Recent References (2010-Present) on the Administration of Dopaminergic Agents Using ALZET® Osmotic Pumps

**Apomorphine**

**Q4660:** T. T. Yan, et al. Daily Injection But Not Continuous Infusion of Apomorphine Inhibits Form-Deprivation Myopia in Mice. INVESTIGATIVE OPHTHALMOLOGY & VISUAL SCIENCE 2015;56(2475-2485)

**Agents:** Apomorphine  **Vehicle:** Not Stated;  **Route:** SC;  **Species:** Mice;  **Pump:** 1002;  **Duration:** 4 weeks;

**ALZET Comments:** Controls received mp w/ vehicle; animal info (male, C57Bl6, 4 weeks old); functionality of mp verified by residual volume; pumps replaced every 2 weeks; comparison of injection vs mp;

**Q0779:** R. Sarkis, et al. Chronic dizocilpine or apomorphine and development of neuropathy in two rat models I: Behavioral effects and role of nucleus accumbens. Experimental Neurology 2011;228(1):19-29

**Agents:** MK-801; apomorphine HCL hemihydrate  **Vehicle:** Saline; Ascorbic acid;  **Route:** CSF/CNS (nucleus accumbens);  **Species:** Rat;  **Pump:** 2002;  **Duration:** Not Stated;

**ALZET Comments:** Controls received mp w/ vehicle; animal info (adult, female, Sprague Dawley, 200-300 g); post op. care (dexamethasone injections to prevent brain edema); behavioral testing (mechanical allodynia, Paw withdrawal latency, cold allodynia, hotplate test, spontaneous motor activity); cannula placement verified by picomicrograph of brain section; CCI, chronic constriction injury; SNI, spared nerve injury

**Bromocriptine**

**Q10331:** T. Shimizu, et al. Inhibition of cardiac PERK signaling promotes peripartum cardiac dysfunction. Sci Rep 2021;11(1):18687

**Agents:** Bromocriptine  **Vehicle:** Not Stated;  **Route:** Not Stated;  **Species:** Mice;  **Pump:** Not Stated;  **Duration:** 3 weeks;

**ALZET Comments:** Dose (400 iU/kg/day); animal info: PERK mice, age 8 weeks old; Blood pressure measured via: tail cuff; Blood pressure measurement: (see pg 7 fig 4); Bromocriptine aka (BCR)cardiovascular; Peripartum cardiomyopathy


**Agents:** Bromocriptine  **Vehicle:** Not Stated;  **Route:** SC;  **Species:** Mice;  **Pump:** 1002;  **Duration:** 2 weeks;

**ALZET Comments:** Dose (8 mg/kg/day); Controls received mp w/ vehicle; animal info (9-17 weeks old, C57BL/6J); diabetes;


**Agents:** Bromocriptine mesylate  **Vehicle:** DMSO;  **Route:** CSF/CSN;  **Species:** Rat;  **Pump:** 1007D or 2002;  **Duration:** 7,14 days;

**ALZET Comments:** Dose (20, 40, or 80 ug); Controls received mp w/ vehicle; animal info (young kittens); 6-hydroxydopamine aka 6-OHDA; neurodegenerative (Dopamine Signaling);

**Dopamine**

**Q9868:** W. Zhang, et al. Inhibition of NADPH oxidase within midbrain periaqueductal gray decreases pain sensitivity in Parkinson’s disease via GABAergic signaling pathway. Physiological Research 2020;

**Agents:** 6-hydroxydopamine  **Vehicle:** CSF, Artificial;  **Route:** CSF/CNS;  **Species:** Rat;  **Pump:** 1003D;  **Duration:** 3 days;

**ALZET Comments:** Dose (6 ul/min); Controls received mp w/ vehicle; animal info (Male, Sprague Dawley, 200-250 g); behavioral testing (Rotation Behavior Test); 6-hydroxydopamine aka 6-OHDA; Brain coordinates (3.3 mm rostral to the interaural line, 1.4 mm left of the midline, and 6.5 and 6.8 mm ventral to the dural surface);


**Agents:** Dopamine, hydroxy-6  **Vehicle:** Not stated;  **Route:** CSF/CNS (visual cortex);  **Species:** Cat;  **Pump:** Not stated;

