



Recent References (2021-Present) on Tolerance and Dependence Research
Using ALZET® Osmotic Pumps

Q11014: J. Vargas-Medrano, *et al.* Sex and diet-dependent gene alterations in human and rat brains with a history of nicotine exposure. *Frontiers in Psychiatry* 2023;14(1104563)

Agents: Nicotine **Vehicle:** Saline; **Route:** Not Stated; **Species:** Rat; **Strain:** Wistar; **Pump:** 2ML2; **Duration:** 14 days;
ALZET Comments: Dose (3.2 mg/kg/day); Controls received sham operation; animal info: Adult rats between 60 and 75 days of age post op. care: topical antibiotic ointment (Neosporin) on the wound, SC administration of analgesic flunixin (2.5 mg/kg);

Q11000: M. L. Smith, *et al.* Identification of candidate genes for nicotine withdrawal in C57BL/6J x DBA/2J recombinant inbred mice. *Genes, Brain and Behavior* 2023;22(2):e12844

Agents: Nicotine **Vehicle:** Saline; **Route:** SC; **Species:** Mice; **Strain:** C57BL/6J; DBA/2J; BXD RI; **Pump:** 2002; **Duration:** 14 days;
ALZET Comments: Dose (24 mg/kg/day); 0.9% sodium chloride used; Controls received mp w/ vehicle; animal info: 7-8 weeks; behavioral testing: plus-maze test, elevated plus maze, somatic signs; dependence

Q10960: L. D. McGill, *et al.* Prenatal nicotine exposure alters gene expression profiles of neurons in the sub-regions of the VTA during early postnatal development. *Scientific Reports* 2023;13(1):4911

Agents: Nicotine hydrogen tartrate **Vehicle:** Saline; **Route:** SC; **Species:** Rat; **Strain:** Sprague Dawley; **Pump:** Not Stated; **Duration:** 7 days;
ALZET Comments: Dose (6 mg/kg/day); Controls received mp w/ vehicle; animal info: Pregnant, female; dependence;

Q10922: R. C. N. Marchette, *et al.* Heroin- and Fentanyl-Induced Respiratory Depression in a Rat Plethysmography Model: Potency, Tolerance, and Sex Differences. *Journal of Pharmacology and Experimental Therapeutics* 2023;385(2):117-134

Agents: Fentanyl citrate **Vehicle:** Saline; **Route:** SC; **Species:** Rat; **Strain:** Long Evan; **Pump:** 2ML1; **Duration:** 7 days;
ALZET Comments: Dose (0.06 mg/kg/d); 0.9% sterile saline used; animal info (Male and females; 8 weeks old); dependence

Q10571: L. Kennedy, *et al.* Secretin Alleviates Biliary and Liver Injury During Late-Stage Primary Biliary Cholangitis Via Restoration of Secretory Processes. *Journal of Hepathology* 2023;78(1):99-113

Agents: Secretin **Vehicle:** Not Stated; **Route:** IP; **Species:** Mice; **Strain:** dnTGFbRII; Wild-type; **Pump:** 1004; **Duration:** 1 week; 8 weeks;
ALZET Comments: Dose: (4 ug/kg body weight/day); animal info: 32-week-old female and male; Secretin aka (SCT); dependence; Secretin- Primary biliary cholangitis (PBC)

Q10951: Y. Jiao, *et al.* Molecular identification of bulbospinal ON neurons by GPER, which drives pain and morphine tolerance. *Journal of Clinical Investigation* 2023;133(1):

Agents: G15 **Vehicle:** CSF, artificial; **Route:** CSF/CNS (cisterna magna); **Species:** Rat; **Strain:** Sprague-Dawley; **Pump:** 2004; **Duration:** Not Stated;
ALZET Comments: Controls received mp w/ vehicle; animal info (Male and female CPM-treated); G15 is a GPER-selective antagonist; PE-10 catheter used; dependence

Q10921: R. Jain. Role of Habb-e-Jawahar in Attenuating Nicotine Withdrawal in Rats. *Journal of Drug and Alcohol Research* 2023;12(**Agents:** Nicotine tartrate, dihydrate **Vehicle:** Saline; **Route:** SC; **Species:** Rat; **Strain:** Wistar **Pump:** 2ML1 **Duration:** 7d

ALZET Comments: Dose (9 mg/kg/day); Controls received mp w/ vehicle; animal info (Male; Albino ; Weighed 175-250 g); behavioral testing (Motor activity); dependence;

Q11105: A. Ganaway, *et al.* Investigating the Modulation of the VTA Neurons in Nicotine-Exposed Pups during Early Maturation Using Optogenetics. *International Journal of Molecular Sciences* 2023;24(3):

Agents: Nicotine hydrogen tartrate **Vehicle:** Not Stated; **Route:** SC; **Species:** Rat; **Strain:** Sprague-Dawley, WT; **Pump:** Not Stated; **Duration:** 28 days;
ALZET Comments: Dose (6 mg/kg/day); Controls received mp w/ vehicle; animal info (Female; Pregnant); dependence;



Q11303: A. D. Dunn, *et al.* Molecular and long-term behavioral consequences of neonatal opioid exposure and withdrawal in mice. *Frontiers in Behavioral Neuroscience* 2023;17(1202099)

