References on the In Vitro or In Situ Use of ALZET® Osmotic Pumps

R0391: T. Coutant, *et al.* Advances in Therapeutics and Delayed Drug Release. Vet Clin North Am Exot Anim Pract 2019;22(3):501-520
Agents: Florfenicoll voriconazole; fentanyl; amikacin **Vehicle:** Not Stated; **Route:** SC; in vitro; **Species:** Rat; Snake (corn, rattle); Iguana; Cat; Hamster; Gelada; Pudu; Wallaby; Monkey; Quail; Hen; **Pump:** Not Stated; **Duration:** Not Stated;
ALZET Comments: "animal info (Eastern massasauga rattlesnakes (Sistrurus catenatus); timber rattlesnake (Crotalus horridus); pudu (Pudu puda); wallaby (Macropus rufogriseus); iguanas (Iguana iguana); Mojave rattlesnakes (Crotalus scutulatus); corn snakes (Elaphe guttata guttata); Japanese quails (Coturnix coturnix japonica); hens (Gallus domesticus)); " Finally, the use of intracoelomic osmotic pumps was reported in iguanas (Iguana iguana) in a study of reproductive behavior.26 No complication due to the pump placement was reported in that study." pg. 508; Advantages: Can be extracted in case of drug overdose or toxicity, Is not altered by its biological environment, Release the drug at a constant rate, Low cost, Commercially available, Release rate and operation time can be chosen; Drawbacks: Necessitate 2 light surgical procedures under anesthesia to be
implanted and explanted, Can sometimes migrate in unwanted location (especially if implanted accidently in air sacs during intracoelomic implantation) "

Q5395: T. H. Lin, *et al.* NF-kappaB decoy oligodeoxynucleotide mitigates wear particle-associated bone loss in the murine continuous infusion model. Acta Biomaterialia 2016;41(273-81
Agents: Ultra-high molecular weight polyethylene particles; oligodeoxynucleotide, decoy; oligodeoxynucleotide, scrambled; Endotoxin, LPS; Brain-derived neurotropic factor; **Vehicle:** Saline; **Route:** In Vitro (cell culture); Bone (Femur); **Species:** Mice (nude); **Pump:** 2006; **Duration:** 4 weeks;
ALZET Comments: Controls received mp w/ vehicle; animal info (Male athymic nude mice, 10-15 weeks old); stability verified by (in vitro experiment); dose-response (pg. 277); good methods (pg. 276); tissue perfusion (bone); Dose (15 mg/ml UHMWPE, 50uM decoy, 1 ug/ml LPS); Therapeutic indication (Bone loss, chronic inflammation);

Q4037: J. Pajarinen, *et al.* Modulation of mouse macrophage polarization in vitro using IL-4 delivery by osmotic pumps. JOURNAL OF BIOMEDICAL MATERIALS RESEARCH PART A 2015;103(1339-1345
Agents: Interleukin-4, mouse recombinant **Vehicle:** BSA; PBS; **Route:** In vitro (cell culture); **Species:** Cell culture; **Pump:** 2006; **Duration:** 4 weeks;
ALZET Comments: 1% BSA used; immunology; "Osmotic pumps delivered IL-4 at a rate that closely followed the expected delivery rate." pg 1343; used vinyl tubing; pumps lead into mouse bone marrow macrophage augmented media; incubated at 37C

Q4514: M. T. Jones, *et al.* Monitoring of jokulhlaups and element fluxes in proglacial Icelandic rivers using osmotic samplers. JOURNAL OF VOLCANOLOGY AND GEOTHERMAL RESEARCH 2015;291(112-124
Agents: Not Stated **Vehicle:** Not Stated; **Route:** In situ (marine environment); **Species:** Not Stated; **Pump:** 2ML1 (osmosampler); **Duration:** 9 months;
ALZET Comments: osmosampler; "This technique allows for continued and unsupervised deployment of a sampler for weeks to months, representing a cost-efficient formof chemical monitoring." pg 112;

