Recent References (2012-Present) on the Administration of Endotoxins Using ALZET® Osmotic Pumps


Agents: Endotoxin, LPS Vehicle: Saline; Route: IP; Species: Rat; Pump: 2006; Duration: 6 weeks;
ALZET Comments: Dose (12.5 μg/kg/hr); Controls received mp w/ vehicle; animal info (male Wistar rats; 200–220 g);

Q6984: M. Bolos, et al. Maturation dynamics of the axon initial segment (AIS) of newborn dentate granule cells in young adult C57BL/6J mice. J Neurosci 2019;

Agents: Endotoxin, LPS Vehicle: PBS; Route: SC; Species: Mice; Pump: 1002; Duration: 2 weeks;
ALZET Comments: Dose (150 μg/kg/day); Controls received mp w/ vehicle; animal info (5week-old C57BL/6J Ola Hsd female mice);


Agents: Endotoxin, Lipopolysaccharide Vehicle: saline; Route: SC; Species: Rat; Pump: 2ML4; Duration: 4 weeks;
ALZET Comments: Dose (1 mg/kg/day); Controls received mp w/ vehicle; animal info (10-week-old, Male, Wistar, ~250g);


Agents: Endotoxin, LPS Vehicle: Not Stated; Route: CSF/CNS (fourth ventricle); Species: Rat; Pump: Not Stated; Duration: 4 weeks;
ALZET Comments: Dose (1.6 mg/ml); animal info (Male adult Wistar rats); post op. care (1% chloramphenicol applied to the exposed skull and scalp, Bupivicaine applied locally to the scalp, and 4 ml of sterile isotonic saline injected s.c. to prevent dehydration); Brain coordinates (-2.5 mm posterior to Lambda, 7 mm ventral to the dura); neurodegenerative (Alzheimer’s);


Agents: Endotoxin, LPS Vehicle: Not Stated; Route: IV (jugular); Species: Rat (pregnant); Pump: 2001D; Duration: 24 hours;
ALZET Comments: animal info (female, Wistar E19); ischemia (intrauterine); no stress (see pg. 4 “No mortality was experienced for dams undergoing the above protocol”); behavioral testing (Righting Reflex, negative geotaxis, open field, elevated plus maze, Morris water maze, balance beam); teratology; Dose (600 ng/hr); Resultant plasma level (4.5 EU/mL after 16 hours of infusion);


Agents: Endotoxin, LPS Vehicle: Saline; Route: SC; Species: Mice; Pump: 2004; Duration: 28 days;
ALZET Comments: Dose (300 μg/kg/day); animal info (8-week-old C57BL/6 J males); LPS treatment is an established model of inflammation/insulin resistance;


Agents: Endotoxin, LPS; coenzyme Q10; temple; Interleukin-1 receptor antagonist; butylhydroquinone, tert- Vehicle: Saline; CSF, artificial; Route: IP; ;CSF/CNS (cisterna magna); Species: Rat; Pump: 1007D; Duration: 7 days;
ALZET Comments: Controls received mp w/ vehicle; animal info (male, Sprague Dawley, 8 weeks old, 250-280g); ALZET brain infusion kit 2 used; post op. care (IM procaine Penicillin 1000 IU); tissue perfusion (cisterna magna); cardiovascular; bp measured using tail cuff; Dose (LPS 1.2 mg/kg/day; coenzyme Q10 3.25 ug/ul/hr; tempol 5 ug/ul/hr; IL-1Ra 0.5 ug/ul/h);
Agents: Endotoxin, LPS Vehicle: CSF, artificial; Route: CSF/CNS; Species: Rat; Pump: 2004; Duration: 28 days;
ALZET Comments: Controls received mp w/ vehicle; animal info (male, Sprague Dalwey, P32); behavioral testing (Open Field test; elevated plus maze; fear conditioning); Cannula placement verified via methylene blue dye; used Plastics One cannula; used PEEK cannula; rats exposed to radio frequency electromagnetic fields while pump implanted; Dose (1.25 ug/h); Brain coordinates;

