References on the Administration of Amphetamines Using ALZET® Osmotic Pumps

**Q7057:** P. Petschner, V. Tamasi, C. Adori, E. Kirilly, R. D. Ando, L. Tothfalusi and G. Bagdy. Gene expression analysis indicates reduced memory and cognitive functions in the hippocampus and increase in synaptic reorganization in the frontal cortex 3 weeks after MDMA administration in Dark Agouti rats. BMC Genomics 2018;19(1):580

**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-methylenedioxyamphetamine aka MDMA or ecstasy;

**Q7002:** P. Petschner, V. Tamasi, C. Adori, E. Kirilly, R. D. Ando, L. Tothfalusi and G. Bagdy. Gene expression analysis indicates reduced memory and cognitive functions in the hippocampus and increase in synaptic reorganization in the frontal cortex 3 weeks after MDMA administration in Dark Agouti rats. BMC Genomics 2018;19(1):580

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


**ALZET Comments:** Amphetamine; DMSO; acetic acid; water; SC; Rat; 2001; 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; 2001; Controls received mp w/ vehicle;


**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:** Phenmetrazine; 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);
Q3632: B. A. Zimmer, K. A. Chiodo and D. C. S. Roberts. Reduction of the reinforcing effectiveness of cocaine by continuous 
**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;.

dopaminergic oscillator generates ultradian rhythms of behavioral arousal. ELIFE 2014;3(U146-U189  
**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;.

cocaine-induced facilitation of intracranial self-stimulation in rats. Psychopharmacology 2014;231(2461-2470  
**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.

and Q. Jiang. MRI of Neuronal Recovery after Low-Dose Methamphetamine Treatment of Traumatic Brain Injury in Rats. 
**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.

improves behavioral and cognitive function after severe traumatic brain injury. JOURNAL OF TRAUMA AND ACUTE CARE 
SURGERY 2012;73(4):S165-S172  
**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.

Q1237: H. Miyata, M. Itasaka, N. Kimura and K. Nakayama. Decreases in Brain Reward Function Reflect Nicotine- and 
**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. "CIS corrected for the bioavailability or fraction of the drug absorbed (CIS/F) was calculated using the equation, CIS/F = infusion rate/CSS, where CSS is the steady-state drug concentration" pg 29.


**ALZET Comments:** Desipramine; mirtazapine; chlorphenniramine; Paroxetine; scopolamine; amphetamine; escitalopram; chloridiazepoxide; 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.
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 pharmakodynamic 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.

**P6686:** S. Semenova and A. Markou. Clozapine treatment attenuated somatic and affective signs of nicotine and amphetamine withdrawal in subsets of rats exhibiting hyposensitivity to the initial effects of clozapine. Biological Psychiatry 2003;54(11):1249-1264

**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(4):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;

**P3426:** M. Macedoni-Luksic and D. Sket. Scopolamine modulates the effects of continuous amphetamine in rats. Acta Pharm 1996;46(23-30

**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).