**ALZET Comments:** Controls received mp w/ vehicle; animal info (young kittens); 6-hydroxydopamine aka 6-OHDA; dependence;
Q8762: F. Han, et al. Dopamine D2 receptor modulates Wnt expression and control of cell proliferation. Scientific Reports 2019;9(1):16861

**Agents:** RNA, small interfering (Dopamine D2 Receptor) **Vehicle:** Not Stated; **Route:** SC; **Species:** Mice; **Duration:** 28 days; **ALZET Comments:** Dose (3 ug/day); animal info (C57BL/6, Male, 20 g, 8-10 weeks old); Dopamine D2 Receptor siRNA aka D2R Receptor ; ischemia (Renal);


**Agents:** Dopamine, anaerobia **Vehicle:** Saline; **Route:** CSF/CNS; **Species:** Mice; **Pump:** 2001; **Duration:** 7 days; **ALZET Comments:** Controls received mp w/ vehicle; animal info (5 month old C57Bl/6 J mice); neurodegenerative (Parkinson’s disease);


**Agents:** Guanethidine, 6-hydroxydopamine hydrochloride **Vehicle:** Saline, Ascorbic acid; **Route:** SC; **Species:** Rat; **Pump:** 2002; **Duration:** 2 weeks; **ALZET Comments:** Controls received mp w/ vehicle; animal info (240-250g); Good alzet diagram ;

Q3720: J. Wedel, et al. Simultaneous subcutaneous implantation of two osmotic minipumps connected to a jugular vein catheter in the rat. Laboratory Animals 2014;48(338-341

**Agents:** Dopamine, N-octanoyl **Vehicle:** Tween 80; saline; **Route:** IV (jugular); **Species:** Rat; **Pump:** 2ML4; **Duration:** 14 days; **ALZET Comments:** animal info (male, Brown Norway, 230-270 g, female, Wistar, 280-310 g); good methods; "Our data show that double pump implantation is a feasible alternative to changing pumps or the use of extracorporeal pump systems connected via a long wire to partly restrained animals.” pg 338; N-octanoyl-dopamine also known as NOD; multiple pumps (2) used; two pumps connected to Y connector, in-house made Y-tube; "we showed that the simultaneous implantation of two slow-flow rate osmotic pumps connected to a jugular vein catheter is feasible and is not linked to additional signs of discomfort compared with single pump-implanted rats.” pg 341


**Agents:** Dopamine; SCH23390 **Vehicle:** Saline; **Route:** CSF/CNS (area X); **Species:** Bird (zebra finch); **Pump:** 1002; **Duration:** Not Stated;

**ALZET Comments:** Controls received mp w/ vehicle; good methods (pg 5731); ALZET brain infusion kit used; animal info (adult, male); Y-connector used; pump externalized with a backpack; pump placed inside microcentrifuge tube; cannula placement verified by histological examination


**Agents:** Amphetamine sulfate; Dopamine **Vehicle:** Propylene Glycol; **Route:** SC; CSF/CNS (nucleus accumbens); **Species:** Rat; **Pump:** 2ML2; **Duration:** 14 days; **ALZET Comments:** comparison of injections and sylastic pellet vs mp; pulsed delivery; PE tubing contained drug and a dye in short sections interspersed with a substance immiscible with drug, to allow 12 hour infusions of drug and 12-hour infusions of the inert substance (perfluorodecalin) throughout a 14 day infusion period.; pumps primed in a physiological saline solution at 37°C for 4 hours.

**Fenoldpam**


**Agents:** Fenoldopam **Vehicle:** Not stated; **Route:** SC; **Species:** Mice; **Pump:** Not stated; **Duration:** 3 weeks; **ALZET Comments:** animal info (Athymic nude mice); Fenoldopam mesylate aka fenoldopam; cancer (Breast);

**Agents:** Fenoldopam  
**Vehicle:** PBS  
**Route:** SC  
**Species:** Mice  
**Pump:** 1004  
**Duration:** 1 week, 3 weeks  

**ALZET Comments:** Controls received mp w/ vehicle; animal info (Eight-week-old female athymic nu/nu mice; inoculated with MDA-MB-231 cells or SUM159 cells); functionality of mp verified by measurement of tumor volumes; cancer (breast cancer); dose-response (pg. 3109); Xenograft models; Dose (400 ng/kg/min or 133 ng/kg/min);

