

# Miniature Infusion Pumps for Mice

*The only implantable, infusion pumps commercially available for use in mice.*



**A**LZET® osmotic pumps are available in small sizes to enable continuous delivery of bioactive compounds to mice. With many inbred strains available, and new transgenic and knockout strains emerging rapidly, scientists are adopting the mouse as the premier mammalian model for *in vivo* research. To keep pace with this trend, laboratory equipment and research tools, including infusion devices, must be compatible for use in mice.

ALZET pumps offer researchers a practical and cost-effective means of test agent administration in freely moving, unrestrained mice. Since the pumps are fully implantable (no need for external connections), mice are untethered and unrestrained during the entire dosing period. The lack of external connections minimizes infection and allows for group housing of animals. Furthermore, ALZET pumps provide continuous infusion for prolonged periods of time, thereby reducing stress responses resulting from frequent handling and repeated dosing.

The use of ALZET pumps in mice is documented since 1976 in over 1,900 published studies. Nine ALZET pump models, in a range of release rates and durations, are appropriate for use in mice. Continuous delivery for up to 6 weeks is feasible with a single pump, and even longer durations can be achieved through serial implantation of pumps.

Model	Capacity	Delivery Rate	Duration
1003D	100µl	1.0 µl/hr	3 days
1007D	100µl	0.5 µl/hr	1 week
1002	100µl	0.25 µl/hr	2 weeks
1004	100µl	0.11 µl/hr	4 weeks
2001D	200µl	8.0 µl/hr	1 day
2001	200µl	1.0 µl/hr	1 week
2002	200µl	0.5 µl/hr	2 weeks
2004	200µl	0.25 µl/hr	4 weeks
2006	200µl	0.15 µl/hr	6 weeks

## Highlights

- The only implantable, infusion pump available for mice
- 9 pump models available for use in mice (including SCID and Nude mice)
- Delivery rates ranging from 0.11 µl/hr to 8 µl/hr
- Delivery durations ranging from 1 day to 6 weeks

## Benefits of ALZET Pumps in Mouse Research Studies

- Convenient and cost-effective method for chronic dosing in mice
- Provide continuous and controlled release of test agents over time
- Minimize side effects and experimental variables
- Reduce handling and stress to animal during dosing period

## Optimum Mouse Sizes

ALZET pumps are suitable for subcutaneous (SC) and intraperitoneal (IP) implantation in mice according to the animal size guidelines described below.

Implantation Route	ALZET Models 1003D, 1007D, 1002 and 1004	ALZET Models 2001D, 2001, 2002, 2004 and 2006
SC	10+ gram mice	20+ gram mice
IP	20+ gram mice	Possible via catheter attachment

## Routes of Administration

ALZET pumps can be implanted SC or IP to enable systemic delivery of experimental agents to mice. They can easily be connected to a catheter for targeted delivery of compounds into vessels, brain tissues, cerebral ventricles, tumors, or other organs and tissues.

## SCID and Nude Mouse Models

The automatic operation and small size of ALZET pumps makes them an ideal infusion system for chronic dosing studies in Nude and SCID mouse models. No researcher intervention is required during infusion, and animal handling is kept to a minimum to reduce the risk of infection and stress. ALZET pumps have been used in immunodeficient mice since 1980, and over 215 publications are available as evidence of their research value in these species. Additional information, including surgical implantation guidelines, is available upon request.

## ▶ INTRAVENOUS INFUSION

Compared to conventional infusion methods in which external catheters and swivels restrict animal movement and pose an infection risk, intravenous (IV) infusion with ALZET pumps present a significant advantage in terms of animal welfare and experimental convenience. For IV infusion, the pump is fully implanted SC with the attached catheter leading into the target vessel. After pump implantation and vessel cannulation, mice can move freely around the cage, even in a group-housed environment.



### MOUSE JUGULAR CATHETERS

DURECT developed a line of catheters designed to facilitate use of ALZET pumps for IV infusion in mice via the external jugular vein. These catheters will fit any ALZET pump model.

### BRAIN INFUSION KIT 3

The ALZET Brain Kit 3 is specifically designed for intraventricular and intraparenchymal infusion in the mouse. The fine gauge stainless steel cannula minimizes trauma to brain tissue during placement, and its 3 mm length is appropriate for targeting the lateral ventricles of adult mice. Uniquely designed depth adjustment spacers allow cannula length adjustment for targeting more superficial brain areas.



## ▶ INTRACEREBRAL INFUSION

For compounds which do not cross the blood-brain barrier, local infusion directly into the brain is the only way to generate reliable data. The low flow rates and small size of ALZET pumps, used together with the Brain Infusion Kit 3, make an ideal combination for intracerebral delivery in mice. ALZET pumps have been used in hundreds of neuroscience studies to infuse agents, from neurotrophic factors to siRNA to psychoactive drugs and more.

### ▶ CSF Volume & Production Rate in the Mouse

CSF Volume: 0.035 ml (35  $\mu$ l)

CSF Production rate: 0.018 ml/hr (18  $\mu$ l/hr)

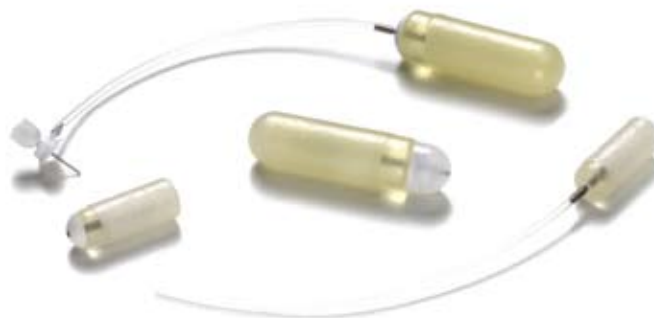
Source: Pardridge, W.M., *Transnasal and intraventricular delivery. In "Peptide Drug Delivery to the Brain"* (Table 4.2) Raven Press, 1991:112.

## Long-Term Administration

ALZET pumps range in duration from 1 day to 6 weeks. However, animals can be dosed for longer periods by performing serial implantation of pumps. This procedure is generally well tolerated and enables steady state exposure of experimental agents over prolonged periods of time. The longest infusion study reported in mice using ALZET pumps is 5 months, with pumps being replaced every 4 weeks (Bello *et al.* *Clinical Cancer Research* 2004;10(13):4527-4537). In contrast with other infusion devices, ALZET pumps contain no moving parts or batteries that can potentially fail during the course of a long-term study.

## In Vivo Imaging Applications

Bioluminescence Imaging (BLI) and Magnetic Resonance Imaging (MRI) techniques are powerful research tools that enable *in vivo* monitoring of ongoing biological processes over time in the same animal. ALZET pumps are increasingly being used in studies involving *in vivo* imaging. ALZET pumps can be easily adapted for compatibility with MRI or BLI equipment. Please contact ALZET technical support for specific information.



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