References on Bilateral CNS Infusion
Using ALZET® Osmotic Pumps


ALZET Comments: S-Methyl-L-thiocitrulline; Saline; SC; Rat; 1007D; 7 days; Dose (0.5 ± 0.1 μL/hr/day); 0.9% saline used; animal info (male Sprague Dawley); post op. care (Ampicillin, meloxicam); enzyme inhibitor (S-Methyl-L-thiocitrulline is a neuronal nitric oxide synthase (nNOS) inhibitor); Brain coordinates (AP −1.0 mm, ML −2.0 mm, DV −3.5mm from bregma); bilateral cannula used; dependence;.

Q6949: T. Zera, et al. Microglia and brain angiotensin type 1 receptors are involved in desensitising baroreflex by intracerebroventricular hypertonic saline in male Sprague-Dawley rats. Auton Neurosci 2019;217(49–57

ALZET Comments: Minocycline, Losartan; Saline, iso-osmotic, Saline, hyperosmotic; CSF/CNS; Rat; 2ML2; 2 weeks; Dose (Minocycline-5 μg/h; Losartan- 12.5 μg/h); 0.9% isosmotic saline with minocycline, 5% Hyperosmotic saline with Losartan used; animal info (Normotensive adult male Sprague-Dawley rats); enzyme inhibitor (microglia;); ALZET brain infusion kit 2 used; Brain coordinates (1.2mm posterior to bregma, −1.8mm laterolateral from sagittal suture, diameter 0.5 mm) bilateral cannula used; cyanoacrylate adhesive; cardiovascular;.

Q6799: H. Tian, et al. Chronic infusion of berberine into the hypothalamic paraventricular nucleus attenuates hypertension and sympathoexcitation via the ROS/Erk1/2/iNOS pathway. Phytomedicine 2019;52(165-224

ALZET Comments: Berberine; CSF, artificial; CSF/CNS (Paraventricular nucleus); Rat; 2006; 28 days; Dose (2 μg / h); Controls received mp w/ vehicle; animal info (adult male Sprague-Dawley rats (240–280 g).); bilateral cannula used;.

Q6955: A. Ortiz-Matamoros, et al. Differential Changes in the Number and Morphology of the New Neurons after Chronic Infusion of Wnt7a, Wnt5a, and Dkk-1 in the Adult Hippocampus In Vivo. Anat Rec (Hoboken) 2019;

ALZET Comments: Wnt7a, Wnt5a, Dkk-1; PBS; CSF/CNS; Rat; 2004; 11 days; Dose (0.25 μL/hr); animal info (Male Wistar rats; 250–300 g, 3-months-old); Wnt7a and Wnt5a are Wnt agonists, and Dkk-1 is a Wnt antagonist; Brain coordinates (AP −3.6, L −3.1, and V + 2.0.); bilateral cannula used(3.5 mm long bilateral cannula made with silicate capillaries); neurodegenerative;.


ALZET Comments: rno-miR-124-3p; CSF, artificial; CSF/CNS (lateral ventricle); Rat; 2004; 28 days; Dose (concentrations of 0, 0.05, 0.1 or 0.5 nmol/day); post op. care (carprofen); ALZET brain infusion kit 2 used; Brain coordinates (1.00mm caudal and 1.40mm lateral to bregma, with no height adjustment spacers ); bilateral cannula used; dependence; Therapeutic indication (Gulf War Illness);.


ALZET Comments: Anti-HSP90a/b monoclonal antibody, mouse IgG; CSF, artificial; CSF/CNS (right lateral ventricle); Mice; 1004; 14 days; Dose (164 ng/mL-HSP90, IgG); aCSF: 148.3mM NaCl, 3mM KCl, 1.4mM CaCl2, 0.8mM MgCl2, 0.75mMNa2HP04, and 0.195mMNaH2PO4 used; animal info (8 wanimal info (8 weeks old, 28-33 g, female, ddY); eeks old, 28-33 g, female, ddY); ALZET brain infusion kit 3 used; Brain coordinates (anteroposterior: −0.22mm, mediolateral: +1mm, dorsoventricular:−2.5mm); bilateral cannula used; cyanoacrylate adhesive; spinal cord injury;.

