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Narcotic

1. Alfentanil

ALZET Comments: Alfentanil; Sufentanil; Saline; SC; Rat (pregnant); 2ML2; 14 days; controls received mp w/ saline; dose-response (text); 3 doses of sufentanil infused; agents infused separately; author states 'in terms of experimental design, the cost of using sc implanted osmotic minipumps is small'; teratology.

2. Buprenorphine

ALZET Comments: Morphine; buprenorphine; methadone; Saline; SC; Mice; 6 days; Dose (45 mg/kg/d; 5 mg/kg/day; 60 mg/kg/day); Controls received mp w/ vehicle; animal info (Male CD-1 mice, approximately 30g); comparison of morphine alkaloid pellet vs mp.

ALZET Comments: Buprenorphine; methadone; Saline; SC; Mice; 6 days; Controls received mp w/ vehicle; animal info (male, CD-1, 30g); behavioral testing (tail flick latencies, mouse locomotion); dependence; Dose (Buprenorphine 5 mg/kg/day; methadone 60 mg/kg/day);

ALZET Comments: Buprenorphine; SC; Mice; 1007D; 7 days; Controls received mp w/ PBS; animal info (female, C57BL6, 8 weeks old); behavioral testing (pain score); "we used subcutaneously implanted ALZET® osmotic pumps to apply the analgesic buprenorphine. We ob¬served strongly reduced pain scores in diseased mice receiving analgesics, whereas the immune response was not altered in these mice. Hence, our study offers a new treatment option to improve wellbeing of mice used to study LCMV-induced meningitis without grossly altering immune parameters " pg 184; "In this study, we subcutane¬ously implanted ALZET® osmotic pumps releasing the anal¬gesic agent buprenorphine. Continuous delivery with osmotic pumps ensures constant compound levels for maximized thera¬peutic efficacy and reduced adverse effects. Additionally, un¬necessary stress¬ful animal handling due to repeated injection is not required. " pg 188; Dose (0.15 mg/kg/day);

ALZET Comments: Fentanyl propionanilide; buprenorphine hydrochloride; Saline, isotonic; CSF/CNS (intrathecal); Rat; 96 hours; Controls received mp w/ vehicle; animal info (male Wistar, 200-250 g); pain.

ALZET Comments: Buprenorphine; DMSO; water; Rat; 2ML1; Controls received mp w/ vehicle; functionality of mp verified by plasma drug levels; animal info (male, Sprague Dawley, 150-200 g); 40% DMSO used; “the osmotic minipump delivered buprenorphine efficiently and predictably” pg. 7342.

ALZET Comments: Buprenorphine; SC; Rat; 2ML2; Controls received sham surgery; animal info (male, Long-Evans, 350-375 g.).
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Bibliography

**P8265:** R. E. Sorge and J. Stewart. The effects of long-term chronic buprenorphine treatment on the locomotor and nucleus accumbens dopamine response to acute heroin and cocaine in rats. Pharmacology Biochemistry and Behavior 2006;84(2):300-305

**ALZET Comments:** Buprenorphine HCL; SC; Rat; 2ML2; 14, 28 days; Controls received sham surgery; dose-response (fig. 2); pumps replaced after 14 days; half-life (pg. 300) long half-life; tolerance; animal info (male, Long-Evans, 325-350g.).

**P8264:** R. E. Sorge and J. Stewart. The effects of chronic buprenorphine on intake of heroin and cocaine in rats and its effects on nucleus accumbens dopamine levels during self-administration. Psychopharmacology 2006;188(1):28-41

**ALZET Comments:** Buprenorphine; SC; Rat; 2ML2; 28 days; Controls received sham surgery; functionality of mp verified by plasma buprenorphine levels; dose-response (fig. 1); pumps replaced after 14 days; no stress (see pg. 29); dependence; animal info (male, Long-Evans, 300-350g.).

**P7423:** R. E. Sorge, H. Rajabi and J. Stewart. Rats maintained chronically on buprenorphine show reduced heroin and cocaine seeking in tests of extinction and drug-induced reinstatement. Neuropsychopharmacology 2005;30(9):1681-1692

**ALZET Comments:** Buprenorphine; CSF/CNS (nucleus accumbens); Rat; 2ML2; Controls received incision and pocket, no pump; dependence; post op. care (antibiotic injection); animal info (male, Long-evans, 350-375 g); Plastics One 20G cannula used.


**ALZET Comments:** Buprenorphine; SC; Rat; 2ML2; 12 hours; Pain treatment.

3. Butorphanol [Back to top]

**Q5136:** M. Meredith M. Clancy DVM, P. Butch KuKanich DVM and J. M. S. I. DVM. Pharmacokinetics of butorphanol delivered with an osmotic pump during a seven-day period in common peafowl (Pavo cristatus). American Journal of Veterinary Research 2015;76(12):1070-1076

**ALZET Comments:** Butorphanol; SC; Bird (peafowl); 2ML1; 7 days; animal info: 14 healthy adult male common peafowl; functionality of mp verified by plasma levels; good methods (pg. 1071-1072); “Use of these osmotic pumps may provide options for avian analgesia.” pg 1070; analgesic administration to avian species; Pharmacokinetics; Dose: 247 ug/kg/h); Resultant plasma level ((mean, 106.4 ug/L; range, 61.8 to 133.0 ug/L)); Industry authored (Wildlife Conservation Society); Interesting (Plasma concentrations of butorphanol in common peafowl were maintained at or above reported efficacious analgesic concentrations; Use of these osmotic pumps may provide options for avian analgesia) pg. 1070.


