



References on the Administration of Agents in Neonatal Animals  
Using ALZET® Osmotic Pumps

**Q7001:** A. Rahman, *et al.* Intraventricular infusion of quinolinic acid impairs spatial learning and memory in young rats: a novel mechanism of lead-induced neurotoxicity. *J Neuroinflammation* 2018;15(1):263

**Agents:** Quinolinic acid **Vehicle:** Saline; **Route:** CSF/CNS (right lateral ventricle); **Species:** Rat (neonate); **Pump:** 1007D; **Duration:** 7 days;

**ALZET Comments:** Dose (9 mM); Controls received mp w/ vehicle; animal info (21-day old Wistar rat pups); behavioral testing (Spatial learning and memory test); ALZET brain infusion kit used; Brain coordinates (anteroposterior—3 mm behind bregma; lateral—3.6 mm from midline; and depth—3.8 mm from skull surface);

**Q6526:** A. Vivekanandarajah, *et al.* Intermittent hypercapnic hypoxia effects on the nicotinic acetylcholine receptors in the developing piglet hippocampus and brainstem. *Neurotoxicology* 2017;60(23-33)

**Agents:** Nicotine Hydrogen Tartate Salt **Vehicle:** Water (sterile); **Route:** IP; **Species:** Pig (neonate); **Pump:** 2ML2; **Duration:** 14 days;

**ALZET Comments:** Dose (2.0 mg/kg/day); animal info (mixed-breed miniature piglets); comparison of patch vs mp; Resultant plasma level (serum cotinine: 23.1 +17.3 ng/mL); "The use of an osmotic minipump as opposed to a skin patch was chosen as the method of nicotine delivery given it provides a steady state, same dose, infusion over our 14 day study whereas patches result in sudden spikes in plasma levels and require replacement of patches every 1–2 days dependent on chosen patch " pg. 2

**Q6297:** B. H. Kim, *et al.* Age-Dependent Effects of ALK5 Inhibition and Mechanism of Neuroprotection in Neonatal Hypoxic-Ischemic Brain Injury. *Developmental Neuroscience* 2017;39(1-4):338-351

**Agents:** SB505124 **Vehicle:** Sodium citrate; DMSO; **Route:** SC; **Species:** Rat (neonate); **Pump:** 1007D; **Duration:** 7 days;

**ALZET Comments:** 30% DMSO used; Controls received mp w/ vehicle; animal info (Wistar rat pups); behavioral testing (sensorimotor testing, Morris water maze); SB505124 is a ALK5 receptor antagonist; Therapeutic indication (hypoxic-ischemic brain injury);

**Q5737:** M. Ishido, *et al.* Neonatal rotenone lesions cause onset of hyperactivity during juvenile and adulthood in the rat. *Toxicol Lett* 2017;266(42-48)

**Agents:** Rotenone **Vehicle:** SMSO, PEG 300; **Route:** SC; **Species:** Rat (neonate); **Pump:** Not Stated; **Duration:** Not Stated;

**ALZET Comments:** Controls received mp w/ vehicle; animal info (5-14 days); 50% DMSO: 50% PEG 300 used; Therapeutic indication (Hyperactivity disorder); Dose (3.0 mg/kg/day);

**Q6394:** M. Guardia Clausi, *et al.* Delayed ALK5 inhibition improves functional recovery in neonatal brain injury. *J Cereb Blood Flow Metab* 2017;37(3):787-800

**Agents:** SB505124 **Vehicle:** Not Stated; **Route:** SC; **Species:** Rat (neonate); **Pump:** 1007D; **Duration:** 7 days;

**ALZET Comments:** Dose (5 mg/h); Controls received mp w/ vehicle; animal info (Wistar pups); behavioral testing (Cylinder rearing test, sticky label test, beam walking test); SB505124 is an antagonist of the type 1 TGFβ1 receptor ALK5; Therapeutic indication (hypoxia-ischemia);

**Q5793:** F. Donato, *et al.* Stellate cells drive maturation of the entorhinal-hippocampal circuit. *Science* 2017;355(6330):

**Agents:** Clozapine-N-oxide **Vehicle:** Saline; **Route:** SC; **Species:** Mice (neonate); **Pump:** 1007D; **Duration:** 7 days;

**ALZET Comments:** Controls received mp w/ vehicle; animal info (11-14 days); clozapine-N-oxide (CNO) Therapeutic indication (learning and memory); Dose (1 mg/kg);

**Q5149:** J. D. Frost, Jr., *et al.* Vigabatrin therapy implicates neocortical high frequency oscillations in an animal model of infantile spasms. *Neurobiol Dis* 2015;82(1-11)

