TITLE: Anesthetic, Analgesic and Sedative Methods Approved by Species for the University of Arizona

PURPOSE: Assure proper anesthetic, analgesia and sedative regimens are being employed by University of Arizona Researchers and UAC staff.

REVIEW/REVISIONS: Permanent amendment/revisions to this policy must be presented to the Institutional Animal Care and Use Committee (IACUC) for review before implementation and should be developed by the University Animal Care Veterinarians, BSS Staff, IACUC Office and/or IACUC membership.

EFFECTIVE DATE: November 1, 2007

PERSON(S) RESPONSIBLE: All persons administering anesthetics, analgesics or sedatives to animals; Investigators, UAC clinical staff and veterinarians.

JUSTIFICATION: The IACUC has developed this policy to help standardize the use of anesthetics, analgesics and sedatives throughout the research community of the University of Arizona, particularly with reference to post-operative or palliative care.

POLICY/PROCEDURES:

This policy is intended to be used as a reference of suggested and possible anesthetic doses of anesthetics and analgesics for a variety of species. To assist in determining the appropriate analgesics, guidelines for recognizing and categorizing pain should be consulted: Charts 1-3 below, and
http://www.iacuc.arizona.edu/training/surgery/module/Controlling_Pain_and_Distress.html

The information provided here is not complete, original or unique. Rather, the information provided has come from a number of sources including IACUC protocols, reference manuals and books, and research and technical articles from journals. It is always advisable to **consult a Veterinarian** and **review Laboratory Animal Formularies** for appropriate agents and dosages. Other options exist, but are not listed in these charts.

When using analgesic agents the concept of pre-emptive analgesia should be followed. That is, relieving the potential pain before the pain is felt. To do so will result in a quicker, less stressful recovery of the patient.

Dosages, Measures, and Methods

BW	body weight			lb	pounds
bid	twice daily			mg	milligrams
d	days			min	minutes
h	hours			ml	milliters
IA	intraarterially			mm	millimeters
IC	intracoelomically			PO	by mouth (per os)
IM	intramuscularly		prn	as needed	
in.	inches			q	every (number of hours)
IP	intraperitoneally			s	seconds
IPP	intrapleuroperitoneally		SC	subcutaneously	
IT	intratracheally			sid	once daily
IU	international units			Tbs	tablespoons (approximately 15 ml)
IV	intravenously			tid	three times daily
kg	kilograms			tsp	teaspoons (approximately 5 ml)
l	liters			%	g/100 ml

Potential sources for information on anesthetic/analgesic doses: Users are encouraged to consult the following for other anesthetic or analgesic agents and techniques:

- Veterinary and clinical animal care staff of the facility, for advice during protocol preparation and during the conduct of the study.
- Scientific and technical journal research and review articles dealing with the research procedures and anesthetics/analgesics that will be used. Books and monographs dealing with veterinary and laboratory animal anesthesia, surgery and research techniques/procedures. Contact veterinary and clinical animal care staff for assistance in identifying current, good and comprehensive volumes.
- Recommended References are at the end of this document.

Guidelines for Assessing Pain in Rodents & Rabbits

Charts 1-3 were taken from: Public Statement. Guidelines for the Assessment and Management of Pain in Rodents and Rabbits. Public Statement, American College of Laboratory Animal Medicine. March 2007. Vol 46:2:97-108.

Chart 1: Pain Potential

Minimal to Mild Pain	Mild to Moderate Pain	Moderate to Severe Pain
Catheter Implantation	Minor Laparotomy incisions	Major Laparotomy/Organ Incision
Tail Clipping	Thyroidectomy	Thoracotomy
Ear Notching	Orchidectomy	Heterotopic Organ Transplantation
Superficial Tumor Implantation	Cesarean Section (C-Section)	Vertebral Procedures
Orbital Sinus Venotomy	Embryo Transfer	Burn Procedures
Superficial Lymphadenectomy	Hypophysectomy	Trauma Models
Ocular Procedures	Thymectomy	Orthopedic Procedures
Multiple ID Antigen Injections		
Intracerebral Electrode Implantation		
Vasectomy		
Vascular Access Port Implantation		

Selection of Appropriate Analgesics depends on:

1) Time until onset of effect,
2) Magnitude of its effect, and
3) Duration of its effect.

Chart 2: Criteria & Considerations – Mouse & Rat

a. Non-pharmacological post-operative support Methods

Minimal to Mild Pain	Mild to Moderate Pain	Moderate to Severe Pain
Wound Care	Wound Care	Wound Care
House Singly Until Ambulatory	Soft, Absorbent bedding, Nest material	Soft, Absorbent bedding, Nest material
	Modified Food and Water Access	Modified Food and Water Access
	House Singly Until Ambulatory	Increased Food Palatability

	Supplemental Heat	Supplementary Heat and Hydration, SC or IP
		House Singly Until Ambulatory

b. Suggested Pharmacological Methods - Mouse

Minimal to Mild Pain	Mild to Moderate Pain	Moderate to Severe Pain
Local anesthesia Lidocaine/ Bupivacaine	Lidocaine/ Bupivacaine (Adjunct to systemic analgesic)	Lidocaine/ Bupivacaine (adjunct to systemic analgesic)
Butorphanol 1–5 mg/kg, SC q4h	Buprenorphine 0.05–0.1 mg/kg SC, IP q8–12h	Buprenorphine 0.05–0.1 mg/kg SC, IP q8–12h
Carprofen 2.5–5 mg/kg, SC Once	Carprofen 2.5–5 mg/kg, SC q24h	Carprofen 2.5–5 mg/kg, SC q24h
		Morphine 2–5 mg/kg, SC q2–4h

c. Suggested Pharmacological Methods- Rat

Minimal to Mild Pain	Mild to Moderate Pain	Moderate to Severe Pain
Local anesthesia Lidocaine/ Bupivacaine	Lidocaine/ Bupivacaine (Adjunct to systemic analgesic)	Lidocaine/ Bupivacaine (adjunct to systemic analgesic)
Butorphanol 2 mg/kg, SC Once	Buprenorphine 0.05 mg/kg SC, IP q6–12h	Buprenorphine* 0.05–0.1 mg/kg SC, IP q8–12h
Carprofen or Ketoprofen 2.5–5 mg/kg, SC Once	Carprofen or Ketoprofen 2.5–5 mg/kg, SC q24h	Carprofen or Ketoprofen* 2.5–5 mg/kg, SC q24h
Meloxicam 1 mg/kg, SC Once	Meloxicam 1–2 mg/kg, SC q24h	Meloxicam* 1–2 mg/kg, SC q24h
		Morphine 2.5–10 mg/kg, SC q2–4h Severe Pain

*Severe pain may be better addressed by the addition of NSAID to an opoid. This multimodal approach allows for action at different points on the pain pathways, and will allow for a lower dosage of each component (Dobromylskyj, et. al., 2000). Buprenorphine, alone, is recommended for only moderate pain management.

Chart 3: Criteria & Considerations – Rabbit

a. Non-pharmacological post-operative support Methods

Minimal to Mild Pain	Mild to Moderate Pain	Moderate to Severe Pain
Wound Care	Wound Care	Wound Care
Soft, Absorbent bedding	Soft, Absorbent bedding, Nest material	Soft, Absorbent bedding
		Modified Food and Water Access
		Increased Food Palatability
		Hydration, SC or IP
		Supplemental Heat

b. Suggested Pharmacological Methods - Rabbit

Minimal to Mild Pain	Mild to Moderate Pain	Moderate to Severe Pain
Local anesthesia Lidocaine/ Bupivacaine	Lidocaine/ Bupivacaine (Adjunct to systemic analgesic)	Lidocaine/ Bupivacaine (adjunct to systemic analgesic)
Ketoprofen 3 mg/kg, SC Once	Buprenorphine 0.01–0.05 mg/kg SC, IM, IV q6–12h	Buprenorphine 0.01–0.05 mg/kg SC, IM, IV q6–12h
Butorphanol 0.1–0.5 mg/kg, IM, IV q4h	Butorphanol 0.1–0.5 mg/kg, IM, IV q4h	Morphine 2–5 mg/kg, SC q2–4h
Carprofen 4.0 mg/kg, SC 1.5 mg/kg,PO Once	Carprofen 4.0 mg/kg, SC 1.5 mg/kg,PO Once	Fentanyl patch 25 ug/h Transdermal q72h
Meloxicam (Metacam) 0.2-0.3 mg/kg, SC, PO Once	Meloxicam 0.3-1.5 mg/kg, PO q24h	

Anesthetics And Analgesics

SPECIES	Anesthetic and Analgesic Agents * Utilized individually or in combination with other authorized agents (Commonly known Registered Trade names in parenthesis) * Indicates a Controlled Drug -Adhere to all DEA rules and regulations
Amphibian	Buprenorphine (Buprenex)*, Butorphanol (Torbugesic, Torbutrol)*, Halothane (Fluothane), Isoflurane (IsoFlo, Aerrane), Meperidine (Demerol)*, Tiletamine/Zolazepam (Telazol), Tricaine methanesulfonate (MS 222)
Amphibian Fish	Atipamezole HCL (Antisedan), Butorphanol (Torbugesic, Torbutrol)*, Ketamine (Ketaset, Vetalar, Vetaket)*, Medetomidine (Domitor), Tricaine methanesulfonate (MS 222)
Amphibian Frog	Benzocaine, Buprenorphine (Buprenex)*, Butorphanol (Torbugesic, Torbutrol)*, Ketamine (Ketaset, Vetalar, Vetaket)*, Lidocaine (Xylocaine), Tiletamine/Zolazepam (Telazol), Tricaine methanesulfonate (MS 222)
Bird / Chicken	Acetylsalicylic Acid (Aspirin), Bupivacaine HCL (Marcaine), Buprenorphine (Buprenex)*, Butorphanol (Torbugesic, Torbutrol)*, Carprofen (Rimadyl), Diazepam (Valium)*, Halothane (Fluothane), Isoflurane (IsoFlo, Aerrane), Ketamine (Ketaset, Vetalar, Vetaket)*, Ketoprofen (Ketofen), Pentothal (Sodium Thiopental)*, Sevoflurane (Ultane), Tribromoethanol (Avertin)
Bovine	Acepromazine Maleate (ACE), Atipamezole HCL (Antisedan), Buprenorphine (Buprenex)*, Butorphanol (Torbugesic, Torbutrol)*, Carprofen (Rimadyl), Flunixin (Banamine), Halothane (Fluothane), Isoflurane (IsoFlo, Aerrane), Ketamine (Ketaset, Vetalar, Vetaket)*, Ketoprofen (Ketofen), Lidocaine (Xylocaine), Medetomidine (Domitor), Pentobarbital (Numbutal, Sodium Pentobarbitone)*, Propofol, Sevoflurane (Ultane), Tiletamine/Zolazepam (Telazol), Xylazine (Rompun, AnaSed),
Cat	Acepromazine Maleate (ACE), Acetylsalicylic Acid (Aspirin), Atipamezole HCL (Antisedan), Buprenorphine (Buprenex)*, Butorphanol (Torbugesic, Torbutrol)*, Carprofen (Rimadyl), Chlorpromazine, Diazepam (Valium)*, Flunixin (Banamine), Halothane (Fluothane), Ibuprofen (Advil, Motrin), Isoflurane (IsoFlo, Aerrane), Ketamine (Ketaset, Vetalar, Vetaket)*, Ketoprofen (Ketofen), Medetomidine (Domitor), Sevoflurane (Ultane), Tiletamine/Zolazepam (Telazol), Xylazine (Rompun, AnaSed), Yohimbine

