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## **Recommended Volume for Administered Substances**

The intent of this SOP is to describe the recommended volumes and needle sizes for substances administered to animals. This SOP is intended for use by all personnel administering such substances. This SOP is approved by the NUS Institutional Animal Care and Use Committee (IACUC). Any deviation must be approved by the IACUC prior to its implementation

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### **1. INTRODUCTION**

This SOP provides information regarding administration volumes and needles sizes/gauges for the commonly used routes of substance administration in various animal species weighing less than 45 kg. These are consensus figures based on guidelines that are not scientifically tested but rather on clinical experience. The volume limits are established to consider animal well-being and to prevent potential complications such as muscle damage from intramuscular injection, or aspiration and pulmonary injury from oral administration or gavage.

The Guide states that, “The use of pharmaceutical-grade chemicals and other substances ensures that toxic or unwanted side effects are not introduced into studies conducted in experimental animals. They should therefore be used, when available, for all animal-related procedures.”

Before administering any substance (therapeutic or experimental) to an animal subject, one must consider the pH, sterility, and chemical nature (odour, taste, mucosal irritability, osmolarity, solubility, light sensitivity and hazard status) of the compound and make appropriate decisions on the dose to be administered, frequency of

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administration, volume to be administered, the solvent (if necessary), and route of administration.

Any compound/substance to be administered must be reviewed and approved by the IACUC before its use.

Compounds/substances that are administered on an emergency basis as part of veterinary care do not require prior IACUC approval. These may include fluids, anesthetics, analgesics, antibiotics or other pharmaceutical compounds.

## **2. MATERIALS**

- a) Needles
- b) Syringes
- c) Substance for administration

## **3. Procedures:**

- a) Verify that the pH of a substance to be injected subcutaneously or intramuscularly has a pH of 7.3 to 7.45 and that the substance is isotonic (e.g. label information, direct measurement). Non-isotonic substances/solutions must be injected slowly if intraperitoneal or intravenous routes are used.
- b) When possible, warm the solutions (using fluid warmer or other warming devices) so that they are at or near body temperature (37°C) before injection.
- c) Give injections at a constant flow rate. No resistance should be encountered during injection. Do not apply overt pressure on the syringe's plunger. The injected substance should flow freely to prevent any unnecessary pain and tissue damage.
- d) For recommended volume and needle size, please refer to Appendix A.
- e) Precautions:
  - i. Do not inject into inflamed or damaged tissue unless medically indicated or scientifically justified and approved by the IACUC.
  - ii. Inject separate drugs/compounds at different sites to avoid cross reaction of chemicals.
  - iii. Subcutaneous administration should be limited to no more than 3 sites per day unless medically indicated or scientifically justified and approved by the IACUC.
  - iv. Intramuscular administration should be limited to 2 sites at one time. Exceptions apply when medically indicated or scientifically justified and approved by the IACUC.

## **4. PERSONNEL SAFETY**

- Medical emergencies: During office hours, please visit the University Health and Wellness Centre, located at University Health Centre, Level 1, 20 Lower Kent Ridge Road, Singapore 119080 or call 6776 1631 (Main line). For on-

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campus emergencies after office hours, please proceed immediately the NUH Accident & Emergency Unit.

## 5. ANIMAL RELATED CONTINGENCIES

- Post contact information for emergency assistance in a conspicuous location within the animal facility.
- Emergency veterinary care is available all times including after hours, weekends and public holidays – please call the emergency vet phone at 90013073.

## 6. REFERENCES

- Cornell University Institutional Animal Care and Use Committee. ACUP 401.01: “Recommended Volumes for Administered Substances”.
- Boston University IACUC Policies and Guidelines. “Administration of Drugs and Experimental Compounds in Mice and Rats”.
- Brown, A.P. et. al., “Stress produced by gavage administration in the rat”. Contemp. Top. Lab. Anim. Sci., 39, 17-21, 2000.
- Diehl et al., “A Good Practice Guide to the Administration of Substances and Removal of Blood, Including Routes and Volumes”, J Applied Toxicology, 21, 15-23, 2001.
- Duke University and Medical Centre, Office of Animal Welfare Assurance. “Guidelines for Drug Administration Routes”.
- Fox, G.F. et al., Laboratory Animal Medicine. 2<sup>nd</sup> Edition. San Diego: Academic Press, 2002.
- Fox, G.F. et. al, Biomethodology and Surgical Techniques in the Mouse in Biomedical Research. 2<sup>nd</sup> Edition. Pg. 444-454, Drug Administration. San Diego: Academic Press, 2007.
- Hawk, C.T. et al., Formulary for Laboratory Animal. 3<sup>rd</sup> Edition. Iowa: Blackwell Publishing, 2005.
- The Guide for the Care and Use of Laboratory Animals. 8<sup>th</sup> Edition. National Research Council.

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.01	Shannon Heo	26 November 2012	403.01
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\*Revision .02- Added NHPs in Appendix

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**7. APPENDIX**

Recommended Volumes and Needle Size per Routes and per Species												
Species and Weight	Oral (mL per dose)		Subcutaneous (mL)		Intramuscular (mL per site)		Intraperitoneal (mL)		Intravenous (mL)		Needle Size (G) (equal to or smaller than) <sup>1</sup>	
	Recommended	Maximum Limit	Recommended	Maximum Limit	Recommended	Maximum Limit	Recommended	Maximum Limit	Recommended	Slow injection	Recommended	Maximum
Rat (per 100g)	1	2	0.5	1	0.05	0.1	1	2	0.5	2	≤23G	≤23G
Mouse (per 10g)	0.1	0.4	0.1-0.2	0.4	0.02	0.04	0.2	0.8	0.05	0.2	≤27G	≤25G
Guinea Pig (per 100g)	1	1.5	0.5	1	0.05	0.1	1	2	0.5	2	≤23G	≤23G
Rabbit (per kg)	10	15	2	2	0.25	0.5	5	20	2	10	≤23G	≤20
Pig (per kg)	5	15	1	2	0.12	0.2	1	10	2.5	5	≤20G	≤20G
Macaque (per kg)	10	15	2	5	0.05	0.5	10	10	2	5	≤21G	≤20G

Note:

- The recommended volumes and needle sizes are not based upon rigorously tested scientific data.
- Compare the weight in the table to the weight of the animal being used in the procedure and alter the dose accordingly.
- Volumes and administration rates can be altered for medical conditions as determined by a veterinarian. (\* Maximum dose for oral gavage with oil vehicle should not exceed 2ml – see Reference 3<sup>rd</sup> Bullet)
- Always use the smallest needle size that is applicable to the procedure.

<sup>1</sup> The higher the gauge, the thinner the needle. For example, a 31 gauge needle is thinner than a 28 gauge needle.