**Agents:** Tetrodotoxin **Vehicle:** PBS; **Route:** CSF/CNS (somatosensory cortex); **Species:** Rat (neonate); **Pump:** 2004; **Duration:** 28 days;

**ALZET Comments:** Controls received mp w/ vehicle; animal info: 11 or 12 day-old male rat pups; functionality of mp verified by EEG; dose-response (pg 3); Plastics One cannula used; Dose: 200 µL of 12 µM tetrodotoxin; Brain coordinates; AP: 2.2, ML: 2.0 from bregma and 0.8 mm below the surface of cortex



**Q3774:** B. L. Callaghan, *et al.* Early Emergence of Adult-Like Fear Renewal in the Developing Rat After Chronic Corticosterone Treatment of the Dam or the Pups. *Behavioral Neuroscience* 2014;128(594-602

**Agents:** Corticosterone **Vehicle:** Water, deionized; **Route:** SC; **Species:** Rat (neonate); **Pump:** 1007D; **Duration:** 7 days;

**ALZET Comments:** Control animals received mp w/ vehicle; animal info (naive, Sprague Dawley, P7). no stress pg 595-596.

"The entire surgery took less than 5 min and the rats recovered well. The dorsal placement of the micropump was chosen because it does not interfere with the feeding position of pups." pg 595. "...dams in the current studies tolerated the pups well after both surgeries and there were no instances of cannibalism or obvious abuse (e.g., bite marks)" pg 596; pumps removed after 1 week;

**Q3166:** J. Qiu, *et al.* Neuroprotective Effects of MicroRNA-210 on Hypoxic-Ischemic Encephalopathy. *Biomaterials Science* 2013;;():U1-U5

**Agents:** Oligonucleotide, miR-210 mimic; inhibitor, miR-210 **Vehicle:** Saline; **Route:** CSF/CNS; **Species:** Rat (neonate); **Pump:** 1007D; **Duration:** 72 hours;

**ALZET Comments:** Controls received mp w/ vehicle; animal info (male, Sprague Dawley, P7); ischemia (hypoxic-ischemic encephalopathy); gene therapy;

**Q3243:** T. Miki, *et al.* Activity-Dependent Neurotrophin Signaling Underlies Developmental Switch of Ca(2+) Channel Subtypes Mediating Neurotransmitter Release. *Journal of Neuroscience* 2013;33(48):18755-18763

**Agents:** Tetrodotoxin; K252a **Vehicle:** Saline; **Route:** CSF/CNS (cerebellum); **Species:** Rat (neonate); **Pump:** 1007D; **Duration:** 7 days;

**ALZET Comments:** Controls received mp w/ vehicle; animal info (Wistar/ST, Postnatal day 6); ALZET brain infusion kit 1 used; tissue perfusion (cerebellum); teratology; good methods(pg. 18757); Pump implantation shown figure 6A pg.P18761. K252a is a CaM kinase and phosphorylase inhibitor;

**Q1485:** J. L. Wilkinson-Berka, *et al.* Aliskiren reduces vascular pathology in diabetic retinopathy and oxygen-induced retinopathy in the transgenic (mRen-2)27 rat. *Diabetologia* 2011;54(10):2724-2735

**Agents:** Aliskiren; lisonopril **Vehicle:** Not Stated; **Route:** SC; **Species:** Rat; Rat (neonate); **Pump:** 2ML4; 1007D; **Duration:** 16 weeks;

**ALZET Comments:** Controls received sham surgery; animal info (Sprague-Dawley, transgenic (mRen-2)27, postnatal days 12-18, female, 180-210 g, STZ-induced diabetes); pumps replaced every 4 weeks; long-term study; diabetes; enzyme inhibitor (renin);

**Q1043:** K. Dummula, *et al.* Bone Morphogenetic Protein Inhibition Promotes Neurological Recovery after Intraventricular Hemorrhage. *Journal of Neuroscience* 2011;31(34):12068-12082

**Agents:** Noggin, human, recomb. **Vehicle:** Not Stated; **Route:** CSF/CNS; **Species:** Rabbit (neonatal); **Pump:** 1003D; 2001; **Duration:** 3, 7 days;

**ALZET Comments:** Controls received mp w/ vehicle; animal info (New Zealand, 24 hours old); ALZET brain infusion kit used

**Q0819:** J. E. Oh, *et al.* Paradoxical Anxiogenic Response of Juvenile Mice to Fluoxetine. *Neuropsychopharmacology* 2009;34(10):2197-2207

**Agents:** Fluoxetine **Vehicle:** Saline; **Route:** SC; **Species:** Mice (neonate); **Pump:** 1007D; **Duration:** 7 days;

