Recent References (2017-Present) on Cerebral Ischemia Research Using ALZET® Osmotic Pumps

Q10239: F. Liu, et al. Electroacupuncture Improves Cerebral Ischemic Injury by Enhancing the EPO-JAK2-STAT5 Pathway in Rats. Neuropsychiatric Disease and Treatment 2021;17:2489-2498

**Agents:** AG490  
**Vehicle:** Not Stated  
**Route:** CSF/CNS (intracerebroventricular)  
**Species:** Rat  
**Pump:** Not Stated  
**ALZET Comments:** "Controls received mp w/ vehicle; animal info: Adult Sprague-Dawley (SD) rats (male: female=1:1, 200– 250 g); post op. care: After suturing the skin, analgesics and antibiotics were injected intraperitoneally to prevent postoperative pain and infection; AG-490 (a Janus-tyrosine kinase-2 (JAK-2) phosphorylation inhibitor); ALZET brain infusion kit used; Brain coordinates (bregma, 0.8 mm posterior, −4.8 mm tral, −1.5 mm lateral); ischemia (cerebral ischemia); ”


**Agents:** Anti-eRNA oligos  
**Vehicle:** CSF/ artificial  
**Route:** CNS/CSF;  
**Species:** Mice  
**Pump:** 1003D  
**Duration:** 3 days  
**ALZET Comments:** Dose (8.3 pmole/ul); animal info (3 months old, 20-30 g, C57BL/6N); antisense (eRNA_06347: 5′-GATTTGGAATTGCTAG-3′; eRNA_093384: 5′-GGAAGCAGGTGAACAG-3′); ALZET brain infusion kit 3 used; ischemia (Cerebral);


**Agents:** GK23; GK13; Conotoxin, w-  
**Vehicle:** CSF, Artificial  
**Route:** IV;  
**Species:** Mice  
**Pump:** 1003D  
**Duration:** 3 days  
**ALZET Comments:** Dose (2 mg/kg/day GK23, GK13; 2.28 ng/kg/day w-Conotoxin); animal info (Adult male C57Bl/6 mice (3-months-old)); behavioral testing (Open field test; Morris water maze; Y-maze test); peptides; ALZET brain infusion kit 3 used; Brain coordinates (coordinates from bregma: anterior-posterior = −0.5 mm; lateral = 1.0 mm); dental cement used;ischemia (cerebral);


**Agents:** NEP1-40  
**Vehicle:** PBS;  
**Route:** CSF/CNS (right lateral ventricle);  
**Species:** Rat  
**Pump:** Not Stated  
**Duration:** 3 days  
**ALZET Comments:** Dose (270 ug/kg); Controls received mp w/ vehicle; animal info (male Sprague–Dawley rats, weighing 60–90 g); behavioral testing (adhesive removal test); NEP1-40 aka Nogo-66 receptor antagonist peptide; peptides; Brain coordinates (relative to bregma: -1.0 mm anteroposterior, 1.4 mm lateral, and -4.0 mm dorsoventral); ischemia (cerebral);

Q9553: S. K. Woo, et al. SUR1-TRPM4 channels, not KATP, mediate brain swelling following cerebral ischemia. Neuroscience Letters 2020;718(134729

**Agents:** Oligodeoxynucleotide  
**Vehicle:** Saline, sterile normal  
**Route:** IV (external jugular);  
**Species:** Rat  
**Pump:** 2001D;  
**Duration:** 24 hours  
**ALZET Comments:** Dose (1.2 mg / 24 h); animal info (Male Wistar rats, aged 11–12 weeks (300–350 gm)); Oligodeoxynucleotide aka ODN; ischemia (cerebral);


**Agents:** Ketorolac  
**Vehicle:** Saline;  
**Route:** SC;  
**Species:** Mice;  
**Pump:** Not Stated;  
**Duration:** 12 hours  
**ALZET Comments:** Dose (0.625 mg/kg/h); Controls received mp w/ vehicle; animal info (Mice (CS7BL/6 background) at 4–6 months) Resultant plasma level (2.03 in Ketorolac concentration); ischemia (cerebral);


