References on the Administration of Amphetamines

Using ALZET® Osmotic Pumps


**ALZET Comments:** Methamphetamine, 3,4-methylenedioxy-; Saline; SC; Rat; 2001; Controls received mp w/ vehicle; animal info (8-week old Dark Agouti rats weighing 152 +/- 3.58 g); 3,4-methylenedioxymethamphetamine aka MDMA or ecstasy;


**ALZET Comments:** Methamphetamine, 3,4-methylenedioxy-; Saline; SC; Rat; 2001; Controls received mp w/ vehicle;


**ALZET Comments:** Amphetamine; DMSO; acetic acid; water; SC; Rat; 2ML1; 7 days; Dose (1.5 mg/kg/day); 2% acetic acid, 25% DMSO used; Controls received mp w/ vehicle; animal info (Male Sprague−Dawley rats weighing 300−350 g);

Q6443: S. V. Kyosseva and W. D. Wessinger. Chronic administration of MDMA (“ECSTASY”) increases insulin-regulated glucose transporter GLUT4 in rat brain and heart. 2017;

**ALZET Comments:** Methamphetamine, 3,4-methylenedioxy-; Saline; SC; Rat; 2ML2; 10 days; Dose (0.3 or 3 mg/kg/day); animal info (Sprague-Dawley rats);


**ALZET Comments:** Methamphetamine; Saline; SC; Rat; 2 weeks; Dose (3.2 mg/kg/day); animal info (Adult male Sprague-Dawley rats (275-320 g)); Methamphetamine aka METH; dependence; Industry authored (InterveXion Therapeutics, LLC);


**ALZET Comments:** Methamphetamine hydrochloride; Saline; SC; Rat; 2ML2; 7 days; Controls received mp w/ vehicle; animal info (male, Sprague Dawley, 275-300g); functionality of mp verified by elevations in ICSS; behavioral testing (ICSS); dependence; pumps removed after 7 days;

Q4443: A. C. Harris, M. G. LeSage, D. Shelley, J. L. Perry, P. R. Pentel, S. M. Owens and A. C. Harris. The Anti-(+)-Methamphetamine Monoclonal Antibody mAb7F9 Attenuates Acute (+)-Methamphetamine Effects on Intracranial Self-Stimulation in Rats. PLoS One 2015;10(U408-U420

**ALZET Comments:** Methamphetamine hydrochloride; Saline; SC; Rat; 2ML2; 7 days; Controls received mp w/ vehicle; animal info (male, Sprague Dawley, 275-300g); functionality of mp verified by elevations in ICSS; behavioral testing (ICSS); dependence; pumps replaced every 7 days;


**ALZET Comments:** Amphetamine, D-; phenmetrazine; Saline; SC; Rat; 2001; 14 days; Controls received mp w/ vehicle; animal info (male, Sprague-Dawley, 300-350g); pumps replaced every 7 days; behavioral testing (cocaine self-administration, food self-administration); dependence;

**ALZET Comments:** Amphetamine, D-; Saline, sterile; SC; Rat; 2001; 7 days; Controls received mp w/ vehicle; animal info (male, Sprague Dawley, 12 week old, 350g); behavioral testing (cocaine self-administration); dependence; pumps removed on day 7; used amphetamine concentration of approx 73ug/ul.


**ALZET Comments:** Methamphetamine; IV (femoral); Rat; 2001D; 24 hours; Controls received mp w/ vehicle; animal info (male, Wistar, 350-500g); functionality of mp verified by plasma serum levels; dose-response (pg.33); behavioral testing (foot fault assessment, morris water maze); pumps implanted in inguinal crease; catheter preloaded with 50% dextrose/50% heparin; pumps removed after 61-65hours;


**ALZET Comments:** Methamphetamine; Saline; SC; Mice; 1002; 2 weeks; Animal info (Bmal1 -/-, ); behavioral testing (locomotor activity running wheels); dependence; delayed delivery; catheter filled with saline for 4 day recovery; used plastics one catheter;