Agents: Morphine **Vehicle:** Saline; **Route:** SC; **Species:** Mice; **Strain:** C57Bl/6NTac; **Pump:** 1004; **Duration:** 14 days;
ALZET Comments: Dose (10 mg/kg/day); Controls received mp w/ vehicle; animal info (Female; 8-13 weeks old); behavioral testing: pups (ultrasonic vocalizations, somatic withdrawal, and hot plate latency), adult (elevated plus maze, tail suspension, learned helplessness, conditioned place preference, self admin; teratology);

Q11096: E. M. Chin, *et al.* In utero methadone exposure permanently alters anatomical and functional connectivity: A preclinical evaluation. *Frontiers in Pediatrics* 2023;11(1139378)

Agents: Methadone **Vehicle:** Saline; **Route:** SC; **Species:** Rat; **Strain:** Sprague-Dawley; **Pump:** Not Stated; **Duration:** 28 days;
ALZET Comments: Dose: (12 mg/kg/day); Controls received mp w/ vehicle; animal info (Female and pregnant); receptor agonist (μ -opioid); dependence;

Q11254: M. D. M. Cajiao-Manrique, *et al.* A male mouse model of WIN 55,212-2 self-administration to study cannabinoid addiction. *Frontiers in Pharmacology* 2023;14(1143365)

Agents: Clozapine-N-oxide **Vehicle:** Saline; **Route:** SC; **Species:** Mice; **Strain:** C57BL/6J; **Pump:** 2004; **Duration:** 15 days;
ALZET Comments: 0.9% saline used; Controls received mp w/ vehicle; animal info (Male; 8 weeks old); behavioral testing (Motivation; Persistence of response; Compulsivity); dependence;

Q11253: B. Buzzi, *et al.* Differential roles of diacylglycerol lipase (DAGL) enzymes in nicotine withdrawal. *Brain Research* 2023;1817(148483)

Agents: Nicotine bitartrate **Vehicle:** Saline; **Route:** SC; **Species:** Mice; **Strain:** DAGL- α KO; WT (99% C57BL/6, 1% 129/ SvEv); **Pump:** Not Stated; **Duration:** 14 days;
ALZET Comments: Dose (24 mg/kg/day); controls received mp w/ vehicle; behavioral testing: light-dark box; somatic withdrawal signs; hot-plate test; dependence; 200 μ l pump used no model specified

Q11251: K. T. Brown, *et al.* Toll-like receptor 4 antagonists reduce cocaine-primed reinstatement of drug seeking. *Psychopharmacology* 2023;240(7):1587-1600

Agents: Naltrexone **Vehicle:** Saline; **Route:** SC; **Species:** Rat; **Strain:** Sprague-Dawley; **Pump:** 2ML1; 2ML2; **Duration:** 7; 14 d
ALZET Comments: Dose: 15 mg/kg/day; Controls received mp w/ vehicle; animal info (Male; Weighed 330-350 g); comparison of acute injection vs mp; dependence; testing cocaine self-administration after pump implant

Q11064: A. T. Amgott-Kwan, *et al.* Endomorphin analog ZH853 shows low reward, tolerance, and affective-motivational signs of withdrawal, while inhibiting opioid withdrawal and seeking. *Neuropharmacology* 2023;227(109439)

Agents: ZH853; morphine **Vehicle:** Saline; **Route:** IV; **Species:** Rat; **Strain:** Sprague-Dawley; **Pump:** 2ML1; **Duration:** 7 days;
ALZET Comments: Dose: (ZH853 6 mg/day; Morphine 10 mg/day); 20% PEG in saline used; animal info: Male and female; 250-275 g and 200-225 g; dependence

Q11196: M. I. Allen, *et al.* PET imaging of dopamine transporters and D2/D3 receptors in female monkeys: effects of chronic cocaine self-administration. *Neuropsychopharmacology* 2023;48(10):1436-1445

Agents: Raclopride **Vehicle:** Saline; **Route:** SC; **Species:** Monkey (cynomolgus); **Strain:** Macaca fascicularis; **Pump:** 2ML4; **Duration:** 30 days;
ALZET Comments: Dose (0.01 mg/kg/h); animal info (3 monkeys did not show recovery of D2/D3 receptor measures after cocaine self-administration + 9 mo off); behavioral testing; dependence;

Q11195: Y. Alkhlaif, *et al.* L-theanine attenuates nicotine reward and withdrawal signs in mice. *Neuroscience Letters* 2023;807(137279)

Agents: Nicotine **Vehicle:** Saline; **Route:** SC; **Species:** Mice; **Strain:** ICR; **Pump:** 2002; **Duration:** 14 days;
ALZET Comments: Dose (24 mg/kg); Controls received mp w/ saline; animal info (Male; 8 weeks old); dependence; behavioral testing: Light-Dark box test, hot-plate test



Q10621: F. Navarrete, *et al.* Biomarkers of the Endocannabinoid System in Substance Use Disorders. *Biomolecules* 2022;12(3):
Agents: Nicotine **Vehicle:** Not Stated; **Route:** Not Stated; **Species:** Mice; **Strain:** C57BL/6J; **Pump:** Not Stated; **Duration:** 14 d
ALZET Comments: Dose (25 mg/kg/day); animal info (Male); toxicology; dependence;