**ALZET Comments:** Butorphanol tartrate; SC; Rat; 2ML1; 48 hours; Controls received mp w/ saline; animal info (Sprague Dawley, male, 302 g); “Implantation of the pumps took less than 1 min per rat, and the length of the anesthesia was approximately 5 min per rat.” pg 576; functionality of mp verified via residual volume.


**ALZET Comments:** Butorphanol tartrate; nitroindazole, 7- Saline; DMSO; CSF/CNS; Rat; 2001; 72 hours; Enzyme inhibitor (nitric oxide synthase, NOS); animal info (male, Sprague Dawley, 250-275 g.); pump connected to catheter after 1 week recovery period; 10% DMSO used; PE60 tubing used.
**ALZET Comments:** Butorphanol tartrate; Saline, physiological; CSF/CNS; Rat; 2001; 3 days; Controls received mp w/ vehicle; dependence; post op. care (procaine penicillin G; animal info (male, Sprague-Dawley, 250-275 g).

**ALZET Comments:** Butorphanol tartrate; CSF/CNS; Rat; 2001; 3 days; Controls received mp w/ saline; dependence; animal info (male, Sprague-Dawley 230-250 g).

**ALZET Comments:** Butorphanol tartrate; CSF/CNS; Rat; 2001; 72 hours; Controls received mp w/ saline; functionality of mp verified by residual drug volume; dependence; post op. care (procaicne penicillin G); stadol; mp primed overnight at 35 degree C in sterile saline.

**ALZET Comments:** Butorphanol; Saline; CSF/CNS; Rat; 2001; 3 days; Controls received mp w/ vehicle; tolerance; guide cannula used (10mm); solution was filter sterilized.

**ALZET Comments:** Butorphanol; morphine; Saline, sterile; CSF/CNS; Rat; 2001; 72 hours; Controls received mp w/ vehicle; dependence; post op. care (penicillin, 0.5% sensorcaine in wound site); guide cannula with stylet was used; dental cement used to adhere cannula to skull; protective aluminum cap was placed around the cannula; tygon tubing was used; solutions were filter sterilized during filling of the pumps; brain diagram (p. 1066).

**ALZET Comments:** Morphine sulfate; butorphanol tartrate; CSF/CNS; Rat; 2001; 3 days; Controls received mp w/ saline; dependence; minimpumps were inserted 6-10 days after guide cannula implantation; stylet used.

**ALZET Comments:** Butorphanol; CSF/CNS; Rat; 2001; 3 days; Controls received mp w/ saline; tolerance; dependence.

**ALZET Comments:** Butorphanol tartrate; Saline, sterile physiological; CSF/CNS; Rat; 2001; 72 hours; Controls received mp w/ vehicle; functionality of mp verified by residual volume; good methods (p. 279); dependence; post op. care (sensorcaine, procaine penicillin G).

4. Codeine [Back to top](#)
**ALZET Comments:** Morphine tartrate; Codeine phosphate; Saline; SC; Rat; 2ML1; 7 days; functionality of mp verified by plasma drug levels; dose response (graphs p. 161); dependence.

5. Fentanyl

**ALZET Comments:** Fentanyl citrate; morphine sulphate salt pentahydrate; PBS; water, sterile; SC; Mice (transgenic); 1007D; 7 days; Dose (Fentanyl (2mg/kg/day); Morphine (17 mg/kg/day)); animal info (knock-in mice with 11S/T-A mutations (Oprm1tm3.1Shlz, MGI:6117673, 11S/T-A)); behavioral testing (hot plate test; open field locomotion test); dependence; “...we used subcutaneously implanted osmotic pumps to deliver opioids at a constant rate. This approach is a powerful means of assessing both tolerance and dependence” (p.5).

Q5277: J. P. Anand, B. T. Boyer, H. I. Mosberg and E. M. Jutkiewicz. The behavioral effects of a mixed efficacy antinociceptive peptide, VRP26, following chronic administration in mice. Psychopharmacology (Berl) 2016;233(13):2479-87
**ALZET Comments:** VRP26, Fentanyl; Saline; SC; mice; 1007D; 7 days; Controls received mp w/ vehicle; animal info (Male, female C57BL/6 wild-type, homozygous MOR knockout; 20-30 g, 8-16 wks); functionality of mp verified by in vitro testing (pg. 2481); dose-response (pg 2481); good methods (pg 2481); behavioral testing (tail suspension test, conditioned place preference and locomotor activities); behavioral testing (tail suspension test, conditioned place preference and locomotor activities); peptides; Primed for 4 hours, 37 degree Saline; antinociceptive peptide; Dose (0.3 mg/kg/day fentanyl or 10 mg/kg/day VRP26);.

