



Recent References (2003-Present) on the Administration of Luteinizing Hormone and LHRH
Using ALZET® Osmotic Pumps

Q7612: M. M. O'Neil, *et al.* Differential Regulation of Gonadotropins in Response to Continuous Infusion of Native Gonadotropin-Releasing Hormone in the Winter Anovulatory Mare and Effects of Treatment With Estradiol-17beta. *J Equine Vet Sci* 2019;75(93-103

Agents: Gonadotropin-releasing Hormone **Vehicle:** Saline; **Route:** SC; **Species:** Horse; **Pump:** 2ML2; **Duration:** 14 days;
ALZET Comments: Dose (20 mg/mL); 0.9% Saline used; animal info (Female,); Gonadotropin-releasing Hormone aka GnRH; dependence;

Q6743: H. Pierce, *et al.* Cholinergic Signals from the CNS Regulate G-CSF-Mediated HSC Mobilization from Bone Marrow via a Glucocorticoid Signaling Relay. *Cell Stem Cell* 2017;20(5):648-658 e4

Agents: Pirenzepine; Scopolamine hydrobromide; Metyrapone; luteinizing hormone; ACTH **Vehicle:** PBS; **Route:** CSF/CNS (Third ventricle); **Species:** Mice (knockout); **Pump:** 1002; **Duration:** Not Stated;
ALZET Comments: Dose (0.6 mg/kg/day Pirenzepine; 1.0 mg/kg Scopolamine hydrobromide; 100mg/kg/day Metyrapone; 2.8 mg/kg/day ACTH; 16ug/day LH); Controls received mp w/ vehicle; animal info (wild-type and Chrm1-/-); luteinizing hormone aka LH and adrenocorticotrophic hormone aka ACTH; peptides; Brain coordinates (A/P -1.6 mm posterior to bregma, D/V -4.7 mm);

Q6290: K. Kyritsi, *et al.* Knockdown of Hepatic Gonadotropin-Releasing Hormone by Vivo-Morpholino Decreases Liver Fibrosis in Multidrug Resistance Gene 2 Knockout Mice by Down-Regulation of miR-200b. *American Journal of Pathology* 2017;187(7):1551-1565

Agents: Gonadotropin-releasing hormone; cetrorelix **Vehicle:** Saline; **Route:** IP; **Species:** Mice; mice (knockout); **Pump:** Not Stated; **Duration:** 1 week;
ALZET Comments: Dose (GRH: 250 ng/kg; cetrorelix: 10 mg/kg/day); animal info (12 week old FVB/NJ wild-type and Mdr2_-/_ mice weighing 25-30g); Therapeutic indication (liver fibrosis);

Q4061: D. Ray, *et al.* Gonadotropin-Releasing Hormone Stimulates Biliary Proliferation by Paracrine/Autocrine Mechanisms. *American Journal of Pathology* 2015;185(1061-1072

Agents: Gonadotropin-releasing hormone **Vehicle:** Not Stated; **Route:** IP; **Species:** Rat; **Pump:** Not Stated; **Duration:** 1 week;
ALZET Comments: Controls received mp w/ saline; animal info (male, Fischer 344);

Q3671: J. F. Thorson, *et al.* Hypothalamic Distribution, Adenohypophyseal Receptor Expression, and Ligand Functionality of RFamide-Related Peptide 3 in the Mare During the Breeding and Nonbreeding Seasons. *Biology of Reproduction* 2014;90(2):U75-U83

Agents: Gonadotropin-releasing hormone **Vehicle:** Not Stated; **Route:** Not Stated; **Species:** Horse; **Pump:** Not Stated;
Duration: 7 days; 12-18 days;
ALZET Comments: Animal info (female, Quarter horse and mixed breed, 5-10 years old);

Q3670: J. F. Thorson, *et al.* Pharmacologic application of native GnRH in the winter anovulatory mare, II: Accelerating the timing of pregnancy. *Theriogenology* 2014;81(4):625-631

Agents: Gonadotropin-releasing hormone **Vehicle:** Saline; **Route:** SC; **Species:** Horse (mare); **Pump:** 2ML2; 2ML4; **Duration:** 8 weeks;
ALZET Comments: Controls received mp w/ vehicle; animal info (female, Quarter Horse grade); pumps replaced every 14 days (2ML2) or 28 days (2ML4); Multiple pumps per animal (4 2ML2 or 2 2ML4); used contralateral side for next pump implantation; pumps removed at end of study;



Q3669: J. F. Thorson, *et al.* Pharmacologic application of native GnRH in the winter anovulatory mare, I: Frequency of reversion to the anovulatory state following ovulation induction and cessation of treatment. *Theriogenology* 2014;81(4):579-586