**Agents:** Ketorolac  
**Vehicle:** Saline;  
**Route:** SC;  
**Species:** Mice;  
**Pump:** Not Stated;  
**Duration:** 12 hours  
**ALZET Comments:** Dose (0.625 mg/kg/h); Controls received mp w/ vehicle; animal info (Mice (CS7BL/6 background), 4–6 months of age); Resultant plasma level (2.03% Ketorolac concentration); ischemia (cerebral);

**Agents:** Flavone, 7,8-dihydroxy  
**Vehicle:** DMSO; PBS  
**Route:** IP  
**Species:** Mice  
**Pump:** 1004  
**Duration:** 28 days  
**ALZET Comments:** Dose (5 mg/kg); 17% DMSO/PBS used; Controls received mp w/ vehicle; animal info (male C57BL/6 mice (10 weeks old); behavioral testing (Y-maze test); 7,8-dihydroxyflavone aka 7.8-DHF; ischemia (cerebral);


**Agents:** Apolipoprotein E; High density lipoprotein  
**Vehicle:** CSF, artificial  
**Route:** CSF/CNS (right lateral ventricle)  
**Species:** Mice  
**Pump:** 1002  
**Duration:** 14 days  
**ALZET Comments:** Dose (25μg); Controls received mp w/ vehicle; animal info (ABCA1-B/-B mice); behavioral testing (adhesive removal test); Apolipoprotein E aka ApoE2; High density lipoprotein aka HDL3; ischemia (cerebral);


**Agents:** G1; G36; Oligodeoxynucleotide, IL1RA antisense; Scrambled Missense  
**Vehicle:** DMSO; Saline  
**Route:** CSF/CNS (left lateral ventricle); SC  
**Species:** Rat  
**Pump:** 2004; 2002; 2001  
**Duration:** 14 days  
**ALZET Comments:** Dose (10 ug/day; 10 nmol/day); 1% DMSO, 0.9% saline used; Controls received mp w/ vehicle; animal info (Adult female Sprague-Dawley rats); G1 aka GPER agonist; G36 aka GPER antagonist; ALZET brain infusion kit Lot no 10331-14 used; Brain coordinates (anteroposterior, 0.8 mm; lateral, 1.5 mm; depth, 3.5 mm; from bregma); ischemia (GPER neuroprotective effects);


**Agents:** NEP1-40  
**Vehicle:** Saline/DMSO  
**Route:** CSF/CNS  
**Species:** Rat  
**Pump:** 2ML4  
**Duration:** 1,2 weeks  
**ALZET Comments:** Dose (1 mg); Controls received mp w/ vehicle; animal info (Male, Sprague Dawley, 8-10 weeks old, 280-320 g); behavioral testing (Beam Walking Test, Morris Water Maze Test); NEP1-40 aka Specific antagonist of the Nogo-66 receptor; ALZET brain infusion kit 2 used; Brain coordinates (anteroposterior −0.9 mm and mediolateral +2.0 mm); ischemia (Cerebral);


**Agents:** XPro1595; Etancercept  
**Vehicle:** Saline  
**Route:** SC  
**Species:** Mice  
**Pump:** 1003D  
**Duration:** 3 days  
**ALZET Comments:** Dose (XPro1595- 2.5 mg/ml/ul/hr or Etancercept- 2.5 mg/ml/ul/hr); 0.9% Saline used; Controls received mp w/ vehicle; animal info (Male, C57BL/6, 7-8 weeks old); behavioral testing (Grip Strength Test); ischemia (Cerebral);