**ALZET Comments:** Fentanyl; Saline; SC; Rat; 2ML4; 28 days; Controls received mp w/ vehicle; animal info (male, Fischer 344 x Brown Norway, 16, 20 and 24 months old); behavioral testing (temperature preference/heat and cold sensitvity, locomotor activity); Pumps removed after 4 weeks;.

**ALZET Comments:** Fentanyl propionanilide; buprenorphine hydrochloride; Saline, isotonic; CSF/CNS (intrathecal); Rat; 96 hours; Controls received mp w/ vehicle; animal info (male Wistar, 200-250 g); pain.

**ALZET Comments:** Morphine; methadone; fentanyl; oxycodone; Water, sterile, distilled; SC; Mice; 7 days; Animal info (male, WT, barr2-KO); dependence; wound clips used.

**ALZET Comments:** Fentanyl; SC; Rat; 2ML4; 4 weeks; Controls received mp w/ saline; animal info (male, Fisher 344 x Brown Norway, 12, 24, 30 mo old); behavioral testing (open field activity, grip strength, rotarod).

**ALZET Comments:** Morphine; fentanyl; Mice; 1003D; 3 days; Controls received mp w/ saline; animal info (CD1 (ICR), 6-8 wks old).
ALZET Comments: Fentanyl; Saline; SC; Mice; 2001; 6 days; Controls received mp w/ vehicle; animal info (adult, male, CD-1); comparison of SC injections vs. mp; “Although acute fentanyl injection (0.25 mg/kg) caused hyperalgesia within 15 min, hyperalgesia was not similarly evident on infusion Day 1 even though pumps were filled with a fentanyl dose (10mg/kg/24 h) that dispenses ~0.42 mg/kg/h, almost double the dose given by bolus injection.” pg 71.

ALZET Comments: Fentanyl; Saline, sterile; SC; Cat (felid); 2ML1; 96 hours; Animal info (spayed, female, 56 months old, 4.5 kg); functionality of mp verified by residual volume; comparison of transdermal patch vs. SC mp; no stress see pg 952; “if fentanyl is “to be used for nondomestic cats, then the faster elimination of fentanyl after removal of a delivery device is an important advantage of the osmotic pump versus the transdermal patch” pg 953; “Compared with a transdermal patch, an osmotic pump provides several pharmacokinetic advantages for fentanyl administration in cats.” pg 954.

ALZET Comments: Fentanyl; SC; Mice; 2001; 72 hours; Dependence; animal info (Swiss-Webster, 25-33g).

6. Hydromorphone Back to top

Q3537: A. Koesters, K. L. Engisch, M. M. Rich and M. M. Rich. Decreased cardiac excitability secondary to reduction of sodium current may be a significant contributor to reduced contractility in a rat model of sepsis. CRITICAL CARE 2014;18(U351-U357
ALZET Comments: Hydromorphone; IP; Rat; 24 hours; Animal info (female, Wistar, adult, 250-300g); post op. care (buprenorphine 0.12 mg/kg SC injection); used 2ML size pump; pain relief.

ALZET Comments: Hydromorphone; Saline; SC; Mice; 2001; 7 days; Controls received inert placebo pellet; tolerance; animal info (male, Swiss Webster, 22-30 g); “There was substantially more tolerance with infusion treatment compared to injection treatment.” pg. 43.

ALZET Comments: Hydromorphone; SC; rabbit; 2ML4; 4 weeks; functionality of mp verified by blood sample assays; comparison of IV bolus administration vs. EVA polymer drug delivery vs. mp; pain; cancer.

ALZET Comments: Hydrocortisone phosphate; Hydromorphone; Saline; SC; monkey; 2 months; monkeys received both a mp w/ HP and a mp w/ saline on alternating menstrual cycles; long-term study.

ALZET Comments: Hydromorphone; Saline; Water; SC; mice (pregnant); 2001; 4 days; no stress or complications (see pg. 170-71); describes mp as ‘valuable tool... ’ and discusses advantages of this type of delivery system (see pgs. 165, 176); toxicology.
7. Levorphanol


**ALZET Comments:** Levorphanol tartrate; Naltrexone HCl; U-50,488H; ICI-154,129; Saline; IP; mice; 2001; 7 days; functionality of mp verified by measuring residual pump volume; tolerance.

8. Meperidine


**ALZET Comments:** Naloxone HCl; Morphine sulfate; Meperidine HCl; Fentanyl citrate; Saline; SC; Rat; 2ML1; 7 days; controls received sham pumps; tolerance.


**ALZET Comments:** Morphine; Meperidine; Fentanyl; Saline; SC; Rat; 2ML1; 1 week; tolerance.


**ALZET Comments:** Ethylketocyclazocine; Heroin; Meperidine; Oxymorphone; Pentazocine; Propoxyphene; Bremazocine; Buprenorphine; Butorphanol; Methadone; Morphine; Nalbuphine; U-50,488H; SC; mice; 3 days; comparison of sc morphine pellets vs. mp infusion; comparison of agents effects; controls received unspecified placebo infusion.

