



## References on the Administration of Cytokines Using ALZET® Osmotic Pumps

### 1. Granulocyte-Macrophage Colony Stimulating Factor

**Q3634:** F. Zhu, *et al.* MINOCYCLINE ALLEVIATES BEHAVIORAL DEFICITS AND INHIBITS MICROGLIAL ACTIVATION INDUCED BY INTRAHIPPOCAMPAL ADMINISTRATION OF GRANULOCYTE-MACROPHAGE COLONY-STIMULATING FACTOR IN ADULT RATS. *Neuroscience* 2014;266(275-281

**Agents:** Colony-stimulating factor, GM, recombinant rat **Vehicle:** Saline; **Route:** CSF/CNS (hippocampus); **Species:** Rat; **Pump:** 1007D; **Duration:** 14 days;

**ALZET Comments:** Controls received mp w/ vehicle; animal info (male, Sprague Dawley, 280-320g); ALZET brain infusion kit 3 used; Multiple pumps per animal (2); behavioral testing (locomotor activity; social interaction test; PPI); used dental acrylic resin; schizophrenia;

**Q0753:** G. Driessens, *et al.* Development of a successful antitumor therapeutic model combining in vivo dendritic cell vaccination with tumor irradiation and intratumoral GM-CSF delivery. *Cancer Immunology, Immunotherapy* 2011;60(2):273-281

**Agents:** Colony-stimulating factor, GM **Vehicle:** Not Stated; **Route:** SC; **Species:** Rat; **Pump:** 2004; **Duration:** 28 days;

**ALZET Comments:** Animal info (male, inbred, Fischer 344, 10-12 wks old); comparison of "all in-vivo therapy" vs mp; cancer

**P8510:** H. R. Djalilian, *et al.* Efficacy of an osmotic pump delivered, GM-CSF-based tumor vaccine in the treatment of upper aerodigestive squamous cell carcinoma in rats. *Cancer Immunology, Immunotherapy* 2007;56(8):1207-1214

**Agents:** Colony-stimulating factor, GM, murine; interleukin-12 **Vehicle:** PBS; **Route:** SC; **Species:** Rat; **Pump:** Not Stated; **Duration:** 28 days;

**ALZET Comments:** Controls received mp w/ vehicle; dose-response (fig 1); no stress (see pg. 1209); cancer (upper aerodigestive tract carcinoma); peptides; animal info (Fisher 344, 125-150 g); good methods; "This latter method (mp) has several advantages. First, the use of minipumps obviates the cumbersome need to transfect tumor cells and completely characterize their cytokine repertoires. Second, it allows for independent and rigorous control over the kinetics of administration of cytokine and antigen dosages. Third, it may generate less controversy than those techniques requiring "gene therapy" IRB approval." (p. 1213).

**P7935:** J. C. Chen, *et al.* Effects of irradiated tumor vaccine and infusion of granulocyte-macrophage colony-stimulating factor and interleukin-12 on established gliomas in rats. *Cancer Immunology, Immunotherapy* 2006;55(7):873-883

**Agents:** Colony-stimulating factor, GM, recomb. mouse; interleukin-12, recomb. mouse **Vehicle:** BSA; PBS; **Route:** SC; **Species:** Rat; **Pump:** 2002; **Duration:** 14 days;

**ALZET Comments:** Controls received mp w/ vehicle or no treatment; cancer (RT-2 glioma); peptides; animal info (Fischer, 200-350 grams, SC and ICV tumors); "continuously infused cytokine using an osmotic mini pump to...avoid the side effects of a single large dose of cytokine and one with a concept similar to that of gene-therapy." (p. 874)

**P6450:** W. C. Jean, *et al.* Effects of combined granulocyte-macrophage colony-stimulating factor (GM-CSF), interleukin-2, and interleukin-12 based immunotherapy against intracranial glioma in the rat. *Journal of Neuro-oncology* 2004;66(1-2):39-49

**Agents:** Colony-stimulating factor, GM; interleukin-2; interleukin-12 **Vehicle:** Not Stated; **Route:** SC; **Species:** Rat; **Pump:** 2004; **Duration:** 4 weeks;

**ALZET Comments:** Cancer (gliosarcoma); GM-CSF was infused alone or with cytokines

### 2. Macrophage Colony Stimulating Factor

**Q0623:** S. A. Lloyd, *et al.* Administration of high-dose macrophage colony-stimulating factor increases bone turnover and trabecular volume fraction. *JOURNAL OF BONE AND MINERAL METABOLISM* 2009;27(5):546-554



**ALZET Comments:** Colony-stimulating factor, M; SC; Mice; 28 days; Animal info (male, C57BL/6 J, 7 wks old); comparison of SC injections vs mp; lack of cortical response in both daily injection and pump studies, pg 550.

**P3103:** D. A. Vallera, *et al.* Antitumor protection from the murine T-cell leukemia/lymphoma EL4 by the continuous subcutaneous coadministration of recombinant macrophage-colony stimulating factor and interleukin-2. *Cancer Res* 1993;53(4273-4280

**ALZET Comments:** Colony-stimulating factor, M; Interleukin-2; Granulocyte-colony stimulating factor; SC; mice; no duration posted; controls received mp with PBS; cancer; immunology; peptides; M-CSF + IL-2 given concomitantly provided best antitumor protection; recomb. IL-2 used; human G-CSF used.

### 3. Erythropoietin

**Q8045:** E. K. Kim, *et al.* Local Subcutaneous Injection of Erythropoietin Might Improve Fat Graft Survival, Whereas Continuous Infusion Using an Osmotic Pump Device Was Harmful by Provoking an Overwhelming Foreign Body Reaction in a Nude Mouse Model. *Archives of Aesthetic Plastic Surgery* 2018;24(3):128-133

**Agents:** Erythropoietin **Vehicle:** Saline; **Route:** SC; **Species:** Mice; **Pump:** 1007D; **Duration:** 1 week;

**ALZET Comments:** Dose (1,000 IU of EPO); animal info (36 weeks old, CD-1, Male, 20-25 g); EPO aka hemangiogenic and antiapoptotic factor ; dependence;

**Q4880:** E. H. Sanchez-Mendoza, *et al.* Implantation of Miniosmotic Pumps and Delivery of Tract Tracers to Study Brain Reorganization in Pathophysiological Conditions. *Journal of Visualized Experiments* 2016;107(1-9

**Agents:** Erythropoietin, recombinant human **Vehicle:** Not Stated; **Route:** CSF/CNS; **Species:** Mice; **Pump:** Not Stated; **Duration:** 30 days;

**ALZET Comments:** Controls received mp w/ vehicle; animal info (C57BL6); good methods (Jove Video; picture of pump and implantation pg. 4); ischemia (cerebral); post op. care (Carprofen 4 mg/kg); behavioral testing (rotarod test; hand grip strength); cyanoacrylate adhesive; "In this work we have shown the method of implantation of minipumps with a cannula connected to the skull in order to deliver the plasticity promoting protein rhEpo directly into the ventricle, thus circumventing the BBB." pg 8; Cannula placement verified via histologic analysis "The are no evident severe tissue alterations based on Nissl staining as compared to the corresponding contralateral area";

**Q6648:** M. Rauner, *et al.* Increased EPO Levels Are Associated With Bone Loss in Mice Lacking PHD2 in EPO-Producing Cells. *J Bone Miner Res* 2016;31(10):1877-1887

**Agents:** Erythropoietin, recomb. human **Vehicle:** Not Stated; **Route:** SC; **Species:** Mice (knockout); Mice (transgenic); **Pump:** Not Stated; **Duration:** 30 days;

**ALZET Comments:** Dose (3 U EPO/day or 10 U EPO/day ); Controls received mp w/ vehicle; animal info (8-12 week old WT and *Osx:cre-PHD2f/f* and *Vav:cre-PHD2f/f* mice);

**Q3130:** G. B. Wang, *et al.* The AKT/mTOR pathway mediates neuronal protective effects of erythropoietin in sepsis. *MOLECULAR AND CELLULAR BIOCHEMISTRY* 2014;385(1-2):125-132

