



References (2005-Present) on the Administration to the Ear  
Using ALZET® Osmotic Pumps

**R0472:** D. Navarro-Tumar, *et al.* Novel Applications in Controlled Drug Delivery Systems by Integrating Osmotic Pumps and Magnetic Nanoparticles. *Sensors (Basel)* 2024;24(21):

**Agents:** DNA, tc; fluvastatin; meloxicam; angiotensin II; perilymph, artificial; isoform FS-288; neurotrophin-3 **Vehicle:** Not Stated; **Route:** IV; SC; CSF/CNS (ventricle); Ear; **Species:** Mice; bird (pigeon); guinea pig; rat; **Strain:** C57BL/6; Mdx52; Mst1-/-; Sprague Dawley; Apoe-/-; **Pump:** 1002; 1004; 2001; 2002; 2004; 2006; 2ML4; **Duration:** Not Stated;

**ALZET Comments:** see Table 1 for list of studies; "This method of drug administration presents several advantages for research purposes over conventional delivery systems including (i) the maintenance of a constant concentration of the drug to maximize its efficacy and reduce adverse effects, (ii) the elimination of the need for researcher intervention during the experiment, and (iii) the time savings by removing the need for frequent handling and repetitive injection of the animal." p. 5

**Q11269:** F. Depreux, *et al.* Statins protect mice from high-decibel noise-induced hearing loss. *Biomedicine & Pharmacotherapy* 2023;163(114674)

**Agents:** Fluvastatin **Vehicle:** DMSO; **Route:** Ear (cochlea); **Species:** Mice; **Strain:** CBA/CaJ; **Pump:** 1004; **Duration:** 28 days;

**ALZET Comments:** Dose (50 µM); 0.5% DMSO used; Controls received mp w/ vehicle; animal info (Male; 10 weeks old); comparison of mp vs oral delivery; good methods (cochleostomy) p. 3

**Q10598:** K. Malfeld, *et al.* Prevention of Noise-Induced Hearing Loss In Vivo: Continuous Application of Insulin-like Growth Factor 1 and Its Effect on Inner Ear Synapses, Auditory Function and Perilymph Proteins. *International Journal of Molecular Sciences* 2022;24(1):

**Agents:** IGF-1, Recombinant human **Vehicle:** Perilymph. artificial; **Route:** Ear (cochlea); **Species:** Guinea pig; **Pump:** 2006; **Duration:** 7 days;

**ALZET Comments:** Dose (2 µg/mL) Controls received mp w/ vehicle; animal info (male Dunkin Hartley guinea pigs); weighting between 350 g and 426 g; post op. care (0.2 mg/kg meloxicam and 10 mg/kg enrofloxacin.) to reduce pain & prevent infection; catheter; dental cement used; (UV cement)

**R0444:** M. Magdy, *et al.* Localized drug delivery to the middle ear: Recent advances and perspectives for the treatment of middle and inner ear diseases. *Journal of Drug Delivery Science and Technology* 2022;69(**Agents:** Liposome; Gd-DOTA **Vehicle:** Not Stated; **Route:** Ear (intratympanic); **Species:** Rat; **Strain:** Not Stated; **Pump:** Not Stated; **Duration:** 17 days;

**ALZET Comments:** toxicology; Therapeutic indication (Middle and inner ear diseases);

**Q9343:** S. Li, *et al.* FGF22 promotes generation of ribbon synapses through downregulating MEF2D. *Aging* 2020;

**Agents:** Adeno-associated virus **Vehicle:** Not Stated; **Route:** Ear (cochlea); **Species:** Mice; **Pump:** 1004; **Duration:** 4 days;

**ALZET Comments:** Animal info (male CBA/J mice, aged 6 weeks, weight around 18g); toxicology;

**Q7262:** C. P. Richter, *et al.* Fluvastatin protects cochleae from damage by high-level noise. *Sci Rep* 2018;8(1):3033

**Agents:** Fluvastatin **Vehicle:** DMSO, Ringer's Solution; **Route:** Ear (cochlea); **Species:** Guinea Pig; **Pump:** 2004; **Duration:** 28 d

**ALZET Comments:** Dose (fluvastatin 50 µM); animal info (Outbred Hartley guinea pigs 200–500 g); post op. care (Buprenex);

**Q5813:** A. Fransson, *et al.* Structural changes in the inner ear over time studied in the experimentally deafened guinea pig. *J Neurosci Res* 2017;95(3):869-875

**Agents:** Glial cell-line derived neurotrophic factor **Vehicle:** artificial perilymph; **Route:** Ear, Cochlea; **Species:** Guinea Pig; **Pump:** 2002; **Duration:** 28 days;

**ALZET Comments:** Controls received mp w/ vehicle; animal info (200-320g); Artificial perilymph : ringer-acetate; Therapeutic indication (Delayed treatment, degeneration, cochlear implant, hearing);



**Q6165:** C. K. Kandathil, *et al.* Effects of brain-derived neurotrophic factor (BDNF) on the cochlear nucleus in cats deafened as neonates. *Hear Res* 2016;342(134-143

