References on the Administration of Progesterone Using ALZET® Osmotic Pumps


**Agents:** Progesterone, medroxy- **Vehicle:** PEG; DMSO; **Route:** SC; **Species:** Rat; **Pump:** 2ML4; **Duration:** 40 days;

**ALZET Comments:** Dose (1 mg/kg/day); Controls received mp w/ vehicle; animal info (Female Long Evans rats, 11 months old); Blood pressure measured via tail cuff method;144 mmHg - 147 mmHg; Medroxyprogesterone aka MPA; dependence;


**Agents:** Progesterone **Vehicle:** 2-Hydroxypropyl-b-cyclodextrin; **Route:** SC; **Species:** Rat; **Pump:** 2ML4; **Duration:** 28 days;

**ALZET Comments:** Dose (4 mg/kg/day); Controls received mp w/ vehicle; animal info (Sprague-Dawley female rats (220-250g/57-70 days old)); post op. care (buprenorphine); Blood pressure measured via tail cuff method; 93.3 mmHg - 105.2 mmHg; Progesterone aka prog; dependence;


**Agents:** Estradiol, 17b-; Progesterone sulfate **Vehicle:** Not Stated; **Route:** SC; **Species:** Mice; **Pump:** 2002; **Duration:** 14 days;

**ALZET Comments:** Dose (17b-estradiol : 0.1 mg/kg/d, progesterone sulfate: 0.25 mg/kg/d, 0.1 mg/kg/d estradiol + 0.25 mg/kg/d progesterone); Controls received mp w/ vehicle; animal info (7-12 week old female C57BL/6J mice); replacement therapy (estradiol, ovariectomy); Therapeutic indication


**Agents:** Chenodeoxycholic acid, progesterone, 11b-hydroxy-, corticosterone, deoxy-, corticosterone, 3α,5α-TH-, progesterone, 3α,5α-TH-11β-hydroxy- **Vehicle:** Not Stated; **Route:** SC; **Species:** Rat; **Pump:** Not Stated; **Duration:** Not Stated;

**ALZET Comments:** Steroidal derivatives of corticosterone; Review presents the role of gut microbial metabolism of endogenous adrenocorticosteroids as a contributing factor in the etiology of essential hypertension.


**Agents:** Progesterone; Prolactin **Vehicle:** Cycloextrin, 2-hydroxypropyl-b; **Route:** SC; **Species:** Mice; **Pump:** 2002; **Duration:** 14 days;

**ALZET Comments:** Dose (progesterone 250 μg/day; prolactin 7 μg/day); 20% (w/v) 2-hydroxypropyl-beta-cyclodextrin used; Controls received mp w/ vehicle; animal info (7–8 week old female mice with bilateral oophorectomy); replacement therapy (oophorectomy);


**Agents:** Corticosterone; progesterone, hydroxy- **Vehicle:** Not Stated; **Route:** SC; **Species:** Rat;

**ALZET Comments:** These infused steroids produce glucocorticoid induced mineralcorticoid receptor mediated Na+ retention


**Agents:** Progesterone **Vehicle:** DMSO; **Route:** SC; **Species:** Mice; **Pump:** 1003D; **Duration:** 7 days;

**ALZET Comments:** Controls received mp w/ vehicle; animal info (male, C57BL6 or BPH2/2, 15-25 weeks old, 25.9-41.2g)); 100% DMSO used; ischemia (cerebral); behavioral testing (Foot fault test, t-maze test); "...mini-pump delivery could offer a more suitable dosing method with the advantages of reducing peaks and troughs in drug levels, the stress associated with repeated injections, and diminishing levels of release over time as seen with pellet implants. Infusion methods are commonly used clinically to maintain drug concentrations and osmotic mini-pump release of agents at a constant rate mimics this approach." pg 2; "Our previous pharmacokinetic study demonstrated that progesterone delivered via i.p. injection has a very short half-life in both plasma and brain but high progesterone concentrations in the brain can be achieved via mini pump infusion." pg 6; pumps primed overnight in 37C saline;
**Q3762:** F. Marcouiller, et al. The Nuclear Progesterone Receptor Reduces Post-Sigh Apneas during Sleep and Increases the Ventilatory Response to Hypercapnia in Adult Female Mice. PLoS One 2014;9(U765-U776

Agents: Progesterone  
Vehicle: Not Stated  
Route: SC  
Species: Mice  
Pump: 1007D  
Duration: 7 days  
ALZET Comments: Control animals received mp w/ vehicle; animal info (PRKO, wt, adult, female, 3-5 mo old)