**Agents:** Erythropoietin, human recombinant **Vehicle:** PBS; BSA; **Route:** SC; **Species:** Rat; **Pump:** Not Stated; **Duration:** 1 week;

**ALZET Comments:** Controls received mp w/ vehicle or sham surgery; animal info (Sprague Dawley, 120 days old, 240-280g); behavioral testing (open field exploration, inhibitory avoidance, Morris water maze);

**Q3518:** M. S. Jeffers, *et al.* Epidermal Growth Factor and Erythropoietin Infusion Accelerate Functional Recovery in Combination With Rehabilitation. *Stroke* 2014;45(185-+

**Agents:** Epidermal Growth Factor; erythropoietin **Vehicle:** CSF, artificial; **Route:** CSF/CNS; **Species:** Rat; **Pump:** 2001; **Duration:** 14 days;

**ALZET Comments:** Animal info (male, Sprague Dawley); pumps replaced every 7 days; ischemia (cerebral); behavioral testing (staircase test); pumps removed 7 days after serial implantation;



#### 4. Interferon

**Q8018:** R. Gutierrez Jauregui, *et al.* IL-1beta Promotes Staphylococcus aureus Biofilms on Implants in vivo. *Front Immunol* 2019;10(1082)

**Agents:** Interleukin-1 beta; Interleukin-6; Interleukin-10; Interleukin-12; Interleukin-17; Interleukin-23; Interferon, gamma; Tumor Necrosis Factor, alpha; Interleukin-1 beta, anti; Transforming Growth Factor-B1, anti **Vehicle:** Saline; **Route:** SC; **Species:** Mice; **Pump:** 1007D; **Duration:** Not stated;

**ALZET Comments:** Dose (IL-1B- 83 ug/ml, IL-6-83 ug/ml, IL-10-166 ug/ml, IL-12-83 ug/ml, IL-17-125 ug/ml, IL-23- 126 ug/ml, IFN $\gamma$ -83 ug/ml, TNFa-166 ug/ml, anti-TGF-B1-166 ug/ml, or anti-IL-1B-150 ug/ml); Controls received mp w/ vehicle; animal info (8-12 weeks old, Female, C57BL/6); immunology;

**Q7344:** R. Gutierrez Jauregui, *et al.* IL-1beta Promotes Staphylococcus aureus Biofilms on Implants in vivo. *Front Immunol* 2019;10(1082)

**Agents:** Interleukin-1 beta; Interleukin-6; Interleukin-10; Interleukin-12; Interleukin-17; Interleukin-23; Interferon, gamma; Tumor Necrosis Factor, alpha; Interleukin-1 beta, anti; Transforming Growth Factor-B1, anti **Vehicle:** PBS; **Route:** SC; **Species:** Mice; **Pump:** 1007D; **Duration:** 10 Days;

**ALZET Comments:** Dose (IL-1b (83 $\mu$ g/ml); IL-6 (83 $\mu$ g/ml); IL-10 (166 $\mu$ g/ml); IL-12 (83 $\mu$ g/ml); IL-17 (125 $\mu$ g/ml); IL-23 (166 $\mu$ g/ml); IFN $\gamma$  (83 $\mu$ g/ml); TNFa (166 $\mu$ g/ml); anti-TGF-b1 (166 $\mu$ g/ml); anti-IL-1b (150 $\mu$ g/ml)); Controls received mp w/ vehicle; animal info (Eight- to twelve-week-old female C57BL/6 mice); Immunology (“evaluate the suitability of osmotic pumps as a model for biofilms in implant associated infections, we implanted osmotic pumps pre-colonized with bioluminescent Staphylococcus aureus”);

**Q7192:** A. Kimura, *et al.* Protective Roles of Interferon-gamma in Cardiac Hypertrophy Induced by Sustained Pressure Overload. *J Am Heart Assoc* 2018;7(6):

**Agents:** Interferon, gamma **Vehicle:** Not Stated; **Route:** SC; **Species:** Mice; **Pump:** 1007D; **Duration:** 7 days; **ALZET Comments:** Dose (15 uM/d); animal info (8-10 week old, male, BALB/c); cardiovascular;

**Q4560:** L. Pereira, *et al.* IFN gamma regulates proliferation and neuronal differentiation by STAT1 in adult SVZ niche. *Frontiers in Cellular Neuroscience* 2015;9(U1-U10)

**Agents:** Interferon, gamma **Vehicle:** Saline; **Route:** CSF/CNS (third ventricle); **Species:** Mice; **Pump:** 1007D; **Duration:** 7 days;

**ALZET Comments:** Controls received mp w/ vehicle; animal info (male, STAT2 KO or 129S6/SvEv); immunology;

**Q5030:** C. Hoyo-Becerra, *et al.* Rapid Regulation of Depression-Associated Genes in a New Mouse Model Mimicking Interferon-alpha-Related Depression in Hepatitis C Virus Infection. *Mol Neurobiol* 2015;52(1):318-29

**Agents:** Interferon-a, murine; polyinosinic/polycytidylic acid **Vehicle:** PBS; **Route:** CSF/CNS; **Species:** Mice; **Pump:** 1002; **Duration:** 14 days;

**ALZET Comments:** Controls received mp w/ vehicle; animal info (C57BL6J); behavioral testing (open field test; tail suspension test; forced swimming test); polyinosinic/polycytidylic acid is a toll-like receptor-3 agonist; Dose (mIFN-a 250 IU/day; poly(I:C) 1 ug/day);

#### 5. Interleukin-1

**Q7035:** Y. P. Zhang, *et al.* Mifepristone attenuates depression-like changes induced by chronic central administration of interleukin-1beta in rats. *Behavioural Brain Research* 2018;347(436-445)

**Agents:** Interleukin-1 beta **Vehicle:** Saline, pyrogen-free; **Route:** CSF/CNS (lateral ventricle); **Species:** Rat; **Pump:** 1002; **Duration:** 14 days;



**ALZET Comments:** Dose (10 ng/7uL/rat/day); Controls received mp w/ vehicle; animal info (Male Sprague Dawley rats (220–260 g)); behavioral testing (open field, elevated plus maze and sucrose preferencet); ALZET brain infusion kit used; Brain coordinates (AP=-1 mm, ML=+1.4 mm, DV=-1 mm); Therapeutic indication (depression);

**Q6989:** Y. P. Zhang, *et al.* Mifepristone attenuates depression-like changes induced by chronic central administration of interleukin-1beta in rats. *Behavioural Brain Research* 2018;347(436-445)

**Agents:** Interleukin-1 beta **Vehicle:** Saline; **Route:** CSF/CNS (lateral ventricle); **Species:** Rat; **Pump:** 1002; **Duration:** 14 days; **ALZET Comments:** Dose (10 ng/7uL/rat/day); animal info (Male Sprague Dawley rats (220–260 g)); behavioral testing (open field, elevated plus maze and sucrose preferencet); functionality of mp verified by residual volume; ALZET brain infusion kit used; Brain coordinates (AP=-1 mm, ML=+1.4 mm, DV=-1 mm.); Cannula placement verified via sectioning the brains coronally;

**Q6320:** M. L. Bonnemaïson, *et al.* Interleukin-1beta as a driver of renal NGAL production. *Cytokine* 2017;91(38-43)

**Agents:** Interleukin-1 beta, mouse recomb. **Vehicle:** PBS; **Route:** SC; **Species:** Mice; **Pump:** 1002; **Duration:** 14 days; **ALZET Comments:** Dose (10 ng/h); 0.1% bovine serum albumin used; animal info (12-week-old male C57Bl/6 mice);

**Q5171:** S. Okizaki, *et al.* Vascular Endothelial Growth Factor Receptor Type 1 Signaling Prevents Delayed Wound Healing in Diabetes by Attenuating the Production of IL-1beta by Recruited Macrophages. *American Journal of Pathology* 2016;186(6):1481-98