**Agents:** Brain-derived neurotrophic factor, recomb. human **Vehicle:** Perilymph, artificial; **Route:** Ear (cochlea); **Species:** Cat; **Pump:** 1002, 2004; **Duration:** 10 weeks;

**ALZET Comments:** Dose (94 mg/ml; 0.25 ml/hr); pumps replaced after 2 and 4 weeks; BDNF stability verified by neuronal cell culture survival assay (28 days);

**Q4838:** H. JIA, *et al.* PREVENTION OF TRAUMA-INDUCED COCHLEAR FIBROSIS USING INTRACOCHELEAR APPLICATION OF ANTI-INFLAMMATORY AND ANTIPROLIFERATIVE DRUGS. *neuroscience* 2016;316(261-278

**Agents:** Dexamethasone; Ara-C **Vehicle:** Perilymph, artificial; **Route:** Ear (cochlea); **Species:** Rat; **Pump:** 2001; **Duration:** 7 d

**ALZET Comments:** Controls received mp w/ vehicle; animal info (Wistar, adult); animal info (Wistar, adult); stability verified by (incubation in 37C saline for 7 days see pg 268); one cochlea received vehicle only, while other received drug;

**Q7008:** M. Y. Lee, *et al.* Continuous topical drug delivery using osmotic pump in animal cochlear implant model: Continuous steroid delivery is effective for hearing preservation. *Acta Otolaryngologica* 2015;135(8):791-8

**Agents:** Dexamethasone **Vehicle:** Saline; **Route:** Ear (cochlea); **Species:** Guinea pig; **Pump:** 1007D; **Duration:** 7 days;

**ALZET Comments:** Dose (4 mg/ml); Controls received mp w/ vehicle; animal info (female Harley Albino guinea pigs, 255–455 g, 7–9 weeks old); dependence;

**Q4141:** Y. Tona, *et al.* Therapeutic potential of a gamma-secretase inhibitor for hearing restoration in a guinea pig model with noise-induced hearing loss. *BMC Neuroscience* 2014;15(U1-U8

**Agents:** MDL28170 **Vehicle:** DMSO; PBS; **Route:** Ear (cochlea); **Species:** Guinea pig; **Pump:** 1002; **Duration:** 14 days;

**ALZET Comments:** Controls received mp w/ vehicle; animal info (Hartley strain, 350-400g); 0.3% DMSO used; tissue perfusion (cochlea); used Teflon tube with inner diameter of 180 um to cannulate cochlea; MDL28170 is a gamma-secretase inhibitor;

**Q3985:** G. Malkoc, *et al.* Histopathological and audiological effects of mechanical trauma associated with the placement of an intracochlear electrode, and the benefit of corticosteroid infusion: prospective animal study. *Journal of Laryngology and Otology* 2014;128(702-708

**Agents:** Dexamethasone **Vehicle:** Saline; **Route:** Ear (round window); **Species:** Rat; **Pump:** Not Stated; **Duration:** 14 days;

**ALZET Comments:** Controls received mp w/ vehicle; animal info (female, Albino, 250-33g, adult); used ALZET IT catheter to cannulate round window; "Dexamethasone infusion given after implantation of the intracochlear model electrode was more effective for preventing hearing loss than the administration of just one dose of dexamethasone" pg 702;

**Q6784:** L. Waaijer, *et al.* The Peripheral Processes of Spiral Ganglion Cells After Intracochlear Application of Brain-Derived Neurotrophic Factor in Deafened Guinea Pigs. *OTOLOGY & NEUROTOLOGY* 2013;34(570-578

**Agents:** Brain-derived neurotrophic factor **Vehicle:** PBS; **Route:** Ear (right cochlea); **Species:** Guinea pig; **Pump:** 2004; **Duration:** 4 weeks;

**ALZET Comments:** Dose (100 µg/ml); Controls received mp w/ vehicle; animal info (10 healthy albino female guinea pigs (strain: Dunkin Hartley; weighing 250-350 g);

**Q6721:** P. A. Leake, *et al.* Effects of brain-derived neurotrophic factor (BDNF) and electrical stimulation on survival and function of cochlear spiral ganglion neurons in deafened, developing cats. *J Assoc Res Otolaryngol* 2013;14(2):187-211

**Agents:** Brain-derived neurotrophic factor, recomb. human **Vehicle:** Perilymph, artificial; **Route:** Ear (cochlea); **Species:** Cat; **Pump:** 1002; 2004; **Duration:** 10 weeks;

**ALZET Comments:** Dose (3.75 µg/day); animal info (deafened cats weighing 520-610g); pumps replaced every 2,4 weeks; long-term study; Because the animals were small at the time of implantation (mean body weight, 560 g; range, 520–610 g), a smaller osmotic pump (model #1002) that delivered 14 days of BDNF was implanted initially. Two weeks later, a brief surgical procedure was performed to replace the initial pump with a larger one containing a 28-day supply of BDNF; this was replaced 1 month later with a final 28-day pump.