Q7218: T. T. Liu. EphrinB3 modulates hippocampal neurogenesis and the reelin signaling pathway in a pilocarpineinduced model of epilepsy. INTERNATIONAL JOURNAL OF MOLECULAR MEDICINE 2018;41(3457-3467

ALZET Comments: Eph B3Fc chimera, mouse recomb.; CSF/CNS (hippocampus); Rat; 7 days; Dose (50 ug/ml); animal info (young male SpragueD awley rats, aged 68 weeks, 200250 g); ALZET brain infusion kit XX used; Brain coordinates (2.8 mm under the dura); bilateral cannula used; The cannula was cemented onto the skull with dental acrylic.; neurodegenerative (Epilepsy);.

**ALZET Comments:** Antibody, anti-GCSF neutralizing antibody, Immunoglobulin G, pre-immune; Saline; CSF/CNS (nucleus accumbens); Mice; 1007D; 7 days; Dose (1 ug/day); animal info (Male, C57BL/6 J, 7 weeks old , 20–25 g ); Multiple pumps per animal (2); Brain coordinates (From bregma: anteroposterior, +1.5; mediolateral, + 1.0; dorsoventral, −4.5); bilateral cannula used; The cannulae were permanently fixed to the skull with Loctite adhesive; dependence.;;


**ALZET Comments:** Lidocaine; Saline; Methylene blue; CSF/CNS (cerebellum); Mice; 7 days; Dose (4% lidocaine); 0.9% saline; 0.01% methylene blue; Controls received mp w/ vehicle; animal info (adult dystonic Ptf1aCre;Vglut2f x/fx mice.); bilateral cannula used;.


**ALZET Comments:** Amyloid-β; Saline; CSF/CNS (bilateral CA1 subregions); Rat; 14 days; Dose (3.6 nmol/day); animal info (Male Sprague Dawley rats, weighing 232±16 g,); Brain coordinates (lateral, −3.3 mm from the bregma; posterior, 2.0 mm from the midline; ventral, −2.5 mm from dura); bilateral cannula used; cyanoacrylate adhesive.;


**ALZET Comments:** Oxadiazolo quinoxalin-1-one, 1H-[1,2,4],[4,3-a]; Saline; CSF/CNS; Rat; 2002; 21 days; Dose (2 mg/kg/day); animal info (Eight-week-old male Sprague-Dawley); 1H-[1,2,4] oxadiazolo [4,3,- a] quinoxalin-1-one aka ODQ; Brain coordinates (lateral, −3.3 mm from the bregma; posterior, 2.0 mm from the midline; ventral, −2.5 mm from dura); bilateral cannula used; cardiovascular.;;


**ALZET Comments:** Ifenprodil tartrate; Tartaric acid; CSF/CNS; Mice; 1002; 14 days; Dose (18ng/h); 0.1% tartaric acid used; animal info (two to three months old, male and female mice from heterozygous matings); Brain coordinates (A/P: +1.1mm, M/L: +/-0.05mm, D/V: 4.5mm); bilateral cannula used; cyanoacrylate adhesive;.

Q6173: J. S. Medel-Matus, et al. Galanin contributes to monoaminergic dysfunction and to dependent neurobehavioral comorbidities of epilepsy. Exp Neurol 2017;289(64-72

**ALZET Comments:** M40, M871, Galanin receptor antagonists; Saline; CSF/CNS (raphe nucleus); CSF/CNS (locus coeruleus);; Rat; 1007D; 3 days; Dose (10 nM solution of M40, 30 nM solution of M871); Controls received mp w/ vehicle; animal info (50 day old maleWistar rats); Multiple pumps per animal (2); M40 is a Galanin receptor type 1/2 antagonist; M871 is a preferential GalR2 antagonist; PlasticsOne cannula used (28 GA; length 6.5 mm for RN, 8.0 mm for LC); bilateral cannula used for LC infusion with 2 pumps; Therapeutic indication (Epilepsy);.


