# References on the Administration of Antioxidants

## Using ALZET® Osmotic Pumps

### 1. AEOL10150


**ALZET Comments:** AEOL 10150; SC; Rat; 2002; 10 weeks; 8 days; Controls received mp w/ vehicle; functionality of mp verified by plasma AEOL 10150 concentrations; dose-response (fig. 4); long-term study; pumps replaced every 2 weeks; half-life (p. 574), short; cancer; animal info (female, Fisher-344, 150-170 grams); "Osmotic mini-pumps provided consistent and dose-dependent delivery of AEOL 10150," "a continuous availability of antioxidant via osmotic infusion pumps throughout the study." (p. 575).


**ALZET Comments:** AEOL 10150; PBS; IV (jugular); Mice; 1003D; 6 hours; Controls received mp w/ vehicle; AEOL 10150 is a catalytic antioxidant metalloporphyrin; ischemia (cerebral); MCAO.


**ALZET Comments:** AEOL 10150; PBS; IV (jugular); Mice; 1003D; 3 days; Controls received mp w/ vehicle; plasma levels of AEOL 10150 determined by HPLC; ischemia (cerebral); MCAO.

### 2. Ascorbic Acid


**ALZET Comments:** Trolox; neomycin; ascorbic acid; Perilymph, artificial; sodium bicarbonate; Ear (cochlea); Guinea pig; 2002; 26 days; Controls received mp w/ vehicle; pumps replaced after 14 days; post op. care (doxycycline); animal info (male, pigmented, 250-400g., neomycin deafening); cannula primed with 10% neomycin solution followed by a small air bubble spacer to allow neomycin infusion for first 2 days; trolox, a vitamin F analogue, and ascorbic acid delivered together in 1 mp; tissue perfusion (cochlea).


**ALZET Comments:** Ascorbic acid; Naltrexone; Saline; SC; Rat (pregnant); Rat; 7 days; controls received mp w/ vehicle.

### 3. Catalase


**ALZET Comments:** Peptide, Nox2ds-tat; polyethylene glycol-conjugated catalase; SC; Rat; mice; 2ML1; 1002; 7 days; Controls received mp w/ scramble ds-tat or vehicle; animal info (Rat male, Wister-Kyoto, 2-3 months; mice male, C57Bl6J and p47 phox -/-, 4.5-6 months old); cardiovascular; peptides; polyethylene glycol-conjugated catalase aka PEG-CAT; arterial ligation; NOX2 is NADPH oxidase.

ALZET® Bibliography

ALZET Comments: Catalase; Dimethyl sulfoxide; Dexamethasone; Indomethacin; Pyrilamine maleate; AA-861; Cimetidine; Phenidone; Ethanol; Saline; SC; mice; 1007D; 72 hours; all agents infused concomitantly in the same pump; preliminary study conducted to test solubility and toxicity for 5 days; enzyme inhibitors; toxicology.

ALZET Comments: Tempol; catalase; CSF/CNS; Gerbil; 1007D; 7 days; Controls received mp with saline; agents given separately and together; ischemia (cerebral).

ALZET Comments: Catalase; tempol; CSF/CNS (intrathecal); monkey; 2ML1; 7 days; controls received inactivated SOD and BSA; functionality of mp verified by measuring enzyme levels in CSF during infusion and testing agent released from pump in vitro for 7 days; stability verified by measuring activity of enzymes released from pumps in vitro over 7 days; daily CSF sampling performed using a subcutaneous Ommaya reservoir; authors report no cases of catheter blockage or dislodgement.

ALZET Comments: Glutathione peroxidase; Catalase; tempol; Rat; no duration posted; Japanese with English abstract.

ALZET Comments: Catalase; tempol; PBS; SC; Rat; 2ML4; 10, 20 days; functionality of mp verified by serum catalase; PEG-conjugated enzymes; antioxidants; stability of enzymes questioned beyond 20 days.

