References on the Administration of Agents to Primates
Using ALZET® Osmotic Pumps

1. Baboon

**ALZET Comments:** CSF, artificial; CSF/CNS (ventricle); Monkey (baboon); 14 days, 2 weeks; Controls received mp w/ vehicle; animal info (all animals were housed in social groups in outdoor enclosures); ALZET pumps used to maintain the patency of the ventricular infusion line and cannula before connection to the syringe pump infusion system.

**ALZET Comments:** Tumor necrosis factor-alpha; PBS; IV (femoral); Monkey (pregnant, baboon); 2ML4; Controls received mp w/ vehicle; animal info (female, baboon, Papio hamadryas).

**ALZET Comments:** Chorionic gonadotropin hormone, human recomb.; Saline; SC; intrauterine; Monkey (baboon); 2ML1; Animal info (30 mo old, spontaneous endometriosis); tissue perfusion (oviductal lumen).

Q0042: Y. Fujimura, et al. Quantification of peripheral benzodiazepine receptors in human brain with 18F-PBR06. Journal of Cerebral Blood Flow and Metabolism 2010;29(S360-S375
**ALZET Comments:** Nicotine; Monkey (baboon); 6 months; Long-term study; animal info (Papio anubis); functionality of mp verified by plasma nicotine concentration; pumps replaced at 15 days, 2, 3, 4 and 5 months.

**ALZET Comments:** Chorionic gonadotropin hormone, human recomb.; Oviductal; Monkey (baboon); 5 days; Animal info (cycling, female, 7-12 years old, 12-18 kg); tissue perfusion (oviduct).

**ALZET Comments:** Gonadotrophin, human chorionic; Oviductal; Monkey (baboon); 5 days; Animal info (papio annubis).

**ALZET Comments:** Gonadotrophin, human chorionic; Oviductal; Monkey (baboon); 5 days; Animal info (female, adult).

**ALZET Comments:** Gonadotrophin, chorionic; Oviductal lumen; Monkey (baboon); 2ML1; 7 days;

**ALZET Comments:** Gonadotrophin, human chorionic, recomb.; interleukin-1, beta, recomb. human; interleukin-1 receptor antagonist, recomb. human; Oviductal; Monkey (baboon); 10 days; Controls received no treatment; pumps replaced at day 5; animal info (female, adult).

ALZET Comments: Angiotensin II; aldosterone; Saline; ethanol; SC; CSF/CNS; Monkey (baboon); 49 days; Controls received mp w/ vehicle; long-term study, pumps replaced every 7 days (6 times); angiotensin II diluted in saline and infused ICV; aldosterone diluted in 10% ethanol in saline and infused SC; some animals implanted w/ 2 pumps.

ALZET Comments: Chorionic gonadotropin hormone, human; follicle stimulating hormone; Monkey (baboon); 5 days; animal info (normally cycling adult female baboon).

ALZET Comments: Gonadotrophin, human chorionic; Intraovarian; Monkey (baboon); 4 days; Animal info (ovariectomized).

ALZET Comments: Heparin, porcine; Saline; IV (femoral); Monkey (baboon); 4, 28, 56 days; Controls received mp w/ vehicle; pumps replaced after 28 days; cardiovascular; multiple pumps per animal (2); long-term study.

ALZET Comments: Gonadotrophin, recombinant human chorionic; Intraovarian (corpus luteum); Monkey (baboon); 2ML1; 7 days; tissue perfusion (corpus luteum).

P4060: J. R. Blair-West, et al. Evidence that brain angiotensin II is involved in both thirst and sodium appetite in baboons. Am. J. Physiol. (Regulatory Integrative Comp. Physiol. 44) 1998;275(R1639-R1646
ALZET Comments: Angiotensin II; Losartan potassium; ZD-7155; Ethanol; CSF, artificial;; SC; CSF/CNS;; Monkey (baboon); 2ML1; 2ML2; 2ML4; no duration posted; controls received mp w/vehicle; amoxicillin and buprenorphine given post-operatively; good methods; aCSF delivered during 1-2 week surgical recovery period; vehicle and compound-filled pumps were alternated; some pumps were filled with peptide and antagonist; ZD-7155 is an AT1 receptor antagonist; peptides; antihypertensive.

ALZET Comments: Luteinizing HRH antagonist; Water; SC; Monkey (baboon, pregnant); 7 days; no comment posted.

ALZET Comments: Aminobutyric acid, Y-; Saline; CSF/CNS; Monkey (baboon); 2ML1; 7 days; functionality of mp verified by removing and opening; pumps replaced once w/ saline-filled mp.

ALZET Comments: Aminobutyric acid, Y-; Saline; CSF/CNS (frontal cortex); Monkey (baboon); 2ML1; no duration posted; controls received mp w/vehicle; mp connected to intracerebral cannula; agent filled mp replaced after 7 days with saline filled mp; tissue perfusion (frontal cortex).

