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ANESTHESIA & ANALGESIA IN REPTILES & AMPHIBIANS: A RESOURCE GUIDE

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Anesthesia and Analgesia in Reptiles and Amphibians: A Resource Guide

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Description: *Anesthesia and Analgesia in Reptiles and Amphibians: A Resource Guide* is a bibliography of biomedical and veterinary literature on the use of anesthesia and analgesia in common reptile and amphibian species covering 2001 to 2021. It contains 361 citations. This bibliography updates [A reference source for analgesia & analgesics in animals](#) compiled by Dr. Richard L. Crawford (AWIC Series 2000-02) published in December 2000 and archived in the National Agricultural Library Digital Collections.

Dr. Crawford subdivided the previous bibliography into twenty sections organized by individual species or species groups. The bibliography covered most vertebrate and some invertebrate animals, including commonly-used laboratory species such as mice, rats, rabbits and other rodents, and primates. One section of the bibliography covered amphibians and reptiles. In the twenty years since Dr. Crawford published this bibliography, the number of publications on veterinary anesthesia and analgesia has increased greatly. Because of the large amount of literature, AWIC staff members decided to compile a [series of bibliographies](#), each one covering a particular group of animals.

Scope: This guide covers peer-reviewed literature (articles in peer-reviewed journals, books, book chapters, and conference proceedings) on anesthesia and analgesia use in reptiles and amphibians published between 2001 and 2021. The following databases were searched:

- PubMed
- Web of Science (All Databases: Web of Science Core Collection as well as Biological Abstracts, BIOSIS Citation Index, Current Contents Connect, KCI-Korean Journal Database, Russian Science Citation Index, SciELO Citation Index, and Zoological Record)
- Scopus
- EBSCO platform databases (Agricola, CAB Abstracts, eBook Collection (EBSCOhost), Global Health, Zoological Record, Biological Abstracts, MEDLINE)

How to Use This Resource Guide:

The bibliography is divided into the following sections. You can navigate directly to each section by clicking on the headings in the Table of Contents:

- **General (Reptiles and/or Amphibians):** This section contains literature discussing anesthesia and analgesia for the two classes, reptiles and amphibians (all species), or covering more than one species.
- **Alligators, Crocodiles, and Caimans:** This section covers anesthesia/analgesia for reptiles of the order Loricata.
- **Bearded dragons:** This section provides citations on reptiles of the genus *Pogona*. The central bearded dragon (*Pogona vitticeps*) and other *Pogona* species are popular as pets.

- **Frogs:** Frogs and toads are amphibians belonging to the order Anura. This section features literature on frogs in the family Ranidae (known as “true frogs”) including northern leopard frog (*Rana pipiens*), American bullfrogs (*Lithobates catesbeianus*), White’s tree frogs (*Litoria caerulea*), map treefrog (*Hypsiboas geographicus*), and blue poison dart frogs (*Dendrobates tinctorius azureus*).
- **Frogs (Laboratory):** All citations in this section cover anesthesia and analgesia of the African clawed frog (*Xenopus laevis*) which is probably the most prevalent amphibian used in biomedical research.
- **Iguanas:** This section contains bibliography on anesthesia and analgesia for the green iguana (*Iguana iguana*), a popular companion reptile species.
- **Lizards (multi-species):** This section includes articles on anesthesia and analgesia for reptiles of the order Squamata excluding bearded dragons and green iguanas.
- **Salamanders and Newts:** This section of the resource guide contains articles on anesthetization of amphibians of the order Urodela, which includes newts and salamanders. Several citations discuss anesthesia for axolotls (*Ambystoma mexicanum*), a species of amphibian frequently used as a model in biomedical research especially for research on vertebrate development.
- **Snakes:** This section covers anesthesia of limbless reptiles of the suborder Serpentes, including sea snakes (Hydrophiinae), boas and pythons (Boidae) and garter snakes (*Thamnophis sirtalis*). Citations on ball pythons (*Python regius*) are the most numerous due to this species’ popularity as a companion animal.
- **Toads:** This section covers anesthesia for Anuran amphibians from the family Bufonidae, the “true toads” with a few citations on fire-bellied toads (*Bombina orientalis*). (Fire-bellied toads are actually frogs but are called toads due to the carbuncles on their backs).
- **Turtles and Tortoises (Terrestrial, Freshwater, and Sea):** Includes citations on reptiles of the order Testudines. The red-eared slider turtle (*Trachemys scripta elegans*) is used as an animal model in spinal and nerve research. Land turtles and tortoises include eastern box turtles (*Terrapene carolina carolina*) and Galapagos tortoises (*Geochelone nigra*). There are also multiple citations about anesthesia for wild species of sea turtles such as the loggerhead (*Caretta caretta*), Kemp’s Ridley (*Lepidochelys kempii*), leatherback (*Dermochelys coriacea*), and green (*Chelonia mydas*).

Citation Order: Citations are arranged in ascending order by the last name of the first author within each section of the bibliography.

Keywords: Each citation is followed by a series of selected keywords derived from the citation records of the database searched. Because this bibliography derives from multiple databases, keywords may vary in form since databases may use different controlled vocabularies and different indexing terms.

Finding Full-Text of Articles:

You may check the National Agricultural Library’s (NAL) online catalog, [AGRICOLA](#), to see which books and periodicals that the library has in its holdings. Some online periodicals in

NAL's holdings are only available to USDA employees through the [Digitop](#) portal. Other articles are open access and may be downloaded for free. If you are not a USDA employee, check with your local or institutional library to see whether your library subscribes to these periodicals or can order them on interlibrary loan.

Information on how to request materials that are included in the National Agricultural Library (NAL)'s collections can be found on the [Request Library Materials](#) page. USDA employees can request books and articles through Document Delivery. All patrons are encouraged to explore local library resources first before contacting the National Agricultural Library. If you are not a USDA employee, you may visit the library during its hours of operation to request items from our circulation desk or read electronic articles on-site. You may also request items on interlibrary loan through your home library (check with your institutional, university, or public library's loan office for further information).

Disclaimer: *This research guide is for informational purposes only. If you are a researcher planning to use any of the anesthesia/analgesia drugs or methods mentioned in these citations on amphibians and reptiles, you should always consult a veterinarian.*

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General (Reptiles and/or Amphibians)

88 citations

Baitchman, E., & Stetter, M. (2014). Amphibians. In *Zoo Animal and Wildlife Immobilization and Anesthesia, 2nd Edition* (pp. 303–311). Wiley Blackwell; Scopus.

<https://doi.org/10.1002/9781118792919.ch17>

Keywords: Amphibians; analgesia; Eugenol; Isoflurane; Tricaine methanesulfonate

Barten, S., & Mader, D. (2015). *Tips and tricks of the old veterans (reptile medicine)*. 1341. CAB Abstracts.

<http://search.ebscohost.com/login.aspx?direct=true&db=lah&AN=20153171075&site=ehost-live>

Keywords: Administration routes; anesthesia; anesthetics; Animal surgery and non-drug therapy; autopsy; lizards; mechanism of drug action; pain killers; pet animals; postmortem inspections; reptiles; Sauria; snakes; surgical techniques; Techniques and Methodology; Testudines; therapeutics; turtles; veterinary pharmacology and anaesthesiology; veterinary surgeons

Bouts, T., & Gasthuys, F. (2002). Anesthesia in reptiles—Part 1: Injection anesthesia. *Vlaams Diergeneeskundig Tijdschrift*, 71(3), 183–194.

Keywords: Acepromazine; alfadolone; anesthesia; anesthesia induction; anesthetic agent; atropine; barbituric acid derivative; cholinergic receptor blocking agent; diazepam; diprenorphine; etorphine; general anesthesia; glycopyrronium bromide; inhalation anesthesia; intubation; ketamine; lidocaine; lizard; local anesthesia; medetomidine; methoxital; midazolam; muscle relaxant agent; neuroleptic agent; opiate; phenothiazine derivative; premedication procaine; propofol; reptile; sedative agent; snake; suxamethonium; thiopental; tiletamine; tubocuraine chloride; xylazine; zolazepam

Bradley, T., Baer, C. K., & Willette, M. M. (2001). *Pain management considerations and pain-associated behaviors in reptiles and amphibians* (ZOOREC:ZOOR13800014614).

<://ZOOREC:ZOOR13800014614>

Keywords: Amphibians; Pain-associated behaviors; Pain management; reptiles

Brown, H. H. K., Tyler, H. K., & Mousseau, T. A. (2004). Orajel(R) as an amphibian anesthetic: Refining the technique. *Herpetological Review*, 35(3), 252–252.

Keywords: Amphibians; Anesthetics; Benzocaine; Orajel

Cecala, K. K., Price, S. J., & Dorcas, M. E. (2007). A comparison of the effectiveness of recommended doses of MS-222 (tricaine methanesulfonate) and Orajel (R) (benzocaine) for amphibian anesthesia. *Herpetological Review*, 38(1), 63–66.

Keywords: Amphibians, Anesthesia, Benzocaine, MS-22, Orajel, Tricaine methanesulfonate

Chai, N. (2016). Surgery in amphibians. *Veterinary Clinics of North America: Exotic Animal Practice*, 19(1), 77–95. CAB Abstracts. <https://doi.org/10.1016/j.cvex.2015.08.004>

Keywords: Amphibians; analgesia; anesthesia; anesthetics; Animal surgery and non-drug therapy; bladder; celiotomy; cloaca; cystotomy; dermatologic surgical procedures; eye surgery; gastrotomy; intestines; lizards; minimally invasive surgery; ophthalmologic surgical procedures; orthopedics; ovariectomy; patient monitoring; pet animals; reptiles; Sauria; skin surgery; stomach; surgical drapes; testis; urinary ladder; veterinary pharmacology and anaesthesiology; visceral prolapse

Chatigny, F., Kamunde, C., Creighton, C. M., & Stevens, E. D. (2017). Uses and Doses of Local Anesthetics in Fish, Amphibians, and Reptiles. *Journal of the American Association for Laboratory Animal Science*, 56(3), 244–253.

Keywords: Amphibians; Analgesics/administration & dosage; anesthesia; anesthetics; anesthetics, local/administration and dosage; animal welfare; aquaculture; aquatic species; Fishes; Lidocaine/administration & dosage; LL82; MM120; pain killers; pain/drug therapy/veterinary; Reptiles; veterinary pharmacology and anaesthesiology

Chinnadurai, S. K., & Kane, L. P. (2014). Advances in amphibian clinical therapeutics. *Journal of Exotic Pet Medicine*, 23(1), 50–55. Scopus. <https://doi.org/10.1053/j.jepm.2013.11.008>

Keywords: Amphibian; analgesia; antibacterial; antifungal; pharmacology

Cooper, J. E. (2010). Terrestrial reptiles: Lizards, snakes and tortoises. In R. Hubrecht & J. Kirkwood (Eds.), *The UFAW handbook on the care and management of laboratory and other research animals* (Vol. 1–Ed.8, pp. 709–730). Universities Federation for Animal Welfare (UFAW); CAB Abstracts.

<http://search.ebscohost.com/login.aspx?direct=true&db=lah&AN=20133278819&site=ehost-live>

Keywords: Anesthesia; anesthetics; animal surgery and non-drug therapy; animal welfare; crocodylia; laboratory animal science; lizards; reptiles; Sauria; snakes; testudines; turtles

Divers, S. J., & Stahl, S. J. (2019). *Mader's reptile and amphibian medicine and surgery, 3rd Edition*. (Issue Ed.3). W.B. Saunders; CAB Abstracts.

<http://search.ebscohost.com/login.aspx?direct=true&db=lah&AN=20193444856&site=ehost-live>

Keywords: Amphibia; anesthesia; animal surgery and non-drug therapy; pain killers; pets and companion animals; reptiles

Duncan, A. (2012). Reptile and amphibian analgesia. In *Fowlers's zoo and wild animal medicine*. In R. Miller and M. Fowler (Vol. 7, pp. 247-253)://[ZOOREC:ZOOR14805035653](https://doi.org/10.1016/j.zoorec.2012.05.003)

Keywords: Amphibia; Analgesia; Reptilia; Sedation

Eatwell, K. (2010). Options for analgesia and anaesthesia in reptiles. *In Practice*, 32(7), 306–311. <https://doi.org/10.1136/inp.c3917>

Keywords: Anesthesia; analgesia; reptiles

Ferrell; S. T., & Bertelsen, M. F. (2013). *Anesthesia and analgesia in reptiles*. Small Animal and Exotics Proceedings. North American Veterinary Conference, Orlando, Florida, USA, 19-23 January 2013., Gainesville, USA. CAB Abstracts.