**Haloperidol**

Q9312: M. Kimura, et al. Effects of repeated electroconvulsive shocks on dopamine supersensitivity psychosis model rats. Schizophrenia Research 2021;228(1-6

**Agents:** Haloperidol  
**Vehicle:** Glacial acetic acid  
**Route:** SC  
**Species:** Rat  
**Pump:** 2ML2  
**Duration:** 14 days  

**ALZET Comments:** Dose (0.75 mg/kg/day); 2% Glacial Acetic Acid used; Controls received mp w/ vehicle; animal info (twelve-week-old male Wistar rats, 240-270 g); Haloperidol aka HAL; ischemia (Schizophrenia);

Q9311: M. Kimura, et al. Reduction of dopamine and glycogen synthase kinase-3 signaling in rat striatum after continuous administration of haloperidol. Pharmacology, Biochemistry and Behavior 2021;202(173114

**Agents:** Haloperidol  
**Vehicle:** Glacial acetic acid  
**Route:** SC  
**Species:** Rat  
**Pump:** 2ML2  
**Duration:** 14 days  

**ALZET Comments:** Dose (0.75 mg/kg/day); Controls received mp w/ vehicle; animal info (twelve-week-old male Wistar rats, 240-260 g);


**Agents:** Haloperidol; Lithium Chloride; Olanzapine  
**Vehicle:** Cyclodextrin, 2-Hydroxypropyl-B-;  
**Route:** SC  
**Species:** Rat  
**Pump:** 2ML4  
**Duration:** 28 days  

**ALZET Comments:** Dose (0.5 mg/kg/day Haloperidol; 2 mmol/L/kg/day Lithium Chloride; 7.5 mg/kg/day Olanzapine); Controls received mp w/ vehicle; animal info (Male Sprague-Dawley rats, 220-270 g, 6-10 weeks old);

Q8921: E. C. Onwordi, et al. Synaptic density marker SV2A is reduced in schizophrenia patients and unaffected by antipsychotics in rats. Nature Communications 2020;11(1):246

**Agents:** Haloperidol; Olanzapine  
**Vehicle:** Cyclodextrin;  
**Route:** SC  
**Species:** Rat  
**Pump:** 2ML4  
**Duration:** 28 days  

**ALZET Comments:** Dose (0.5 or 2 mg/kg/day ; 7.5 mg/kg/day); 20% B-Hydroxypropylcyclodextrin used; Controls received mp w/ vehicle; animal info (Male Sprague-Dawley rats, body weight 240–270 g, 6–10 weeks of age); Haloperidol aka HAL; Olanzapine aka OLZ; neurodegenerative (Schizophrenia);

Q8240: T. A. Lanz, et al. Postmortem transcriptional profiling reveals widespread increase in inflammation in schizophrenia: a comparison of prefrontal cortex, striatum, and hippocampus among matched tetrads of controls with subjects diagnosed with schizophrenia, bipolar or major depressive disorder. Transl Psychiatry 2019;9(1):151

**Agents:** Haloperidol or Risperidone  
**Vehicle:** Acetic Acid;  
**Route:** CSF/CNS  
**Species:** Rat  
**Pump:** Not stated  
**Duration:** 21 days  

**ALZET Comments:** Dose (haloperidol-0.25 mg/kg/day or risperidone-5 mg/kg/day); 1% Acetic Acid used; Controls received mp w/ vehicle; animal info (2 months old, Sprague Dawley, Male); neurodegenerative (Psychiatric Disorder);


**Agents:** haloperidol  
**Vehicle:** water, distilled, ascorbic acid, cyclodextrin;  
**Route:** SC  
**Species:** Rat  
**Pump:** 2ML2  
**Duration:** 14 days  

**ALZET Comments:** Dose (0.05, 0.5 mg/kg/day); distilled water containing 0.3% ascorbic acid / 10% cyclodextrin used; Controls received mp w/ vehicle; animal info (male, Sprague-Dawley, 330-380 g); behavioral testing (AMPH-induced locomotion, within-session habituation, acoustic startle response, novel object recognition); HAL is an antipsychotic drug that targets the postsynaptic D2 receptors; schizophrenia induced by amphetamine-sensitization-induced psychosis model;