**Q3105:** T. G. Landry, *et al.* Chronic neurotrophin delivery promotes ectopic neurite growth from the spiral ganglion of deafened cochleae without compromising the spatial selectivity of cochlear implants. *Journal of Comparative Neurology* 2013;521(12):2818-2832

**Agents:** Neurotrophin; Brain-derived neurotrophic factor **Route:** Ear (cochlea); **Species:** Guinea pig **Pump:** 2004 **Duration:** 28d  
**ALZET Comments:** Controls received mp w/ artificial perilymph; animal info (young adult, 300-600g); tissue perfusion

**Q2425:** H. Toyota, *et al.* A novel treatment for vestibular disorder with FGLM-NH<sub>2</sub> plus SSSR. *Neuroscience Letters* 2012;526(2):128-132

**Agents:** FGLM-NH<sub>2</sub>; SSSR **Vehicle:** Not Stated; **Route:** Ear (cochlea); **Species:** Guinea pig; **Pump:** 2002; **Duration:** 14 days;  
**ALZET Comments:** Control animals received mp w/ artificial perilymph; animal info (male, Hartley); FGLM-NH<sub>2</sub> also known as Phenylalanine-Glycine-Leucine-Methionine-Amide; SSSR also known as Serine-Serine-Serine-Arginine; tissue perfusion

**Q1915:** D. J. Sly, *et al.* Brain-Derived Neurotrophic Factor Modulates Auditory Function in the Hearing Cochlea. *JARO-JOURNAL OF THE ASSOCIATION FOR RESEARCH IN OTOLARYNGOLOGY* 2012;13(1):1-16

**Agents:** Brain-derived neurotrophic factor **Route:** Ear (cochlea); **Species:** Guinea pig; **Pump:** 2004; **Duration:** 4 weeks;  
**ALZET Comments:** Controls received mp w/ Ringers solution; animal info (adult, male, Dunkin-Hartley pigmented, 233-815 g); post op. care (buprenorphine); "Polymers, particularly hydrogels that may be applied directly to the round window, were considered... However, most have a release profile that varies over time, so instead we chose to place a cannula attached to a mini-osmotic pump directly onto the round window." pg 2; tissue perfusion (cochlea, round window niche)

**Q2064:** E. Bas, *et al.* Efficacy of three drugs for protecting against gentamicin-induced hair cell and hearing losses. *British Journal of Pharmacology* 2012;166(6):1888-1904

**Agents:** Gentamicin; dexamethasone; melatonin **Route:** Ear (round window); **Species:** Rat; **Pump:** 2001; **Duration:** 7 days;  
**ALZET Comments:** Controls received mp w/ saline; animal info (Wistar, male, 220-250 g); stability verified after 7 days

**Q1509:** X. Li, *et al.* Protective Role of Hydrogen Sulfide against Noise-Induced Cochlear Damage: A Chronic Intracochlear Infusion Model. *PLoS One* 2011;6(10):U487-U492

**Agents:** Sodium hydrosulfide; propargylglycine, DL- **Vehicle:** Not Stated; **Route:** Ear (cochlea); **Species:** Rat; **Pump:** 2002;  
**ALZET Comments:** Controls received mp w/ artificial perilymph; animal info (Sprague Dawley, 250-350 g); tissue perfusion (cochlear); ALZET mouse jugular catheter used (#0007700); stress/adverse effects, pg e26728 "Two rats died of post-surgical infection, and one rat died of hemorrhage."

**Q1195:** P. A. Leake, *et al.* Brain-Derived Neurotrophic Factor Promotes Cochlear Spiral Ganglion Cell Survival and Function in Deafened, Developing Cats. *Journal of Comparative Neurology* 2011;519(8):1526-1545

**Agents:** Brain-derived neurotrophic factor, human **Vehicle:** Perilymph, artificial; **Route:** Ear (cochlea); **Species:** Cat; **Pump:** 1002; 2004; **Duration:** 10 weeks;  
**ALZET Comments:** Controls received mp w/ vehicle; long-term study; animal info (adult, 4 wks old, deafened); functionality of mp verified via residual volume; pumps replaced after two weeks then after 28 days; tissue perfusion (cochlea); "The drug-delivery cannula within the cochlear implant... was connected to vinyl tubing..., which was connected to the regulator of the osmotic pump, which was implanted behind the right pinna."; artificial perilymph recipe

**Q1178:** T. Kondo, *et al.* Wnt Signaling Promotes Neuronal Differentiation from Mesenchymal Stem Cells Through Activation of Tlx3. *Stem Cells* 2011;29(5):836-846

**Agents:** Wnt1; brain-derived neurotrophic factor **Route:** Ear (cochlea); **Species:** Gerbil; **Pump:** 2004; **Duration:** 28 days;  
**ALZET Comments:** Controls received mp w/ saline or BDNF only; animal info (Mongolian, 4 mo old); pumps replaced after 72 hours; tissue perfusion (intracochlea)