**Agents:** Placenta growth factor, recombinant human; antibody, interleukin-1B **Vehicle:** PBS; **Route:** SC; **Species:** Mice; **Pump:** 1007D; **Duration:** 7 days;

**ALZET Comments:** Controls received mp w/ vehicle or control antibody; animal info (male, C57BL6, 8 weeks old, STZ); immunology; diabetes; Dose (PIGF 10 ug/mouse; anti-IL-1B 1 ug/day);

**Q6636:** C. S. Nunemaker. Considerations for Defining Cytokine Dose, Duration, and Milieu That Are Appropriate for Modeling Chronic Low-Grade Inflammation in Type 2 Diabetes. *J Diabetes Res* 2016;2016(2846570)

**Agents:** Interleukin-1beta; Interleukin-6 **Vehicle:** Saline; **Route:** SC; **Species:** Mice; **Pump:** 1007D; **Duration:** 7 days; **ALZET Comments:** Dose (32

## 6. Interleukin-2

**Q8018:** R. Gutierrez Jauregui, *et al.* IL-1beta Promotes Staphylococcus aureus Biofilms on Implants in vivo. *Front Immunol* 2019;10(1082)

**Agents:** Interleukin-1 beta; Interleukin-6; Interleukin-10; Interleukin-12; Interleukin-17; Interleukin-23; Interferon, gamma; Tumor Necrosis Factor, alpha; Interleukin-1 beta, anti; Transforming Growth Factor-B1, anti **Vehicle:** Saline; **Route:** SC; **Species:** Mice; **Pump:** 1007D; **Duration:** Not stated;

**ALZET Comments:** Dose (IL-1B- 83 ug/ml, IL-6-83 ug/ml, IL-10-166 ug/ml, IL-12-83 ug/ml, IL-17-125 ug/ml, IL-23- 126 ug/ml, IFN $\gamma$ -83 ug/ml, TNFa-166 ug/ml, anti-TGF-B1-166 ug/ml, or anti-IL-1B-150 ug/ml); Controls received mp w/ vehicle; animal info (8-12 weeks old, Female, C57BL/6); immunology;

**Q7344:** R. Gutierrez Jauregui, *et al.* IL-1beta Promotes Staphylococcus aureus Biofilms on Implants in vivo. *Front Immunol* 2019;10(1082)

**Agents:** Interleukin-1 beta; Interleukin-6; Interleukin-10; Interleukin-12; Interleukin-17; Interleukin-23; Interferon, gamma; Tumor Necrosis Factor, alpha; Interleukin-1 beta, anti; Transforming Growth Factor-B1, anti **Vehicle:** PBS; **Route:** SC; **Species:** Mice; **Pump:** 1007D; **Duration:** 10 Days;

**ALZET Comments:** Dose (IL-1b (83 $\mu$ g/ml); IL-6 (83 $\mu$ g/ml); IL-10 (166 $\mu$ g/ml); IL-12 (83 $\mu$ g/ml); IL-17 (125 $\mu$ g/ml); IL-23 (166 $\mu$ g/ml); IFN $\gamma$  (83 $\mu$ g/ml); TNFa (166 $\mu$ g/ml); anti-TGF-b1 (166 $\mu$ g/ml); anti-IL-1b (150 $\mu$ g/ml)); Controls received mp w/ vehicle; animal info (Eight- to twelve-week-old female C57BL/6 mice); Immunology (“evaluate the suitability of osmotic pumps as a model for biofilms in implant associated infections, we implanted osmotic pumps pre-colonized with bioluminescent Staphylococcus aureus”);



**Q4522:** P. T. Mantani, *et al.* IL-25 Inhibits Atherosclerosis Development in Apolipoprotein E Deficient Mice. *PLoS One* 2015;10(U1274-U1291)

**Agents:** Interleukin-25, recombinant mouse **Vehicle:** Not Stated; **Route:** SC; **Species:** Mice; **Pump:** 1004; **Duration:** 4 weeks; **ALZET Comments:** Controls received mp w/ control medium; animal info (ApoE -/-, 9-10 or 21 weeks old); cardiovascular; brain tissue distribution; pumps removed after 4 weeks in young mice;

**Q4140:** A. Y. Tilahun, *et al.* Systemic Inflammatory Response Elicited by Superantigen Destabilizes T Regulatory Cells, Rendering Them Ineffective during Toxic Shock Syndrome. *Journal of Immunology* 2014;193(2919-2930)

**Agents:** Interleukin-2, murine; antibody, anti-interleukin-2 **Vehicle:** PBS; **Route:** SC; **Species:** Mice (transgenic); **Pump:** Not Stated; **Duration:** 10 days;

**ALZET Comments:** Controls received mp w/ vehicle; animal info (HLA-DR3); comparison of injection vs mp; immunology;

**Q5597:** K. R. Mott, *et al.* Role of interleukin-2 and herpes simplex virus 1 in central nervous system demyelination in mice. *J Virol* 2013;87(22):12102-9

**Agents:** Interleukin-2 **Vehicle:** PBS; **Route:** CSF/CNS; SC; **Species:** Mice; **Pump:** Not Stated; **Duration:** 2 weeks;

**ALZET Comments:** Controls received mp w/ Interleukin 2 without HSV-1 infection; animal info (6 weeks) ; ALZET brain infusion kit 1 used; neurodegenerative (demyelination); Therapeutic indication (CNS demyelination; Herpes simplex virus 1; HSV); Dose (1 ug/24 h);

## 7. Interleukin-3

**Q5345:** M. Feld, *et al.* The pruritus- and TH2-associated cytokine IL-31 promotes growth of sensory nerves. *J Allergy Clin Immunol* 2016;138(2):500-508 e24

**Agents:** Interleukin-31, recombinant mouse **Vehicle:** Not Stated; **Route:** SC; **Species:** Mice; **Pump:** Not Stated; **Duration:** 14 days;

**ALZET Comments:** animal info (6 – 8 week old, C57BL/6 and Trpv1 knockout mice); functionality of mp verified by observation of skin phenotype; dose-response (pg. 508.e5); Dose (20 mg/day);

**Q2996:** K. N. Rao, *et al.* Ikaros limits basophil development by suppressing C/EBP-alpha expression. *Blood* 2013;122(15):2572-2581

**Agents:** Interleukin-3 **Vehicle:** Not Stated; **Route:** SC; **Species:** Mice; **Pump:** Not Stated; **Duration:** Not Stated;

**ALZET Comments:** Animal info (C57BL/6:SV129 IK-/-)

**P9822:** T. Yoshimoto, *et al.* Basophils contribute to T<sub>H</sub>2-IgE responses in vivo via IL-4 production and presentation of peptide-MHC class II complexes to CD4<sup>+</sup> T cells. *NATURE IMMUNOLOGY* 2009;10(7):706-U54

**Agents:** Interleukin-3 **Vehicle:** PBS; **Route:** SC; **Species:** Mice; **Pump:** Not Stated; **Duration:** Not Stated;

**ALZET Comments:** Animal info (DO11.10, IL-4 deficient)

**Q0809:** S. Kim, *et al.* Basophils Can Directly Present or Cross-Present Antigen to CD8 Lymphocytes and Alter CD8 T Cell Differentiation into IL-10-Producing Phenotypes. *Journal of Immunology* 2009;183(5):3033-3039

**Agents:** Interleukin-3 **Vehicle:** Not Stated; **Route:** Not Stated; **Species:** Mice (transgenic); **Pump:** Not Stated; **Duration:** 7 days;

**ALZET Comments:** Animal info (C57BL/6, OT-I TCR-transgenic, IL-4KO B6); immunology

**P9722:** T. Shen, *et al.* T cell-derived IL-3 plays key role in parasite infection-induced basophil production but is dispensable for in vivo basophil survival. *International Immunology* 2008;20(9):1201-1209

**Agents:** Interleukin-3 **Vehicle:** Not Stated; **Route:** Not Stated; **Species:** Mice; **Pump:** Not Stated; **Duration:** Not Stated;