Agents: Endotoxin, LPS Vehicle: Saline; Route: SC; Species: Mice; Pump: 2004; Duration: 28 days;
ALZET Comments: Controls received mp w/ vehicle; animal info (male, C57BL/6N, 12 weeks old); immunology; diabetes; Dose (600 ug/kg/day);

Agents: Ultra-high molecular weight polyethylene particles; oligodeoxynucleotide, decoy; oligodeoxynucleotide, scrambled; Endotoxin, LPS; Brain-derived neurotropic factor; Vehicle: Saline; Route: In Vitro (cell culture); Bone (Femur); Species: Mice (nude); Pump: 2006; Duration: 4 weeks;
ALZET Comments: Controls received mp w/ vehicle; animal info (Male athymic nude mice, 10-15 weeks old); stability verified by (in vitro experiment); dose-response (pg. 277); good methods (pg. 276); tissue perfusion (bone); Dose (15 mg/ml UHMWPE, 50uM decoy, 1 ug/ml LPS); Therapeutic indication (Bone loss, chronic inflammation);

Agents: Endotoxin, LPS Vehicle: PBS; Route: SC; Species: Mice (knockout); Pump: 1004; Duration: 4 weeks;
ALZET Comments: Controls received mp w/ vehicle; cardiovascular; Therapeutic indication (atherosclerosis); Dose (252ug/kg);

Q5384: D. Lana, et al. The neuron-astrocyte-microglia triad involvement in neuroinflammaging mechanisms in the CA3 hippocampus of memory-impaired aged rats. Experimental Gerontology 2016;83(71-88
Agents: Endotoxin, LPS Vehicle: CSF, artificial; Route: CSF/CNS (fourth ventricle); Species: Rat; Pump: Not Stated; Duration: 4 weeks;
ALZET Comments: Controls received mp w/ vehicle; animal info (Male Wistar rats, 3 months & 20 months old); Plastics One cannula used; post op. care (chloramphenicol (1% solution) applied to exposed skull, scalp; bupivacaine applied topically); “A volume overload to the brain is minimal using this procedure because the 0.15 ul/h administered contributes only about 0.16% of the total CSF volume produced by the rat each hour and is only 0.09% of the rat’s total CSF volume” pg 73; Memory/learning study; aging; Brain coordinates; 4th ventricle: 2.5 mm posterior to Lambda, on the midline, and 7mm ventral to the dura; Dose (1.6 ug/ml);

Agents: Endotoxin, LPS Vehicle: Saline, normal; Route: CSF/CNS (striatum); Species: Rat; Pump: 1007D; Duration: 7 days;
ALZET Comments: Controls received mp w/ vehicle; animal info (Male Wistar rats aged 8-12 weeks); ALZET brain infusion kit 2 used; good methods (pg. 3); tissue perfusion (striatum); model to study TLR4 activation in vivo; nitrosative/oxidative stress and neuroinflammation; Brain coordinates; 1-mm burr hole was made over the right striatum [AP, +0.75 mm; ML, +1.7 mm relative to bregma]; Dose (5 ug/day);

**Agents:** Endotoxin, LPS **Vehicle:** Saline, isotonic; **Route:** IP; **Species:** mice; **Pump:** 1003D; **Duration:** 3 days;

**ALZET Comments:** Controls received mp w/ vehicle; animal info (WT, PAI-1 deficient, & TLR4 deficient male mice); animal info (WT, PAI-1 deficient, & TLR4 deficient male mice); Strain/dose-specific reactions (pg. 505); “As expected, the sham and vehicle control (saline) showed no lethality in mice survival as compared to LPS-challenged mice” pg 504; Inflammation induction; Dose (10 ug/ul);


**Agents:** Endotoxin, LPS **Vehicle:** Not Stated; **Route:** Oral cavity; **Species:** Sheep (ewe); **Pump:** Not Stated; **Duration:** 1 day; 6 days;