Q11206: E. Minakova, *et al.* Perinatal oxycodone exposure causes long-term sex-dependent changes in weight trajectory and sensory processing in adult mice. *Psychopharmacology (Berl)* 2022;239(12):3859-3873
Agents: Oxycodone **Vehicle:** Saline; **Route:** SC; **Species:** Mice; **Strain:** C57BL/6J; **Pump:** Not Stated; **Duration:** 4, 6 weeks;
ALZET Comments: Dose-response: 5, 10, 15 mg/kg/day; 0.9% NaCl used; Controls received mp w/ vehicle; animal info: adult male; behavioral testing: (see p.3861) Table 1; dependence; "Specifically, we implemented subcutaneous, continuous infusion of oxycodone (Oxy) at different durations enabling comparison of the long-term consequences of Oxy exposure until birth (short Oxy) to the impact of continued postnatal opioid exposure (long Oxy) spanning gestation through birth and lactation." p. 2

Q11172: C. R. Leibrand, *et al.* Independent actions by HIV-1 Tat and morphine to increase recruitment of monocyte-derived macrophages into the brain in a region-specific manner. *Neuroscience Letters* 2022;788(136852)
Agents: Morphine **Vehicle:** Not Stated; **Route:** SC; **Species:** Mice; **Strain:** Tat+; Tat-; **Pump:** 2002; 2001; **Duration:** 19 days;
ALZET Comments: Dose: 0.77 mg/day; 1.5 mg/day; animal info: adult, female mice approx. 70 days of age; post op. care: bupivacaine applied to all surgical sites immediately after implantation; immunology; dependence

Q10757: E. Y. P. Kung Huang, *et al.* Effect of Dextromethorphan on Nicotine-Induced Reward, Behavioral Sensitization, Withdrawal Signs, and Drug Seeking-Related behavior in Rats. *Nicotine and Tobacco Research* 2022;
Agents: Nicotine, Dextromethorphan **Vehicle:** Saline; **Route:** SC; **Species:** Rat; **Strain:** Sprague Dawley; **Pump:** 2ML1;
Duration: 7 Days;
ALZET Comments: Dose (Nicotine 9 mg/kg/day; DM 10 mg/kg/day); animal info (Male; 8 weeks old; Weighed 300-400 g); behavioral testing (Locomotor activity); dependence; Therapeutic indication (Nicotine dependence);

Q11154: J. Keady, *et al.* Age-specific impacts of nicotine and withdrawal on hippocampal neuregulin signalling. *European Journal of Neuroscience* 2022;56(6):4705-4719
Agents: Nicotine tartrate **Vehicle:** Saline; **Route:** SC; **Species:** Mice; **Strain:** B6/129S F1 (C57/B6 and 129S hybrid); **Pump:** 2002;
Duration: 14 days;
ALZET Comments: Dose (18 mg/kg/d); 0.9% saline used; Controls received mp w/ vehicle; animal info: Male and female mice 8-20 weeks of age; wound clips used; behavioral testing: open field; dependence;

Q10949: M. R. Jain, *et al.* ZYKR1, a novel, potent, and peripherally selective kappa opioid receptor agonist reduces visceral pain and pruritus in animal models. *European Journal of Pharmacology* 2022;924(174961)
Agents: ZYKR1; Fentanyl **Vehicle:** Saline; **Route:** IP; **Species:** Mice; **Strain:** ICR; **Pump:** 1007D; **Duration:** 7 days;
ALZET Comments: Dose: Fentanyl (3.2 mg/kg/day); ZYKR1 (10 mg/kg/day); Controls received mp w/ vehicle; animal info: male ICR mice; behavioral testing: the animals were observed for behavioral visceral episodes (postures) for 30 min in a transparent acrylic chamber; Resultant plasma level (at 0.25 h after IV administration of ZYKR1 (1 mg/kg) in rats, plasma level was found to be 1713.03 ±261.95 ng/ml.); pg. 7; ZYKR1 is a peripherally selective kappa opioid receptor; dependence; "The osmotic pump was used to avoid repeated intravenous administration of drug and also released the drug substance at constant rate for 7 days." p. 3

Q10609: C. M. Francisco, *et al.* Resveratrol Reverses Male Reproductive Damage in Rats Exposed to Nicotine During the Intrauterine Phase and Breastfeeding. *Andrology* 2022;10(5):951-972
Agents: Nicotine **Vehicle:** Not Stated; **Route:** SC; **Species:** Rat; **Strain:** Wistar; **Pump:** 2ML4; **Duration:** 50 days;
ALZET Comments: Dose: Nicotine (2 mg/kg/day); Controls received mp w/ vehicle; animal info: rats pregnant female; cyanoacrylate glue used; pumps replaced after 28 days; dependence



Q10519: A. C. Dutra-Tavares, *et al.* Adolescent nicotine potentiates the inhibitory effect of raclopride, a D(2)R antagonist, on phencyclidine-sensitized psychotic-like behavior in mice. *Toxicology and Applied Pharmacology* 2022;456(116282)

