



**Recent References (2010-2019) on the Administration of Norepinephrine
Using ALZET® Osmotic Pumps**

Q5605: X. P. Duan, *et al.* Norepinephrine-Induced Stimulation of Kir4.1/Kir5.1 Is Required for the Activation of NaCl Transporter in Distal Convolutated Tubule. *Hypertension* 2019;73(1):112-120

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);

Q5926: J. Xu, *et al.* Clinical Relevance and Role of Neuronal AT1 Receptors in ADAM17-Mediated ACE2 Shedding in Neurogenic Hypertension. *Circ Res* 2017;121(1):43-55

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);

Q6076: M. D. Montgomery, *et al.* An Alpha-1A Adrenergic Receptor Agonist Prevents Acute Doxorubicin Cardiomyopathy in Male Mice. *PLoS One* 2017;12(1):e0168409

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;

Q6408: Caesar C, *et al.* Cyclic Strain and Hypertension Increase Osteopontin Expression in the Aorta. *Cell Mol Bioeng* 2017;10(2):144-152

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;

Q4898: J. T. K. Kathryn R. Walsh, Joon W. Shim, and Richard D. Wainford. Norepinephrine-evoked salt-sensitive hypertension requires impaired renal sodium chloride cotransporter activity in Sprague-Dawley rats. *Am J Physiol Regul Integr Comp Physiol* 2016;310(R115-R124)

ALZET Comments: Norepinephrine; hydrochlorothiazide; losartan; Saline; DMSO; 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);

Q4799: Kathrin Broekmans, *et al.* Angiotensin II-Induced Hypertension Is Attenuated by Reduction of Sympathetic Output in NO-Sensitive Guanylyl Cyclase 1 Knockout Mice. *The Journal of Pharmacology and Experimental Therapeutics* 2016;356):191-199

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 (Ang II 1.44 mg/kg/day; NE 2.88 mg/kg/day); good bp graph;

Q4577: B. M. Schmit, *et al.* Hypertension overrides the protective effect of female hormones on the development of aortic aneurysm secondary to Alk5 deficiency via ERK activation. *AMERICAN JOURNAL OF PHYSIOLOGY-HEART AND CIRCULATORY PHYSIOLOGY* 2015;308(H115-H125)

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;

Q4972: T. Nakashima, *et al.* TLR4 is a critical regulator of angiotensin II-induced vascular remodeling: the roles of extracellular SOD and NADPH oxidase. *Hypertens Res* 2015;38(10):649-55

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);



Q5231: Matsuda S, *et al.* Angiotensin II Activates MCP-1 and Induces Cardiac Hypertrophy and Dysfunction via Toll-like Receptor 4. *Journal of Atherosclerosis and Thrombosis* 2015;228(8):833-844

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; peptides; Dose (Ang II – 1.1 mg/kg/day, Norepinephrine – 5.6 mg/kg/day);.

Q4501: J. Liu, *et al.* The effect of chronic stress on anti-angiogenesis of sunitinib in colorectal cancer models. *PSYCHONEUROENDOCRINOLOGY* 2015;52(130-142

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);.

Q4491: Y. H. Lee, *et al.* Cellular origins of cold-induced brown adipocytes in adult mice. *FASEB JOURNAL* 2015;29(286-299

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

Q5150: J. L. Fry, *et al.* Vascular Smooth Muscle Sirtuin-1 Protects Against Aortic Dissection During Angiotensin II-Induced Hypertension. *J Am Heart Assoc* 2015;4(9):e002384

ALZET Comments: Angiotensin II; Norepinephrine; Saline; Ascorbate; SC; mice; 1007D; 1002; 1 week; 2 weeks; animal info: WT, SMKO, and SMTg mice aged 8 weeks (C57Bl/6J genetic background); functionality of mp verified by radiotelemetry; 1 mmol/L ascorbate; cardiovascular; antihypertensive, norepinephrine; Dose: 1 mg/kg per day of AngII; 10 mg/kg per day of norepinephrine.

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);.

Q3828: A. J. Case, *et al.* Redox-Regulated Suppression of Splenic T-Lymphocyte Activation in a Model of Sympathoexcitation. *Hypertension* 2015;65(916+

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. *Cardiovasc 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/h; 1 mg/kg/day 5-aza-2'-deoxycytidine); Controls received mp w/ vehicle; animal info (Six-month-old Sprague–Dawley male rats); cardiovascular;.

Q4059: D. L. Rateri, *et al.* Angiotensin II Induces Region-Specific Medial Disruption during Evolution of Ascending Aortic Aneurysms. *American Journal of Pathology* 2014;184(2586-2595

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;.



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 increased bp; cardiovascular; immunology; peptides; bp measured using tail-cuff;

Q3184: G. H. Deng, *et al.* Exogenous norepinephrine attenuates the efficacy of sunitinib in a mouse cancer model. *JOURNAL OF EXPERIMENTAL & CLINICAL CANCER RESEARCH* 2014;33(;):U1-U12

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.

Q3291: J. Chen, *et al.* Neuronal over-expression of ACE2 protects brain from ischemia-induced damage.

Neuropharmacology 2014;79(;):550-558

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;.

Q1835: Q. Wu, *et al.* Ablation of neurons expressing agouti-related protein, but not melanin concentrating hormone, in leptin-deficient mice restores metabolic functions and fertility. *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA* 2012;109(8):3155-3160

ALZET Comments: Norepinephrine; Ascorbate; SC; Mice; 1002; 14 days; Animal info (Lep Ob+, 55 g, 14 wks old).

Q2697: T. Kurihara, *et al.* Neutrophil-Derived Matrix Metalloproteinase 9 Triggers Acute Aortic Dissection. *Circulation* 2012;126(25):3070-U532

ALZET Comments: Angiotensin II; norepinephrine; SC; Mice; 24 hours; Animal info (MMP9 -/-, 7 wks old); peptides.

Q1244: S. Mu, *et al.* Epigenetic modulation of the renal beta-adrenergic-WNK4 pathway in salt-sensitive hypertension.

Nature Medicine 2011;17(5):573-U92

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).

Q1137: N. Ishizaka, *et al.* Liver lipid content is reduced in rat given 7-day administration of angiotensin II. *JOURNAL OF THE RENIN-ANGIOTENSIN-ALDOSTERONE SYSTEM* 2011;12(4):462-468

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

Q1256: A. Penn, *et al.* Dose-Response Relationship between Norepinephrine and Erythropoiesis: Evidence for a Critical Threshold. *Journal of Surgical Research* 2010;163(2):E85-E90

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

Q0026: A. I. Owens, *et al.* Angiotensin II Induces a Region-Specific Hyperplasia of the Ascending Aorta Through Regulation of Inhibitor of Differentiation 3. *Circulation Research* 2010;106(3):611-U108

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.

Q3033: P. J. Marvar, *et al.* Central and Peripheral Mechanisms of T-Lymphocyte Activation and Vascular Inflammation Produced by Angiotensin II-Induced Hypertension. *Circulation Research* 2010;107(2):263-U186



ALZET Comments: Angiotensin II; norepinephrine; Mice; 2002; 14 days; Controls received mp w/ vehicle; animal info (C57BL/6, RAG1 -/-, OVA-specific, OT-II tg); peptides; blood pressure measured via telemetry or tail cuff.

Q1545: K. Kimura, *et al.* Norepinephrine-induced nerve growth factor depletion causes cardiac sympathetic denervation in severe heart failure. *Autonomic Neuroscience-Basic & Clinical* 2010;156(1-2):27-35

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.