**ALZET Comments:** Animal info (BALB/c, IL-3 deficient)





## 8. Interleukin-4

**Q6977:** Cottrell JN, *et al.* Interleukin-4 supplementation improves the pathophysiology of 4 hypertension in response to placental ischemia in RUPP rats. *American Journal of Physiology Regulatory, Integrative, and Comparable Physiology* 2019;316(2):R165-R171

**Agents:** Interleukin-4 **Vehicle:** Not Stated; **Route:** IP; **Species:** Rat (pregnant); **Pump:** Not Stated; **Duration:** 19 days; **ALZET Comments:** Dose (600 ng/day); animal info (pregnant Sprague-Dawley rats; pumps implanted on gestational day 14); ischemia (placental);

**Q5193:** T. Sato, *et al.* The effect of local IL-4 delivery or CCL2 blockade on implant fixation and bone structural properties in a mouse model of wear particle induced osteolysis. *J Biomed Mater Res A* 2016;104(9):2255-62

**Agents:** Ultra-high molecular weight polyethylene particles; interleukin-4, mouse recombinant **Vehicle:** BSA; PBS; **Route:** Bone (femur); **Species:** Mice; **Pump:** 2006; **Duration:** 4 weeks; **ALZET Comments:** Controls received mp w/ vehicle; animal info (male, BALB/cByJ, 10-12 weeks old); 1% BSA used; post op. care (buprenorphine injection SC); used vinyl tubing to connect pumps to titanium rods;

**Q5411:** X. Liu, *et al.* Interleukin-4 Is Essential for Microglia/Macrophage M2 Polarization and Long-Term Recovery After Cerebral Ischemia. *Stroke* 2016;47(2):498-504

**Agents:** Interleukin-4 **Vehicle:** Saline; **Route:** CSF/CNS (ventricle); **Species:** Mice (knockout); **Pump:** 2001; **Duration:** 7 days; **ALZET Comments:** Controls received mp w/ vehicle; animal info (C57/BL6 mice; 8-10 weeks, 25-30 g); ischemia (cerebral; stroke model); behavioral testing (Rotarod, corner, foot fault, and Morris water maze tests); healing, recovery; learning, memory; Therapeutic indication (Cerebral ischemia); Dose (60 ng/day); Brain coordinates: -0.20 mm anterior and 1.00 mm lateral to bregma;

**Q4037:** J. Pajarinen, *et al.* Modulation of mouse macrophage polarization in vitro using IL-4 delivery by osmotic pumps. *JOURNAL OF BIOMEDICAL MATERIALS RESEARCH PART A* 2015;103(1339-1345

**Agents:** Interleukin-4, mouse recombinant **Vehicle:** BSA; PBS; **Route:** In vitro (cell culture); **Species:** Cell culture; **Pump:** 2006; **Duration:** 4 weeks; **ALZET Comments:** 1% BSA used; immunology; "Osmotic pumps delivered IL-4 at a rate that closely followed the expected delivery rate." pg 1343; used vinyl tubing; pumps lead into mouse bone marrow macrophage augmented media; incubated at 37C

**Q4370:** J. D. Cherry, *et al.* Arginase 1+ microglia reduce Abeta plaque deposition during IL-1beta-dependent neuroinflammation. *Journal of Neuroinflammation* 2015;12(U14-U26

**Agents:** Antibody, interleukin-4Ra **Vehicle:** Not Stated; **Route:** CSF/CNS (hippocampus); **Species:** Mice; **Pump:** 1004; **Duration:** 28 days; **ALZET Comments:** Controls received mp w/ control antibody; animal info (APPswe/SP1dE9, 7-5 months old); ALZET brain infusion kit 3 used; neurodegenerative (Alzheimer's disease); immunology; pumps primed 48 hours in 37C saline;

## 9. Interleukin-5

**Q3803:** L. M. Amaral, *et al.* Progesterone supplementation attenuates hypertension and the autoantibody to the angiotensin II type I receptor in response to elevated interleukin-6 during pregnancy. *American Journal of Obstetrics and Gynecology* 2014;211(U377-U382

**ALZET Comments:** Interleukin-5, recombinant rat; Rat (pregnant); 2002; 5 days; Controls received mp w/ vehicle; animal info (pregnant, 14-19 days gestation); cardiovascular; bp measured using catheter; preeclampsia;

**P5279:** A. Mishra, *et al.* IL-5 promotes eosinophil trafficking to the esophagus. *J Immunol* 2002;168(5):2464-2469

**ALZET Comments:** Interleukin-5; PBS; BSA; IP; Mice (transgenic); 2001; 8 days; Controls received mp w/ vehicle; Immunology; peptides; human IL-5 used.



## 10. Interleukin-6

**Q8018:** R. Gutierrez Jauregui, *et al.* IL-1beta Promotes Staphylococcus aureus Biofilms on Implants in vivo. *Front Immunol* 2019;10(1082)

**Agents:** Interleukin-1 beta; Interleukin-6; Interleukin-10; Interleukin-12; Interleukin-17; Interleukin-23; Interferon, gamma; Tumor Necrosis Factor, alpha; Interleukin-1 beta, anti; Transforming Growth Factor-B1, anti **Vehicle:** Saline; **Route:** SC; **Species:** Mice; **Pump:** 1007D; **Duration:** Not stated;

**ALZET Comments:** Dose (IL-1B- 83 ug/ml, IL-6-83 ug/ml, IL-10-166 ug/ml, IL-12-83 ug/ml, IL-17-125 ug/ml, IL-23- 126 ug/ml, IFN $\gamma$ -83 ug/ml, TNFa-166 ug/ml, anti-TGF-B1-166 ug/ml, or anti-IL-1B-150 ug/ml); Controls received mp w/ vehicle; animal info (8-12 weeks old, Female, C57BL/6); immunology;

**Q7344:** R. Gutierrez Jauregui, *et al.* IL-1beta Promotes Staphylococcus aureus Biofilms on Implants in vivo. *Front Immunol* 2019;10(1082)

**Agents:** Interleukin-1 beta; Interleukin-6; Interleukin-10; Interleukin-12; Interleukin-17; Interleukin-23; Interferon, gamma; Tumor Necrosis Factor, alpha; Interleukin-1 beta, anti; Transforming Growth Factor-B1, anti **Vehicle:** PBS; **Route:** SC; **Species:** Mice; **Pump:** 1007D; **Duration:** 10 Days;

**ALZET Comments:** Dose (IL-1b (83 $\mu$ g/ml); IL-6 (83 $\mu$ g/ml); IL-10 (166 $\mu$ g/ml); IL-12 (83 $\mu$ g/ml); IL-17 (125 $\mu$ g/ml); IL-23 (166 $\mu$ g/ml); IFN $\gamma$  (83 $\mu$ g/ml); TNFa (166 $\mu$ g/ml); anti-TGF-b1 (166 $\mu$ g/ml); anti-IL-1b (150 $\mu$ g/ml)); Controls received mp w/ vehicle; animal info (Eight- to twelve-week-old female C57BL/6 mice); Immunology (“evaluate the suitability of osmotic pumps as a model for biofilms in implant associated infections, we implanted osmotic pumps pre-colonized with bioluminescent Staphylococcus aureus”);

**Q7205:** L. Madaro, *et al.* Denervation-activated STAT3-IL-6 signalling in fibro-adipogenic progenitors promotes myofibres atrophy and fibrosis. *Nat Cell Biol* 2018;20(8):917-927

**Agents:** Interleukin-6 **Vehicle:** Not Stated; **Route:** SC; **Species:** Mice; **Pump:** Not Stated; **Duration:** 15 days; **ALZET Comments:** Dose (1.0 mg/ml); Dose (1.0 mg/ml); Interleukin-6 aka IL-6; spinal cord injury;

**Q5906:** C. von Loeffelholz, *et al.* The human longevity gene homolog INDY and interleukin-6 interact in hepatic lipid metabolism. *Hepatology* 2017;66(2):616-630