ALZET Comments: Catalase, PEG-; Saline, balanced; Rat; 2ML4; 28 days; controls received surgery but no mp; dose response; 3 doses of agent infused.

4. Dimethylthiourea

ALZET Comments: Angiotensin II; Dimethylthiourea;; PBS;; IP;; Rat;; 2002;; 7 days;; Controls received mp w/ vehicle; cardiovascular; peptides; Dimethylthiourea, also called DMTU, is an antioxidant; some animals received 2 pumps (IP): one pump for ANG II infusion and one for DMTU infusion;;

5. Ebselen

ALZET Comments: Ebselen; DMSO; saline; SC; Rat; 2ML4; 1 week; Controls received mp w/ vehicle; animal info (male, Sprague Dawley, 200g); 80% DMSO used; cardiovascular; bp measured with radiotelemetry; Dose (10 mg/kg/day);.

ALZET Comments: Ebselen; DMSO; SC; Mice; 2004; Controls received mp w/ vehicle; animal info (8 wks old, Prdx -/-, ApoE -/-); 80% DMSO used.
ALZET Comments: Tempol; ebselen; DMSO; saline; SC; IV (jugular); Mice; 2ML1; 1007D; 4 days; Animal info (male, 11-13 wks old, C57BL/6, P47 phox -/-); 50% DMSO used.

ALZET Comments: Ebselen; DMSO; SC; Mice (transgenic); 14 days; Controls received mp w/ vehicle; cardiovascular; 50% DMSO; ebselen is a glutathione peroxidase-mimetic antioxidant (a.k.a Harmokisane).

6. EUK-189

R0300: J. P. Williams, et al. Treatment for Radiation-Induced Pulmonary Late Effects: Spoiled for Choice or Looking in the Wrong Direction? CURRENT DRUG TARGETS 2010;11(11):1386-1394
ALZET Comments: EUK-189;

ALZET Comments: EUK-189; Mannitol; SC; Mice (transgenic); 2004; 7 days; Controls received mp w/ vehicle; animal info (alpha synuclein A53T Tg).

ALZET Comments: EUK-189; EUK-207; Mannitol; SC; Mice; 2004; 6 months; Controls received mp w/ vehicle; long-term study; pumps replaced every 28 days; animal info (C57BL/6N Sim, 27-36 g, 17 months old).

ALZET Comments: EUK-189; Mannitol; SC; Mice; 2004; 28 days; Controls received mp w/vehicle; neurodegenerative (Parkinson’s disease).

ALZET Comments: EUK-189; SC; Mice; 8-10 days; Animal info (female, 6-8 weeks old, BALB/C and C57BL/6).

ALZET Comments: EUK-189; Water, distilled; SC; Rat; 2004; 30 days; Controls received mp w/ vehicle; functionality of mp verified by residual volume; animal info (male, Fischer 344, 6 month old, 300-400g., 24 month old, 350-450g.).

ALZET Comments: EUK-189; Mannitol; SC; Mice; 2004; 28 days; Controls received mp w/ vehicle; neurodegenerative (Parkinson’s disease).

7. Genistein

**ALZET Comments:** Genistein; DMSO; water, distilled; SC; Rat; 1002; 14 days; Controls received mp w/ vehicle; animal info (female, ovariectomized); 50% DMSO used; ischemia (cerebral); cardiovascular;.

**ALZET Comments:** Genistein; Cyclodextrin, hydroxypropyl beta; IP; Rat; 2ML1; 3 days; Control animals received mp w/ vehicle; animal info (Wistar, male, 300-350 g).

P6396: I. F. Benter, et al. Inhibition of Ras-GTPase, but not tyrosine kinases or Ca²⁺/calmodulin-dependent protein kinase II, improves recovery of cardiac function in the globally ischemic heart. MOLECULAR AND CELLULAR BIOCHEMISTRY 2004;259(1-2):35-42
**ALZET Comments:** Genistein; KN-93; FPT III; IP; Rat; 2ML1; 6 days; Controls received mp w/ vehicle; enzyme inhibitor (tyrosine kinase, CaMKII); cardiovascular; ischemia (cardiac).