**Q0954:** L. Abaamrane, *et al.* Intracochlear perfusion of leupeptin and z-VAD-FMK: influence of antiapoptotic agents on gunshot-induced hearing loss. *European Archives of Oto-Rhino-Laryngology* 2011;268(7):987-993

**Agents:** Leupeptin; z-VAD-FMK **Vehicle:** Not Stated; **Route:** Ear (cochlea); **Species:** Guinea pig; **Pump:** 2001; **Duration:** 7 days;  
**ALZET Comments:** Controls received no treatment; animal info (albino, 400-600 g); enzyme inhibitor (caspase); artificial perilymph solution recipe; "A miniature glass pipette with a ring of glue placed next to the tip to provide a leak-proof seal protecting the cochlea from contamination was connected to the catheter." pg 988; tissue perfusion



**Q1665:** F. Watanabe, *et al.* Signaling through erbB receptors is a critical functional regulator in the mature cochlea. *European Journal of Neuroscience* 2010;32(5):717-724

**Agents:** PD153035; 4557W **Vehicle:** DMSO; artificial perilymph; **Route:** Ear (cochlea); **Species:** Guinea pig; **Pump:** 2002  
**ALZET Comments:** Controls received mp w/ artificial perilymph; animal info (female, pigmented, 250-500 g); functionality of mp verified by residual volume; tissue perfusion (intracochlear); 0.1% DMSO used; enzyme inhibitor (tyrosine kinase)

**Q1391:** A. Warnecke, *et al.* Artemin improves survival of spiral ganglion neurons in vivo and in vitro. *NeuroReport* 2010;21(7):517-521

**Agents:** Artemin; brain-derived neurotrophic factor **Route:** Ear (scala tympani) **Species:** Guinea pig **Pump:** 2002 **Duration:** 28d  
**ALZET Comments:** Negative controls received mp w/ artificial perilymph; animal info (deafened, pigmented, 250-450 g); pumps replaced after 14 days; tissue perfusion (scala tympani); pump connected to silicone-polyimide tubing

**Q1616:** H. N. Lang, *et al.* Chronic Reduction of Endocochlear Potential Reduces Auditory Nerve Activity: Further Confirmation of an Animal Model of Metabolic Presbycusis. *JARO-JOURNAL OF THE ASSOCIATION FOR RESEARCH IN OTOLARYNGOLOGY* 2010;11(3):419-434

**Agents:** Furosemide **Vehicle:** Not Stated; **Route:** Ear (round window niche); **Species:** Gerbil; **Pump:** 2004; **Duration:** 4 weeks;  
**ALZET Comments:** Controls were untreated; animal info (3-6 mo old, young adult); good methods, pg 421; tissue perfusion (round window)

**Q1685:** A. Fransson, *et al.* Post-Treatment Effects of Local GDNF Administration to the Inner Ears of Deafened Guinea Pigs. *Journal of Neurotrauma* 2010;27(9):1745-1751

**Agents:** Glial-derived neurotrophic factor **Route:** Ear (cochlea); **Species:** Guinea pig; **Pump:** 2002; **Duration:** 4 weeks;  
**ALZET Comments:** Controls received mp w/ artificial perilymph; animal info (deafened); silicone tube used; tissue perfusion (cochlea); pump replaced after 2 weeks; post op. care (lidocaine)

**P9515:** V. Scheper, *et al.* Effects of Delayed Treatment With Combined GDNF and Continuous Electrical Stimulation on Spiral Ganglion Cell Survival in Deafened Guinea Pigs. *Journal of Neuroscience Research* 2009;87(6):1389-1399

**Agents:** Glial-derived neurotrophic factor **Route:** Ear (cochlea); **Species:** Guinea pig; **Pump:** 2002; **Duration:** 48 days;  
**ALZET Comments:** Controls received mp w/artificial perilymph; tissue perfusion (cochlea); long-term study; pumps replaced after 13 days; good methods (pg. 1391); animal info (male, pigmented, 250-450 g.); pumps primed; image of pump and electrode cannula device used on fig. 1

**P9844:** H. Orita, *et al.* Unilateral intra-perilymphatic infusion of substance P enhances ipsilateral vestibulo-ocular reflex gains in the sinusoidal rotation test. *Neuroscience Letters* 2009;449(3):207-210

**Agents:** Substance P; neurokinin-1 receptor antagonist **Vehicle:** Not Stated; **Route:** Ear (round window); **Species:** Guinea pig;  
**Pump:** 2002; **Duration:** Not Stated;  
**ALZET Comments:** Post op. care (piperacillin sodium); animal info (Hartley); pump was connected to a PE catheter filled with artificial perilymph for a 12-hour delayed infusion; tissue perfusion (round window)

**Q0333:** Y. Nguyen, *et al.* An animal model of cochlear implantation with an intracochlear fluid delivery system. *Acta Otolaryngologica* 2009;129(11):1153-1159