**ALZET Comments:** Controls received mp w/ saline; animal info (Merino); teratology; immunology;


**Agents:** Endotoxin, LPS **Vehicle:** PBS; **Route:** SC; **Species:** Mice; **Pump:** 1004; **Duration:** 8 weeks;

**ALZET Comments:** Animal info (female, 8 wks old, C57BL/6JRcc); long-term delivery; pumps replaced after 4 weeks


**Agents:** Endotoxin, LPS **Vehicle:** CSF, artificial; **Route:** CSF/CNS (fourth ventricle); **Species:** Rat; **Pump:** 2004; **Duration:** 28 days;

**ALZET Comments:** Animal info (male, F-344, 3 months old); behavioral testing (rotarod; open field test; forced swim test); tissue perfusion (fourth ventricle); immunology;


**Agents:** Endotoxin, LPS **Vehicle:** Not Stated; **Route:** CSF/CNS (fourth ventricle); **Species:** Rat; **Pump:** 2004; **Duration:** 28 days;

**ALZET Comments:** Controls received mp w/ aCSF; animal info (male F-344, 3 months old); neurodegenerative (Alzheimer’s disease); behavioral testing (Morris Water Maze); immunology;

Q4451: Y. H. Ho, et al. Peripheral inflammation increases seizure susceptibility via the induction of neuroinflammation and oxidative stress in the hippocampus. JOURNAL OF BIOMEDICAL SCIENCE 2015;22(U1-U14

**Agents:** Endotoxin, LPS, NS398; tempol **Vehicle:** Saline; DMSO; **Route:** IP; CSF/CNS; **Species:** Rat; **Pump:** 1007D; **Duration:** 7 days;

**ALZET Comments:** Controls received mp w/ vehicle; animal info (male, Sprague Dawley, 10 weeks old, 250-282g); ALZET brain infusion kit 2 used; 1% DMSO used; Multiple pumps per animal (2); post op. care (IM procaine penicillin 1000IU); immunology; used dental cement; NS398 is a COX-2 inhibitor and anti-inflammatory; tempol scavanges ROS;


**Agents:** Endotoxin, LPS **Vehicle:** Saline; **Route:** IP; **Species:** Rat; **Pump:** 2ML4; **Duration:** 1 week; 4 weeks;

**ALZET Comments:** Controls received mp w/ vehicle; animal info (male, Sprague Dalwely, 299.9g); post op. care (Rimadyl 50 mg/ml); behavioral testing (forced swim test, open field testing); “Osmotic minipumps allow a continuous slow infusion of LPS, whereas daily injections might induce stress because of the daily handling as well as local inflammation due to the needle. Moreover, when the daily volume is administered at once, the effect may be more abrupt and deleterious.” pg 193;
**Agents:** Endotoxin, LPS  
**Vehicle:** Not Stated  
**Route:** IP  
**Species:** Rat  
**Pump:** 2004; 2006  
**Duration:** 4 weeks; 6 weeks  
**ALZET Comments:** Controls received mp w/ saline; animal info (male, Wistar, 237g); functionality of mp verified by circulating LPS; long-term study;

**Agents:** Insulin, recombinant cat; endotoxin, LPS  
**Vehicle:** CSF, artificial  
**Route:** CSF/CNS (fourth ventricle)  
**Species:** Rat  
**Pump:** 2004  
**Duration:** 4 weeks  
**ALZET Comments:** Controls received mp w/ 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;

**Agents:** Endotoxin, LPS  
**Vehicle:** Not Stated  
**Route:** Intra-amniotic  
**Species:** Sheep (fetus)  
**Pump:** Not Stated  
**Duration:** 24 hours  
**ALZET Comments:** Controls received mp w/ saline; animal info (124 gestation day); immunology;

Q4116: G. Stifano, et al. Chronic Toll-like receptor 4 stimulation in skin induces inflammation, macrophage activation, transforming growth factor beta signature gene expression, and fibrosis. ARTHRITIS RESEARCH & THERAPY 2014;16(U1-U10)
**Agents:** Endotoxin, LPS  
**Vehicle:** Not Stated  
**Route:** SC  
**Species:** Mice  
**Pump:** Not Stated  
**Duration:** 7 days; 28 days  
**ALZET Comments:** Controls received mp w/ PBS, sterile; animal info (TLR2-//- or MyD88-//-); immunology;

