



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

**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)

**ALZET Comments:** Erythropoietin, recombinant human; CSF/CNS; Mice; 30 days; 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

**ALZET Comments:** Erythropoietin, recomb. human; SC; Mice (knockout); Mice (transgenic); 30 days; 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);.

**Q4450:** S. Hiram-Bab, *et al.* Erythropoietin directly stimulates osteoclast precursors and induces bone loss. *FASEB JOURNAL* 2015;29(1890-1900)

**ALZET Comments:** Erythropoietin; SC; Mice (transgenic); 10 days; Controls received mp w/ vehicle; animal info (female, Tg6, 12 weeks old);.

**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

**ALZET Comments:** Erythropoietin, human recombinant; PBS; BSA; SC; Rat; 1 week; 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-+)

**ALZET Comments:** Epidermal Growth Factor; erythropoietin; CSF, artificial; CSF/CNS; Rat; 2001; 14 days; Animal info (male, Sprague Dawley); pumps replaced every 7 days; ischemia (cerebral); behavioral testing (staircase test); pumps removed 7 days after serial implantation;.

**Q3269:** Y. F. Wang, *et al.* Bioengineered sequential growth factor delivery stimulates brain tissue regeneration after stroke. *JOURNAL OF CONTROLLED RELEASE* 2013;172(1):1-11

**ALZET Comments:** Epidermal growth factor; erythropoietin; CSF, artificial; CSF/CNS; Mice; 1007D; 14 days; Animal info (male, C57BL6, 9-11 weeks old); EGF-PGF pumps replaced after 7 days with pump filled with ETO; ALZET brain infusion kit 3 used; comparison of epicortical composite vs mp; stress/adverse reaction: "Unlike the ICV catheter/minipump, which causes significant tissue damage, the epicortical composite provides a minimal invasiveness and no tissue damage." (see pg.9); immunology; Pumps implanted 4 days after stroke; BIK implanted same day as stroke;.

**Q2546:** J. Uden, *et al.* Post-ischemic continuous infusion of erythropoietin enhances recovery of lost memory function after global cerebral ischemia in the rat. *BMC NEUROSCIENCE* 2013;14(1):U1-U8

**ALZET Comments:** Erythropoietin; Saline; IV (jugular); Rat; 2001D; 1003D; 72 hours; Control animals received mp w/ vehicle; animal info (Wistar, male, 300-350 g); silastic tubing used.

**Q2677:** L. M. Yamaleyeva, *et al.* Cell Therapy with Human Renal Cell Cultures Containing Erythropoietin-Positive Cells Improves Chronic Kidney Injury. *STEM CELLS TRANSLATIONAL MEDICINE* 2012;1(5):373-383 **Erythropoietin**



**ALZET Comments:** Erythropoietin, recomb. human; Saline; IP; Rat (nude); 2ML4; Animal info (athymic, male, 10-15 wks old); pump functionality measured via residual volume.

**Q1294:** R. Reitmeir, *et al.* Post-acute delivery of erythropoietin induces stroke recovery by promoting perilesional tissue remodelling and contralesional pyramidal tract plasticity. *Brain* 2011;134(1):84-99

**ALZET Comments:** Erythropoietin; NaCl; CSF/CNS; Mice; 4 weeks; Controls received mp w/ vehicle; animal info (C57Bl6/j, male, 23-25 g, 8-10 wks); ALZET brain infusion kit 3 used; ischemia (focal cerebral).

**Q1055:** A. Erlandsson, *et al.* Immunosuppression promotes endogenous neural stem and progenitor cell migration and tissue regeneration after ischemic injury. *Experimental Neurology* 2011;230(1):48-57

**ALZET Comments:** Epidermal growth factor, recomb. human; erythropoietin; cyclosporine A; CSF/CNS; SC; Mice (NOD/SCID); 1007D; Animal info (male, C57/BL6, 8-10 wks old); pumps replaced after 7 days; ALZET brain infusion kit 3 used.

**Q1286:** C. D. Price, *et al.* Effect of continuous infusion of asialoerythropoietin on short-term changes in infarct volume, penumbra apoptosis and behaviour following middle cerebral artery occlusion in rats. *Clinical and Experimental Pharmacology and Physiology* 2010;37(2):185-192

**ALZET Comments:** Erythropoietin, asialo-; Saline, sterile; SC; Rat; 2001; 4 days; Controls received mp w/ vehicle; animal info (male, Sprague Dawley, 250-275 g).