<http://search.ebscohost.com/login.aspx?direct=true&db=lah&AN=20133225634&site=ehost-live>

Keywords: Chelonia; crocodiles; Crocodylia; lizards; pets and companion animals; lizards; reptiles; Sauria; snakes; Testudines; Veterinary pharmacology & anesthesiology

Firmin, Y. (2001). Surgery in reptiles. Anaesthesia in reptiles: Species-specific problems. *Point Veterinaire*, 32(221), 40–43.

Keywords: Anesthesia; reptiles; surgery

Genz, E. J. (2007). Medicine and surgery of amphibians. *ILAR Journal*, 48(3), 255–259.

<https://doi.org/10.1093/ilar.48.3.255>

Keywords: Aminobenzoates/pharmacology; Amphibians/*anatomy & histology/*physiology/*surgery; Anesthetics/*pharmacology; Euthanasia/methods; Skin Absorption/*physiology; Surgical Procedures; Operative/*veterinary

Głodek, J., Adamiak, Z., & Przeworski, A. (2016). Magnetic resonance imaging of reptiles, rodents, and lagomorphs for clinical diagnosis and animal research. *Comparative Medicine*, 66(3), 216–219. Scopus.

Keywords: Anesthesia; diagnostic imaging; general anesthesia; hypnotic sedative agent; hypnotics and sedatives; immobilization; magnetic resonance imaging; nuclear magnetic resonance imaging; organ; procedures; reptiles; risk factors

Gumpenberger, M. (2021). Diagnostic Imaging of the Respiratory Tract of the Reptile Patient. *Veterinary Clinics of North America - Exotic Animal Practice*, 24(2), 293–320. Scopus.

<https://doi.org/10.1016/j.cvex.2021.01.002>

Keywords: CAT; computer assisted tomography; CT; diagnostic imaging; digital radiography; dyspnea; echography; emphysema; general anesthesia; image analysis; nuclear magnetic resonance imaging; pathology; pneumonia; respiratory system; respiratory tract diseases; review; snake; tooth radiography; urine retention

Hadfield, C. A., & Whitaker, B. R. (2005). Amphibian emergency medicine and care. *Seminars in Avian and Exotic Pet Medicine*, 14(2 SPEC. ISS.), 79–89. Scopus.

<https://doi.org/10.1053/j.saep.2005.04.003>

Keywords: Amphibian; Analgesia; Critical care; emergency medicine; fluid therapy; nutritional support

Hawkins, M. G. (2006). The Use of Analgesics in Birds, Reptiles, and Small Exotic Mammals. *Journal of Exotic Pet Medicine*, 15(3), 177–192. Scopus. <https://doi.org/10.1053/j.jepm.2006.06.004>

Keywords: Analgesia; NSAID; opioid; reptile; Reptilia

Heard, D. J. (2001). Reptile anesthesia. *The Veterinary Clinics of North America. Exotic Animal Practice*, 4(1), 83–117, vii. Scopus. [https://doi.org/10.1016/S1094-9194\(17\)30053-1](https://doi.org/10.1016/S1094-9194(17)30053-1)

Keywords: Anesthesia/veterinary; lizards/physiology; monitoring; physiologic/veterinary; preanesthetic medication/veterinary; premedication; review; snakes/physiology; turtles/physiology

Hernandez-Divers, S. J., & Anonymous. (2006). Meloxicam and reptiles—A practical approach to analgesia. In *Proceedings of the North American Veterinary Conference, January 7-11, 2006. Orlando, Florida. Small animals and exotics edition*. (Vol. 20, Book 2, pp, 1636-1640). (://ZOOREC:ZOOR14301007744

Keywords: Analgesia; meloxicam; reptiles

Hernandez-Divers, S. M., Schumacher, J., Stahl, S., & Hernandez-Divers, S. J. (2004). *Reptile clinical anaesthesia: Advances in research*. 6(3), 64–69. CAB Abstracts. <http://search.ebscohost.com/login.aspx?direct=true&db=lah&AN=20043122955&site=ehost-live>

Keywords: Aquaculture (animals); lizards; pets and companion animals; reptiles; Sauria; snakes; Techniques and Methodology; Testudines; turtles; Veterinary pharmacology and anaesthesiology

Hnizdo, J. (2002). A brief survey of anaesthesia in reptiles. *Akvarium Terarium*, 45(7), 64–68.

Keywords: Anesthesia; reptiles

Johnson, J. H. (2004). Husbandry and medicine of aquatic reptiles. *Seminars in Avian and Exotic Pet Medicine*, 13(4), 223–228. Scopus. <https://doi.org/10.1053/j.saep.2004.04.008>

Keywords: Alligator; Alligatoridae; anesthesia induction; aquatic; atipamezole; butorphanol; Caiman; *Chrysemys picta*; *Clemmys guttata*; *Clemmys insculpta*; *Clemmys mamorata*; Crocodylidae; diazepam; *Emydoidea blandingii*; isoflurane; ketamine; medetomidine; propofol; *Pseudemys concinna floridana*; reptiles; Reptilia; Testudines; *Trachemys scripta elegans*; turtles

Kempf, H. (2010). Herpetological sadism—Pain sensitivity in reptiles. *Elaphe*, 18(1), 53–57.

Keywords: Pain sensitivity; reptiles

Koelle, P., Bolle, I., & Moritz, J. (2017). Pain in Reptiles. *Tieraerztliche Umschau*, 72(12), 469–475.

Keywords: Pain; reptiles

Lennox, A. M. (2011). *Use of alfaxalone (Alfaxan) in reptiles*. 1643–1644. CAB Abstracts. <http://search.ebscohost.com/login.aspx?direct=true&db=lah&AN=20113161819&site=ehost-live>

Keywords: Alfaxalone; Alfaxan; anesthesia; anesthetics; drug action; injectable anesthetics, laws and regulations; lizards; mechanism of drug action; North America; OECD Countries; pets and companion animals; reptiles; rules; Sauria; snakes; Testudines; turtles; Veterinary pharmacology and anaesthesiology

Lillywhite, H. B., Shine, R., Jacobson, E., Denardo, D. F., Gordon, M. S., Navas, C. A., Wang, T., Seymour, R. S., Storey, K. B., Heatwole, H., Heard, D., Brattstrom, B., & Burghardt, G. M. (2017). Anesthesia and Euthanasia of Amphibians and Reptiles Used in Scientific Research: Should Hypothermia and Freezing Be Prohibited? *Bioscience*, 67(1), 52–60. Zoological Record.

Keywords: Anesthesia; amphibians; euthanasia; reptiles; freezing; hypothermia

Longley, L. (2004). Reptile analgesia. *Veterinary Times*, 34(25), 30. CAB Abstracts.

Keywords: Lizards; pets and companion animals; reptiles; Sauria; snakes; Testudines; tortoises; Veterinary pharmacology and anaesthesiology

Lumb, W. V., & Read, M. (2004). Wants more information on anesthesia in reptiles [1] (multiple letters). *Journal of the American Veterinary Medical Association*, 224(8), 1245. Scopus. <https://doi.org/10.2460/javma.2004.224.1245>

Keywords: Alligator; anesthesia; anesthesia complication; anesthesiological techniques; anesthetic agent; cause of death; lizard; reptiles; Reptilia; Serpentes; snake; Squamata; Testudines; turtle

Machin, K. L. (2001). Fish, amphibian, and reptile analgesia. *The Veterinary Clinics of North America. Exotic Animal Practice*, 4(1), 19–33. Scopus. [https://doi.org/10.1016/S1094-9194\(17\)30048-8](https://doi.org/10.1016/S1094-9194(17)30048-8)

Keywords: Amphibia; Amphibians/physiology; analgesia/veterinary; Pain/physiopathology/prevention & control/*veterinary; Reptiles/physiology; review

Mader, D. (2018). *Fracture repair in reptiles*. (R. Cari Sarmiento, Ed.). Latin American Veterinary Conference (LAVC); CAB Abstracts. <http://search.ebscohost.com/login.aspx?direct=true&db=lah&AN=20183347233&site=ehost-live>

Keywords: Animal surgery and non-drug therapy; pets and companion animals; reptiles

Mader, D. (2015). *Loco-regional analgesia in reptile medicine*. 1361–1363. CAB Abstracts. <http://search.ebscohost.com/login.aspx?direct=true&db=lah&AN=20153171084&site=ehost-live>

Keywords: Anesthesia; drug action; inhaled anesthetics; injectable anesthetics; local anesthesia; mechanism of drug action; pain killers; pets and companion animals; reptiles; Veterinary pharmacology and anaesthesiology

Mans, C. (2016). Reptile anesthesia and analgesia: Tips and tricks. In *Proceedings of the NAVC Conference, 16-20 January 2016, Orlando, Florida, USA. Volume 30, Small Animal and Exotics*,

pp.1531–1533. Gainesville: North American Veterinary Community. CAB Abstracts.
<http://search.ebscohost.com/login.aspx?direct=true&db=lah&AN=20163321501&site=ehost-live>

Keywords: Analgesia; anesthesia; pain killers; pharmaceuticals; reptiles

Martin, K. K., & Stevens, C. W. (2002). Analgesia effects of nociceptin in amphibians. *Society for Neuroscience Abstract Viewer and Itinerary Planner, 2002*, Abstract No. 553.2-Abstract No. 553.2.

Keywords: Amphibians; analgesia; Nociceptin

Martinez-Jimenez, D., & Hernandez-Divers, S. J. (2007). Emergency Care of Reptiles. *Veterinary Clinics of North America - Exotic Animal Practice, 10*(2), 557–585. Scopus.
<https://doi.org/10.1016/j.cvex.2007.02.003>

Keywords: Analgesia; animal surgery and non-drug therapy; Crocodylia; pain killers; pets and companion animals; reptiles; Reptilia; Sauria; snakes; Techniques and Methodology; Testudines; turtles; Veterinary pharmacology and anaesthesiology

Mauragis, D., & Berry, C. R. (2014). Reptile radiography. *Today's Veterinary Practice, 4*(6), 62–66. CAB Abstracts.

Keywords: Anesthesia; lizards; pets and companion animals; reptiles; Sauria; sedation; Testudines; tortoises; turtles

Mitchell, M. (2015). Reptile anesthesia: You mean it is about more than passing gas? *40th World Small Animal Veterinary Association Congress, Bangkok, Thailand, 15-18 May, 2015. Proceedings book* (pp. 253–254). CAB Abstracts.