Dog	Acepromazine Maleate (ACE), Acetaminophen (Tylenol), Acetylsalicylic Acid (Aspirin), Atipamezole HCL (Antisedan), Atropine, Buprenorphine (Buprenex)*, Butorphanol (Torbugesic, Torbutrol)*, Carprofen (Rimadyl), Chlorpromazine, Diazepam (Valium)*, Flunixin (Banamine), Halothane (Fluothane), Ibuprofen (Advil, Motrin), Isoflurane (IsoFlo, Aerrane), Ketamine (Ketaset, Vetalar, Vetaket)*, Ketoprofen (Ketofen), Lidocaine (Xylocaine), Medetomidine (Domitor), Pentothal (Sodium Thiopental)*, Propofol, Sevoflurane (Ultane), Tiletamine/Zolazepam (Telazol), Xylazine (Rompun, AnaSed), Yohimbine
Ferret	Acepromazine Maleate (ACE), Acetylsalicylic Acid (Aspirin), Atipamezole HCL (Antisedan), Buprenorphine (Buprenex)*, Butorphanol (Torbugesic, Torbutrol)*, Carprofen (Rimadyl), Diazepam (Valium)*, Fentanyl/Droperidol (Innovar-Vet)*, Flunixin (Banamine), Halothane (Fluothane), Ibuprofen (Advil, Motrin), Isoflurane (IsoFlo, Aerrane), Ketamine (Ketaset, Vetalar, Vetaket)*, Ketoprofen (Ketofen), Medetomidine (Domitor), Pentazocine (Talwin)*, Propofol, Sevoflurane (Ultane), Tiletamine/Zolazepam (Telazol), Yohimbine
Gerbil	Acetaminophen (Tylenol), Acetylsalicylic Acid (Aspirin), Atipamezole (Antisedan), Atropine, Buprenorphine (Buprenex)*, Butorphanol (Torbugesic, Torbutrol)*, Carprofen (Rimadyl), Chlorpromazine, Diazepam (Valium)*, Flunixin (Banamine), Halothane (Fluothane), Isoflurane (IsoFlo, Aerrane), Ketamine (Ketaset, Vetalar, Vetaket)*, Ketoprofen (Ketofen), Medetomidine (Domitor), Pentazocine (Talwin)*, Sevoflurane (Ultane), Tiletamine/Zolazepam (Telazol), Tribromoethanol (Avertin), Xylazine (Rompun, AnaSed)
Guinea Pig	Acepromazine Maleate (ACE), Acetaminophen (Tylenol), Acetylsalicylic Acid (Aspirin), Atipamezole (Antisedan), Buprenorphine (Buprenex)*, Butorphanol (Torbugesic, Torbutrol)*, Carprofen (Rimadyl), Chlorpromazine, Diazepam (Valium)*, Fentanyl/Droperidol (Innovar-Vet)*, Flunixin (Banamine), Halothane (Fluothane), Ibuprofen (Advil, Motrin), Inactin, Isoflurane (IsoFlo, Aerrane), Ketamine (Ketaset, Vetalar, Vetaket)*, Ketoprofen (Ketofen), Medetomidine (Domitor), Morphine*, Pentazocine (Talwin)*, Pentobarbital (Nembutal, Sodium Pentobarbitone)*, Sevoflurane (Ultane), Tiletamine/Zolazepam (Telazol), Xylazine (Rompun, AnaSed), Yohimbine
Hamster	Acetaminophen (Tylenol), Acetylsalicylic Acid (Aspirin), Atipamezole HCL (Antisedan), Buprenorphine (Buprenex)*, Butorphanol (Torbugesic, Torbutrol)*, Carprofen (Rimadyl), Chlorpromazine, Diazepam (Valium)*, Fentanyl/Droperidol (Innovar-Vet)*, Flunixin (Banamine), Halothane (Fluothane), Isoflurane (IsoFlo, Aerrane), Ketamine (Ketaset, Vetalar, Vetaket)*, Ketoprofen (Ketofen), Medetomidine (Domitor), Morphine*, Pentazocine (Talwin)*, Pentobarbital (Nembutal, Sodium Pentobarbitone)*, Sevoflurane (Ultane), Tiletamine/Zolazepam (Telazol) - only with Xylazine, Xylazine (Rompun, AnaSed), Yohimbine
Mouse	Acepromazine Maleate (ACE), Acetaminophen (Tylenol), Acetylsalicylic Acid (Aspirin), Buprenorphine (Buprenex)*, Butorphanol (Torbugesic, Torbutrol)*, Carprofen (Rimadyl), Celecoxib (Celebrex), Chlorpromazine, Diazepam (Valium)*, Fentanyl/Droperidol (Innovar-Vet)*, Flunixin (Banamine), Halothane (Fluothane), Ibuprofen (Advil, Motrin), Isoflurane (IsoFlo, Aerrane), Ketamine (Ketaset, Vetalar, Vetaket)*, Ketoprofen (Ketofen), Medetomidine (Domitor), Meloxicam (Metacam), Morphine*, Pentazocine (Talwin)*, Pentobarbital (Nembutal, Sodium Pentobarbitone)*, Pentothal (Sodium Thiopental)*, Sevoflurane (Ultane), Tetracaine (Pontocaine), Tribromoethanol (Avertin), Urethane, Xylazine (Rompun, AnaSed), Yohimbine

Non-Human Primate	Acepromazine Maleate (ACE), Acetaminophen (Tylenol), Acetylsalicylic Acid (Aspirin), Atipamezole HCL (Antisedan), Atropine, Buprenorphine (Buprenex)*, Butorphanol (Torbugesic, Torbutrol)*, Carprofen (Rimadyl), Diazepam (Valium)*, Fentanyl (Durgesic)*, Fentanyl/Droperidol (Innovar-Vet)*, Flunixin (Banamine), Halothane (Fluothane), Ibuprofen (Advil, Motrin), Isoflurane (IsoFlo, Aerrane), Ketamine (Ketaset, Vetalar, Vetaket)*, Ketoprofen (Ketofen), Lidocaine (Xylocaine), Medetomidine (Domitor), Midazolam (Versed)*, Naproxen (Naprosyn, Syntex), Oxymorphone*, Pentazocine (Talwin)*, Pentobarbital (Nembutal, Sodium Pentobarbitone)*, Pentothal (Sodium Thiopental)*, Propofol, Sevoflurane (Ultane), Tiletamine/Zolazepam (Telazol), Xylazine (Rompun, AnaSed), Yohimbine
Rabbit	Acepromazine Maleate (ACE), Acetaminophen (Tylenol), Acetylsalicylic Acid (Aspirin), Atipamezole HCL (Antisedan), Atropine, Buprenorphine (Buprenex)*, Butorphanol (Torbugesic, Torbutrol)*, Carprofen (Rimadyl), Codeine*, Diazepam (Valium)*, Fentanyl/Droperidol (Innovar-Vet)*, Flunixin (Banamine), Halothane (Fluothane), Ibuprofen (Advil, Motrin), Isoflurane (IsoFlo, Aerrane), Ketamine (Ketaset, Vetalar, Vetaket)*, Ketoprofen (Ketofen), Lidocaine (Xylocaine), Medetomidine (Domitor), Meloxicam (Metacam), Pentobarbital (Nembutal, Sodium Pentobarbitone)*, Propofol, Sevoflurane (Ultane), Tetracaine (Pontocaine), Thiopental Sodium (Pentothal)*, Tiletamine/Zolazepam (Telazol), Xylazine (Rompun, AnaSed), Yohimbine
Rat	Acepromazine Maleate (ACE), Acetaminophen (Tylenol), Acetylsalicylic Acid (Aspirin), Atipamezole HCL (Antisedan), Atropine, Buprenorphine (Buprenex)*, Butorphanol (Torbugesic, Torbutrol)*, Carprofen (Rimadyl), Diazepam (Valium)*, Fentanyl/Droperidol (Innovar-Vet)*, Flunixin (Banamine), Halothane (Fluothane), Ibuprofen (Advil, Motrin), Inactin, Isoflurane (IsoFlo, Aerrane), Ketamine (Ketaset, Vetalar, Vetaket)*, Ketoprofen (Ketofen), Medetomidine (Domitor), Meloxicam (Metacam), Morphine*, Pentazocine (Talwin)*, Pentobarbital (Nembutal, Sodium Pentobarbitone)*, Pentothal (Sodium Thiopental)*, Propofol, Sevoflurane (Ultane), Tetracaine (Pontocaine), Tiletamine/Zolazepam (Telazol), Tribromoethanol (Avertin), Urethane, Xylazine (Rompun, AnaSed), Yohimbine
Reptile	Acepromazine Maleate (ACE), Buprenorphine (Buprenex)*, Butorphanol (Torbugesic, Torbutrol)*, Carprofen (Rimadyl), Diazepam (Valium)*, Flunixin (Banamine), Halothane (Fluothane), Isoflurane (IsoFlo, Aerrane), Ketamine (Ketaset, Vetalar, Vetaket)*, Sevoflurane (Ultane), Tiletamine/Zolazepam (Telazol), Tricaine methanesulfonate (MS 222)
Reptile Snake	Acepromazine Maleate (ACE), Buprenorphine (Buprenex)*, Butorphanol (Torbugesic, Torbutrol)*, Carprofen (Rimadyl), Diazepam (Valium)*, Flunixin (Banamine), Halothane (Fluothane), Isoflurane (IsoFlo, Aerrane), Ketamine (Ketaset, Vetalar, Vetaket)*, Pentobarbital (Nembutal, Sodium Pentobarbitone)*, Sevoflurane (Ultane), Tiletamine/Zolazepam (Telazol)
Reptile Turtle	Acepromazine Maleate (ACE), Buprenorphine (Buprenex)*, Butorphanol (Torbugesic, Torbutrol)*, Carprofen (Rimadyl), Diazepam (Valium)*, Flunixin (Banamine), Halothane (Fluothane), Isoflurane (IsoFlo, Aerrane), Ketamine (Ketaset, Vetalar, Vetaket)*, Pentobarbital (Nembutal, Sodium Pentobarbitone)*, Sevoflurane (Ultane), Tiletamine/Zolazepam (Telazol)
Sheep	Acepromazine Maleate (ACE), Acetylsalicylic Acid (Aspirin), Atropine, Buprenorphine (Buprenex)*, Butorphanol (Torbugesic, Torbutrol)*, Diazepam (Valium)*, Flunixin (Banamine), Halothane (Fluothane) (Fluothane), Isoflurane (IsoFlo, Aerrane), Ketamine (Ketaset, Vetalar, Vetaket)*, Ketoprofen (Ketofen), Medetomidine (Domitor), Meperidine (Demerol)*, Pentazocine (Talwin)*, Pentobarbital (Nembutal, Sodium Pentobarbitone)*, Phenylbutazone , Propofol, Sevoflurane (Ultane), Thiopental Sodium (Pentothal)*, Xylazine (Rompun, AnaSed), Yohimbine