**Q0577:** A. Kondo, *et al.* Erythropoietin exerts anti-epileptic effects with the suppression of aberrant new cell formation in the dentate gyrus and upregulation of neuropeptide Y in seizure model of rats. *Brain Research* 2009;1296(1):127-136

**ALZET Comments:** Erythropoietin, human, recomb.; antibody, anti-EPO; Saline; CSF/CNS; Rat; 6 days; 24 hours; Controls received mp w/ rat serum albumin, or control mouse IgG; animal info (male, Fischer 344, 10-12 wks old, 200-250 g, SLC).

**P9496:** T. Kadota, *et al.* Continuous intraventricular infusion of erythropoietin exerts neuroprotective/rescue effects upon Parkinson's disease model of rats with enhanced neurogenesis. *Brain Research* 2009;1254(1):120-127

**ALZET Comments:** Erythropoietin; Albumin, rat serum; saline; CSF/CNS; Rat; 2001; 1 week; Controls received mp w/ vehicle; animal info (Sprague Dawley, 220-250 g.).

**Q0293:** B. J. Jobst, *et al.* Endothelial Cell Seeding Fails to Prevent Intimal Hyperplasia Following Arterial Injury in the Rat Carotid Model. *Cardiovascular Drugs and Therapy* 2009;23(5):343-353

**ALZET Comments:** Granulocyte-colony stimulating factor, human, recomb.; erythropoietin, human, recomb.; IP; Rat; 2ML1; 48 hours; Controls received mp w/ saline; animal info (male, CD, 250 g, splenectomy).

**Q0263:** M. Jing, *et al.* The combined therapy of intrahippocampal transplantation of adult neural stem cells and intraventricular erythropoietin-infusion ameliorates spontaneous recurrent seizures by suppression of abnormal mossy fiber sprouting. *Brain Research* 2009;1295(1):203-217

**ALZET Comments:** Erythropoietin, human, recomb.; Saline; albumin, rat serum; CSF/CNS; Rat; 2001; 7 days; Controls received mp w/ vehicle; animal info (male, 190-210 g).

**P9369:** L. Belayev, *et al.* A novel neurotrophic therapeutic strategy for experimental stroke. *Brain Research* 2009;1280(1):117-123

**ALZET Comments:** Erythropoietin; Saline; IV (femoral); Rat; 2ML1; 3 days; Controls received mp w/ vehicle; animal info (male, Long-Evans, 280-330 g., MCAO).

**P8932:** S. Oya, *et al.* Region-specific proliferative response of neural progenitors to exogenous stimulation by growth factors following ischemia. *NeuroReport* 2008;19(8):805-810

**ALZET Comments:** Epidermal growth factor, recomb. human; fibroblast growth factor-2, recomb. human; insulin-like growth factor I, recomb. human; erythropoietin, recomb. rat; brain-derived neurotrophic factor, recomb. human; DDL4, recomb. mouse; CSF/CNS; Rat; 1003D; 3 days; Ischemia; animal info (male, Wistar, 8wks old, 280-300 g.); bilateral infusion.



**P9049:** M. Hack, *et al.* A systemic combination therapy with granulocyte-colony stimulating factor plus erythropoietin aggravates the healing process of balloon-injured rat carotid arteries. *Cardiovascular Drugs and Therapy* 2008;22(5):351-362

**ALZET Comments:** Granulocyte-colony stimulating factor-, recomb. human; erythropoietin; IP; Rat; 2ML1; 7 days; Controls received mp w/ saline; peptides; animal info (male, Sprague Dawley, 300-350 g., splenectomy); "We used implantable osmotic minipumps to guarantee continuous systemic delivery of the tested cytokines over the first even days upon intraperitoneal deposition." pg. 353.

**P8660:** J. Soliz, *et al.* Soluble erythropoietin receptor is present in the mouse brain and is required for the ventilatory acclimatization to hypoxia. *JOURNAL OF PHYSIOLOGY-LONDON* 2007;583(1):329-336

**ALZET Comments:** Erythropoietin receptor, soluble; Phosphate buffer; CSF/CNS; Mice; 1003D; 3 days; Controls received mp w/ vehicle; ALZET brain infusion kit used; animal info (male C57/BL6, 3 months old, hypoxia).

**Q0248:** B. Kolb, *et al.* Growth factor-stimulated generation of new cortical tissue and functional recovery after stroke damage to the motor cortex of rats. *Journal of Cerebral Blood Flow and Metabolism* 2007;27(9):983-997

**ALZET Comments:** Erythropoietin; epidermal growth factor; CSF, artificial; CSF/CNS; Rat; 2001; 7, 14 days; Controls received mp w/ vehicle; peptides; animal info (male, Long-Evans, 90-110 days old); ischemia (cerebral); behavioral testing (forelimb assymetry, forelimb inhibition (swimming), reaching); some animals received 7 days EGF.