Q3922: E. R. Horn, *et al.* Gender- Related Sensitivity of Development and Growth to Real Microgravity in Xenopus laevis. Journal of Experimental Zoology Part A-Ecological Genetics and Physiology 2014;321(1-12
Agents: Nettle powder **Vehicle:** Water, spring; **Route:** In vitro; **Species:** Toad (tadpole); **Pump:** 2ML2; **Duration:** 12 days;
ALZET Comments: Animal info (Xenopus laevis); teratology; spaceflight;

P8571: C. Baj-Rossi, *et al.* Continuous monitoring of Naproxen by a cytochrome P450-based electrochemical sensor. Biosensors and Bioelectronics 2014;53(283-7
Agents: Naproxen **Vehicle:** PBS; **Route:** In vitro; **Species:** Not Stated; **Pump:** 1002; **Duration:** Not Stated;
ALZET Comments: Naproxen is anon- steroidal anti-inflammatory agent; This paper reports the characterization of an electrochemical biosensor for the continuous monitoring of Naproxen delivered by alzet pumps

Q4700: C. Baj-Rossi, *et al.* Continuous monitoring of Naproxen by a cytochrome P450-based electrochemical sensor. BioTechniques 2014;53(;):283-287
Agents: Naproxen **Vehicle:** Methanol; **Route:** In Vitro; **Species:** Not Stated; **Pump:** 1002; **Duration:** 16 hours;
ALZET Comments: Functionality of mp verified by naproxen levels measured with sensors;

Q2848: D. Sabater, *et al.* The use of Transwells(TM) improves the rates of differentiation and growth of cultured 3T3L1 cells. Analytical Biochemistry 2013;405(16):5605-5610
Agents: Spermine nitric oxide complex **Vehicle:** DMEM-GlutaMAX-I; **Route:** In vitro (cell culture); **Species:** Not Stated; **Pump:** 1003D; **Duration:** 3 days;
ALZET Comments: Spermine nitric oxide complex is a nitric oxide donor; polyethylene capillary tube used; image of ALZET pump inside Transwells(TM); pumps were placed in wells containing sterile water

Q3602: E. T. Polymeropoulos, *et al.* Respirometry: Correcting for Diffusion and Validating the Use of Plastic Multiwell Plates with Integrated Optodes. PHYSIOLOGICAL AND BIOCHEMICAL ZOOLOGY 2013;86(5):588-592
Agents: Sodium sulfite **Vehicle:** Not Stated; **Route:** In Vitro; **Species:** Not Stated; **Pump:** 1003D; **Duration:** Not Stated;
ALZET Comments:

Q6717: L. Lapham, *et al.* Temporal variability ofin situmethane concentrations in gas hydrate-bearing sediments near Bullseye Vent, Northern Cascadia Margin. Geochemistry, Geophysics, Geosystems 2013;14(7):2445-2459
Agents: Not Stated **Vehicle:** Not Stated; **Route:** In situ (marine environment); **Species:** Not Stated; **Pump:** 2ML1 (osmosampler); **Duration:** Not Stated;
ALZET Comments: In situ CH4 concentrations were measured on water samples collected with a Mini-Pore Fluid Array (mPFA), which is a modified version of an existing sample collection tool that collects and maintains samples at in situ pressure. The mPFA is a polyvinyl chloride box that contains three OsmoSamplers, a high-pressure valve submerged in oil to reduce corrosion, and three 300 m long coils of copper tubing (Figure 3). Each OsmoSampler has eight 2ML1 semipermeable membranes that separate a saturated salt solution from deionized water, creating an osmotic potential, which creates the pump. Sampler pumping rates were calibrated in the laboratory prior to deployment and found to be ~0.5 mL/d at 4oC.

