References on the Administration of Epinephrine
Using ALZET® Osmotic Pumps

ALZET Comments: Norepinephrine; SC; Mice; Mice (knockout); 7 days; Dose (2.5 mg/kg/d); Controls received mp w/ vehicle; animal info (C57BL/6 mice (either sex, 12 weeks old); kidney-specific conditional Kcnj10−/− or Kir4.1 knockout (Ks-Kir4.1 KO) mice);

ALZET Comments: Norepinephrine; SC; Mice (transgenic); 1002; 14 days; Controls received mp w/ vehicle; animal info (male, AT1aR knockdown, 14-16 weeks old, 25-30g); cardiovascular; Dose (3.8ug/kg/min);

ALZET Comments: A61603; Norepinephrine; Vitamin C; NaCl; SC; Mice; 1002; 7 days; Dose (A61603 10 μg/kg/d, NE 2.5 mg/kg/d); vitamin C 100 μM in 0.9% NaCl; animal info (12 w male mice); A61603 aka N-[5-(4,5-dihydro-1H-imidazol-2-yl)-2-hydroxy-5,6,7,8-tetrahydronaphthalen-1-yl]methanesulfonamide; cardiovascular;

ALZET Comments: Angiotensin II; Norepinephrine; Mice (knockout); 2004; Dose (Ang II: 0.75 mg/kg/day; Norepinephrine: 5.6 mg/kg/day); animal info (C57BL/6 (Wildtype, WT) or Osteopontin Knockout (OPN KO) mice); cardiovascular;

ALZET Comments: Norepinephrine; hydrochlorothiazide; losartan; Saline; SC; SC; Rat; 2ML2; 14 days; Controls received mp w/ vehicle; animal info (male, Sprague Dalwey, 275-299g); post op. care (penicillin 0.3 ml IM 300,000 units/ml); cardiovascular; Dose (losartan 3 mg/kg/day, NE 600 ng/min; HCTZ 4 mg/kg/day);

ALZET Comments: Angiotensin II; norepinephrine; Saline; SC; Mice; 1002; 2 weeks; animal info (male, NO-GC1 KO, 2-3 months old); cardiovascular; peptides; bp measured using tail cuff or radiotelemetry (DSI); Dose (Angiotensin II 1.44 mg/kg/day; norepinephrine 5.6 mg/kg/day);

ALZET Comments: Norepinephrine; Mice; 2004; 28 days; Animal info (Alk5 iko or Alk5 f/f or C57BL6, 7-15 weeks old, OVX or ORX); cardiovascular; bp measured using tail cuff;

ALZET Comments: Angiotensin II; norepinephrine; Saline; SC; Mice; 1002; 2 weeks; Controls received mp w/ vehicle; animal info (male, WT, 12-16 weeks old); cardiovascular; peptides; bp measured using tail cuff; Dose (Angiotensin II 1.1 mg/kg/day; norepinephrine 5.6 mg/kg/day);

**ALZET Comments:** Angiotensin II, Norepinephrine; Saline, physiological; SC; mice; 1002; 2 weeks; Controls received mp w/ vehicle; animal info (male, 12-16 wks, WT Balb/c mice); functionality of mp verified by ECG; cardiovascular; peptides; Dose (Ang II – 1.1 mg/kg/day, Norepinephrine – 5.6 mg/kg/day).


**ALZET Comments:** Norepinephrine bitartrate hydrate; propranolol; Ascorbic acid; PBS; SC; Mice; 1004; 20 days; Animal info (female, BALB/c, 5-7 weeks old); cancer (colorectal carcinoma, human).


**ALZET Comments:** Norepinephrine; uridine, 5-bromo-2’-deoxyuridine; Ascorbic acid; Mice; 7 days; Controls received mp w/ vehicle; animal info (C57BL6J or tdTomato).