Agents: Nicotine **Vehicle:** Water, milli-Q; **Route:** SC; **Species:** Mice; **Strain:** C57BL/6; **Pump:** 1002; **Duration:** 8 days;

ALZET Comments: Dose (24 mg/kg/day); Controls received mp w/ vehicle; animal info: mice, post op. care: flunixin and enrofloxacin for pain and infection management; behavioral testing (Open field); dependence; no stress (see pg. 3)

Q10509: B. Cruz, *et al.* Alcohol self-administration and nicotine withdrawal alter biomarkers of stress and inflammation and prefrontal cortex changes in Gbeta subunits. *The American Journal of Drug and Alcohol Abuse* 2022;1-12

Agents: Nicotine, hydrogen ditartrate **Vehicle:** Saline; **Route:** SC; **Species:** Rat; **Strain:** Not Stated **Pump:** 2ML2 **Duration:** 14d

ALZET Comments: Dose (3.2 mg/kg/day); 0.9% saline used; animal info (Male; Rats; Weighed 250-300 g); wound clips used; dependence;

Q10430: M. Crespo-Masip, *et al.* Elimination of Vitamin D Signaling Causes Increased Mortality in a Model of Overactivation of the Insulin Receptor: Role of Lipid Metabolism. *Nutrients* 2022;14(7):

Agents: Glucose, D-(+); Mannitol, D- **Vehicle:** Not Stated; **Route:** CSF/CNS (intracerebroventricular); **Species:** Mice; **Strain:** Cre-negative; VDR-KO; PTEN-KO; **Pump:** 2006; **Duration:** 42 days;

ALZET Comments: Controls received mp w/ vehicle; animal info: Cre-negative littermates were used as controls (CNT). Twenty-one days after birth, dependence; Taken together, the results shown in the present paper point to the paramount role of an adequate (vitamin D) signaling pathway in hypoglycemia induced by overactivation of the insulin receptor. Thus, in T1 diabetic patients, especially in the lean phenotype, maintaining correct levels of vitamin D could support proper lipid metabolism and decrease deaths induced by insulin dosing errors. (pg.13)"; diabetes

Q10457: K. E. Clafin, *et al.* Pharmacological FGF21 signals to glutamatergic neurons to enhance leptin action and lower body weight during obesity. *Molecular Metabolism* 2022;64(101564)

Agents: Fibroblast growth factor 21; Leptin; Leptin antagonist **Vehicle:** Not Stated; **Route:** SC; CSF/CNS; **Species:** Mice; **Strain:** DIO Wild-type; **Pump:** 1002; 1004; **Duration:** 2 weeks;

ALZET Comments: Dose: FGF21 (1 mg/kg/day); Leptin (250 ng/h); Leptin antagonist (8 ug/day); Controls received mp w/ vehicle; animal info: 12-18 wks; Fibroblast growth factor 21 aka (FGF21); ALZET brain infusion kit 3 used; Brain coordinates (1 mm lateral, 0.34 mm caudal to bregma, and 2.5 mm ventral from the surface of the skull.); dental cement used; Vetbond (3 M);

Q10453: D. Chen, *et al.* Qingda granule alleviate angiotensin ii -induced hypertensive renal injury by suppressing oxidative stress and inflammation through NOX1 and NF-kappaB pathways. *Biomedicine & Pharmacotherapy* 2022;153(113407)

Agents: Angiotensin II; Qingda granule **Vehicle:** Saline; **Route:** Not Stated; **Species:** Mice; **Strain:** C57BL/6; **Pump:** 2002;

Duration: Not Stated;

ALZET Comments: Dose: (500 ng/kg/min.)Controls received mp w/ vehicle; animal info: mice aged 6–8 weeks; blood pressure measured via: noninvasive BP monitor; blood pressure measurement (pg.5) fig. 1 Angiotensin II aka (Ang II); dependence; cardiovascular; (Hypertension)

Q10407: S. L. Baringer, *et al.* Regulation of brain iron uptake by apo- and holo-transferrin is dependent on sex and delivery protein. *Fluids Barriers CNS* 2022;19(1):49

Agents: Apotransferrin; Holo-transferrin **Vehicle:** Not Stated; **Route:** CSF/CNS (lateral ventricle); **Species:** Mice; **Strain:** Wild-type; **Pump:** 2004; **Duration:** 48 hours;

ALZET Comments: Controls received mp w/ vehicle; animal info (3 months old); post op. care: The incision was then sutured with nylon sutures. The mice were then placed in a heated recovery chamber until they regained consciousness.; artificial cerebrospinal fluid aka aCSF; Brain coordinates (1 mm lateral to Bregma; 0.5 mm posterior to lateral ventricle); dependence;

Q10404: N. Baidoo, *et al.* Inhibition of noradrenergic and corticotrophin-releasing factor systems: Effects on enhancement of memory consolidation by unconditioned and conditioned heroin withdrawal. *Neuropharmacology* 2022;209(109018)

Agents: Heroin **Vehicle:** Not Stated; **Route:** SC; **Species:** Rat; **Strain:** Not Stated; **Pump:** 2002; **Duration:** 14 days;

ALZET Comments: Dose (3.5 mg/kg/day); animal info (Male; Weighed 225-250 g); behavioral testing (Conditioning chambers; Y-apparatus); dependence;



