Recent References (2019-2020) on Cancer Research Using ALZET® Osmotic Pumps

Q8564: K. Kawamoto, et al. Cell proliferation analysis is a reliable predictor of lack of carcinogenicity: Case study using the pyrethroid imiprothrin on lung tumorigenesis in mice. Regul Toxicol Pharmacol 2020;113(104646

Agents: uridine, bromodeoxy-; Vehicle: DMSO; Route: SC; Species: Mice; Pump: 2001; Duration: 7 days;
ALZET Comments: Dose (40 mg BrdU/mL); 10% DMSO used; animal info (Male mice aged 9 weeks); bromodeoxyuridine aka BrdU; cancer (carcinogenicity);


Agents: Interleukin-31, recombinant mouse Vehicle: Not stated; Route: Not stated; Species: Mice; Pump: Not stated;
Duration: 3 weeks;
ALZET Comments: Dose (14 ug/day); animal info (BALB/c female mice, 10 weeks old); recombinant mouse Interleukin-31 aka IL-31; cancer (Breast Cancer);


Agents: Apelin-13 Vehicle: CSF, Artificial; Route: CNS/CSF; Species: Mice; Pump: 1002; Duration: 14 days;
ALZET Comments: Dose (30 μg); Controls received mp w/ vehicle; animal info (APLNKO mice); Apelin-13 aka APLN; ALZET brain infusion kit 3 used; Brain coordinates (1 mm anterior and 1.5 mm right to the bregma); cancer (Glioblastoma);


Agents: Carboplatin Vehicle: Not stated; Route: CSF/CNS (intracerebral); IV; Species: Rat; Pump: Not stated; Duration: 7 days;
ALZET Comments: Dose (84 ug/g); animal info (Fischer rats); cancer (Glioma);


Agents: M2BPGI Vehicle: PBS; Route: SC; Species: Mice; Pump: 2002; Duration: 14 days;
ALZET Comments: Dose (3.6 ug/ml/day); Controls received mp w/ vehicle; animal info (female NOD-SCID mice, 7 weeks old, 19-20 g); M2BPGI aka Mac-2-binding protein; cancer (Carcinoma);


Agents: nitro-octadec-9-enoic acid, 10- Vehicle: Saline, DMSO; Route: SC; Species: Mice; Pump: Not stated; Duration: Not stated;
ALZET Comments: Dose (5 mg/kg/day); 50% Saline, 50% DMSO used; Controls received mp w/ vehicle; animal info (KI transgenic mouse, 12-14 weeks); 10-nitro-octadec-9-enoic acid aka nitro-oleate; cancer (tumor proliferation and growth);


Agents: Irinotecan Vehicle: Saline; Route: SC; Species: Mice; Pump: Not stated; Duration: Not stated;
ALZET Comments: Dose (130 ug/h); Controls received mp w/ vehicle; animal info (athymic nude mice); cancer (ewan sarcoma);


Agents: Interleukin-27, recombinant Vehicle: PBS; Route: SC; Species: Mice; Pump: 2004; Duration: 4 weeks;
ALZET Comments: Dose (800 ng); Controls received mp w/ vehicle; animal info (TxA23 mice, 20 g, 5 weeks of age); recombinant Interleukin-27 aka rIL27; cancer (gastric cancer);
Agents: Metformin Vehicle: PBS; Route: SC; Species: Mice; Pump: Not stated; Duration: 7 days;
ALZET Comments: Dose (200 mg/kg/day); Controls received mp w/ vehicle; animal info (C57BL/6 Mice); behavioral testing (Y maze, Open field, Novel place recognition, Elevated plus maze); cancer (Brain Tumors);

Agents: SB225002 Vehicle: DMSO; Route: CNS/CSF (parenchyma); Species: Mice; Pump: 2002; 2001; Duration: 14, 7 days;
ALZET Comments: Dose (15, 30 ug/day); Controls received mp w/ vehicle; animal info (Female C57BL6/N mice); SB225002 aka CXCR2-antagonist; Brain coordinates (1 mm anterior and 2 mm lateral to the bregma); cancer (Brain tumour);

Agents: SB225002 Vehicle: DMSO; Route: CNS/CSF (parenchyma); Species: Mice; Pump: 2002; 2001; Duration: 14, 7 days;
ALZET Comments: Dose (15, 30 ug/day); Controls received mp w/ vehicle; animal info (Female C57BL6/N mice); SB225002 aka CXCR2-antagonist; Brain coordinates (1 mm anterior and 2 mm lateral to the bregma); cancer (Brain tumour);