**ALZET Comments:** Genistein; Estradiol, 17B-; DMSO; PEG 300; SC; Mice; 2002; 4 weeks; Replacement therapy (ovariectomy); dose-response (p.336); 20% DMSO used in vehicle.

**ALZET Comments:** Genistein; DMSO; ethanol; water; IV (superior vena cava); Rat; 2ML2; 14 days; Controls received mp w/ vehicle; comparison of IP injections vs IV mp; immunology; transplantation; Genistein is a soybean isoflavone; antioxidant; Vehicle composition: DMSO, ethanol; water (50/20/30).

**ALZET Comments:** Genistein; estradiol, 17B-; DMSO; PEG 300; SC; Mice; 2002; Controls received mp w/ vehicle.

**ALZET Comments:** Estradiol, 17B-; Genistein; DMSO; PEG 300; SC; Mice; 2 - 4 weeks; controls received mp w/vehicle; replacement therapy (ovariectomy); genistein is an isoflavone present in soybeans; structure is similar to estrogen;.
8. Glutathione

**ALZET Comments:** S-nitrosoglutathione; insulin; glutathione; CSF/CNS (third ventricle); Rat; mice; 1002; 2002; 1 week; Dose (GSNO (50 μM)/insulin (0.033 UI/μL) and GSH (50 μM)/insulin (0.033 UI/μL)); animal info (Male 4-week-old Wistar rats, Swiss, C57BL/6 and iNOS-null (iNOS−/−) mice); S-nitrosoglutathione is an NO donor; Brain coordinates (rats DV: −8.5 mm and AP: −0.5 mm; mice DV: −5 mm and AP: −1.8 mm).

**ALZET Comments:** S-nitrosoglutathione; PBS; SC; Mice; 24 hours; 7 days; Dose (10 mg/kg/day); Controls received mp w/ vehicle; animal info (GRK2-C340S mice); cardiovascular.

**ALZET Comments:** Ascorbate; glutathione; tocopherol, alpha-; SC; Mice; 1007D; Controls received mp w/ saline; animal info (male, C57BL/6J, 25-30g, 10-12 weeks old); compounds were mixed and infused together as an antioxidant cocktail.

**ALZET Comments:** Amyloid protein, beta (1-42), human oligomeric; lipoprotein, high density; glutathione ethyl ester; HEPES; CSF/CNS; Mice (transgenic); 1004; 28 days; Controls received mp w/ vehicle; animal info (Tg-SREBP-2, NPC1−/−, Tg-APP/PS1); neurodegenerative (Alzheimer’s Disease).

**ALZET Comments:** Glutathione; CSF/CNS (third ventricle); Rat; 1003D; 3 days; Controls received mp w/ PBS -HEPES; animal info (obese, lean, male, Zucker, 7 wks old); cannula placement verified by angiogensin II dipsogenic effect; Plastics One cannula used; no stress (see pg 2193) "Well being of the animals (weight gain and food intake) was preserved during the infusion"; good methods.

**ALZET Comments:** Glutathione, monoethyl ester; MPP⁺; Saline; SC; CSF/CNS; Rat; 2ML4; 28 days; Controls received mp w/ vehicle; dose-response (fig. 6); stability verified by incubation for 0-28 days at 37 celsius, assessed by HPLC; half-life (pg. 515) 10-14 hours in culture; brain tissue distribution; toxicology; animal info (Sprague-Dawley, 300g.); neurodegenerative (Parkinson’s disease).

**ALZET Comments:** Fibroblast growth factor-2, basic, human; penicillamine, S-nitroso N-acetyl; glutathione, S-nitroso N-acetyl; SC; Mice; 14 days; Peptides; animal info (male, C57BL/6, 6-8 wks old); SNAP and SNAG are nitric oxide donors.