**Q4468:** D. J. Morris, et al. An alternative explanation of hypertension associated with 17alpha-hydroxylase deficiency syndrome. Steroids 2014;79(44-8

Agents: corticosterone; progesterone, hydroxy-  
Vehicle: Propylene glycol  
Route: sc  
Species: Rat  
Duration: 14 days  
ALZET Comments: Controls received mp w/ vehicle; animal info: adrenally intact rats; functionality of mp verified by measuring systolic blood pressure pg 46; replacement therapy (the agents infused); Dose: 5 ug/hr of both agents


Agents: estrogen; progesterone; dehydroepiandrosterone  
Vehicle: DMSO;  
Route: SC;  
Species: Rat  
Duration: Not Stated  
ALZET Comments: animal info: Sprague-Dawley,bladder outlet obstruction model, ovariectomized model; functionality of mp verified by plasma measurement; mp used to infuse estrogen, progesterone, and DHEA to examine their effect on angiogenesis of the bladder detrusor; dose: E2 (0.1 mg/kg/day); P4 (1mg/kg/day); P4 and DHEA (300 ug/kg/day);


Agents: Progesterone  
Vehicle: DMSO;  
Route: SC;  
Species: Mice;  
Pump: 1003D;  
Duration: Not Stated  
ALZET Comments: animal info (C57BL/6, male, wks old); 100% DMSO used; “AUC shows that far higher progesterone concentrations were reached and maintained in both plasma and brain using osmotic minipump delivery with loading dose compared with a bolus dose alone.” pg 1616; comparison of bolus dosing vs mp; “Osmotic minipumps were used as the method of infusion as they release progesterone at a constant rate, therefore avoiding diminishing release levels over time as is the case with pellet implants.” pg 1617; pk study; comparison of mp vs pellet;

**Q061:** P. S. Suresh, et al. The effect of progesterone replacement on gene expression in the corpus luteum during induced regression and late luteal phase in the bonnet monkey (Macaca radiata). Reproductive Biology and Endocrinology 2011;9(U1-U1

Agents: Progesterone  
Vehicle: Ethanol; Propylene glycol;  
Species: Monkey (macaca radiata);  
Pump: 2ML1;  
Duration: 24 hr  
ALZET Comments: Animal info (adult, female, bonnet, macaca radiata, 3.3-5.1 kg); multiple pumps per animal (3); replacement therapy (corpus leuteum); endocrinology

**Q1290:** T. Quintela, et al. Progesterone Enhances Transthyretin Expression in the Rat Choroid Plexus In Vitro and In Vivo via Progesterone Receptor. Journal of Molecular Neuroscience 2011;44(3):152-158

Agents: Progesterone  
Vehicle: Polypropylene glycol; ethanol; DMSO;  
Route: SC;  
Species: Rat;  
Pump: 1007D;  
Duration: 2 wks  
ALZET Comments: Controls received mp w/ vehicle; animal info (Wistar); 1% ethanol used; 1% DMSO used; replacement therapy (ovariectomy)

**Q0987:** B. B. Braden, et al. Medroxyprogesterone acetate impairs memory and alters the GABAergic system in aged surgically menopausal rats. Neurobiology of Learning and Memory 2010;93(3):444-453

Agents: Medroxyprogesterone acetate  
Vehicle: Propylene glycol;  
Route: SC;  
Species: Rat;  
Pump: 2ML4;  
ALZET Comments: Controls received mp w/ vehicle; animal info (18 mo old, female, Fischer 344); functionality of mp verified by blood serum levels of MPA; pumps replaced every 31-32 days; behavioral testing (Morris maze test); replacement therapy (ovariectomy)


Agents: Progesterone  
Vehicle: Saline;  
Route: SC;  
Species: Mice;  
Pump: Not Stated;  
Duration: 6 days  
ALZET Comments: Animal info (adult, 6-8 wks old, BALB/cAnNCrl, C57BL/6, CD1(ICR)); pumps replaced after 3 days

**Agents:** Estradiol, 17b-; progesterone; megestrol acetate **Vehicle:** Cyclodextrin, b-; water; **Route:** SC; **Species:** Mice (nude);

**ALZET Comments:** Replacement therapy (ovariectomy); animal info (female, athymic); cancer (ovarian)


**Agents:** Estradiol; progesterone **Vehicle:** Propylene glycol; **Route:** SC; **Species:** Rat; **Pump:** 2ML2; **Duration:** 9 days;