Q2744: A. Hill, *et al.* In vitro-in vivo evaluation of nanosuspension release from subcutaneously implantable osmotic pumps. International Journal of Pharmaceutics 2013;451(1-2):57-66
Agents: Compound A, nanosuspension **Vehicle:** Acetonitrile; water; **Route:** SC; in vitro; **Species:** Mice; **Pump:** 1007D; **Duration:** 7 days;
ALZET Comments: Animal info (Crl NMRI, 27-32.5 g, female); comparison of SC mp versus bolus injections; "Subcutaneously implanted osmotic pumps prove to be a valuable delivery system for nanosuspensions in pharmacokinetic studies by consideration of the key parameter viscosity in release kinetics."; good methods

Q5534: C. M. Buffinton, *et al.* Stress and strain adaptation in load-dependent remodeling of the embryonic left ventricle. Biomechanics and Modeling in Mechanobiology 2013;12(5):1037-51
Agents: Verapamil **Vehicle:** Saline; **Route:** In vitro (egg); **Species:** Bird (chicken embryo); **Pump:** 2001; **Duration:** Not Stated;
ALZET Comments: Controls received mp w/ (saline); Dose (1 ng/µl);

Q2714: C. J. Xu, *et al.* A Portable Chemotaxis Platform for Short and Long Term Analysis. PLoS One 2012;7(9):U279-U285
Agents: FITC **Vehicle:** Not Stated; **Route:** In vitro (cell migration); **Species:** Not Stated; **Pump:** 2ML2; **Duration:** 24, 72 hours;
ALZET Comments: Controls received mp w/ PBS; "we show that by powering our chemotaxis platform with two ALZET osmotic pumps, our chemotaxis platform can achieve both exquisite control and long-term stability over the gradient." pg 2

Q2112: A. Hill, *et al.* Controlled delivery of nanosuspensions from osmotic pumps: Zero order and non-zero order kinetics. JOURNAL OF CONTROLLED RELEASE 2012;158(3):403-412
Agents: Fenofibrate nanosuspension; captopril; methylene blue **Vehicle:** Hydroxypropylmethylcellulose; dioctyl sulfosuccinate sodium salt; hydroxyethylcellulose; **Route:** In vitro; **Species:** Not Stated; **Pump:** 1007D; **Duration:** 7 days;
ALZET Comments: Functionality of mp verified; effect of different osmolalities, viscosities, particle size, and pump orientation on release rate kinetics

Q2083: A. Gkritzalis-Papadopoulos*, et al.* Adaptation of an Osmotically Pumped Continuous in Situ Water Sampler for Application in Riverine Environments. Environmental Science & Technology 2012;46(13):7293-7300
Agents: Not Stated **Vehicle:** Not Stated; **Route:** In situ (marine environment); **Species:** Not Stated; **Pump:** 2ML1 (osmosampler); **Duration:** 1 month;
ALZET Comments: Comparison of osmotic pump in situ water osmosampler versus manual sampling; 12 Model 2ML1 pumps; maximum depth of 180 cm; "The Alzet pump specification states that there is a ±10% uncertainty in flow rate for each pump element in the absence of any calibration. By comparison, the maximum error in the laboratory determination of flow rate was ±5%, and the error using the dye marker was ±1 cm and does not change with sample age." pg 7297; "The key modification that we have made to osmosampler technology to enable use and evaluation in dynamic environments is implementation of time stamping using a tracer/dye. This enables comparison of performance with laboratory characterization of flow rate as a function of temperature." pg 7298

Q1960: G. Remington*, et al.* Modeling chronic olanzapine exposure using Pharmacological limitations. Pharmacology Biochemistry and Behavior 2011;100(1):86-89
Agents: Olanzapine **Vehicle:** Acetic acid, glacial; water, sterile; **Route:** In vitro; **Species:** Not Stated; **Pump:** 2ML4; **Duration:** Not Stated;
ALZET Comments: Controls received vehicle; drug levels verified using a liquid-liquid extraction and liquid chromatography; "We suggest that olanzapine administration via (ALZET pumps) represents a viable option for (sub)chronic exposure with the caveats that a) duration be confined to 2 weeks..., and b) consideration be given to strategies in dissolving olanzapine that diminish the risk of oxidation." pg 89; "we strongly agree with van der Zwaal and colleagues (2008) that the issue of drug degradation is not specific to olanzapine, and that it is imperative to establish whether compounds being considered for minipump administration are capable of remaining stable in solution at body temperature."