**ALZET Comments:** Amphetamine; Saline; SC; Rat; 2ML4; 14 days; Controls received mp w/ vehicle; animal info (male, Sprague Dawley, 311-406g); post op. care (Ketoprofen 5 mg/kg); behavioral testing (cocaine self administration); dependence; pumps removed after 14 days;

Q5002: M. Iijima, H. Koike and S. Chaki. Effect of an mGlu2/3 receptor antagonist on depressive behavior induced by withdrawal from chronic treatment with methamphetamine. Behav Brain Res 2013;246(24-8

**ALZET Comments:** methamphetamine (MAP); saline; SC; Rat; 2ML1; 5 days; animal info: male, Sprague-Dawley, 5 wks old; tolerance studies; dependence; behavioral testing: forced swimming test, locomotor activity; mp used to infuse methamphetamine to induce a withdrawal-like effect in rats to study the effect of LY341495 (mGlu2/3 receptor antagonist) on withdrawal-induced depressive behavior; dose: 2.5, or 5 mg/kg/day.


**ALZET Comments:** Methamphetamine; IV; Rat; 24 hours; Controls received mp w/ saline; animal info. (male, wistar rats, 200-300 g); functionality of mp verified by MRI measurement of fractional anisotropy.


**ALZET Comments:** Methamphetamine; IV (femoral); Rat; 2001D; 24 hours; Control animals received mp w/ saline; animal info (Wistar, male, adult, 400 g); PE50 tubing used.


**ALZET Comments:** Nicotine; methamphetamine; Saline; SC; Rat; 2001; 7 days; Controls received mp w/ vehicle; animal info (Sprague Dawley, male, 332-396 g).
**ALZET Comments:** Methamphetamine hydrochloride; Saline; SC; Rat; 2ML1; 7 days; Controls received mp w/ vehicle; animal info (Sprague Dawley, male, 275-300 g); functionality of mp verified via residual volume.

**ALZET Comments:** Methamphetamine; Saline, sterile; SC; Mice; 2002; 1 week; Controls received mp w/ vehicle; animal info (ICR, 38-55 g); wound clips used; behavioral testing (tail suspension).

**ALZET Comments:** Amphetamine; SC; Rat; 2ML1; 7 days; Controls received mp w/saline; animal info (maternally separated, Long Evans); behavioral testing (maternal behavior).

**ALZET Comments:** Amphetamine sulfate; Dopamine; Propylene Glycol; SC; CSF/CNS (nucleus accumbens); Rat; 2ML2; 14 days; 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.

**ALZET Comments:** Methamphetamine; amphetamine; SC; Rat (pregnant); 2ML2; 2 weeks; Controls received mp w/ saline; animal info (female, Sprague-Dawley, 180-270 g); dose-response (fig. 1); no stress (see pg.) There were no observable adverse health changes" pg 30; stress/adverse reaction (see pg. 30) "Two rats (in the 10- and 13.2-mg/kg/day groups) developed an abscess at the pump site, which appeared to be confined to the sc minipump implantation site." pg 30; "one animal chewed her skin at the pump site, exposing the osmotic pump" pg 30. "ClS c orrected for the bioavailability or fraction of the drug absorbed (ClS/F) was calculated using the equation, ClS/F = infusion rate/CSS, where CSS is the steady-state drug concentration" pg 29.

**ALZET Comments:** Desipramine; mirtazapine; chlorpheniramine; Paroxetine; scopolamine; amphetamine; escitalopram; chlordiazepoxide; SC; IP; Rat; 2ML2; 14, 21 days; Controls received mp w/vehicle; dose-response (Fig 2-5); pumps replaced on day 14; good methods pg 629; animal info (male, Sprague Dawley, 5-7 mo old, 550-700g); "Importantly, use of minipumps also eliminates the need for repeated handling and injection of animals to administer the drug chronically." pg. 628; IP catheter used.