Agents: Propranolol Hydrochloride Vehicle: PBS; Route: SC; Species: Mice; Pump: Not stated; Duration: Not stated;
ALZET Comments: Dose (2 mg/kg/day); Controls received mp w/ vehicle; animal info (Male BALB/c nude mice (5weeks old, weighing ~20 g)); cancer (gastric cancer);

Agents: Rapamycin, LY294002, Interleukin-1Receptor antagonist, SC144, etanercept, Vehicle: CSF, artificial; Route: CSF/CNS (midbrain periaqueductal gray); Species: Rat; Pump: Not Stated; Duration: Not Stated;
ALZET Comments: animal info (200-250 gr Wistar rats); rapamycin is an mTOR inhibitor; LY294002 is a PI3K inhibitor; IL-1Ra is an IL-1b receptor antagonist, etanercept is a TNF-a receptor antagonist; ALZET brain infusion kit used; Brain coordinates (7.6 mm posterior to the bregma, 0.65mm lateral to the midline, and 4.2 mm ventral to the brain surface); Therapeutic indication (bone cancer pain);

Agents: IPI-9119 Vehicle: 1-methyl-2-pyrrolidinone; sodium phosphate buffer; Route: SC; Species: Mice; Pump: 2002; Duration: 4 weeks;
ALZET Comments: Dose (100 mg/mL); 20% 1-methyl-2-pyrrolidinone used; enzyme inhibitor (fatty acid synthase); cancer (prostate); no stress: Mice did not show any signs of toxicity, stress, weight loss, or changes in feeding behavior. (see pg. 635);

Agents: 9.2.27-PE38KDEL immunotoxin, ABT-737 Vehicle: PBS, captisol, mouse serum albumin; Route: CSF/CNS (intratumoral); Species: Mice (nude); Pump: 1007D; Duration: 3 days;
ALZET Comments: 5% Captisol and 2% mouse serum albumin used; enzyme inhibitor (fatty acid synthase); cancer (glioblastoma); "Convection-enhanced delivery (CED), utilizing osmotic pumps, has been successfully used to bypass the blood-brain barrier and to deliver ITs directly into brain tumors" pg.12 ;

Agents: NRG-1 Vehicle: PBS; Route: SC; Species: Mice; Pump: Not Stated; Duration: 24 hours;
ALZET Comments: Dose (10 ug/d); Controls received mp w/ vehicle; post op. care (carprofen); cancer (breast);

Agents: Epoxyoctadecenoic acid, 12,13- Vehicle: DMSO, PEG 400; Route: SC; Species: Mice; Pump: 1004; Duration: 4 weeks;

ALZET Comments: Dose (2 mg/kg/day); 1:1 DMSO:PEG 400 used; Controls received mp w/ vehicle; animal info (C57BL/6 male mice (age = 6 weeks)); cancer (colon);


Agents: Topotecan Vehicle: Saline; Route: CSF/CNS (ventricle); Species: Mice; Pump: 2004; Duration: 28 days;

ALZET Comments: Dose (5.28 μg/day); Controls received mp w/ vehicle; animal info (J:NU mice (homozygous for the Foxn1nu mutation); comparison of bolus dosing vs mp; cancer (Leptomeningeal medulloblastoma);

Q8369: G. Pirovano, et al. 2019;

Agents: (Iodine-123 Meitner-Auger PARP1 inhibitor Vehicle: PEG; PBS; Route: CNS/CSF; Species: Mice; Pump: 1003D; Duration: 3 days;

ALZET Comments: 30% PEG/PBS used; (Iodine-123 Meitner-Auger PARP1 inhibitor aka 123 I-MAPi; enzyme inhibitor ((Iodine-123 Meitner-Auger PARP1 inhibitor); ALZET brain infusion kit 3 used; cancer (Glioblastoma);


Agents: Sulfasalazine Vehicle: Ammonium Hydroxide; Route: IP; Species: Mice; Pump: 1002; Duration: 14 days;

ALZET Comments: Dose (6.6 mg/kg/day); Controls received mp w/ vehicle; animal info (BALBl/c, 4-6 weeks old); behavioral testing (Nociception Test); Sulfasalazine aka SSZ; cancer (Cancer -induced pain);


Agents: 5-bromo-20-deoxyuridine Vehicle: Saline; Route: SC; Species: Mice; Pump: Not stated; Duration: 5 days;

ALZET Comments: Dose (200-250 mg/ml); animal info (C3H/He, 8-11 weeks old, 22.1 g); 5-bromo-20-deoxyuridine aka BrdU; cancer (Tumor Cells);