**Agents:** Interleukin-6, human **Vehicle:** NaCl; BSA; **Route:** Not Stated; **Species:** Mice; **Pump:** Not Stated; **Duration:** 14 days; **ALZET Comments:** animal info (male, mINDY KO); 0.1% BSA used; immunology;

**Q6604:** D. Z. Milikovsky, *et al.* Electrographic Dynamics as a Novel Biomarker in Five Models of Epileptogenesis. *J Neurosci* 2017;37(17):4450-4461

**Agents:** Transforming growth factor- $\beta$ 1; SJN2511; Interleukin-6; Bovine serum albumin **Vehicle:** CSF; artificial; dextran; **Route:** CSF/CNS; **Species:** Mice; **Pump:** Not Stated; **Duration:** 7 days;

**ALZET Comments:** Dose (0.4mM BSA, 100 ng/ml (TGF)-  $\beta$ 1, 300 $\mu$ M SJN2511); Controls received mp w/ vehicle; animal info (2- to 3-month-old FVB/N and C57BL/6 mice); SJN2511 is a selective blocker of the TGF-B type I receptor/ALK5; Brain coordinates (0.5 mm posterior, 1 mm lateral to bregma);

## 11. Interleukin-7

**Q5839:** H. K. Kim, *et al.* Distinct IL-7 signaling in recent thymic emigrants versus mature naive T cells controls T-cell homeostasis. *European Journal of Immunology* 2016;46(7):1669-80

**Agents:** Interleukin-7 **Vehicle:** PBS; **Route:** SC; **Species:** Mice; **Pump:** Not Stated; **Duration:** 5 days;

**ALZET Comments:** Controls received mp w/ vehicle; immunology; “we utilized osmotic pumps to administer recombinant IL-7 and increase IL-7 bioavailability in vivo... T-cell proliferation was dramatically increased in IL-7 pump installed mice compared to control PBS pump installed mice” pg 1671; Therapeutic indication (T-cell homeostasis); Dose (5 ug);



**Q1289:** J. Quiel, *et al.* Antigen-stimulated CD4 T-cell expansion is inversely and log-linearly related to precursor number. PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA 2011;108(8):3312-3317  
**Agents:** Interleukin-2; interleukin-7; interleukin-15 **Vehicle:** Not Stated; **Route:** SC; **Species:** Mice; **Pump:** 2001; **Duration:** 7 days;

**ALZET Comments:** Controls received mp w/ PBS; animal info (6-12 wks old, gender, age matched); immunology

**Q1758:** M. J. Palmer, *et al.* Signaling thresholds govern heterogeneity in IL-7-receptor-mediated responses of naive CD8(+) T cells. Immunology and Cell Biology 2011;89(5):581-594

**Agents:** Interleukin-7 **Vehicle:** Not Stated; **Route:** SC; **Species:** Mice; **Pump:** 1007D; **Duration:** 7 days;

**ALZET Comments:** Controls received mp w/ PBS; animal info (C57BL/6, 6-16 wks old); wound clips used; post op. care (betadine)

**P9932:** J. H. Park, *et al.* Signaling by intrathymic cytokines, not T cell antigen receptors, specifies CD8 lineage choice and promotes the differentiation of cytotoxic-lineage T cells. NATURE IMMUNOLOGY 2010;11(3):257-U10

**Agents:** Interleukin-7, recomb, mouse **Vehicle:** Not Stated; **Route:** SC; **Species:** Mice; **Pump:** Not Stated; **Duration:** 2 weeks;

**ALZET Comments:** Animal info (79Z); immunology

**Q0940:** J. H. Park, *et al.* 'Coreceptor tuning': cytokine signals transcriptionally tailor CD8 coreceptor expression to the self-specificity of the TCR. NATURE IMMUNOLOGY 2007;8(10):1049-1059

**Agents:** Interleukin-7, recomb. mouse **Vehicle:** Not Stated; **Route:** SC; **Species:** Mice; **Pump:** Not Stated; **Duration:** 7 days;

**ALZET Comments:** Controls received mp w/ PBS; animal info (C57BL/6)

## 12. Interleukin-8

**P3730:** E. H. Garin, *et al.* Effect of interleukin-8 on glomerular sulfated compounds and albuminuria. Pediatric Nephrology 1997;11(274-279)

**ALZET Comments:** Interleukin-8; BSA; IA (renal); Rat; 2ML1; 5 days; controls received mp w/BSA; good methods (pg. 275); peptides; used PE-10 catheter stretched to further reduce its diameter.

**P4097:** C. R. Plata-Salaman, *et al.* Anorexia induced by chronic central administration of cytokines at estimated pathophysiological concentrations. Physiol. Behav 1996;60(3):867-875

**ALZET Comments:** Interleukin-1 receptor antagonist; Interleukin-6; Interleukin-1, beta heat inactivated; Interleukin-8; Interleukin-1, beta; Tumor necrosis factor- $\alpha$ ; Saline, sterile physiological; BSA; CSF/CNS; Rat; 2001; 7 days; controls received mp w/vehicle; guide cannula was used, and a sterile 29 g stainless steel obturator was used to ensure cannula patency during at least a 10 day recovery period after surgery; BSA added as stabilizing agent and carrier protein for cytokines; recomb. human IL-6 & 8 used.

## 13. Interleukin-10

**Q6788:** M. F. Iulita, *et al.* CD4(+) Regulatory T Lymphocytes Prevent Impaired Cerebral Blood Flow in Angiotensin II-Induced Hypertension. J Am Heart Assoc 2019;8(1):e009372

**Agents:** Angiotensin II; Interleukin-10, recomb. human **Vehicle:** PBS; **Route:** SC; **Species:** Mice; **Pump:** 1002; **Duration:** 14 days;

**ALZET Comments:** Dose (Angiotensin II (1000 ng/kg/min); IL-10 (60ng/day)); Controls received mp w/ vehicle; animal info (Eight- to 10-week-old C57BL/6 male mice); cardiovascular;

**Q8018:** R. Gutierrez Jauregui, *et al.* IL-1 $\beta$  Promotes Staphylococcus aureus Biofilms on Implants in vivo. Front Immunol 2019;10(1082)





**Agents:** Interleukin-1 beta; Interleukin-6; Interleukin-10; Interleukin-12; Interleukin-17; Interleukin-23; Interferon, gamma; Tumor Necrosis Factor, alpha; Interleukin-1 beta, anti; Transforming Growth Factor-B1, anti **Vehicle:** Saline; **Route:** SC; **Species:** Mice; **Pump:** 1007D; **Duration:** Not stated;  
**ALZET Comments:** Dose (IL-1B- 83 ug/ml, IL-6-83 ug/ml, IL-10-166 ug/ml, IL-12-83 ug/ml, IL-17-125 ug/ml, IL-23- 126 ug/ml, IFN $\gamma$ -83 ug/ml, TNFa-166 ug/ml, anti-TGF-B1-166 ug/ml, or anti-IL-1B-150 ug/ml); Controls received mp w/ vehicle; animal info (8-12 weeks old, Female, C57BL/6); immunology;

**Q7344:** R. Gutierrez Jauregui, *et al.* IL-1beta Promotes Staphylococcus aureus Biofilms on Implants in vivo. *Front Immunol* 2019;10(1082)

**Agents:** Interleukin-1 beta; Interleukin-6; Interleukin-10; Interleukin-12; Interleukin-17; Interleukin-23; Interferon, gamma; Tumor Necrosis Factor, alpha; Interleukin-1 beta, anti; Transforming Growth Factor-B1, anti **Vehicle:** PBS; **Route:** SC; **Species:** Mice; **Pump:** 1007D; **Duration:** 10 Days;  
**ALZET Comments:** Dose (IL-1b (83 $\mu$ g/ml); IL-6 (83 $\mu$ g/ml); IL-10 (166 $\mu$ g/ml); IL-12 (83 $\mu$ g/ml); IL-17 (125 $\mu$ g/ml); IL-23 (166 $\mu$ g/ml); IFN $\gamma$  (83 $\mu$ g/ml); TNFa (166 $\mu$ g/ml); anti-TGF-b1 (166 $\mu$ g/ml); anti-IL-1b (150 $\mu$ g/ml)); Controls received mp w/ vehicle; animal info (Eight- to twelve-week-old female C57BL/6 mice); Immunology (“evaluate the suitability of osmotic pumps as a model for biofilms in implant associated infections, we implanted osmotic pumps pre-colonized with bioluminescent Staphylococcus aureus”);