**ALZET Comments:** Controls received mp w/ vehicle; animal info (Swiss Webster, C57Bl/6, male, pups 2 weeks old and adult 8 week old); male pups implanted with SC pumps at 2 weeks of age; incisions closed by wound glue; pumps removed at 3 weeks of age; no stress (see pg.2197); pump implantation/removal did not alter overall behavior in the novelty-induced hypophagia (NIH) test; behavioral testing (elevated plus maze, open-field, NIH tests, forced swim test; Dose: 2, 3, and 4 mg/kg/day

**P9368:** J. L. W. Berka, *et al.* Identification of a Retinal Aldosterone System and the Protective Effects of Mineralocorticoid Receptor Antagonism on Retinal Vascular Pathology. *Circulation Research* 2009;104(1):124-U309

**Agents:** Aldosterone **Vehicle:** DMSO; Saline; **Route:** SC; **Species:** Rat (neonate); **Pump:** 1007D; **Duration:** 7 days;

**ALZET Comments:** Animal info (Sprague Dawley, OIR); 2% DMSO used



**P8816:** A. M. Depino, *et al.* GABA homeostasis contributes to the developmental programming of anxiety-related behavior. *Brain Research* 2008;1210(189-199)

**Agents:** Diazepam **Vehicle:** DMSO; Propylene glycol; **Route:** SC; **Species:** Mice; Mice (neonate); **Pump:** 1002; 2002; **Duration:** 14 days;

**ALZET Comments:** Controls received mp w/ vehicle; dose-response (Fig. 1); no stress (see pg. 193); post op. care (flumazenil); animal info (C57BL/6 x 129/SvJ, male, 14 days old, 60 days old); 50% DMSO used; behavioral testing (maze); wound clips used; 50% propylene glycol used

**P8303:** M. H. Zissen, *et al.* Tolerance, opioid-induced allodynia and withdrawal associated allodynia in infant and young rats. *Neuroscience* 2007;144(1):247-262

**Agents:** Morphine **Vehicle:** Saline; **Route:** SC; **Species:** Rat (neonate); **Pump:** 1003D; **Duration:** 72 hours;

**ALZET Comments:** Controls received mp w/ vehicle; dose-response (p. 250); comparison of acute or intermittently injections vs. mp; vs. pellet; good methods (p. 249); tolerance; post op. care (IP penicillin, fluid therapy); animal info (Sprague-Dawley); morphine withdrawal; behavioral testing; "Using the pellet in P7 rats produced a high rate of mortality from respiratory depression following pellet implantation and precluded parallel studies in the younger rats." (p. 254); Vetbond tissue adhesive was used

**P8494:** D. C. Stoller, *et al.* Role of kappa and delta opioid receptors in mediating morphine-induced antinociception in morphine-tolerant infant rats. *Brain Research* 2007;1142(28-36)

**Agents:** Morphine **Vehicle:** Not Stated; **Route:** SC; **Species:** Rat (neonate); **Pump:** 1003D; **Duration:** 72 hours;

**ALZET Comments:** Controls received mp w/ vehicle; tolerance; post op. care (10% povidone iodine swab); animal info (P14, 30 g); Vetbond tissue adhesive used to close incision

**P8483:** M. Say, *et al.* Changes in serotonergic receptors 1A and 2A in the piglet brainstem after intermittent hypercapnic hypoxia (IHH) and nicotine. *Brain Research* 2007;1152(17-26)

**Agents:** Nicotine **Vehicle:** Water, sterile; **Route:** IP; **Species:** Pig (neonate); **Pump:** 2ML2; **Duration:** 2 weeks;

**ALZET Comments:** Controls received mp w/ vehicle; SIDS; animal info (mini-piglet; 0-2 days old)

**P8623:** O. H. Khan, *et al.* Calcium antagonism in neonatal rats with kaolin-induced hydrocephalus. *Journal of Child Neurology* 2007;22(10):1161-1166

**Agents:** Magnesium chloride; MAfferent signalling through the common hepatic branch of the vagus inhibits voluntary lard intake and modifies plasma metabolite levels in rats

magnesium sulfate **Vehicle:** **Route:** SC; **Species:** Rat (neonate); **Pump:** 2002; 2004; **Duration:** 14 days;

**ALZET Comments:** Controls received mp w/ saline, equimolar; dose-response (table 1); comparison of SC injections vs. mp; stress/adverse reaction : (see pg 1162) high magnesium sulfate concentrations led to necrosis and skin sloughing at implant site; animal info (Sprague-Dawley, P7); skin was closed with staples (wound clips used)

**P7934:** M. H. Zissen, *et al.* Acute and chronic morphine alters formalin pain in neonatal rats. *Neuroscience Letters* 2006;400(1-2):154-157

**Agents:** Morphine **Vehicle:** Saline; **Route:** Not Stated; **Species:** Rat (neonate); **Pump:** 1003D; **Duration:** 72 hours;