**ALZET Comments:** Methamphetamine; Saline, sterile; SC; Rat; 1003D; Animal info (male, Sprague-Dawley, 250-280 g); 2-week ALZET pump used.
**Q0431:** K. A. Chiodo and D. C. S. Roberts. Decreased reinforcing effects of cocaine following 2 weeks of continuous d-amphetamine treatment in rats. Psychopharmacology 2009;206(3):447-456  
**ALZET Comments:** Amphetamine, D-; Saline, sterile; SC; Rat; 2001; 14 days; Animal info (male, Sprague-Dawley, 350 g).

**ALZET Comments:** Amphetamine sulfate; Saline, sterile; SC; Rat; 2001; 7 days; Controls received mp w/ vehicle; no stress (see pg. 535); post op. care (Bupivacaine, antibiotic ointment); ischemia (cerebral); animal info (male, Sprague Dawley, 285 g., CCI injury); behavioral testing (voluntary wheel exercise); "This drug administration method was chosen since our prior studies of RW exposure after TBI have left animals undisturbed for the 1 week exercise period." (p. 530).

**ALZET Comments:** Amphetamine sulfate, D-; Saline; SC; Rat; 2001; 7, 14 days; Controls received mp w/ vehicle; pump replaced after 7 days; no stress (see pg. 470, 472); tolerance; animal info (male, Sprague Dawley, 350 g.) Behavioral testing (cocaine self-administration, food-reinforced responding); "the present dose delivered via mini-pump is not debilitating or overtly toxic." (p. 472).

**ALZET Comments:** Methamphetamine; Saline; SC; Rat; 2ML1; 7 days; Controls received mp w/ vehicle; functionality of mp verified by residual volume; dose-response (fig. 1, p. 104); stress/adverse reaction: (see pg. 101) "Animals that did show self-injuries were treated with an oral antibiotic (Sulfatrim) in their drinking water and, if this was ineffective they were humanely destroyed" p. 101; good methods p. 102; half-life (p. 101) "short"; post op. care (Apo-sulfatrim); animal info (male, Sprague-Dawley, 360-400g); "The pump was removed after 7 days... no animal had greater than 0.2 ml methamphetamine (ie 10% initial volume) remaining" (p. 102).

**ALZET Comments:** Methamphetamine; SC; Rat; 2ML1; 7 days; Controls received mp w/ saline; functionality of mp verified by residual volume; comparison of injections vs. mp; good methods (p. 301); animal info (male, Sprague-Dawley, 300-320 grams); behavioral study.

**ALZET Comments:** Amphetamine; SC; Rat; 2ML1; 7 days; Controls received mp w/ vehicle or saline; dose-response (fig. 4); comparison of escalating SC dose injections vs. mp; dependence; post op. care (PVP-iodine); animal info (male, wistar, 300-350 g).

**ALZET Comments:** Amphetamine; fluvoxamine; haloperidol; Water; ethanol; SC; Rat; 2ML4; 3 weeks; Functionality of mp verified by residual volume; 50% ethanol used [not suggested by ALZET].

**ALZET Comments:** Amitriptyline HCl; venlafaxine HCl; clordiazepoxide HCl; imipramine HCl; phenelzine sulfate; scopolamine HBr; desipramine HCl; bupropion HCl; chlorpheniramine maleate; fluoxetine HCl; sertraline; amphetamine sulfate, D-;
Water, sterile distilled; PEG; SC; Rat; 2ML2; 6,14 days; Controls received mp w/ vehicle; functionality of mp verified by agent blood levels; dose-response (fig. 5); animal info (male, female, susceptible, selectively bred); some animals had saline-filled catheter attached to mp to delay drug infusion by 5 days; "The most notable advantage of minipump delivery is that it eliminates stress resulting from daily injection of drug....minipumps also provide constant infusion of drug" (pg. 22).