**Agents:** Saline **Vehicle:** Not Stated; **Route:** Ear (cochlea); **Species:** Guinea pig; **Pump:** 1007D; **Duration:** Not Stated;  
**ALZET Comments:** Controls received pump without electrode implant; animal info (albino, male, 3 to 7 months old, 290-1030 g.); good methods pg 1154; post op. care (enrofloxacin); "the pump was fixed subcutaneously between the scapulae using a vicryl 3/0 suture (Ethicon)" pg 1154; image of pump-electrode device, Fig. 1; tissue perfusion (cochlea)

**Q1126:** Z. Q. Hu, *et al.* Functional Evaluation of a Cell Replacement Therapy in the Inner Ear. *Otology & Neurotology* 2009;30(4):551-558

**Agents:** Nerve growth factor **Vehicle:** Hank's based salt solution; albumin, guinea pig serum; **Route:** Ear (cochlea); **Species:** Guinea pig; **Pump:** 2002; **Duration:** Not Stated;  
**ALZET Comments:** Controls received mp w/ vehicle; animal info (pigmented, adult, 270-470 g); pumps replaced after 13 days; post op. care (daily injections of cyclosporin and doxycycline); tissue perfusion



**P9796:** A. Fransson, *et al.* In Vivo Infusion of UTP and Uridine to the Deafened Guinea Pig Inner Ear: Effects on Response Thresholds and Neural Survival. *Journal of Neuroscience Research* 2009;87(7):1712-1717

**Agents:** Uridine triphosphate; uridine **Vehicle:** Not Stated; **Route:** Ear (cochlea); **Species:** Guinea pig; **Pump:** 2002; **Duration:** 25 days;

**ALZET Comments:** Controls received mp w/ artificial perilymph; pumps replaced on day 13; animal info (pigmented, 280-440 g); tissue perfusion

**Q0453:** M. J. H. Agterberg, *et al.* Enhanced Survival of Spiral Ganglion Cells After Cessation of Treatment with Brain-Derived Neurotrophic Factor in Deafened Guinea Pigs. *JARO-JOURNAL OF THE ASSOCIATION FOR RESEARCH IN OTOLARYNGOLOGY* 2009;10(3):355-367

**Agents:** Brain-derived neurotrophic factor **Vehicle:** BSA; **Route:** Ear (cochlea); **Species:** Guinea pig; **Pump:** 2004; **Duration:** 4 w

**ALZET Comments:** Controls were untreated; animal info (albino, female, 250-350 g); pump connected to Cochlear (R) electrode array; tissue perfusion (cochlea)

**P9856:** M. J. Adkesson, *et al.* MEDICAL AND SURGICAL MANAGEMENT OF OTITIS IN CAPTIVE BONGO (TRAGELAPHUS EURYCERUS). *JOURNAL OF ZOO AND WILDLIFE MEDICINE* 2009;40(2):332-343

**Agents:** Amikacin **Vehicle:** Not Stated; **Route:** Ear; **Species:** Antelope (bongo); **Pump:** 2ML4; **Duration:** 24 days;

**ALZET Comments:** Functionality of mp verified by residual volume; animal info (10 years old, male, 326 kg); "An osmotic pump was beneficial for antibiotic delivery in case 2 and may be an effective therapy for low-grade infections or for continued therapy once a severe infection is under control." pg. 340

**P9292:** R. J. Vivero, *et al.* Dexamethasone Base Conserves Hearing from Electrode Trauma-Induced Hearing Loss. *Laryngoscope* 2008;118(11):2028-2035

**Agents:** Dexamethasone base **Vehicle:** Perilymph, artificial; **Route:** Ear (scala tympani); **Species:** Guinea pig; **Pump:** 2001; **Duration:** 8 days;

**ALZET Comments:** Controls received mp w/ vehicle; replacement therapy (cochleostomy); tissue perfusion (scala tympani); animal info (pigmented, 250-300 g.)

**R0266:** E. E. L. Swan, *et al.* Inner ear drug delivery for auditory applications. *Advanced Drug Delivery Reviews* 2008;60(15):1583-1599

**Agents:** Cisplatin; Sodium thiosulfate; Brain-derived neurotrophic factor; Fibroblast growth factor; D-JNKI-1; BN82270; Tetrodotoxin; Perilymph, artificial; Dexamethasone; Methylprednisone; Caroverine; Methionine, D-; Thiourea; Liposome, cationic; Neomycin **Route:** SC; Ear (round window membrane, cochlea, scala tympani); **Species:** Guinea pig; **Duration:** 3, 7, 14, 28 days;

**ALZET Comments:** Gene therapy; peptides; no stress; enzyme inhibitor (peroxidase); stress/adverse reaction (see pg 1593) "Ref #161 found local trauma and inflammatory responses"; tissue perfusion (scala tympani, cochlea, round window membrane); comparison of middle ear injections vs. mp;

**P9051:** B. N. Song, *et al.* Effects of delayed brain-derived neurotrophic factor application on cochlear pathology and auditory physiology in rats. *Chinese Medical Journal* 2008;121(13):1189-1196

**Agents:** Brain-derived neurotrophic factor, recomb. human **Vehicle:** Albumin, rat; Ringer's solution; **Route:** Ear (cochlea); **Species:** Rat; **Pump:** 2004; **Duration:** 28 days;