**ALZET Comments:** Controls received mp w/ vehicle; post op. care (penicillin, ringer's solution); animal info (male and female Sprague-Dawley); Vetbond tissue used

**P7827:** S. Thyssen, *et al.* Ontogeny of regeneration of beta-cells in the neonatal rat after treatment with streptozotocin. *Endocrinology* 2006;147(5):2346-2356

**Agents:** Glucagon-like polypeptide-1(9-39) **Vehicle:** Saline; **Route:** SC; **Species:** Rat (neonate); **Pump:** 1002; **Duration:** 2 weeks;

**ALZET Comments:** Controls received mp w/ vehicle; no stress (see pg. 2352); peptides; animal info (Wistar, PD5, STZ-treated); GLP-1 receptor antagonist; "GLP-1-(9-39) treatment did not alter weight gain in these animals or have any visible deleterious effect.";



**P7925:** T. Tada, *et al.* Intraventricular administration of hepatocyte growth factor treats mouse communicating hydrocephalus induced by transforming growth factor beta 1. *NEUROBIOLOGY OF DISEASE* 2006;21(3):576-586

**Agents:** Hepatocyte growth factor, recomb. human **Vehicle:** PBS; BSA; **Route:** CSF/CNS; **Species:** Mice (neonate); **Pump:** 1007D; 1002; **Duration:** 7,14 days;

**ALZET Comments:** Animal info (C57BL/6, 10-day old)

**P7924:** A. Suryawan, *et al.* Expression of the TGF-beta family of ligands is developmentally regulated in skeletal muscle of neonatal rats. *PEDIATRIC RESEARCH* 2006;59(2):175-179

**Agents:** Follistatin **Vehicle:** PBS; **Route:** SC; **Species:** Rat (neonate); **Pump:** Not Stated; **Duration:** 11 days;

**ALZET Comments:** Peptides; animal info (10 days old)

**P8207:** R. Machaalani, *et al.* Postnatal nicotine and/or intermittent hypercapnic hypoxia effects on apoptotic markers in the developing piglet brainstem medulla. *Neuroscience* 2006;142(1):107-117

**Agents:** Nicotine hydrogen tartrate salt **Vehicle:** Water, sterile; **Route:** IP; **Species:** Pig (neonate); **Pump:** 2ML2; **Duration:** 11,13 days;

**ALZET Comments:** Controls received mp w/ vehicle; functionality of mp verified by serum cotinine; no stress (see p.109); animal info (mixed-breed miniature piglet, 2 days old, male, female, 1.2 kg)

**P8182:** A. Eskild-Jensen, *et al.* Glomerular and tubular function during AT1 receptor blockade in pigs with neonatal induced partial ureteropelvic obstruction. *American Journal of Physiology Renal Physiology* 2006;292(3):921-929

**Agents:** Candesartan **Vehicle:** Saline, physiological; **Route:** SC; **Species:** Pig (neonate); **Pump:** Not Stated; **Duration:** 7 days;

**ALZET Comments:** Controls received mp w/ vehicle; no stress (see pg. F923); animal info (female, Danish Landrace; 2, 23 days old); congenital urinary tract obstruction model

**P7198:** R. Machaalani, *et al.* Effects of postnatal nicotine exposure on apoptotic markers in the developing piglet brain. *Neuroscience* 2005;132(2):325-333

**Agents:** Nicotine hydrogen tartrate salt **Vehicle:** water, sterile; **Route:** IP; **Species:** Pig (neonate); **Pump:** 2ML2; **Duration:** 2 weeks;

**ALZET Comments:** Controls received mp w/ vehicle; functionality of mp verified by cotinine levels in serum and urine; no stress (see pg. 326); post op. care (cephalexin)

**P7020:** D. C. Stoller, *et al.* Buprenorphine blocks withdrawal in morphine-dependent rat pups. *Pediatric Anesthesia* 2004;14(8):642-649

**Agents:** Morphine sulphate **Vehicle:** Water, distilled; **Route:** SC; **Species:** Rat (neonate); **Pump:** 1003D; **Duration:** 72 hours;

**ALZET Comments:** Controls received mp w/ isotonic saline; dependence; Vetbond tissue used

**P6448:** Y. Abreu-Villaca, *et al.* Prenatal nicotine exposure alters the response to nicotine administration in adolescence: Effects on cholinergic systems during exposure and withdrawal. *Neuropsychopharmacology* 2004;29(5):879-890

**Agents:** Nicotine **Vehicle:** Water, sterile; **Route:** SC; **Species:** Rat (neonate); **Pump:** 1002; 2ML2; **Duration:** 2 weeks;

**ALZET Comments:** Controls received mp w/ vehicle; teratology; 1002's used in neonatal rats and 2ML2 pumps were used in adult rats; incision was closed with wound clips

**P5622:** H. W. Sundell, *et al.* Impaired cardiorespiratory recovery after laryngeal stimulation in nicotine-exposed young lambs. *PEDIATRIC RESEARCH* 2003;53(1):104-112

**Agents:** Nicotine tartrate **Vehicle:** Saline; **Route:** SC; **Species:** Sheep (lamb, neonate); **Pump:** 2ML4; **Duration:** 4 weeks;

**ALZET Comments:** Controls received mp w/ vehicle; functionality of mp verified by nicotine plasma levels (HPLC method); cardiovascular; teratology; postnatal lambs (1 day old).