**ALZET Comments:** Thyroxin, L-; Adenovirus vector; Gene, green fluorescent protein; Gene, AMP-activated protein kinase; Saline; CSF/CNS (hypothalamus); Rat; 1007D; 7, 21 days; bilateral cannula used; animal info (200-250g); gene therapy; Therapeutic indication (Browning, thyroid hormones);.


**ALZET Comments:** GYY4137, hydroxylamine hydrochloride; CSF, artificial; CSF/CNS; Rat; 2006; 6 weeks; Controls received mp w/ vehicle; animal info (male Dahl rats,); post op. care (buprenorphine); hydroxylamine hydrochloride aka HA; Brain...
coordinates (1.8 mm posterior to the bregma, 0.4 mm lateral to the central line, and 7.9 mm ventral to the zero level); bilateral cannula used; Cannula placement verified via histological confirmation;

**ALZET Comments:** Corticosterone; 2-hydroxypropyl-B-cyclodextrin; TDZD-8TDZD-8; Saline; CSF/CNS (hippocampus); Mice; 2 weeks; animal info (5 weeks); functionality of mp verified by ELISA; bilateral cannula; behavioral testing (Y-maze, novel object preference task); TDZD-8 is a non-ATP-competitive selective inhibitor of GSK3b; Dose (2 uM/day);

**ALZET Comments:** L-lactate, Sodium; CSF, artificial; CSF/CNS; Mice; 1002; 2 weeks; Controls received mp w/ vehicle; animal info (8 weeks old); bilateral cannula; Therapeutic indication (Sleep); Dose (5 mM);

**ALZET Comments:** 1-allylglycine; CSF/CNS (hypothalamus); Rat; 2002; animal info (male Sprague-Dawley rats weighing 300–350 g); Brain coordinates (1.2 mm posterior, +2.1 mm lateral, +9.1 mm ventral); bilateral cannula used;

**ALZET Comments:** Butylhydroquinone, tert-; Tempol; CSF, artificial; DMSO; CSF/CNS (hypothalamic paraventricular nucleus); Rat; 1004; 2 weeks; Dose; tBHQ (0.8 μg/day), or tempol (20 μg/h); 1% DMSO used; Controls received mp w/ vehicle; animal info (250 g–270 g spontaneously hypertensive rats and Wistar-Kyoto rats); antihypertensive; bilateral cannula used;

**ALZET Comments:** Peptide 234; CSF, artificial; CSF/CNS; Rat; 2002; 14 days, 2 weeks; animal info (21 and 100 day old rats); Peptide 234 is a kisspeptin receptor antagonist; Bilateral cannulae used; Correct cannula placement in the MePD was confirmed by microscopic inspection of 30 μm brain sections; Therapeutic indication (Obesity); Dose (2 nmol in 6 μl/d); Brain coordinates; 2.5 mm posterior to bregma (AP), 3.2 mm lateral (ML), and 7.8 mm below the surface of the dura (DV);

**ALZET Comments:** gallate, Epigallocatechin-3-O; CSF; artificial; CSF/CNS (paraventricular nucleus); Rat; 1004; 4 Weeks; Controls received mp w/ vehicle; animal info (male, Wistar Kyoto, Spontaneously Hypertensive Rat, 14 weeks old, 275–300g); bilateral cannula used; post op. care (buprenorphine 0.01 mg/kg SC Q12H); cardiovascular; Cannula placement verified; bilateral infusion; used dental acrylic and stainless steel screws; Dose (20 ug/hr); Brain coordinates “1.8 mm posterior, 0.4 mm lateral to the bregma and 7.9 mm ventral to the zero level" pg 277;

Q5503: Q. Y. Yi, et al. Chronic infusion of epigallocatechin-3-O-gallate into the hypothalamic paraventricular nucleus attenuates hypertension and sympahtoexcitation by restoring neurotransmitters and cytokines. Toxicol Lett 2016;262(105-113
**ALZET Comments:** Epigallocatechin-3-O-gallate; CSF; artificial; CSF/CNS (paraventricular nucleus); Rat; 1004; 4 Weeks; Controls received mp w/ vehicle; animal info (male, Wistar Kyoto, Spontaneously Hypertensive Rat, 14 weeks old, 275-300g); bilateral cannula used; post op. care (buprenorphine 0.01 mg/kg SC Q12H); cardiovascular; Cannula placement verified; bilateral infusion; used dental acrylic and stainless steel screws; Dose (20 ug/hr); Brain coordinates (pg 106);