**ALZET Comments:** Glutathione S-transferase; glutathione S-transferase-Nogo-66; CSF/CNS (sciatic nerve); Rat; 2002; 14 days; Controls received mp w/ GST or no treatment; peptides; animal info (male, Sprague Dawley, 240-260g., Sciatic nerve transection); pain; silicon tube used.

**ALZET Comments:** Mactinin; glutathione 5-transferase; Saline; SC; Rat; mice (transgenic); 1007D; 1, 7 days; Controls received mp w/ vehicle, or GST; peptides; animal info (Tgu PA-/- or wt; Fisher, 150-200g); Polyvinyl alcohol sponges soaked in agent implanted SC, with mp catheter directed to center of sponge: "osmotic pumps were used to continually deliver the fragment and replenish the mactinin in the sponges" (p.125); wound healing.


**ALZET Comments:** Glutathione monoethyl ester; Saline; CSF/CNS; Rat; 2001; Controls received mp w/ vehicle; ALZET brain infusion kit 2 used; dental cement used; post op. care (xylocaine/adrenaline injected into site of wound); neuroprotection; ischemia (cerebral); antioxidant.

9. Magnolol


**ALZET Comments:** Magnolol; Alcohol; SC; Rat; 2001; 2 weeks; Dose-response (p. 129); pumps replaced every 7 days; magnolol, an active component purified from magnolia officinalis, is a commonly used Chinese medicinal herb, with reported anti-inflammatory and antioxidant effects.

10. Mannitol


**ALZET Comments:** Aminobutyric acid, Y-; mannitol; Saline; CSF/CNS (amygdala); Rat; 2001; 7 days; Controls received mp w/mannitol; functionality of mp verified by cutting open & visual inspection; dose-response (table 1); no stress (see pg. 25).


**ALZET Comments:** Mannitol; Inulin;; Radio-isotopes; 3H tracer; saline; ethanol; Ear (round window); Guinea pig; 1007D; 7 days; Tissue perfusion (round window).


**ALZET Comments:** Mannitol; Radio-isotopes; Pyrrolidone, N-methyl-2-; Propylene glycol; PEG; 14C tracer; Water; Dimethylacetamide; in vitro; 2ML1; 8 days; Functionality of mp verified by in vitro testing; ALZAIID chemical compatibility kit used; various solvents employed to find compatibility with drug reservoir.


**ALZET Comments:** Cerebrospinal fluid, artificial; Mannitol; CSF/CNS; Rat; 2002; no duration posted; controls were sham operated and received mixed-concentration aCSF, received no infusions, or received aCSF w/normal physiological balance of sodium and potassium; experimental groups consisted of varying the ratio of potassium to sodium in the aCSF; mannitol added to infusate in one high-potassium group to maintain isosmolality.


**ALZET Comments:** Potassium Chloride, hypertonic; Sodium chloride, hypertonic; Mannitol, hypertonic; Saline, isotonic; Water; CSF/CNS (preoptic area); Rat; 2002; 2 weeks; bilateral infusion to brain.
11. Melatonin

**ALZET Comments:** Melatonin; Rat; animal info (Sprague-Dawley rats); comparison of infusion pump, pellets, transdermal, beads, sponge, iPRECIO vs mp; Lynch coil;

**ALZET Comments:** Melatonin; Intrauterine; Sheep (pregnant);

**ALZET Comments:** Melatonin; Saline; CSF/CNS (lateral ventricle); Rat; 7 days; Dose (1 mg•kg body wt_1•day_1); Controls received mp w/ vehicle; animal info (Male Fischer 344 rats weighing 175–200 g); Brain coordinates (_0.80 mm, ML: _1.50 mm, DV: _4.00 mm from Bregma);