<http://search.ebscohost.com/login.aspx?direct=true&db=lah&AN=20163336727&site=ehost-live>

Keywords: Adverse reactions; anesthesia; anesthetics; drug action; pain killers; pets and companion animals; reptiles; veterinary pharmacology and anaesthesiology

Mitchell, M. A. (2002). Diagnosis and management of reptile orthopedic injuries. *Veterinary Clinics of North America - Exotic Animal Practice, 5*(1), 97–114. Scopus.
[https://doi.org/10.1016/S1094-9194\(03\)00048-3](https://doi.org/10.1016/S1094-9194(03)00048-3)

Keywords: Alpha 2 adrenergic receptor stimulating agent; analgesic agent; anesthesia; anesthesiological techniques; anesthetic agent; butorphanol tartrate; fracture fixation; Fractures; Bone; isoflurane; ketamine; lidocaine; local anesthetic agent; medetomidine; opiate; pain; postoperative care; preoperative care; propofol; reptiles; Reptilia; review; species difference; surgical technique; telazol; Testudines; tiletamine; turtle; xylazine; zolazepam

Mitchell, M. A. (2009). Anesthetic Considerations for Amphibians. *Journal of Exotic Pet Medicine, 18*(1), 40–49. Scopus. <https://doi.org/10.1053/j.jepm.2008.11.006>

Keywords: Amphibia; amphibians; anesthesia; anesthetic; anuran; monitoring; *Syzygium aromaticum*; urodelan

Mohan, S., & Stevens, C. W. (2006). Systemic and spinal administration of the mu opioid, remifentanyl, produces antinociception in amphibians. *European Journal of Pharmacology*, 534(1–3), 89–94. <https://doi.org/10.1016/j.ejphar.2006.01.011>

Keywords: Amphibians; analgesia; opioids; remifentanyl

Mosley, C. (2011). Pain and nociception in reptiles. *Veterinary Clinics of North America - Exotic Animal Practice*, 14(1), 45–60. Scopus. <https://doi.org/10.1016/j.cvex.2010.09.009>

Keywords: Analgesia/veterinary; Analgesics/therapeutic use; Nociceptors/physiology; Pain/prevention & control/veterinary; Reptiles/physiology; review

Mosley, C. A. E. (2005). Anesthesia and analgesia in reptiles. *Seminars in Avian and Exotic Pet Medicine*, 14(4), 243–262. Scopus. <https://doi.org/10.1053/j.saep.2005.09.005>

Keywords: Analgesia; Anesthesia; cardiopulmonary physiology; monitoring; Perianesthetic support; reptiles; Reptilia

Mosley, C. A. E., & Anonymous. (2006a). Anatomic and physiologic considerations for reptile anesthesia: Review of current reptile anesthetic techniques: the do's and don'ts. *Proceedings of the North American Veterinary Conference. January 7-11, 2006. Orlando, Florida. Small animals and exotics edition. Book 2.* (Vol. 20, pp. 1643-1646).://ZOOREC:ZOOR14301007749

Keywords: Anatomy; anesthesia; anesthetic techniques; physiology; reptile; review

Mosley, C. I., & Mosley, C. A. (2017). Comparative Anesthesia and Analgesia of Reptiles, Amphibians, and Fishes. In *Veterinary Anesthesia and Analgesia: The Fifth Ed. Of Lumb and Jones* (pp. 784–799). Wiley; Scopus. <https://doi.org/10.1002/9781119421375.ch42>

Keywords: Amphibian anesthesia; anesthetic drugs; reptile anesthesia; thermoregulation; veterinary analgesia

Newman, L. C., Sands, S. S., Wallace, D. R., & Stevens, C. W. (2002). Characterization of mu, kappa, and delta opioid binding in amphibian whole brain tissue homogenates. *Journal of Pharmacology and Experimental Therapeutics*, 301(1), 364–370. <https://doi.org/10.1124/jpet.301.1.364>

Keywords: Amphibians; analgesia; grass frog; opioid agonists; *Rana pipiens*

O'Rourke, D. P., & Jenkins, A. L. (2008). Chapter 19—Anesthesia and Analgesia in Reptiles. In R. E. Fish, M. J. Brown, P. J. Danneman, & A. Z. Karas (Eds.), *Anesthesia and Analgesia in Laboratory Animals (Second Edition)* (pp. 501–510). Academic Press. <https://doi.org/10.1016/B978-012373898-1.50023-1>

Keywords: American College of Laboratory Animal Medicine (ACLAM); anesthesia; analgesia; reptiles.

O'Rourke, D. P., & Jenkins, A. L. (2008). Chapter 20—Anesthesia and Analgesia in Amphibians. In R. E. Fish, M. J. Brown, P. J. Danneman, & A. Z. Karas (Eds.), *Anesthesia and*

Analgesia in Laboratory Animals (Second Edition) (pp. 511–518). Academic Press.

<https://doi.org/10.1016/B978-012373898-1.50024-3>

Keywords: American College of Laboratory Animal Medicine (ACLAM); amphibians; anesthesia; analgesia

Perry, S. M., & Nevarez, J. G. (2018). Pain and Its Control in Reptiles. *Veterinary Clinics of North America - Exotic Animal Practice*, 21(1), 1–16. Scopus.

<https://doi.org/10.1016/j.cvex.2017.08.001>

Keywords: Aerophagia; agonists; *Alligator mississippiensis*; alpha 2 adrenergic receptor stimulating agent; analgesia/veterinary; bupivacaine; buprenorphine; butorphanol; carprofen; drug efficacy; electroneurology; fentanyl; hydromorphone; lidocaine; mepivacaine; methadone; morphine; mu opiate receptor; multimodal analgesia; nerve conduction; neurophysiology; neuroanatomy; opioid; pain; Pain managements/methods/veterinary; pethidine; Receptors; Opioid; mu; reptiles; review; signal transduction; spinal anesthesia; tapentadol; tramadol; *Trachemys scripta elegans*

Pizzi, R. (2003). Anaesthesia and surgery of Indian reptiles. *Veterinary Practitioner*, 4(2), 75–79. CAB Abstracts.

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Keywords: Administration routes; adverse reactions; anesthesia; animal surgery and non-drug therapy; *Chelonoidis*; *Chelonoidis nigra*; *Geochelone nigra*; intrathecal anesthesia; pets and companion animals; phallectomy; reptiles; surgical techniques; Testudines; Testudinidae; veterinary pharmacology and anaesthesiology

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Keywords: Alfaxalone; anesthesia; anesthetics; drug action; lizards; pets and companion animals; physiology and biochemistry (wild animals); preanesthetic medication; reptiles; Sauria; snakes; Testudines; turtles; veterinary pharmacology and anaesthesiology; zoo animals

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Keywords: Anesthesia; anesthetics; Crocodylia; drug action; lizards; pain killers; pets and companion animals; reptiles; Sauria; snakes; Testudines; turtles; veterinary pharmacology and anaesthesiology

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Keywords: Analgesics; opioid; butorphanol; controlled clinical trial; cross-over studies; does response; drug effect; morphine; narcotic analgesic agent; pain; pain assessment; pain measurement; prospective study; randomized controlled trial; Reptilia; respiration; Testudines; time factors; *Trachemys scripta*; turtles

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Keywords: Amphibians/physiology; central nervous system/physiology; narcotics/pharmacology; Pain/genetics/metabolism/physiopathology; protein structure, tertiary/genetics; Receptors, Opioid/drug effects/genetics/metabolism; Sequence homology, amino acid

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Keywords: Acetic acid test; amphibia; amphibians/physiology; analgesia/veterinary; analgesic agent; analgesia/therapeutic use; opiate peptide; Opioid; Opioid peptides/physiology; Pain/prevention & control/veterinary; *Rana pipiens*; review

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Keywords: Anesthesia; anesthetics; animal surgery and non-drug therapy; drug action; pets and companion animals; reptiles; veterinary pharmacology and anesthesiology; zoo animals

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Keywords: Anesthesia; anesthetics; animal surgery and non-drug therapy; drug action; pets and companion animals; preanesthetic medication; reptiles; Sauria; snakes; Testudines; turtles; veterinary pharmacology and anaesthesiology

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Keywords: Amphibia; amphibians/physiology; anesthesia; anesthesia, general/veterinary; animal euthanasia; ectotherm; endotherm; Euthanasia, animal; Hypothermia, induced/veterinary; reptiles/physiology

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Keywords: Analgesia; analgesic agent; anesthesia; atropine; buprenorphine; butorphanol; carprofen; corticosteroid; diazepam; dyspnea; emergency medicine; emergency treatment; meloxicam; morphine; nonsteroid anti-inflammatory agent; opiate; pethidine; pralidoxime; Reptiles; Reptilia; review

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Keywords: Amphibians; anesthesia; steroid levels

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Keywords: Anesthesia; animal surgery and non-drug therapy; pain killers; pets and companion animals; reptiles; veterinary pharmacology and anaesthesiology

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Keywords: Anesthesia; animal surgery and non-drug therapy; exotic pets; intubation; pain killers; pets and companion animals; reptiles; traumas; veterinary pharmacology and anaesthesiology

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Keywords: Anesthesia; anesthetics; drug action; pain killers; pets and companion animals; reptiles; veterinary pharmacology and anaesthesiology

Alligators, Crocodiles, and Caimans

17 citations



American alligator (*Alligator mississippiensis*)

Abhishek, M. S., Sunil Kumar, Satish Kumar, Das, A. K., & Mahesh Kumar. (2020). Managing a fishing-hook foreign-body evoked obstruction of cervico-thoracic oesophagus in a 2 year old free-living crocodile. *Indian Veterinary Journal*, 97(3), 46–47. CAB Abstracts.

Keywords: Anesthesia; anesthetics; animal surgery and non-drug therapy; crocodiles; Crocodylia; Crocodylidae; Crocodylus; esophagus; reptiles; veterinary pharmacology and anaesthesiology

Bianchi, C., Adami, C., Dirrig, H., Cuff, A., d'Ovidio, D., & Monticelli, P. (2020). Mandibular nerve block in juvenile Nile crocodile: A cadaveric study. *Veterinary Anaesthesia and Analgesia*, 47(6), 835–842. <https://doi.org/10.1016/j.vaa.2020.04.016>

Keywords: Alligators and Crocodiles/anatomy & histology; crocodilians, Injections/methods/veterinary; Mandibular Nerve/anatomy & histology; Nerve Block/methods/veterinary; Nile crocodile; Tomography, X-Ray computed/veterinary

Fleming, G. J. (2001). Crocodylian anesthesia. *The Veterinary Clinics of North America. Exotic Animal Practice*, 4(1), 119–145, vii. [https://doi.org/10.1016/s1094-9194\(17\)30054-3](https://doi.org/10.1016/s1094-9194(17)30054-3)

Keywords: Anesthetics/administration & dosage; Alligators and Crocodiles/anatomy & histology; Anesthesia/veterinary; Monitoring/Physiologic/veterinary; Restraint, Physical/veterinary

Fleming, G. J. (2007). Crocodylians (Crocodiles, Alligators, Caimans, Gharial). In *Zoo Animals and Wildlife Immobilization and Anesthesia: Second Ed* (pp. 325-326). Wiley Blackwell. <https://doi.org/10.1002/9780470376478.ch18>

Keywords: Alligators; analgesia; crocodilians; restraint techniques; sedatives; tranquilizers

Gatson, B. J., Goe, A., Granone, T. D., & Wellehan, J. F. X. (2017). Intramuscular epinephrine results in reduced anesthetic recovery time in American alligators (*Alligator mississippiensis*) undergoing isoflurane anesthesia. *Journal of Zoo and Wildlife Medicine : Official Publication of the American Association of Zoo Veterinarians*, 48(1), 55–61. <https://doi.org/10.1638/2015-0293.1>

Keywords: Alligators and Crocodiles; Anesthesia Recovery Period; alligator; Alligator mississippiensis; Alligatoridae; Alligators and Crocodiles; anesthesia; Anesthesia Recovery Period; Anesthetics, Inhalation/administration & dosage; crocodylian; Crocodylia; Epinephrine; inhalation anesthetic agent; Injections, Intramuscular; intramuscular drug administration; Isoflurane/administration & dosage/pharmacology; recovery; reptiles; time factor; veterinary pharmacology and anaesthesiology

Gorczak, R., Chaves, R. O., Teixeira, M. L., Freitas, Í. B. de, Martins, R. C., Valandro, M. A., Copat, B., & Soares, A. V. (2017). Anesthesia in American alligator (*Alligator mississippiensis*) for a limb amputation. *Acta Scientiae Veterinariae*, 45(Supplement), 195. CAB Abstracts.

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[https://doi.org/10.1638/1042-7260\(2002\)033\[0036:EOMKAW\]2.0.CO;2](https://doi.org/10.1638/1042-7260(2002)033[0036:EOMKAW]2.0.CO;2)

Keywords: Adrenergic alpha-Agonists; alligator; *Alligator mississippiensis*; Alligatoridae; Alligators and Crocodiles; alpha adrenergic receptor blocking agent; alpha adrenergic receptor stimulating agent; American alligator; analgesic agent; Analgesics/Non-Narcotic; anesthesia; anesthesia recovery period; anesthetic agent; Anesthetics, Combined; Anesthetics, Dissociative; Atipamezole; breathing; drug antagonism; drug effect; electrocardiography; heart rate; imidazole; ketamine; Medetomidine; reflex; Respiration; Restraint, Physical

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Keywords: Alligator; American alligator; *Alligator mississippiensis*; anesthesia; blood flow

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<https://doi.org/10.1242/jeb.178194>

Keywords: Adrenaline; cardiac filling; Crocodilian; Myocardial Contraction; Reptile; Alligators and Crocodiles/physiology; Anesthetics, Inhalation/pharmacology, Atrial Function/physiology; Cardiac Output/physiology; Epinephrine/pharmacology; Isoflurane/pharmacology

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Physiology. Part A, Molecular & Integrative Physiology, 222, 60–65.