**Agents:** Haloperidol; PG-01037 dihydrochloride **Vehicle:** Acetic Acid, glacial; NaOH; TWEEN 80 Buffered; **Route:** SC; **Species:** Rat; **Pump:** 2ML2; **Duration:** 14 days;

**ALZET Comments:** Dose ((haloperidol 0.75 mg/kg/day), PG-01037 (0.6 mg/kg/day)); 2% glacial acetic acid/H2O solution (pH 3.6 w/ NaOH) with 0.5% TWEEN 80 used; Controls received mp w/ vehicle; animal info (7 weeks, male, Wistar); post op. care (antibiotic treatment; identity not stated); behavioral testing (Quinpirole-induced hyperlocomotion); comparison of oral administration of haloperidol vs mp; PG-01037 is a selective dopamine D3 antagonist; minipumps were removed 14 days after implantation. "In this study, we were unable to use an osmotic pump for continuous administration of blonanserin due to poor solubility in the vehicle used for haloperidol." p.31;


**Agents:** haloperidol; olanzapine **Vehicle:** Not Stated; **Route:** SC; **Species:** Mice; **Pump:** 1007D; **Duration:** 7 days;

**ALZET Comments:** "Dose ((Hal 0.5 mg/kg/d), (Ola 10 mg/kg/d)); Controls received mp w/ vehicle; animal info (6-12 weeks, male, C57BL/6 or homo- and heterozygous C57Bl6-D2eGFP); behavioral testing (TruScan open field); Resultant plasma level ((Hal 5.85 ± 0.27 ng/mL), (Ola 45.93 ± 5.72 ng/mL)); haloperidol (Hal) and olanzapine (Ola) are antipsychotic drugs; Furthermore, in animal studies, APDs were often administered with regimens that fail to achieve the high D2R occupancy (>70%) required to yield therapeutic benefits (Farde et al., 1988; Kapur and Mamo, 2003; Kapur et al., 2003). To overcome such limitations, we delivered haloperidol or olanzapine via implanted osmotic mini-pumps, which offers a reliable method to obtain clinically meaningful levels of D2R blockade (Amato et al., 2011; Amato et al., 2018; Samaha et al., 2007, 2008)." pg.75 ; Brain concentration of agents include ((Hal 3.42 ± 0.42 ng/g), (Ola 26.32 ± 1.78 ng/g));


**Agents:** Haloperidol, olanzapine **Vehicle:** Cyclodextrin; **Route:** SC; **Species:** Rat; **Pump:** 2ML4; **Duration:** 8 weeks;

**ALZET Comments:** Controls received mp w/ vehicle; animal info (10-week old, male, Sprague-Dawley, 240–250 g); pumps replaced every 4 weeks; long-term study; dependence;


**Agents:** Haloperidol **Vehicle:** Acetic acid, water; **Route:** SC; **Species:** Rat; **Pump:** 2ML2; **Duration:** Not Stated;

**ALZET Comments:** Controls received mp w/ vehicle; animal info (200-225 g); Mp vs. intermittent administration by injection; Therapeutic indication (Anti-psychosis); Dose (0.5 mg/kg);


**Agents:** Haloperidol-Hcl **Vehicle:** Saline; **Route:** SC; **Species:** Mice; **Pump:** 2004; **Duration:** 14 days;

**ALZET Comments:** Controls received mp w/ vehicle; animal info (hemizygous bacterial artificial chromosome (BAC) transgenic mice (p28-p38) expressing eGFP under either Drd1a or Drd2 control); Therapeutic indication (Schizophrenia); Dose (0.25 mg/kg/day);


**Agents:** Haloperidol **Vehicle:** Acetic acid, glacial; Water; **Route:** SC; **Species:** Rat; **Pump:** 2ML2; **Duration:** 14 days;