**P6038:** S. Sarlos, *et al.* Retinal angiogenesis is mediated by an interaction between the angiotensin type 2 receptor, VEGF, and angiopoietin. *American Journal of Pathology* 2003;163(3):879-887

**Agents:** PD123319 **Vehicle:** Not Stated; **Route:** IP; **Species:** Rat (neonate); **Pump:** 2004; **Duration:** Not Stated;

**ALZET Comments:** Controls received mp w/ vehicle; animal info (11 days old); insertion wound was then closed with a small stitch



**P5134:** C. I. Thompson, *et al.* Plasma constituents and mortality in rat pups given chronic insulin via injection, pellet, or osmotic minipump. *Canadian Journal of Physiology and Pharmacology* 2002;80(180-192

**Agents:** Insulin, bovine **Vehicle:** Saline; **Route:** SC; **Species:** Rat (neonate); **Pump:** 1002; **Duration:** 10 days;

**ALZET Comments:** Animal info (neonates, 9 days old), controls received mp w/ vehicle; functionality of mp verified by plasma insulin levels and residual aspiration; comparison of pellet vs. sc injections vs. mp; no stress (see p. 186); "The minipumps appeared to be well tolerated and caused no obvious difficulty with nursing" (p. 186); teratology; peptides; "..pups tolerate insulin more readily from a minipump than from a pellet." (p. 190) "pellets caused high mortality within 24 h" (abstract); "Hypothermia is safe, and it has been shown to be an effective technique for inducing anesthesia in neonatal and preweaning rats. We therefore used moderate hypothermia to subcutaneously implant the osmotic minipumps..." p. 186; "It took approximately 1.5 min to implant the minipump in each pup..." p. 186; "The present studies indicate that subcutaneous insulin pellets are not suitable for this purpose (chronic insulin delivery in rat pups), since rat pups do not tolerate them well." p. 191

**P5341:** D. C. Stoller, *et al.* Loss of antinociceptive efficacy in rat pups infused with morphine from osmotic minipumps. *Pharmacology* 2002;66(1):11-18

**Agents:** Morphine sulfate **Vehicle:** Saline, isotonic; **Route:** SC; **Species:** Rat (neonate); **Pump:** 1003D; **Duration:** 72 hours;

**ALZET Comments:** Controls received mp w/ saline; toxicology; teratology; tolerance; dependence; 6-day and 14-day old rat pups implanted; incision closed w/ vetbond tissue adhesive

**P5789:** G. Santoni, *et al.* Expression of substance P and its neurokinin-1 receptor on thymocytes: Functional relevance in the regulation of thymocyte apoptosis and proliferation. *NEUROIMMUNOMODULATION* 2002;10(4):232-246

**Agents:** Substance P; SR140333 **Vehicle:** Water, distilled; DMSO; **Route:** SC; **Species:** Rat (neonate); **Pump:** 2001; **Duration:** 7 days;

**ALZET Comments:** Controls received mp w/ one of two vehicles; functionality of mp verified by plasma levels of (sp); dose-response (p.241); peptides; SR140333 (A NK-1R antagonist) was diluted in 1% DMSO distilled water, alone, or in combination with (sp); pups were 28 days old

**P6604:** M. J. Marino, *et al.* Haloperidol-induced alteration in the physiological actions of group I mGluR in the subthalamic nucleus and the substantia nigra pars reticulata. *Neuropharmacology* 2002;43(2):147-159

**Agents:** Haloperidol **Vehicle:** Lactic acid; NaOH; saline; **Route:** SC; **Species:** Rat (neonate); **Pump:** 2001; **Duration:** 16 hours;

**ALZET Comments:** Cyanoacrylate adhesive applied over sutures; animal info (15-18 days old, 20-37 grams)

**P5382:** E. Margotti, *et al.* TRKB signalling controls the expression of N-methyl-D-aspartate receptors in the visual cortex. *European Journal of Neuroscience* 2002;16(6):1067-1074

**Agents:** Immunoglobulin G, TrkB **Vehicle:** Saline; **Route:** CSF/CNS (occipital cortex); **Species:** Rat (neonate); **Pump:** Not Stated; **Duration:** 16 days;