Q0754: V. N. Ivanenko*, et al.* Description, distribution and microhabitats of a new species of Tisbe (Copepoda: Harpacticoida: Tisbidae) from a deep-sea hydrothermal vent field at the Mid-Atlantic Ridge (37degreesN, Lucky Strike). CBM-Cahiers de Biologie Marine 2011;52(1):89-106
Agents: Sodium sulfide **Vehicle:** Not Stated; **Route:** In situ (marine environment); **Species:** Not Stated; **Pump:** Not Stated; **Duration:** Not Stated;
ALZET Comments: "A new species, Tisbe dahmsi, sp. nov., is described from the Eiffel Tower edifice located in the Lucky Strike vent field"; pump at depth of 1698 m

P9959: C. H. Vinkers*, et al.* The rapid hydrolysis of chlordiazepoxide to demoxepam may affect the outcome of chronic osmotic minipump studies. Psychopharmacology 2010;208(4):555-562
Agents: Chlordiazepoxide **Vehicle:** Not Stated; **Route:** In vitro; **Species:** Not Stated; **Pump:** Not Stated; **Duration:** Not Stated;
ALZET Comments: "When the cumulative CDP concentration over time was corrected for its hydrolysis, drug release from the minipumps followed the theoretical release profile over time (white symbols), suggesting that CDP hydrolysis completely accounted for the declined CDP release over time." pg 558; "In general, the use of osmotic minipumps presents a valid and attractive alternative to the labor-intensive daily injections. However, the issue of drug stability and release should always be carefully investigated before initiating chronic minipump experiments." pg 562

Q0254: Y. P. Yan*, et al.* Monocyte chemoattractant protein-1 plays a critical role in neuroblast migration after focal cerebral ischemia. Journal of Cerebral Blood Flow and Metabolism 2007;27(6):1213-1224
Agents: Monocyte chemoattractant protein-1 **Vehicle:** CSF, artificial; BSA; **Route:** CSF/CNS (striatum); in vitro (cell culture); **Species:** Rat; **Pump:** 1003D; 2001; **Duration:** 3, 7 days;
ALZET Comments: Controls received sham operation; peptdies; cardiovascular; animal info (SHR, 270-300g); ischemia (cerebral); dose-response (fig. 5); in vitro MCP-1 administration to neurospheres in a culture plate was performed by submerging mp in normal saline in an adjacent well in the culture plate, connected via catheter (see fig. 5D)

P7395: H. W. Jannasch, *et al.* Continuous chemical monitoring with osmotically pumped water samplers: OsmoSampler design and applications. Limnology and Oceanography-Methods 2004;2(102-113
Agents: Not Stated **Vehicle:** Not Stated; **Route:** In situ (marine environment); **Species:** Not Stated; **Pump:** 2ML1 (osmosampler); **Duration:** >3 years;
ALZET Comments: Novel use of ALZET Osmotic Pumps to sample seawater (osmosampler); "the inherent simplicity of osmotic pumps makes them an excellent replacement for electromechanical pumps, especially for extended sampling periods in harsh aquatic environments." p. 103; device diagram, p. 103, fig 1; flow rate is 4 ul/hr at 20 Celsius; membranes have successfully been used for more than 3 years; pumps have operated at depths up to 4,000 m

P6591: G. Paasche, *et al.* Technical report: Modification of a cochlear implant electrode for drug delivery to the inner ear. Otology & Neurotology 2003;24(2):222-227
Agents: Dye, methylene blue **Vehicle:** Not Stated; **Route:** in vitro; **Species:** Not Stated; **Pump:** 2002; **Duration:** 3 days;
ALZET Comments:

P4692: B. Bittner, *et al.* The impact of co-solvents and the composition of experimental formulations on the pump rate of the ALZET® osmotic pump. International Journal of Pharmaceutics 2000;205(195-198
Agents: Mannitol; Radio-isotopes **Vehicle:** Pyrrolidone, N-methyl-2-; Propylene glycol; PEG; 14C tracer; Water; Dimethylacetamide; **Route:** In vitro; **Species:** Not Stated; **Pump:** 2ML1; **Duration:** 8 days;
ALZET Comments: Functionality of mp verified by in vitro testing; ALZAID chemical compatibility kit used; various solvents employed to find compatibility with drug reservoir

P9100: S. Froidevaux, *et al.* Differential regulation of somatostatin receptor type 2 (sst 2) expression in AR4-2J tumor cells implanted into mice during octreotide treatment. Cancer Research 1999;59(15):3652-3657
Agents: Octreotide **Vehicle:** NaCl; **Route:** SC; In vitro (cell culture); **Species:** Mice (SCID); **Pump:** 1002; **Duration:** 7 days;
ALZET Comments: Cancer; animal info (AR4-2J tumor-bearing, CB17)

P4075: D. Sedmera, *et al.* A quantitative study of the ventricular myoarchitecture in the stage 21-29 chick embryo following decreased loading. European Journal of Morphology 1998;36(2):105-119
Agents: Verapamil **Vehicle:** Saline; **Route:** In vitro (egg); extraembryonic vascular bed; **Species:** Bird (chicken embryo); **Pump:** 2001; **Duration:** 24, 48, 72 hours;
ALZET Comments: controls received mp w/vehicle; pump immersed in saline; teratology; cardiovascular

P3556: M. I. Arnot, *et al.* Dimethyl sulfoxide/propylene glycol is a suitable solvent for the delivery of diazepam from osmotic minipumps. J. Pharm. & Tox. Meth 1996;36(29-31
Agents: Diazepam; Clonazepam; flumazenil **Vehicle:** DMSO; Propylene glycol; Tetraglycol; ^{3}H tracer; Radio-isotopes; **Route:** In vitro (egg); **Species:** Not Stated; **Pump:** 2ML4; **Duration:** Not Stated;
ALZET Comments: no comment posted

P2537: H. W. Jannasch, *et al.* Submersible, osmotically pumped analyzers for continuous determination of nitrate in situ. Analytical Chemistry 1994;66(3352-3361
Agents: Not Stated **Vehicle:** Not Stated; **Route:** In vitro; **Species:** Not Stated; **Pump:** 2ML1; 2ML4; **Duration:** Not Stated;
ALZET Comments: "Our sample pumps, therefore, usually contain at least four 2ML1 membranes for a total flow rate of at least 12 ul/h at 20C."

P3604: G. Lorenzi, *et al.* Cultivation of hamster kidney cells in a dynamic cell culture system in space (spacelab IML-1 mission). Microgravity Sci. Technol 1993;VI/1(34-38
Agents: NaHCO3; Glucose; HEPES; DMEM; Serum, fetal calf; Gentamicin **Vehicle:** Not Stated; **Route:** In vitro (cell culture); **Species:** Not Stated; **Pump:** 2001; **Duration:** Not Stated;
ALZET Comments: Mp connected to cell culture chamber; "...the osmotic pump delivered sufficient fresh medium to support cell growth in the perfusion chambers." p. 37; spaceflight

P3217: R. S. Janzer, *et al.* Astrocytes secrete a factor inducing the expression of HT7-protein and neurothelin in endothelial cells of choriaoallantoic vessels. Advances in Experimental Medicine and Biology 1993;331(217-221
Agents: Medium, astrocyte conditioned- **Vehicle:** Not Stated; **Route:** In vitro (egg); chorioallantoic membrane; **Species:** Bird (chicken embryo); **Pump:** 2002; **Duration:** 5 days;
ALZET Comments: Controls received mp with PBS; gelfoam placed on chorioallantoic membrane; mp connected to gelfoam with PE tubing; mp kept in saline