**ALZET Comments:** Dose (0.75 mg/kg/day); 2% glacial acetic acid/H2O solution (pH adjusted to 3.8 with NaOH); Controls received mp w/ vehicle; animal info (Eleven-week-old male Wistar rats weighing 240–270 g); Therapeutic indication (dopamine supersensitivity psychosis);
Q6104: K. Chikama, et al. Chronic atypical antipsychotics, but not haloperidol, increase neurogenesis in the hippocampus of adult mouse. Brain Research 2017;1676(77-82
Agents: Haloperidol; quetiapine; aripiprazole; clozapine; olanzapine; risperidone
Vehicle: Not Stated; Route: IP; Species: Mice; Pump: 1004; Duration: 21 days;
ALZET Comments: Dose (haloperidol 1 mg/kg/d, quetiapine 20 mg/kg/d, aripiprazole 3 mg/kg/d, clozapine 20 mg/kg/d, olanzapine 2 mg/kg/d, risperidone 0.5 mg/kg/d); Controls received mp w/ vehicle; “It is known that osmotic pumps serve some preferable aspect such as to reduce stress to the animals, minimize unwanted experimental variables, and hold the drug concentration constant” pg. 80;

Agents: Haloperidol
Vehicle: Saline; Route: SC; Species: Rat; Pump: 2002; Duration: 14 days;
ALZET Comments: Controls received mp w/ vehicle; animal info (female Sprague-Dawley rats); behavioral testing (Locomotor activity boxes); Haloperidol aka HAL;

Agents: Haloperidol
Vehicle: Saline; Route: SC; Species: Rat; Pump: 2002; Duration: 14 days;
ALZET Comments: Controls received mp w/ vehicle; Animal info (OVX Sprague Dawley rats, 200-250 g, 2 months old); post op. care (Anafen analgesic 0.1 mL/rat, and local antibiotic ointment); replacement therapy (estrogen replacement); MRI compatible PEKK tubing used; Dose (0.25 mg/kg/day); Therapeutic indication (Schizophrenia);

Agents: Haloperidol, Olanzapine
Vehicle: Cyclodextrin, hydroxypropyl-β-, Ascorbic acid; Route: SC; Species: Rat; Pump: 2ML4; Duration: 28 days;
ALZET Comments: Controls received mp w/vehicle; animal info (10 weeks old) pumps replaced every 4 weeks; Therapeutic indication (Learning and memory, hippocampus, antipsychotic); Dose (HAL (2 mg/kg perday), or OLZ (10 mg/kg perday);

Agents: Haloperidol
Vehicle: Acetic acid, glacial; water; Route: SC; Species: Rat; Pump: 2ML2; Duration: 14 days;
ALZET Comments: Controls received mp w/ vehicle; animal info (Eleven-week-old male Wistar rats, 240–260 g ); functionality of mp verified by ELIZA testing; 2% acetic acid used; good methods (pg 1309); stress/adverse reaction: “One animal did not recover from pump-implanting surgery and was excluded from analysis” (see pg. 1310); behavioral testing (MAP-induced locomotion test); Vehicle pH adjusted to 3.6-3.8 with NaOH; 9mm wound clips used; Dose (0.75 mg/kg/d);

Agents: Haloperidol
Vehicle: Not Stated; Route: SC; Species: Rat; Pump: 2002; Duration: 14 days;
ALZET Comments: Controls received sham surgery; animal info (female, Sprague Dawley, 200-250g 2-3 months old, OVX); post op. care (Anafen analgesic 0.1 mL/rat; antibiotic ointment); MRI; PEEK; Dose (0.25 mg/kg/day);

Agents: Haloperidol; Olanzapine
Vehicle: Acetic acid; water; Route: SC; Species: Rat; Pump: 2ML2; Duration: 15 days; 17 days;
ALZET Comments: Controls received sham surgery; animal info: Male Sprague-Dawley rats; %0.5 or %2 of acetic acid; behavioral testing (trained to associate the delivery of 100 ml water (the unconditioned stimulus; UCS) into a receptacle with a light/tone conditioned stimulus (CS)); Dose: 0.5 mg/kg/day (haloperidol); 10 mg/kg/day (olanzapine)
Q5134: A. Charron, et al. 5-HT2 receptors modulate the expression of antipsychotic-induced dopamine supersensitivity. European Neuropsychopharmacology 2015;25(12):2381-93
Agents: Haloperidol  Vehicle: Acetic acid, glacial; water;  Route: SC;  Species: Rat;  Pump: 2ML2;  Duration: 15, 17 days;
ALZET Comments: Controls received sham surgery consisting of an incision and sutures; animal info: Male Sprague-Dawley rats 200–225g; water (pH 5) used; half-life (p. 2383 ), 1.5 hours; models the kinetics of standard antipsychotic treatment in patients; Dose: 0.5 mg/ kg/day