**ALZET Comments:** Controls received mp w/ vehicle; animal info (adult, female, male, multiparous, Sprague Dawley); estradiol and progesterone in same pump; replacement therapy (ovariectomy)


**Agents:** Progesterone **Vehicle:** Propylene glycol; **Route:** SC; **Species:** Rat (lactating); **Pump:** 2ML2; **Duration:** 9 days;

**ALZET Comments:** Controls received mp w/ vehicle; animal info (female, postnatal day 1, lactating); “This approach ensures adequate hormonal exposure in pups since steroids are excreted through the milk, and prevents the potential confounding influences of pup's manipulation on respiratory or metabolic variables.” (p. 14)


**Agents:** Estradiol, 17b-; testosterone; progesterone; pregnane-3,20 dione, 5B-; pregnane-3a-ol, 20-one, 5a-; dehydroepiandrosterone; testosterone, 5a-dihydroxy **Vehicle:** Ethanol; water, distilled; **Route:** CSF/CNS; **Species:** Rat;

**ALZET Comments:** Controls received mp w/ vehicle; ALZET brain infusion kit used; 3% ethanol; animal info (S D, 250-325 g)


**Agents:** NE-100; progesterone; pregnenolone; dehydroepiandrosterone; pregnane -3,20-dione, 5B-; pregnane -3a-ol, 20-one, 5a-; pregnane -3,20-dione, 5a; pregnane -5B-ol,20-one, 3a; pregnane -3B-ol,20-one, 5B; pregnane -3B-ol,20-one, 5a **Vehicle:** Water, distilled; ethanol; **Route:** SC; CSF/CNS; **Species:** Rat; **Pump:** Not Stated; **Duration:** 7,14,21 days;

**ALZET Comments:** Controls received mp w/ vehicle, or saline; replacement therapy (ovariectomy); NE-100 is N,N-dipropyl-2-(4-methoxy-3-(2-phenylethoxy) phenyl)-ethylamine; allopregnanolone; DHP and THP metabolite stereoisomers


**Agents:** Progesterone acetate, medroxy-; progesterone **Vehicle:** DMSO; **Route:** SC; **Species:** Monkey; **Pump:** 2ML1; **Duration:** 1 week;

**ALZET Comments:** Controls received placebo; functionality of mp verified by serum hormone levels; replacement therapy (ovariectomy); NE-100 is N,N-dipropyl-2-(4-methoxy-3-(2-phenylethoxy) phenyl)-ethylamine; allopregnanolone; DHP and THP metabolite stereoisomers


**Agents:** Testosterone; estradiol; progesterone; flutamide **Vehicle:** Cyloextrin, 2-beta-hydroxypropl; **Route:** SC; **Species:** Mice (nude); **Pump:** 2004; **Duration:** 4 weeks;

**ALZET Comments:** Replacement therapy (castration); cancer (prostate); CWR22 xenograft used; flutamide is an anti-androgen; animal info (5-6 week old, nude, ORX)

Agents: Estradiol, 17β-; Progesterone; Gonadotrophin, human chorionic
Vehicle: Not Stated; Route: SC; Species: Mice; Pump: 2002; Duration: 14 days;
ALZET Comments: Controls received sham operation; functionality of mp verified by serum levels; replacement therapy (ovariectomy); vascular cuff injury; B human chorionic gonadotrophin used;


Agents: Aldosterone; Hydroxyprogesterone, 11α; Carbenolone
Vehicle: Not Stated; Route: SC; CSF/CNS; Species: Rat (pregnant);
Pump: 2002; 2004; Duration: 14, 28 days;
ALZET Comments: Controls received mp w/ vehicle; stress/adverse reaction (p.1370); seroma around pump assembly in systemic carbenolone and hydroxyprogesterone high dose groups; some pumps became disconnected from cannula; glucocorticoids; comparison of sc vs. icv infusion


Agents: Progesterone, 11α; Hydroxyprogesterone, 11β; RU-28318; Corticosterone
Vehicle: Propylene glycol; Route: SC; Species: Rat; Pump: 2002; Duration: 14 days;
ALZET Comments: controls received mp w/vehicle; functionality of mp verified by residual volume; replacement therapy (adrenalectomy); agents infused singly and concomitantly in same pump; cardiovascular


Agents: Estradiol, 17β-; Progesterone
Vehicle: Propylene glycol; Route: SC; Species: Rat; Pump: 2ML1; Duration: 7 days;
ALZET Comments: controls received sham oophorectomy and/or mp w/ vehicle; replacement therapy (ovariectomy)