P3013: J. F. Di Joseph, *et al.* Osmotic pump delivery of rapamycin. Transplantation 1993;55(2):450-452
Agents: Rapamycin **Vehicle:** Dimethylacetamide; Tween 80; PEG 400; **Route:** in vitro; **Species:** Not Stated; **Pump:** 2002; **Duration:** 2 weeks;
ALZET Comments: stability verified by in vitro testing and HPLC for 14 days; in vitro validation of functionality and rapamycin stability

Q0611: J. A. Lobrinus, *et al.* Induction of the blood-brain barrier specific HT7 and neurothelin epitopes in endothelial cells of the chick chorioallantoic vessels by a soluble factor derived from astrocytes. Brain Research 1992;70(207-211
Agents: Medium, astrocyte conditioned- **Vehicle:** Not Stated; **Route:** In vitro (egg); chorioallantoic membrane; **Species:** Bird (chicken embryo); **Pump:** 2004; **Duration:** 5 days;
ALZET Comments: Schematic diagram of the experiment with ALZET pump, fig. 1; mp connected to gelfoam with PE tubing; mp kept in saline

P1954: E. B. Clark, *et al.* Effect of chronic verapamil treatment on ventricular function and growth in chick embryos. American Journal of Physiology Heart and Circulatory Physiology 1991;261(H166-H171
Agents: Verapamil **Vehicle:** Not Stated; **Route:** In vitro (egg); **Species:** Bird (chicken embryo, extraembryonic vascular bed); **Pump:** Not Stated; **Duration:** Not Stated;
ALZET Comments: En ovo, schematic p. H167

P4504: O. Rasmussen, *et al.* Plant protoplast development on "Biokosmos 9". ESA 1990;307(527-530
Agents: Growth medium **Vehicle:** Not Stated; **Route:** In vitro (cell culture); **Species:** Not Stated; **Pump:** Not Stated; **Duration:** 14 days;
ALZET Comments: mp used to deliver growth medium to protoplasts during spaceflight

P2765: H. L. Vahlsing, *et al.* An improved device for continuous intraventricular infusions prevents the introduction of pump-derived toxins and increases the effectiveness of ngf treatments. Experimental Neurology 1989;105(3):233-243
Agents: Nerve growth factor **Vehicle:** CSF, artificial; **Route:** in vitro; CSF/CNS; **Species:** Rat; **Pump:** 2002; **Duration:** 3,7,14 days;
ALZET Comments: No stress-see page 236; stress/adverse reaction: pages 233,236; previous experiments by investigators brought about evidence that mp were introducing cytotoxic substances into infusion fluid. This paper documents creation of coiled (Lynch coil) tubing method w/air/oil spacer whereby the fluid infused is insulated from mp while still propelled by its advance; paraffin dipping of pump utilized to reduce release rate; residual flow rate was slower in in vivo pumps than in in vitro pumps; with the modified pump fewer than 10% of rats had infusion-induced lesions; tracing air-oil space movement allows a precise measurement of volume of infusate

P1552: P. J. Linser, *et al.* A role for carbonic anhydrase in early eye morphogenesis. Invest. Ophthalmol. Vis. Sci 1989;30(4):783-785
Agents: Methazolamide **Vehicle:** Tyrode's solution; **Route:** Eye; in vitro (egg, eye); **Species:** Bird (chicken embryo); **Pump:** 2001; **Duration:** 3 days;
ALZET Comments: comparison of topical dosing vs. mp infusion; tissue perfusion

P3948: F. K. Gmunder, *et al.* Mammalian cell cultivation in space. Advances in Space Research 1989;9(11):119-127
Agents: Culture media **Vehicle:** Glucose; Fetal calf serum; HEPES buffer; Gentamycin;; **Route:** In vitro (cell culture); **Species:** Not Stated; **Pump:** 2001; 2002; **Duration:** Not Stated;
ALZET Comments: Diagram of dynamic cell culture system on page 123; in vitro; spaceflight