**Q4375:** M. J. Choi, et al. hTERT mediates norepinephrine-induced Slug expression and ovarian cancer aggressiveness. *ONCOGENE* 2015;34(3402-3412)

**ALZET Comments:** Norepinephrine; Saline; Ascorbic acid; SC; Mice (nude); 1004; 7 weeks; Controls received mp w/ vehicle; animal info (female, nude, 4 weeks old); cancer (ovarian).


**ALZET Comments:** Norepinephrine; SC; Mice; 1002; 14 days; Controls received mp w/ saline; animal info (male, C57BL6, 20-25g, 8-12 weeks old); functionality of mp verified by plasma levels; good methods (see supplement); post op. care (incision cleaned with iodine); cardiovascular; immunology; bp measured using radiotelemetry (DSI).

**Q3654:** D. L. Xiao, et al. Inhibition of DNA methylation reverses norepinephrine-induced cardiac hypertrophy in rats. *Cardiovascular Research* 2014;101(3):373-382

**ALZET Comments:** Norepinephrine; Rat; 2ML4; 28 days; Controls received mp w/saline; animal info (male, Sprague Dawley, 6 months old); functionality of mp verified by plasma levels pg.375; dose-response (pg735, table 1); cardiovascular; arterial blood pressure measured using catheter in femoral artery.

**Q6787:** D. Xiao, et al. Inhibition of DNA methylation reverses norepinephrine-induced cardiac hypertrophy in rats. *Cardiovac Res* 2014;101(3):373-82

**ALZET Comments:** Norepinephrine; Cytidine, 5-aza-2’-deoxy-; Saline; SC; Rat; 2ML4; 28 days; Dose (norepinephrine 100 mg/kg/h; norepinephrine 200 mg/kg/day 5-aza-2’-deoxycytidine); Controls received mp w/ vehicle; animal info (six-month-old Sprague–Dawley male rats); cardiovascular.


**ALZET Comments:** Angiotensin II; norepinephrine; Saline; Ascorbic acid; SC; Mice; 2004; 28 days; Controls received mp w/ vehicle; animal info (male, C57BL6J or Ldlr-/); post op. care (topical anesthetic cream); cardiovascular; peptides; bp measured using tail cuff.
**ALZET Comments:** epinephrine, macrophage-activating lipopeptide-2; ICI-118,551; SC; mice; 1002; 7 days; 11 days; animal info (Jax Mice, male, 8-10 weeks of age); peptides; macrophage-activating lipopeptide-2 aka MALP-2; Dose (7mg/kg body weight/day EPI; .7 mg/kg body weight/day ICI);.

**ALZET Comments:** Epinephrine; antagonist, beta adrenergic receptor; Saline; SC; Mice (transgenic); 1002; 8 days; Controls received mp w/ vehicle; animal info (male, C57Bl6, 36 weeks old); functionality of mp verified by increased bp; cardiovascular; immunology; peptides; bp measured using tail-cuff;.

Q3477: Y. X. Gao, et al. ADAMTS-7 Expression Increases in the Early Stage of Angiotensin II-Induced Renal Injury in Elderly Mice. KIDNEY & BLOOD PRESSURE RESEARCH 2014;38(121-131
**ALZET Comments:** Angiotensin II; norepinephrine; Saline; SC; Mice; 3 days; Controls received mp w/ vehicle; animal info (male, C57Bl6, 36 weeks old); functionality of mp verified by plasma levels; dose-response (pg. 810); immunology;.

**ALZET Comments:** Norepinephrine; propranolol; Ascorbic acid; saline; SC; Mice; 1004; 14 days; Controls received mp w/ vehicle; animal info (Female, C57BL6, 4-6 weeks old); cancer (melanoma; adenocarcinoma); immunology; "Seeing that microosmotic pumps (1004 type) are of the ability of pumping drugs contained incessantly for up to 4 weeks and exhibit reliable effects in mouse models, the pumps were taken into account in our research to deal with the short half life period of NE." pg 7; Primed pumps in 37C saline for 48 hours; Picture on pg 6 of pump and tumor on mouse.