- Q10403:** S. Arakaki, *et al.* Role of noradrenergic transmission within the ventral bed nucleus of the stria terminalis in nicotine withdrawal-induced aversive behavior. *Neuropsychopharmacology Reports* 2022;42(2):233-237
Agents: Nicotine **Vehicle:** Saline; **Route:** SC; **Species:** Rat; **Strain:** Sprague–Dawley; **Pump:** 2ML2; 2ML4; **Duration:** Not Stated; **ALZET Comments:** "Dose: (13.7 mg/kg/d) as nicotine tartrate (4.8 mg/kg/d as a nicotine base; Controls received mp w/ vehicle; animal info: rats weighing 190–250g; behavioral testing (elevated plus-maze test; CPA test); dependence; Nicotine dependence in rats was established in rats by subcutaneous implantation with a nicotine-filled osmotic minipump (2ML2) for microdialysis experiments, 2ML4 for behavioral experiments"
- Q9828:** Z. Zheng, *et al.* Involvement of 5-Hydroxytryptamine Receptor 2A in the Pathophysiology of Medication-Overuse Headache. *Journal of Pain Research* 2021;14(453-461
Agents: Sumatriptan **Vehicle:** Not Stated; **Route:** SC; **Species:** Rat; **Strain:** Wistar; **Pump:** Not Stated; **Duration:** 7 days; **ALZET Comments:** Dose (0.6mg/kg/day); animal info (Adult male rats, 8 weeks old, 180–200 g); dependence;
- Q9874:** A. Zamora-Moratalla, *et al.* Prolactin enhances hippocampal synaptic plasticity in female mice of reproductive age. *Hippocampus* 2021;31(3):281-293
Agents: Prolactin **Vehicle:** Saline; **Route:** SC; **Species:** Mice; **Strain:** nulliparous; **Pump:** 2001; **Duration:** 7 days; **ALZET Comments:** Dose (150 ug/day); Controls received mp w/ vehicle; animal info (female mice, 2-3 months old);
- Q10730:** H. Xia, *et al.* Selecting Relevant Genes From Microarray Datasets Using a Random Forest Model. *IEEE Access* 2021;9(97813-97821
Agents: Nicotine **Vehicle:** Saline; **Route:** SC; **Species:** Rat; **Strain:** Sprague Dawley; **Pump:** Not Stated; **Duration:** Not Stated; **ALZET Comments:** animal info: pregnant rats; toxicology; dependence
- Q9545:** C. Wang, *et al.* Salidroside and isorhamnetin attenuate urotensin II-induced inflammatory response in vivo and in vitro: Involvement in regulating the RhoA/ROCK II pathway. *Oncology Letters* 2021;21(4):292
Agents: Urotensin II **Vehicle:** Saline; **Route:** SC; **Species:** Rat; **Strain:** Wistar; **Pump:** 2006D; **Duration:** 7 days; **ALZET Comments:** Dose (10 ng/kg/min); Controls received mp w/ vehicle; animal info (healthy male rats, 180-200 g, 8 weeks old); Urotensin II aka Ull; dependence;
- Q9522:** E. Walsh-Wilkinson, *et al.* Segmental analysis by speckle-tracking echocardiography of the left ventricle response to isoproterenol in male and female mice. *PeerJ* 2021;9(e11085
Agents: Isoproterenol **Vehicle:** Saline; **Route:** SC; **Species:** Mice; **Strain:** C57Bl6/J; **Pump:** 1004; **Duration:** 21 days; **ALZET Comments:** Dose (30 mg/kg/day); Controls received mp w/ vehicle; animal info (mice, 8 weeks old);
- Q9957:** T. Wakamatsu, *et al.* Type I Angiotensin II Receptor Blockade Reduces Uremia-Induced Deterioration of Bone Material Properties. *Journal of Bone & Mineral Research* 2021;36(1):67-79
Agents: Olmesartan, Hydralazine Hydrochloride **Vehicle:** Saline; **Route:** SC; **Species:** Rat; **Strain:** Not Stated; **Pump:** 2ML2; **Duration:** 6 weeks; **ALZET Comments:** Dose (Olmesartan- 3 mg/kg/day or Hydralazine Hydrochloride- 10 mg/kg/day); Controls received mp w/ vehicle; animal info (); pumps replaced every 2 weeks; long-term study; Blood pressure measured via Tail Cuff Method
- Q9521:** V. Vergote, *et al.* Chloroquine, an Anti-Malaria Drug as Effective Prevention for Hantavirus Infections. *Frontiers in Cellular and Infection Microbiology* 2021;11(580532
Agents: Chloroquine **Vehicle:** Not Stated; **Route:** SC; **Species:** Hamster; **Strain:** Not Stated; **Pump:** Not Stated; **Duration:** 17 d **ALZET Comments:** Dose (100 mg/kg/day); animal info (Five-week-old female Syrian hamsters); dependence;
- Q10070:** C. Y. Tsai, *et al.* Perinatal nicotine exposure alters lung development and induces HMGB1-RAGE expression in neonatal mice. *Birth Defects Research* 2021;113(7):570-578
Agents: Nicotine **Vehicle:** Saline, sterile; **Route:** SC; **Species:** Mice; **Strain:** C57BL/6N; **Pump:** 2001; 2004; **Duration:** 7; 28 days; **ALZET Comments:** Dose (6 mg/kg/day); Controls received mp w/ vehicle; animal info (pregnant mice); dependence;