9. Methadone


**ALZET Comments:** Morphine; buprenorphine; methadone; Saline; SC; Mice; 6 days; Dose (45 mg/kg/d; 5 mg/kg/day; 60 mg/kg/day); Controls received mp w/ vehicle; animal info (Male CD-1 mice, approximately 30g); comparison of morphine alkaloid pellet vs. mp;.


**ALZET Comments:** methadone; escitalopram; venlafaxine; desipramine; clomipramine; SC; Mice; 2002; 14 days; Dose: methadone (0.5 mg/kg) venlafaxine (2.5 mg/kg); escitalopram (20mg/kg); desipramine (1mg/kg); clomipramine (0.5 mg/kg); animal info (Male ICR mice, 25-35g); dependence.


**ALZET Comments:** Buprenorphine; methadone; Saline; SC; Mice; 6 days; Controls received mp w/ vehicle; animal info (male, CD-1, 30g); behavioral testing (tail flick latencies, mouse locomotion); dependence; Dose (Buprenorphine 5 mg/kg/day; methadone 60 mg/kg/day;).


**ALZET Comments:** Methadone; Saline; SC; Rat (pregnant); 2ML4; 28 days; Controls received mp w/ vehicle; animal info (female, Pregnant, Sprague Dawley, GD7); teratology; dependence.

**ALZET Comments:** Methadone; SC; Mice; 1007D; 14 days; Animal info (male, ICR, 25-35g); behavioral testing (hot plate); dependence;

**Q0735:** K. M. Raehal and L. M. Bohn. The role of beta-arrestin2 in the severity of antinociceptive tolerance and physical dependence induced by different opioid pain therapeutics. Neuropsychopharmacology 2011;60(1):58-65

**ALZET Comments:** Morphine; methadone; fentanyl; oxycodone; Water, sterile, distilled; SC; Mice; 7 days; Animal info (male, WT, barr2-KO); dependence; wound clips used.


**ALZET Comments:** Morphine; methadone; Water; SC; Rat; 2ML1; 2001; 6 days; Controls received mp w/ vehicle; tolerance; animal info (adult (150-250 g, male, Sprague Dawley).


**ALZET Comments:** Methadone; SC; Rat; 2002; 14 days; Controls received mp w/ saline; animal info (adult, male, Sprague Dawley); post op. care (Topical antibiotic powder); wound clips used.

**Q0665:** P. A. Madia, S. V. Dighe, S. Sirohi, E. A. Walker and B. C. Yoburn. Dosing protocol and analgesic efficacy determine opioid tolerance in the mouse. Psychopharmacology 2009;207(3):413-422

**ALZET Comments:** Etorphine; oxycodone; hydrocodone; methadone; Saline; DMSO; SC; Mice; 2001; 7 days; Controls received placebo pellets wrapped in nylon mesh; animal info (Male, Swiss Webster, 23-30 g); tolerance; comparison of SC injections vs mp; "Higher doses of hydrocodone, oxycodone, and methadone could not be infused due to solubility issues." pg 415; 20% DMSO used; "infusion with hydrocodone or methadone produced greater tolerance than acute or intermittent treatment" pg 417.


**ALZET Comments:** Methadone; SC; Rat; 2ML2; 14 days; Controls received mp w/ vehicle; animal info (Sprague Dawley, male, 225-250 g); wound clips used.


**ALZET Comments:** Methadone; Saline; SC; Mice; 2002; 14 days; Controls received mp w/ vehicle; dose-response (fig. 1, 2, 3); half-life (p. 1249) “short”; animal info (male, female, C57BL/6, 12 wks old, 25-27 g); “because of methadone’s short half-life in rodents, methadone was delivered through osmotic pumps to mimic SSM maintenance in humans.” p. 1249; incorrectly stated 2ML2 pumps used; behavioral (home cage motor activity, sensory testing, contextual fear conditioning.


**ALZET Comments:** Methadone HCl; SC; Rat; 2ML2; 14 days; Controls received mp w/ vehicle; good methods p. 2291; dependence; animal info (male, Sprague-Dawley, Long Evans).

10. Morphine

**Q7004:** S. Moon, S. Kang, H. Shin, T. Yayeh, B. Sur and S. Oh. Morphine Dependence is Attenuated by Treatment of 3,4,5-Trimethoxy Cinnamic Acid in Mice and Rats. Neurochem Res 2019;


**ALZET Comments**: Morphine; Saline; SC; Mice; 2001; 7 days; Dose (64 mg/mL); animal info (8 week old C57BL/6NCr mice); comparison of pellets vs mp; Resultant plasma level (Fig. 1, Pg 3); dependence.


**ALZET Comments**: Morphine; SC; Mice; 6 days; Dose (45 mg/kg/day); animal info (Male CD-1 mice weighing 30 g); comparison of sc pellet vs mp; tolerance.


