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

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;

Agents: Fluvastatin Vehicle: DMSO, Ringer’s Solution; Route: Ear (cochlea); Species: Guinea Pig; Pump: 2004; Duration: 28 days;
ALZET Comments: Dose (fluvastatin 50 μM); animal info (Outbred Hartley guinea pigs 200–500 g); post op. care (Buprenex);

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 INTRACOCHLEAR APPLICATION OF ANTI-INFLAMMATORY AND ANTI-PROLIFERATIVE DRUGS. neuroscience 2016;316(261-278
Agents: Dexamethasone; Ara-C Vehicle: Perilymph, artificial; Route: Ear (cochlea); Species: Rat; Pump: 2001; Duration: 7 days;
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 recieved drug;

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;

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 Tefron tube with inner diameter of 180 um to cannulate cochlea; MDL28170 is a gamma-secretase inhibitor;

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;

**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);


**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:** 28 days;

**ALZET Comments:** Controls received mp w/ artificial perilymph; animal info (young adult, 300-600g); tissue perfusion


**Agents:** FGLM-NH₂; 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-NH₂ also known as Phenylalanine-Glycine-Leucine-Methionine-Amide; SSSR also known as Serine-Serine-Serine-Arginine; tissue perfusion


**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)


**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


**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.”
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

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)

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

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)

Agents: Artemin; brain-derived neurotrophic factor Route: Ear (scala tympani); Species: Guinea pig; Pump: 2002; Duration: 28 days;
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

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)

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)
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

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)

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 (enrofloxacine); “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)

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 pump without electrode implant; animal info (pigmented, adult, 270-470 g); pumps replaced afer 13 days; post op. care (daily injections of cyclosporin and doxycycline); tissue perfusion

Agents: Uridine triphosphate; uridine Vehicle: Not Stated; Route: Ear (cochlea); Species: Guinea pig; Pump: 2002; Duration: 25 days;
ALZET Comments: Controls received mp w/ vehicle; animal info (pigmented, adult, 270-470 g); pumps replaced on day 13; animal info (pigmented, 280-440 g); tissue perfusion

Agents: Brain-derived neurotrophic factor Vehicle: BSA; Route: Ear (cochlea); Species: Guinea pig; Pump: 2004; Duration: 4 weeks;
ALZET Comments: Controls were untreated; animal info (albino, female, 250-350 g); pump connected to Cochlear (R) electrode array; tissue perfusion (cochlea)

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
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.)

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;

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

Agents: Brain-derived neurotrophic factor, recomb. human Vehicle: 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)

Agents: Doxycycline; Brain-derived neurotrophic factor; Gial 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

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)

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

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 sequence to facilitate its entry into cells; tissue perfusion (round window membrane)

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)

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.)

Agents: Brain-derived neurotrophic factor; fibroblast growth factor-1 Vehicle: Perilymph, artificial; Igbumin, 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)

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)

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...”
**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

**Agents:** Uridine, bromodeoxy  
**Vehicle:** PBS;  
**Route:** Ear (perilymphatic fluid);  
**Species:** Bird (chicken);  
**Pump:** 2002;  
**Duration:** 8 days;  
**ALZET Comments:** No stress (see p. 167); Alzet brain infusion kit used; animal info (White Legorn, 5-10 days old)

**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)

**Agents:** Nerve growth factor; NT-3; adenovirus; brain-derived neurotrophic factor; perilymph, artificial; gliad-derived neurotrophic factor; ciliary neurotrophic factor; fibroblast growth factor, acidlic; 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

**Agents:** Brain-derived neurotrophic factor, recomb. human  
**Vehicle:** PBS; Albumin, chicken; Hank’s solution;  
**Route:** Ear (scala tympani);  
**Species:** Guinea pig;  
**Pump:** Not Stated;  
**Duration:** 1 week;  
**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)

**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

**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)
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)

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)

Agents: NT-3, recomb. human; brain-derived neurotrophic factor Vehicle: Ringer's solution; Route: Ear (scala tympani);
Species: Guinea pig; Pump: 2004; Duration: 28 days;
ALZET Comments: Comparison of bolus infusion vs. mp; peptides; animal info (adult, pigmented Dunkin-Hartley, 455g.); tissue perfusion (scala tympani)

Agents: Tetrodotoxin Vehicle: Not Stated; Route: Ear (cochlea perilymphatic space); Species: Guinea pig; Pump: 2002; Duration: 7 days;
ALZET Comments: Controls received mp w/ sterile saline; post op. care (piperacillin sodium); animal info (male, Hartley, 600g.); tissue perfusion (cochlea)