**ALZET Comments:** Controls received mp w/ vehicle; functionality of mp verified by TrkB-IgG immunohistochemistry in visual cortex; immunology; TrkB-IgG consists of the soluble form of the tyrosine Kinase receptor engineered as an immunoadhesin by fusing it to the Fc portion of an IgG; 20-21 day old rats used; Fig. 2A (graphic of infusion site)

**P5628:** S. Eiden, *et al.* Developmental and food-access-dependent changes in effector systems activated by leptin. *PFLUGERS ARCHIV-EUROPEAN JOURNAL OF PHYSIOLOGY* 2002;445(3):366-374

**Agents:** Leptin **Vehicle:** PBS; **Route:** SC; **Species:** Rat (neonate); **Pump:** Not Stated; **Duration:** 10 days;

**ALZET Comments:** Controls received mp w/ vehicle; comparison of injections v. mp; peptides; 14 day and 25 day old rat pups used.

**P5198:** F. R. Dunshea, *et al.* Insulin-like growth factor-I and analogues increase growth in artificially-reared neonatal pigs. *British Journal of Nutrition* 2002;87(6):587-593

**Agents:** Insulin-like growth factor I; Insulin-like growth factor I, LR3- **Vehicle:** Acetic acid; **Route:** SC; **Species:** Pig (neonate);

**Pump:** 2001; **Duration:** 8,9,18 days;

**ALZET Comments:** Controls received mp w/ vehicle; functionality of mp verified by plasma levels; pumps replaced after 8 or 9 days; peptides;



**P4822:** H. Sameshima, *et al.* Long-term magnesium sulfate treatment as protection against hypoxic-ischemic brain injury in seven-day-old rats. *American Journal of Obstetrics & Gynecology* 2001;184(185-190)

**Agents:** Magnesium sulfate **Vehicle:** Not Stated; **Route:** SC; **Species:** Rat (neonate); **Pump:** 1003D; **Duration:** 3 days;

**ALZET Comments:** Controls received mp w/ saline; functionality of mp verified by measuring magnesium ion concentrations; teratology; seven-day old rat pups weighed on average 13.9 ± 2.5 grams; neuroprotection; ischemia (cerebral)

**P5008:** S. E. Robinson, *et al.* Effect of perinatal buprenorphine exposure on development in the rat. *Journal of Pharmacology and Experimental Therapeutics* 2001;298(2):797-804

**Agents:** Buprenorphine; Methadone **Vehicle:** Water; **Route:** SC; **Species:** Rat (pregnant); Rat (neonate); **Pump:** Not Stated; **Duration:** 14, 28 days;

**ALZET Comments:** controls received mp w/ vehicle; replacement therapy (enterectomy); dose-response (graphs p. 802); teratology; toxicology; dependence; no stress (see pg. 258-259); 28-day pumps implanted in pregnant rats; 14-day pumps implanted in 10-day old rat pups,

**P4632:** A. B. Lohmann, *et al.* Buprenorphine substitution ameliorates spontaneous withdrawal in fentanyl-dependent rat pups. *Pediatr. Res* 2001;49(1):50-55

**Agents:** Fentanyl citrate **Vehicle:** Saline, isotonic; **Route:** SC; **Species:** Rat (neonate); **Pump:** 1003D; **Duration:** 72 hours;

**ALZET Comments:** Controls received mp w/ vehicle; teratology; tolerance; dependence; the surgical incision was closed with Vetbond Tissue Adhesive; pumps implanted in 14-day old rat pups.

**P5021:** S. Eiden, *et al.* Leptin responsiveness of juvenile rats: proof of leptin function within the physiological range. *Journal of Physiology-London* 2001;530(131-139)

**Agents:** Leptin, recombinant mouse **Vehicle:** PBS; **Route:** SC; **Species:** Rat (neonate); **Pump:** 1002; 2002; **Duration:** 9 days;

**ALZET Comments:** Controls received mp w/ vehicle; functionality of mp verified by plasma leptin levels; dose-response (page 135); peptides; 1002 pumps used in 15-day old pups, 2002 used in 24-day old pups; His6-tagged murine leptin used

**P4328:** S. R. Thornton, *et al.* Fentanyl self-administration in juvenile rats that were tolerant and dependent to fentanyl as infants. *Pharmacology Biochemistry and Behavior* 2000;65(3):563-570

**Agents:** Fentanyl HCl **Vehicle:** Saline, pyrogen-free isotonic; **Route:** SC; **Species:** Rat (neonate); **Pump:** 1003D; **Duration:** 3,5 day;