**Agents:** Endotoxin, LPS  
**Vehicle:** Not Stated  
**Route:** Amniotic sac  
**Species:** Sheep (fetus)  
**Pump:** 2ML4  
**Duration:** 4 weeks  
**ALZET Comments:** Controls received mp w/ saline; animal info (female, pregnant, GD80); post op. care (benacillin); teratology; immunology; E.coli LPS 055:B5, 18 mg/ml;

Q3556: J. H. Ma, et al. Chronic brain inflammation causes a reduction in GluN2A and GluN2B subunits of NMDA receptors and an increase in the phosphorylation of mitogen-activated protein kinases in the hippocampus. MOLECULAR BRAIN 2014;7(U1-U10)
**Agents:** Endotoxin, LPS  
**Vehicle:** CSF, artificial  
**Route:** CSF/CNS (fourth ventricle)  
**Species:** Rat  
**Pump:** 2004  
**Duration:** 28 days  
**ALZET Comments:** Controls received mp w/ PBS; animal info (male, Fischer-344); behavioral testing (morris water maze); tissue perfusion (fourth ventricle); immunology; LPS from E.coli, serotype 055:B5;

**Agents:** Endotoxin, LPS  
**Vehicle:** PBS  
**Route:** SC  
**Species:** Mice  
**Pump:** 1002; 1004  
**Duration:** 2 weeks; 4 weeks; 8 weeks;  
**ALZET Comments:** Animal info (female, C57BL6Jcc, 6 weeks old); pumps replaced every 4 weeks; neurodegenerative (Alzheimer’s); immunology;

Q3976: W. Liang, et al. Metabolically induced liver inflammation leads to NASH and differs from LPS- or IL-1 beta-induced chronic inflammation. LABORATORY INVESTIGATION 2014;94(4):491-502
**Agents:** Endotoxin, LPS; interleukin-1B, recombinant murine  
**Vehicle:** Not Stated  
**Route:** SC  
**Species:** Mice  
**Pump:** 1004  
**Duration:** 10 weeks  
**ALZET Comments:** Controls received mp w/ PBS; animal info (male, APOE3L.CETP, 10-14 weeks old); immunology;

Agents: Endotoxin, PgLPS ATCC 33277 Vehicle: Not Stated; Route: Not Stated; Species: Mice; Pump: 1003D; 1007D; 2004; Duration: 28 days;

ALZET Comments: Controls received mp w/ saline; animal info (C57BL6/ or MMP-9 -/-, 4-7 months old); cardiovascular; myocardial infarction; immunology;


Agents: Endotoxin, LPS Vehicle: CSF, artifical; Route: CSF/CNS (fourth ventricle); Species: Rat; Pump: 2006; Duration: 21 days; 56 days;

ALZET Comments: Controls received mp w/ vehicle; animal info (male, F-344 rats, 3 months or 9 months or 23 months old); post op. care (lidocane 1% on wound; 2ML isotonic saline SC injection; 2% tylenol in drinking water 3 days after surgery); tissue perfusion (fourth ventricle); long-term study; immunology; LPS aka lipopolysaccharide;


Agents: Angiotensin II; endotoxin, LPS Vehicle: Not Stated; Route: IP; Species: Rat; Pump: Not Stated; Duration: 6 weeks;

ALZET Comments: Control animals received mp w/ PBS; animal info (Wistar, male, wks old, 220-280 g); multiple pumps used (2); peptides; long-term study;


Agents: Endotoxin, LPS Vehicle: Not Stated; Route: Not Stated; Species: Rat; Pump: 2004; Duration: 2; 4 weeks;

ALZET Comments: Controls received mp w/ saline; immunology; animal info (205-300g, male, wistar); LPS (E. coli O55:B5);


Agents: Endotoxin, LPS Vehicle: CSF, artifical; Route: CSF/CNS (fourth ventricle); Species: Rat; Pump: 2004; Duration: 3 weeks;