Agents: Progesterone; Cortisol; Cortisone; Corticosterone; Dehydroepiandrosterone; Androstenedione, 4-; Androstendiol, 5-; Testosterone; Nortestosterone, 19-; Estradiol, B-; Estrone; Estriol; Deoxycorticosterone
Vehicle: PEG 400; Route: IV (lower cava);
Species: Rat; Pump: 2002; Duration: 15 days;
ALZET Comments: controls received mp with PEG; no stress (see pg. 351); pumps placed into peritoneal cavity and sutured to musculature; surgical wound sprinkled with sulphathiazol


Agents: Estradiol, B-; Progesterone
Vehicle: Propylene glycol; Ethanol; Ascorbic acid; Route: IP; Species: Rabbit; Pump: 2001; Duration: 4,5 days;
ALZET Comments: Controls received mp w/pg; functionality of mp verified by plasma levels; comparison of injections vs. mp


Agents: EM-170; Progesterone acetate, medroxy-
Vehicle: DMSO; Route: Not Stated; Species: Mice; Pump: Not Stated; Duration: 40 days;
ALZET Comments: Replacement therapy (ovariectomy); long-term study, pumps replaced every 20 days; cancer; antiestrogen


Agents: Progesterone Vehicle: Ethanol; propylene glycol; Route: SC; Species: Pig; Pump: 2ML1; Duration: 7 days;
ALZET Comments: Multiple pumps per animal (12); “implanted pumps effectively suppressed follicular growth” (p. 296)
Agents: Estradiol, 17B-; Progesterone Vehicle: Propylene glycol; Route: Not Stated; Species: Guinea pig; Duration: 7 days; ALZET Comments: Pump model not stated; controls received mp w/vehicle; separate and simultaneous infusion of agents; replacement therapy (oophorectomy)

Agents: Aldosterone; Corticosterone; Dexamethasone phosphate; Estradiol, 17B-; Progesterone; Testosterone Vehicle: PEG 400; PEG 600; Route: IP; Species: Rat; Pump: 1701; 2001; Duration: 3, 8 days; ALZET Comments: Comparison of agents effects; replacement therapy (adrenalectomy & ovariectomy); controls received mp with solvent or glass rods of mp size; no stress implied G125, weight regained; functionality of mp verified

Agents: Estradiol, 17B-; Progesterone Vehicle: Not Stated; Route: SC; Species: Rat; Pump: 2001; Duration: 24 hours; ALZET Comments: separate and simultaneous infusion of agents; 2 doses of E2 infused; functionality of mp verified by radioimmunoassay

Agents: Progesterone Vehicle: Not Stated; Route: IP; Species: Rabbit; Pump: 2ML1; Duration: Not Stated; ALZET Comments: Replacement therapy (ovariectomy)

Agents: CI-628; Progestins; R-5020; Catecholestrogens; Estradiol, 17B-; Progesterone Vehicle: Ascorbic acid; PEG; Route: SC; Species: Rat; Pump: 2001; Duration: 2, 3 days; ALZET Comments: organ replacement therapy (ovariectomy); agents used alone and/or in combination; CI-628 is an anti-estrogen; R-5020 is a progestin

Agents: Aldosterone acetate; Progesterone, 19-nor- Vehicle: Ethanol; Propylene glycol; Water; Route: SC; Species: Rat; Pump: 1701; ALZET Comments: Pumps replaced after 7 and 14 days

P0146: R. Bochskanl, et al. Uteroglobin and the accumulation of progesterone in the uterine lumen of the rabbit. Wilhelm Roux's Archives 1981;190(127-131
Agents: Progesterone Vehicle: Ethanol; Propylene glycol; Route: IP; Species: Rabbit; Pump: 2001; Duration: 4 days; ALZET Comments: Organ replacement therapy (ovariectomy); 1-2 pumps/animal

Agents: Aldosterone; Corticosterone; Deoxycorticosterone acetate; Dexamethasone acetate; Estradiol, 17B-; Hydrocortisone; Progesterone; Spironolactone; Testosterone Vehicle: PEG; PEG 400; PEG 600; Route: IP; Species: Rat; Pump: 1701; ALZET Comments: 3-7 days aldosterone, 6 days PEG only; replacement therapy (adrenalectomy)

Agents: Progesterone Vehicle: Ethanol; Propylene glycol; Route: SC; Species: Cat; Pump: 1701; Duration: 8 days; ALZET Comments: Comparison of injections 2x/day vs. infusion; organ replacement therapy (ovariectomy)