BLOOD COLLECTION SITES AND VOLUME RECOMMENDATIONS

This document provides guidance to investigators regarding safe blood collection volumes in laboratory animals. All procedures must be approved by the Institutional Animal Care and Use Committee (IACUC). Depending on the study, the type of blood collection to be used, the intervals between blood collection procedures, and the amount of blood to be removed, should be outlined in the approved protocol.

Blood collection methods and volumes will vary depending on the animal species, the frequency of collection, and the experimental needs. It is important for researchers to plan and perform each sampling protocol with an appreciation for the stresses associated with blood loss for the animal and to do everything in their power to minimize the animal's reaction to the stress. It is important to carefully plan and control blood sampling, as well as all experimental variables associated with it, not only to benefit the animal, but also to minimize confounding influences.

Volume:

On average, the total circulating blood volume is equal to 5.5 -8.0 % of the animal's body weight. **Non-terminal blood collections should be limited to 10% of the total circulating blood** volume per collection or every two weeks for serial collections.

Example (Using mean blood volume table below): a 4 kg rabbit is calculated to have a total blood volume of 224 ml (56 ml/kg x 4.0 kg). Thus, 22.4 ml (10% of 224 ml) may be collected without giving replacement fluids once every two weeks.

Species	Blood Volume Range (ml / kg)	Blood Volume Range (ml / kg)	Blood Volume Average (ml)	
			7.50%	10%
Mouse (25g average Weight)	58.6	55-80	0.11	0.15
Rat (250g)	64	58-70	1.2	1.6
Rabbit (4kg)	56	44-70	17.0	22.0
Non Human Primates (6kg)	54	44-67	25.0	33.3
Swine (30kg)	65	61-68	145.1	193.5
Sheep (30kg)	66	60-74	150.8	201.0

Species	Recommended Sites & Conditions
Mouse	Superficial temporal vein (a.k.a., "submandibular" or "facial"), saphenous vein, tail vein, retro-orbital (anesthetized), cardiac (anesthetized, terminal)
Rat	Tail vein, saphenous vein, superficial temporal vein (a.k.a., "submandibular" or "facial"), cardiac (anesthetized, terminal), sublingual, jugular
Dog, Cat, Non-human Primate	Cephalic, saphenous veins, femoral and jugular viens
Guinea pig, Hamster	Saphenous, cardiac (anesthetized, terminal)
Rabbit	Marginal ear vein, cardiac (anesthetized, terminal)
Swine	Jugular, ear vein
Chicken	Brachial/wing vein, jugular
Ruminant, Equine	Jugular

Guidelines for Rodent Blood Collection

For rodents the circulating blood volume, approximately 10% of the total volume can be safely removed every 2 to 4 weeks, 7.5% every 7 days, and 1% every 24 hours. Fluid and/or cellular replacement should be provided if volumes to be collected are greater than the recommended ranges and must be justified scientifically. The table below provides approximations of blood sample volumes for various body weights

Body Weight (g)	*CBV (ml)	1% CBV (ml) every 24 hours**	7.5% CBV (ml) every 7 days**	10% CBV (ml) every 2-4 weeks**
20	1.10-1.40	0.011-0.014	0.082-0.105	0.11-0.14
25	1.37-1.75	0.014-0.018	0.10-0.13	0.14-0.18
30	1.65-2.10	0.017-0.021	0.12-0.16	0.17-0.21
35	1.93-2.45	0.019-0.025	0.14-0.18	0.19-0.25
40	2.20-2.80	0.022-0.28	0.16-0.21	0.22-0.28
125	6.88-8.75	0.069-0.088	0.52-0.66	0.69-0.88
150	8.25-10.50	0.082-0.105	0.62-0.79	0.82-1.00
200	11.00-14.00	0.11-0.14	0.82-1.05	1.10-1.40
250	13.75-17.50	0.14-0.18	1.00-1.30	1.40-1.80
300	16.50-21.00	0.17-0.21	1.20-1.60	1.70-2.10
350	19.25-24.50	0.19-0.25	1.40-1.80	1.90-2.50
*Circulating Blood Volume		** Maximum sample volume for that sampling frequency		

Fluid replacement

Lactated Ringer's Solution (LRS) is the recommended balanced crystalloid solution for fluid replacement. Alternatively, 0.9% sterile isotonic saline may be used. For adult mice, 1.0 ml of warmed LRS or isotonic saline can be given by IP or SC administration. For adult rats, administer 5 -10 ml warmed LRS or 0.9% saline (½ of the total volume via IP and ½ via SC routes)

REFERENCES:

1. Hawk TC, Leary, ST, and Morris, TH. 2005. Formulary for Laboratory Animals, 3rd ed. Ames, IA Blackwell Publishing
2. University of Kentucky; Division of Laboratory Animal Resources, Guidelines for Blood Collection in Laboratory Animals.
3. University of California, Berkeley, Animal Care and Use Program, Blood Collection Techniques and Limits

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