Agents: apelin-F13A, DC101, Antibody,anti-VEGFR2 Vehicle: CSF, artificial; Route: CNS/CSF (intratumoral); Species: Mice; Pump: 1002; 2004; Duration: 14 and 28 days;

ALZET Comments: Dose (30 or 60 μg of apelin-F13A, 0.8 mg of DC101); apelin-F13A is a mutant APLNR ligand, DC101 is a VEGFR2-blocking antibody; ALZET brain infusion kit 3 used; cancer (glioblastoma);


Agents: Necuparanib Vehicle: Saline; Route: SC; Species: Mice; Pump: 1004; Duration: Not stated;

ALZET Comments: Dose (40 mg/kg/day); Controls received mp w/ vehicle; animal info (C57bl/6/FVB); cancer (Pancreatic);


Agents: Selisistate Vehicle: Not Stated; Route: SC; Species: Mice; Pump: 10074D; Duration: 1 week;

ALZET Comments: Dose (0.5 lg/h); Controls received mp w/ vehicle; animal info (Male BALB/c mice (20–30 g)); cancer (pain); Therapeutic indication (cancer pain (nociception));

Agents: Cydn-4-36, Temozolomide, or both Vehicle: DMSO; Route: SC; Species: Mice; Pump: Not stated; Duration: 14 days; 
ALZET Comments: Dose (Cydn- 150 mg/kg/day or TMZ-20 mg/kg/day); animal info (8-10 weeks old, BALB/c nu/nu); Cydn-4-36 aka dynamin inhibitor, TMZ aka temozolomide aka DNA-alkylating prodrug; enzyme inhibitor (Dynamin inhibitor); cancer (Glioma); 

Agents: C646 Vehicle: PBS, DMSO; Route: SC; Species: Mice; Pump: Not Stated; Duration: 14 days; 
ALZET Comments: Dose (10 mg/kg/day); 50% DMSO used; animal info (8-week-old male C57BL/6 mice); C646 is a specific pharmacological inhibitor of p300; cancer (Lewis lung carcinoma); Therapeutic indication (Muscle wasting); 

Agents: Angiotensin (1-7) Vehicle: CSF, artificial; Route: SC; Species: Rat; Pump: Not Stated; Duration: 14 days; 
ALZET Comments: Dose (1 pmol/0.5 μl/h, 100 pmol/0.5 μl/h or 10 nmol/0.5 μl/h per 3 times/week); Controls received mp w/ vehicle; animal info (Male Sprague–Dawley rats of 280–320 g); cancer (Brain Glioma); 

Agents: Folic acid-conjugated cytochrome c-containing nanoparticles Vehicle: Saline; Route: CSF/CNS; Species: Mice; Pump: 2004; Duration: 14 days; 
ALZET Comments: Dose (100 mg/mL); Controls received mp w/ vehicle; animal info (C57BL/6, 12-16 weeks old); Folic acid-conjugated cytochrome c-containing nanoparticles aka FA-CytC NPs ; ALZET brain infusion kit 3 used; Brain coordinates (2 mm lateral, 1 mm caudal and 3 mm ventral a small burr hole); cancer (Glioma); 

Agents: DV1 Vehicle: Saline; Route: CSF/CNS (left ventricle); Species: Mice (nude); Pump: 1007D; Duration: 7 days; 
ALZET Comments: Dose (50 mg/kg/day); Controls received mp w/ vehicle; animal info (female athymic nude mice, 8 weeks old,); DV1 is a synthetic inhibitor of Chemokine receptor 4 (CXC4); ALZET brain infusion kit 3 used; cyanoacrylate adhesive; cancer (breast); the skin incision was closed with Vetbond; Brain coordinates (skull at 0.3 mm posterior, 1.0 mm lateral to the bregma, 3.0mm deep); 

Q6967: M. Kondo, et al. Involvement of peroxisome proliferator-activated receptor-alpha in liver tumor production by permethrin in the female mouse. Toxicol Sci 2019; 
Agents: Uridine, Bromodeoxy Vehicle: DMSO; Route: SC; Species: Mice; Rat; Pump: 2001; 2ML2; Duration: 7 days; 
ALZET Comments: Dose (8.4 mgBrdU/mouse.; 33.6 mg BrdU/rat); 10% DMSO used; cancer (liver); stress/adverse reaction: One animal was dead due to anesthesia at implantation of osmotic pump; 

Agents: Chloridotetrakis (ibuprofenato)diruthenium-(II,III) Vehicle: Not Stated; Route: Not Stated; Species: Rat; Pump: Not Stated; Duration: Not Stated; 
ALZET Comments: cancer (glioma); 