**Q7435:** A. F. Bressan, *et al.* Interleukin-10 negatively modulates extracellular signal-regulated kinases 1 and 2 in aorta from hypertensive mouse induced by angiotensin II infusion. *Fundam Clin Pharmacol* 2019;33(1):31-40

**Agents:** Angiotensin II, Interleukin-10 **Vehicle:** Saline; **Route:** SC; **Species:** Mice; **Pump:** 1002; **Duration:** 14 days;  
**ALZET Comments:** Dose (90 ng/min- Ang II, 0.5 ng/min- IL10); Controls received mp w/ vehicle; animal info (10-12 weeks old, male, C57BL/6, IL10 knockout); enzyme inhibitor (IL-10-immune-regulatory cytokine); cardiovascular;

**Q7405:** A. F. Bressan, *et al.* Interleukin-10 negatively modulates extracellular signal-regulated kinases 1 and 2 in aorta from hypertensive mouse induced by angiotensin II infusion. *Fundam Clin Pharmacol* 2019;33(1):31-40

**Agents:** Angiotensin II, Interleukin-10 **Vehicle:** Saline; **Route:** SC; **Species:** Mice; **Pump:** 1002; **Duration:** 14 days;  
**ALZET Comments:** Dose (90 ng/min- Ang II, 0.5 ng/min- IL10); Controls received mp w/ vehicle; animal info (10-12 weeks old, male, C57BL/6, IL10 knockout); enzyme inhibitor (IL-10-immune-regulatory cytokine); cardiovascular;

#### 14. Interleukin-11

**Q4341:** J. N. Buzzelli, *et al.* IL-1RT1 signaling antagonizes IL-11 induced STAT3 dependent cardiac and antral stomach tumor development through myeloid cell enrichment. *ONCOTARGET* 2015;6(679-695)

**ALZET Comments:** Interleukin-11, recombinant human; SC; Mice; 1007D; 7 days; Controls received mp w/ saline; animal info (WT or IL-1RT1, 12-14 weeks old); immunology;

**P5900:** K. A. Kuenzler, *et al.* IL-11 pretreatment reduces cell death after intestinal ischemia-reperfusion. *Journal of Surgical Research* 2002;108(2):268-272

**ALZET Comments:** Interleukin-11; Saline; IV (jugular); Rat; 1003D; 48 hours; Controls received mp w/ vehicle; peptides; IL-11 was human recomb; ischemia (intestinal).

**P5148:** K. A. Kuenzler, *et al.* Interleukin-11 enhances intestinal absorptive function after ischemia-reperfusion injury. *Journal of Pediatric Surgery* 2002;37(457-459)

**ALZET Comments:** Interleukin-11; Saline; IV (jugular); Rat; 1003D; 3 days; controls received mp w/ vehicle; peptides; ischemia (bowel).

**P4291:** I. Roeder, *et al.* Interactions of erythropoietin, granulocyte colony-stimulating factor, stem cell factor, and interleukin-11 on murine hematopoiesis during simultaneous administration. *Blood* 1998;91(9):3222-3229



**ALZET Comments:** Interleukin-11; Stem cell factor; Granulocyte-colony stimulating factor, PEGylated; Erythropoietin;; SC;; mice;; 2002; 1007D;; 7 days;; controls received mp w/ saline; functionality of mp verified by pilot studies; no stress (see pg. 3223); peptides; recomb. human interleukin-11, EPO, & G-CSF used; recomb. rat stem cell factor used (pegylated);agents were given in every combination;

**P3407:** J. P. Leonard, *et al.* Constant subcutaneous infusion of rhIL-11 in mice: efficient delivery enhances biological activity. *Exp. Hematol* 1996;24(270-276

**ALZET Comments:** Interleukin-11; Antibody, anti-interleukin-1 receptor; Serum, mouse; Saline, sterile; SC; mice; 3, 7, 10, 13 days; controls received mp w/vehicle; comparison of sc injections vs. mp; immunology; peptides; cardiovascular; "Compared to SC injection, both the magnitude and duration of the platelet increase were significantly enhanced following continuous SC infusion." (pg. 270).

## 15. Interleukin-12

**Q8018:** R. Gutierrez Jauregui, *et al.* IL-1beta Promotes Staphylococcus aureus Biofilms on Implants in vivo. *Front Immunol* 2019;10(1082

**Agents:** Interleukin-1 beta; Interleukin-6; Interleukin-10; Interleukin-12; Interleukin-17; Interleukin-23; Interferon, gamma; Tumor Necrosis Factor, alpha; Interleukin-1 beta, anti; Transforming Growth Factor-B1, anti **Vehicle:** Saline; **Route:** SC;

**Species:** Mice; **Pump:** 1007D; **Duration:** Not stated;

**ALZET Comments:** Dose (IL-1B- 83 ug/ml, IL-6-83 ug/ml, IL-10-166 ug/ml, IL-12-83 ug/ml, IL-17-125 ug/ml, IL-23- 126 ug/ml, IFN $\gamma$ -83 ug/ml, TNFa-166 ug/ml, anti-TGF-B1-166 ug/ml, or anti-IL-1B-150 ug/ml); Controls received mp w/ vehicle; animal info (8-12 weeks old, Female, C57BL/6); immunology;

**Q7344:** R. Gutierrez Jauregui, *et al.* IL-1beta Promotes Staphylococcus aureus Biofilms on Implants in vivo. *Front Immunol* 2019;10(1082

**Agents:** Interleukin-1 beta; Interleukin-6; Interleukin-10; Interleukin-12; Interleukin-17; Interleukin-23; Interferon, gamma; Tumor Necrosis Factor, alpha; Interleukin-1 beta, anti; Transforming Growth Factor-B1, anti **Vehicle:** PBS; **Route:** SC;

**Species:** Mice; **Pump:** 1007D; **Duration:** 10 Days;

**ALZET Comments:** Dose (IL-1b (83 $\mu$ g/ml); IL-6 (83 $\mu$ g/ml); IL-10 (166 $\mu$ g/ml); IL-12 (83 $\mu$ g/ml); IL-17 (125 $\mu$ g/ml); IL-23 (166 $\mu$ g/ml); IFN $\gamma$  (83 $\mu$ g/ml); TNFa (166 $\mu$ g/ml); anti-TGF-b1 (166 $\mu$ g/ml); anti-IL-1b (150 $\mu$ g/ml)); Controls received mp w/ vehicle; animal info (Eight- to twelve-week-old female C57BL/6 mice); Immunology ("evaluate the suitability of osmotic pumps as a model for biofilms in implant associated infections, we implanted osmotic pumps pre-colonized with bioluminescent Staphylococcus aureus");

**Q3101:** C. M. Krejsa, *et al.* Interleukin-21 Enhances Rituximab Activity in a Cynomolgus Monkey Model of B Cell Depletion and in Mouse B Cell Lymphoma Models. *PLoS One* 2013;8(6):U875-U888

**Agents:** Interleukin-12, recomb. human **Vehicle:** Saline; **Route:** SC; **Species:** Mice (SCID; NOD/SCID); **Pump:** 2004; **Duration:** 28 days;

**ALZET Comments:** Animal info (female, SCID and NOD/SCID, 8-10 weeks old); cancer (Lymphoma);

**Q3684:** J. V. Berg, *et al.* Intratumoral IL-12 combined with CTLA-4 blockade elicits T cell-mediated glioma rejection. *Journal of Experimental Medicine* 2013;210(13):2803-2811

**Agents:** Interleukin-12, murine **Vehicle:** PBS; **Route:** CSF/CNS (intratumoral); **Species:** Mice; **Pump:** 1004; 2004; **Duration:** 28 days;

