



UNIVERSITY OF OTTAWA  
ANIMAL CARE COMMITTEE (ACC) POLICY

## ACC-03 BLOOD COLLECTION GUIDELINES

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### 1. PURPOSE

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The purpose of this policy is to provide general guidance in determining the volumes of blood to be withdrawn from different laboratory animal species, in chronic and acute situations, as well as accepted methods for blood collection. The guidelines are consistent with the Ontario Animals for Research Act, R.S.O. 1990, c.A22 and Canadian Council on Animal Care standards and policies.

### 2. GENERAL

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When designing a study protocol, the following guidelines must be considered to determine the volume, frequency and methods used for blood collection (please refer to Table 1, 2 and 3 below). This information needs to be defined within the relevant animal use protocol submission to the Animal Care Committee.

For any questions about blood collection or for species or guidelines not listed, an ACVS Veterinarian can assist with the selection of appropriate procedures. Larger volumes of blood can be collected when performed under general anesthesia for terminal purposes.

It is critical, when choosing a technique for blood sampling, that the researcher carefully consider possible adverse side effects associated with the procedure (and with other procedures performed on the same animal) and consult an ACVS Veterinarian as needed.

**If the volume of blood required and/or number and frequency of punctures exceeds this guideline, justification will be required prior to ACC review and approval.**

### 3. DEFINITIONS

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- A. **Puncture:** Refers to the number of needle/capillary punctures for one site, with or without successful blood withdrawal.
- B. **Site:** A blood vessel (in this case a vein) will be considered as one site.

Table 1: Circulating blood volumes in laboratory species	
Species	Mean <sup>1</sup> * Blood Volume (ml/kg)
Mouse	72
Rat	64
Guinea pig	70
Rabbit	56

Table 1: Circulating blood volumes in laboratory species	
Pig	67
Fish	50

#### 4. RECOMMENDATIONS FOR BLOOD SAMPLING PROCEDURES VERSUS VOLUME WITHDRAWN

The recommended percentage of blood sampling detailed in the table below should be followed. However, higher percentages of blood withdrawal may be evaluated and approved by the Animal Care Committee under certain conditions.

Table 2: Limit volumes and recovery periods <sup>1</sup>			
Single sampling (e.g. toxicity study)		Multiple sampling (e.g. toxicokinetic study)	
% circulatory blood volume removed	Approximate recovery period	% circulatory blood volume removed in 24 h	Approximate recovery period
7.5%	1 week	7.5%	1 week
10%	2 weeks	10-15%	2 weeks
15%	4 weeks	20% <sup>2</sup>	3 weeks

<sup>1</sup> This table does not include a terminal sample (taken when the animal is terminally anesthetized).

<sup>2</sup> The higher volume (20%) is intended to facilitate serial blood sampling for toxic- or pharmacokinetic purposes where multiple, small samples are usually required.

#### 5. RECOMMENDATIONS FOR MAXIMUM DAILY PUNCTURES/ SAMPLING

For needle puncture, a maximum of five punctures/site/day is suggested. If, due to unforeseen circumstances, the number of punctures exceeds this recommendation, the condition of the site should be evaluated and monitored. A vessel must not be used for subsequent puncture if it shows signs of severe inflammation or hematoma.

Cannulation is an important technique for repeated bleeding. Butterfly needles may be used for the short term (day); however, for long-term use, surgical implantation of a cannula should be considered. This method of cannulation allows for repeated blood drawing with minimal discomfort and distress for the animal. For long-term use, a subcutaneous vascular access port is preferred. Long-term cannulation may lead to thrombosis of the vessel and other medical complications.

Table 3: Recommended sites for repeated blood sampling	
Species	Recommended sites (veins unless stated otherwise) <sup>3</sup>
Mouse	Saphenous, lateral tail
Rat	Saphenous, lateral tail, sub-lingual
Rabbit	Marginal ear, central ear artery, jugular
Pig	Cranial vena cava (blind stick)
Fish	Caudal, dorsal aorta, caudal artery, cardiocentesis <sup>4</sup>

<sup>3</sup> Additional sites might be appropriate and will be evaluated by the Animal Care Committee on a case-by-case basis.

<sup>4</sup> This method does impose greater potential risk and the operator must be very familiar with the species anatomy.

Table 4: Summary of the advantages and disadvantages of the various methods of blood sampling				
Route/Vein	Anesthesia requirement	Tissue damage	Repeat bleeds	Volume
Jugular	No	Low	Yes	+++
Saphenous/Lateral tarsal	No	Low	Yes	++(+)
Marginal ear	Local	Low	Yes	+(+)
Sub-lingual	General	Low	Yes	+++
Lateral tail	No	Low	Yes	++(+)
Central ear artery	Local	Low	Yes	+++
Central vena cava	No	Low	Yes	+++
Tail tip amputation (<1-3 mm)	General	Moderate	Limited	+
Cardiocentesis	General	Moderate	No	+++

## **POLICY HISTORY**

DATE	NEW VERSION
December 2013	Policy creation (v1)
November 2019	Policy revised (v2, e.g. format and code updated)

Appendix 1: Mouse blood volumes based on body weight					
Body Weight (g)	Total Volume of Blood (72 mL/kg)	Volume per collection			
		7.50%	10%	15%	20%
15	1.08	0.08	0.11	0.16	0.22
16	1.15	0.09	0.12	0.17	0.23
17	1.22	0.09	0.12	0.18	0.24
18	1.30	0.10	0.13	0.19	0.26
19	1.37	0.10	0.14	0.21	0.27
20	1.44	0.11	0.14	0.22	0.29
21	1.51	0.11	0.15	0.23	0.30
22	1.58	0.12	0.16	0.24	0.32
23	1.66	0.12	0.17	0.25	0.33
24	1.73	0.13	0.17	0.26	0.35
25	1.80	0.14	0.18	0.27	0.36
26	1.87	0.14	0.19	0.28	0.37
27	1.94	0.15	0.19	0.29	0.39
28	2.02	0.15	0.20	0.30	0.40
29	2.09	0.16	0.21	0.31	0.42
30	2.16	0.16	0.22	0.32	0.43
31	2.23	0.17	0.22	0.33	0.45
32	2.30	0.17	0.23	0.35	0.46
33	2.38	0.18	0.24	0.36	0.48
34	2.45	0.18	0.24	0.37	0.49
35	2.52	0.19	0.25	0.38	0.50
36	2.59	0.19	0.26	0.39	0.52
37	2.66	0.20	0.27	0.40	0.53
38	2.74	0.21	0.27	0.41	0.55
39	2.81	0.21	0.28	0.42	0.56
40	2.88	0.22	0.29	0.43	0.58