Agents: Gonadotropin-releasing hormone **Vehicle:** Saline, sterile; **Route:** SC; **Species:** Horse (mare); **Pump:** 2ML2; **Duration:** 28 days;

ALZET Comments: Controls received sham pumps (silastic tubing); animal info (female, American Quarter Horses, 409-522 kg); pumps replaced every 14 days; post op. care (wound cleaned, disinfected with povidone iodine, antibacterial ointment - PO); pumps primed for 16 hours in 37C saline; used contralateral location for next pump implantation;

Q3663: T. Takeda, *et al.* Maternal Exposure to Dioxin Imprints Sexual Immaturity of the Pups through Fixing the Status of the Reduced Expression of Hypothalamic Gonadotropin-Releasing Hormone. *MOLECULAR PHARMACOLOGY* 2014;85(1):74-82

Agents: Gonadotropin-releasing hormone **Vehicle:** Saline; HCl; **Route:** CSF/CNS; **Species:** Rat; **Pump:** 2002; **Duration:** Not Stated;

ALZET Comments: Controls received mp w/ vehicle; animal info (male, Wistar, PND63); ALZET brain infusion kit 2 used; behavioral testing (sexual behavior); stability verified by (incubation of GnRH at 37C for 2 weeks - half of GnRH remains in unchanged form pg.78); teratology; Cannula placement verified via 0.1% infusion of bromophenol blue; 0.1 M HCl

R0324: P. M. Gibbons. ADVANCES IN REPTILE CLINICAL THERAPEUTICS. *Journal of Exotic Pet Medicine* 2014;23(1):21-38

Agents: Amikacin; Florfenicol; Gonadotropin-releasing hormone **Vehicle:** Not Stated; **Route:** Not Stated; **Species:** Snake; Iguana; **Pump:** Not Stated; **Duration:** Not Stated;

ALZET Comments: Animal info (Euttata corn snake, Cscutulaus Mojave rattlesnake, green iguana); stress/adverse reaction: (see pg. 23);

Q2691: H. Kagawa, *et al.* Using osmotic pumps to deliver hormones to induce sexual maturation of female Japanese eels, *Anguilla japonica*. *Aquaculture* 2013;388(1):30-34

Agents: Salmon pituitary extract; gonadotrophin, human chorionic; gonadotropin-releasing hormone analogue **Vehicle:** Sodium chloride; **Route:** IP; **Species:** Fish (eel); **Pump:** 2002; **Duration:** Not Stated;

ALZET Comments: Control animals received mp w/ saline, vehicle; animal info (female, cultured); functionality of mp verified via residual volume; "osmotic pump was implanted into the peritoneal cavity of each eel after cutting an approximately 8-mm opening in the abdomen with a fine scalpel. The wound was not sutured, but healed naturally within 2 weeks." pg 31; "This study confirms the effectiveness of using osmotic pumps to induce the maturation of captive female eels..." pg 33; comparison of mp vs injections

R0333: H. Kagawa. Oogenesis in Teleost Fish. *Aquaculture* 2013;6(4):99-127

Agents: Gonadotropin releasing hormone **Vehicle:** BSA; Sodium chloride; **Route:** IP; **Species:** Fish (eel); **Pump:** 2002; **Duration:** Not Stated;

ALZET Comments: Controls received mp w/ vehicle; animal info (freshwater eels, *Anguilla* spp.); 0.1% BSA used; dose-response (pg 118); "implantation of these osmotic pumps loaded with protein hormones, instead of repeated injections of hormones, is a reliable sustained-release delivery system for inducing sexual maturation in fish." pg 119; picture of pump implantation pg 118; Dose (GnRH α 0.9, 1.8 or 3.6 μ g/day; hCG 50 IU/day; salmon pituitary extract 2.24 mg/day);

Q0948: G. K. Mak, *et al.* Paternal recognition of adult offspring mediated by newly generated CNS neurons. *Nature Neuroscience* 2010;13(6):753-U134

Agents: Prolactin, mouse, recomb.; luteinizing hormone, mouse, recomb.; antibody, prolactin neutralizing **Vehicle:** Albumin, mouse serum; PBS;; **Route:** SC; CSF/CNS; **Species:** Mice; **Pump:** 1003D; 1007D; **Duration:** 2 days;

ALZET Comments: Controls received mp w/ vehicle or normal goat antibody; animal info (8 wks old, Prlr +/+, Prlr -/-, male)

Q0928: G. Mak, *et al.* Male pheromone-stimulated neurogenesis in the adult female brain: possible role in mating behavior. *Nature Medicine* 2008;10(8):1003-1011

Agents: Luteinizing hormone; ara-C **Vehicle:** Saline; **Route:** SC; CSF/CNS; **Species:** Mice; **Pump:** 1007D; **Duration:** 2 days;