**ALZET Comments:** Epinephrine; macrophage-activating lipopeptide-2; ICI-118,551; SC; mice; 1002; 7 days; 11 days; animal info (Jax Mice, male, 8-10 weeks of age); peptides; macrophage-activating lipopeptide-2 aka MALP-2; Dose (7mg/kg body weight/day EPI; .7 mg/kg body weight/day ICI);.

**ALZET Comments:** Norepinephrine; A-779; CSF, artificial; CSF/CNS; Mice (transgenic); 7 days; Controls received mp w/ vehicle; animal info (male, SARA or RA transgenic, 6-10 weeks); ALZET brain infusion kit used; ischemia (cerebral); cardiovascular; Pumps primed overnight in 37C saline;.

**ALZET Comments:** Epinephrine; atenolol; ICI-118,551; PBS; Ascorbic acid; SC; Mice (nude); 1002; 2 weeks; Controls received mp w/ PBS, PHE (2mg/kg/d) and PRO (2mg/kg/d), CRS PBS, CRS PHE (2mg/kg/d) and PRO (2mg/kg/d); animal info (nude); cancer (colorectal); dose-response (Fig.4, SS); ICI 118,551 is a specific B2-AR antagonist; "Considering the critical role of stress in regulating tumor growth and the fact that stress hormones and their antagonists could be quickly metabolized, we used microosmotic pumps instead of repeated injection to administer the stress hormones and antagonists to reduce the stress response as much as possible during manipulations of the animals." pg 9.

**ALZET Comments:** Norepinephrine; Ascorbate; SC; Mice; 1002; 14 days; Animal info (Lep Ob+, 55 g, 14 wks old).
**ALZET Comments:** Angiotensin II; norepinephrine; SC; Mice; 24 hours; Animal info (MMP9 -/-, 7 wks old); peptides.

**ALZET Comments:** Norepinephrine; isoproterenol; ICI-118,551; metoprolol; SC; Mice; Rat; 2 weeks; Controls received mp w/ vehicle; animal info (C57BL/6j, male, Sprague Dawley, 250-270 g, 8 wks old, nephrectomy).

**ALZET Comments:** Angiotensin II, [Val 5]; norepinephrine; SC; Rat; 7 days; animal info (male, Sprague Dawley, 10 wks old); peptides.

**ALZET Comments:** Epinephrine; Saline, buffered; SC; Mice; 2001; 4 days; Controls received mp w/ vehicle; animal info (BALB/c).

**ALZET Comments:** Norepinephrine bitartrate;; Saline; IP; Rat; 1007D; 5 days; Controls received mp w/ vehicle; animal info (male, Sprague Dawley, 300-350 g).

**ALZET Comments:** Angiotensin II; norepinephrine; losartan; Saline; Mice; 4 weeks; 28 days; Controls received mp w/vehicle; peptides; cardiovascular; animal info (male, C57BL/6, AT1aR -/-, p47phox -/-, Id3 -/-); functionality of mp verified by systolic blood pressure.

**ALZET Comments:** Angiotensin II; norepinephrine; Mice; Rat; 2004; 1004; Controls received mp w/ vehicle; animal info (female, Sprague-Dawley, 8 wks old, 250 g; female, black-6, 7-8 wks old, 15-20 g).

**ALZET Comments:** Norepinephrine; Saline; ascorbate; SC; Rat; mice; 2004; 1, 3, 7, 14, 28 days; Controls received mp w/ vehicle; animal info (Wistar, male, 240-260 g, 7 wks old; 5 wks old, DBH-Cre/Floxed-EGFP); functionality of mp verified by plasma NE levels.

**ALZET Comments:** Norepinephrine; Saline; Ascorbic acid; IP; Rat; 2004; 28 days; Controls received mp w/ vehicle; animal info (female, Sprague-Dawley, 8 wks, 230g).

**ALZET Comments:** Norepinephrine; Ascorbic acid; saline; IP; Mice; Rat; 2004; 1004; Controls received mp w/ vehicle; animal info (female, Sprague-Dawley, 8 wks old, 250 g; female, black-6, 7-8 wks old, 15-20 g).
ALZET Comments: Norepinephrine; SC; Mice; 1, 3 days; 4 hours; Controls received unfilled mp; animal info (IL-6 -/-, IL-6 +/+).