**ALZET Comments**: Morphine hydrochloride; SC; Rat; 2ML1; 5 days; Dose (41–48 mg/kg/day); animal info (8-week-old male Wistar rats weighing 200–240 g); Therapeutic indication (Knee arthritis).


**ALZET Comments**: Morphine; Saline; SC; Rat, Mice; 2ML1, 1007D; 7 days; Controls received mp w/ vehicle; animal info (180-200 g); functionality of mp verified by residual volume; behavioral testing (Cold plate assay); Therapeutic indication (Analgesic, Opioid); Dose (15 mg/mL).


**ALZET Comments**: JNJ63955918, Morphine; Saline; CSF/CNS (intrathecal); Rat; 2002, 2001; 14 days, 2 weeks; Controls received mp w/ vehicle; animal info (250-300g) behavioral testing (Hargreaves test, hotplate test, tail-flick test, formalin flinching); JNJ63955918 is a tarantula venom-derived peptide (a potent, highly selective, closed-state Nav1.7 blocking peptide); Therapeutic indication (Pain, analgesia, electrophysiology).


**ALZET Comments**: Morphine; endomorphine analog; Saline; CSF/CNS; Rat; 2ML1; 7 days; Controls received mp w/ vehicle; animal info (male, Sprague Dawley, 220-240g); half-life (p. 219); behavioral testing (tail flick test; rotarod testing); stability verified by (internal testing; stability >1 year at 37C); pumps primed in 37C saline for 16 hours; used PE-8 IT catheter; Dose (2 ug/hr morphine; 0.056-0.075 ug/hr analog).


**ALZET Comments**: Morphine; CSF/CNS (intrathecal); Rat; 120 hours; Controls received mp w/ saline; animal info (male, Wistar); behavioral testing (tail-flick); Dose (15 ug/h).

ALZET Comments: Oxymorphine; IP; Rat; 5 days; post op. care (buprenorphine SC 0.12 mg/kg; 5 ml SC saline; Baytril SC 10 mg/kg Q12H); used 2ML size; pumps used for continuous pain relief in rat sepsis model; Dose (30 ug/kg/h);


ALZET Comments: Morphine; Saline; Rat; 2002; 10.1210/en.2016-1374; Dose (10 mg/kg/day); Controls received mp w/ vehicle; animal info (Female adult freely-cycling Sprague-Dawley rats weighing ~280 g); dependence.


ALZET Comments: Morphine; Ro 25-6981; Saline; SC; Rat; 2ML1; 1 week; Controls received mp w/ vehicle; animal info (Male Sprague-dawley rats, 220-250 g); functionality of mp verified by behavioral tests; good methods (pg. 148); post op. care (opiate administration using pumps); behavioral testing (Hargreaves plantar test); Dependence/tolerance induced; Opiate use; Dose (15 mg/ml Morphine, 5 mg/kg Ro 25-6981);


ALZET Comments: Morphine; Saline; SC; Guinea pig; 2002; 14 days, 2 weeks; Controls received mp w/ vehicle; good methods (catheter construction pg. 379);

stress/adverse reaction: Note that these animals were receiving infusion through in-house/Non-Alzet catheters (see pg. 385 Therapeutic indication (Granuloma); Dose (0.25, 2.5, 8, or 25 mg/ml));

11. Nalbuphine Back to top


ALZET Comments: Morphine chloride; nalbuphine HCl; Saline; CSF/CNS; Rat; 2001; 3 days; Controls received mp w/ vehicle; comparison of IP injections vs. mp; tolerance; dependence; animal info (male, Sprague Dawley, 220-240 g.).


ALZET Comments: Ethylketocyclazocine; Heroin; Meperidine; Oxymorphone; Pentazocine; Propoxyphene; Bremazocine; Buprenorphine; Butorphanol; Methadone; Morphine; Nalbuphine; U-50,488H; SC; mice; 3 days; comparison of sc morphine pellets vs. mp infusion; comparison of agents effects; controls received unspecified placebo infusion.

12. Normorphine Back to top


ALZET Comments: DsThr; Enkephalin agonist DADL; Fentanyl; FK-33824; MR-2034; MRZ; Normorphine; Water; SC; Guinea pig; 2001; 6 days; peptides.

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Bibliography

ALZET Comments: Endorphin, a-neo-; DsThr; Dynorphin; Enkephalin analog DADLE; FK-33824; MR-2034; MRZ; Normorphine; Sufentanil; Water; SC; mice; 2001; 6 days; peptides; MRZ is 5,9-dimethyl,2'S-5,9-dimethyl-2'-hydroxy-2-(2-methoxy-propyl)-6,7-benzomorphan, a kappa opioid agonist.

13. Oxymorphone Back to top

ALZET Comments: Oxymorphone; Intramuscular (abdominal); Rat; Post op. care (buprenorphine); animal info (female, Wistar, 250-300g).

ALZET Comments: Oxymorphone HCl; IP; Rat; 32 hours; functionality of mp verified by pain relief indicators - posture, physical condition, behavior; comparison of iv infusions vs mp; compared bolus iv infusion, continuous iv infusion, osmotic pump.