ALZET Comments: Controls received mp w/ vehicle; animal info (8-10 wks old, female, CD1)



Q0835: Y. Kasuga, *et al.* Induction of sexual maturation of male Japanese eel (*Anguilla japonica*) by continuous administration of various hormones using osmotic pump. *Cybiurn* 2008;32(2):171-171

Agents: Chorionic gonadotropin hormone, human; salmon pituitary extract; gonadotropin-releasing hormone agonist **Vehicle:** Not Stated; **Route:** IP; **Species:** Fish (eel); **Pump:** 2006; **Duration:** 42 days;

ALZET Comments: Animal info (male, Japanese); long-term study; comparison of IP injections vs IP mp; incorrectly listed Model 2002; "HCG administration of 50 IU day⁻¹ by using OS was an efficient and reliable method for the artificial maturation of male Japanese eel, instead of the weekly injections method." pg 171

P8916: S. M. Collins, *et al.* Continuous administration of low-dose GnRH in mares II. Pituitary and ovarian responses to uninterrupted treatment beginning near the autumnal equinox and continuing throughout the anovulatory season. *Theriogenology* 2007;68(4):673-681

Agents: Gonadotropin-releasing hormone **Vehicle:** Saline, physiological; **Route:** SC; **Species:** Horse; **Pump:** 2004; **Duration:** 120 days;

ALZET Comments: Controls received sham pumps; long-term study; pumps replaced every 30 days; animal info (mare, 18 mo to 24 years); pumps were disinfected using chlorhexidine gluconate, sham pumps were made from silicon tubing filled with medical grade silicone adhesive to approximate the size of the ALZET pumps, then cold-sterilized (similar to pumps) before surgical insertion

P8066: M. Bielinska, *et al.* GATA-4 is required for sex steroidogenic cell development in the fetal mouse. *Developmental Dynamics* 2007;236(1):203-213

Agents: Luteinizing HRH, D-Triple **Vehicle:** Not Stated; **Route:** SC; **Species:** Mice (nude); **Pump:** Not Stated; **Duration:** 3 weeks;

ALZET Comments: Replacement therapy (gonadectomy); peptides; animal info (female, NU/J, chimeric teratoma)

R0259: J. M. Sykes. Techniques for drug delivery in reptiles and amphibians. *Journal of Exotic Pet Medicine* 2006;15(3):210-217

Agents: Amikacin; gonadotropin-releasing hormone **Vehicle:** Not Stated; **Route:** Not Stated; **Species:** Snake; Iguana; **Pump:** 1002; **Duration:** Not Stated;

ALZET Comments: Peptides; animal info (corn snake); review, see p. 211; ref #9; "Alzet osmotic pumps can deliver medications continuously without the need for periodic injections. They hold promise for future delivery options in reptiles." (p. 211)

P8309: T. M. Siler-Khodr, *et al.* Dose-related of GnRH II analog in the cycling rhesus monkey. *Contraception* 2006;74(2):157-164

Agents: Gonadotropin-releasing hormone II, analog **Vehicle:** PBS; **Route:** SC; **Species:** Monkey; **Pump:** Not Stated; **Duration:** 6 days;

ALZET Comments: Controls received mp w/ vehicle; dose-response (fig. 1); stress/adverse reaction: (see pg. 160) 1 control (of 13) and 1 treated (of 19) animals died of diarrhea; half-life (pg. 160) 4 hours; peptides; animal info (Rhesus, female, 5-7 yrs. old); mp primed 16 hours in PBS; *Endocrinology*

P7590: A. G. Geiser, *et al.* A new selective estrogen receptor modulator with potent uterine antagonist activity, agonist activity in bone, and minimal ovarian stimulation. *Endocrinology* 2005;146(10):4524-4535

Agents: Luteinizing HRH, D-Triple **Vehicle:** Not Stated; **Route:** Not Stated; **Species:** Rat; **Pump:** Not Stated; **Duration:** 35 days;

ALZET Comments: Peptides; animal info (female, Sprague-Dawley, 270 g); GnRH agonist

P5142: I. S. Kim, *et al.* Changes in the testis interstitium of Brown Norway rats with aging and effects of luteinizing and thyroid hormones on the aged testes in enhancing the steroidogenic potential. *Biology of Reproduction* 2002;66(1359-1366)

Agents: Luteinizing hormone; Thyroxine **Vehicle:** Saline; **Route:** SC; **Species:** Rat; **Pump:** 2ML4; **Duration:** 4 weeks;

ALZET Comments: controls received mp w/ saline; functionality of mp verified by residual volume and plasma levels of LH & T4 via radioimmunoassay; dose-response (table, p. 1364); multiple pumps per animal (1-2): one for T4 and one for LH