<https://doi.org/10.1016/j.cbpa.2018.03.008>

Keywords: Alligators and Crocodiles/physiology; Analgesics, Opioid/administration & dosage/pharmacology; Carbon Dioxide/metabolism; Dose-Response Relationship, Drug; Hypercapnia/physiopathology; Hypoxia, physiopathology; Oxygen/metabolism; Pulmonary Gas Exchange/drug effects; Respiration/drug effects

Monticelli, P., Ronaldson, H. L., Hutchinson, J. R., Cuff, A. R., d'Ovidio, D., & Adami, C. (2019). Medetomidine–ketamine–sevoflurane anaesthesia in juvenile Nile crocodiles (*Crocodylus niloticus*) undergoing experimental surgery. *Veterinary Anaesthesia and Analgesia*, 46(1), 84–89. Scopus. <https://doi.org/10.1016/j.vaa.2018.09.004>

Keywords: Alligators and Crocodiles/physiology; Anesthesia/veterinary; anesthesia level; anesthetic agent; Anesthetics, Combined; Anesthetics, Inhalation/administration & dosage/pharmacology; atipamezole; breathing rate; crocodiles; crocodilian; Crocodylia; Crocodylidae; Crocodylus; *Crocodylus niloticus*; electrocardiogram; electromyography; eyelid reflex; general anesthesia; Hypnotics and Sedatives/administration & dosage/pharmacology; immobilization; implantation; inhalation anesthesia; ketamine/pharmacology; Medetomidine/administration & dosage/pharmacology; Nile crocodile; reptiles; sedation; Sevoflurane/administration & dosage/pharmacology; spirometry; Techniques and Methodology; temperature; veterinary pharmacology and anaesthesiology

Olsson, A., Phalen, D., & Dart, C. (2013). Preliminary studies of alfaxalone for intravenous immobilization of juvenile captive estuarine crocodiles (*Crocodylus porosus*) and Australian freshwater crocodiles (*Crocodylus johnstoni*) at optimal and selected sub-optimal thermal zones. *Veterinary Anaesthesia and Analgesia*, 40(5), 494–502. Scopus. <https://doi.org/10.1111/vaa.12031>

Keywords: Alfaxalone; Alligators and Crocodiles; anesthetic agent; Anesthetics; Australian freshwater crocodile; *C. johnstoni*; controlled clinical trial; controlled study; crocodilian; Crocodylidae; *Crocodylus johnsoni*; *Crocodylus porosus*; cross-over studies; crossover procedure; Estuarine crocodile; immobilization; Infusions, Intravenous; intravenous drug administration; Pregnanediones; randomized controlled trial; temperature

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Keywords: Animal surgery and non-drug therapy; Crocodylia; Crocodylidae; Crocodylus; *Crocodylus palustris*; reptiles; veterinary pharmacology and anaesthesiology; zoo animals

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Keywords: Adrenergic beta-1 Receptor Agonists/pharmacology; Alligators and Crocodiles/growth & development; Anaerobiosis; Cardiovascular System/drug effects/physiopathology; Crocodilian; Developmental programming; Hypoxia; Oxygen/metabolism; Phenotypic plasticity; Reptile; Receptors, Adrenergic, beta/metabolism

Stegmann, G. F., Williams, C. J. A., Franklin, C., Wang, T., & Axelsson, M. (2017). Long-term surgical anaesthesia with isoflurane in human habituated Nile Crocodiles. *Journal of the South African Veterinary Association*, 88(1). Scopus. <https://doi.org/10.4102/jsava.v88i0.1451>

Keywords: Alligators and Crocodiles/physiology/surgery; anesthesia induction; anesthesiological procedure; anesthetic recovery; Anesthetics, Inhalation/administration * dosage; Atipamezole; balanced anesthesia; body temperature; crocodiles; crocodilian; Crocodylia; Crocodylidae; Crocodylus; *Crocodylus niloticus*; environmental temperature; heart rate; hypnotic sedative agent; Hypnotics and Sedatives/administration & dosage; intraoperative period; Medetomidine/administration & dosage; Monitoring/Physiologic/veterinary

Tisdale, R. K., Lesku, J. A., Beckers, G. J. L., & Rattenborg, N. C. (2018). Bird-like propagating brain activity in anesthetized Nile crocodiles. *Sleep*, 41(8). <https://doi.org/10.1093/sleep/zsy105>

Keywords: Anesthesia; Crocodiles; Nile crocodiles

Bearded Dragons

7 citations



Two bearded dragons (*Pogona vitticeps*)

Couture, É. L., Monteiro, B. P., Aymen, J., Troncy, E., & Steagall, P. V. (2017). Validation of a thermal threshold nociceptive model in bearded dragons (*Pogona vitticeps*). *Veterinary Anaesthesia and Analgesia*, 44(3), 676–683. <https://doi.org/10.1016/j.vaa.2016.07.005>

Keywords: analgesia; Analgesics, Opioid; Lizards; Morphine; nociception; opioid; pain; Pain Measurement/methods/veterinary; Pain Threshold/physiology; Random Allocation; Reproducibility of Results; reptile

Ferreira, T. H., & Mans, C. (2019). Evaluation of neuraxial anesthesia in bearded dragons (*Pogona vitticeps*). *Veterinary Anaesthesia and Analgesia*, 46(1), 126–134. <https://doi.org/10.1016/j.vaa.2018.09.001>

Keywords: Anesthesia/veterinary; Anesthetics, Local/administration & dosage/pharmacology; Injections/veterinary; intrathecal anesthesia; Lidocaine/administration & dosage/pharmacology; Lizards/physiology

Ferreira, T. H., Mans, C., & Di Girolamo, N. (2019). Evaluation of the sedative and physiological effects of intramuscular lidocaine in bearded dragons (*Pogona vitticeps*) sedated with alfaxalone. *Veterinary Anaesthesia and Analgesia*, 46(4), 496–500.

<https://doi.org/10.1016/j.vaa.2019.03.003>

Keywords: Anesthetics/administration & dosage/pharmacology; Anesthetics, Local/administration & dosage/pharmacology; chemical restraint, Cross-Over Studies; Injections, Intramuscular; Lidocaine/administration & dosage/pharmacology; lizard; local anesthetic; Pregnanediones/administration & dosage/*pharmacology; Random Allocation; reptile; sedation

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MEDLINE. <https://doi.org/10.1016/j.vaa.2018.12.002>

Keywords: Cross-Over Studies; animal experiment; nonhuman; Article; controlled study; animal; metabolism; crossover procedure; Random Allocation; veterinary medicine; randomization; plasma (blood); analgesia; anesthesia; Anesthesia/*veterinary; pain killers; sedation; Injections, Subcutaneous; lizard; solid phase extraction; Pharmacology; high performance liquid chromatography; area under the curve; maximum plasma concentration; time to maximum plasma concentration; antinociception; subcutaneous drug administration; Analgesics, Opioid; narcotic analgesic agent; mean residence time; Anesthesia; Lizards; half life time; Half-Life; Hydromorphone/administration & dosage; hydromorphone; maximum concentration; Testudines; turtle; quadrupole mass spectrometry; pharmacokinetic parameters; LL882; Veterinary Pharmacology and Anaesthesiology; Physiology and Biochemistry (Wild Animals); YY400; VV730; Turtles; Animal Health and Hygiene (General); LL800; *Trachemys scripta*; Turtles/*metabolism; reptiles; reptile; Analgesics, Opioid/*pharmacokinetics; bearded dragon; Hydromorphone/administration & dosage/*pharmacokinetics; Lizards/*metabolism; opioid; red-eared slider; lizards; lethargy; *Pogona vitticeps*; *Trachemys scripta elegans*; elimination rate constant; Hydromorphone; *Trachemys*; Sauria; turtles; Agamidae; Emydidae; *Pogona*; terrapins; Hydromorphone/*pharmacokinetics

O, O., Churgin, S. M., Sladky, K. K., & Smith, L. J. (2015). Anesthetic induction and recovery parameters in bearded dragons (*Pogona vitticeps*): comparison of isoflurane delivered in 100% oxygen versus 21% oxygen. *Journal of Zoo and Wildlife Medicine : Official Publication of the American Association of Zoo Veterinarians*, 46(3), 534–539. <https://doi.org/10.1638/2014-0193.1>

Keywords: Anesthesia; Anesthesia Recovery Period; Anesthesia, Inhalation/methods/veterinary; Anesthetics, Inhalation/administration and dosage; bearded dragon; Cross-Over Studies; induction; isoflurane; Oxygen/administration & dosage/pharmacology; recovery

Ratliff, C., Parkinson, L. A. B., & Mans, C. (2019). Effects of the fraction of inspired oxygen on alfaxalone-sedated inland bearded dragons (*Pogona vitticeps*). *American Journal of Veterinary Research*, 80(2), 129–134. <https://doi.org/10.2460/ajvr.80.2.129>

Keywords: Anesthesia/veterinary; Anesthetics/administration & dosage/pharmacology; Cross-Over Studies; Oxygen/administration & dosage/pharmacology; Pregnanediones/administration & dosage/*pharmacology; Random Allocation

Sladky, K. K., Kinney, M. E., & Johnson, S. M. (2008). Analgesic efficacy of butorphanol and morphine in bearded dragons and corn snakes. *Journal of the American Veterinary Medical Association*, 233(2), 267–273. Scopus. <https://doi.org/10.2460/javma.233.2.267>

Keywords: Analgesics; Opioid; breathing; Butorphanol; Cross-Over Studies; crossover procedure; dose response; Dose-Response Relationship; Drug; drug effect; Lizards; Morphine; narcotic analgesic agent; pain; pain assessment; Pain Measurement; *Pantherophis guttatus*; physiology; Respiration; Snakes; species difference; Species Specificity; Time Factors

Frogs (multi-species)

30 citations



Leopard frog (*Rana pipiens*)

Balko, J. A., Posner, L. P., & Chinnadurai, S. K. (2019). Immersion in tricaine methanesulfonate (MS-222) is not sufficient for euthanasia of smokey jungle frogs (*Leptodactylus pentadactylus*). *Journal of Zoo and Wildlife Medicine*, 50(1), 89–95. Scopus. <https://doi.org/10.1638/2018-0033>

Keywords: Aminobenzoates; anesthetic agent; Anesthetics; animal euthanasia; Anura; breathing rate; consciousness; death; dose response; Dose-Response Relationship; Drug; drug exposure; euthanasia; Euthanasia, Animal; heart beat; immersion; jumping; *Leptodactylus*; *Leptodactylus pentadactylus*; nociceptive stimulation; stimulus response; tricaine; Tricaine methanesulfonate

Balko, J. A., Watson, M. K., Papich, M. G., Posner, L. P., & Chinnadurai, S. K. (2018). Plasma concentrations of ketoprofen and meloxicam after subcutaneous and topical administration in the smoky jungle frog (*Leptodactylus pentadactylus*). *Journal of Herpetological Medicine and Surgery*, 28(3/4), 89–92. CAB Abstracts. <https://doi.org/10.5818/17-10-129.1>

Keywords: Amphibia; Anura; frogs; Pharmacology; reptiles; Techniques and Methodology; veterinary pharmacology and anaesthesiology

Barbon, A. R., Routh, A., & Lopez, J. (2019). Inhalatory isoflurane anesthesia in mountain chicken frogs (*Leptodactylus fallax*). *Journal of Zoo and Wildlife Medicine*, 50(2), 453–456. Scopus. <https://doi.org/10.1638/2018-0138>

Keywords: Ultrasound; Article;; heart rate; animals; veterinary medicine; Gallus; birds; fowls; Galliformes; Gallus; Phasianidae; nociception; Isoflurane; isoflurane; anesthesia; intubation; Anesthesia; Anesthesia, Inhalation; inhalation anesthesia; Anesthetics, Inhalation; inhalation anesthetic agent; righting reflex; Amphibia; endangered species; tracer; LL882; Veterinary Pharmacology and Anaesthesiology; Farm and Horticultural Structures; NN300; Anesthetics, Inhalation/*pharmacology; Isoflurane/*pharmacology; Endangered Species; Anura; *Anura; Anesthesia, Inhalation/*veterinary; *Leptodactylus fallax*; mountain chicken frog; frogs; ED50; positive end expiratory pressure

Barter, L. S., & Antognini, J. F. (2008). Kinetics and potency of halothane, isoflurane, and desflurane in the Northern Leopard frog *Rana pipiens*. *Veterinary Research Communications*, 32(5), 357–365. Scopus. <https://doi.org/10.1007/s11259-008-9041-2>