**ALZET Comments:** Controls received mp w/ vehicle; animal info (male, albino, Sprague Dawley, 10-12 wks old, 220-250 g.); tissue perfusion (cochlea); functionality of mp verified by residual volume; good methods pg. 1191; pumps were primed in sterile saline at 37 degree Celsius for 48 hours; 1-cm len

**P9218:** R. K. Shepherd, *et al.* Neurotrophins and electrical stimulation for protection and repair of spiral ganglion neurons following sensorineural hearing loss. *Hearing Research* 2008;242(1-2):100-109

**Agents:** Brain-derived neurotrophic factor, recomb. human **Vehicle:** Ringer's solution; Albumin, guinea pig; **Route:** Ear (scala tympani); **Species:** Guinea pig; **Pump:** 2004; **Duration:** 4 weeks;

**ALZET Comments:** Controls received no treatment to contralateral cochlea; functionality of mp verified by residual volume and intact connections; peptides; post op. care (Carprofen, Baytril); tissue perfusion (scala tympani); animal info (pigmented, 400-844 g., kanamycin/furosemide deafened)



**P9224:** J. H. Reyes, *et al.* Glutamatergic Neuronal Differentiation of Mouse Embryonic Stem Cells after Transient Expression of Neurogenin 1 and Treatment with BDNF and GDNF: In Vitro and In Vivo Studies. *Journal of Neuroscience* 2008;28(48):12622-12631

**Agents:** Doxycycline; Brain-derived neurotrophic factor; Glial cell line-derived neurotrophic factor **Vehicle:** Not Stated; **Route:** Ear (scala tympani); **Species:** Guinea pig; **Pump:** 2002; **Duration:** 27 days;

**ALZET Comments:** Controls received no treatment to contralateral ear; pumps replaced; peptides; tissue perfusion (scala tympani); animal info (NIH strain, 275-315 g., deafened); cannula and catheter contained doxycycline, mp contained BDNF/GDNF (delayed delivery) to follow, thus providing 2 days Dox, 25 days BDNF/GDNF

**P9306:** R. Panford-Walsh, *et al.* Midazolam reverses salicylate-induced changes in brain-derived neurotrophic factor and Arg3.1 expression: Implications for tinnitus perception and auditory plasticity. *MOLECULAR PHARMACOLOGY* 2008;74(3):595-604

**Agents:** Midazolam **Vehicle:** Not Stated; **Route:** Ear (round window niche); **Species:** Rat; **Pump:** 2001; **Duration:** 7 days;

**ALZET Comments:** Controls received mp w/ artificial perilymph; comparison of systemic injections vs. mp; animal info (female, Wistar, 200-300 g., cochlear trauma); behavioral testing (tinnitus perception via sound/reward); tissue perfusion (round window niche)

**P9760:** E. M. Keithley, *et al.* Tumor necrosis factor alpha can induce recruitment of inflammatory cells to the cochlea. *OTOLOGY & NEUROTOLOGY* 2008;29(6):854-859

**Agents:** Tumor necrosis factor-alpha **Route:** Ear (cochlea); **Species:** Guinea pig; **Pump:** 2001; **Duration:** 2-4 days;

**ALZET Comments:** Controls received mp w/vehicle; animal info (Hartley albino); tissue perfusion

**P9239:** J. A. Harris, *et al.* Afferent Deprivation Elicits a Transcriptional Response Associated with Neuronal Survival after a Critical Period in the Mouse Cochlear Nucleus. *Journal of Neuroscience* 2008;28(43):10990-11002

**Agents:** Tetrodotoxin **Vehicle:** Citrate buffer; **Route:** Ear (round window niche); **Species:** Mice; **Pump:** 1003D; **Duration:** 24 h

**ALZET Comments:** Controls received mp w/ saline or no treatment to contralateral side; tissue perfusion (round window niche); comparison of cochlear removal vs. mp; animal info (male, female, C57BL/6J, 21 days old)

**P8368:** J. Wang, *et al.* Inhibition of the c-Jun N-terminal kinase-mediated mitochondrial cell death pathway restores auditory function in sound-exposed animals. *Molecular Pharmacology* 2007;71(3):654-666

**Agents:** Jun, c-, N-Terminal kinase Inhibitor-1, D-; peptide, D-TAT; Jun, c-, N-Terminal kinase Inhibitor-1-mutant **Vehicle:** Perilymph, artificial; PBS; **Route:** Ear (round window membrane); **Species:** Guinea pig; **Pump:** 2001; **Duration:** 7 days;

**ALZET Comments:** Controls received mp w/ vehicle, or inactive JNKI-1-mutant or TAT-empt peptide or contralateral untreated ear; dose-response (fig 6); comparison of acute infusion vs. hyaluronic acid gel vs.; enzyme inhibitor (c-Jun N-terminal kinase); peptides; animal info (pigmented, 250-300g.; sound trauma); D-JNKI-1 peptide contains a 10-amino acid HIV-TAT transporter sequece to facilitate its entry into cells; tissue perfusion (round window membrane)