Q9513: M. M. Uddin, *et al.* Neuroestradiol regulation of ventromedial hypothalamic nucleus 5'-AMP-activated protein kinase activity and counterregulatory hormone secretion in hypoglycemic male versus female rats. *AIMS Neuroscience* 2021;8(1):133-147

Agents: Letrozole **Vehicle:** CSF, artificial; DMSO; **Route:** CSF/CNS (left ventricle); **Species:** Rat; **Strain:** Sprague Dawley; **Pump:** 1007D; **Duration:** 5 days;

ALZET Comments: Dose (1.678 ug/uL); 30% Artificial CSF, 70% DMSO used; Controls received mp w/ vehicle; animal info (Adult male and female rats, 3–4 months old); Letrozole aka Lz; ALZET brain infusion kit 1 used; Brain coordinates (0.0 mm posterior to bregma; 1.5 mm lateral to bregma; 3.5 mm ventral to brain surface); dependence;

Q9504: E. A. Townsend, *et al.* A drug-vs-food "choice" self-administration procedure in rats to investigate pharmacological and environmental mechanisms of substance use disorders. *Journal of Neuroscience Methods* 2021;354(109110)

Agents: Buprenorphine **Vehicle:** Ethanol; DMSO; Sterile water; **Route:** SC; **Species:** Rat; **Strain:** Sprague-Dawley; **Pump:** 2001; 2ML1; **Duration:** 1 week;

ALZET Comments: Dose (0.01; 0.032 mg/kg/h); 15% ethanol, 20% DMSO, 65% sterile water used; Controls received mp w/ vehicle; animal info (female rats, 240– 260 g, ~12 weeks old and male rats, 290– 310 g, ~11 weeks old); dependence;

Q9497: C. Tang, *et al.* Implantation of a mini-osmotic pump plus stereotactical injection of retrovirus to study newborn neuron development in adult mouse hippocampus. *STAR Protocols* 2021;2(1):100374

Agents: Pleiotrophin **Vehicle:** Saline **Route:** Hippocampus **Species:** Mice **Strain:** C57BL/6 **Pump:** 1002 **Duration:** 2w

ALZET Comments: Controls received mp w/ vehicle; animal info (Adult mice, 8–12 weeks old); ALZET brain infusion kit 3 used; cyanoacrylate adhesive; dependence;

Q9494: M. Tanaka, *et al.* Regular Article Ropinirole Prevents Light-Induced Retinal Photoreceptor Damage in Mice. *BPB Reports* 2021;

Agents: Ropinirole **Vehicle:** Not Stated; **Route:** SC; **Species:** Mice; **Strain:** C57BL/6J; **Pump:** 2006; **Duration:** 1 week;

ALZET Comments: Dose (2 mg/kg/day); animal info (male black mice); dependence;

Q10344: E. Starikova, *et al.* Protective Role of Mytilus edulis Hydrolysate in Lipopolysaccharide-Galactosamine Acute Liver Injury. *Frontiers in Pharmacology* 2021;12(667572)

Agents: N2-01 **Vehicle:** Not Stated; **Route:** SC; **Species:** Mice; **Strain:** CBA/ BALB; **Pump:** 1003D; **Duration:** 3 days;

ALZET Comments: Dose: (0.05 ml/kg per hour or 1.2 ml/kg per day); Controls received mp w/ vehicle; animal info: 8 week-old male C57BL/6 mice, white mongrel female and male (F1) mice; N2-01 is *M. edulis* hydrolysate; dependence;

Q10340: M. K. Song, *et al.* Environmental enrichment modulates silent information regulator 1 (SIRT1) activity to attenuate central presbycusis in a rat model of normal aging. *Experimental Gerontology* 2021;155(111552)

Agents: Dexamethasone **Vehicle:** Not Stated; **Route:** Not Stated; **Species:** Rat; **Strain:** Sprague-Dawley; **Pump:** Not Stated; **Duration:** 4 weeks;

ALZET Comments: Dose: (1 mg/kg/day); animal info: male rats-aged eight weeks (weighing 250 g) and 62 weeks (weighing 550–650 g); behavioral testing: Hearing test; Dexamethasone aka (DX); dependence;

Q9163: B. Smith, *et al.* Trabecular and cortical bone are unaltered in response to chronic lipopolysaccharide exposure via osmotic pumps in male and female CD-1 mice. *Plos One* 2021;16(2):

Agents: Lipopolysaccharide **Vehicle:** PBS; **Route:** SC; **Species:** Mice; **Strain:** CD-1; **Pump:** 2006; **Duration:** 42 days;

ALZET Comments: Dose (14.4, 3.6, or 0.9 µg/d); animal info (male and female 7-week old mice, 27.1–32.2 g); Lipopolysaccharide aka LPS; dependence;

Q10329: N. Shahsavani, *et al.* Availability of neuregulin-1beta1 protects neurons in spinal cord injury and against glutamate toxicity through caspase dependent and independent mechanisms. *Experimental Neurology* 2021;345(113817)