ALZET Comments: Epinephrine; SC; Rat; 2004; 14 days; Animal info (adrenal medullectomy, adult, male, Sprague Dawley, 300-400 g); functionality of mp verified by plasma drug levels.

ALZET Comments: Angiotensin II, (Val 5); norepinephrine; SC; Rat; Peptides; animal info (male, Sprague Dawley, 250-300 g).

ALZET Comments: Epinephrine; Saline; SC; Mice; 5 days; Half-life (p. G1227) "very short"; animal info (male, C57BL/6, 4-6 wks old); "Owing to the very short half-life of epinephrine, the hormone was infused instead of injected to maintain a low-grade elevated plasma level over a prolonged period which better mimics the effect of ethanol." pg. G1227.

ALZET Comments: Angiotensin II; norepinephrine; tempol; Saline; SC; Mice; 2002; 14 days; Controls received sham surgery with no mp or empty mp; functionality of mp verified by blood pressure; cardiovascular; peptides; multiple pumps per animal (2); animal info (female, C57BL/6EJ blotchy MNK mut, 8-12 wks old).

ALZET Comments: Epinephrine; Saline; Ascorbic acid; SC; Rat; 2004; 3 weeks; Replacement therapy (adrenal medullectomy); animal info (male, Sprague Dawley, 250-450g.).

ALZET Comments: Epinephrine; Saline; Ascorbic acid; Rat; Animal info (male, Sprague Dawley, 270-450 g.).

ALZET Comments: Angiotensin II; norepinephrine; SC; Mice; 2002; 14 days; Blood pressure taken; cardiovascular; peptides; animal info (CF1-CRP).

ALZET Comments: Norepinephrine; phenylephrine; Vitamin C; SC; Rat; 2002; 7 days; Controls received mp w/ vehicle; cardiovascular; animal info (male, Sprague-Dawley, 330-440 grams, 12 weeks old).

ALZET Comments: Norepinephrine; Mice; 2 weeks; Replacement therapy (nephrectomy); dose-response (fig 3); cardiovascular; animal info (OP+, 3-4 months old, 20-35 g).

**ALZET Comments:** Angiotensin II; norepinephrine; SC; Mice (transgenic); 2004; 16 days; Functionality of mp verified by blood pressure; cardiovascular; peptides; animal info (FVB/N Podocin/rt TA tg, 7-8 wks old, 20-25g) nephrology.


**ALZET Comments:** Norepinephrine; SC; Rat; 2001; 7 days; Functionality of mp verified by mean arterial blood pressure; cardiovascular; animal info (male, Sprague-Dawley, 200-300g., unilateral renal artery stenosis).


**ALZET Comments:** Angiotensin II; norepinephrine; SC; Rat; 2002; 14 days; Controls received mp w/ vehicle, or sham surgery; cardiovascular; peptides; animal info (Sprague-Dawley, 200-300g., unilateral renal artery stenosis).


**ALZET Comments:** Angiotensin II; norepinephrine; IP; Rat; 2002; 7 days; Controls received mp w/ PBS; peptides; animal info (male, Wistar, 200g.) nephrology.


**ALZET Comments:** Norepinephrine; propranolol; Saline, physiological; Ascorbic acid; SC; Mice (nude); 1002; 4 weeks; Controls received mp w/ vehicle; pumps replaced after 2 weeks; half-life (pg. 2745) short, quickly metabolized; cancer (prostate carcinoma); animal info (female, BALB/C nude, athymic, 6 wk. old, 15g.).


**ALZET Comments:** Angiotensin II, [Val 5]; norepinephrine; SC; Rat; 2001; 7 days; Controls received no treatment; functionality of mp verified by systolic blood pressure; cardiovascular; peptides; animal info (male, Sprague-Dawley, 250-300 g.) nephrology.