Keywords: Amphibia; Amphibian, Anesthesia; anesthesia induction; anesthesiological techniques; anesthetic potency; Anesthetics, Inhalation; animal experiment; Anura; controlled study; Desflurane; Dose-Response Relationship; Drug; drug exposure; drug potency; drug response; electrostimulation; Frog; general anesthesia; Halothane; immobilization; Isoflurane; nociceptive stimulation; *Rana pipiens*; Random Allocation

Barter, L. S., Mark, L. O., Smith, A. C., & Antognini, J. F. (2007). Isoflurane potency in the northern leopard frog *Rana pipiens* is similar to that in mammalian species and is unaffected by decerebration. *Veterinary Research Communications*, 31(6), 757–763. Scopus. <https://doi.org/10.1007/s11259-007-0077-5>

Keywords: Amphibia; Amphibian; Anaesthetic potency; Anesthesia; anesthesia induction; anesthesia mechanism; anesthetic potency; Anesthetics, Inhalation; animal experiment; Anura; concentration response; controlled study; decerebration; dose response; drug efficacy; drug exposure; drug potency; drug response; electrostimulation; Frog; general anesthesia; Halothane; immobilization; Isoflurane; nociceptive stimulation; Pain Measurement; *Rana pipiens*; Random Allocation; species difference

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Keywords: Anesthesia; Benzocaine; Pentobarbital; leopard frogs; MS-222; *Rana pipiens*; Tricaine

Carrasco, D. C. (2015). Intramuscular anaesthesia with alfaxalone in a barred leaf frog (*Phyllomedusa tomopterna*) for correction of traumatic evisceration. In *British Veterinary Zoological Society: Proceedings of the Spring Meeting 2015, 20-22 March, 2015, Holywell Park, Imago, Loughborough University and Twycross Zoo, UK. Camelid Medicine & Zoo Population Management* (F. Molenaar & M. Stidworthy, Eds.; p. 22). Loughborough, UK: British Veterinary Zoological Society; CAB Abstracts.
<http://search.ebscohost.com/login.aspx?direct=true&db=lah&AN=20193073138&site=ehost-live>

Keywords: Alfaxalone; Amphibia; anesthesia; anesthetics; Animal Surgery and Non-drug Therapy; Anura; frogs; Pets and Companion Animals; *Phyllomedusa tomopterna*; traumas; veterinary pharmacology and anaesthesiology

Cui, J., Zhu, B., Fang, G., Smith, E., Brauth, S. E., & Tang, Y. (2017). Effect of the Level of Anesthesia on the Auditory Brainstem Response in the Emei Music Frog (*Babina daunchina*). *Plos One*, 12(1). <https://doi.org/10.1371/journal.pone.0169449>

Keywords: Acoustic Stimulation; Aminobenzoates; Anesthesia/methods; Brain Stem/drug effects; Evoked Potentials, Auditory; Brain Stem/drug effects; Ranidae

Doss, G. A., Nevarez, J. G., Fowlkes, N., & Da Cunha, A. F. (2014). Evaluation of metomidate hydrochloride as an anesthetic in leopard frogs (*Rana pipiens*). *Journal of Zoo and Wildlife Medicine*, 45(1), 53–59. Scopus. <https://doi.org/10.1638/2013-0056R1.1>

Keywords: Anesthesia; anesthetic agent; Anesthetics; bradycardia; clinical trial; drug derivative; Etomidate; leopard frog; metomidate; metomidate hydrochloride; prolonged recovery; *Rana pipiens*

Gray, E. J., Miller, A. L., Machta, B. B., & Veatch, S. L. (2015). Hexadecanol Reverses Ethanol Induced Tadpole Anesthesia and Raises Critical Temperatures in Isolated Plasma Membrane Vesicles. *Biophysical Journal*, 108(2), 289A-289A. <https://doi.org/10.1016/j.bpj.2014.11.1577>

Keywords: Anesthesia; anesthesia reversal; ethanol; frog; hexadecanol; tadpole, temperature

Hausmann, J. C., Krisp, A., Sladky, K., Miller, P. E., & Mans, C. (2017). Measuring intraocular pressure in White's tree frogs (*Litoria caerulea*) by rebound tonometry: Comparing device, time of day, and manual versus chemical restraint methods. *Journal of Zoo and Wildlife Medicine*, 48(2), 413–419. CAB Abstracts. <https://doi.org/10.1638/2016-0268r.1>

Keywords: Amphibia; anesthesia; Anura; frogs; Hylidae; *Litoria caerulea*; Techniques and Methodology; veterinary pharmacology and anaesthesiology

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Keywords: Amphibians; anesthetics; benzocaine; frogs; Orajel

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Keywords: Anesthetics; frogs; general anesthetics; tadpoles

Krisp, A. R., Hausmann, J. C., Sladky, K. K., & Mans, C. (2020). Anesthetic Efficacy of MS-222 in White's Tree Frogs (*Litoria caerulea*). *Journal of Herpetological Medicine and Surgery*, 30(1), 38–41. Agricola. <https://doi.org/10.5818/18-11-170.1>

Keywords: Amphibia; amphibian anesthesia; anesthetics; Anura; cross-over studies; diagnostic techniques; drug action; frogs; heart rate; Hylidae; *Litoria caerulea*; mechanism of drug action; MS-222; Pets and Companion Animals; reflexes; sedation; sulfonates; surgery; tricaine methanesulfonate; veterinary pharmacology and anaesthesiology; White's tree frogs

Magori, N., Fujita, T., Mizuta, K., & Kumamoto, E. (2019). Inhibition by general anesthetic propofol of compound action potentials in the frog sciatic nerve and its chemical structure. *Naunyn-Schmiedeberg's Archives of Pharmacology*, 392(3), 359–369. <https://doi.org/10.1007/s00210-018-01596-w>

Keywords: Analgesia; Benzocaine/pharmacology; Compound action potential; Frog sciatic nerve; Nerve conduction; Propofol; Action Potentials/drug effects; Alcohols/pharmacology; Anesthetics, General/chemistry/pharmacology; Anesthetics, Local/pharmacology; Ketones/pharmacology; Phenols/chemistry/pharmacology; Ranidae; Sciatic Nerve/drug effects/physiology

Medler, S. (2019). Anesthetic MS-222 eliminates nerve and muscle activity in frogs used for physiology teaching laboratories. *Advances in Physiology Education*, 43(1), 69–75. <https://doi.org/10.1152/advan.00114.2018>

Keywords: Aminobenzoates/pharmacology; Anesthetics/pharmacology; cardiac muscle; frogs; MS-222; Muscle Contraction/drug effects/physiology; Muscle, Skeletal/drug effects/physiology; nerve; *Rana pipiens*; Sciatic Nerve/drug effects/physiology; skeletal muscle

Newman, L. C., Sands, S. S., Wallace, D. R., & Stevens, C. W. (2002). Characterization of mu, kappa, and delta opioid binding in amphibian whole brain tissue homogenates. *Journal of Pharmacology and Experimental Therapeutics*, 301(1), 364–370.
<https://doi.org/10.1124/jpet.301.1.364>

Keywords: Amphibians; Opioids

Ruiz-Fernández, M. J., Jiménez, S., Fernández-Valle, E., García-Real, M. I., Castejón, D., Moreno, N., Ardiaca, M., Montesinos, A., Ariza, S., & González-Soriano, J. (2020). Sex determination in two species of anuran amphibians by magnetic resonance imaging and ultrasound techniques. *Animals*, 10(11), 1–14. Scopus. <https://doi.org/10.3390/ani10112142>

Keywords: Amphibians; anesthesia; Anurans; article; case report; clinical article; Kaloula; Magnetic resonance; nuclear magnetic resonance imaging; sonographer; sex determination sexual maturity; testis; ultrasonics; Ultrasonography; *Xenopus laevis*; zoos

Salbego, J., Maia, J. L. dos S., Toni, C., Rodrigues, A. S. S., Sousa, E. M. O., Silva, L. V. F. da, Mourão, R. H. V., Barata, L. E. S., Heinzmann, B. M., & Baldisserotto, B. (2017). Anesthesia and sedation of map treefrog (*Hypsiboas geographicus*) tadpoles with essential oils. *Ciência Rural*, 47(11), e20160909. CAB Abstracts. <https://doi.org/10.1590/0103-8478cr20160909>

Keywords: Amphibia; anesthesia; angiosperms; Aniba; Aniba rosaeodora; Animal and in-vitro Models for Pharmaceuticals; Anura; essential oil crops; Hylidae; Hypsiboas geographicus; Lamiales; Lauraceae; Laurales; Lippia; *Lippia alba*; *Lippia origanoides*; magnoliids; minor forest products; oil crops; plants; Verbenaceae

Sears, B., Snyder, P., & Rohr, J. (2013). No Effects of Two Anesthetic Agents on Circulating Leukocyte Counts or Resistance to Trematode Infections in Larval Amphibians. *Journal of Herpetology*, 47(3), 498–501. <https://doi.org/10.1670/12-144>

Keywords: Amphibians; Anesthetic agents; leukocytes; trematode infections

Shaw, S. D., Berger, L., Harvey, C., Alley, M. R., Bishop, P. J., & Speare, R. (2017). Adenomatous hyperplasia of the mucous glands in captive Archey's frogs (*Leiopelma archeyi*). *New Zealand Veterinary Journal*, 65(3), 140–146. CAB Abstracts. <https://doi.org/10.1080/00480169.2016.1255158>

Keywords: Amphibia; anesthesia; Animal Physiology and Biochemistry (Excluding Nutrition); Anura; autopsy; frogs; infectious agents; *Leiopelma archeyi*; Leiopelmatidae; postmortem inspections; veterinary pharmacology and anaesthesiology; Zoo Animals

Speare, R., Speare, B., Muller, R., & Bishop, P. (2014). Anesthesia of tadpoles of the southern brown tree frog (*Litoria ewingii*) with isoeugenol (Aqui-S). *Journal of Zoo and Wildlife Medicine*, 45(3), 492–496. Scopus. <https://doi.org/10.1638/2013-0088R.1>

Keywords: Amphibia; anesthesia; anesthetic agent; Anesthetics; drug derivative; drug effect; Eugenol; Hylidae; Isoeugenol; Larva; Litoria ewingii; physiology; Ranidae; Southern brown tree frog; Tadpoles

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Keywords: Analgesia; analgesic agent; Analgesics; Animals, Laboratory; Body Temperature; Disease Models, Animal; experimental animal; frog; methodology; Pain; Rana pipiens

Stevens, C. W., Martin, K. K., & Stahlheber, B. W. (2009). Nociceptin produces antinociception after spinal administration in amphibians. *Pharmacology Biochemistry and Behavior*, 91(3), 436–440. <https://doi.org/10.1016/j.pbb.2008.08.022>

Keywords: Amphibians; Frogs; Nociceptin; Rana pipiens

Stokes, D., Abou-Zahr, T., & Carrasco, D. C. (2017). Nursing case study: Argentinian horned frog (*Ceratophrys ornata*) with an impaction. In *British Veterinary Zoological Society: Proceedings of the BVZS Conference 2017, 13-15 October, 2017, Zoological Society of London, London Zoo, Regent's Park, London, UK* (S. Jayson & S. Pellett, Eds.; p. 46). London: UK: British Veterinary Zoological Society; CAB Abstracts. <http://search.ebscohost.com/login.aspx?direct=true&db=lah&AN=20193073319&site=ehost-live>

Keywords: Amphibia; Animal Surgery and Non-drug Therapy; Anura; frogs; veterinary pharmacology and anaesthesiology

Williams, C. J. A., Alstrup, A. K. O., Bertelsen, M. F., Jensen, H. M., Leite, C. A. C., & Wang, T. (2017). When local anesthesia becomes universal: Pronounced systemic effects of subcutaneous lidocaine in bullfrogs (*Lithobates catesbeianus*). *Comparative Biochemistry and Physiology. Part A, Molecular & Integrative Physiology*, 209, 41–46. <https://doi.org/10.1016/j.cbpa.2017.03.019>

Keywords: Amino amides; Amphibian; Analgesia; Anesthesia; Anesthesia, Local; local anesthesia, Systemic effects; Heart Rate/drug effects; Injections, Subcutaneous; Lidocaine/pharmacology; Nociception/drug effects; *Rana catesbeiana*/physiology; Respiratory Rate

Williams, C. J. A., Alstrup, A. K. O., Bertelsen, M. F., Jensen, H. M., Leite, C. A. C., & Wang, T. (2018). Cardiovascular effects of alfaxalone and propofol in the bullfrog, *Lithobates catesbeianus*. *Journal of Zoo and Wildlife Medicine : Official Publication of the American Association of Zoo Veterinarians*, 49(1), 92–98. <https://doi.org/10.1638/2017-0152R.1>