**Agents:** Ephrin B2-Fc, human recombinant; Fc-IgG, human recombinant  
**Vehicle:** PBS, Human Serum Albumin buffered  
**Route:** CSF/CNS (lateral ventricle)  
**Species:** Rat  
**Pump:** Not Stated  
**Duration:** 3 days  
**ALZET Comments:** Dose ((EphB2-Fc 100 μl), (IgG-Fc 100 μl)); 0.01M phosphate-buffered saline (pH7.4) containing 0.1% human serum albumin used; Controls received sham surgery; animal info (male, Sprague-Dawley, 80-100g); post op. care (Body temperature of animals kept at 37+/-0.5C with a heating pad during recovery); behavioral testing (Adhesive removal test); Brain coordinates (1.0 mm anteroposterior, 1.4 mm lateral, 4.0 mm dorsoventral relative to bregma); Cannula placement verified via stereotaxic frame; ischemia (cerebral infarction); pump model not stated although flow rate listed as 100ul; Therapeutic indication (EphB2-Fc treatment significantly accelerated the sensory recovery compared with those in the IgG-Fc group. Activation of ephrinB2 can promote angiogenesis, decrease Abeta deposits and rescue the secondary neurodegeneration of thalamus after cerebral infarction);
Agents: Mdivi-1 Vehicle: Not Stated; Route: Not Stated; Species: Rat; Pump: 1003D; Duration: Not Stated;
ALZET Comments: Dose (1 mg/kg/day); Controls received mp w/ vehicle; animal info (Adult male Sprague-Dawley rats 250–300 g); behavioral testing (Bames Maze Task, Morris Water Maze Test); enzyme inhibitor (selective inhibitor of mitochondrial fission protein Drp1);

Q4964: S. Bake, et al. Insulin-like Growth Factor (IGF)-1 treatment stabilizes the microvascular cytoskeleton under ischemic conditions. Experimental Neurology 2019;311(162-172)
Agents: Insulin-like growth factor-1, recomb. Human; JB-1 Vehicle: CSF, artificial; Route: CSF/CNS (right lateral ventricle);
Species: Rat; Pump: 1003D; 1007D; Duration: 1 day; 5 days;
ALZET Comments: Dose (100 μg/ml rhIGF-1; 20 μg/ml JB-1); Controls received mp w/ vehicle; animal info (Female Sprague Dawley rats; 10–12 months; weight range 325–350 g); JB-1 is an IGFR inhibitor; Brain coordinates (~1.0mm posterior to bregma, −1.4mm medial lateral, −3.5mm from dural surface); cyanoacrylate adhesive; ischemia (cerebral);

Agents: Peptide, human alpha calcitonin gene-related Vehicle: Saline, Sterile Physiological; Route: SC; Species: Mice; Duration: 28 days;
ALZET Comments: Dose (1 μmol/l at 0.5μl/h); Controls received mp w/ vehicle; animal info (8 weeks, male, C57BL/6); CGRP is a 37-amino acid peptide produced as a consequence of alternative RNA processing of the calcitonin gene; only WT mice were used for mp experiments; Therapeutic indication (Calcitonin gene-related peptide administration promotes cerebral blood flow recovery, suppresses astrocyte activation and increases angiogenesis after cerebral ischemia);

Agents: Phenserine, (+); Pifithrin-a Vehicle: Saline, physiological; DMSO; Route: SC; Species: Mice; Pump: 2002; Duration: 14 days;
ALZET Comments: Dose (25 mg/kg/day (+)-Phenserine); (2 mg/kg/day PFT-a); 10% DMSO in saline for PFT-a; Controls received mp w/ vehicle; animal info (male, 10–12-week-old, C57BL6); behavioral testing (Accuscan activity monitor, novel object recognition); (+)-phenserine aka Posiphen; ischemia (cerebral); Therapeutic indication (stroke);

Agents: neurotrophic factor, recombinant human glial cell line-derived; neurotrophic factor, mesencephalic astrocyte-derived Vehicle: PBS; Route: CSF/CNS (Lateral ventricle); Species: Rat; Pump: 2002; Duration: 13 days;
ALZET Comments: Dose ((GDNF 0.25 μg/μL at 12 μL/day), (MANF 0.25 μg/μL at 12 μL/day)); Controls received mp w/ vehicle; animal info (male, Sprague-Dawley, 220-260g); GDNF promotes differentiation and tangential migration of cortical GABAergic neurons during brain development. MANF is a non-classical neurotrophic factor that resides in the endoplasmic reticulum; Brain coordinates (A/P 0.5; L/M +1.9; D/V 2.5); Cannula placement verified via stereotaxic frame; ischemia (Cerebral ischemia); pumps were implanted from day 3 to day 16 of experiment before being removed.; Therapeutic indication (the neuroregenerative potential of MANF via promoting neuroblast recruitment to the lesioned cortex in stroke rats);