Swine	Acepromazine Maleate (ACE), Acetaminophen (Tylenol), Acetylsalicylic Acid (Aspirin), Atropine, Buprenorphine (Buprenex)*, Butorphanol (Torbugesic, Torbutrol)*, Chlorpromazine, Diazepam (Valium)*, Fentanyl/Droperidol (Innovar-Vet)*, Flunixin (Banamine), Halothane (Fluothane), Isoflurane (IsoFlo, Aerrane), Ketamine (Ketaset, Vetalar, Vetaket)*, Lidocaine (Xylocaine), Ketoprofen (Ketofen), Medetomidine (Domitor), Meperidine (Demerol)*, Morphine*, Pentobarbital (Nembutal, Sodium Pentobarbitone)*, Pentothal (Sodium Thiopental)*, Sevoflurane (Ultane), Tiletamine/Zolazepam (Telazol), Xylazine (Rompun, AnaSed), Yohimbine

Anesthetics And Analgesics – Listed by Species (All Dosages in the following tables are given per kg Body Weight unless otherwise noted)

Amphibians: Anesthetics and Analgesics

Anesthesia in Amphibians	**Dose & Route**	**Comments**
Inhalant Anesthetics: Isoflurane (IsoFlo, Aerrane) * IsoFlo is preferred Halothane (Fluothane)	To effect. In general, 3–4% induction, 1–2% maintenance; inhalation. 0.5–2.0 ml/L bath or vaporize then bubble in water.	Precision vaporizer; Adequate ventilation or scavenging essential; Levels in water are difficult to control *NOT recommended
Ketamine (Ketaset,Vetalar,Vetaket)* Combinations are recommended: Diazepam (Valium)*	20–40 mg/kg Ketamine + 0.2–0.4 mg/kg Diazepam, IM	Variable results
Tiletamine/ Zolazepam (Telazol)	5–20 mg/kg, IM	Restraint; Variable results
Tricaine methanesulfonate (MS 222)	Immerse in 0.1% buffered solution, 50–150 mg/kg, SC, IM, IC	Buffer with $NaHCO_3$
Analgesia in Amphibians	**Dose & Route**	**Comments**
Buprenorphine (Buprenex)*	38 mg/kg, SC	Analgesia > 4h
Butorphanol (Torbugesic, Torbutrol)*	^ 0.2–0.4 mg/kg, IM	^ Dosage not determined, but assumed to be similar to that in mammals.
Meperidine (Demerol)*	49 mg/kg, SC	Analgesia >4h

Amphibians: Anesthetics & Analgesics in Fish

Anesthesia in Fish	**Dose & Route**	**Comments**
Ketamine (Ketaset,Vetalar,Vetaket)* Combinations are recommended: Medetomidine (M) Reverse (M) with Atipamezole (Antisedan)	1–2 mg/kg Ketamine + 0.05–0.10 mg/kg Medetomidine, IM *Reversal agent:* 0.2mg Atipamezole, IM	
Tricaine methanesulfonate (MS 222)	Immerse in buffered solution, 50–100 mg/l bath, induction; 50–60 mg/l maintenance	Buffer with $NaHCO_3$
Analgesia in Fish	**Dose & Route**	**Comments**
Butorphanol (Torbugesic, Torbutrol)*	0.05–0.10 mg/kg, IM 0.4 mg/kg, IM Post-op in KOI	Buffer solution

Amphibians: Anesthetics & Analgesics in Frogs

Anesthesia in Frogs	Dose & Route	Comments
Benzocaine	200–300 mg/L, bath	Buffer solution (Dissolve in Ethanol first)
Ketamine (Ketaset, Vetalar, Vetaket)* + Diazepam (Valium)*	20–40 mg/kg Ketamine + 0.2–0.4 mg/kg Diazepam, IM	Variable results
Lidocaine (Xylocaine) **Use with Caution	Local infiltration	2% solution, plus Ketamine; Used for minor surgeries
Tiletamine/ Zolazepam (Telazol)	10–20 mg/kg, IM	Rapid Recovery; Variable results
Tricaine methanesulfonate (MS 222)	Immerse in buffered 1g/L buffered bath solution Most Amphibian Species: 50–200 mg/kg, SC, IM Frog, Salamander: 0.5–2.0g/l buffered bath to effect. Leopard Frogs: 100–200 mg/kg, IC Bullfrogs: 100–400 mg/kg, IC	Buffer with $NaHCO_3$ Induction takes 15–30 min
Analgesia in Frogs	**Dose & Route**	**Comments**
Buprenorphine (Buprenex)*	38 mg/kg, SC	Analgesia > 4h. (ED50 in Leopard Frog)
Butorphanol (Torbugesic, Torbutrol)*	0.2– 0.4 mg/kg, IM	Buffer solution

Bird / Chicken: Anesthetics and Analgesics

Anesthesia in Birds	Dose & Route	Comments
Bupivacaine HCL (Marcaine)	2 mg/kg infused SC; 2–10 mg/kg infused into incision site; 3mg/0.3 ml saline injected intraarticularly for musculoskeletal pain; 50:50 mix with Dimethyl sulfoxide (DMSO) applied topically	Local; 4-6 hr duration
Diazepam (Valium)*	0.05–0.15 mg/kg, IV 1–1.5 mg/kg IV, IM 2.5–4mg/kg, PO prn 5.5 mg/L drinking water	Sedative
Inhalant Anesthetics: Isoflurane (IsoFlo, Aerrane) Halothane (Fluothane) Sevoflurane (Ultane)	* To effect. In general, 0.5–4% induction, 1–3% maintenance; inhalation.	Precision vaporizer; Adequate ventilation or scavenging essential; * Anesthetic choice in birds
Ketamine (Ketaset,Vetalar,Vetaket)* Combinations are recommended:	Dosage depends on usage with other anesthetic/analgesic agent.	Best if used with another agent; See Formulary for combination dosages
Thiopental Sodium (Pentothal)*	90 mg/kg, IP; 5.5–11.0 mg/kg, IV	IV dose is short acting
Tribromoethanol (Avertin)	Waterfowl: 1266 mg/kg (on corn) Granivores: 12,000 mg/kg (on grain)	Dissolved in water then poured on corn or grain & rapidly dried.
Analgesia in Birds	**Dose & Route**	**Comments**

Acetylsalicylic Acid (Aspirin)	5.0 mg/kg , PO q8h	
Buprenorphine (Buprenex)*	0.01–0.05 mg/kg, IM q8–12h 6.5 mg/L drinking water	Most species
Butorphanol (Torbugesic, Torbutrol)*	1 –4 mg/kg, IM q6–12h African Grey – 1mg/kg IM	PRN; Not to exceed q 4h
Carprofen (Rimadyl)	5–10 mg/kg, IM, IV, PO	Non-Steroidal Anti-inflammatory, analgesia
Ketoprofen (Ketofen)	5–10 mg/kg, IM	Non-steroidal Anti-Inflammatory

Bovine: Anesthetics and Analgesics

Anesthesia in Bovine	**Dose & Route**	**Comments**
Acepromazine Maleate (ACE)	0.02–0.05 mg/kg, IV 0.05–0.2 mg/kg, IM, SC	Sedative
Guaifenesin	60–100 mg/kg, IV.	Muscle relaxant during anesthetic induction
Inhalant Anesthetics: Isoflurane (IsoFlo, Aerrane) Halothane (Fluothane) Sevoflurane (Ultane)	To effect. In general, 3–4% induction, 1–2% maintenance; inhalation.	Precision vaporizer; Adequate ventilation or scavenging essential.
Ketamine (K) (Ketaset, Vetalar, Vetaket)* Combinations are recommended: IV doses should be mixed with: Diazepam (D)*, Medetomidine (M) Or Xylazine (X)	10 mg/kg Ketamine, IV 2.2–7.5 (K) + 0.1–0.375 mg/kg (D) Or 0.5mg/kg (K) + 0.02mg/kg(M) ,IV; Or 2.2–7.5 (K) + 0.1mg/kg (X), IV	Consult Veterinarian: Calves require different dosages; See Formulary for combinations and appropriate dosages
Lidocaine (Xylocaine)	Local injection to effect.	Local, topical anesthetic
Medetomidine Reversal agent: Atipamezole HCL (Antisedan),	0.005–0.03mg/kg Medetomidine ,IM, or 0.01mg/kg Medetomidine ,IV *Reversal agent:* Atipamezole: 0.02 mg/kg, IV	Sedative, Analgesic
Pentobarbital (Nembutal, Sodium Pentobarbitone)*	12–30 mg/kg, IV	
Propofol	4–6 mg/kg, IV	
Tiletamine/ Zolazepam (Telazol) Used in Combination: Ketamine (K), Xylazine (X)	4 mg/kg, IV Used in combination with: 4 mg/kg (K) + 0.1mg/kg (X), IM	Restraint; Variable results
Xylazine HCL (Rompun, AnaSed) Reversed with Yohimbine	0.02–0.15 mg/kg, IV 0.05–0.3 mg/kg IM, SC *Reversal Agent:* Yohimbine Up to 0.3mg/kg, IV	

Analgesia in Bovine	**Dose & Route**	**Comments**

Buprenorphine (Buprenex)*	0.01 mg/kg, IM, IV	
Butorphanol (Torbugesic, Torbutrol)*	0.5 mg/kg, SC, IV	
Carprofen (Rimadyl)	1.4 mg/kg, IV, SC	Only Once; Non-Steroidal Anti-inflammatory, analgesia
Flunixin (Banamine)	2.2 mg/kg, IM, IV sid	Up to 3 days; Non-Steroidal Anti-inflammatory
Ketoprofen (Ketofen)	3 mg/kg, IM, IV sid for up to 3 days	Non-steroidal Anti-Inflammatory

Cat: Anesthetics and Analgesics (*Consult the Veterinary Staff to assure the agents selected are appropriate for the procedure. Other options exist, but are not listed in this chart)*

Anesthesia in Cats	**Dose & Route**	**Comments**
Acepromazine Maleate (ACE)	0.1–0.2 mg/kg , IM, SC 0.5–1.0 mg/lb, PO prn	Sedative
Diazepam (Valium)*	1 mg/kg, IV, to Max of 5mg 1 mg/kg IM, PO	Sedative
Inhalant Anesthetics: Isoflurane (IsoFlo, Aerrane) Halothane (Fluothane) Sevoflurane (Ultane)	To effect. In general, 3–4% induction, 1–2% maintenance; inhalation.	Precision vaporizer; Adequate ventilation or scavenging essential.
Ketamine (Ketaset,Vetalar,Vetaket)* Combinations are recommended: Acepromazine, Butorphanol, Medetomidine, or Xylazine	10 – 30 mg/kg, IM, IV	Frequently used in combination with other anesthetics or analgesics; See Formulary for combination dosages
Medetomidine (Domitor) - Often used in combination with Ketamine or Butorphanol Reversed with Atipamezole HCL (Antisedan)	Medetomidine : 0.01–0.05 mg/kg, IV or 0.04–0.15 mg/kg IM + Ketamine or Butorphanol *Reversal agent:* Atipamezole: Given IM, Refer to drug insert for dosage (generally 0.5-1 times the dosage of Medetomidine).	Sedative & Analgesic; Potent alpha2-agonist
Tiletamine/ Zolazepam (Telazol)	7.5 mg/kg, IM 10–15 mg/kg, IM, 5–7.5mg/kg, IV	
Xylazine (Rompun, AnaSed)	0.5–1.5 mg/lb, IV; 1 mg/lb, SC; 1–3 mg/kg, IM *Reversal agent:* Yohimbine	Sedative.
Analgesia in Cats	**Dose & Route**	**Comments**
Acetaminophen (Tylenol) **-Warning**	-Contraindicated - **NEVER use -**	Toxic – causes methemoglobinemia
Acetylsalicylic Acid (Aspirin)	10 mg/kg, PO q48h 1 children's aspirin, PO q36h	Children's Aspirin = 1.25 grains
Analgesia in Cats (Cont.)	**Dose & Route**	**Comments**

