Epilepsy);


**Agents:** Antibody, anti-TGF ; Angiotensin II

**Vehicle:** Not Stated; **Route:** CSF/CNS (left ventricle); **Species:** Mice; **Pump:** 1002; **Duration:** 2 weeks;

**ALZET Comments:** Dose (TG neutralizing antibody: 50 μg/d; Ang II: 500 ng/kg/min); animal info (8-10 week old male adult wild-type, Tg, 34Lan, and B6.129P-Cx3cr1tm1Litt/J mice); Multiple pumps per animal (second pump with angiotensin II implanted 3 or 7 days after first pump); antihypertensive; ALZET brain infusion kit 3used; Brain coordinates (0.5 mm caudal to Bregma; 1 mm lateral to the midline; 2 mm ventral to the dura); cardiovascular;


**Agents:** Angiotensin II; Relaxin Vehicle: Saline; Sodium acetate; **Route:** SC; **Species:** Mice (knockout); **Pump:** 2004; 1004; **Duration:** 28 days;

**ALZET Comments:** Dose (Angiotensin II: 1.4 mg/kg/day; Relaxin: 0.1, 0.3, or 0.6 mg/kg/day); Controls received mp w/ vehicle; animal info (male C57BL/6 and Apoe−/− mice); Multiple pumps per animal (2); cardiovascular;
Agents: Exendin-4; FK506 Vehicle: PBS; saline; Route: SC; Species: Mice (NSG), mice (NOD); Pump: 1004; 1002; Duration: 4 weeks; 2 weeks;
ALZET Comments: Dose (exendin-4: 24 nmol/kg/d; FK506: 0.25 mg/kg/d); Controls received mp w/ vehicle; animal info (NOD.Cg-Prkdcscid1Il2rtg1Wjl/Sz (NSG) mice); Multiple pumps per animal (2): some animals received a second pump containing FK506 after 2 weeks; diabetes;

Agents: Nicotine; mecamylamine; methyllycaconitine Vehicle: Not Stated; Route: SC; Species: Rat (pregnant); Pump: 2004; Duration: 28 days;
ALZET Comments: Controls received mp w/ vehicle; animal info (female, Sprague Dawley, 250-300g); pumps replaced on GD7; Multiple pumps per animal (2); no stress (see pg. 110-111); teratology; MLA is an a7nAChR antagonist; methyllycaconitine aka MLA; Dose (nicotine 6 mg/kg/day; mecamylamine 0.03 mg/kg/day; methyllycaconitine 3 mg/kg/day);

Q5113: L. Zhao, et al. Bronchopulmonary C-fibers’ IL1RI contributes to the prolonged apneic response to intra-atrial injection of capsaicin by prenatal nicotinic exposure in rat pups. Toxicol Appl Pharmacol 2016;303(58-64
Agents: Nicotine; methyllycaconitine Vehicle: Saline; Route: SC; Species: Rat; Pump: 2004; Duration: 28 days;
ALZET Comments: Controls received mp w/ vehicle; animal info (female, Sprague Dawley, 250-300g); pumps replaced every 28 days; Multiple pumps per animal (2); long-term study; teratology; Dose (Nicotine 6 mg/kg/day; mecamylamine 0.03 mg/kg/day; methyllycaconitine 3 mg/kg/day);

Agents: HMGB1; Box A; OxPAPC Vehicle: CSF, artificial; Route: CSF/CNS; Species: Rat; Pump: 1003D; Duration: 2 days;
ALZET Comments: Controls received mp w/ vehicle; animal info (male, Sprague Dawley, 250-300g); Multiple pumps per animal (2); Bilateral infusion; Dose (HMGB1 120 ng/h; Box A 12-120 ng/hr; OxPAPC 20 ug/h);

Agents: Rapamycin; amyloid protein, beta (1-42) Vehicle: CSF, artificial; Route: CSF/CNS; Species: Rat; Pump: 1002; Duration: 14 days;
ALZET Comments: animal info (male, Sprague Dawley, 3-4 months old, 300-350g); Multiple pumps per animal (2); neurodegenerative (Alzheimer’s); behavioral testing (Y-maze); immunology; Bilateral infusion; used jewelers’ screw and dental zinc cement; Dose (10 mg/kg amyloid beta, rapamycin 500 ug/2 weeks); Brain coordinates;

Agents: Angiotensin II Vehicle: Not Stated; Route: SC; Species: Mice; Pump: 1004; Duration: 8 weeks;
ALZET Comments: Controls received mp w/ PBS; animal info (male, LDLR -/-, 8-10 weeks old); pumps replaced every 4 weeks; Multiple pumps per animal (2); post op. care (injection of bupivicane and carpofen); cardiovascular; peptides; bp measured using tail cuff; Dose (1.5 ug/kg/min);

Agents: Ephrin-B2, Vehicle: CSF, patient; Route: CSF/CNS (ventricle); Species: Mice; Pump: 1002; Duration: 14 days;
ALZET Comments: animal info (8-10 weeks old, 25-30 g; C57BL/6J); behavioral testing (novel object recognition, tail suspension, forced swim test); The CSF infused was pooled from patient’ samples; Multiple pumps per animal (2); Therapeutic indication (Memory, neuroplasticity);
Agents: Tubacin; Niltubacin Vehicle: DMSO; PBS; Route: SC; Species: Mice; Pump: 1004; Duration: 30 days;
ALZET Comments: Dose (0.0083 mg/day); 50% DMSO, 50% PBS used; animal info (4-6 month old Berkeley sickle mice); Multiple pumps per animal (2); enzyme inhibitor (HDAC6);