Q4900: P. Q. H. Renjun Wang, MD; Rui Zhou, BSc; Zengxiang Dong, PhD, et al. Sympahtoexcitation in Rats With Chronic Heart Failure Depends on Homeobox D10 and MicroRNA-7b Inhibiting
GABBR1 Translation in Paraventricular Nucleus. Circ Heart Fail. 2016;9(1-10)

**ALZET Comments:** AntagomiR-7b; RNA, small interfering GABBR1; angiotensin II; CSF/CNS (paraventricular nucleus); Rat; 1004; 1002; 4 weeks; 2 weeks; animal info (male, Wistar, 180-200g); pumps replaced after 4 weeks; bilateral cannula used; tissue perfusion (paraventricular nucleus); cardiovascular; peptides; bilateral infusion; Dose (AntagomiR-7b or Ad-siGABBR1 40 ng/h; angiotensin II 1 ng/kg/min);


**ALZET Comments:** Pyrrolidine dithiocarbamate; CSF, artificial; CSF/CNS (Paraventricular Nucleus); Rat; 2006; 6 weeks; Dose (5 ug/h); Controls received mp w/ vehicle; animal info (Eight-week-old male Dahl salt-sensitive (S) rats); pyrrolidine dithiocarbamate aka PDTC; enzyme inhibitor (NF-kB); Brain coordinates (1.5 mm caudal to the bregma, 0.4 mm lateral to central line, and 7.8 mm below the skull surface); bilateral cannula used;

Q5390: H. B. Li, et al. TLR4/MyD88/NF-kappaB signaling and PPAR-gamma within the paraventricular nucleus are involved in the effects of telmisartan in hypertension. Toxicol Appl Pharmacol 2016;305(93-102)

**ALZET Comments:** Telmisartan; Losartan; GW9662; CSF, artificial; CSF/CNS (Hypothalamic paraventricular nucleus); Rat; 2004; 4 weeks; Controls received mp w/ vehicle; animal info (12-week-old male normotensive Wistar-Kyoto); functionality of mp verified by blood pressure; bilateral cannula used; dose-response (pg. 94); post op. care (buprenorphine 0.04 mg/kg, sc); tissue perfusion (hypothalamic paraventricular nucleus); cardiovascular; antihypertensive; Dose (10 ug/hr TEL, 20 ug/hr LOS, 100 ug/hr GW); Brain coordinates (1.8mm posterior to bregma, 0.4mm from midline, and 7.9mm ventral to dura);


**ALZET Comments:** Resveratrol; EX-527; DMSO; SC; Mice; 1002; 14 days; Controls received mp w/ vehicle; animal info (7-9 weeks; C57BL/6J); Multiple pumps per animal (2); behavioral testing (open field, elevated-plus maze, forced swim test, sucrose preference test); Plastics One guide cannula used; bilateral cannulae (one pump for each pedestal); Lecit adhesive used; EX-527 is a SIRT1 antagonist; Therapeutic indication (Depression); Dose (0.1 or 0.2 ug/day, EX-527: 0.5 or 1.0 ug/day);

Q4199: H. J. Yang, et al. Fermenting soybeans with Bacillus licheniformis potentiates their capacity to improve cognitive function and glucose homeostasis in diabetic rats with experimental Alzheimer’s type dementia. EUROPEAN JOURNAL OF NUTRITION 2015;54(77-88)

**ALZET Comments:** Amyloid protein, beta (35-25); amyloid protein, beta (25-35); Saline; CSF/CNS (hippocampus); Rat; 14 days; Controls received mp w/ control B-amyloid protein (25-35); animal info (male, Sprague Dawley, 223g); bilateral cannula used; neurodegenerative (alzheimer’s); behavioral testing (locomotor activity, passive avoidance test, morris water maze); diabetes;

Q3792: J. Y. Vargas, et al. WASP-1, a canonical Wnt signaling potentiator, rescues hippocampal synaptic impairments induced by Abeta oligomers. Experimental Neurology 2015;264(14-25)

**ALZET Comments:** Amyloid protein, beta (35-25); amyloid protein, beta (25-35); Saline; CSF/CNS (hippocampus); Rat; 14 days; Controls received mp w/ control B-amyloid protein (25-35); animal info (male, Sprague Dawley, 223g); bilateral cannula used; neurodegenerative (Alzheimer’s disease).