Q3580: S. Natesan, et al. Effect of chronic antipsychotic treatment on striatal phosphodiesterase 10A levels: a [(11C)]MP-10 PET rodent imaging study with ex vivo confirmation. TRANSLATIONAL PSYCHIATRY 2014;4(U4-U10
Agents: Haloperidol  Vehicle: Cyclodextrin, 2-hydroxypropyl-b-; Ascorbic acid;  Route: SC;  Species: Rat;  Pump: 2ML4;  Duration: 3 weeks;
ALZET Comments: Controls received mp w/ vehicle; animal info (male, Sprague Dalwy, 308-456g); functionality of mp verified by plasma; 20% B-hydroxypropylcyclodextrin used; behavioral testing (chewing movements); "Daily intraperitoneal injections in rodents lead to plasma levels that dip to a negligible level during a 24-h period as most antipsychotics have a half-life of 2-4 h in rodents, whereas the half-life of most antipsychotics in humans is usually 12-24 h.14 Hence, the present study was designed taking into consideration a delivery method (subcutaneous mini-osmotic pumps) that maintained constant plasma levels to evaluate the effect of chronic antipsychotic treatment on striatal PDE10A levels in rodents" pg 1;

Agents: Haloperidol  Vehicle: Saline;  Route: SC;  Species: Rat;  Pump: 2002;  Duration: 12 days;
ALZET Comments: Animal info (female, Sprague Dawley, ovariectomized); behavioral testing (motor activity); replacement therapy

Q3884: J. Gao, et al. Differential effects of intermittent versus continuous haloperidol treatment throughout adolescence on haloperidol sensitization and social behavior in adulthood. PROGRESS IN NEURO-PSYCHOPHARMACOLOGY & BIOLOGICAL PSYCHIATRY 2014;54(67-75
Agents: Haloperidol  Vehicle: Water, sterile;  Route: SC;  Species: Rat;  Pump: 2ML4;  Duration: 28 days;
ALZET Comments: Controls received mp w/ vehicle; animal info (male, Sprague Dawley, PND44-71); comparison of injection vs mp; post op. care (incision cleaned with 75% ethanol); behavioral testing (two-way avoidance conditioning apparatus; locomotor activity monitoring apparatus; avoidance training); dependence; pumps removed after 28 days;

Agents: Haloperidol  Vehicle: Lactic acid; NaOH;  Route: SC;  Species: Mice (transgenic);  Pump: 2002;  Duration: 14 days;
ALZET Comments: Controls received mp w/ vehicle; animal info (male, D2R-OE, adult); behavioral testing (open field, locomotor activity);

Agents: Haloperidol; clozapine; LY379268  Vehicle: Saline; acetic acid; water, sterile;  Route: SC;  Species: Rat;  Pump: 2ML4;  Duration: 28 days;
ALZET Comments: Controls received mp w/ vehicle; animal info (male, Wistar, 10-12 weeks old, 250-350g); functionality of mp verified by residual volume; behavioral testing (locomotor activity);

