

BLOOD COLLECTION: THE RAT
IACUC Guideline
Effective Date: August 2016



General guidelines:

- The acceptable quantity and frequency of blood sampling is determined by the circulating blood volume and the red blood cell (RBC) turnover rate. Excessive blood collection may result in hypovolemic shock, physiological stress and even death.
- For optimal health, blood draws should be limited to the lower end of the range. Maximum blood volumes should be taken only from healthy animals.
- The approximate blood volume of a rat is 55-70 ml/kg of body weight. For a 300 g rat this is equivalent to 17-21 ml (5).
- **Single sample:** Without fluid replacement, the maximum blood volume which can be safely removed for a one time sample is 10% of the total blood volume or 5.5-7 ml/kg. For a 300 g rat, this is equivalent to 1.7-2.1 ml. With fluid replacement, up to 15% of the total blood volume or approximately 8.3-10.5 ml/kg can be removed. For a 300 g rat this is equivalent to 2.5-3.2 ml. Fluid replacement should be warmed and given subcutaneously (5).
- **Multiple samples:** If it is necessary to take multiple samples, smaller blood volumes should be drawn. The maximum blood volume that should be drawn per week is no more than 7.5% of the total blood volume or 4-5.3 ml/kg. For a 300 g rat, this is equivalent to 1.2-1.6 ml per week. If sampling will occur every 2 weeks, up to 10% of the total blood volume may be drawn or 5.5-7 ml/kg (4). For a 300 g rat, this is equivalent to about 1.7-2.1 ml every 2 weeks. For repeated blood collection, fluid replacement does not allow for a larger blood volume or more frequent blood collection.
- **Exsanguination:** Approximately half of the total blood volume can be collected at exsanguination. This is equivalent to about 35 ml/kg or approximately 11 ml for a 300 g rat.
- Take into account the total blood volume yielded from the chosen blood collection technique when calculating frequency and volume of blood collection.
- If you are not experienced in blood collection technique and would like training contact: trainerIACUC@ucsf.edu

Collection Site	Advantages	Disadvantages
Lateral Tail Vein Sampling	<ul style="list-style-type: none"> • Anesthesia not required • Vein is easily accessed • Allows for repeat collection 	<ul style="list-style-type: none"> • Must be securely restrained • Yields only small quantities • Requires some specialized equipment
Ventral Artery Sampling	<ul style="list-style-type: none"> • Moderate volume of blood can be collected 	<ul style="list-style-type: none"> • Anesthesia required • Requires some specialized equipment
Jugular Vein Sampling	<ul style="list-style-type: none"> • Medium to large volumes of blood can be collected • Results in a high quality sample 	<ul style="list-style-type: none"> • Does not lend to repeated sampling • Anesthesia required • Please contact the IACUC Trainer at IACUCTrainer@ucsf.edu for training.
Lateral Saphenous Vein Sampling	<ul style="list-style-type: none"> • Anesthesia not required • Repeated sampling is possible • Moderate volume of blood can be collected 	<ul style="list-style-type: none"> • Requires specialized training and some specialized equipment • Variable sample quality/quantity
Cardiac Puncture	<ul style="list-style-type: none"> • Maximum volume of blood can be collected • Requires deep anesthesia 	<ul style="list-style-type: none"> • Non-survival procedure only

References:

1. http://jaxmice.jax.org/faq/withdrawingblood_amounts.html
2. Mitruka BM, Rawnsley HM. 1981. Clinical, biochemical and hematological reference values in normal experimental animals and normal humans. New York: Masson Publishing; 413 p.
3. Harkness JE, Wagner JE. 1989. Biology and husbandry. In: Harkness JE, Wagner JE, editors. The biology and medicine of rabbits and rodents, 3rd ed. Philadelphia: Lea & Febiger; 372 p.
4. McGill MW, Rowan AN. 1989. Biological effects of blood loss: implications for sampling volumes and techniques. *ILAR News* 31:5-20