**ALZET Comments:** Controls received mp w/ vehicle; animal info (C57BL6); cancer (glioma); tissue perfusion (tumor; glioma); immunology; pumps primed at 37C; pumps explanted after 28 days;

**P8510:** H. R. Djalilian, *et al.* Efficacy of an osmotic pump delivered, GM-CSF-based tumor vaccine in the treatment of upper aerodigestive squamous cell carcinoma in rats. *Cancer Immunology, Immunotherapy* 2007;56(8):1207-1214



**Agents:** Colony-stimulating factor, GM, murine; interleukin-12 **Vehicle:** PBS; **Route:** SC; **Species:** Rat; **Pump:** Not Stated; **Duration:** 28 days;

**ALZET Comments:** Controls received mp w/ vehicle; dose-response (fig 1); no stress (see pg. 1209); cancer (upper aerodigestive tract carcinoma); peptides; animal info (Fisher 344, 125-150 g); good methods; "This latter method (mp) has several advantages. First, the use of minipumps obviates the cumbersome need to transfect tumor cells and completely characterize their cytokine repertoires. Second, it allows for independent and rigorous control over the kinetics of administration of cytokine and antigen dosages. Third, it may generate less controversy than those techniques requiring "gene therapy" IRB approval." (p. 1213).

## 16. Interleukin-13

**R0378:** B. Halle, *et al.* Convection-enhanced Drug Delivery for Glioblastoma: A Systematic Review Focused on Methodological Differences in the Use of the Convection-enhanced Delivery Method. *Asian-Australasian Journal of Animal Sciences* 2019;14(1):5-14

**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);

**Q5433:** A. Suzuki, *et al.* Analysis of biodistribution of intracranially infused radiolabeled interleukin-13 receptor-targeted immunotoxin IL-13PE by SPECT/CT in an orthotopic mouse model of human glioma. *J Nucl Med* 2014;55(8):1323-9

**Agents:** Interleukin-13 Pseudomonas exotoxin **Vehicle:** PBS; HSA; **Route:** CSF/CNS (intracranial); **Species:** Mice; **Pump:** 1003D; **Duration:** 3 days;

**ALZET Comments:** Controls received mp w/ vehicle; animal info (tumor-bearing mice); cancer (glioblastoma multiforme); brain tissue distribution; HSA aka human serum albumin; CED model, convection-enhanced delivery; orthotopic mouse model of human glioma; Dose (3,700 kBq);

**Q0801:** T. Fujisawa, *et al.* Targeting IL-13Ralpha2 in human pancreatic ductal adenocarcinoma with combination therapy of IL-13-PE and gemcitabine. *International Journal of Cancer* 2011;128(5):1221-1231

**Agents:** Interleukin-13-Pseudomonas exotoxin, recomb. **Vehicle:** Not Stated; **Route:** IP; **Species:** Mice (nude); **Pump:** Not Stated; **Duration:** 14 days;

**ALZET Comments:** Animal info (nu/nu, 5-6 wks old); comparison of IP injections vs IP mp; IL-13-PE is a recombinant immunotoxin; "Mice receiving continuous IL-13-PE exhibited better tumor response compared to bolus administration" pg 1224

**Q1342:** T. Shimamura, *et al.* Interleukin 13 Mediates Signal Transduction through Interleukin 13 Receptor alpha 2 in Pancreatic Ductal Adenocarcinoma: Role of IL-13 Pseudomonas Exotoxin in Pancreatic Cancer Therapy. *Clinical Cancer Research* 2010;16(2):577-586

**Agents:** Interleukin-13 **Vehicle:** PBS; albumin, human serum; **Route:** IP; **Species:** Mice (SCID); **Pump:** 1007D; **Duration:** 7 days;

**ALZET Comments:** Controls received vehicle injections; animal info (5-6 wks old, male, SCID); comparison of ip injections vs ip mp; cancer (pancreatic); "Compared with (bolus IP) administration of 50 ug/kg IL-13 cytotoxin daily for 7 consecutive days, (ALZET pumps) (infused over 7 days) significantly suppressed tumor growth (P = 0.022) from the beginning of the treatment until the end of the experiment... Compared with the (bolus IP) 50 ug/kg group, a significant prolonged survival time was observed in the (ALZET pump) 50 ug/kg group", pg 581

**Q0583:** J. D. Milner, *et al.* Sustained IL-4 exposure leads to a novel pathway for hemophagocytosis, inflammation, and tissue macrophage accumulation. *Blood* 2010;116(14):2476-2483

**Agents:** Interleukin-4, recomb. mouse; interleukin-13 recomb. mouse **Vehicle:** Not Stated; **Route:** SC; **Species:** Mice; **Pump:** Not Stated; **Duration:** 3 days;

**ALZET Comments:** Controls received mp w/ PBS; animal info (C57BL6, b6 Rag2 -/-, b6 Stat6 -/-); 100 ul sized pump used; immunology



### 17. Interleukin-15

**Q4425:** S. Garofalo, *et al.* Enriched environment reduces glioma growth through immune and non-immune mechanisms in mice. *Nature Communications* 2015;6(U26-U38)

**ALZET Comments:** Interleukin-15; brain-derived neurotrophic factor; PBS; CSF/CNS (striatum); Mice; 1007D; 7 days; Controls received mp w/ vehicle; animal info (male, C57BL6, 3 weeks or 2 months old); ALZET brain infusion kit 3 used; cancer (glioma, U87MG human); tissue perfusion (right striatum); immunology; pumps primed in 37C saline overnight;

**Q1289:** J. Quiel, *et al.* Antigen-stimulated CD4 T-cell expansion is inversely and log-linearly related to precursor number. *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA* 2011;108(8):3312-3317

**ALZET Comments:** Interleukin-2; interleukin-7; interleukin-15; SC; Mice; 2001; 7 days; Controls received mp w/ PBS; animal info (6-12 wks old, gender, age matched); immunology.

**P9700:** J. S. Do, *et al.* IL-15 produced and trans-presented by DCs underlies homeostatic competition between CD8 and gamma-delta T cells in vivo. *Blood* 2009;113(25):6361-6371

**ALZET Comments:** Interleukin-15, murine; Mice; 14 days; Animal info (Thy 1.1 C57BL/6).

**P8943:** E. E. Pistilli, *et al.* Systemic elevation of interleukin-15 in vivo promotes apoptosis in skeletal muscles of young adult and aged rats. *Biochemical and Biophysical Research Communications* 2008;373(1):20-24

**ALZET Comments:** Interleukin-15, recomb. human; SC; Rat; 2002; 14 days; Peptides; animal info (Fischer Brown Norway).

**P7460:** S. Roychowdhury, *et al.* IL-15 but not IL-2 rapidly induces lethal xenogeneic graft-versus-host disease. *Blood* 2005;106(7):2433-2435

**ALZET Comments:** Interleukin-15, recomb. human; interleukin-2, recomb. human; PBS; albumin, human; SC; Mice (SCID); 1007D; 10 days; Controls received mp w/ vehicle; immunology; animal info (female, CB17, hu-PBL-SCID, 8-12 weeks old).