Keywords: Alfaxalone; alfaxan; amphibians; anesthesia; Anesthetics/administration dosage/pharmacology; Cardiovascular System/drug effects; Hypnotics and Sedatives/administration & dosage/pharmacology; Infusions, Intra-Arterial/veterinary; Injections, Intramuscular/veterinary; Pilot Projects; Pregnanediones/administration & dosage/pharmacology; Propofol/administration & dosage/pharmacology; *Rana catesbeiana*/physiology



Blue poison dart frog (*Dendrobates azureus*)

Yaw, T. J., Mans, C., Martinelli, L., & Sladky, K. K. (2020). Comparison of subcutaneous administration of alfaxalone-midazolam-dexmedetomidine with ketamine-midazolam-dexmedetomidine for chemical restraint in juvenile blue poison dart frogs (*Dendrobates tinctorius azureus*). *Journal of Zoo and Wildlife Medicine : Official Publication of the American Association of Zoo Veterinarians*, 50(4), 868–873. MEDLINE. <https://doi.org/10.1638/2019-0033>

Keywords: Adrenergic alpha-2 Receptor Antagonists/administration & dosage/pharmacology; Aging; alfaxalone; alfaxan; Amphibia; amphibian; analgesic agent; Analgesics/administrator & dosage/pharmacology; anesthesia; anesthetic agent; anesthetic recovery; Anesthetics/administration & dosage/pharmacology; Antidotes/administration & dosage/pharmacology; Anura; anuran; atipamezole; blue poison dart frog; breathing rate; chemical restraint; combination drug therapy; conscious sedation; Conscious Sedation; controlled study; Cross-Over Studies; crossover procedure; *Dendrobates*; *Dendrobates tinctorius azureus*; Dexmedetomidine/administration & dosage/pharmacology; Flumazenil/administration & dosage/pharmacology; frogs; gastric prolapse; heart rate; hypnotic sedative agent; Hypnotics and Sedatives/administration & dosage/pharmacology; Imidazoles; Ketamine/administration & dosage/pharmacology; Midazolam/administration & dosage/pharmacology; Pets and Companion Animals; Pregnanediones/administration & dosage/*pharmacology; prospective study; randomized controlled trial; recumbency; respiration depression righting reflex; sedate; tactile stimulation; vetaket; Veterinary pharmacology and anaesthesiology; von Frey test; Zoo Animals

Yaw, T. J., Mans, C., Martinelli, L., & Sladky, K. K. (2021). Evaluation of Subcutaneous Alfaxalone for Sedation in Juvenile Blue Poison Dart Frogs (*Dendrobates tinctorius azureus*). *Journal of Herpetological Medicine and Surgery*, 30(4), 248–253. Agricola. <https://doi.org/10.5818/19-01-185.1>

Keywords: Alfaxalone, Amphibia, amphibian, , anesthesia, anesthetic agent, anesthetic recovery, Anura, anuran, apnea, *Dendrobates*, *Dendrobates tinctorius azureus*, Dendrobatidae, drug action, frogs, heart rate, juveniles, neuroactive steroid, Pets and Companion Animals; prospective studies, respiratory rate, sedation, subcutaneous injection, surgery, Veterinary pharmacology and anaesthesiology, von Frey test, Zoo Animals

Frogs (Laboratory) (*Xenopus laevis* or African clawed frog)

27 citations



African clawed frogs (*Xenopus laevis*)

Bartlett, H. L., Escalera II, R. B., Patel, S. S., Wedemeyer, E. W., Volk, K. A., Lohr, J. L., & Reinking, B. E. (2010). Echocardiographic assessment of cardiac morphology and function in *Xenopus*. *Comparative Medicine*, *60*(2), 107–113. Scopus.

Keywords: Aminobenzoic Acids; Anesthetics; animal experiment; Blood Flow Velocity; body weight; Coronary Circulation; Doppler echocardiography; Echocardiography; Electrocardiography; flow rate; Heart; Heart Conduction System; heart electrophysiology; heart function; Hemodynamics; Isoflurane; tricaine; two dimensional echocardiography; *Xenopus laevis*

Coble, D. J., Taylor, D. K., & Mook, D. M. (2011). Analgesic effects of meloxicam, morphine sulfate, flunixin meglumine, and xylazine hydrochloride in African-clawed frogs (*Xenopus laevis*). *Journal of the American Association for Laboratory Animal Science*, *50*(3), 355–360. CAB Abstracts.

Keywords: Amphibia; Animal Surgery and Non-drug Therapy; Anura; Laboratory Animal Science; Pipidae; veterinary pharmacology and anaesthesiology; *Xenopus laevis*

Fan, Y., Yue, X., Xue, F., Brauth, S. E., Tang, Y., & Fang, G. (2018). The right thalamus may play an important role in anesthesia-awakening regulation in frogs. *PeerJ*, 6, e4516.
<https://doi.org/10.7717/peerj.4516>

Keywords: Approximate entropy (ApEn); General anesthesia; Lateralization; Permutation entropy (PE); Thalamus; *Xenopus laevis*

Fiddes, M. (2013). Topical alfaxalone anaesthesia in African clawed frogs (*Xenopus laevis*) [Conference poster]. In *British Veterinary Zoological Society Proceedings of the Autumn Meeting 2013. Conservation, Education and Research, Luton and ZSL Whipsnade Zoo, UK, 9-10 November 2013* (F. Molenaar, M. Stidworthy, & V. Roberts, Eds.; p. 44). Romford, UK: British Veterinary Zoological Society; CAB Abstracts.
<http://search.ebscohost.com/login.aspx?direct=true&db=lah&AN=20153057640&site=ehost-live>

Keywords: animals; Chordata; eukaryotes; vertebrates; anesthesia; anesthetics; drug action; mechanism of drug action; *Xenopus laevis*; Amphibia; *Xenopus*; LL882; Veterinary Pharmacology and Anaesthesiology; Aquaculture (Animals); MM120; alfaxalone; Anura; frogs; Pipidae

Goulet, F., Helie, P., & Vachon, P. (2010). Eugenol Anesthesia in African Clawed Frogs (*Xenopus laevis*) of Different Body Weights. *Journal of the American Association for Laboratory Animal Science*, 49(4), 460–463.

Keywords: Prospective Studies; Time Factors; *Body Weight; *Xenopus laevis*; Amphibia; *Xenopus*; LL882; Veterinary Pharmacology and Anaesthesiology; Animal Physiology and Biochemistry (Excluding Nutrition); LL600; Animal Surgery and Non-drug Therapy; LL884; Anura; Anesthesia/methods/*veterinary; Reflex/drug effects.

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<https://doi.org/10.1177/0192623311399785>

Keywords: Dose-Response Relationship, Drug; Drug Administration Routes; Drug Evaluation, Preclinical; Toxicity Tests/methods; **Xenopus laevis*; Half-Life; Apoptosis/drug effects; Anesthetics/*toxicity; Eugenol/*toxicity; Kidney Tubules/drug effects/*pathology

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Keywords: Review; xylazine; medical research; Animal Welfare; veterinary medicine; drug effect; buprenorphine; postoperative pain; Pain; postoperative analgesia; analgesic agent; Analgesia; fentanyl; morphine; butorphanol; dexmedetomidine; animal use; *Xenopus laevis*; animal care; drug safety; experimental animal welfare; lethality; codeine; pethidine; animal wellbeing.

Guénette, S. A., Beaudry, F., & Vachon, P. (2008). Anesthetic properties of propofol in African clawed frogs (*Xenopus laevis*). *Journal of the American Association for Laboratory Animal Science : JAALAS*, 47(5), 35–38.

Keywords: Time Factors; Dose-Response Relationship, Drug; Area Under Curve; Pharmacology; Amphibia; **Xenopus laevis*; Half-Life; Anesthesia, General/veterinary; *Xenopus*; LL882; Veterinary Pharmacology and Anaesthesiology; Animal Physiology and Biochemistry (Excluding Nutrition); LL600; VV730; Anura; frogs; Anesthetics/pharmacokinetics/*pharmacology; Propofol/pharmacokinetics/*pharmacology; Pipidae

Guénette, S. A., Giroux, M.-C., & Vachon, P. (2013). Pain perception and anaesthesia in research frogs. *Experimental Animals*, 62(2), 87–92. Scopus.
<https://doi.org/10.1538/expanim.62.87>

Keywords: Surgical technique; review; ketamine; egg; Animalia; research; nociception; pain; isoflurane; Animals, Laboratory; experimental animal; anesthesia; propofol; perception; Anesthetics; *Animals, Laboratory; Mammalia; Anesthesia; pentobarbital; drug megadose; tricaine; Eugenol; barbituric acid derivative; Amphibia; benzocaine; *Xenopus laevis*/*physiology; oxygenation; anesthesia level; hormonal regulation; methoxyflurane; Frogs; Anura; MS-222; *Anesthesia; Aminobenzoates; *Anesthetics/administration & dosage; Pain Perception/*physiology; Benzocaine; halothane; Pain Perception; pain receptor; tiletamine; tiletamine plus zolazepam

Guénette, S. A., Hélie, P., Beaudry, F., & Vachon, P. (2007). Eugenol for anesthesia of African clawed frogs (*Xenopus laevis*). *Veterinary Anaesthesia and Analgesia*, 34(3), 164–170. Scopus.
<https://doi.org/10.1111/j.1467-2995.2006.00316.x>

Keywords: Time Factors; Surgery; Random Allocation; Dose-Response Relationship, Drug; Animalia; Administration, Topical; Heart Rate/drug effects; Drug Administration Routes; Area Under Curve; Injections, Subcutaneous/veterinary; Anesthesia; Eugenol; Amphibia; *Xenopus laevis*/*physiology; Half-Life; Respiration/drug effects; *Xenopus*; LL882; Veterinary Pharmacology and Anaesthesiology; Frogs; Aquaculture (Animals); MM120; Animal Surgery and Non-drug Therapy; LL884; Anura; frogs; Anesthesia/methods/*veterinary; Anesthetics/*administration & dosage/pharmacokinetics; Eugenol/*administration & dosage/pharmacokinetics; Skin/drug effects/*metabolism; Pipidae

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Keywords: Heart Rate/drug effects; Respiratory Rate/drug effects; Laboratory Animal Science; Amphibia; *Xenopus laevis*/*physiology; Anesthetics/*administration & dosage; Immersion; *Xenopus*; LL882; Veterinary Pharmacology and Anaesthesiology; LL040; Oxygen/blood; Anura; frogs; Anesthesia/methods/*veterinary; Aminobenzoates/*administration & dosage/pharmacokinetics; Pain Measurement/veterinary; Reflex/drug effects; Pipidae

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Keywords: Animal Welfare; Analgesics; Anesthesia/*veterinary; Anesthesia/methods; Pain Management; Amphibia; **Xenopus laevis*; Benzocaine/*pharmacology; *Xenopus*; LL810; LL882; Veterinary Pharmacology and Anaesthesiology; Anesthetics/administration & dosage/pharmacology; Anura; Aminobenzoates/*pharmacology; Anesthesia/methods/*veterinary; Aminobenzoates/administration & dosage/*pharmacology; Benzocaine/administration & dosage/*pharmacology; Clonixin/administration & dosage/*analogs & derivatives/pharmacology; Etomidate/administration & dosage/*pharmacology; Anesthetics/pharmacology; Aminobenzoates/administration & dosage; Anesthetics/administration & dosage; Benzocaine/administration & dosage; Clonixin/*analogs & derivatives; Clonixin/administration & dosage; Clonixin/pharmacology; Etomidate/*pharmacology; Etomidate/administration & dosage; Pipidae

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Keywords: animals; Chordata; eukaryotes; vertebrates; angiosperms; plants; Spermatophyta; *Xenopus laevis*; Amphibia; eudicots; Myrtaceae; Myrtales; *Xenopus*; HH400; Pesticides and Drugs (General); Aquatic Biology and Ecology; MM300; *Syzygium*; *Syzygium aromaticum*; Reproduction, Development and Life Cycle (Wild Animals); YY200; Anura; frogs; Toxicology and Poisoning (Wild Animals); YY900

Iguanas

25 citations



Two green iguanas (*Iguana iguana*)