Q3870: A. W. Eifert, et al. Effect of melatonin or maternal nutrient restriction on vascularity and cell proliferation in the ovine placenta. ANIMAL REPRODUCTION SCIENCE 2015;153(13-21
**ALZET Comments:** Melatonin; luzindole; DMSO; water; Intrauterine; Sheep (ewe; pregnant); 2ML4; 28 days; Controls received mp w/ vehicle; animal info (female, Western white face, GD62); functionality of mp verified by serum levels; 45% DMSO used; stress/adverse reaction: (see pg. 2); post op. care (For two days: flunixin meglumine 50 mg/ml IM twice a day; Penicillin G procain 300,000 u/ml once per day); tissue perfusion (uterus mesometrium); cardiovascular;

**ALZET Comments:** Melatonin; Luzindole; DMSO; water; Intrauterine (uterine horn); Sheep (ewe); 2ML4; 28 days; Controls received mp w/ vehicle; functionality of mp verified by serum levels of melatonin taken; 45% DMSO used; stress/adverse reaction: (see pg. 2); post op. care (For two days: flunixin meglumine 50 mg/ml IM twice a day; Penicillin G procain 300,000 u/ml once per day); tissue perfusion (uterus mesometrium); cardiovascular;

**ALZET Comments:** Melatonin; Saline; DMSO; SC; 2 weeks; Controls received mp w/ vehicle; “The method of melatonin infusion via s.c. osmotic mini-pumps provided constant steady-state hormonal concentrations.” Pg. 45; Dose (10 mg/kg/day).

**ALZET Comments:** Gentamicin; dexamethasone; melatonin; Ear (round window); Rat; 2001; 7 days; Controls received mp w/ saline; animal info (Wistar, male, 220-250 g); stability verified after 7 days (data not shown).

**ALZET Comments:** Melatonin; ramelteon; Saline; ethanol; SC; Hamster; 2004; 8 weeks; Controls received mp w/ vehicle; long-term study; pumps replaced after 4 weeks; animal info (Siberian, adult, male); 15% ethanol used; ramelteon is a specific MT1/MT2 agonist.
ALZET Comments: Melatonin; SC; Mice (pregnant); 1007D; 7 days; Controls received mp w/saline; animal info (pregnant, spiny).

ALZET Comments: Melatonin; PEG 400; SC; Rat; 2002; 2 weeks; Controls received mp w/vehicle; no stress (see pg. 62); cardiovascular; ischemia (cardiac); animal info (male, Sprague Dawley, 240-290 g., MI); "28-day subcutaneous infusion of melatonin in rats had no obvious toxicity or side effects." (p. 62).

12. Resveratrol

ALZET Comments: Resveratrol; Nicotinamide; Cyclodextrin, 2-hydroxypropyl-b; Saline; SC; Mice; 28 days; Dose (resveratrol 1 mg/kg/day; nicotinamide 250 mg/kg/day); Controls received mp w/vehicle; animal info (9-month-old YAC128 transgenic mice and age-matched WT controls); neurodegenerative (Huntington's Disease).

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); Loctite 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).

ALZET Comments: Resveratrol; DMSO; SC; mice; 1004; 4 weeks; Controls received mp w/vehicle; animal info: Male, 6-week-old C57BL/6J mice; %50 of DMSO; dose-response (pg.1257-1259); Resveratrol aka RSV; Animals fed high-fat diets concurrently; Dose: 8 mg/kg/day.

ALZET Comments: Resveratrol; DMSO; SC; Mice; 1004; 4 weeks; Controls received mp w/vehicle; animal info (male, C57BL6); 50% DMSO used; no stress (see pg. 697); diabetes; "Resveratrol was administered via an osmotic pump, which is a safe and standard delivery system for rodents" "no side effects were observed by monitoring weight change, behavior and inflammatory response around the implantation area." pg 697.

ALZET Comments: Resveratrol; DMSO; ethanol; SC; Mice; 2002; 14 days; Control animals received mp w/vehicle; animal info (6 wks old, female, C57BL/6J); 50% DMSO used; 15% ethanol used; "Owing to the limited compatibility of the osmotic pumps with DMSO and/or ethanol, as well as the limited solubility of resveratrol in aqueous solutions, it wasn’t possible to achieve higher doses of resveratrol using osmotic pumps" pg 17585.