**ALZET Comments:** Cerebrospinal fluid, human; PBS; CSF/CNS; Mice; 1002; 21 days; Control animals received aCSF; animal info (double tg APPswe/PS1dE9, male, 7 mo old); Plastics One bilateral cannula used; WASP-1 also known as Wnt-activating small molecule potentiator-1; neurodegenerative (Alzheimer's disease).

**ALZET Comments:** Allylglycine, L-; CSF, artificial; CSF/CNS (prefrontal cortex); Rat; 2002; 14 days; Controls received mp w/ vehicle; animal info (male, Sprague Dalwey); bilateral cannula used; Multiple pumps per animal (2); behavioral testing (standard time reaction test; locomotor activity); tissue perfusion (prefrontal cortex); enzyme inhibitor (glutamic acid decarboxylase); Dose (3.5 ug/0.5ul/h).


**ALZET Comments:** Bicuculline; AP5, D-; CSF/CNS (posterodorsal subnucleus); Rat; 2002; 14 days; Controls received mp with vehicle; animal info (female, Sprague Darwey, late pregnant); bilateral cannula used; behavioral testing (social interaction; play fighting behavior); Cannula placement verified via histological analysis; bilateral infusion with Plastics One cannula.


**ALZET Comments:** Immunoglobulin G, anti-salusin b; CSF/CNS (paraventricular nucleus); Rat; 2004; 2 weeks; Controls received mps with vehicle and control antibody; animal info (male, Wistar Kyoto, SHR, 10 weeks old); bilateral cannula used; post op. care (buprenorphine SC); tissue perfusion (paraventricular nucleus); cardiovascular; Cannula placement verified via histological analysis; bilateral infusion; bp measured using tail cuff; Dose (50, 100, 150 ng/kg/day).


**ALZET Comments:** Leptin; insulin, human; CSF/CNS; CSF/CNS (intra-arcuate nucleus of the hypothalamus); Mice; 1002; 6 days; Control animals received mps with vehicle; animal info (8 wks old, C57BL/6); ALZET brain infusion kit (3) used; Plastics One bilateral cannula used with PEG tubing and a Y connector.


**ALZET Comments:** VIPER; CSF, artificial; CSF/CNS (paraventricular nucleus); Rat; 2004; 14 days; Control animals received mps with control peptide; animal info (male, SHR, WKY, 10-12 wks old, 230-340 g); Plastics One bilateral cannula used; VIPER is a viral inhibitory peptide of TLR4.

Q4383: H. I. Covington, et al. ANTIDEPRESSANT ACTION OF HDAC INHIBITION IN THE PREFRONTAL CORTEX. NEUROSCIENCE 2015;298(329-335)

**ALZET Comments:** MS-2758; Cyclodextrin, hydroxypropyl-β-; CSF/CNS (prefrontal cortex); Mice; 1002; 5 days; Controls received mps with vehicle; animal info (male, C57BL6J); 5% cyclodextrin used; Plastics One bilateral cannula used; behavioral testing (locomotor activity; social interaction, sucrose preference, forced swim test); Cannula placement verified; bilateral infusion.

Q4347: N. Carrier, et al. The Anxiolytic and Antidepressant-like Effects of Testosterone and Estrogen in Gonadectomized Male Rats. BIOLOGICAL PSYCHIATRY 2015;78(259-269)

**ALZET Comments:** Fadrozole; Saline, sterile; CSF/CNS (dentate gyrus); Rat; 2004; 5 days; Controls received mps with vehicle; animal info (male, C57BL6J); 5% cyclodextrin used; Plastics One bilateral cannula used; behavioral testing (sucrose preference test, open field test); tissue perfusion (dentate gyrus); Cannula placement verified via a posteriori by sectioning on cryostat; bilateral infusion; coordinates; pumps primed for 48 hours in 37C sterile saline; used Plastics One cannula.