ALZET Comments: Luteinizing HRH agonist; Saline; SC; Monkey (baboon); 7 days; peptides.

2. Marmoset
ALZET Comments: Hepatocyte growth factor, recomb. human; PBS; CSF/CNS (intrathecal); Monkey (marmoset); 2004; 4 weeks; Controls received mp w/ vehicle; animal info (adult, female, common, 295-350 g); ALZET rat intrathecal catheter used.

ALZET Comments: Rotigotine hydrochloride; DMSO; water, sterile; SC; Marmoset; 2004; 28 days; Comparison of SC injections or PO administration vs. SC mp; animal info (adult, common, male, female, 2-7 years old, 350-500); 50% DMSO used; "These data suggest that dyskinesia induced by pulsatile drug treatment may be improved by switching to continuous rotigotine delivery." pg. 79; "...this study highlights the potential benefits of continuous drug delivery." pg 84.

ALZET Comments: Prolactin, human, recomb.; Glycerol; NaHCO3; NaCl; SC; Monkey (marmoset); 2004; Controls received mp w/ saline; animal info (2.5-9 yrs old, male, parentally experienced); "... these pellets (from Innovative Research of America) did not raise the level of prolactin in the blood over the level of our control parentally experienced fathers... Therefore, we chose to use the osmotic minipump (Alzet, CA) for our test males." pg 439; "The position of the pumps on the lower area of a male's back precluded any interference with infant carrying since infant carrying occurs nearer the neck" pg 439; comparison of pellets vs mp.

ALZET Comments: Rotigotine; Saline, sterile; SC; Monkey (marmoset); 2004; Controls received mp w/ vehicle; animal info (adult common, male, female, 354 g); comparison of sc injections vs. mp; neurodegenerative (Parkinson's disease); post op. care (Rimadyl, Synulox); "pumps were removed... and replaced with new minipumps implanted into the opposite flank." pg 534; "These results demonstrate that the anti-parkinsonian benefits associated with a continuous infusion of rotigotine were more sustained compared to pulsatile rotigotine or L-DOPA treatment..." pg 541; long-term study.

P8082: R. J. Hornby, et al. Multiple vaccine and pyridostigmine bromide interactions in the common marmoset Callithrix jacchus: Immunological and endocrinological effects. INTERNATIONAL IMMUNOPHARMACOLOGY 2006;6(12):1765-1779
ALZET Comments: Pyridostigmine bromide; Saline, sterile isotonic; SC; Marmoset; 2004; Controls received mp w/ vehicle; no stress (see p.1776); immunology; animal info (female, vasectomized male, 331-565g. 2-5.5 yrs. old); mp primed 40 hours.

P8143: G. D. Griffiths, et al. Development of methods to measure humoral immune responses against selected antigens in the common marmoset (Callithrix jacchus) and the effect of pyridostigmine bromide administration. INTERNATIONAL IMMUNOPHARMACOLOGY 2006;6(12):1755-1764
ALZET Comments: Pyridostigmine bromide; Saline, sterile isotonic; SC; Marmoset; 28 days; Controls received mp w/ vehicle; no stress (see p.1759,1762); immunology; animal info (male, female, 300-500g.); mp primed 40 hours; "delivery by pump ensured the animals would receive an appropriate dose of the drug over the desired time period.", oral delivery "would introduce unacceptable stress into the experiment and presentation in food was discounted because of difficulties in estimating the dose administered." (p.1757).

ALZET Comments: Pyridostigmine bromide; Propylene glycol: ethanol; acidic acid, glacial; water, distilled; SC; Marmoset; 2002; Controls received mp w/ vehicle; toxicology; sarin vapor.

ALZET Comments: Pyridostigmine bromide; Propylene glycol; ethanol; water; acetic acid, glacial; SC; Guinea pig; marmoset; 2002; 4 days; Controls received mp w/ vehicle; toxicology.


ALZET Comments: Physostigmine salicylate; scopolamine hydrobromide; Saline; SC; Monkey (marmoset); 2002; 14 days; Controls received mp w/ vehicle; behavioral testing; agents infused via same pumps; toxicology.


ALZET Comments: Clomethiazole; AR-R15896AR; NXY-059; Saline; SC; Monkey (marmoset); 2001D; 48 hours; Controls received mp w/ vehicle; pumps replaced every 24 hours; ischemia (cerebral); neuroprotective; post op. care (incubator); behavioral study.


ALZET Comments: NXY-059; Saline; IV; Monkey (marmoset); 2001D; 48 hours; Controls received mp w/ vehicle; NXY-059 plasma levels taken; pumps replaced every 24 hours; post op. care (flunixin meglumine); behavior study; neuroprotective; ischemia (cerebral).