ALZET Comments: Controls received mp w/ vehicle; animal info (Fisher F-344, 3 months old); behavioral testing (Morris water maze); tissue perfusion (fourth ventricle); immunology;


Agents: Endotoxin, LPS Vehicle: CSF, artifical; Route: CSF/CNS (fourth ventricle); Species: Rat; Pump: 2006; Duration: 21 days, 56 days;

ALZET Comments: Controls received mp w/ vehicle; animal info (male, F-344, 3 months, 9 months, and 23 months of age); post op. care (1% lidocane to closure, saline injected SC); behavioral testing (Morris Water Maze); used Tygon tubing


Agents: Endotoxin, LPS Vehicle: Not Stated; Route: IP; Species: Rat; Pump: 1002; Duration: 14 days;

ALZET Comments: Control animals received mp w/ saline; animal info (Sprague Dawley, male, adult, 10 wks old, 200-250 g)


Agents: Endotoxin, LPS Vehicle: Not Stated; Route: CSF/CNS (fourth ventricle); Species: Rat; Pump: 2004; Duration: 28 days;

ALZET Comments: Controls received mp w/ artificial CSF; animal info (Sprague Dawley, male, 200-250 g); Plastics One cannula


Agents: Endotoxin, LPS; TLR4 antagonist Vehicle: CSF, artificial; Route: CSF/CNS; SC; Species: Mice; Pump: 1004; Duration: 4 weeks;

ALZET Comments: Control animals received mp w/ vehicle; animal info (C57BL/6, 2 mo old); ALZET brain infusion kit 3 used
Q2727: M. Kellom, et al. Dose-dependent changes in neuroinflammatory and arachidonic acid cascade markers with synaptic marker loss in rat lipopolysaccharide infusion model of neuroinflammation. BMC Neuroscience 2012;13(;):U1-U11
**Agents:** Endotoxin, E. coli  **Vehicle:** Not Stated;  **Route:** CSF/CNS (fourth ventricle);  **Species:** Rat;  **Pump:** 2002;  **Duration:** 6 days;
**ALZET Comments:** Control animals received mp w/ aCSF; animal info (3 mo old, male, F344 Fischer); post op. care (triple antibiotic ointment, saline injection)

**Agents:** Endotoxin, LPS  **Vehicle:** Not Stated;  **Route:** CSF/CNS (fourth ventricle);  **Species:** Rat;  **Pump:** Not Stated;  **Duration:** 4 weeks;
**ALZET Comments:** Control animals received mp w/ aCSF; animal info (Wistar, male, 22 mo old); post op. care (bupivicaine on scalp for pain, sterile isotonic saline SC for dehydration); aCSF recipe

**Agents:** Interleukin-6, recomb. murine; endotoxin, LPS  **Vehicle:** Not Stated;  **Route:** SC;  **Species:** Mice;  **Pump:** Not Stated;  **Duration:** 7 days;
**ALZET Comments:** Animal info (C57BL/6J, male, IL-6 null); functionality of mp verified via blood IL-6 levels

**Agents:** Endotoxin, E. Coli  **Vehicle:** CSF, artificial;  **Route:** CSF/CNS (fourth ventricle);  **Species:** Rat;  **Pump:** 2004;  **Duration:** 28 days;
**ALZET Comments:** Animal info (3 mo old, male, F344)

**Agents:** Endotoxin, LPS  **Vehicle:** CSF, artificial;  **Route:** CSF/CNS (fourth ventricle);  **Species:** Rat;  **Pump:** 2004;  **Duration:** 28 days;
**ALZET Comments:** Controls received mp w/ vehicle; animal info (3 mo old, male, F344)

Q2715: A. Atik, et al. Long-Term Pulmonary Effects of Intrauterine Exposure to Endotoxin Following Preterm Birth in Sheep. REPRODUCTIVE SCIENCES 2012;19(12):1352-1364
**Agents:** Endotoxin, LPS  **Vehicle:** Saline;  **Route:** Intrauterine;  **Species:** Sheep (ewe);  **Pump:** 2ML4;  **Duration:** 28 days;
**ALZET Comments:** Control animals received mp w/ saline; multiple pumps used (2)