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Keywords: Animal experiment; article; controlled study; clinical trial; Dose-Response Relationship, Drug; dose response; Isoflurane; anesthesia induction; isoflurane; sevoflurane; butorphanol; lizard; morbidity; drug distribution; Latin square design; ether derivative; Anesthetics, Inhalation; inhalation anesthetic agent; artificial ventilation; drug derivative; endotracheal intubation; electrostimulation; Reptilia; Iguana; desflurane; Iguanas; Methyl Ethers; Iguana; *Iguana iguana*; drug uptake; minimum lung alveolus concentration; atmospheric pressure

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Keywords: Alfaxalone; Anaesthesia; Reptile; Reptilia; Iguana; Iguana

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Keywords: Article; nonhuman; controlled study; Isoflurane; anesthesia induction; isoflurane; sevoflurane; lizard; area under the curve; drug elimination; Latin square design; Anesthesia, Inhalation; Anesthetics, Inhalation; inhalation anesthetic agent; Half-Life; drug solubility; compartment model; anesthetic recovery; blood gas; desflurane; Iguanas; Methyl Ethers; *Iguana iguana*; drug uptake; minimum lung alveolus concentration

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Keywords: Prospective Studies; Single-Blind Method; animal experiment; article; controlled study; sodium chloride; drug effect; Hot Temperature; Injections, Intramuscular; quantitative analysis; analgesia; Pain Measurement; observational study; analgesic activity; Analgesics, Opioid; butorphanol tartrate; skin temperature; Reptilia; Iguana; Butorphanol; thermal stimulation; Iguanas; *Iguana iguana*; Nociceptive Pain; single blind procedure; temperature sense; visual field

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Keywords: Isoflurane; Anesthesia; Squamata; Sevoflurane; Butorphanol; Iguana iguana

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Keywords: Pesticides and Drugs; Control; anesthesia; anesthetics; clinical picture; communicable diseases; rehydration therapy; LL860; LL882; Non-Communicable Diseases and Injuries of Animals; Veterinary Pharmacology and Anaesthesiology; LL070; Pets and Companion Animals; HH300; HH405; Diagnosis of Animal Diseases; LL886; LL822; causal agents; etiology; Animal Surgery and Non-drug Therapy; LL884; reptiles; lizards; *Iguana*; *Iguanidae*; *Iguana iguana*; Sauria; kidney disorders; nephropathy; renal diseases

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<https://doi.org/10.1023/B:VERC.0000045444.84631.36>

Keywords: Article; veterinary medicine; monitoring; Isoflurane; anesthesia induction; isoflurane; oxygen; lizard; Anesthesia; Anaesthesia; Anesthetics, Dissociative; Heart Rate; endotracheal intubation; anesthetic recovery; Reptiles; Reptilia; Squamata; *Iguana*; *Iguanidae*; *Iguana iguana*; anesthesiological techniques; GABA Modulators;

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Keywords: Animal experiment; article; nonhuman; controlled study; isoflurane; lizard; inhalation anesthesia; butorphanol tartrate; lung ventilation; Squamata; *Iguana*; *Iguana iguana*; anesthesia mechanism; minimum lung alveolus concentration; Mycobacterium avium complex (MAC)

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Keywords: Animal experiment; article; controlled study; isoflurane; lizard; drug safety; inhalation anesthesia; butorphanol tartrate; Squamata; *Iguana iguana*; minimum lung alveolus concentration; anesthesia complication; Mycobacterium avium complex (MAC); heart arrest

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Keywords: Cross-Over Studies; Prospective Studies; animal experiment; article; controlled study; male; animal; blood pressure; Blood Pressure; femoral artery; physiology; female; prospective study; correlation analysis; sodium chloride; metabolism; crossover procedure; randomized controlled trial; clinical trial; heart rate; animal disease; blood sampling

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Keywords: Computer assisted tomography; physiology; procedures; vascularization; clinical trial; anatomy and histology; Tomography, X-Ray Computed; liver; veterinary; Liver; echography; Ultrasonography; Anesthesia, General; general anesthesia; Contrast Media; contrast medium; Iguanas; Iguanidae

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Keywords: Analgesia; Opioids; Reptiles; Reptilia; Squamata; Iguana; *Iguana iguana*; Induction time

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Keywords: Analgesia; Ketoprofen; Pharmacokinetics; Mammalia; NSAID; Reptile; Reptilia; Squamata; Iguana iguana; Green iguana (*Iguana iguana*)

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Keywords: Anesthesia; Iguana iguana; reptiles

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Keywords: Anesthesia; *Iguana iguana*; reptiles; Tiletamine; Zolazepam

Lizards (multi-species)

16 citations



Tegu lizard (*Salvator merianae*)

Barrillot, B., Roux, J., Arthaud, S., Averty, L., Clair, A., Herrel, A., & Libourel, P.-A. (2018). Intramuscular administration of ketamine-medetomidine assures stable anaesthesia needed for long-term surgery in the Argentine tegu *Salvator merianae*. *Journal of Zoo and Wildlife Medicine : Official Publication of the American Association of Zoo Veterinarians*, 49(2), 291–296. <https://doi.org/10.1638/2017-0089.1>

Keywords: Ketamine; Dose-Response Relationship, Drug; Anesthesia/*veterinary; medetomidine; Drug Combinations; Anesthesia; Injections, Intramuscular/veterinary; Hypnotics and Sedatives/administration & dosage/*pharmacology; reptile; Lizards/*physiology; Anesthetics, Dissociative/administration & dosage/*pharmacology; Ketamine/administration & dosage/*pharmacology; Medetomidine/administration & dosage/*pharmacology; *Salvator merianae*

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Keywords: LL860; LL882; Non-Communicable Diseases and Injuries of Animals; Veterinary Pharmacology and Anaesthesiology; LL070; Pets and Companion Animals; Animal Surgery and Non-drug Therapy; LL884; reptiles; snakes; lizards; Sauria; Chamaeleo; *Chamaeleo calytratus*; Chamaeleonidae

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<http://search.ebscohost.com/login.aspx?direct=true&db=lah&AN=20143309911&site=ehost-live>

Keywords: Adverse reactions; anesthesia; anesthetics; drug action; mechanism of drug action; administration routes; pain killers; preanesthetic medication; Anesthesia; Sedation; inhaled anesthetics; Other Wildlife Diseases; YY800; LL882; Veterinary Pharmacology and Anaesthesiology; Diagnosis of Animal Diseases; LL886; Animal Surgery and Non-drug Therapy; LL884; Snakes; reptiles; snakes; lizards; Squamates; Taxonomy; Sauria; parenteral injection

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Keywords: Drug Therapy, Combination; analgesia; benzodiazepine; Injections, Intramuscular/veterinary; Analgesics/administration & dosage/*pharmacology; Dexmedetomidine/administration & dosage/*pharmacology; Midazolam/administration & dosage/*pharmacology; Hypnotics and Sedatives/administration & dosage/*pharmacology; reptiles; *Lizards; Deep Sedation/methods/veterinary; Immobilization/methods/*veterinary; lizards; Pain Management/methods/*veterinary; $\alpha(2)$ -adrenergic agonist

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<https://doi.org/10.5818/17-11-132.1>

Keywords: Techniques and Methodology; ZZ900; LL882; Veterinary Pharmacology and Anaesthesiology; Animal Health and Hygiene (General); LL800; reptiles; lizards; Sauria

Bueno do Prado Guirro, E. C., da Cunha, O., Santos, A. P., Toffanetto, L., & Moreira, N. (2010). Multimodal anesthesia in tegu lizard *Tupinambis merianae*: Case report. *Ciencia Animal Brasileira*, 11(2), 458–460.

Keywords: Anesthesia; case report; Lizards; Reptiles; Tegu lizards; *Tupinambis merianae*

Doss, G. A., Fink, D. M., Sladky, K. K., & Mans, C. (2017). Comparison of subcutaneous dexmedetomidine-midazolam versus alfaxalone-midazolam sedation in leopard geckos (*Eublepharis macularius*). *Veterinary Anaesthesia and Analgesia*, 44(5), 1175–1183. <https://doi.org/10.1016/j.vaa.2017.03.007>

Keywords: Cross-Over Studies; Drug Therapy, Combination; midazolam; sedation; dexmedetomidine; Injections, Subcutaneous/veterinary; alfaxalone; Hypnotics and Sedatives/*administration & dosage; *Lizards; *Dexmedetomidine/administration & dosage; *Midazolam/administration & dosage; *Pregnanediones/administration & dosage

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Keywords: Fracture; Internal fixation; Article; male; fracture external fixation; femur fracture; open fracture; postoperative pain; meloxicam; postoperative analgesia; lizard; cefotaxime; Prolapse; callus; fracture healing; osteosynthesis; radius fracture; ulna fracture; *Varanus bengalensis*

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Keywords: Cross-Over Studies; Random Allocation; Drug Combinations; Dexmedetomidine/administration & dosage/*pharmacology; Hypnotics and Sedatives/administration & dosage/*pharmacology; *Lizards; Anesthetics, Dissociative/administration & dosage/*pharmacology; Ketamine/administration & dosage/*pharmacology

Kleinschmidt, L. M., Hanley, C. S., Sahrman, J. M., & Padilla, L. R. (2018). Randomized controlled trial comparing the effects of alfaxalone and ketamine hydrochloride in the Haitian giant galliwasp (*Celestus warreni*). *Journal of Zoo and Wildlife Medicine : Official Publication of the American Association of Zoo Veterinarians*, 49(2), 283–290. <https://doi.org/10.1638/2017-0164.1>

Keywords: Random Allocation; anesthesia; Alfaxalone; Pregnanediones/administration & dosage/*pharmacology; Lizards/*physiology; Anesthetics/administration & dosage/*pharmacology; Ketamine/administration & dosage/*pharmacology; *Celestus warreni*; Haiti; Haitian giant galliwasp; ketamine hydrochloride

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Keywords: Anesthesia; anesthetics; drug action; mechanism of drug action; inhaled anesthetics; LL882; Veterinary Pharmacology and Anaesthesiology; LL070; Pets and Companion Animals; alfaxalone; reptiles; lizards; *Pogona vitticeps*; Sauria; Agamidae; *Pogona*; *Physignathus cocincinus*; *Pogona henrylawsoni*

Leal, W. P., Carregaro, A. B., Bressan, T. F., Bisetto, S. P., Melo, C. F., & Sladky, K. K. (2017). Antinociceptive efficacy of intramuscular administration of morphine sulfate and butorphanol tartrate in tegus (*Salvator merianae*). *American Journal of Veterinary Research*, 78(9), 1019–1024. <https://doi.org/10.2460/ajvr.78.9.1019>

Keywords: Cross-Over Studies; *Lizards; Analgesics, Opioid/administration & dosage/*therapeutic use; Analgesics/*therapeutic use; Butorphanol/administration & dosage/*therapeutic use; Morphine/*therapeutic use

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Keywords: Article; medical education; temperature; animal behavior; animal housing; blood sampling; feces analysis; veterinary medicine; animal food; diet supplementation; Animalia; species difference; animal husbandry; humidity; anesthesia induction; sedation; lizard; animal care; vein puncture; catheterization; illumination; species differentiation; eating habit; health care quality; species diversity; consultation; nursing; Squamata; radiodiagnosis

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Keywords: Animal experiment; animal model; nonhuman; surgical technique; Article; controlled study; postoperative care; ketamine; physiology; female; procedures; Random Allocation; drug effect; randomization; analgesia; meloxicam; anesthesia induction; anesthesia; sedation; Injections, Subcutaneous; *Anolis*; dexmedetomidine; lizard; tribromoethanol; Anesthetics; injection site; subcutaneous drug administration; Pain Management; anesthetic agent; adverse event; general anesthesia; combination drug therapy; bromethol; respiration depression; Lizards; Anesthetics/*administration & dosage; hydromorphone; conscious sedation; Conscious Sedation; anesthetic recovery; polymyxin B; neomycin; anesthesia level; LL882; Veterinary Pharmacology and Anaesthesiology; alfaxalone; reptiles; *Injections, Subcutaneous; Conscious Sedation/*methods; Lizards/*physiology; Pain Management/*methods; alfaxan; *Anolis sagrei*; bacitracin zinc; coeliotomy; Sauria; Injections, Subcutaneous*; Dactyloidae