Buprenorphine (Buprenex)*	0.005–0.01 mg/kg, SC, IM q12h 0.005–0.01 mg/kg, IV, SC q8–12h	
Butorphanol (Torbugesic, Torbutrol)*	0.2–0.4 mg/kg, SC q4–6h 0.22 mg/kg, IM 0.4–1.5 mg/kg, PO q4–8h 0.2–0.6 mg/kg, IV, IM	
Carprofen (Rimadyl)	4 mg/kg, IV, SC	Non-Steroidal Anti-inflammatory, analgesia
Chlorpromazine	1–2mg/kg, IM,IV,q12h; 2–3mg/kg, PO	Decreases nausea, vomiting
Flunixin (Banamine)	1 mg/kg, PO, IV q24h 0.3 mg/kg, IM	Non-Steroidal Anti-inflammatory
Ibuprofen (Advil, Motrin)	5 mg/kg, PO q24h	Non-Steroidal Anti-inflammatory
Ketoprofen (Ketofen)	2 mg/kg, PO initially, then 1 mg/kg / day maintenance 1-2 mg/kg IM, IV, SC sid 1 mg/kg, PO after first 24h following injection	Non-steroidal Anti-Inflammatory

Dog: Anesthetics and Analgesics

Anesthesia in Dogs	**Dose & Route**	**Comments**
Acepromazine Maleate (ACE)	0.1–0.5 mg/kg, IV, IM, SC 0.25–1.0 mg/lb, PO prn	Sedative
Atropine	0.05 mg/kg IM, IV, SC (Used as a Preanesthetic)	Adjunct: Anticholinergic; decreases fluid secretions, suppresses vagal tone to the heart, prevents bradycardia
Diazepam (Valium)*	1 mg/kg, IV, to Max of 20mg 1 mg/kg IM, IV, PO	Sedative
Inhalant Anesthetics: Isoflurane (IsoFlo, Aerrane) Halothane (Fluothane) Sevoflurane (Ultane)	To effect. In general, 3–4% induction, 1–2% maintenance; inhalation.	Precision vaporizer; Adequate ventilation or scavenging essential
Ketamine(K) (Ketaset, Vetalar, Vetaket)* + Medetomidine(M) Or Ketamine(K) + Xylazine (X)	(K) 1–3mg/kg, IV + (M)10–20ug/kg, IV (K) 3–5mg/kg, IM + (M)30–40ug/kg, IM (K) 10mg/kg, IM + (X)2mg/kg, IM	Used as a sedative in dogs, not an appropriate anesthetic for major procedures; See Formulary for more combination dosages
Lidocaine (Procaine)	Local injection to effect.	Local anesthetic
Medetomidine (Domitor) Often used in combination with Ketamine Reversed with Atipamezole HCL (Antisedan)	Medetomidine : 0.005–0.08 mg/kg, IM, IV, or 0.03–0.04 mg/kg IM + Ketamine or Butorphanol *Reversal Agent:* Atipamezole: Given IM, Refer to drug insert for dosage.	Sedative, Analgesic; Potent alpha2-agonist
Propofol	6–7 mg/kg, IV 1 mg/kg IV for Induction	
Anesthesia in Dogs (Cont.)	**Dose & Route**	**Comments**

Thiopental Sodium (Pentothal)*	6–12 mg/lb, IV; lower dose with pre-anesthetic tranquilization 10-18 mg/kg IV	
Tiletamine/ Zolazepam (Telazol)	7.5–25 mg/kg , IM 4–10 mg/kg, IV In Combination: 10mg/kg Telazol + 1 mg/kg Xylazine, IM	
Xylazine (Rompun, AnaSed) Reversal Agent: Yohimbine	0.5–1.5 mg/kg, IV 2.2 mg/kg, SC 1 mg/kg, IM *Reversal agent:* Yohimbine 0.125-0.3mg/kg, IV	Sedative
Analgesia in Dogs	**Dose & Route**	**Comments**
Acetaminophen (Tylenol)	15 mg/kg, PO q8h	
Acetylsalicylic Acid (Aspirin)	10-20 mg/kg, PO q12h Antirheumatic max. dosage – 40mg/kg, PO q 18h	Use buffered tabs only
Buprenorphine (Buprenex)*	0.01–0.02 mg/kg, SC q12h 0.005–0.02 mg/kg, IM, IV, SC q6–12h	
Butorphanol (Torbugesic)*	0.1–0.6 mg/kg, SC, IM, IV q2–5h 1–3mg/kg, PO 0.1mg/kg IV, followed by 0.1mg/kg, IM, SC	2 -5 hours of analgesia
Chlorpromazine	0.5mg/kg, IM, q8h; 2–3mg/kg, PO	Decreases nausea, vomiting
Carprofen (Rimadyl)	4 mg/kg IV, SC sid; 1–2.2mg/kg, PO bid	As long as needed, guideline of 3-4 days for soft tissue surgery and 8-10 following orthopedic procedures; Non-Steroidal Anti-inflammatory, analgesia
Flunixin (Banamine)	1 mg/kg, IV, sid for 3 days 1 mg/kg, PO q24h	Non-Steroidal Anti-inflammatory
Ibuprofen (Advil, Motrin)	5–10 mg/kg, PO q24-48h	Non-Steroidal Anti-inflammatory
Ketoprofen (Ketofen)	2 mg/kg, IM	Non-steroidal Anti-Inflammatory

Ferret: Anesthetics and Analgesics

Anesthesia in Ferrets	**Dose & Route**	**Comments**
Acepromazine Maleate (ACE)	0.2–0.5 mg/kg, IM, SC 0.1–0.3 mg/kg, IM, IV	Sedative
Inhalant Anesthetics: Isoflurane (IsoFlo, Aerrane) Halothane (Fluothane) Sevoflurane (Ultane)	To effect. In general, 3–4% induction, 0.5–2.5% maintenance; inhalation.	Precision vaporizer; Adequate ventilation or scavenging essential
Anesthesia in Ferrets (Cont.)	**Dose & Route**	**Comments**

Diazepam (Valium)*	1–2 mg/kg, IM 0.5–3 mg/kg, IM, SC 1 mg, IV per animal	Sedative
Fentanyl/Droperidol (Innovar-Vet)*	0.15 mg/kg, IM	Sedative/analgesic; May need pre-anesthetic atropine
Ketamine (Ketaset,Vetalar,Vetaket)* Used in Combination with Acepromazine, Diazepam (Valium)*, Xylazine (Rompun, AnaSed)	10–60 mg/kg, IM See Formulary for combination agents and dosages	Frequently used in combination with other anesthetics or analgesics;
Medetomidine (Domitor) Often used in combination with Butorphanol Reversed with Atipamezole HCL (Antisedan)	Medetomidine: 0.08–0.2mg/kg, IM, SC + Butorphanol 0.1–0.2 mg/kg, IM *Reversal agent:* Atipamezole 0.4 mg/kg, IM; Or 1 mg/kg, SC, IV, IP	Sedative & Analgesic; Potent alpha2-agonist
Propofol	2–5 mg/kg, IV	Induction
Tiletamine/ Zolazepam (Telazol) Can combine with Ketamine, Xylazine (see Formulary)	12–22 mg/kg, IM	
Xylazine (Rompun, AnaSed)	1–2 mg/kg, IM 4–6 mg/kg, SC *Reversal agent:* Yohimbine 0.5-1.0mg/kg, IV	Sedative
Analgesia in Ferrets	**Dose & Route**	**Comments**
Acetylsalicylic Acid (Aspirin)	0.5–22 mg/kg, PO q8–24h	
Buprenorphine (Buprenex)*	0.01–0.03 mg/kg, IM, IV, SC q8–12h 0.01–0.5 mg/kg, IV, SC q8–12h	
Butorphanol (Torbugesic)*	0.05–0.1 mg/kg, SC q8–12h 0.4 mg/kg, IM q4–6h	
Carprofen (Rimadyl)	1 mg/kg, PO q12–24h	Non-Steroidal Anti-inflammatory, analgesia
Flunixin (Banamine)	0.3–2 mg/kg, PO, SC q12–24h	Non-Steroidal Anti-inflammatory
Ibuprofen (Advil, Motrin)	1 mg/kg, PO q12–24h	Non-Steroidal Anti-inflammatory
Ketoprofen (Ketofen)	1 mg/kg, IM, PO, SC q24h	Non-steroidal Anti-Inflammatory
Pentazocine (Talwin)*	5–10 mg/kg, IM q4h	Analgesic; Narcotic agonist/antagonist

Gerbil: Anesthetics and Analgesics

Anesthesia in Gerbils	**Dose & Route**	**Comments**
Atropine	0.05–0.1 mg/kg, SC	Adjunct: Anticholinergic; decreases fluid secretions, suppresses vagal tone to the heart, prevents bradycardia

Diazepam (Valium)*	3–5 mg/kg, IP	Sedative
Anesthesia in Gerbils (Cont.)	**Dose & Route**	**Comments**
Inhalant Anesthetics: Isoflurane (IsoFlo, Aerrane) Halothane (Fluothane) Sevoflurane (Ultane)	To effect. In general, 3–4% induction, 1–2% maintenance; inhalation.	Precision vaporizer; Adequate ventilation or scavenging essential
Ketamine (K) (Ketaset, Vetalar, Vetaket)* Used in Combination: Diazepam* (D), Medetomidine (M), Xylazine (X)	200 mg/kg, IM Immobilization 50mg/kg (K),IM + 5mg/kg (D, IP 75mg/kg (K),IM + 0.5mg/kg (M), IP 50mg/kg (K),IM + 2mg/kg (X), IM	Frequently used in combination with other anesthetics or analgesics; See Formulary for combination dosages
Medetomidine (Domitor) Reversed with Atipamezole HCL (Antisedan)	Medetomidine : 0.1–0.2 mg/kg, SC *Reversal Agent:* Atipamezole: 1 mg/kg, SC	Variable effects ; Light –moderate Sedative & Analgesic; Potent alpha2-agonist
Tiletamine/ Zolazepam (Telazol) (T) + combined with Xylazine (X)	60 mg/kg, IM; (T) 20 mg/kg +(X) 10mg/kg, IP	
Tribromoethanol (Avertin)	250–300 mg/kg, IP (See Appendix 1 below for mixing instructions)	15+ minute duration of anesthesia, ~90 min to complete recovery
Analgesia in Gerbils	**Dose & Route**	**Comments**
Acetaminophen (Tylenol)	1–2 mg/ml in drinking water	
Acetylsalicylic acid (Aspirin)	100–150 mg/kg, PO q4h; 240 mg/kg, PO q24h;	
Buprenorphine (Buprenex)*	0.1–0.2 mg/kg, SC q8h	
Butorphanol (Torbugesic)*	1–5 mg/kg, SC q4–12h 0.4 mg/kg, IM q4–6h	
Carprofen (Rimadyl)	4–5 mg/kg, SC q24h	Non-Steroidal Anti-inflammatory, analgesia
Chlorpromazine	0.5 mg/kg, IM	Decreases nausea, vomiting
Flunixin (Banamine)	2.5 mg/kg, SC q12–24h	Non-Steroidal Anti-inflammatory
Ketoprofen (Ketofen)	5 mg/kg, SC	Non-Steroidal Anti-inflammatory; Good for musculoskeletal pain
Pentazocine (Talwin)*	10 mg/kg, SC q2–4h	Analgesic; Narcotic agonist/antagonist