Q3150: S. J. Sheu, et al. Resveratrol Stimulates Mitochondrial Bioenergetics to Protect Retinal Pigment Epithelial Cells From Oxidative Damage. INVESTIGATIVE OPHTHALMOLOGY & VISUAL SCIENCE 2013;54(9):6426-6438
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Bibliography

ALZET Comments: Resveratrol; Coenzyme Q10; DMSO; IP; Rat; 2004; 4 weeks; Controls received mp w/ vehicle or sham surgery; animal info (Female, Brown Norway, 200-265g); 0.8% DMSO used; post op. care (Procaine penicillin 1000 IU IM); Coenzyme Q10 aka ubiquinone.;

ALZET Comments: Resveratrol; chloroquine; SC; Mice; 14 days; Control animals received mp w/ vehicle; animal info (C57BL/6, male, 8-10 wks old).

ALZET Comments: Resveratrol; Sirt1 inhibitor III; NH125; Ethanol; SC; Mice; 14 days; Controls received mp w/ vehicle; animal info (C57BL/6, eFK2 -/-); 25% ethanol used.

ALZET Comments: Resveratrol; Saline, sterile; CSF/CNS; Mice; 1004; 5 weeks; Controls received mp w/vehicle; animal info (C57BL/6, male); "This daily dose of resveratrol (0.03mg/ul) is approximately 8.5 million or approximately 152 million times lower, respectively, compared with the dose orally delivered in two previous studies" pg 5327; diabetes; endocrinology.

ALZET Comments: Resveratrol, trans-; DMSO; SC; Mice; 2004; 4 weeks; Controls received mp w/ vehicle; comparison of oral vs. SC mp; animal info (C57/BL6); 50% degassed DMSO.

13. Retinoic Acid

ALZET Comments: Retinoic acid, 13-cis-; Ethanol; SC; Mice (transgenic); 1007D; 5 weeks; Controls received mp w/vehicle; dose-response (fig. 1); no stress (see pg. 312-13); cancer (neuroblastoma).

ALZET Comments: Retinoic acid; uridine, bromodeoxy-; SC; Mice; 1, 3, 6 days; Controls received mp w/ vehicle; comparison of SC injections vs. mp; cancer (gastric); multiple pumps per animal (2).

ALZET Comments: Transforming growth factor; insulin-like growth factor I; retinoic acid; brain-derived neurotrophic factor;; PBS; BSA;; Ear (vestibule); Guinea pig; 2002; 4 weeks; Controls received mp w/ vehicle; pumps replaced after 2 weeks; peptides; IntraEAR catheter used; GFI group pumps filled with TGF, IGF and Retinoic acid; GFII group pumps filled with TGF, IGF, BDNF and retinoic acid; tissue perfusion (vestibule).

ALZET Comments: Dipyridamole; Lazaroids; Retinoic acid; Review of adhesion formation and prevention; mentions the use of mini-osmotic pumps to evaluate new agents to reduce experimental pelvic adhesions (p. 125).

**ALZET Comments:** Retinoic acid; Quinacrine; Dipyridamole; PBS; Ethanol; injury site; rabbit; 2ML1; 1, 2, 3, 7 days; controls received mp w/vehicle; tissue perfusion (surgical injury site); animals given morphine i.m. for post-operative pain; catheter stabilized in sidewall w/suture; in some studies, catheter tubing was disconnected to halt flow at specific times; immunology.

**P3491:** M. Kaya, et al. Chemical induction of fenestrae in vessels of the blood-brain barrier. Exp. Neurol 1996;142(6-13)

**ALZET Comments:** Retinoic acid; Phorbol myristate acetate; ETHANOL; Gibco BRL minimal essential medium; DMSO; Culture medium, serum-free; CSF/CNS (cortex); Rat; 2ML1; 21, 28 days; controls received mp w/ vehicle; functionality of mp verified by residual volume; pumps replaced weekly.