Agents: Nerve growth factor, human Vehicle: Saline, sterile; Route: SC; Species: Mice; Pump: Not stated; Duration: 14 days; 
ALZET Comments: Dose (40 or 80 ng/h); Controls received mp w/ vehicle; animal info (Five-week-old BALB/c Slc nu/nu mice); human nerve growth factor aka NGF; cancer (Tumor growth);
Agents: pteroyl-closo-dodecaborate conjugate Vehicle: Not Stated; Route: CSF/CNS (surface of brain); Species: Rat; Pump: 2001D; Duration: 2 hours, 6 hours, 24 hours;
ALZET Comments: Dose (200 μl/24 h); Controls received no treatment; animal info (male, Fischer, F98 glioma-bearing, 200-240g); PBC is a novel boron compound that interacts with the folate receptor containing a pteroyl group and closo-dodecaborate; Brain coordinates (1-mm posterior and 4-mm right lateral positions to the bregma, 5 mm from the dura); cancer (glioma); “In addition, CED offers a great pharmacokinetic advantage over systemic administration due its convective effects (i.e., CED uses pressure-driven bulk flow of infusate to deliver therapeutic agents directly into the solid tissue. The bulk flow is created by a small pressure gradient from a pump that pushes the solute through a catheter) (Bobo et al. 1994). It is noted that it is possible to have a high concentration and extensive drug distribution in the brain tumor, while only a small amount of drug is distributed to other systemic organs resulting in very little systemic toxicity.” pg.65 ; Therapeutic indication (boron-delivery agent for boron neutron capture therapy of tumor cells);

Agents: fluorouracil, 5- Vehicle: Saline; Route: SC; Species: Mice; Pump: Not Stated; Duration: 7 days;
ALZET Comments: Dose (10, 30 mg/kg/day); Controls received mp w/ vehicle; animal info (5.5 weeks, male, athymic, Balb-c/nu); cancer (colorectal); “An equivalent dose of 5-FU (JW Pharmaceutical, Seoul, Korea) was continuously delivered by osmotic pumps (Direct, Cupertino, CA, USA) over 7 days, to minimize possible side effects of severe weight loss by repeated bolus injections of 5-FU [26].” pg.112; Therapeutic indication (improved effectiveness of capecitabine (5-FU precursor) monotherapy due to synergistic effect with MEK inhibitor);

Agents: Etoposide, Bevacizumab, IMCA12, Interleukin-13-PE38, Tetrakis Chlorin Vehicle: Not Stated; Route: CSF/CNS (intratumoral); Species: Mice, Rat; Pump: 2001D, 1003D, 1007D, 1004, 2004; Duration: 24 hours, 3, 7, 21, 28 days;
ALZET Comments: ALZET brain infusion kit 1,2, and 3 used; cancer (Glioblastoma);

Agents: Aspirin-triggered specialized pro-resolving mediators Vehicle: Not stated; Route: SC; Species: Mice; Pump: Not stated; Duration: 14 days;
ALZET Comments: Dose (0.6 ug/kg/day); animal info (6-8 weeks old, C57BL/6); Aspirin-triggered specialized pro-resolving mediators aka AT-SPMs ; cancer (Tumor growth);

Agents: PTUPB Vehicle: Not Stated; Route: IP; Species: Mice (SCID); Pump: Not Stated; Duration: 4 weeks;
ALZET Comments: Dose (30 mg/kg/d); animal info (6-wk-old female C57BL/6 or SCID mice); PTUPB aka 4-(5-phenyl-3-{3-[4-(trifluoromethyl-phenyl)-ureido]-propyl}-pyrazol-1-yl) benzenesulfonamide is a dual COX-2/sEH inhibitor; enzyme inhibitor (cyclooxygenase-2 and soluble epoxide hydrolase); cancer (ovarian);

Agents: CCT196969, LY3009120, MLN2480; Vehicle: DMSO; Route: IP; Species: Mice (knockout); Pump: 1003D; Duration: 48 hours;
ALZET Comments: Dose: CCT196969 (5 mg/ml), LY3009120 (3 mg/ml), MLN2480 (5 mg/ml); animal info (WT and Mdr1a/b -/-; Bcrp1-/- mice, 8–16-week-old, approx. 15–35 grams); panRAF inhibitors; brain tissue distribution (p. 458); cancer (melanoma);

**Agents:** Cisplatin  
**Vehicle:** Saline  
**Route:** CSF/CNS  
**Species:** Mice  
**Pump:** 1003D  
**Duration:** 3 days