Guinea Pig: Anesthetics and Analgesics

Anesthesia in Guinea Pigs	**Dose & Route**	**Comments**
Acepromazine Maleate (ACE)	0.5–1.0 mg/kg, IM	Sedative
Diazepam (Valium)*	2–5 mg/kg, IP; 0.5–3 mg/kg, IM	Sedative

Fentanyl/Droperidol (Innovar-Vet)*	0.22–0.88 mg/kg, IM	Sedative/analgesic - may cause inflammation at site with higher dosages; May need pre-anesthetic atropine
Inhalant Anesthetics: Isoflurane (IsoFlo, Aerrane) Halothane (Fluothane) Sevoflurane (Ultane)	To effect. In general, 2–5% induction, 0.25–4% maintenance; inhalation.	Precision vaporizer; Adequate ventilation or scavenging essential
Ketamine (K) (Ketaset, Vetalar, Vetaket)* Used in Combination: Diazepam*(D), Medetomidine (M), Xylazine (X) Guinea Pig Mix = same as Rabbit Mix, See Appendix 2	22–44 mg/kg, IM Light-heavy sedation 20–100mg/kg (K) + 1–8mg/kg (D), IM 40mg/kg (K) + 0.5mg/kg (M), IP 20–40mg/kg (K) + 2–5mg/kg (X), IM Guinea Pig Mix: Induction – ½ cc/kg Full anesthesia – 1cc/kg	See Formulary for combination dosages; Medetomidine *Reversal agent* is Atipamezole
Medetomidine (Domitor) Reversed with Atipamezole HCL (Antisedan)	Medetomidine : 0.3 mg/kg, SC *Reversal Agent:* Atipamezole: 1 mg/kg, SC	Sedative, Analgesic; Potent alpha2-agonist; Variable effects
Pentobarbital (Nembutal, Sodium Pentobarbitone)* NOT recommend	25–35 mg/kg, IP Marginal -Variable Response	Caution! Potentially significant cardiovascular and respiratory depression
Tiletamine/ Zolazepam (Telazol) + combined with Xylazine (X), Butorphanol (B)	40–60 mg/kg, IM; (T) 40 mg/kg +(X) 5mg/kg, IP (T) 60 mg/kg +(X) 5mg/kg +(B) 0.1 mg/kg, IP	
Xylazine (Rompun, AnaSed)	3-5 mg/kg, IM 5-40 mg/kg, IP *Reversal agent:* Yohimbine 0.5-1.0mg/kg, IV	Sedative
Analgesia in Guinea Pigs	**Dose & Route**	**Comments**
Acetaminophen (Tylenol)	1–2 mg/ml in drinking water	
Acetylsalicylic acid (Aspirin)	50–100 mg/kg, PO q4h	
Buprenorphine (Buprenex)*	0.05–0.5 mg/kg, SC q6–12h	
Butorphanol (Torbugesic)*	2.0 mg/kg, SC q2–4h	
Carprofen (Rimadyl)	1–4 mg/kg, SC q24h	Non-Steroidal Anti-inflammatory, analgesia
Chlorpromazine	0.5 mg/kg, IM; 0.2 mg/kg, SC	Decreases nausea, vomiting
Flunixin (Banamine)	2.5–5 mg/kg, SC q12–24h	Non-Steroidal Anti-inflammatory
Analgesia in Guinea Pigs (Cont.)	**Dose & Route**	**Comments**
Ibuprofen (Advil, Motrin)	10 mg/kg, IM, PO q4h 0.6 mg/ml in drinking water	Non-Steroidal Anti-inflammatory
Ketoprofen (Ketofen)	1 mg/kg, SC, IM q12–24h	Non-Steroidal Anti-inflammatory; Good for musculoskeletal pain

Morphine *	2–5 mg/kg, SC, IM q4h	Up to 4 hours of analgesia
Pentazocine (Talwin)*	10 mg/kg, SC q2–4h	Analgesic; Narcotic agonist/antagonist

Hamster: Anesthetics and Analgesics

Anesthesia in Hamsters	**Dose & Route**	**Comments**
Acepromazine Maleate (ACE)	0.5–1.0 mg/kg, IM	Sedative
Atropine	0.05–0.1 mg/kg, SC 10mg/kg q20min for organophosphate overdose	Adjunct: Anticholinergic; decreases fluid secretions, suppresses vagal tone to the heart, prevents bradycardia
Diazepam (Valium)*	3 –5 mg/kg, IM, IP	Sedative
Inhalant Anesthetics: Isoflurane (IsoFlo, Aerrane) Halothane (Fluothane) Sevoflurane (Ultane)	To effect. In general, 2–5% induction, 0.25–4% maintenance; inhalation.	Precision vaporizer; Adequate ventilation or scavenging essential
Fentanyl/Droperidol (Innovar-Vet)*	0.01 mg/kg, IP NOT recommended	Sedative, analgesic; May cause CNS stimulation
Ketamine (K) (Ketaset, Vetalar, Vetaket)* Used in Combination: Diazepam*(D), Medetomidine (M), Xylazine (X)	20–40 mg/kg, IM Light-heavy sedation; 10-30 mg/100g IP 70mg/kg (K) + 2mg/kg (D), IM 40–100mg/kg (K) + 5mg/kg (D), IP 100mg/kg (K) + 0.25mg/kg (M), IP 80mg/kg (K) + 5mg/kg (X), IM, IP 200mg/kg (K) + 10mg/kg (X), IP	See Formulary for combination dosages; Medetomidine *Reversal agent* is Atipamezole
Medetomidine (Domitor) Reversed with Atipamezole HCL (Antisedan)	Medetomidine : 0.1 mg/kg, SC *Reversal agent:* Atipamezole 1 mg/kg, SC	Light – moderate Sedative, Analgesic; Potent alpha2-agonist; Variable effects
Pentobarbital (Nembutal, Sodium Pentobarbitone)* NOT recommend	50–90 mg/kg IP, IP boost with 1.2mg/100g Marginal -Variable Response	Caution! Potentially significant cardiovascular and respiratory depression
Tiletamine/ Zolazepam (Telazol) (T) + combined with Xylazine (X) (Rompun, AnaSed)	(T) 30 mg/kg +(X) 10mg/kg, IM, IP	Telazol alone is NOT recommended
Xylazine (Rompun, AnaSed)	4 mg/kg, IM 10 mg/kg, IP *Reversal agent:* Yohimbine 0.5-1.0mg/kg, IV	Sedative
Analgesia in Hamsters	**Dose & Route**	**Comments**
Acetaminophen (Tylenol)	1–2 mg/ml in drinking water	
Acetylsalicylic acid (Aspirin)	100–150 mg/kg, PO q4h; 240 mg/kg, PO q24h	
Buprenorphine (Buprenex)*	0.01 – 0.05 mg/kg, SC, IV q8-12h 0.5 mg/kg, SC q8h	8 – 12 hours of analgesia

Butorphanol (Torbugesic, Torbutrol)*	1 – 5 mg/kg, SC q4h	
Carprofen (Rimadyl)	5 mg/kg, SC, q24h	Non-Steroidal Anti-inflammatory, analgesia
Chlorpromazine	0.5 mg/kg, IM	Decreases nausea, vomiting
Flunixin (Banamine)	2.5 mg/kg, SC q12–24h	Non-Steroidal Anti-inflammatory
Ketoprofen (Ketofen)	5 mg/kg, SC	Non-Steroidal Anti-inflammatory; Good for musculoskeletal pain
Morphine *	2–5 mg/kg, SC q4h	Up to 4 hours of analgesia
Pentazocine (Talwin)*	10 mg/kg, SC q2–4h	Analgesic; Narcotic agonist/antagonist

Mouse: Anesthetics and Analgesics

Anesthesia in Mice	**Dose & Route**	**Comments**
Acepromazine Maleate (ACE)	0.5–1 mg/kg, IM; 2–5 mg/kg, IP	Sedative
Diazepam (Valium)*	3–5 mg/kg, IM, IP	Sedative
Fentanyl/Droperidol (Innovar-Vet)*	Sedation: 0.2–0.33 ml/kg, IM Anesthesia: 0.3–0.5 ml/kg, IM	Sedative/analgesic; May need pre-anesthetic atropine
Inhalant Anesthetics: Isoflurane (IsoFlo, Aerrane) Halothane (Fluothane) Sevoflurane (Ultane)	To effect. In general, 3-4% induction 1-2% maintenance; inhalation.	Precision vaporizer; Adequate ventilation or scavenging essential
Ketamine (Ketaset, Vetalar, Vetaket)* Use in Combination: Acepromazine (A), Diazepam*(D), Medetomidine (M), Xylazine (X)	22–44 mg/kg, IM Light-heavy sedation; 100-200 mg/kg IP 100mg/kg (K) + 2.5–5mg/kg (A), IM 200mg/kg (K) + 5mg/kg (D), IP 50mg/kg (K)+10–15mg/kg (X), IP, IM** Males: 50 mg/kg (K) + 1-10mg/kg (M), IP Females: 75 mg/kg(K) + 1-10mg/kg (M), IP	**UAC uses a combination of: 0.01ml of 20mg/ml Xylazine + 0.01ml of 100mg/ml Ketamine, IM Medetomidine *Reversal Agent* is Atipamezole.
Medetomidine (Domitor) Reversed with Atipamezole HCL (Antisedan)	Medetomidine : 0.03–0.1 mg/kg, SC *Reversal Agent:* Atipamezole: 1.0–2.5 mg/kg, IP	Variable effects ; Light - Moderate Sedative, Analgesic; Potent alpha2-agonist
Anesthesia in Mice (Cont.)	**Dose & Route**	**Comments**
Pentobarbital (Nembutal, Sodium Pentobarbitone)*	40–85 mg/kg, IP (diluted 1:9 in sterile saline)	NOT recommended; autonomic depression
Pentothal (Sodium Thiopental)*	50 mg/kg, IP	
Tetracaine (Pontocaine)	0.5% solution topical or ophthalmic application	Topical and ophthalmic solutions available
Tiletamine/ Zolazepam (Telazol)		NOT recommended