Agents: Nicotine ditartrate, pyrilamine Vehicle: Saline; Route: SC; Species: Rat; Pump: 2ML2, 2ML4; Duration: 2 weeks;
ALZET Comments: Controls received mp w/ vehicle; Multiple pumps per animal (2); animal info (Young adult female Sprague-Dawley rats, 8 weeks old); Nicotine dependence; Chronic nicotine infusion via sc implanted osmotic minipumps is functionally similar to the zero order kinetic of steady nicotine infusion achieved by nicotine skin patches; Therapeutic indication (Nicotine dependency); Dose (Nicotine administered for 4 weeks with 2ML4 at 2.5, 5 mg/kg/day, Pyrilamine administered for 2 weeks with 2ML2 at 25 mg/kg/day);

Agents: Angiotensin II; Glucagon-like peptide-1; Glucose-dependent insulinotropic polypeptide Vehicle: Saline; Route: SC; Species: Mice; Pump: 1002; Duration: 4 weeks;
ALZET Comments: Controls received mp w/ vehicle; animal info (Apoe -/- mice, 9 weeks old); functionality of mp verified by plasma levels, blood pressure; pumps replaced every 2 weeks; Multiple pumps per animal (2); 1 for either Ang II, GLP-1 or GIP; enzyme inhibitor (Dipeptidyl Peptidase-4 inhibitor); cardiovascular; atherosclerosis; peptides; Pathophysiology similarities btwn abdominal aortic aneurysms, atherosclerosis; Therapeutic indication (Abdominal aortic aneurysm); Dose (2000 ng/kg/min AngII, 2.16 nmol/kg/day GLP-1, 25 nmol/kg/day GIP); Resultant blood pressure (Start: 104 mmHg, End: 118 mmHg);

Agents: Resveratrol; EX-527 Vehicle: DMSO; Route: SC; Species: Mice; Pump: 1002; Duration: 14 days;
ALZET Comments: Controls received mp w/ vehicle; animal info (7-9 weeks; C57BL/6J); Multiple pumps per animal (2); behavioral testing (open field, elevated-plus maze, forced swim test, sucrose preference test); Plastics One guide cannula used; bilateral cannulae (one pump for each pedestal); Loctite adhesive used; EX-527 is a SIRT1 antagonist; Therapeutic indication (Depression); Dose (0.1 or 0.2 ug/day, EX-527: 0.5 or 1.0 ug/day);

Agents: Dextrose, C21, PD-123319, Angiotensin II Vehicle: Water; Route: SC; Species: Rat; Pump: 1007D, 2001; Duration: 1 week;
ALZET Comments: Controls received mp w/ vehicle; animal info (12 weeks); good methods (p. 546); Multiple pumps per animal (2); Multiple pumps per animal (2); Intrarenal infusion; Therapeutic indication (Hypertension); Dose (C21: 60ng/kg/min, PD-123319: 10 ng/kg/min, Dextrose/AngII: 200 ng/kg/min);

Agents: Rapamycin, marinobufagenin Vehicle: Not Stated; Route: SC; Species: Rat; Pump: 2004; Duration: 4 weeks;
ALZET Comments: animal info (Male Sprague-Dawley rats weighing 250–300 g); Multiple pumps per animal (2 minipumps were implanted for coadministration of rapamycin and MBG); Marinobufagenin is a cardiotonic steroid; Dose (MBG 10 ug/kg/day; rapamycin 0.2 mg/kg/d);

**Agents:** Aldosterone, eplerenone, FAD286  
**Vehicle:** CSF, artificial; acetonitrile  
**Route:** SC; CSF/CNS  
**Species:** Rat  
**Pump:** 2004  
**Duration:** 2 weeks, 3 weeks  

**ALZET Comments:** Controls received mp w/ vehicle; animal info (male, Wistar, 200-250g); 4% acetonitrile used; Multiple pumps per animal; cardiovascular; bp measured using radiotelemetry; dose (1.5 and 7.5 ug/kg/hr Aldosterone, 5ug/day Eplerenone, 25 ug/day FAD286)

Q6094: L. Deng, et al. Prophylactic treatment with the tricyclic antidepressant desipramine prevents development of paclitaxel-induced neuropathic pain through activation of endogenous analgesic systems. Pharmacol Res 2016;114(75-89

**Agents:** Desipramine, naloxone, AM251, AM630  
**Vehicle:** Water, saline, PEG 400, DMSO  
**Route:** SC  
**Species:** Rat  
**Pump:** 2ML4  
**Duration:** 28 days  

**ALZET Comments:** Dose: Desipramine (10 mg/kg/d), Naloxone (12 mg/kg/d), AM251 (3 mg/kg/d), AM630 (3 mg/kg/day); Desipramine dissolved distilled water, naloxone dissolved in saline, AM251 and AM630 dissolved in 50% PEG400 and 50% DMSO; Controls received mp w/ vehicle; animal info (Sprague-Dawley rats weighing 275–350 g); Multiple pumps per animal (2 when given the treatment of 2 different agents), Desipramine, vehicle, and all antagonists were delivered in separate osmotic pumps;


**Agents:** Antibody, beta-2-glycoprotein, hydroxychloroquine  
**Vehicle:** Water, distilled  
**Route:** Not Stated  
**Species:** Mice (pregnant)  
**Pump:** 1002  
**Duration:** Not Stated  

**ALZET Comments:** Animal info (Age 2-3 months old; pump inserted day 8 of pregnancy); Multiple pumps per animal (2); A group of pregnant mice received hydroxychloroquine administered by a second microosmotic pump (Alzet model 1002) on day 8 of pregnancy.; peptides; “Administration through microosmotic pumps ensures constant antibody concentrations are maintained throughout pregnancy to closely resemble the clinical condition.” Pg 32 ; Therapeutic indication (Pregnancy, antiphospholipid syndrome); Dose (200 ug/mouse/day);