**ALZET Comments:** Controls received mp with saline; tolerance; dependence; pain

**P4553:** T. A. Doucette, *et al.* Use of osmotic minipumps for sustained drug delivery in rat pups: effects on physical and neurobehavioural development. *Physiology and Behavior* 2000;71(207-212)

**Agents:** Not Stated **Vehicle:** Saline; **Route:** SC; **Species:** Rat (neonate); **Pump:** 1007D; **Duration:** 9 days;

**ALZET Comments:** Controls received sham surgery; no stress (p. 211-212); good surgical methods (p. 208-209); teratology

**P4722:** C. H. Choe, *et al.* Sedative tolerance accompanies tolerance to the analgesic effects of fentanyl in infant rats. *Pediatr. Res* 2000;47(6):727-735

**Agents:** Fentanyl **Vehicle:** Saline; **Route:** Not Stated; **Species:** Rat (neonate); **Pump:** 1003D; **Duration:** 3 days;

**ALZET Comments:** Controls received mp w/ vehicle; functionality of mp verified by plasma fentanyl levels; dose-response (table p. 729 / graph p. 730); tolerance; dependence; pumps implanted in 14 day old rat pups; Vetbond tissue adhesive

**P8482:** J. A. Trauth, *et al.* Adolescent nicotine exposure causes persistent upregulation of nicotinic cholinergic receptors in rat brain regions. *Brain Research* 1999;851(1-2):9-19

**Agents:** Nicotine **Vehicle:** Not Stated; **Route:** SC; **Species:** Rat (neonate); Rat; **Pump:** 1002; 2ML2; **Duration:** 17 days;

**ALZET Comments:** No stress (see pg. 10); animal info (P30-P47, Sprague-Dawley, male, 120 g, female 100 g); anesthetized with ether; adult animal info (90 days old, 350 g, Sprague-Dawley); incision was closed with wound clips

**P4487:** K. Fhølenhag, *et al.* Effects of human growth hormone on the porto-arterial concentration differences of glucose and amino acids in the newborn piglet. *Horm. Metab. Res* 1999;31(22-26)

**Agents:** Growth hormone, recomb. human **Vehicle:** PBS; **Route:** IP; **Species:** Pig (neonate); **Pump:** 2ML1; **Duration:** 7 days;

**ALZET Comments:** Controls received mp w/vehicle; peptides



**P4308:** S. R. Thornton, *et al.* Long-term alterations in opiate antinociception resulting from infant fentanyl tolerance and dependence. *European Journal of Pharmacology* 1998;363(113-119)

**Agents:** Fentanyl HCl **Vehicle:** Saline; **Route:** SC; **Species:** Rat (neonate); **Pump:** 1003D; **Duration:** 3,5 days;  
**ALZET Comments:** Controls received mp w/ vehicle; tolerance; dependence

**P3917:** J. M. Hutson, *et al.* Congenital undescended testes in neonatal pigs and the effect of exogenous calcitonin gene-related peptide. *J. Urol* 1998;159(1025-1028)

**Agents:** Calcitonin gene-related peptide **Vehicle:** Not Stated; **Route:** Scrotal; **Species:** Pig (neonate); **Pump:** 2002; **Duration:** 2 weeks;

**ALZET Comments:** Controls received mp w/PBS; tissue perfusion (undescended testes); replacement therapy (cryptorchidism); dose-response; peptides; "Injection of excess CGRP into the scrotum may delay descent...the pig model has overcome some of these difficulties as the o

**P4116:** M. K. Herrington, *et al.* Effects of epidermal growth factor on neonatal pancreatic growth in the guinea pig. *Int. J. Pancreatol* 1998;24(1):35-41

**Agents:** Epidermal growth factor; Devazepide **Vehicle:** DMSO; Ringer's solution, lactated; **Route:** SC; **Species:** Guinea pig (neonate); **Pump:** 1003D; 2002; **Duration:** 4,15 days;

**ALZET Comments:** peptides

**P4180:** S. R. Thornton, *et al.* Characterization of neonatal rat morphine tolerance and dependence. *European Journal of Pharmacology* 1997;340(161-167)

**Agents:** Morphine sulfate **Vehicle:** Saline, sterile isotonic; **Route:** SC; **Species:** Rat (neonate); **Pump:** 1003D; **Duration:** 3 days;

**ALZET Comments:** controls received mp w/saline; pumps implanted in 14 day old rat pups; "osmotic minipumps may provide a reliable method of examining the tolerance and dependence liability of many opioids in neonatal rats" (p. 165); toxicology; teratology; tolerance; dependence; good surgical methods (p.102)

**P3449:** S. R. Thornton, *et al.* Characterization of neonatal rat fentanyl tolerance and dependence. *J. Pharmacol. Exp. Ther* 1997;281(1):514-521