Tribromoethanol (Avertin)	240 mg/kg, IP (See Appendix 1 below for mixing instructions)	15+ minute duration of anesthesia, ~90 min to complete recovery
Urethane Terminal Procedures ONLY	1.2 – 200 mg/kg IP (No reference found for this dosage)	Caution! Prolonged anesthesia; carcinogenic and mutagenic
Xylazine (Rompun, AnaSed) Reversed with Yohimbine	4–8 mg/kg, IM; 10 mg/kg, IP *Reversal agent:* Yohimbine 0.5-1.0mg/kg, IV	Sedative; Best used in combination with Ketamine
Analgesia in Mice	**Dose & Route**	**Comments**
Acetaminophen (Tylenol)	300 mg/kg, PO; 1–2 mg/ml drinking water	Preferred method: flavored Tylenol in drinking water
Acetylsalicylic acid (Aspirin)	100–150 mg/kg, PO q4h	
Buprenorphine (Buprenex)*	0.05–0.1 mg/kg SC, IP q8–12h	
Butorphanol (Torbugesic, Torbutrol)*	1–5 mg/kg, SC q2–4h	Up to 4 hours of analgesia
Carprofen (Rimadyl)	2.5–5 mg/kg, PO, SC q24h	Non-Steroidal Anti-inflammatory, analgesia
Celecoxib (Celebrex)	200 mg/kg	Non-steroidal anti-inflammatory
Chlorpromazine	3–35 mg/kg, IM; 5–10 mg/kg, SC	Decreases nausea, vomiting
Flunixin (Banamine)	2.5 mg/kg, SC q12–24h	Non-Steroidal Anti-inflammatory
Ibuprofen (Advil, Motrin)	7–15 mg/kg, PO q4h; 40 mg/kg, PO as 0.2 mg/ml drinking water	Non-Steroidal Anti-inflammatory
Ketoprofen (Ketofen)	5–10 mg/kg, SC	Non-Steroidal Anti-inflammatory; Good for musculoskeletal pain
Meloxicam (Metacam)	1–2 mg/kg, PO, SC q24h	Non-Steroidal Anti-inflammatory; analgesic
Morphine*	2–5 mg/kg, SC q2–4h	
Pentazocine (Talwin)*	10 mg/kg, SC q2–4h	Analgesic; Narcotic agonist/antagonist

Non-Human Primates (NHP): Anesthetics and Analgesics

Anesthesia in NHP	**Dose & Route**	**Comments**
Acepromazine Maleate (ACE)	0.2–1.0 mg/kg, IM, SC, PO	Sedative
Anesthesia in NHP (Cont.)	**Dose & Route**	**Comments**
Atropine	0.02–0.04 mg/kg, SC, IM, IV	Adjunct: Anticholinergic; decreases fluid secretions, suppresses vagal tone to the heart, prevents bradycardia
Diazepam (Valium)*	0.25–1 mg/kg, IM, IV	Sedative

Inhalant Anesthetics: Isoflurane (IsoFlo, Aerrane) Halothane (Fluothane) Sevoflurane (Ultane)	To effect. In general, 2–4% induction, 1–2% maintenance; inhalation.	Precision vaporizer; Adequate ventilation or scavenging essential; ^Note: Halothane may result in dose dependent, cardiovascular depression in macaques
Fentanyl/Droperidol (Innovar-Vet)*	0.05–0.1 ml/kg, IM, IV Pre-anesthetic 0.15–0.3 ml/kg, IM, SC For Minor Procedures	NHP's appear to be more sensitive than dogs; high does produce respiratory depression; A Preanesthetic dose of atropine may be necessary.
Ketamine (Ketaset, Vetalar, Vetaket)* Use in Combination: Acepromazine, Diazepam*, Medetomidine, Midazolam, Xylazine	5-40 mg/kg, IM Consult for Combinations and dosages	Sedative; Consult Veterinarian and formularies for dosages and combinations per procedures and appropriateness for the type of NHP.
Lidocaine (Xylocaine)	Local injection to effect.	
Medetomidine (Domitor) Follow with Ketamine* Combine with Butorphanol* & Midazolam* Reversed with Atipamezole HCL (Antisedan)	Medetomidine: 0.05–0.1 mg/kg, IM, PO followed by Ketamine [- IV of this dosage provides inconsistent sedation] Squirrel monkeys: 0.1 mg/kg, SC, IM Ring-tailed Lemurs: 0.04mg/kg, IM *Reversal agent* - Atipamezole: 4 times Medetomidine dose, SC, IM,IV Chimpanzees: 0.15-0.30 mg/kg, IV Squirrel Monkeys: 0.2 mg/kg, IV	Light - Moderate Sedative, Analgesic; Potent alpha2-agonist; Variable effects
Midazolam (Versed)*	0.05–0.15 mg/kg IM, IV Midazolam 0.2-.04 mg/kg, IV + Fentanyl 1-2 ug/kg, IV	Sedative
Pentobarbital (Nembutal, Sodium Pentobarbitone)*	20 mg/kg, IV; decrease to 5–10 mg/kg if used in combination with Ketamine	Severe respiratory depression; Inability to modulate depth of anesthesia; Variable responses between species; Prolonged recovery
Propofol	7.5–12.5 mg/kg IV OR ^^2–6 mg/kg, IV followed by 200-600ug/kg/min continuous infusion	Dosage varies with species; Consult Veterinarian; ^^ For non-painful procedures only
Anesthesia in NHP (Cont.)	**Dose & Route**	**Comments**
Thiopental Sodium (Pentothal)*	15–25 mg/kg IV; decrease to 5–7 mg/kg if used in combination with Ketamine	
Tiletamine/ Zolazepam (Telazol)	1–6 mg/kg, IM	Wide range of dosages for different species; Consult Veterinarian; Marked

		hypothermia
Xylazine (Rompun, AnaSed) Reversed with Yohimbine	0.5 mg/kg, IV; Used with Ketamine for combination *Reversal Agent:* Yohimbine 0.05 mg/kg, IV	Light to moderate sedation; some analgesia
Analgesia in NHP	**Dose & Route**	**Comments**
Acetaminophen (Tylenol)	5–10 mg/kg, PO q6h	
Acetylsalicylic Acid (Aspirin)	10–20 mg/kg, PO q6–8h; 100 mg/kg, PO q24h 25 mg/kg rectal suppository	Analgesia; anti-inflammatory; antipyretic; Use enteric-coated tablet
Buprenorphine (Buprenex)*	0.005–0.01 mg/kg, IM, IV q6–12h 0.01–0.02 mg/kg IM, IV q12h	
Butorphanol (Torbugesic, Torbutrol)*	0.1–0.2 mg/kg, IM q4–12h	
Carprofen (Rimadyl)	2–4 mg/kg, PO, SC q12–24h	Non-Steroidal Anti-inflammatory, analgesia
Chlorpromazine	1–6 mg/kg, IM; 2–5mg/kg, PO	Decreases nausea, vomiting
Fentanyl (Durgesic)*	0.005–0.1 mg/kg, IV 0.05–0.1 mg/kg, SC, IM	Analgesic
Flunixin (Banamine)	0.5 mg/kg, IM q24h; 1 mg/kg, IV q12h; Prosimians: 0.5 mg/kg, IM q24h; 10mg/kg, IM	Non-Steroidal Anti-inflammatory
Ibuprofen (Advil, Motrin)	20 mg/kg, PO q24h	Non-Steroidal Anti-inflammatory
Ketoprofen (Ketofen)	5 mg/kg, IM q6–8h	Non-Steroidal Anti-inflammatory; Good for musculoskeletal pain
Medetomidine (Domitor) See above for Anesthetic dosages Reversed with Atipamezole HCL (Antisedan)	0.08 mg/kg, IM *Reversal Agent:* Atipamezole 4x Medetomidine dose, SC, IM, IV (general)	Analgesic; Light - Moderate Sedative; Potent alpha2-agonist; Refer to Formulary for specific species differences.
Meperidine (Demerol)*	2–10 mg/kg, IM q4h; 2 mg/kg, IV q 2–4h	Analgesic and sedative
Morphine*	1–2 mg/kg, PO, SC, IM, IV q4h	
Naproxen (Naprosyn, Syntex)	10 mg/kg, PO q12h	Non-steroidal anti-inflammatory; analgesic; antipyretic
Analgesia in NHP (Cont.)	**Dose & Route**	**Comments**
Oxymorphone*	0.03–0.2 mg/kg, SC, IM, IV q6–12h New World Primates: 0.075 mg/kg, SC, IM, IV q4–6h Old World Primates : 0.15 mg/kg, SC, IM, IV q4–6h	Analgesia
Pentazocine (Talwin)*	1.5–3 mg/kg, SC, IM q2–4h NOT to exceed 60mg	Analgesic; Narcotic agonist/antagonist

Rabbit: Anesthetics and Analgesics

Anesthesia in Rabbits	Dose & Route	Comments
Acepromazine Maleate (ACE)	0.25–1 mg/kg IM 1–5 mg/kg , SC, IM (Lower dosage is preferred)	Preanesthetic; Sedative
Atropine	Due to serum atropinase, some rabbits require very high doses: 0.1–3.0 mg/kg, SC, IM	Adjunct: Anticholinergic; decreases fluid secretions, suppresses vagal tone to the heart, prevents bradycardia
Diazepam (Valium)*	1–5 mg/kg, IV; 5–10 mg/kg, IM	Preanesthetic Sedative; tranquilizer. Used with Ketamine
Fentanyl/Droperidol (Innovar-Vet)*	0.15–0.44 ml/kg, IM (0.22 ml/kg is optimal)	May cause muscle necrosis
Inhalant Anesthetics: Isoflurane (IsoFlo, Aerrane) Halothane (Fluothane) Sevoflurane (Ultane)	To effect. In general, 3–4% induction, 1–2% maintenance; inhalation.	Precision vaporizer; Adequate ventilation or scavenging essential
Ketamine (Ketaset, Vetalar,Vetaket)* Use in Combination: Acepromazine, Diazepam*, Medetomidine, Midazolam, Xylazine **Rabbit Mix** (Appendix 2): Acepromazine Maleate + Ketamine HCl* + Xylazine HCl	Ketamine alone, ~60 min sedation: 20–50 mg/kg IM; 15–20 mg/kg IV Rabbit Mix: Induction –½ cc/kg Full anesthesia– 1cc/kg	Should be used in Combination: See Formulary for agents and dosages Make Rabbit Mix in sterile vile
Lidocaine (Xylocaine)	Local injection to effect.	Local anesthetic
Medetomidine (Domitor) Used in combination with Ketamine, Midazolam, Propofol Reversed with Atipamezole HCL (Antisedan)	0.25–0.5 mg/kg, IM; *Reversal Agent:* Atipamezole 0.001 mg/kg, SC, IV, IP; Give 5x Medetomidine dose (in mg)	Light - Moderate Sedative; Analgesic; Potent alpha2-agonist See Formulary for combination agents/dosages.
Meloxicam (Metacam)	0.3-1.5 mg/kg, PO q24h 0.2mg/ml drinking water	Non-Steroidal Anti-inflammatory; analgesic
Pentobarbital (Nembutal, Sodium Pentobarbitone)*	30–50 mg/kg IV, IP	Not recommended. Marginal analgesia; autonomic depression.
Anesthesia in Rabbits (Cont.)	**Dose & Route**	**Comments**
Propofol	7.5–15 mg/kg, IV	
Thiopental Sodium (Pentothal)*	15–30 mg/kg, IV	
Tiletamine/ Zolazepam (Telazol)	3 mg/kg, IM 10 mg/kg, Intranasal (No renal compromise reported)	Caution – NOT recommended for use in rabbits; causes mild-severe renal tubular necrosis depending on dose