Agents: Neuregulin-1-beta-1 **Vehicle:** BSA; Saline; **Route:** CSF/CNS (subarachnoid space); **Species:** Rat; **Strain:** Sprague-Dawley; **Pump:** 1003D; 2001; **Duration:** 3 days; 7 days;

ALZET Comments: Dose: (1 µg/day); 0.1% BSA; 0.9% Saline vehicle used; Controls received mp w/ vehicle; animal info: adult female (SD) rats (8–10 weeks, 250 g); Neuregulin-1beta 1 aka (Nrg-1β1); spinal cord injury; dependence;



Q10327: A. Servonnet, *et al.* Dopaminergic mechanisms underlying the expression of antipsychotic-induced dopamine supersensitivity in rats. *Neuropharmacology* 2021;197(108747)

Agents: Haloperidol **Vehicle:** Not Stated; **Route:** SC; **Species:** Rat; **Strain:** Sprague-Dawley; **Pump:** 2ML2; **Duration:** 17 days; **ALZET Comments:** Dose: (0.5 mg/kg/day); Controls received mp w/o vehicle; (sham surgery) animal info: Male rats (200–275 g);

Q10324: Z. L. Sebo, *et al.* Testosterone metabolites differentially regulate obesogenesis and fat distribution. *molecular Metabolism* 2021;44(101141)

Agents: Testosterone; Dihydrotestosterone; Estradiol; Letrozole; Bicalutamide **Vehicle:** 2-hydroxypropyl- β -cyclodextrin; PBS; DMSO; **Route:** SC; **Species:** Mice; **Strain:** ARdY; mTmG; **Pump:** 1004; **Duration:** Not Stated;

ALZET Comments: Dose: Testosterone (2 mg/kg body weight/day); Estradiol (2 ug/kg body weight/day); Letrozole (0.4 mg/kg body weight/day); Dutasteride (0.5 mg/kg body weight/day); 10% DMSO vehicle used Controls received mp w/ vehicle; animal info: 3 weeks of age; replacement therapy; (Testosterone); dependence;

Q10065: C. Schnoz, *et al.* Deletion of the transcription factor Prox-1 specifically in the renal distal convoluted tubule causes hypomagnesemia via reduced expression of TRPM6 and NCC. *Pflügers Archiv* 2021;473(1):79-93

Agents: Bumetanide; Uridine, bromodeoxy- **Vehicle:** Water; PEG 300; **Route:** SC; **Species:** Mice; **Strain:** Not Stated; **Pump:** 2001; **Duration:** 3 days;

ALZET Comments: Dose (40 mg/kg/day Bumetanide; 40 mg/kg/day bromodeoxyuridine); dependence;

Q9438: B. Russell, *et al.* GPR52 agonists attenuate ropinirole-induced preference for uncertain outcomes. *Behavioral Neuroscience* 2021;135(1):8-23

Agents: Ropinirole **Vehicle:** Saline; **Route:** SC; **Species:** Rat; **Strain:** Long Evans; **Pump:** 2ML; **Duration:** 28 days;

ALZET Comments: Dose (5 mg/kg/day); 0.9% Saline used; Controls received mp w/ vehicle; animal info (male rats, 275-300 g); behavioral testing (rat betting task); dependence;

Q8846: B. M. Rush, *et al.* Genetic or pharmacologic Nrf2 activation increases proteinuria in chronic kidney disease in mice. *Kidney International* 2021;99(1):102-116

Agents: Angiotensin II **Vehicle:** Acetic Acid; **Route:** SC; **Species:** Mice; **Strain:** C57BL/6J; **Pump:** 2004; **Duration:** 4 weeks;

ALZET Comments: Dose (1.5 mg/kg/day); Controls received mp w/ vehicle; animal info (13 weeks old); Blood pressure measured via Telemetry; dependence;

Q10661: A. Rivera, *et al.* Dopamine D(4) Receptor Is a Regulator of Morphine-Induced Plasticity in the Rat Dorsal Striatum. *Cells* 2021;11(1):

Agents: Morphine; PD168077 **Vehicle:** DMSO; Saline; **Route:** SC; **Species:** Rat; **Strain:** Sprague Dawley; **Pump:** Not Stated; **Duration:** 7 days; 14 days;

ALZET Comments: Dose: (morphine 20 mg/kg/d; PD168077 1 mg/kg/d); 2% DMSO, 0.9% NaCl vehicle used; animal info (1-2 months old; Male); post op. care: animals kept warm on heating pad; dependence

Q9430: R. Riquelme, *et al.* Huperzine-A administration recovers rat ovary function after sympathetic stress. *Journal of Neuroendocrinology* 2021;33(1):e12914

Agents: Huperzine-A **Vehicle:** Saline; **Route:** SC; **Species:** Rat; **Strain:** Sprague-Dawley; **Pump:** 2004; **Duration:** 28 days;

ALZET Comments: Dose (10 umol/L); Controls received mp w/ vehicle; animal info (female rats, 250-300 g); Huperzine-A aka Hup-A; dependence;

Q8822: A. Recabal, *et al.* The FGF2-induced tanycyte proliferation involves a connexin 43 hemichannel/purinergic-dependent pathway. *Journal of Neurochemistry* 2021;156(2):182-199