P7173: C. Davidson, T. H. Lee and E. H. Ellinwood. Acute and chronic continuous methamphetamine have different long-term behavioral and neurochemical consequences. NEUROCHEMISTRY INTERNATIONAL 2005;46(3):189-203

ALZET Comments: Methamphetamine; Saline, sterile; SC; Rat; 2ML1; 7 days; Controls received mp w/ vehicle; functionality of mp verified by residual volume; comparison of SC injections vs. mp; half-life (p. 189) 15-70 minutes in rodents; dependence; "MP treatment provides a better pharmacodynamic model for the human methamphetamine binger and may also better approximate the neuropathological outcome known in humans." (p. 200).


ALZET Comments: Methamphetamine hcl; Methamphetamine hcl, 3,4-methylenedioxy-; Water, distilled; SC; Rat; 2ML1; 5 days; Controls received mp w/ vehicle; toxicology.


ALZET Comments: Nicotine tartrate; amphetamine; clozapine; HCL; saline; SC; Rat; 2ML1; 7,14 days; Controls received mp w/ vehicle; pumps replaced every 7 days for the 14 day study infusing clozapine; dependence; "in this experiment involving three pump implantations each pump was placed in a different part of the rats' body (left or right side of the back of the animal or at the shoulder area)." p. 1252; behavioral study.


ALZET Comments: Amphetamine; SC; Mice; 1 week; Toxicology; ALZET pumps mentioned on pg. 181, ref. 36; "These pumps have a continuous uniform rate assuring a constant drug concentration." (p. 181).

P5001: N. E. Paterson, C. Myers and A. Markou. Effects of repeated withdrawal from continuous amphetamine administration on brain reward function in rats. Psychopharmacology 2000;152(440-446

ALZET Comments: Amphetamine sulfate; Saline; SC; Rat; 2ML1; 6 days; controls received mp w/ vehicle; dose-response (fig 1. p. 443); dependence; 2 administration periods, 1 6-day period, 12 days of withdrawal, then another 6-day period; "Even though the duration of amphetamine withdrawal was no longer, the magnitude of the effect was greater, and the use of mini-pumps eased drug administration considerably compared to repeated experimenter-administered injections". p. 445;.


ALZET Comments: Amphetamine sulfate, d-; Scopolamine hydrobromide; Saline; SC; Rat; 2ML1; 7 days; controls received mp w/ saline; functionality of mp verified by residual volume; tolerance.


ALZET Comments: Amphetamine sulfate; Saline; SC; Rat; 2ML1; 7 days; dependence.


ALZET Comments: Amphetamine; Amphetamine, 4-methoxy-; Amphetamine, 4-ethoxy-; Propylene glycol; SC; Rat; 2ML2; 14 days; controls received mp w/ Propylene glycol; dose-response (graph, p. 1830); toxicology.
**ALZET Comments:** Amphetamine sulfate; Saline; SC; Rat; 2001; 7 days; comparison of IP injections vs. mp; brain tissue distribution; tolerance; half-life (45-60 min, p.10).

**ALZET Comments:** Amphetamine, d-; Water; SC; Rat; 2001; 2ML1; 7 days; Controls received plastic pellets; multiple pumps per animal (2) (2001); comparison of IP injections vs. mp infusion.

**ALZET Comments:** Apomorphine; Haloperidol; Methamphetamine; SC; Rat; 2 weeks; japanese with english abstract.

**ALZET Comments:** Amphetamine sulfate, d-; Cocaine HCl; Saline; IV (jugular); SC; Rat; 2ML1; 3, 30 days; controls received silastic plug implant.

**ALZET Comments:** Methamphetamine; SC; Rat; 2002; 21 days; controls received sham operation; rats received bilateral lesions in the suprachiasmatic nucleus (SCN); comparison of methamphetamine in drinking water vs. mp infusion; functionality of mp verified.