**P8738:** P. Roehm, *et al.* Gentamicin uptake in the chinchilla inner ear. *Hearing Research* 2007;230(1-2):43-52

**Agents:** Gentamicin **Vehicle:** Not Stated; **Route:** Ear (round window); **Species:** Chinchilla; **Pump:** 2002; **Duration:** 1, 3, 6, 14 days; 4, 8 hours;

**ALZET Comments:** Comparison of transtympanic injections vs. mp; tissue perfusion (round window); animal info (male, female, chinchilla langier)

**P8080:** H. Nagano, *et al.* Effects of kallidinogenase on ischemic changes induced by repeated intravitreal injections of endothelin-1 in rabbit retina. *Current Eye Research* 2007;32(2):113-122

**Agents:** Kallidinogenase **Vehicle:** Saline; **Route:** IV (marginal ear vein); **Species:** Rabbit; **Pump:** Not Stated; **Duration:** 4 weeks;

**ALZET Comments:** Controls received mp w/ vehicle; ischemia (retinal); animal info (male, New Zealand, 2.5-3.5 kg.)



**P8661:** J. M. Miller, *et al.* Delayed neurotrophin treatment following deafness rescues spiral ganglion cells from death and promotes regrowth of auditory nerve peripheral processes: Effects of brain-derived neurotrophic factor and fibroblast growth factor. *Journal of Neuroscience Research* 2007;85(9):1959-1969

**Agents:** Brain-derived neurotrophic factor; fibroblast growth factor-1 **Vehicle:** Perilymph, artificial; Ibumin, guinea pig serum; **Route:** Ear (scala tympani); **Species:** Guinea pig; **Pump:** 2002; **Duration:** 26 days;

**ALZET Comments:** Controls received mp w/ vehicle; pumps replaced at day 13; peptides; tissue perfusion (scala tympani); animal info (male, female, pigmented, 250-300g, deafened)

**P8402:** J. Maruyama, *et al.* Effects of antioxidants on auditory nerve function and survival in deafened guinea pigs. *Neurobiology of Disease* 2007;25(2):309-318

**Agents:** Trolox; Neomycin; Ascorbic acid **Vehicle:** Perilymph, artificial; Sodium bicarbonate; **Route:** Ear (cochlea); **Species:** Guinea pig; **Pump:** 2002; **Duration:** 26 days;

**ALZET Comments:** 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)

**P8724:** R. Hori, *et al.* Pharmacological inhibition of Notch signaling in the mature guinea pig cochlea. *NeuroReport* 2007;18(18):1911-1914

**Agents:** MDL 28170 **Vehicle:** DMSO; PBS; **Route:** Ear (cochlea); **Species:** Guinea pig; **Pump:** 1002; **Duration:** 14 days;

**ALZET Comments:** Tissue perfusion (cochlea); enzyme inhibitor (gamma secretase); peptides; animal info (Hartley strain, 350-400g); MDL 28170 is a gamma-secretase inhibitor; 0.3% DMSO used; "a silicon tube (180 micron OD) connected to a micro-osmotic minipump..."

**P8429:** B. L. Frederiksen, *et al.* Does erythropoietin augment noise induced hearing loss? *Hearing Research* 2007;223(1-2):129-137

**Agents:** Erythropoietin **Vehicle:** Not Stated; **Route:** Ear (round window); **Species:** Guinea pig; **Pump:** 1007D; **Duration:** 1 week;

**ALZET Comments:** Controls received mp w/ saline; replacement therapy (noise-induced hearing impairment); comparison of acute admin. vs. mp; peptides; animal info (male, Dunkin-Hartley); tissue perfusion (round window); mp primed 6 hours in 37 Celsius saline; correct catheter placement confirmed

**P8068:** J. Cafaro, *et al.* Atoh1 expression defines activated progenitors and differentiating hair cells during avian hair cell regeneration. *Developmental Dynamics* 2007;236(1):156-170

**Agents:** Uridine, bromodeoxy- **Vehicle:** PBS; **Route:** Ear (perilymphatic fluid); **Species:** Bird (chicken) **Pump:** 2002 **Duration:** 8d

**ALZET Comments:** No stress (see p. 167); Alzet brain infusion kit used; animal info (White Legorn, 5-10 days old)

**P8388:** I. Sendowski, *et al.* Therapeutic efficacy of intra-cochlear administration of methylprednisolone after acoustic trauma caused by gunshot noise in guinea pigs. *Hearing Research* 2006;221(1-2):119-127

**Agents:** Methylprednisolone; Perilymph, artificial **Vehicle:** Perilymph, artificial; **Route:** Ear (scala tympani); **Species:** Guinea pig; **Pump:** 2001; **Duration:** 14 days;

**ALZET Comments:** Controls received mp w/ vehicle, or non-implanted ear; dose-response (fig. 1); pumps replaced after 7 days of artificial perilymph; animal info (pigmented, 400-500g., acoustic trauma, gunshot); tissue perfusion (scala tympani)