Agents: Uridine, bromodeoxy-; Fibroblast Growth Factor 2; Gap27 **Vehicle:** CSF, filtered; **Route:** CSF/CNS; **Species:** Rat; **Strain:** Sprague Dawley; **Pump:** 1007D; **Duration:** 8 days;

ALZET Comments: Dose (0.75 ug/h BrdU, 0.0125 ug/hr FGF2, 0.13 ug/h Gap27); Controls received mp w/ vehicle; animal info (Male, 20-280 g); Bromodeoxyuridine aka BrdU, Fibroblast Growth Factor 2 aka FGF2, Gap27 aka selective Cx43HC inhibitor ; enzyme inhibitor (Cx43HC Inhibitor); dental cement used; dependence;



Q10307: F. Ravanetti, *et al.* SSC-ILD mouse model induced by osmotic minipump delivered bleomycin: effect of Nintedanib. *Scientific Reports* 2021;11(1):18513

Agents: Bleomycin **Vehicle:** Saline; **Route:** SC; **Species:** Mice; **Strain:** C57BL/6; **Pump:** 1007D; **Duration:** 7 days;
ALZET Comments: Dose (60 u/kg); Controls received mp w/ vehicle; animal info: 7–8-week-old female mice; Bleomycin aka (BLM); dependence;

Q9415: C. B. Pietrobon, *et al.* Pancreatic steatosis in adult rats induced by nicotine exposure during breastfeeding. *Endocrine* 2021;72(1):104–115

Agents: Nicotine **Vehicle:** Saline; **Route:** SC; **Species:** Rat; **Strain:** Wistar; **Pump:** 2ML2; **Duration:** 14 days;
ALZET Comments: Dose (6 mg/kg/d); 0.9% NaCl used; Controls received mp w/ vehicle; animal info (virgin female rats, 3 months old); Nicotine aka NIC; dependence;

Q9410: T. C. Peixoto, *et al.* Nicotine exposure during lactation causes disruption of hedonic eating behavior and alters dopaminergic system in adult female rats. *Appetite* 2021;160(105115

Agents: Nicotine **Vehicle:** Saline; **Route:** SC; **Species:** Rat; **Strain:** Wistar; **Pump:** 2ML2; **Duration:** 14 days;
ALZET Comments: Dose (6 mg/kg body mass); Controls received mp w/ vehicle; animal info (rats, male and female); Nicotine aka Nic; dependence;

Q9408: W. I. Payette, *et al.* An anti-narcolepsy drug reveals behavioral and fitness costs of extreme activity cycles in arctic-breeding songbirds. *Journal of Experimental Biology* 2021;224(7):

Agents: Modafinil **Vehicle:** DMSO; PEG; **Route:** SC; **Species:** Bird; **Strain:** Lapland longspurs; snow bunting; **Pump:** 1003D; **Duration:** 3 days;
ALZET Comments: Dose (75 mg/kg/day); 50% DMSO, 50% PEG used; Controls received mp w/ vehicle; dependence;

Q10641: F. Pantouli, *et al.* Comparison of Morphine, Oxycodone and the Biased MOR Agonist SR-17018 For Tolerance and Efficacy in Mouse Models of Pain. *Neuropharmacology* 2021;185(108439

Agents: Morphine **Vehicle:** Saline; **Route:** Not Stated; **Species:** Mice; **Strain:** C57BL/6J; **Pump:** 2001; **Duration:** 6 days;
ALZET Comments: Controls received mp w/ vehicle; animal info: mice 10–20 weeks of age (23–32 g)dependence; pain

Q10053: J. Pajarinen, *et al.* Interleukin-4 repairs wear particle induced osteolysis by modulating macrophage polarization and bone turnover. *Journal of Biomedical Material Research Part A* 2021;109(8):1512–1520

Agents: Polyethylene, ultra high molecular mass weight; Interleukin-4, mouse recombinant **Vehicle:** BSA; PBS; **Route:** SC; **Species:** Mice; **Strain:** BALB/cByJ; **Pump:** 2006; **Duration:** 8 weeks;
ALZET Comments: Dose (15 mg/ml ultra high molecular mass weight polyethylene; 10 ug/ml Interleukin-4); 1% BSA-PBS used; Controls received mp w/ vehicle; animal info (male mice, 10–12 weeks); post op. care (buprenorphine); functionality of mp verified by residual volume; pumps replaced every 4 weeks; ultra high molecular mass weight polyethylene aka UHMWPE; mouse recombinant interleukin-4 aka IL-4; dependence;

Q10292: K. Ogata, *et al.* Club Cells Are the Primary Target for Permethrin-Induced Mouse Lung Tumor Formation. *Toxicological Sciences* 2021;184(1):15–32

Agents: Uridine, bromodeoxy- **Vehicle:** DMSO; **Route:** SC; **Species:** Mice; **Strain:** Not Stated; **Pump:** 2001; **Duration:** 7 days;
ALZET Comments: Dose 40 mg/ml; 10% DMSO vehicle used; Controls received mp w/ vehicle; animal info: Female 10 weeks old; Bromodeoxyuridine aka (BrdU); dependence;