**ALZET Comments:** Angiotensin II; norepinephrine; SC; Mice; 2004; 7, 14, 21, 28 days; Controls received mp w/ saline; dose-response (fig.1); stress/adverse reaction: (see pg. 313) 2 animals of 105 had mp extrusion; cardiovascular; peptides; animal info (C57BL/6J wt or ApoE -/-, male, 8-6 months old).


**ALZET Comments:** Angiotensin II; norepinephrine; SC; Mice; 1002; 2 weeks; Controls received mp w/ saline; dose-response (fig.1); stress/adverse reaction: (see pg. 313) 2 animals of 105 had mp extrusion; cardiovascular; peptides; animal info (female, C57BL/6, 8 weeks old).


**ALZET Comments:** Angiotensin II, [Val 5]; norepinephrine; SC; Rat; 2001; 7 days; Controls received no treatment; functionality of mp verified by systolic blood pressure; cardiovascular; peptides; animal info (male, Sprague-Dawley, 250-300 g); lipotoxicity.

ALZET Comments: Angiotensin II, [Val 5]; norepinephrine; SC; Rat; 7 days; Controls received no treatment; cardiovascular; animal info (male, Sprague-Dawley).

ALZET Comments: Epinephrine bitartrate; Saline; Ascorbic acid; SC; Rat; 1007D; 7 days; Controls received no treatment; animal info (male, Sprague-Dawley).

ALZET Comments: Epinephrine; Saline; Ascorbic acid; SC; Rat; 1007D; 2002; 7, 14 days; Functionality of mp verified by plasma epinephrine levels; replacement therapy (adrenal medullectomy, adrenal gland denervation); dose-response (Fig 3).

ALZET Comments: Angiotensin II, [Val 5]; norepinephrine; SC; Rat; 2001; 4 weeks; 7 days; Controls received no treatment; dose-response (fig. 1); cardiovascular; peptides; animal info (male, Sprague-Dawley).

ALZET Comments: Angiotensin II; eprosartan; norepinephrine; Saline; SC; IP; IV (jugular); Rat; 2001; 2ML2; 3, 7 days; Controls received mp w/ vehicle or sham HS surgery; cardiovascular; peptides; animal info (male, Sprague-Dawley).

ALZET Comments: Isoprenaline; norepinephrine; SC; Mice; 4 weeks; Controls received mp w/ vehicle.

ALZET Comments: Norepinephrine; Saline, pyrogen-free; Mice; 3,4 weeks; Controls received mp w/ vehicle.

ALZET Comments: Angiotensin II; eprosartan; norepinephrine; Saline; SC; IP; IV (vena cava); Rat; 2001; 2002; 2ML2; 1,3,5,7,11,14 days; Controls received empty mp for 7 days; functionality of mp verified by SBP; cardiovascular; peptides.

ALZET Comments: Norepinephrine; Saline; IV; Rat; 2001; 44 hours; Controls received mp w/ vehicle; blood pressure taken; dose-response (p. 1329); brain injury.

ALZET Comments: Angiotensin II; Norepinephrine; SC; Rat; 2001; 1 week; Peptides.

ALZET Comments: Norepinephrine; Saline; IV (jugular); Rat; 2001; 5 days; Controls received mp w/ vehicle; cardiovascular; silastic catheter used.
P6079: P. Li, et al. Gene expression profile of cardiomyocytes in hypertrophic heart induced by continuous norepinephrine infusion in the rats. CELLULAR AND MOLECULAR LIFE SCIENCES 2003;60(10):2200-2209
**ALZET Comments:** Norepinephrine; Ascorbic acid; IV (jugular); Rat; 2002; 7 days; Functionality of mp verified by liquid chromatography; cardiovascular.