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

**ALZET Comments:** Erythropoietin; Ear (round window); Guinea pig; 1007D; 1 week; 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.

**P7614:** S. Malhotra, *et al.* Ischemic preconditioning is mediated by erythropoietin through PI-3 kinase signaling in an animal model of transient ischemic attack. *Journal of Neuroscience Research* 2006;83(1):19-27

**ALZET Comments:** Erythropoietin receptor, soluble; PBS; BSA; CSF/CNS; Rat; 1007D; 5 days; Controls received mp w/ vehicle; peptides; ischemia (cerebral); animal info (male, Wistar, 200-225 g); MCAO.

**P5948:** K. Prass, *et al.* Hypoxia-induced stroke tolerance in the mouse is mediated by erythropoietin. *Stroke* 2003;34(8):1981-1986

**ALZET Comments:** Erythropoietin, soluble receptor; PBS; BSA; CSF/CNS; Mice; 1003D; 64 hours; Controls received mp w/ vehicle; peptides; ischemia (cerebral); human EPO used; 0.1%BSA used in vehicle.

**P5801:** T. Shingo, *et al.* Erythropoietin regulates the in vitro and in vivo production of neuronal progenitors by mammalian forebrain neural stem cells. *J Neurosci* 2001;21(24):9733-9743

**ALZET Comments:** Erythropoietin; antibody, rabbit anti-EPO neutralizing; rabbit IgG; Saline; albumin, mouse serum; rat serum; CSF/CNS; Mice; 1007D; 6 days; Controls received mp w/ vehicle; peptides; Erythropoietin (EPO) Recomb. Human, antibody & IgG were dissolved in 0.9% saline with 1 mg/ml mouse serum albumin; pump/cannula schematic (p. 9739 fig A).

**P4619:** B. R. Walker, *et al.* Nitric oxide-dependent pulmonary vasodilation in polycythemic rats. *Am. J. Physiol. (Heart Circ. Physiol.)* 2000;279(H2382-H2389)

**ALZET Comments:** Erythropoietin; Saline; Rat; 2 weeks; controls received mp w/vehicle; peptides; cardiovascular.

**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;.



**P2546:** G. de Haan, *et al.* Hemotoxicity by prolonged etoposide administration to mice can be prevented by simultaneous growth factor therapy. *Cancer Res* 1995;55(324-329)

**ALZET Comments:** Erythropoietin; Granulocyte-colony stimulating factor; Etoposide; SC; mice; 7 days; dose-response curves (pg. 326-328); cancer; peptides; etoposide is VP-16-213; EPO and VP-16-213 given in same pump initially, but this inactivated the G-CSF; multiple pumps per animal (1-2) for G-CSF/VP-16 mice.

**P2737:** A. Hoffman, *et al.* Continuous versus pulsatile administration of erythropoietin (EPO) via the uterus in anemic rats. *Int. J. Pharmaceutics* 1994;111(197-202)

**ALZET Comments:** Erythropoietin; intrauterine; Rat; 2002; 5 days; controls received intrauterine bolus of saline; replacement therapy (gentamicin-induced anemia); comparison of iv bolus and intrauterine bolus vs. mp; peptides; mp implanted subdermally in abdomen; "administration of drug at a constant rate produces considerably greater biological effect than that observed in the pulsatile mode." (pg. 200); tissue perfusion (uterus); recomb. human EPO used.

**P2523:** T. Berney, *et al.* Murine autoimmune hemolytic anemia resulting from Fc-gamma receptor-mediated erythrophagocytosis: protection by erythropoietin but not by interleukin-3, and aggravation by granulocyte-macrophage colony-stimulating factor. *Blood* 1992;79(11):2960-2964

**ALZET Comments:** Erythropoietin; Interleukin-3; Colony-stimulating factor, GM; PBS; Glycerol; SC; mice; 2002; 14 days; immunology; peptides.

**P2970:** T. Shibata, *et al.* Interleukin 3 perfusion prevents death due to acute anemia induced by monoclonal antierythrocyte autoantibody. *J. Exp. Med* 1990;171(1809-1814)

**ALZET Comments:** Interleukin-3; Colony-stimulating factor, GM; Erythropoietin; PBS; Glycerol; LPS, e. coli; SC; mice; 2002; no duration posted; controls received mp with vehicles +/- LPS; immunology; peptides; recomb. mouse GM-CSF & IL-3 used; recomb. human EPO used.

**P0016:** M. P. McGarry, *et al.* Application of continuous flow osmotic minipumps in the study of hemopoietic regulators. *Exp. Hematol* 1978;6(10):809-811

**ALZET Comments:** Erythropoietin; SC; Mice; 1701; 7 days; comparison of injections vs. mp infusion; peptides.