Tetracaine (Pontocaine)	0.5% solution topical or ophthalmic application; 2-3 drops in each eye.	Primarily used for ocular procedures.
Xylazine (Rompun, AnaSed) Reversed with Yohimbine	1–3 mg/kg, SC, IM *Reversal agent:* Yohimbine 0.2-1.0 mg/kg, IM, IV	Preanesthetic; lower end of dose is recommended
Analgesia in Rabbits	**Dose & Route**	**Comments**
Acetaminophen (Tylenol) Often combined with Codeine*	200–500 mg/kg, PO; 1–2 mg/ml drinking water Combined with Codeine: 1 ml elixir/100ml drinking water	Analgesia; Non-steroidal anti-inflammatory
Acetylsalicylic Acid (Aspirin)	10–100 mg/kg, PO q8–12h; 100 mg/kg, PO q4h	Analgesia; Non-steroidal anti-inflammatory; antipyretic
Buprenorphine (Buprenex)*	0.02–0.1 mg/kg SC, IV 0.01–0.05 mg/kg, SC, IM, IV 0.5 mg/kg , pert rectum q12h	6-12h analgesia
Butorphanol (Torbugesic, Torbutrol)*	0.1–0.5 mg/kg, IM, IV, SC q4h	Up to 4 hours of analgesia
Carprofen (Rimadyl)	1–2.2 mg/kg, PO q12h 4 mg/kg, SC q24h	Non-Steroidal Anti-inflammatory, analgesia
Flunixin (Banamine)	1.1 mg/kg, IM q12h 1–2 mg/kg, SC q12–24h 0.3–2 mg/kg, PO, IM, IV q12–24h	Analgesic; Non-Steroidal Anti-inflammatory; Do not use more than 3 days
Ibuprofen (Advil, Motrin)	10–20 mg/kg, PO q4h	Analgesic; Non-Steroidal Anti-inflammatory; May have Gastrointestinal side effects
Ketoprofen (Ketofen)	3 mg/kg, SC q24h Topical gel: apply q6–12h	Non-Steroidal Anti-inflammatory; Good for musculoskeletal pain
Pentazocine (Talwin)*	5–10 mg/kg, SC q2–4h	Analgesic; Narcotic agonist/antagonist

Rat: Anesthetics and Analgesics

Anesthesia in Rats	**Dose & Route**	**Comments**
Acepromazine Maleate (ACE)	0. 5–1 mg/kg IM	Preanesthetic; Sedative
Diazepam (Valium)*	4 mg/kg, IP: 3–5 mg/kg IM	Sedative
Fentanyl/Droperidol (Innovar-Vet)*	0.02–0.06 ml/100g, IP 0.1–0.5 ml/kg, IM (Lower dose for sedation; higher dose for anesthesia)	
Anesthesia in Rats (Cont.)	**Dose & Route**	**Comments**
Inactin	80–100 mg/kg, IP	
Inhalant Anesthetics: Isoflurane (IsoFlo, Aerrane) Halothane (Fluothane) Sevoflurane (Ultane)	To effect. In general, 3–4% induction, 1–2% maintenance; inhalation.	Precision vaporizer; Adequate ventilation or scavenging essential

Ketamine (Ketaset, Vetalar,Vetaket)* Best if used in Combination with one or more: Acepromazine, Diazepam*, Medetomidine, Xylazine Rat Mix Combination = same as Rabbit Mix, See Appendix 2	44–100 mg/kg, IM Best used in Combinations. Rat Mix: Induction–½ cc/kg Full anesthesia –1cc/kg	See Formulary for combinations and dosages
Medetomidine (Domitor) Best when combined with Ketamine or Fentanyl Reversed with Atipamezole HCL (Antisedan)	0.03–0.1 mg/kg, SC See Formulary for combination agents and dosages. *Reversal agent* – Atipamezole: 1 mg/kg, SC	Light - Moderate Sedative, Analgesic; Potent alpha2-agonist; Variable effects
Pentobarbital (Nembutal, Sodium Pentobarbitone)*	30–50 mg/kg, IP	NOT recommended; autonomic depression
Pentothal (Sodium Thiopental)*	30 mg/kg, IV 40 mg/kg, IP	Short anesthesia
Propofol*	7.5–10 mg/kg, IV	
Tetracaine (Pontocaine)	0.5% solution topical or ophthalmic application	Topical and ophthalmic solutions available
Tiletamine/ Zolazepam (Telazol) Combined with Butorphanol, Xylazine	20–40 mg/kg, IP Alone or combined with: Butorphanol 1.25–5 mg/kg, IP Or Xylazine 5–10 mg/kg, IP	
Tribromoethanol (Avertin)	300 mg/kg, IP (See Appendix 1 below for mixing instructions)	15+ minute duration of anesthesia, ~90 min to complete recovery
Urethane	1000 mg/kg, IP	Caution! Prolonged anesthesia; terminal procedures only; carcinogenic and mutagenic.
Xylazine (Rompun, AnaSed) Reversed with Yohimbine	1–8 mg/kg,, IM; 10 mg/kg IP *Reversal agent:* Yohimbine 0.5–1 mg/kg, IV	Best used in combination with Ketamine or Telazol: see Formularies
Analgesia in Rats	**Dose & Route**	**Comments**
Acetaminophen (Tylenol)	100–300 mg/kg, PO q4h; 1–6 mg/ml in drinking water	
Acetylsalicylic Acid (Aspirin)	100–150 mg/kg, PO q4h	
Atropine	0.05–0.1 mg/kg, SC	May cause organophosphate toxicity in some strains
Analgesia in Rats, cont.	**Dose & Route**	**Comments**

Buprenorphine (Buprenex)* Can also combine with Carprofen	0.01–0.5 mg/kg, SC, IV q6-12h; 0.1–0.25 mg/kg, PO q8-12h; 0.02 mg/ml drinking water Combination: 0.05 mg/kg SC, IM + 5 mg/kg Carprofen, PO	6-12 hours analgesia
Butorphanol (Torbugesic, Torbutrol)*	0.05–2.0 mg/kg, SC, IP q2–4h	2-4 hours analgesia
Carprofen (Rimadyl) Can combine with Buprenorphine (see above)	2.5–5 mg/kg, PO, SC q24h	Non-Steroidal Anti-inflammatory, analgesia
Flunixin (Banamine)	1.1–2.5 mg/kg, SC, IM q12h	Analgesic; Non-Steroidal Anti-inflammatory
Ibuprofen (Advil, Motrin)	10–30 mg/kg, PO q4h 1.3 mg/ml in drinking water	Analgesic; Non-Steroidal Anti-inflammatory; 4 hours analgesia
Ketoprofen (Ketofen)	5 mg/kg, PO, SC, IM q24h	Non-Steroidal Anti-inflammatory; Good for musculoskeletal pain
Meloxicam (Metacam)	1–2 mg/kg, PO, SC q24h	Non-Steroidal Anti-inflammatory; analgesic
Morphine*	2–10 mg/kg, SC q2–4h	Up to 3 hours analgesia

Reptiles: Anesthetics and Analgesics

Anesthesia in Reptiles	**Dose & Route**	**Comments**
Inhalant Anesthetics: Isoflurane (IsoFlo, Aerrane) * IsoFlo is preferred Halothane (Fluothane) Sevoflurane (Ultane)	To effect. In general, 3–4% induction, 1–2% maintenance; inhalation. 0.5–2.0 ml/L bath or vaporize then bubble in water. *Use with Butorphanol, see below	Precision vaporizer; Adequate ventilation or scavenging essential; Levels in water are difficult to control; *NOT recommended
Ketamine (Ketaset, Vetalar, Vetaket)* + Diazepam (Valium)*	Most Species: 10 mg/kg SC, IM, q30min. OR 20–60 mg/kg + 2–5mg/kg IM Diazepam	Alone provides Sedation; Combination provides Anesthesia with improved muscle relaxation
Tricaine methanesulfonate (MS 222)	200–300 mg/kg, IPP	
Tiletamine/ Zolazepam (Telazol)	Lizards: 30mg/kg IM Alligators: 15 mg/kg IM	Adequate for minor procedures
Analgesia in Reptiles	**Dose & Route**	**Comments**
Acepromazine Maleate (ACE)	0.05–0.5 mg/kg, IM	Use with Preanesthetic
Buprenorphine (Buprenex)*	0.005–0.02 mg/kg, IM, q 24-48h 0.01–1.0 mg/kg, IM	Most species/analgesia
Butorphanol (Torbugesic, Torbutrol)*	0.5–2.0 mg/kg, IM or 0.2– 0.5 mg/kg IV, IO Lizards: 0.05 mg/kg, IM, q24h x 2–3d Lizards: 1.0–1.5 mg/kg SC, IM **	Preanesthesia; analgesic **Administer 30 minutes prior to Isoflurane induction – smoother, shorter induction
Analgesia in Reptiles	**Dose & Route**	**Comments**

Carprofen (Rimadyl)	1-4 mg/kg, PO, SC, IM, IV, q 24h follow with half the dose q 24–72 h	Non-Steroidal Anti-inflammatory, analgesia
Flunixin (Banamine)	0.1–0.5 mg/kg, IM, q12–24h Lizards: 1–2 mg/kg IM q 24h x 2 treatments.	Up to 3 days; Non-steroidal Anti-Inflammatory

Reptiles: Anesthetics and Analgesics in Snakes

Anesthesia in Snakes	**Dose & Route**	**Comments**
Inhalant Anesthetics: Isoflurane (IsoFlo, Aerrane) * IsoFlo is preferred Halothane (Fluothane)	To effect. In general, 3–4% induction, 1–2% maintenance; inhalation.	Precision vaporizer; Adequate ventilation or scavenging essential
Ketamine (Ketaset,Vetalar,Vetaket)* + Diazepam (Valium)*	20–60 mg/kg SC, IM 60–80 mg/kg, IM Ketamine + 0.2–0.8 mg/kg IM Diazepam	Alone provides Sedation; Combination provides Anesthesia with improved muscle relaxation
Pentobarbital (Nembutal, Sodium Pentobarbitone)*	15–30mg /kg IPP	
Tiletamine/ Zolazepam (Telazol)	10–22mg /kg IM	
Analgesia in Snakes	**Dose & Route**	**Comments**
Acepromazine Maleate (ACE)	0.05– 0.5 mg/kg, IM	Use with Preanesthetic
Buprenorphine (Buprenex)*	0.005–0.02 mg/kg, IM, q 24–48h 0.01–1.0 mg/kg, IM	Most species/analgesia
Butorphanol (Torbugesic, Torbutrol)*	1–2 mg/kg, IM	Preanesthesia, analgesic
Carprofen (Rimadyl)	1v4 mg/kg, PO, SC, IM, IV, q 24h follow with half the dose q 24–72 h	Non-Steroidal Anti-inflammatory, analgesia
Flunixin (Banamine)	0.1–0.5 mg/kg, IM, q12–24h	Up to 3 days; Non-steroidal Anti-Inflammatory