Agents: Haloperidol; olanzapine  Vehicle: Not Stated;  Route: SC;  Species: Rat;  Pump: 2ML4;  Duration: 8 weeks;
ALZET Comments: Control animals received mp w/ vehicle; animal info (Sprague Dawley, male, 9 wks old, 240-250 g)
<table>
<thead>
<tr>
<th>Reference</th>
<th>Authors</th>
<th>Title</th>
<th>Agents</th>
<th>Vehicle</th>
<th>Route</th>
<th>Species</th>
<th>Pump</th>
<th>Duration</th>
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<tr>
<td>Q2891</td>
<td>A. M. Bedard, et al.</td>
<td>Prior Haloperidol, but not Olanzapine, Exposure Augments the Pursuit of Reward Cues: Implications for Substance Abuse in Schizophrenia. SCHIZOPHRENI A BULLETIN 2013;39(3):692-702</td>
<td>Haloperidol; olanzapine</td>
<td>Acetic acid; water, distilled</td>
<td>SC</td>
<td>Rat</td>
<td>2ML2</td>
<td>19 Days;</td>
<td>Animal info (male, sprague-dawley, 200-225g); half-life (24hr, haloperidol); behavioral testing (lever pressing)</td>
</tr>
<tr>
<td>Q2054</td>
<td>A. C. Vernon, et al.</td>
<td>Contrasting Effects of Haloperidol and Lithium on Rodent Brain Structure: A Magnetic Resonance Imaging Study with Postmortem Confirmation. Biological Psychiatry 2012;71(10):855-863</td>
<td>Haloperidol</td>
<td>Cyclodextrin, hydroxypropyl beta; Ascorbic acid</td>
<td>SC</td>
<td>Rat</td>
<td>2ML4</td>
<td>8 weeks;</td>
<td>Controls received mp w/ vehicle; animal info (Sprague Dawley, male, 10 wks old); MRI; 20% cyclodextrin used; long-term study; functionality of mp verified via plasma drug levels</td>
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<tr>
<td>Q2717</td>
<td>S. Tadokoro, et al.</td>
<td>Chronic Treatment With Aripiprazole Prevents Development of Dopamine Supersensitivity and Potentially Supersensitivity Psychosis. SCHIZOPHRENI A BULLETIN 2012;38(5):1012-1020</td>
<td>Haloperidol; aripiprazole</td>
<td>Acetic acid, glacial; saline; water</td>
<td>SC</td>
<td>Rat</td>
<td>2ML2</td>
<td>28 days;</td>
<td>Control animals received mp w/ vehicle; animal info (Sprague Dawley, male, 240-250 g); wound clips used; pumps replaced after 14 days; good methods “When a subsequent pump was implanted in exchange for a former one, the most recent pump was inserted on the other side of the scapulae across from the former pump.” pg 1013</td>
</tr>
<tr>
<td>Q1815</td>
<td>L. J. Steward, et al.</td>
<td>Chronic phencyclidine (PCP)-induced modulation of muscarinic receptor mRNAs in rat brain: Impact of antipsychotic drug treatment. Neuropsychopharmacology 2012;62(3):1554-1563</td>
<td>Clozapine; haloperidol</td>
<td>Acetic acid; saline; water</td>
<td>SC</td>
<td>Rat</td>
<td>2ML4</td>
<td>Not Stated;</td>
<td>Animal info (Hooded Long Evans, 186-248 g); pump functionality verified via residual volume</td>
</tr>
<tr>
<td>Q0902</td>
<td>A. M. Bedard, et al.</td>
<td>Continuous, but not Intermittent, Antipsychotic Drug Delivery Intensifies the Pursuit of Reward Cues. Neuropsychopharmacology 2011;36(6):1248-1259</td>
<td>Haloperidol</td>
<td>Acetic acid, glacial; water</td>
<td>SC</td>
<td>Rat</td>
<td>2ML2</td>
<td>19 days;</td>
<td>Controls received mp w/ vehicle; animal info (male, Sprague-Dawley, 200-225 g); comparison of injections vs mp</td>
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**L- DOPA**

<table>
<thead>
<tr>
<th>Reference</th>
<th>Authors</th>
<th>Title</th>
<th>Agents</th>
<th>Vehicle</th>
<th>Route</th>
<th>Species</th>
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<tr>
<td>Q6625</td>
<td>G. Mulas, et al.</td>
<td>Differential induction of dyskinesia and neuroinflammation by pulsatile versus continuous L-DOPA delivery in the 6-OHDA model of Parkinson’s disease. Experimental Neurology 2016;286(83-92</td>
<td>L-DOPA; Benserazide</td>
<td>Not Stated</td>
<td>SC</td>
<td>Rat</td>
<td>2ML2</td>
<td>2 weeks;</td>
<td>Dose (12mg/kg/day); animal info (6-OHDA-lesioned male Sprague-Dawley rats weighing 275-300g); comparison of pulsatile injections vs mp; neurodegenerative (Parkinson’s disease);</td>
</tr>
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</table>
Agents: L-DOPA Vehicle: Not Stated; Route: CSF/CNS (striatum); Species: Rat; Pump: 2004; 2ML1; 2ML4; Duration: 21 days;
ALZET Comments: Controls received mp w/ vehicle; pumps replaced every week; cyanoacrylate adhesive; ALZET brain infusion kit 2 used; animal info (male, Sprague Dawley)