### 18. Interleukin-31

**Q5345:** M. Feld, *et al.* The pruritus- and TH2-associated cytokine IL-31 promotes growth of sensory nerves. *J Allergy Clin Immunol* 2016;138(2):500-508 e24

**ALZET Comments:** Interleukin-31, recombinant mouse; SC; Mice; 14 days; animal info (6 – 8 week old, C57BL/6 and Trpv1 knockout mice); functionality of mp verified by observation of skin phenotype; dose-response (pg. 508.e5); Dose (20 mg/day);

**P7009:** S. R. Dillon, *et al.* Interleukin 31, a cytokine produced by activated T cells, induces dermatitis in mice. *NATURE IMMUNOLOGY* 2004;5(7):752-760

**ALZET Comments:** Interleukin-31, mouse; PBS; BSA; SC; Mice; 7-14 days; Controls received mp w/ vehicle; immunology.

### 19. Leukemia inhibitory factor

**Q6323:** M. Engelhardt, *et al.* Leukemia inhibitory factor impairs structural and neurochemical development of rat visual cortex in vivo. *Mol Cell Neurosci* 2017;79(81-92)

**Agents:** Leukemia inhibitory factor; **Cytochrome C** **Vehicle:** Saline; **Route:** CSF/CNS (secondary visual cortex); **Species:** Rat; **Pump:** 1007D; **Duration:** 7 days;

**ALZET Comments:** Dose (0.083 µg/µl); Controls received mp w/ vehicle; To control for unspecific effects of the infusion protocol, 2 animals were infused with cytochrome C (cytC, 8.3 µg/µl). animal info (Pigmented Long Evans); Brain coordinates (1 mm lateral to lambda into medial area 18);



**Q5190:** Y. H. Rhee, *et al.* Neural stem cells secrete factors facilitating brain regeneration upon constitutive Raf-Erk activation. *Sci Rep* 2016;6(32025)

**Agents:** Raf-Transducer cells, conditioned media; leukemia inhibitory factor; fibroblast growth factor 2; vascular endothelial growth factor **Vehicle:** CSF, artificial; **Route:** CSF/CNS; **Species:** Mice; **Pump:** 1007D; **Duration:** 6 days;

**ALZET Comments:** Controls received mp w/ vehicle or control media; animal info (male, C57Bl6, 50-100g); ALZET brain infusion kit 2 used; immunology; cyanoacrylate adhesive; Brain coordinates;

**Q3111:** Y. Liu, *et al.* Leukemia inhibitory factor promotes nestin-positive cells, and increases gp130 levels in the Parkinson disease mouse model of 6-hydroxydopamine. *Neurosciences* 2013;18(4):363-370

**Agents:** Leukemia inhibitory factor **Vehicle:** Saline; **Route:** CSF/CNS (intrathecal); **Species:** Mice; **Pump:** 2002; **Duration:** 3 weeks;

**ALZET Comments:** Controls received mp w/ vehicle or sham surgery; animal info (C57BL, 8 weeks old); neurodegenerative (Parkinson's disease); no stress (see pg. 368); behavioral testing (rotarod, bar grabbing, tremor analysis);

**Q6718:** C. Laterza, *et al.* iPSC-derived neural precursors exert a neuroprotective role in immune-mediated demyelination via the secretion of LIF. *Nat Commun* 2013;4(2597)

**Agents:** Antibody, leukemia inhibitory factor neutralizing **Vehicle:** PBS; **Route:** CSF/CNS (lateral ventricle); **Species:** Mice; **Pump:** 1007D; **Duration:** 7 days;

**ALZET Comments:** Dose (2 micrograms per day); Controls received mp w/ vehicle; animal info (E2.5 pseudo-pregnant CD1 females,); ALZET brain infusion kit 3 used; Brain coordinates ((from bregma, 0.3mm anterior, 0.8 lateral);

**Q2411:** W. H. Huang, *et al.* Effects of leukemia inhibitory factor and basic fibroblast growth factor on free radicals and endogenous stem cell proliferation in a mouse model of cerebral infarction. *Neural Regeneration Research* 2012;7(19):1469-1474

**Agents:** Leukemia inhibitory factor; fibroblast growth factor, basic **Vehicle:** Saline, normal; **Route:** Not Stated; **Species:** Mice; **Pump:** Not Stated; **Duration:** 21 days;

**ALZET Comments:** Animal info (C57BL/6, male, 8 wks old)

## 20. Tumor Necrosis Factor

**Q8018:** R. Gutierrez Jauregui, *et al.* IL-1beta Promotes Staphylococcus aureus Biofilms on Implants in vivo. *Front Immunol* 2019;10(1082)

**Agents:** Interleukin-1 beta; Interleukin-6; Interleukin-10; Interleukin-12; Interleukin-17; Interleukin-23; Interferon, gamma; Tumor Necrosis Factor, alpha; Interleukin-1 beta, anti; Transforming Growth Factor-B1, anti **Vehicle:** Saline; **Route:** SC; **Species:** Mice; **Pump:** 1007D; **Duration:** Not stated;

**ALZET Comments:** Dose (IL-1B- 83 ug/ml, IL-6-83 ug/ml, IL-10-166 ug/ml, IL-12-83 ug/ml, IL-17-125 ug/ml, IL-23- 126 ug/ml, IFN $\gamma$ -83 ug/ml, TNFa-166 ug/ml, anti-TGF-B1-166 ug/ml, or anti-IL-1B-150 ug/ml); Controls received mp w/ vehicle; animal info (8-12 weeks old, Female, C57BL/6); immunology;

**Q7344:** R. Gutierrez Jauregui, *et al.* IL-1beta Promotes Staphylococcus aureus Biofilms on Implants in vivo. *Front Immunol* 2019;10(1082)

**Agents:** Interleukin-1 beta; Interleukin-6; Interleukin-10; Interleukin-12; Interleukin-17; Interleukin-23; Interferon, gamma; Tumor Necrosis Factor, alpha; Interleukin-1 beta, anti; Transforming Growth Factor-B1, anti **Vehicle:** PBS; **Route:** SC; **Species:** Mice; **Pump:** 1007D; **Duration:** 10 Days;

**ALZET Comments:** Dose (IL-1b (83 $\mu$ g/ml); IL-6 (83 $\mu$ g/ml); IL-10 (166 $\mu$ g/ml); IL-12 (83 $\mu$ g/ml); IL-17 (125 $\mu$ g/ml); IL-23 (166 $\mu$ g/ml); IFN $\gamma$  (83 $\mu$ g/ml); TNFa (166 $\mu$ g/ml); anti-TGF-b1 (166 $\mu$ g/ml); anti-IL-1b (150 $\mu$ g/ml)); Controls received mp w/ vehicle; animal info (Eight- to twelve-week-old female C57BL/6 mice); Immunology ("evaluate the suitability of osmotic pumps as a model for biofilms in implant associated infections, we implanted osmotic pumps pre-colonized with bioluminescent Staphylococcus aureus");





**Q7844:** Z. Qing, *et al.* Vitamin C deficiency aggravates tumor necrosis factor alpha-induced insulin resistance. *European Journal of Pharmacology* 2018;829(1-11)

**Agents:** Tumor necrosis factor, alpha **Vehicle:** Saline, BSA Buffered; **Route:** SC; **Species:** Mice; **Pump:** Not Stated; **Duration:** 7 days;

**ALZET Comments:** Dose (6.44 µg/ml at 1 µl/h); Controls received mp w/ vehicle; animal info (9 weeks, male, Gulo(-/-)); diabetes;

**Q5898:** M. C. L. Tse, *et al.* Tumor Necrosis Factor-alpha Promotes Phosphoinositide 3-Kinase Enhancer A and AMP-Activated Protein Kinase Interaction to Suppress Lipid Oxidation in Skeletal Muscle. *Diabetes* 2017;66(7):1858-1870

**Agents:** Tumor necrosis factor, alpha human recombinant **Vehicle:** PBS; **Route:** SC; **Species:** Mice; **Pump:** 1003D; **Duration:** 24 hours;

**ALZET Comments:** Controls received mp w/ vehicle; animal info (female, C57BL6, 5-6 months old); Dose (1 ug/kg/day);

**Q5764:** F. Charlton, *et al.* The protective effect of apolipoprotein in models of trophoblast invasion and preeclampsia. *American Journal of Physiology Regulatory, Integrative, and Comparable Physiology* 2017;312(1):R40-R48

**Agents:** Tumor necrosis factor-a **Vehicle:** Saline; **Route:** SC; **Species:** Mice; **Pump:** 1007D; **Duration:** Not Stated;

**ALZET Comments:** Controls received mp w/ vehicle; animal info (C57BL/6JArc); MRI; Therapeutic indication (Hypertension, pre-eclampsia, pregnancy); Dose (500 ng/kg/day);