ALZET Comments: Ethylketocyclazocine; Heroin; Meperidine; Oxymorphone; Pentazocine; Propoxyphene; Bremazocine; Buprenorphine; Butorphanol; Methadone; Morphine; Nalbuphine; U-50,488H; SC; mice; 3 days; comparison of sc morphine pellets vs. mp infusion; comparison of agents effects; controls received unspecified placebo infusion.

14. Pentazocine Back to top

ALZET Comments: Haloperidol; JO-1784; Pentazocine; DTG; SC; Rat; 2-21 days; controls received mp w/saline; DTG is di(2-tyl)guanidin.

ALZET Comments: Pentazocine, d-; Saline; SC; Rat; 2ML4; 4 weeks; no comment posted.

ALZET Comments: Ethylketocyclazocine; Heroin; Meperidine; Oxymorphone; Pentazocine; Propoxyphene; Bremazocine; Buprenorphine; Butorphanol; Methadone; Morphine; Nalbuphine; U-50,488H; SC; mice; 3 days; comparison of sc morphine pellets vs. mp infusion; comparison of agents effects; controls received unspecified placebo infusion.

15. Propoxyphene Back to top

ALZET Comments: Ethylketocyclazocine; Heroin; Meperidine; Oxymorphone; Pentazocine; Propoxyphene; Bremazocine; Buprenorphine; Butorphanol; Methadone; Morphine; Nalbuphine; U-50,488H; SC; mice; 3 days; comparison of sc morphine pellets vs. mp infusion; comparison of agents effects; controls received unspecified placebo infusion.
16. Sufentanil [Back to top]

ALZET Comments: Sufentanil citrate; Nimodipine; Saline; Ethanol; Propylene glycol; Water; SC; Rat; 2001; 7 days; Controls received mp w/ vehicle; tolerance; Group 1 received sufentanil, Group 2 received sufentanil & nimodipine, Group 3 received nimodipine, Group 4 received vehicle; Nimodipine is a Ca channel blocker; sufentanil was diluted in saline; nimodipine was diluted in 10% ethanol / 20% propylene glycol / 70% water.

ALZET Comments: Sufentanil citrate; Nimodipine; Saline; Ethanol; Propylene glycol; Water; SC; Rat; 2001; 7 days; Controls received mp w/ vehicle; tolerance; Group 1 received vehicle alone, Group 2 received chronic sufentanil, Group 3 received sufentanil & nimodipine, Group 4 received nimodipine alone; Nimodipine is a Ca2+ antagonist opioid; sufentanil citrate was diluted in saline; nimodipine was diluted in 10% ethanol / 20% propylene glycol / 70% water.

ALZET Comments: Sufentanil; Nimodipine; Bay K 8644; Saline; SC; Guinea pig; 2001; 7 days; controls received mp w/saline; tolerance.

ALZET Comments: Morphine; DADLE; ST-91; Sufentanil; DAMGO; CSF/CNS (intrathecal); Rat; 7 days; controls received mp w/ saline; cancer; peptides; tolerance; comprehensive review of mp infusion methods using y-catheter.

ALZET Comments: Sufentanil; Saline, sterile; SC; Guinea pig; 2001; 7 days; controls received mp w/vehicle; tolerance.

ALZET Comments: Morphine; Sufentanil; Enkephalin; Saline; IV; CSF/CNS (intrathecal); CSF/CNS; Rat; 7 days; controls received mp w/vehicle; dose-response (p. 163); tolerance; pain; reference of mp pump study on pp. 162-164.

ALZET Comments: Morphine sulfate; Sufentanil citrate; Saline; CSF/CNS (intrathecal); Rat; 2001; 7 days; dose-response; tolerance; PE10 heat fused to PE60; externalized loop of catheter permitted cessation of infusion without pump removal.

Non-Narcotic

17. Acetylsalicylic Acid [Back to top]

ALZET Comments: CI-988; chlordiazepoxide; Acetylsalicylic acid; DMSO; saline; SC; CSF/CNS (intrathecal); Rat; 2ML1; 2001; 2002; 14 days; Controls received mp w/ vehicle; animal info (Male, Sprague-Dawley, 300-325 g, 8 wks old; ALZET intrathecal catheter used (0007740); behavioral testing (elevated plus-maze).
**ALZET Comments:** Acetylsalicylic acid, lysine; Saline; SC; Mice; 2002; 4 weeks; Controls received mp w/ placebo; functionality of mp verified by serum salicylate concentrations; pumps replaced after 2 weeks; cardiovascular; ischemia (cardiac); animal info (female, C57BL/6, 8-12 weeks old, 20-25 grams); MI induced by coronary artery ligation.

**ALZET Comments:** Acetylsalicylic acid; salicylate, sodium; SC; Rat; mice; 2002; 2ML2; 3-4 weeks; Controls received mp w/ vehicle; 2ML2 used in rats, 2002 used in mice; acetylsalicylic acid also called aspirin: dose was 120 mg/kg/day; diabetes (type II).