**Agents:** Fentanyl **Vehicle:** Not Stated; **Route:** SC; **Species:** Rat (neonate); **Pump:** 1003D; **Duration:** Not Stated;

**ALZET Comments:** Controls received mp w/ saline; excellent methodology for working with neonates; animals were given penicillin G prophylactically, along with .5 ml saline to prevent hypovolemia; pumps were implanted 1.5 cm from the base of the tail to obviate problems w/ nursing; tolerance; dependence; teratology

**P3542:** C.-B. Steeb, *et al.* Systemic infusion of IGF-I or LR(3)IGF-I stimulates visceral organ growth and proliferation of gut tissues in suckling rats. *American Journal of Physiology Gastrointestinal and Liver Physiology* 1997;272(G522-G533)

**Agents:** Insulin-like growth factor I; Insulin-like growth factor I, LR3- **Vehicle:** Not Stated; **Route:** SC; **Species:** Rat (neonate); **Pump:** 1007D; **Duration:** 6.5 days;

**ALZET Comments:** controls received mp w/ vehicle; peptides; teratology; neonates were 6 or 12 days old; recomb. human IGF-I and human LR3IGF-I used; good surgical methodology (see pg G523)

**P3925:** P. A. Schoknecht, *et al.* Exogenous insulin-like growth factor-I increases weight gain in intrauterine growth-retarded neonatal pigs. *Pediatr. Res* 1997;42(2):201-207

**Agents:** Insulin-like growth factor I **Vehicle:** Saline; Acetic acid; **Route:** SC; **Species:** Pig (neonate); **Pump:** 2001; **Duration:** 7 days;

**ALZET Comments:** Controls received mp w/ saline; functionality of mp verified by plasma assays; peptides; recomb. human IGF-I used

**P3889:** W. J. Brooks, *et al.* Effect of chronic administration of NMDA antagonists on synaptic development. *Synapse* 1997;26(104-113)

**Agents:** APV **Vehicle:** Saline; **Route:** CSF/CNS (occipital cortex); **Species:** Rat (neonate); **Pump:** 2002; **Duration:** 14 days;

**ALZET Comments:** controls received mp w/vehicle; animal info (15-day old); ALZET brain infusion kit used; APV is 2-amino-5-phosphonovaleric acid



**P4245:** M. Rocha, *et al.* Rapid acquisition of dendritic spines by visual thalamic neurons after blockade of N-methyl-D-aspartate receptors. *Proc. Natl. Acad. Sci. USA* 1995;92(8026-8030

**Agents:** APV **Vehicle:** Saline; **Route:** CSF/CNS (thalamus); **Species:** Ferret (neonate); **Pump:** 2001; **Duration:** 1 week;  
**ALZET Comments:** Controls received mp w/vehicle

**P4033:** M. K. Herrington, *et al.* On the importance of cholecystokinin in neonatal pancreatic growth and secretory development in guinea pigs. *Pancreas* 1995;11(1):38-47

**Agents:** MK-329 **Vehicle:** DMSO; Saline; **Route:** SC; **Species:** Guinea pig (neonate); Guinea pig (pregnant); **Pump:** 2002; 2ML4; 1003D; **Duration:** 4,15 days;

**ALZET Comments:** Animal info (female, pregnant, or neonate 1-3 hours old); cholecystokinin receptor antagonist; controls received mp w/vehicle; teratology; peptides

**P1950:** G. F. Glasscock, *et al.* Effects of continuous infusion of insulin-like growth factor I and II, alone and in combination with thyroxine or growth hormone, on the neonatal, hypophysectomized rat. *Endocrinology* 1992;130(1):203-210

**Agents:** Insulin-like growth factor I; Insulin-like growth factor II **Vehicle:** Acetic acid; PBS; **Route:** SC; **Species:** Rat (neonate); **Pump:** 1003D; **Duration:** 9 days;

**ALZET Comments:** peptides; teratology; pumps implanted in 10-day old rat pups; pumps replaced on postnatal days 13 and 16; functionality of mp verified by IGF serum levels assayed by RIA; wound clips used

**P0594:** N. Bouby, *et al.* Stimulation of tubular reabsorption of magnesium and calcium by antidiuretic hormone in conscious rats: study in Brattleboro rats with hereditary hypothalamic diabetes insipidus. *Pflugers Arch* 1984;402(458-464

**Agents:** Vasopressin, 1-desamino-8-D arginine **Vehicle:** Saline; **Route:** IP; **Species:** Rat (neonate); **Pump:** 2002; **Duration:** 2+ weeks;

**ALZET Comments:** no stress p. 463 - refers to value of exp. with non-stressed animals; prior to implant w/ mp, neonate rats received daily sc admin. of Vasopressin, 1-desamino-8-D arginine; peptides; teratology