Lisuride
Agents: Lisuride Vehicle: Hydrogen maleate; Route: SC; Species: Rat; Pump: 2ML1; Duration: Not Stated;
ALZET Comments: Animal info (Sprague Dawley, male, 350-380 g)

Pramipexole
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;

Agents: Pramipexole HCL; Mirtazapine Vehicle: Pramipexole HCL; Mirtazapine; Route: SC; Species: Rat; Pump: 2002; 2ML4; Duration: 12 - 14 days;
ALZET Comments: Controls received mp w/ vehicle; animal info (250-300 g, male Sprague-Dawley rats); For mirtazapine, saline brought to 5.5-6.0 pH with 1 N NaOH; good methods (pg. 79); neurodegenerative (Parkinson's disease); behavioral testing (forelimb step task); PPX is a dopamine D2 receptor agonist; Mirtazapine is an atypical antidepressant; akinesia and risk-taking rat model; Dose (PPX 0.3 and 1.2 mg/kg/day; Mirtazapine 5 mg/kg/day);

Agents: Pramipexole Vehicle: Not Stated; Route: Not Stated; Species: Rat; Pump: Not Stated; Duration: Not Stated;
ALZET Comments: Comparison of injections vs mp; "While higher therapeutic benefit in early morning akinesia was obtained with pramipexole CR (continuous release via ALZET pumps), motor impairment was reversed for several hours with pramipexole IR (instant release via injections)" pg 1508

Agents: Pramipexole Vehicle: Not Stated; Route: SC; Species: Rat; Pump: Not Stated; Duration: 14 days;
ALZET Comments: Controls received mp w/ physiologic saline; animal info (Sprague Dawley, male, 270-320 g)

Agents: Pramipexole Vehicle: Saline; Route: SC; Species: Rat; Pump: 1007D; 2004; Duration: 2, 14 days;
ALZET Comments: Controls received mp w/ vehicle; animal info (male, Wistar, 250-300 g); comparison of SC injections vs mp; neurodegenerative (Parkinson's Disease); "...this study highlights the potential benefit of CDS (continuous dopaminergic stimulation) using PPX-CR and the advantage over PPX-IR in two symptomatic PD models" pg 540; half-life "long" pg 534; haloperidol-induced catalepsy; pk study
Quinpirole


**Agents:** Quinpirole hydrochloride  
**Vehicle:** Water, sterile  
**Route:** SC  
**Species:** Rat  
**Pump:** 2ML1  
**Duration:** 7 days

**ALZET Comments:** Controls received sham mp; animal info (male, Sprague Dawley, adult, 250-300g); functionality of mp verified by incubating pumps after explantation in 37C saline and noted collected amount of fluid - post explantation in vitro testing; behavioral testing (tactile and cold allodynia); neuropathic pain; pumps primed in 37C saline for 2 hours


**Agents:** Apamin; Muscimol; Quinpirole; Riluzole; FPL64176; Nimodipine; Picrotoxin; Benzimidazolinone  
**Vehicle:** Not Stated  
**Route:** CSF/CNS (midbrain); CSF/CNS (dorsal striatum)  
**Species:** Mice  
**Pump:** 1002  
**Duration:** 2 weeks

**ALZET Comments:** Animal info (eight-week-old, C57BL6/J, male); ALZET brain infusion kit 1 used; neurodegenerative (Parkinson’s disease)


**Agents:** SCH23390; raclopride; quinpirole; SKF 81297  
**Vehicle:** Water, distilled  
**Route:** SC  
**Species:** Rat  
**Pump:** 2ML2  
**Duration:** 5, 10 days

**ALZET Comments:** Controls received sham surgery; animal info (Wistar, male, 180-210 g); SCH23390 is a D1DA receptor antagonist; raclopride is a D2Da receptor antagonist; wound clips used