### 14. Tempol

**Q7198:** O. Le, et al. INK4a/ARF Expression Impairs Neurogenesis in the Brain of Irradiated Mice. Stem Cell Reports 2018;10(6):1721-1733

**ALZET Comments:** Porphyrin-based superoxide dismutase mimetic (MnHex); SC; Mice; 1004; 8 weeks; Dose (450 ug/kg/day); pumps replaced every 4 weeks; Porphyrin-based potent superoxide dismutase mimetic aka (Mn(III) meso-tetrakis-(n-hexylypyridinium-2-yl) porphyrin (MnTnHex-2-PyP5+); neurodegenerative (ionizing radiation).


**ALZET Comments:** mitochondrial superoxide dismutase mimetic (Hexyl); Saline; SC; Monkey; 6 weeks; Dose (0.1 mg/kg/day); Controls received mp w/ vehicle; animal info (Rhesus monkeys); MnTnHex-2-PyP5+ aka hexyl; cardiovascular.


**ALZET Comments:** Losartan; Tempol; Clonidine; CSF, artificial; CSF/CNS (lateral ventricle); Rat; Dose (1 mg/kg/day losartan; 4.5 ug/kg/day tempol; 5.76 ug/kg/day clonidine); Controls received mp w/ vehicle; animal info (Five-week-old male Sprague-Dawley rats); Therapeutic indication (5/6 nephrectomy).


**ALZET Comments:** Tempol; Saline; CSF/CNS (cisterna magna); Rat; 1002; 14 days; Dose (10 mM); Controls received mp w/ vehicle; animal info (Male, adult spontaneously hypertensive rats and Wistar–Kyoto rats); ALZET brain infusion kit 2 used.

**Q5333:** C. Y. Tsai, et al. Nitrosative Stress-Induced Disruption of Baroreflex Neural Circuits in a Rat Model of Hepatic Encephalopathy: A DTI Study. Sci Rep 2017;7(40111

**ALZET Comments:** FeTMPyP; Tempol; CSF, artificial; CSF/CNS (intracisternal); Rat; 2001; 6 days; Controls received mp w/ vehicle; animal info (male adult Sprague-Dawley rats 278 +/-28 g); FeTMPyP is an active peroxynitrite decomposition catalyst; tempol is an antioxidant; Dose: FeTMPyP (100 pmol/ul/hr); tempol (4 nmol/ul/hr); tissue perfusion (cisternae).

**Q5692:** H. Z. Toklu, et al. Intracerebroventricular tempol administration in older rats reduces oxidative stress in the hypothalamus but does not change STAT3 signalling or SIRT1/AMPK pathway. Appl Physiol Nutr Metab 2017;42(1):59-67

**ALZET Comments:** Tempol; CSF, artificial; CSF/CNS; Rat; 3 weeks; Controls received mp w/ vehicle; animal info (male, Fischer 344 x Brown Norway, 3 months or 23 months old); functionality of mp verified by ; Vehicle pumps replaced after one week; Dose (300 ug/h).

**Q6024:** M. J. De Blasio, et al. The superoxide dismutase mimetic tempol blunts diabetes-induced upregulation of NADPH oxidase and endoplasmic reticulum stress in a rat model of diabetic nephropathy. Eur J Pharmacol 2017;807(12-20
ALZET Comments: Tempol; Water; SC; Rat; 4 weeks; Controls received mp w/ vehicle; animal info (Diabetic rats); diabetes; Therapeutic indication (Diabetes); Dose (1.5 mM/kg/day).

**Q6113:** E. Bouvier, et al. Nrf2-dependent persistent oxidative stress results in stress-induced vulnerability to depression. Mol Psychiatry 2017;22(12):1701-1713

**ALZET Comments:** Butylhydroquinone, tert-; Tempol; Water, distilled; Ethanol; CSF/CNS (right lateral ventricle); Rat; 6 days, 4 weeks; Tempol 8 umol kg/day dissolved in distilled water and delivered for 4 weeks; t-BHQ (1 mM) dissolved in 1% Ethanol in water and delivered for 6 days ICV; Controls received mp w/ vehicle; animal info (9 week old Sprague-Dawley rats weighing 290–310 g); Tempol is an antioxidant; Brain coordinates (1 mm caudal; – 1.5 mm lateral; – 3.4 mm below the surface).