**ALZET Comments:** Epinephrine; Saline; Ascorbic acid; SC; Sheep (fetus); 2ML1; 4 days; Teratology.

**ALZET Comments:** ICI-118,551; epinephrine; Saline; Ascorbic acid; ethanol; SC; Rat; 1007D; 2004; 3, 7, 14 days; Controls received mp w/ vehicle; dose-response (p. 911); ICI-118, 55 dissolved in ethanol and saline and infused for 7 days via 1007D pumps; epinephrine dissolved in saline and ascorbic acid and delivered for 3, 7, or 14 days via 2004 pumps.

**ALZET Comments:** Norepinephrine; dobutamine; isoproterenol; Saline; sodium metabisulfite; SC; Rat; 2002; 3 days; 6, 12, 24, 72 hours; Controls received mp w/ vehicle; the norepinephrine vehicle solution contained sodium metabisulfite as an antioxidant; the b-adrenergic agonists (isoproterenol, dobutamine, and CL316243) were dissolved in saline and infused over 3 days.

**ALZET Comments:** Serotonin, binoxaiate; Norepinephrine; serotonin trifluoroacetate; Serotonin creatinin sulfate; L-DOPA; CSF, artificial; radio-isotopes; 3H tracer; CSF/CNS; Rat; 2001; 7 days;

**ALZET Comments:** Norepinephrine; Saline; Ascorbic acid; IV (jugular); Rat; 14 days; Controls received mp w/ vehicle; cardiovascular; Norepinephrine is also called Noradrenalin; ascorbic acid added to vehicle solution to prevent oxidation.

**ALZET Comments:** Epinephrine; Angiotensin II; SC; Rat; 6 days; Controls received mp w/ saline; plasma levels reported; cardiovascular; pump rate 0.5 ul hr (p.15).

**ALZET Comments:** Angiotensin II; Norepinephrine; SC; Rat; 2002; 6-10 days; peptides; all animals received either Ang II or NE.

**ALZET Comments:** Angiotensin II; Norepinephrine; Phenylephrine; Saline; Ascorbic acid; SC; mice (transgenic); 2004; 18 days; controls received mp w/ vehicle; cardiovascular; peptides; Ang II infused in saline, NE and PHE in 0.2% ascorbic acid.

**ALZET Comments:** Angiotensin II; Norepinephrine; SC; Rat; 2001; 7 days; cardiovascular.
**ALZET Comments:** Angiotensin II, [Val 5]; Norepinephrine; Rat; 7 and 14 days; Peptides.

**ALZET Comments:** Angiotensin II; hydralazine; losartan; norepinephrine; SC; Rat; 2001; 7 days; Antihypertensive.

**ALZET Comments:** Angiotensin II; Norepinephrine; SC; Rat; 2001; 7 days; Peptides.

**ALZET Comments:** Isoproterenol; Norepinephrine; Phenylephrine; HCl; SC; Rat; 3, 7 days; controls received mp with vehicle; alpha & beta adrenergic agonist.

**ALZET Comments:** Norepinephrine; benoxathian; prazosin; KMD-3213; AH11110A; BMY-7378; propranolol; RX-821002; Ringer's, lactated; ascorbate; Perivascular; Rat; 2ML2; 14, 28 days; Tissue perfusion (left carotid wall); pumps replaced after 14 days for prazosin; catheter constructed from thin walled vinyl tubing and fenestrated at end placed near vessel; norepinephrine is a catecholamine; propranolol is a beta adrenoceptor antagonist; all other agents are antagonists alpha antagonists.

**ALZET Comments:** Epinephrine; Angiotensin II; Saline; SC; Rat; 1007D; 6 days; Controls received mp w/ vehicle; functionality of mp verified by epinephrine plasma levels; cardiovascular; peptides; various methods of inducing hypertension explored.

**ALZET Comments:** Norepinephrine; Saline; SC; Rat; 2 weeks; Controls received mp w/ vehicle; functionality of mp verified by norepinephrine plasma levels (p.148); cardiovascular; also called noradrenalin (a catecholamine).

**ALZET Comments:** Angiotensin II, [Val 5]; Norepinephrine; Rat; 2001; up to 7 days; Dose-response (p. 151); cardiovascular; peptides.