ALZET Comments: NXY-059; Saline; SC; monkey (marmoset); 2001D; 24 hours; controls received mp w/ vehicle; functionality of mp verified by plasma drug levels; pumps replaced after 24 hours; NXY-059 is a novel free-radical trapping agent; multiple pumps per animal (2) used simultaneously; ischemia (cerebral).


ALZET Comments: Saline; nerve growth factor, recomb. human; cytochrome C; CSF/CNS; Marmoset; 2004; 35 -42 days; Controls received mp w/ cytochrome C; functionality of mp verified by CSF levels of rhNGF; pumps replaced after 7-14 days of saline; immunology; ALZET brain infusion kit used; peptides; animal info (callithrix jacchus); "we chose to use an intracranial route to ensure accurate delivery of the drug into the CNS. This resulted in sustained elevated concentrations of rhNGF in the CSF of all rhNGF-treated animals." (p. 1801).


ALZET Comments: Clomethiazole;; IP;; monkey (marmoset);; 2001D;; 24 hours;; clomethiazole is neuroprotective in rodents following ischemia; ischemia (cerebral).


ALZET Comments: CGP-29287; Methylcellulose; Saline; IP; monkey (marmoset); 2002; 7 days; dose-response; CGP-29287 is a renin inhibitor.


ALZET Comments: CGP-29287; IP; monkey (marmoset); 2002; 14 days; dose-response; only high dose affected bp; mp removed after delivery.
3. Monkey


**Agents**: 1-methyl-4-phenyl-1,2,3,6-tetrahydropyridine  
**Vehicle**: Saline; **Route**: SC; **Species**: Monkey; **Pump**: Not stated; **Duration**: 2 weeks;

**ALZET Comments**: Dose (0.5 mg/day); animal info (adult female monkeys, 4 to 11 years old, 2.4 to 4.6 kg); 1-methyl-4-phenyl-1,2,3,6-tetrahydropyridine aka MPTP; neurodegenerative (Parkinson’s Disease);

**Q8477**: R. P. Gale, *et al.* Use of molecularly-cloned haematopoietic growth factors in persons exposed to acute high-dose, high-dose rate whole-body ionizing radiations. Blood Rev 2020;100690

**Agents**: Granulocyte Macrophage Colony-Stimulating Factor, Recombinant Human  
**Vehicle**: Not stated; **Route**: SC; **Species**: Monkey; **Pump**: Not stated; **Duration**: 7 days;

**ALZET Comments**: Recombinant Human Granulocyte Macrophage Colony-Stimulating Factor aka rhG/M-CSF; dependence;


**Agents**: Anti-RGMa antibody  
**Vehicle**: Saline; **Route**: CNS/CSF; **Species**: Monkey; **Pump**: 2ML4; **Duration**: 4 weeks;

**ALZET Comments**: Dose (50 ug/kg/day); animal info (Rhesus, 3-5 years old, 2.8-5.4 kg); spinal cord injury;


**Agents**: Florfenicol voriconazole; fentanyl; amikacin  
**Vehicle**: Not Stated; **Route**: SC; in vitro; **Species**: Rat; Snake (corn, rattle); Iguana; Cat; Hamster; Gelada; Pudu; Wallaby; Monkey; Quail; Hen; **Pump**: Not Stated; **Duration**: Not Stated;

**ALZET Comments**: “animal info (Eastern massasauga rattlesnakes (Sistrurus catenatus); timber rattlesnake (Crotalus horridus); pudu (Pudu puda); wallaby (Macropus rufogriseus); iguanas (Iguana iguana); Mojave rattlesnakes (Crotalus scutulatus); corn snakes (Elaphe guttata guttata); Japanese quails (Coturnix coturnix japonica); hens (Gallus domesticus));” Finally, the use of intracoelomic osmotic pumps was reported in iguanas (Iguana iguana) in a study of reproductive behavior.26 No complication due to the pump placement was reported in that study. “ pg. 508; Advantages: Can be extracted in case of drug overdose or toxicity, Is not altered by its biological environment, Release the drug at a constant rate, Low cost, Commercially available, Release rate and operation time can be chosen; Drawbacks: Necessitate 2 light surgical procedures under anesthesia to be implanted and explanted, Can sometimes migrate in unwanted location (especially if implanted accidently in air sacs during intracoelomic implantation) "

**Q7031**: M. Fregosi, *et al.* Changes of motor corticobulbar projections following different lesion types affecting the central nervous system in adult macaque monkeys. European Journal of Neuroscience 2018;48(4):2050-2070

**Agents**: Antibody, anti-Nogo-A  
**Vehicle**: Not Stated; **Route**: CSF/CNS (Intrathecal), SC; **Species**: Monkey (Macaca fascicularis); **Pump**: 2ML2; **Duration**: 4 weeks;

**ALZET Comments**: Dose (3 mg/ml); One pump administered the treatment intrathecaally to the cervical spinal cord, whereas the other pump delivered the antibody close to the lesioned site in M1 below the dura; Multiple pumps per animal (2);