**ALZET Comments:** Acetylsalicylic acid; DMSO; Saline; IV (superficial cervical vein); dog; 2ML1; 3 days; pumps primed for 4 hrs. before implant; used prefilled catheter in vein; greater solubility of ASA in DMSO allowed greater concentration in smaller total volume.

18. Aminopyrine [Back to top]

**ALZET Comments:** Aminopyrine; Formate, sodium; radio-isotopes; 14C tracer; water, acidified; NaOH; SC; Rat; 2001; no duration posted; stability of [N-dimethyl-14C] aminopyrine verified by radiochromatographic analysis- no decomposition observed.

**ALZET Comments:** Aminopyrine; Radio-isotopes; 14C tracer; Saline; SC; mice; 2002; 7 days; animals infected with listeria monocytogenes.

19. Antipyrine [Back to top]

**ALZET Comments:** Antipyrine; bleomycin; dopamine HCl; melatonin; methotrexate, sodium; nicotine; prednisolone; radio-isotopes; valproic acid; 14C tracer; 3H tracer; IA; IP; SC; Mice, rabbit, Rat; no duration posted; ALZA-authored; synoptic review of mp; post op. care (antibiotic); comparison of sc injections vs. mp infusion; pulsed delivery.

**ALZET Comments:** Antipyrine; Dopamine HCl; Methotrexate, sodium; Radio-isotopes; 14C tracer; 3H tracer; CSF, artificial; Sodium fluorescein; CSF/CNS (diencephalon); rabbit; 2001; 6 days; comparison of agents effects; mp primed in saline 16 hr. prior to implant; stability of labelled & unlabelled Dop. & MTX tested by paper chromat. after 7 days at 37C; brain tissue distribution.

20. Indomethacin [Back to top]

ALZET Comments: NA-398; SC-560; indomethacin; DMSO; SC; Mice; 30 days; Controls received mp w/ vehicle; animal info (female, BALB/c); immunology.

ALZET Comments: Hydrocortisone; indomethacin; olvanil; PEG 200; SC; mice; 2 days; Controls received mp w/ vehicle; toxicology.

ALZET Comments: Iloprost; Cicaprost; L-NAME; Indomethacin; Saline; SC; Rat (pregnant); 2ML2; 2 weeks; controls received mp w/ vehicle; comparison of SC injections vs. mp; cardiovascular; L-NAME is a synthase inhibitor.

ALZET Comments: Antibody, anti-interferon gamma; Antibody, indomethacin; Antibody, anti-TNFa; PBS, sterile; ETHANOL; Indomethacin; SC; mice; 1007D; 7 days; immunology; pump implanted next to Dacron graft; peptides.

ALZET Comments: Indomethacin; Antibody, anti-IL-1a; Antibody, anti-TNFa; PBS; ETHANOL; SC; Mice; 7 days; Controls received mp w/ vehicle; immunology.

ALZET Comments: Catalase; Dimethyl sulfoxide; Dexamethasone; Indomethacin; Pyrilamine maleate; AA-861; Cimetidine; Phenidone; Ethanol; Saline; SC; mice; 1007D; 72 hours; all agents infused concomitantly in the same pump; preliminary study conducted to test solubility and toxicity for 5 days; enzyme inhibitors; toxicology.

ALZET Comments: Indomethacin; Sodium carbonate; SC; Rat; 2ML2; 7 days; sonication used to suspend indomethacin.

ALZET Comments: Indomethacin; GBR buffer; Cycloedextrin, B-; Eye (vitreous); monkey; 2ML2; 14 days; control eyes received mp with vehicles; enzyme inhibitor; indomethacin is a cyclooxygenase (COX) inhibitor; detailed description of vitreal cannula implantation; empty pump implanted at time of cannula implantation to allow 1-month recovery period; beta-cycloedextrin used as a carrier molecule; some monkeys served both as control and drug treatment group (different treatment in each eye); a vitreous opacity appeared in some eyes during infusion but disappeared after the pump was disconnected.

21. Ketorolac Back to top

ALZET Comments: Ketorolac; Saline, sterile; SC; Mice; 1007D; 2 days; Controls received mp w/ vehicle; animal info (male, C57BL/6J, 4-5 wks old).
**ALZET Comments:** Ketorolac tromethamine; Saline; CSF/CNS (intrathecal); Rat; 2001; 48 hours; controls received mp w/ vehicle; ketorolac is an NSAID sold as Toradol; cannula patency verified by saline injection.

**ALZET Comments:** Ketorolac; IV (jugular); rabbit; 2ML1; 7 days; controls received mp w/saline; functionality of mp verified by residual volume; comparison of i.m. injections vs. mp; ketorolac also called Toradol; NSAID.

22. Naproxen **Back to top**

**ALZET Comments:** JNJ7777120; naproxen; SC; Mice; 1004; Control animals received mp w/ vehicle; animal info (male, C57BL/6, ~2 mo old, 25-30 g); infusion rate listed as 0.11 ul/hr; JNJ7777120 also known as (1-[(5-chloro-1H-indol-2-yl)carbonyl]-4-methylpiperazine), is a selective H4R antagonist; one group received combination of JNJ7777120 and naproxen.

