

TITLE:	Use of Neuromuscular Blocking Agents
Policy Number:	2014-018
Responsible Department:	Institutional Animal Care and Use Committee
Policy Contact:	IACUCOffice@westernu.edu
Approval Date:	8/13/14
Reviewed:	7/12/17 (No changes); 3/11/2020
Revised:	3/11/2020 (Added: info to be included in protocol; determinants for depth of anesthesia; BP monitoring for some animals)
Legislation:	Animal Welfare Act (Title 9 CFR Subchapter A, Part 2, Subpart C, § 2.31 (d)(1)(iv)(C))

Purpose of Policy: To ensure that signs and reflexes that indicate pain or discomfort in an animal undergoing surgery are not masked by the effects of neuromuscular blockers (NMBs).

Policy Information: [The Animal Welfare Act](#) states that “Procedures that may cause more than momentary or slight pain or distress to the animals will not include the use of paralytics without anesthesia” and that such procedures will “be performed with appropriate sedatives, analgesics or anesthetics...”. The National Research Council’s [Guide for the Care and Use of Laboratory Animals](#) states that “Acute stress is believed to be a consequence of paralysis in a conscious state...” and that “If paralyzing agents are to be used, the appropriate amount of anesthetic should first be defined...using the anesthetic without a blocking agent.”

NMBs can mask clinical signs such as changes in skeletal muscle tone, rate and effort of respiration and gross purposeful movements that are indicators of the level of anesthesia and, by extension, of pain or stress. Although there may be cases where an NMB is required, in most cases they are not and, therefore, WesternU strongly discourages their use. Any use of NMBs must first be approved by the Institutional Animal Care and Use Committee (IACUC) and will require rigorous scientific justification. Protocols requesting the use of NMBs must include the following:

- Anesthetic protocol
- NMB regimen
- Method of respiratory ventilation
- Methods to monitor anesthetic depth
- A description of the signs of pain or distress
- Any planned use of reversal agents
- Methods to monitor recovery from the NMB.

If approved, the following policies and procedures will be in effect:

1. It is the responsibility of the Principal Investigator to ensure that adequate anesthesia is provided throughout the use of an NMB. The depth of anesthesia should be verified by application of a non-harmful, aversive stimulus. A 20% or greater increase in heart rate may indicate inadequate anesthetic depth and the procedure should be discontinued until an adequate anesthetic depth is achieved and maintained. Pupil enlargement and peripheral nerve responsiveness during NMB time-of-effect are other indicators of possible inadequate anesthetic depth. Aversive stimulus tests should be repeated at regular intervals at least every 30 minutes.
2. The Attending Veterinarian must be consulted for species-appropriate methods of determining depth of anesthesia. Signs to be monitored may include heart rate, electroencephalogram (EEG), blood pressure, blood oxygen saturation, end-tidal CO₂ and/or blood gas concentration, body temperature and general autonomic signs of arousal such as salivation, pupil size and lacrimation.
3. Documentation on the use of NMBs in animals and all monitoring must be maintained and made available for veterinary and IACUC review.
3. A surgical plane of anesthesia must first be induced and the animals intubated before administering the NMB.
4. Controlled heart rate and ventilation must be maintained prior to administering an NMB and throughout the experiment. The person(s) monitoring respiration must be properly trained and skilled in the use of monitoring and ventilation equipment.
5. Blood pressure monitoring should be considered for some animals, such as swine and rabbits, when feasible.
6. A surgical plane of anesthesia must be maintained during the entire time the NMB is active *in vivo*.
7. The NMB must not be administered until after the skin incision has been made to ensure adequate depth of anesthesia and analgesia.
8. NMBs may not be used as a substitute for poor control of anesthesia.
9. Only general anesthetics that provide a surgical plane of anesthesia may be used with an NMB. Therefore nitric oxide cannot be used in this manner.
10. Signs of pain and stress (e.g. heart rate and blood pressure) must be continuously monitored when possible.
11. If performing survival surgery, a means to determine post-operative recovery of neuromuscular function must be employed.