Reptiles: Anesthetics and Analgesics in Turtles

Anesthesia in Turtles	**Dose & Route**	**Comments**
Inhalant Anesthetics: Isoflurane (IsoFlo, Aerrane) * IsoFlo is preferred Halothane (Fluothane) Sevoflurane (Ultane)	To effect. In general, 3–4% induction, 1–2% maintenance; inhalation.	Precision vaporizer; Adequate ventilation or scavenging essential
Ketamine (Ketaset,Vetalar,Vetaket)* + Diazepam (Valium)*	20–60 mg/kg SC, IM 60–80 mg/kg, IM Ketamine + 0.2–1.0 mg/kg IM Diazepam	Alone provides Sedation; Combination provides Anesthesia with improved muscle relaxation
Pentobarbital (Nembutal, Sodium Pentobarbitone)*	10–18 mg/kg IC	
Tiletamine/ Zolazepam (Telazol)	10–20 mg/kg IM	
Analgesia in Turtles	**Dose & Route**	**Comments**
Acepromazine Maleate (ACE)	0.05–0.5 mg/kg, IM	Use with Preanesthetic
Buprenorphine (Buprenex)*	0.005–0.02 mg/kg, IM, q 24–48h 0.01 –1.0 mg/kg, IM	Most species/analgesia
Analgesia in Turtles (Cont.)	**Dose & Route**	**Comments**

Butorphanol (Torbugesic, Torbutrol)*	0.4–1.0 mg.kg, IM, SC (0.2 mg.kg IM used experimentally in Tortoises)	Preanesthesia , analgesic
Carprofen (Rimadyl)	1–4 mg/kg, PO, SC, IM, IV, q 24h follow with half the dose q 24–72 h	Non-Steroidal Anti-inflammatory, analgesia
Flunixin (Banamine)	0.1–0.5 mg/kg, IM, q12–24h	Up to 3 days; Non-steroidal Anti-Inflammatory

Sheep: Anesthetics and Analgesics (Sheep should be fasted 18-24h prior to induction; Withhold water for only 6 h)

Anesthesia in Sheep	**Dose & Route**	**Comments**
Acepromazine Maleate (ACE)	0.05–0.2 mg/kg, IM, SC	
Atropine	0.1 –1.0 mg/kg, SC, IM, IV Repeat q 15–30 minutes	Adjunct: Anticholinergic; decreases fluid secretions, suppresses vagal tone to the heart, prevents bradycardia
Diazepam (Valium)*	0.2–0.5 mg/kg, IM, IV	Sedative
Inhalant Anesthetics: Isoflurane (IsoFlo, Aerrane) Halothane (Fluothane) Sevoflurane (Ultane)	To effect. In general, 3–4% induction, 1-2% maintenance; inhalation.	Precision vaporizer; Adequate ventilation or scavenging essential
Ketamine (Ketaset,Vetalar,Vetaket)* Used in Combination: Diazepam*, Medetomidine, Xylazine	2–7 mg/kg, IV; 22-44 mg/kg, IM Combinations: Consult Veterinarian and formularies for agents and dosages	Alone: poor anesthetic; Better if used in combination with other agents
Propofol	3.0-7.0 mg/kg IV	
Pentobarbital (Nembutal, Sodium Pentobarbitone)*	20–40 mg/kg, IV	
Thiopental Sodium (Pentothal)*	20–25 mg/kg, IV	
Xylazine (Rompun, AnaSed) Recommended to use with Butorphanol, plus dose of Ketamine Reverse with Yohimbine	Use 20mg/ml concentration Combination: 100mg/ml Xylazine + 1 ml Butorphanol + 8 ml Sterile water: 0.05 mg/kg, IV And give 1 ml Ketamine, IM *Reversal agent:* Yohimbine 0.2 mg/kg, IV	Sedative; analgesic
Analgesia in Sheep	**Dose & Route**	**Comments**
Acetylsalicylic Acid (Aspirin)	10–20 mg/kg, PO q4h	Analgesia, anti-inflammatory; antipyretic; Use enteric-coated tablet
Buprenorphine (Buprenex)*	0.005-0.01 mg/kg, IM q4–6h	4–6 hours analgesia
Butorphanol (Torbugesic, Torbutrol)*	0.5 mg/kg, SC q2–3h	2–3 hours analgesia
Flunixin (Banamine)	1 mg/kg, IM, IV sid for up to 3 days	Non-Steroidal Anti-inflammatory
Analgesia in Sheep (Cont.)	**Dose & Route**	**Comments**
Ketoprofen (Ketofen)	1 mg/kg, IM, IV sid for up to 3 days	Non-steroidal Anti-Inflammatory
Medetomidine (Domitor)	5–30 ug/kg, IM; 10 ug/kg, IV	

Meperidine (Demerol)*	2–10 mg/kg, IM, SC; 2 mg/kg, IV, IM q2–4h	
Pentazocine (Talwin)*	2 mg/kg, IM q4h	Analgesic; Narcotic agonist/ antagonist
Phenylbutazone	4–8 mg/kg, PO q 24h; 2–5 mg/kg, IV q 24h	

Swine: Anesthetics and Analgesics

Anesthesia in Swine	**Dose & Route**	**Comments**
Acepromazine Maleate (ACE)	Pigs: 10 mg/cc (Dose at 1 cc/kg): Not to exceed 15 mg total. Mini-Pigs: 0.03–0.1 mg/kg, IM	Mini-Pig: low dose for catheter placement, higher dose for tranquilization
Atropine	0.05(mini-pigs) – 0.5 (Bigger pigs) mg/kg, SC, IM, IV	Adjunct: Anticholinergic; decreases fluid secretions, suppresses vagal tone to the heart, prevents bradycardia
Diazepam (Valium)*	0.5–10 mg/kg, IM; 0.5–1.5 mg/kg, IV	Sedative
Fentanyl/Droperidol (Innovar-Vet)*	Sedation: 0.07–0.10 ml/kg, IM Mini-pigs: 1mg/9–14kg, IM Sedation; 1ml/12–25kg, IM Tranquilization for minor procedures	Sedative/analgesic; Lower dose takes 20 minutes to maximum effect
Inhalant Anesthetics: Isoflurane (IsoFlo, Aerrane) Halothane (Fluothane) Sevoflurane (Ultane)	To effect. In general, 4–5% induction, 1–2% maintenance; inhalation.	Precision vaporizer; Adequate ventilation or scavenging essential
Ketamine (Ketaset,Vetalar,Vetaket)* Used in Combination: Diazepam*(D), Medetomidine (M), Midazolam, Xylazine (X) Best if include Butorphanol to increase analgesia.	15–20 mg/kg, IV; 15–25 mg/kg, IM Combinations: 10–18mg/kg (K) + 1-2mg/kg (D), IM Or 1-2mg/kg (D), IM then 12-20mg/kg (K), IM Or 10mg/kg (K) + 0.08mg/kg (M), IM Or 11 mg/kg (K)+ 2 mg/kg (X) + 0.22mg/kg Butorphanol, IM	Alone: poor anesthetic; Better if used in combination with other agents
Lidocaine (Xylocaine)	Local injection to effect.	Local anesthetic
Pentobarbital (Nembutal, Sodium Pentobarbitone)*	25–35 mg/kg, PO; 30 mg/kg, IP; 20–30 mg/kg, IV	
Thiopental Sodium (Pentothal)*	24–30 mg/kg BW IP 5–19 mg/kg BW IV	
Tiletamine/ Zolazepam (Telazol) Recommended in combinations with: Ketamine, Xylazine	Various Combinations/Dosages	Refer to Formulary; Consult Veterinary staff for combinations and dosages
Xylazine (Rompun, AnaSed)	0.5–10 mg/kg, IM *Reversal agent:* Yohimbine 0.125-0.3mg/kg, IV	Sedative
Analgesia in Swine	**Dose & Route**	**Comments**
Acetylsalicylic Acid (Aspirin)	10–20 mg/kg, PO q4–12h	Analgesia, anti-inflammatory; antipyretic; Use enteric-coated tablet;. Lower dose q4h, higher does q12h

Buprenorphine (Buprenex)*	0.005–0.1 mg/kg, IM, IV q12h	Up to 12 hours of analgesia; Use higher dose w/ major surgical procedures
Butorphanol (Torbugesic,Torbutrol)*	0.1–0.3 mg/kg, IM, IV q8-12h	
Analgesia in Swine, cont.	**Dose & Route**	**Comments**
Chlorpromazine	0.5–4.0 mg/kg, IM; 0.55–3.3mg/kg, IV	Decreases nausea, vomiting
Flunixin (Banamine)	0.5–2.2 mg/kg, SC, IV q12–24h	Non-Steroidal Anti-inflammatory
Ketoprofen (Ketofen)	3 mg/kg, IM sid for up to 3 days	Non-steroidal Anti-Inflammatory
Medetomidine (Domitor)	0.08 mg/kg, IM	Analgesic; Light - Moderate Sedative, Potent a2-agonist
Meperidine (Demerol)*	2–10 mg/kg, IM q4h; 2 mg/kg, IV q 2–4h	
Morphine*	0.2 mg/kg, IM q4h; 0.2–0.9 mg/kg, SC	

APPENDIX I. Tribromoethanol (Avertin) Solution (1.2%)

Components:

- 2,2,2 Tribromoethanol (Avertin), Aldrich T4, 840.2 or eq.
- Tert-amyl alcohol

Stock solution (1.6 g/ml):

- Add 15.5 ml Tert-amyl alcohol to 25 g. Avertin in dark bottle (the bottle that the Avertin is shipped in works great).
- Stir on magnetic stirrer until the Avertin is dissolved (about 12 hours).
- Avertin stock is light sensitive and hydroscopic
- Keep in dark bottle at room temperature:
  - If the solution is kept at 4 deg. F. the Avertin will "freeze" out, necessitating redissolving the Avertin.
- Keep away from light and tightly sealed. Do not leave the bottle open longer than necessary.

Working solution:

- Mix 0.5 ml Avertin stock solution and 39.5 ml normal saline in glass vessel (graduate cylinder works great).
- Seal container with parafilm, wrap in foil to exclude light and stir on magnetic stirrer for about 12 hours or until dissolved.
- Filter sterilize through 0.2 micron filter and store at 4deg C.
- It can be aliquoted into ~5 ml lots in foil wrapped, sterile serum vials or kept in a dark, capped bottle at 4 deg. C.

Comments:

It will take about 5 min. for the animal to become fully anesthetized (lack of toe pinch reflex). An additional 0.1-0.2 ml can be given to effect. The animal will remain anesthetized for approximately 15–20 minutes and recover within 30-60 minutes. Keep animal warm during recovery. Note: that the effective dosage is dependent upon the weight of the animal. Older, fatter or lactating animals will need more Avertin to become fully anesthetized. It is difficult to over-anesthetize (kill) the animal even at higher dosages.

* This information is provided from a number of different sources, therefore it is not accountable.

WARNING: Stored solutions are known to be unstable and potentially hepatotoxic. Frequent use may induce chemical peritonitis.

APPENDIX 2. Rabbit Mix Solution

Components:	**Comments:**
In Sterile Vile, mix: Acepromazine Maleate 20 mg (2cc of 10 mg/ml) + Ketamine HCl* 500 mg (5 cc of 100 mg/ml) + Xylazine HCL 160 mg (8 cc of 20 mg/ml) **Dosage:** As an Induction agent: ½ cc/kg, IM For use as the Full anesthetic: 1cc/kg, IM	Used primarily for Guinea Pigs Rabbits, Rats. **WARNING:** Not for use in Cattle, Sheep, Goats, other ruminants or Horses

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