**ALZET Comments:** Naproxen; PBS; In vitro; 1002; Naproxen is anon- steroidal anti-inflammatory agent; This paper reports the characterization of an electrochemical biosensor for the continuous monitoring of Naproxen delivered by alzet pumps.

**ALZET Comments:** Naproxen; Methanol; In Vitro; 1002; 16 hours; Functionality of mp verified by naproxen levels measured with sensors.;

**ALZET Comments:** Ibuprofen; naproxen; PBS; SC; Rat; mice; 2004; 2ML4; 4 weeks; Controls received mp w/ vehicle; animal info (female, Sprague Dawley, 11-12 wks old, 250-270 g., female, C57BL/6, 8-9 wks old, 20 g.); spinal cord injury; behavioral testing (BBB locomotor scale, Basso mouse scale).

23. Sodium Salicylate **Back to top**

**ALZET Comments:** Acetylsalicylic acid; salicylate, sodium; SC; Rat; 2002; 2ML2; 3-4 weeks; Controls received mp w/ vehicle; 2ML2 used in rats, 2002 used in mice; acetylsalicylic acid also called aspirin; dose was 120 mg/kg/day; diabetes (type II).

**ALZET Comments:** Scopolamine; Methylscopolamine nitrate; Salicylate, sodium; SC; Rat; 2002; 10 days; temperatures were taken with radiotelemetry.

**ALZET Comments:** Salicylate, sodium; Water; IV; Rat; 2ML1; no duration posted; teratology.
24. Tramadol


ALZET Comments: Tramadol; Saline; SC; Rat; 2ML1; 7 days; Controls received mp w/ vehicle; comparison of sc injections vs. mp; immunology; multiple pumps per animal (2) used in high-dose groups; nociception; tramadol is a centrally acting analgesic.


ALZET Comments: Tramadol; Saline; SC; Rat; 2ML1; 7 days; controls received mp w/ vehicle; functionality of mp verified by paw withdrawal latency (analgesia index); dose-response (graph p. 337); comparison of sc injection vs. mp; analgesia.

25. F13640


ALZET Comments: F13640; Acetate buffer; water, sterile; SC; Rat; 2ML1; 2ML2; 2ML4; 2, 4, 8 weeks; 1, 2, 4, 7 days; Controls received mp w/ vehicle; dose-response (fig. 2); long-term study; pumps replaced; half-life (p. 139) 2.5 hrs. in rat plasma; multiple pumps per animal (2); post op. care (Na ampicillin); animal info (male, Sprague Dawley, 220-240 g., intraorbital nerve ligation).


ALZET Comments: F13640; morphine, HCl; Saline; SC; Rat; 2ML2; 6 weeks; Controls received mp w/ vehicle; long-term study; pumps replaced every two weeks; multiple pumps per animal (2); animal info (male, Sprague-Dawley, 220-240 g); during pump replacement a new incision was made about 1 cm away from the previous incision.


ALZET Comments: F13640; SC; Rat; 2ML4; 56 days; Controls received mp w/ saline; functionality of mp verified by plasma levels; long-term study; pumps replaced at day 28; 5-HT_{1A} receptor agonist; spinal cord injury; pain.


ALZET Comments: F13640; SC; Rat; 2ML4; 56 days; Controls received mp w/ saline; functionality of mp verified by F13640 plasma levels; long-term study; pumps replaced (after 28 days).


ALZET Comments: F13640; Water, distilled; SC; Rat; 2ML2; 5 weeks; Controls received mp w/ saline; dose-response (Fig.2; p.275); pumps replaced every week, F13640 is a novel analgesic; serotonin receptor agonist; post op. care (the site of pump emplacement was massaged daily to avoid tissue adherence).

P5902: K. Deseure, W. Koek, H. Adriaensen and F. C. Colpaert. Continuous administration of the 5-hydroxytryptamine 1A agonist (3-chloro-4-fluoro-phenyl)-[4-fluoro-4-[[([5-methyl-pyridin-2-ylmethyl)-amino]-methyl]piperidin-1-y]-methadone (F

**ALZET Comments:** F13640; F13714; morphine; baclofen; Saline; SC; Rat; 2ML2; 14 days; Controls received mp w/ vehicle; Post Op. Care (aerosol bandage applied to protect against bacterial contamination); F13640 is a novel analgesic & 5-HT1A receptor agonist; behavioral study; F13640, F13714 & morphine were infused in one pump; baclofen infused in two pumps due to limited solubility.


**ALZET Comments:** F13640; morphine HCl; imipramine HCl; ketamine HCl; gabapentin; Water, double distilled; SC; Rat; 2ML2; 14 days; Controls received mp w/ saline; dose-response (fig. 3); comparison of IP & SC injections vs. mp; tolerance; dependence; “Continuous F 13640 infusion uniquely produced profound analgesia in this model of severe, chronic pain.” (p. 955).