P1080: P. F. Gately, D. S. Segal and M. A. Geyer. Sequential changes in behavior induced by continuous infusions of amphetamine in rats. Psychopharmacology 1987;91(217-220
**ALZET Comments:** Amphetamine; Saline; SC; Rat; 2ML2; 9 days; controls received mp w/saline.

**ALZET Comments:** Amphetamine, d-; Propylene glycol; SC; Rat; 2002; 16 days; controls received mp w/ vehicle; rats were hemidecorticated.

**ALZET Comments:** Methamphetamine; Saline; SC; Rat; 2002; 14 days; controls received mp w/ saline; some animals given ascorbic acid and/or MA in drinking water; comparison of MA in drinking water vs. mp infusion.

**ALZET Comments:** Methamphetamine; SC; Rat; 2ML2; 14 days; controls received cutaneous incision on the back-no mp or drugs; apomorphine challenge 7 days after mp removal; comparison of intermittent therapy vs. mp infusion.

**ALZET Comments:** Amphetamine sulfate, d-; PEG; SC; Rat; 2002; 12 days; controls received mps w/ polyethylene glycol.

**ALZET Comments:** Amphetamine; mice; Rat; no duration posted; References the mp for continuous infusion of amphetamine in rats or mice.
**ALZET Comments:** Flupenthixol, cis-; Flupenthixol, trans-; Amitriptyline; Amphetamine; Atropine; Chlorpromazine; Clozapine; Fluphenazine; Haloperidol; Morphine; Prazosin; SC; Rat; 2 weeks; mp model not stated; comparison of sc injections vs. mp infusion; antihypertensive.

**ALZET Comments:** Amphetamine sulfate, d-; Methamphetamine HCl, d-; Saline; SC; Rat; 2001; .5-12 days; comparison of agents effects; control rats did not receive mp due to expense; peptides.

**ALZET Comments:** Amphetamine sulfate, d-; Saline; SC; mice; 2001; 1 week; intermittent sc injec twice daily vs. mp infusion; measured amount of residual amp. in pumps at end of exp.

**ALZET Comments:** Amphetamine sulfate, d-; Water; SC; Rat; 2ML1; .5-24 hours; pump primed overnight in saline at 37C; each pump used to treat several rats; control rats were implanted w/ used pump.

**ALZET Comments:** Amphetamine sulfate, d-; SC; Rat; 2001; 2002; 1 or 2 weeks; comparison of routes of admin; 2 pumps (2001 or 2002)/animal.

**ALZET Comments:** Amphetamine, d-; PEG 300; SC; Rat; 2001; 5, 9, and 14 days; pumps replaced after 1 week; up to multiple pumps per animal (3).

**ALZET Comments:** Amphetamine, d-; SC; Rat; no duration posted; 2 pumps/animal.

**ALZET Comments:** Amphetamine, d-; PEG; SC; Rat; 2001; 2 and 5 days; comparison of sc silicone tube implant vs. mp infusion; comparison of behavioral & neurochem. changes caused by Amph. in different deliv. sys. w/ different release characteristics.

**ALZET Comments:** Amphetamine; Saline; SC; mice; 2-7 days; no comment posted.

**ALZET Comments:** Amphetamine sulfate, d-; Saline; SC; mice; 7 days; no comment posted.

ALZET Comments: Amphetamine; PEG 300; SC; Rat; 2001; 7 days; no comment posted.


ALZET Comments: Trifluoperazine; Amphetamine sulfate, d-; Saline; CSF/CNS (corpus striatum); Rat; 7 days; caudate putamen.


ALZET Comments: Amphetamine; Chloroamphetamine, p-; Water; SC; mice; 3 and 6 days; no comment posted.


ALZET Comments: Chloroamphetamine, p-; Saline; SC; Mice; 1701; 3 days; Half-life (p. 2035).