**R0239:** R. T. Richardson, *et al.* Inner ear therapy for neural preservation. *Auditory Neuroscience* 2006;11(6):343-356

**Agents:** Nerve growth factor; NT-3; adenovirus; brain-derived neurotrophic factor; perilymph, artificial; glial-derived neurotrophic factor; ciliary neurotrophic factor; fibroblast growth factor, acidic; fibroblast growth factor-1; fibroblast growth factor-2; fibroblast growth factor, basic **Vehicle:** Not Stated; **Route:** Ear (cochlea); ear (scala tympani); **Species:** Guinea pig; **Pump:** Not Stated; **Duration:** 1,2,4,8 weeks; 15-60, 11-12, 26 days;

**ALZET Comments:** Comparison of polymers, hydrogels, gene therapy, cell-based therapy, and injections vs. mp; long-term study; pumps replaced; no stress (see pg. 350); half-life (p. 344), short in blood; gene therapy; peptides; animal info (deafened); Table 2; "The mini-osmotic pump device is ideally suited to studying the effects of neurotrophic factors in the cochlea experimentally." (p. 350); tissue perfusion



**P8176:** A. Radeloff, *et al.* Brain-derived neurotrophic factor treatment does not improve functional recovery after hair cell regeneration in the pigeon. *Acta Otolaryngologica* 2006;126(5):452-459

**Agents:** Brain-derived neurotrophic factor, recomb. human **Vehicle:** PBS; Albumin, chicken; Hank's solution; **Route:** Ear (scala tympani); **Species:** Bird (pigeon); **Pump:** 2002; **Duration:** 8 weeks;

**ALZET Comments:** Controls received mp w/ vehicle or no treatment to contralateral ear; long-term study; pumps replaced every 14 days; ALZET brain infusion kit used; peptides; animal info (*Columba livia*, 6 months old, 320-580 grams); deafening of both ears; tissue perfusion (scala tympani)

**P7898:** A. A. Eshraghi, *et al.* D-JNK1-1 treatment prevents the progression of hearing loss in a model of cochlear implantation trauma. *OTOLOGY & NEUROTOLOGY* 2006;27(4):504-511

**Agents:** Peptide, D-JNK inhibitor 1 **Vehicle:** Perilymph, artificial; **Route:** Ear (cochlea); **Species:** Guinea pig; **Pump:** 2001; **Duration:** 1 week;

**ALZET Comments:** Controls received mp w/ vehicle; no stress (see pg.507); enzyme inhibitor (c-Jun N-terminal kinases); peptides; mp primed overnight in 37 Celsius Ringer solution; "the specificity of this molecule is high and therefore should limit the occurrence of any unwanted side effects." (pg.510); tissue perfusion

**P7331:** A. K. Wise, *et al.* Resprouting and survival of guinea pig cochlear neurons in response to the administration of the neurotrophins brain-derived neurotrophic factor and neurotrophin-3. *Journal of Comparative Neurology* 2005;487(2):147-165

**Agents:** Brain-derived neurotrophic factor, recomb. human; NT-3 **Vehicle:** Not Stated; **Route:** Ear (scala tympani); **Species:** Guinea pig; **Pump:** 2004; **Duration:** 28 days;

**ALZET Comments:** Controls received mp w/ Ringer's solution; cannula patency ascertained by visual inspection; tissue perfusion (scala tympani)

**P7529:** K. Tanaka, *et al.* Post-exposure administration of edaravone attenuates noise-induced hearing loss. *European Journal of Pharmacology* 2005;522(1-3):116-121

**Agents:** Edaravone; saline **Vehicle:** Water; NaOH; **Route:** Ear (cochlea); **Species:** Guinea pig; **Pump:** 2002; **Duration:** 12 hours;

**ALZET Comments:** Controls received no treatment to left ear; pumps replaced, mp w/ saline used then replaced with mp with agent; stability verified for 24 hours; post op. care (antibiotic ointment); animal info (male, Hartley, 300-450 g); tissue perfusion (cochlea)

**P7306:** R. K. Shepherd, *et al.* Chronic depolarization enhances the trophic effects of brain-derived neurotrophic factor in rescuing auditory neurons following a sensorineural hearing loss. *Journal of Comparative Neurology* 2005;486(2):145-158

**Agents:** Brain-derived neurotrophic factor, recomb. human; perilymph, artificial **Vehicle:** Ringer's solution; Albumin, recomb. guinea-pig; **Route:** Ear (scala tympani); **Species:** Guinea pig; **Pump:** 2004; **Duration:** 28 days;

**ALZET Comments:** Controls received mp w/ artificial perilymph or untreated contralateral cochlea; functionality of mp verified by residual fluid, cannula connection and patency; no stress (see pg. 155); good methods; peptides; post op. care (carprofen, Baytril); mp primed 36-48 hours in 37 degrees celsius Ringer's solution; Electrode array also inserted into scala tympani; "We observed no evidence of mechanical trauma to cochlea following long-term implantation and AP or BDNF delivery." (p. 155); tissue perfusion (scala tympani)