

Procedure: IACUC-31
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**UC Davis
Institutional Animal Care and Use Committee (IACUC)**

Title: Blood Collection: Volumes, Frequency and Sites

I. Purpose:

This document is intended to provide guidance regarding safe volumes and common routes for blood collection from laboratory animals.

II. Background:

The volume of blood collected for research purposes from most mammals is generally not a problem. However, repeated blood sample collection in mice, rats, hamsters, guinea pigs, small cats, birds and some fish can be problematic because of their small body size. In order to prevent anemia, electrolyte imbalance, hypovolemic shock or other complications, the following guidelines should be followed:

III. Guidelines:

As a general rule, 1% of an animal's body weight (measured in grams) can be collected in blood (measured in milliliters) within a 24-hour period, every 14 days. For example, 0.3 ml can be collected once every two weeks from a 30-gram mouse. Alternatively, 0.05 ml of blood can be collected hourly for 6 consecutive hours from a 30-gram mouse, every two weeks ($0.05 \times 6 = 0.3$ ml). Although blood *volume* is rapidly restored in an animal after blood collection, a two-week "rest period" is needed for blood *constituents* (e.g., red blood cells, platelets, clotting factors) to be regenerated by the body.

If blood samples need to be collected once a week, it is recommended that not more than 0.5% of the animal's body weight in blood be removed within a 24-hour period. For example, 0.15 ml can be collected once a week from a 30-gram mouse. This volume can be further divided if blood samples needs to be collected more frequently. For example, 0.03 ml can be collected once a day for five days from a 30-gram mouse, provided the mouse is given a one week (or greater) "rest period" before blood is collected again. ***The key to determining how much and how frequently blood can be drawn depends on the "rest period" between blood collections.***

Blood collection can be performed from several anatomical sites in mice, rats and hamsters. Table 1 provides a summary of sites and collection frequencies. Typical venipuncture sites for non-rodent species may include but are not limited to jugular, cephalic, lateral saphenous, and aural (rabbit) sites. Blood collection frequency must take into account maximum blood volumes collected with intended rest period (see above).

Table 2 provides examples of blood volumes and percentages that can be collect at the given weights. It is recommended that individual blood volumes and percentages be calculated for each specific animal. The recommended recovery periods are also listed in table 2. It is recommended that animals do not have additional blood collections sooner than the minimum recovery period after the described blood volumes have been collected.

Hemostasis can be achieved by using a silver nitrate stick, Quick Stop powder or by applying a gauze sponge over the site with gentle pressure until bleeding stops.

Table 1. Blood Collection Sites

Location	Anesthesia	Frequency	Comments
Retro-orbital sinus	Yes, general anesthesia	Same eye, once every 2 weeks; can be performed on same eye if blood is collected within 30 minutes of the first sample	Good for large blood collection on a weekly (monthly) basis
Saphenous vein	No	Multiple	Good for multiple collection of small volumes
Tail vein	No	Multiple	Good for multiple collection of small volumes
Tail nick	No	Multiple	Good for multiple collection of small volumes
Submandibular nick	No	Multiple	Good for multiple small or single large blood collection volumes
Cardiac puncture	Yes; general anesthesia, terminal procedure only	Not applicable	Good for large, one-time collection
Tail clipping	No, local anesthesia recommended	Multiple (small volumes) e.g:glucose measurements	<1mm (mice), <2mm (rat) distal tail the first time –for subsequent collections only the

			scab/clot should be gently removed
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Table 2: Total Blood and Blood Sample Volumes

Species (weight)	Blood Volume (mL)	7.5% (mL)	10% (mL)	15% (mL)
Mouse (25 g)	1.8	0.1	0.2	0.3
Rat (250 g)	16	1.2	1.6	2.4
Syrian Hamster (115 g)	8.4	0.6	0.8	1.2
Gerbil (75 g)	5.0	0.4	0.5	0.8
Guinea Pig (850g)	64	4.8	6.4	9.6
Ferret (1 kg)	75	5.6	7.5	11
Rabbit (4 kg)	224	17	22	34
Cat (4 kg)	160	12	16	24
Dog (10 kg)	850	64	85	127
Macaque, Rhesus (5 kg)	280	21	28	42
Macaque, Cynomolgus (5 kg)	325	24	32	49
Marmoset (350 g)	25	2.0	2.5	3.5
Minipig (15 kg)	975	73	98	146
Goat (30 kg)	2,400	180	240	360
Horse (500 kg)	35,000	2,600	3,500	5,250
Recovery period for single sampling		1 week	2 weeks	4 weeks
Recovery period for multiple sampling		1 week	2 weeks	2 weeks

For assistance with blood collection sites in other species, or for further assistance in tailoring blood volumes and blood collection frequencies to project needs or for animals of compromised health status, please contact Campus Veterinary Services at 530-752-0514/clinic@ucdavis.edu or the IACUC Office for species-specific training.

IV. **References:**

1. Diehl, K., et al., A Good Practice Guide to the Administration of Substances and Removal of Blood, Including Routes and Volumes, J Appl Toxicol 21:15-23, 2001.
2. NIH Guidelines for Survival Bleeding in Mice and Rats, 2007.
3. The Care and Feeding of an IACUC, Second Edition 2015.