P1301: G. F. Seran*, et al.* Metabolism of methadone by chicken embryos prevents induction of chronic opioid-type dependence after a single injection: use of osmotic pumps for continuous infusion. Pharmacol. Biochem. Behav 1988;30(2):357-363
Agents: Methadol, N-desmethyl-1-acetyl; Methadone; Radio-isotopes **Vehicle:** 3H tracer; Propylene glycol; Saline; Water; **Route:** In vitro (egg); **Species:** Bird (chicken embryo); **Pump:** 2001; **Duration:** 7 days;
ALZET Comments: pump delivered to chicken egg via catheter; pump extracorporeal; comparison of a single injection vs. mp infusion

P1382: F. K. Gmunder*, et al.* Dynamic cell culture system: a new cell cultivation instrument for biological experiments in space. J. Biotechnol 1988;7(217-228
Agents: Culture media, DMEM; HEPES; Serum, fetal calf; Gentamicin; Glucose **Vehicle:** Not Stated; **Route:** in vitro (cell culture); **Species:** Not Stated; **Pump:** 2001; **Duration:** 7 days;
ALZET Comments: Mp connected to cell culture chamber; cytotoxicity described; spaceflight

P1389: T. A. Carpenter*, et al.* Magnetic resonance imaging of the delivery of a paramagnetic contrast agent by an osmotic pump. Drug Design and Discovery 1988;3(263-266
Agents: GdDTPA **Vehicle:** Water; **Route:** In vitro; **Species:** Not Stated; **Pump:** 2ML1; **Duration:** 220 hours;
ALZET Comments: GdDTPA is gadolinium diethylenetriamine pentaacetic acid; MRI

P0773: M. D. Lifschitz. Prostaglandins may mediate chloride concentration gradient across domes formed by MDCK1 cells. American Journal of Physiology Renal Physiology 1986;250(F525-F531
Agents: Prostaglandin E2 **Vehicle:** Glycine; **Route:** In vitro (cell culture); **Species:** Not Stated; **Pump:** 2002; **Duration:** 5 hours;
ALZET Comments: Mp infusion in culture dish to continually add PGE2 to MDCK cell culture

P0218: J. E. Neely*, et al.* Using miniature osmotic infusion pumps to maintain tritiated thymidine exposure to cells in culture. J. Histochem. Cytochem 1982;30(6):536-537
Agents: Radio-isotopes; Thymidine **Vehicle:** 3H tracer; Saline; **Route:** In vitro (cell culture); **Species:** Not Stated; **Pump:** 2001; **Duration:** Not Stated;
ALZET Comments: Pumps immersed in tissue culture dish for thymidine experiments

P0241: J. M. Hock*, et al.* Use of osmotic minipumps for delivery of parathyroid hormone. Calcified Tissue International 1982;34(270-272
Agents: Parathyroid hormone, bovine 1-84 **Vehicle:** Culture medium, BGJ; Cysteine; HCl; Saline; Serum, rat; **Route:** Bone (parietal); in vitro; **Species:** Rat; **Pump:** Not Stated; **Duration:** Not Stated;
ALZET Comments: In vitro: pump immersed in Ringer's solution 2-6 days; in vivo: tubing from mp wired to supraorbital ridges w/outlet cut in tubing overlying parietal bone for 2 days; peptides; tissue perfusion

P1240: P. R. Waggoner*, et al.* Method for long term delivery of soluble agents to the chick chorioallantoic membrane. Cellular and Molecular Life Sciences 1981;37(3):321-322
Agents: Thyroxine, l- **Vehicle:** Not Stated; **Route:** In vitro (egg); chorioallantoic membrane; **Species:** Bird (chicken embryo); **Pump:** 2001; **Duration:** 7 days;
ALZET Comments: mp placed in small test tube filled w/ water and then sealed w/ parafilm; mp connected to catheter that bathed the chorioallantoic membrane