**Q5581:** J. Bai, et al. Central administration of tert-butylhydroquinone attenuates hypertension via regulating Nrf2 signaling in the hypothalamic paraventricular nucleus of hypertensive rats. Toxicol Appl Pharmacol 2017;333(100-109)

**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.

**Q5838:** H. K. Kim, et al. Tempol Ameliorates and Prevents Mechanical Hyperalgesia in a Rat Model of Chemotherapy-Induced Neuropathic Pain. Front Pharmacol 2016;7(532)

**ALZET Comments:** Tempol; Saline; IP; Rat; 2001; 7 days; Controls received mp w/ vehicle; animal info (200-350 g); cancer (Chemotherapy); behavioral testing; Therapeutic indication (Pain study, chemotherapy-induced neuropathic pain); Dose (200 mg/kg).

**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)

**ALZET Comments:** Endotoxin, LPS; NS398; tempol; saline; DMSO; CSF/CNS; Rat; 1007D; 7 days; 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.


**ALZET Comments:** Losartan; clonidine; tempol; hydralazine; PBS; CSF, artificial; CSF/CNS; intragastric; Rat; 2 weeks; Controls received mp w/ vehicle; animal info (male, Sprague Dawley, 5 weeks old, 5/6x nephrectomy); dose-response (pg 1627); cardiovascular; bp measured using catheter.

15. Thioredoxin


**ALZET Comments:** Thioredoxin-interacting protein DNAzyme; SC; Rat; 2006; 12 weeks; Controls received mp w/ scrambled TXNIP DNAzyme; animal info (female, heterozygous (mRen-2)27, 6 weeks old); pumps replaced every 6 weeks; cardiovascular; diabetes; Thioredoxin-interacting protein aka TXNIP.

**P7999:** S. Ueda, et al. Recombinant human thioredoxin suppresses lipopolysaccharide-induced bronchoalveolar neutrophil infiltration in rat. LIFE SCIENCES 2006;79(12):1170-1177

**ALZET Comments:** Thioredoxin, human recomb.; SC; Mice (nude); 2002; 2 weeks; Controls received mp w/ PBS; plasma levels taken; cancer (colon, carcinoma); peptides; animal info (female, 6 weeks old, nude); xenograft.
**ALZET Comments:** Thioredoxin; IP; Rat; 2002; 4 weeks; controls received mp w/saline; pumps replaced after 2 weeks; immunology; peptides; thioredoxin is an endogenous antioxidant protein.

16. Vitamin E

**ALZET Comments:** PMC; tocopherol, alpha; SC; Rat; 14 days; Controls received mp w/ normal saline; animal info (Wistar, male, 350-400 g); PMC, also known as (2,2,5,7,8-pentamethyl-6-hydroxychromane, is a vitamin E derivative; tocopherol also known as vitamin E.

**ALZET Comments:** Ascorbate; glutathione; tocopherol, alpha-; SC; Mice; 1007D; Controls received mp w/saline; animal info (male, C57BL/6J, 25-30g, 10-12 weeks old); compounds were mixed and infused together as an antioxidant cocktail.

**ALZET Comments:** Vitamin E; IP; Rat; 2001; 7 days; functionality of mp verified by measuring EPC-K1 plasma levels; immunology; EPC-K1 is a diester of a-tocopherol and ascorbic acid; agent also called D-alpha-tocopherol.

**ALZET Comments:** Phosphatidylcholine; vitamin E; Liposomes; CSF/CNS (cortex); Rat; 2001; 7 days; Multiple pumps per animal (2); agent also called D-alpha-tocopherol.