Agents: Estradiol, 17b Vehicle: Cyclodextrin, B; Route: SC; Species: Rat; Pump: Not Stated; Duration: 14 days;
ALZET Comments: Dose (0.0167 mg); 20% β-cyclodextrin used; animal info (3 month old, female, Sprague Dawley);

Agents: Cyclosporin A Vehicle: Ethanol, Cremaphor; Route: SC; Species: Mice; Pump: Not Stated; Duration: 4-49 days;
ALZET Comments: Dose (15 mg/kg/day); animal info (adult male C57BL/6 mice 6–8 weeks of age; 20–25 g); pumps replaced; ischemia (cerebral); 65% ethanol and 35% cremaphor used

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Agents: YY1-siRNA Vehicle: Not stated; Route: CSF/CNS; Species: Mice; Pump: Not stated; Duration: 4 days;
ALZET Comments: animal info (Male, C57B/6, 25-35 g); Brain coordinates (mediolateral=1.0 mm, anteroposterior=0.2 mm; dorsoventral=3.1 mm); ischemia (Cerebral);

Agents: Methylene blue Vehicle: Saline; Route: SC; Species: Rat; Pump: 1003D; Duration: 3 days;
ALZET Comments: Dose (0.5 mg/kg/day); Controls received mp w/ vehicle; animal info (Male, Sprague Dawley, 3 months old, 250-300 g); ischemia (Global Cerebral Ischemia);

Agents: RNA, small interfering (ASK1) Vehicle: siPORTNeoFX Transfection agent; Route: CSF/CNS (left lateral ventricle); Species: Mice; Pump: 1003D; Duration: 3 days;
ALZET Comments: Dose (1 lL/h/ day); animal info (Adult,C57BL/6, male); enzyme inhibitor (apoptosis signal-regulating kinase 1); ALZET brain infusion kit used; ALZET brain infusion kit used; ischemia (Cerebral);

Agents: Vasopressin Vehicle: Not Stated; Route: SC; Species: Rat; Pump: 2002; Duration: 3.5 days;
ALZET Comments: Dose (2.4 μg/24 h); animal info (Adult male Wistar rats weiging 250–300 g); ischemia (cerebral); cardiovascular; Minipumps used administer asopressin to induce prolonged hyponatremia;

Agents: Bumetanide Vehicle: Saline; Route: CSF/CNS (lateral ventricle); Species: Rat; Pump: 2004; Duration: 21 days;
ALZET Comments: Dose (0.2 mg/kg/day); animal info (Adult male Wistar rats); enzyme inhibitor (selective Na+–K+–Cl−-co-transporter inhibitor,); ALZET brain infusion kit used; Brain coordinates (AP-0.9 mm, ML+ 1.9 mm);

Agents: Memantine Vehicle: Saline; Route: CSF/CNS (lateral ventricle); Species: Rat; Pump: 2004; Duration: 28 days;
ALZET Comments: Dose (4 or 20 mg/kg/d); animal info (8-12 week old C57BL6/j male mice weighing 23-28g); ischemia (cerebral); “...we decided to use a subcutaneous delivery strategy for memantine in this study using miniosmotic pumps, given that miniosmotic pumps allowed to achieve most stable plasma memantine levels “ pg.981 ; Therapeutic indication (stroke);

Agents: Cytosine-β-Darabinofuranoside Vehicle: Saline; Route: CSF/CNS (lateral ventricle); Species: Rat; Pump: 2001; Duration: 7 days;
ALZET Comments: 0.9% Saline used; Controls received mp w/ vehicle; Brain coordinates (1.6 mm lateral to the midline , .8 mm posterior to the bregma, and 4.0 mm deep); Therapeutic indication (cerebral ischemia);

Agents: Bradykinin B1 receptor agonist; Bradykinin B2 receptor agonist; Vehicle: Saline; Route: SC; Species: Mice; Pump: 1007D; Duration: Not Stated;
ALZET Comments: Controls received mp w/ vehicle; animal info (C57/BL6, 18weeks old); ischemia (cerebral); Compound AKA: SarLys[Hyp3, Igl5, DPhe8]desArg9-bradykinin and [Hyp(3),Thi(5),(N)Chg(7),Thi(8)]-bradykinin; Dose (720 nmol/kg/day and 240 nmol/Kg/day);