**ALZET Comments:** Insulin, recombinant cat; endotoxin, LPS; CSF, artificial; CSF/CNS (fourth ventricle); Rat; 2004; 4 weeks; Controls received mps with vehicle; animal info (male, F-344, 3 months old, 21 months old); bilateral cannula used; behavioral testing (morris water maze); tissue perfusion (fourth ventricle); bilateral infusion; used tygon tubing to attach cannula to pump.
Q3696: M. Wosiski-Kuhn, et al. Glucocorticoid receptor activation impairs hippocampal plasticity by suppressing BDNF expression in obese mice. Psychoneuroendocrinology 2014;42(165-177)

**ALZET Comments:** Corticosterone; Cyclodextrin, 2-hydroxypropyl-b-; CSF/CNS (hippocampus); Mice; 2 weeks; Controls received mp w/ vehicle and aCSF; animal info (male, C57BL6J or db/db, 5 weeks old); functionality of mp verified by hippocampal corticosterone levels; Multiple pumps per animal (2); behavioral testing (y-maze apparatus); tissue perfusion (bilateral hippocampi); immunology; Cannula placement verified via histology; used Plastics One bilateral cannula; bilateral infusion;


**ALZET Comments:** AP5, D-; CSF, artificial; CSF/CNS (hippocampus); Rat; 1007D; 7 days; 14 days; Animal info (male, albino Wistar); pumps replaced every 7 days; Plastics One bilateral cannula used; Multiple pumps per animal (2); behavioral testing (morris water maze, probe test); tissue perfusion (hippocampus); Cannula placement verified via histological analysis; pumps primed for 24 hours in 37C saline; bilateral infusion;

Q3730: M. D. Opal, et al. Serotonin 2C receptor antagonists induce fast-onset antidepressant effects. Molecular Psychiatry 2014;19(1106-1114

**ALZET Comments:** SB 242084; DMSO; saline; CSF/CNS (ventral tegmental area); Mice; 5 days; Control animals received mp w/ vehicle; animal info (6-10 wks old, female, BALB/cJ); Plastics One bilateral cannula used; 5% DMSO used.


**ALZET Comments:** Amyloid, protein beta; CSF/CNS (hippocampus); Rat; 14, 28 days; Animal info (Sprague-Dawley, 2-5 mo old, adult, male); Plastics One bilateral cannula used; neurodegenerative (Alzheimer's disease); bilateral infusion;


**ALZET Comments:** Losartan; interleukin-1, beta; CSF, artificial; CSF, artificial; CSF/CNS; rats; 2004; 4 weeks; Controls: sham rats w/ no treatment; rats given artificial CSF; animal info (Male Sprague–Dawley rats, 200–250 g); functionality of mp verified by echocardiography and plasma levels; bilateral cannula used; Plastics One double cannula; cardiovascular; heart failure; brain tissue distribution; Cannula placement verified via brain coordinates; LOS aka losartan; IL-1B aka interleukin-1B; Dose: LOS 200ug/day, IL-1B 1ug/day; Resultant plasma level (pg 872-874); Brain coordinates; pg. 871 (2.0mm posterior to the bregma and 8.5mm ventral from the skull surface).

Q3966: H. B. Li, et al. Chronic infusion of lisinopril into hypothalamic paraventricular nucleus modulates cytokines and attenuates oxidative stress in rostral ventrolateral medulla in hypertension. TOXICOLOGY AND APPLIED PHARMACOLOGY 2014;279(141-149

**ALZET Comments:** Lisinopril; CSF, artificial; CSF/CNS (paraventricular nucleus); Rat; 1004; 4 weeks; Controls received mp w/ vehicle; animal info (male, Sprague Dawley, 7 weeks old, 275-300g); functionality of mp verified by ACE expression in PVN; bilateral cannula used; post op. care (buprenorphine); Cannula placement verified via histological identification; bilateral infusion; cannula fixed to skull using dental acrylic and two stainless steel screws; bp measured using tail-cuff;