**ALZET Comments:** Dose (1080, 120, or 12 ug/kg/day); 0.9% Saline used; animal info (C57BL/6, NSG, 8-10 weeks old, 18-21 weeks old); ALZET brain infusion kit 3 used; cyanoacrylate adhesive; cancer (Glioma);


**Agents:** Bevacizumab; RNA, small interfering (anti-HIF-1α/PEG); Immunotoxin, DTAT/DATEGF; Endostatin; 17-ODYA; Miconazole  
**Vehicle:** Not Stated  
**Route:** CSF/CNS (intratumoral), IV  
**Species:** Mice  
**Pump:** Not Stated  
**Duration:** Not Stated

**ALZET Comments:** enzyme inhibitor (CYP epoxygenase); cancer (glioblastoma); This review describes methods (including convection-enhanced delivery devices, implantable polymer devices, nanocarriers, and cellular vehicles) to deliver antiangiogenic factors to intracranial tumors.


**Agents:** Bortezomib  
**Vehicle:** Not stated  
**Route:** CSF/CNS  
**Species:** Not stated  
**Pump:** Not stated  
**Duration:** Not stated

**ALZET Comments:** Dose (200 ul); cancer (Glioblastoma);


**Agents:** WP1130  
**Vehicle:** Not stated  
**Route:** CSF/CNS (caudate nucleus)  
**Species:** Mice  
**Pump:** Not stated  
**Duration:** 7 days

**ALZET Comments:** Dose (25 mg/kg at 0.5 μl/h); Controls received mp w/ vehicle; animal info (NO D/SCID); WP1130 is a USP9X inhibitor; enzyme inhibitor (USP9X); Brain coordinates (2 mm anterior, 2 mm lateral, 3 mm depth from the dura); Cannula placement verified via MRI after removal of the pump system.; cancer (glioblastoma); MRI; vehicle use stated but identity not listed in paper.; Therapeutic indication (promotes robust polyubiquitylation of ALDH1A3, which results in a marked reduction in ALDH1A3 protein levels and functional activity, leading to attenuation of the tumor-initiating ability of MES GSCs);


**Agents:** Not Stated  
**Vehicle:** Saline  
**Route:** CSF/CNS (nucleus striatum)  
**Species:** Mice (SCID)  
**Pump:** Not stated  
**Duration:** 2 weeks

**ALZET Comments:** ALZET brain infusion kit 3 used; cyanoacrylate adhesive; cancer (glioblastoma multiforme); good method; Methods paper describing local intracranial delivery of drugs by osmotic mini-pumps.


**Agents:** Fenoldopam  
**Vehicle:** Not stated  
**Route:** SC  
**Species:** Mice  
**Pump:** Not stated  
**Duration:** 3 weeks

**ALZET Comments:** animal info (Athymic nude mice); Fenoldopam mesylate aka fenoldopam; cancer (Breast);


**Agents:** Porcine  
**Vehicle:** Saline  
**Route:** SC  
**Species:** Mice  
**Pump:** 1007D  
**Duration:** 5 days

**ALZET Comments:** Dose (1mg/kg per day); Controls received mp w/ vehicle; animal info (Adult (3–4 months old) Swiss-Webster female and male mice); cancer (Transgenic mice overexpressing growth hormone (GH) spontaneously develop liver tumors);

Agents: E6201  Vehicle: Water, sterile;  Route: IP;  Species: Mice;  Pump: 1003D;  Duration: 7 hours;
ALZET Comments: Dose (6 μg/h); Controls received mp w/ agent; animal info (8-15 weeks, FVB and Mdr1a/b(-/-)Bcrp1(-/-)); Resultant plasma level ((26.54±4.60 ng/mL in WT; 18.57±2.46 ng/mL in Mdr1a/b(-/-)Bcrp1(-/-)); E6201 is an ATP-competitive MEK1 inhibitor that has demonstrated preclinical activity in BRAF V600E mutant melanoma cell lines; enzyme inhibitor (MEK1); cancer (Malignant melanoma); The half-life for E6201 in mice is approximately 45 min and so an infusion lasting for 7 h was considered sufficient to attain steady-state E6201 levels in both plasma and brain. Brain concentration levels of E601 measured at 48.22±20.99 ng/g in WT and 82.32 ± 21.59 ng/g in Mdr1a/b(-/-)Bcrp1(-/-);
Therapeutic indication (E6201 has promising brain distribution properties for the treatment of brain metastases and has demonstrated effectiveness in cell lines with known MAPK pathway resistance, including the MEK1-C1215 resistance mutation);