Trnkova, S., Knotkova, Z., & Knotek, Z. (2007). Light anaesthesia in terrapins and lizards. In *British Veterinary Zoological Society Proceedings of the November Meeting 2007. The University of Nottingham School of Veterinary Medicine and Science, Nottingham, UK, 10th-11th November, 2007. Recent advances in comparative medicine* (V. Roberts, Ed.; pp. 28–29). Romford: UK: British Veterinary Zoological Society; CAB Abstracts.
<http://search.ebscohost.com/login.aspx?direct=true&db=lah&AN=20093041814&site=ehost-live>

Keywords: Testudines; LL882; Veterinary Pharmacology and Anaesthesiology; LL070; Pets and Companion Animals; reptiles; lizards; Sauria; turtles

Salamanders and Newts

11 citations



Axolotl or Mexican salamander (*Ambystoma mexicanum*)

Burns, P. M., Langlois, I., & Dunn, M. (2019). Endoscopic removal of a foreign body in a Mexican axolotl (*Ambystoma mexicanum*) with the use of ms222-induced immobilization. *Journal of Zoo and Wildlife Medicine : Official Publication of the American Association of Zoo Veterinarians*, 50(1), 282–286. <https://doi.org/10.1638/2012-0118>

Keywords: Treatment Outcome; Anesthesia, General/*veterinary; Anesthetics/*administration & dosage; Immersion; Immobilization/veterinary; **Ambystoma mexicanum*; *axolotl; *immersion anesthesia; *MS222; *tricaine methanesulfonate; *Ambystoma mexicanum*/*injuries/surgery; Aminobenzoates/*administration & dosage; Endoscopy/*veterinary; Foreign Bodies/surgery/*veterinary

Cermakova, E., Oliveri, M., Ceplecha, V., & Knotek, Z. (2020). Anesthesia with intramuscular administration of alfaxalone in Spanish ribbed newt (*Pleurodeles waltl*). *Journal of Exotic Pet Medicine*, 33, 23–26. Scopus. <https://doi.org/10.1053/j.jepm.2020.01.003>

Keywords: Immobilization; article; controlled study; clinical article; heart rate; intramuscular drug administration; muscle; anesthesia; sedation; Alfaxalone; methods; Anesthesia; righting reflex; Monitoring; Amphibia; Pleurodeles; forelimb; Intramuscular; anesthesia level; Biological Resources (Animal); PP710; LL882; Veterinary Pharmacology and Anaesthesiology; Physiology and Biochemistry (Wild Animals); YY400; threatened species; alfaxalone; Amphibian; Caudata; *Pleurodeles waltl*; Salamandridae

Crook, A. C., & Whiteman, H. H. (2006). An evaluation of MS-222 and benzocaine as anesthetics for metamorphic and paedomorphic tiger salamanders (*Ambystoma tigrinum nebulosum*). *American Midland Naturalist*, 155(2), 417–421. [https://doi.org/10.1674/0003-0031\(2006\)155\[417:aeomab\]2.0.co;2](https://doi.org/10.1674/0003-0031(2006)155[417:aeomab]2.0.co;2)

Keywords: *Ambystoma tigrinum nebulosum*; Amphibians; Anesthetics; Benzocaine; Tricaine methanesulfonate (MS-222); Tiger salamanders

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Keywords: Amphibians; Axolotl; Limb regeneration; Methods and protocols; salamanders

Kinkead, K. E., Lanham, J. D., & Montanucci, M. R. (2006). Comparison of anesthesia and marking techniques on stress and behavioral responses in two *Desmognathus* salamanders. *Journal of Herpetology*, 40(3), 323–328. [https://doi.org/10.1670/0022-1511\(2006\)40\[323:coaamt\]2.0.co;2](https://doi.org/10.1670/0022-1511(2006)40[323:coaamt]2.0.co;2)

Keywords: Amphibians; anesthesia; animal behavior; animal identification; *Desmognathus* salamanders; Stress responses

Koeller, C. A. (2009). Comparison of Buprenorphine and Butorphanol Analgesia in the Eastern Red-Spotted Newt (*Notophthalmus viridescens*). *Journal of the American Association for Laboratory Animal Science*, 48(2), 171–175.

Keywords: Amphibians; analgesia; Buprenorphine; Butorphanol; Eastern red-spotted newt; *Notophthalmus viridescens*

Llaniguez, J. T., Szczepaniak, M. A., Rickman, B. H., Gelovani, J. G., Hish, G. A., & Cotroneo, T. M. (2020). Quantitative and Qualitative Behavioral Measurements to Assess Pain in Axolotls (*Ambystoma mexicanum*). *Journal of the American Association for Laboratory Animal Science : JAALAS*, 59(2), 186–196. <https://doi.org/10.30802/AALAS-JAALAS-19-000063>

Keywords: Animals; Behavior, Animal; Laboratory Animal Science; Pain Measurement/methods/*veterinary; Pain/prevention & control/*veterinary; **Ambystoma mexicanum*; Analgesia/*methods; Analgesics/administration & dosage/*pharmacology; Buprenorphine/administration & dosage/pharmacology; Butorphanol/administration & dosage/pharmacology; Pain Management/*veterinary

Lowe, J. (2004). Rates of tricaine methanesulfonate (MS-222) anesthetization in relation to pH and concentration in five terrestrial salamanders. *Herpetological Review*, 35(4), 352–354.

Keywords: Amphibians; anesthesia; salamanders; Tricaine methanesulfonate (MS-222)

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Keywords: Amphibians; Anesthesia; salamanders

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Keywords: *Ambystoma tigrinum*; amphibians; anesthesia; Clove oil; Propofol; Tiger salamanders

Peterman, W. E., & Semlitsch, R. D. (2006). Effects of tricaine methanesulfonate (MS-222) concentration on anesthetization and recovery in four plethodontid salamanders. *Herpetological Review*, 37(3 N1-Peterman, William/H-7809-2013 Semlitsch, Raymond/0000-0002-7999–5762; Peterman, William/0000-0001-5229-9268 12), 303–304.

Keywords: Amphibians; anesthesia; salamanders; Tricaine methanesulfonate (MS-222)

Snakes

36 citations



Female ball python (*Python regius*) with firefly morph markings

Bel, L., Mihalca, A., Peştean, C., Ober, C., & Oana, L. (2015). Surgical management of dystocia in snakes and lizards. *Bulletin of University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca. Veterinary Medicine*, 72(1), 205–206. CAB Abstracts.

Keywords: LL860; LL882; Non-Communicable Diseases and Injuries of Animals; Veterinary Pharmacology and Anaesthesiology; LL070; Pets and Companion Animals; Animal Surgery and Non-drug Therapy; LL884; reptiles; snakes; lizards; Sauria; *Chamaeleo*; *Chamaeleo calytratus*; Chamaeleonidae

Bertelsen, M. F. (2007). Squamates (snakes and lizards). In G. West, D. Heard, & N. Caulkett (Eds.), *Zoo animal and wildlife immobilization and anesthesia* (pp. 233–243). Blackwell Publishing; CAB Abstracts.

<http://search.ebscohost.com/login.aspx?direct=true&db=lah&AN=20143309911&site=ehost-live>

Keywords: Adverse reactions; anesthesia; anesthetics; drug action; mechanism of drug action; administration routes; pain killers; preanesthetic medication; Anesthesia; Sedation; inhaled anesthetics; Other Wildlife Diseases; YY800; LL882; Veterinary Pharmacology and Anaesthesiology; Diagnosis of Animal Diseases; LL886; Animal Surgery and Non-drug Therapy; LL884; Snakes; reptiles; snakes; lizards; Squamates; Taxonomy; Sauria; parenteral injection

Bertelsen, M. F. (2014). Squamates (Snakes and Lizards). In *Zoo animal and wildlife immobilization and anesthesia: Second Ed.* (pp. 351–363). Wiley Blackwell; Scopus. <https://doi.org/10.1002/9781118792919.ch21>

Keywords: Anesthesia; Lizards; Endotracheal intubation; Snakes; Inhalant anesthetics; Vascular access site

Bertelsen, M. F., Buchanan, R., Jensen, H. M., Leite, C., Abe, A., Nielsen, S. S., & Wang, T. (2012). Ventilating anaesthetised snakes—How much is enough? In *Proceedings of the International Conference on Diseases of Zoo and Wild Animals 2012, May 16th - 19th, 2012, Bussolengo/Italy.* (p. 126). <://ZOOREC:ZOOR14812077820>

Keywords: Anesthesia; reptiles; snakes; ventilation

Bunke, L. G., Sladky, K. K., & Johnson, S. M. (2018). Antinociceptive efficacy and respiratory effects of dexmedetomidine in ball pythons (*Python regius*). *American Journal of Veterinary Research*, 79(7), 718–726. <https://doi.org/10.2460/ajvr.79.7.718>

Keywords: Time Factors; Temperature; Drug Administration Schedule; Behavior, Animal/*drug effects; Analgesics, Non-Narcotic/*pharmacology; Respiration/*drug effects; *Boidae; Dexmedetomidine/*pharmacology

Chen, K., Keating, S., Strahl-Heldreth, D., & Clark-Price, S. (2020). Effects of intracoelomic alfaxalone-dexmedetomidine on righting reflex in common garter snakes (*Thamnophis sirtalis*): Preliminary data. *Veterinary Anaesthesia and Analgesia*, 47(6), 793–796. MEDLINE. <https://doi.org/10.1016/j.vaa.2020.08.002>

Keywords: Pilot Projects; immobilization; animal experiment; Article; crossover procedure; pilot study; drug efficacy; heart rate; veterinary medicine; drug effect; chemotherapy; adverse reactions; analgesia; anesthesia; Heart Rate/drug effects; anesthetics; drug action; mechanism of drug action; clinical picture; dexmedetomidine; Drug Interactions; mean arterial pressure; Immobilization; anesthetic agent; Reflex, Righting; righting reflex; Heart Rate; Dexmedetomidine; drug administration route; drug interaction; LL882; Veterinary Pharmacology and Anaesthesiology; LL070; Pets and Companion Animals; Immobilization/veterinary; *Colubridae; alfaxalone; Anesthetics, Combined/*pharmacology; Dexmedetomidine/*pharmacology;

Pregnanediones/*pharmacology; Reflex, Righting/*drug effects; snake; Pregnanediones; reptiles; snakes; Anesthetics, Combined; Colubridae; Doppler flowmetry; intracoelomic injection; loss of righting reflex; pregnanedione; return of righting reflex; *Thamnophis sirtalis*; Colubridae*; Thamnophis

Chinnadurai, S. K., Wrenn, A., & Devoe, R. S. (2009). Evaluation of noninvasive oscillometric blood pressure monitoring in anesthetized boid snakes. *Journal of the American Veterinary Medical Association*, 234(5), 625–630. Scopus. <https://doi.org/10.2460/javma.234.5.625>

Keywords: Article; standard; physiology; reproducibility; Reproducibility of Results; methodology; animal disease; Animalia; instrumentation; Isoflurane; sensitivity and specificity; isoflurane; anesthesia; hypotension; chemically induced disorder; Sensitivity and Specificity; Anesthesia; blood pressure monitoring; snake; Boa constrictor; Blood Pressure Monitoring, Ambulatory; Blood Pressure Monitors; Boidae; diastole; Diastole; Hypotension; monitor; oscillometry; Oscillometry; *Python reticulatus*; Pythonidae; Serpentes; systole; Systole

Cushing, A. C., Smith, C. K., Ramsay, E. C., Nelson, S., & Giori, L. (2020). Transcutaneous oxygen monitoring in Louisiana pine snakes (*Pituophis ruthveni*). *Journal of Zoo and Wildlife Medicine*, 50(4), 874–878. Zoological Record.

Keywords: LL882; Veterinary Pharmacology and Anaesthesiology; LL070; Pets and Companion Animals; reptiles; snakes; Colubridae; Pituophis; *Pituophis ruthveni*

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Keywords: Animal experiment; Article; controlled study; heart rate; locomotion; anesthesia; midazolam; respiratory function; latent period; immobilization stress; breathing rate; drug dose comparison; anesthetic recovery; body position; Reptiles; Snakes; comparative effectiveness; snake; Benzodiazepine; *Boa constrictor*; cardiovascular effect; mesothelium; muscle tone; Pharmacological restraint; tranquilizing activity

Gillett, A. K., Flint, M., & Mills, P. C. (2014). An antemortem guide for the assessment of stranded Australian sea snakes (Hydrophiinae). *Journal of Zoo and Wildlife Medicine*, 45(4), 755–765. Scopus. <https://doi.org/10.1638/2013-0265.1>

Keywords: Injury; pathology; animal; physiology; animal behavior; Behavior, Animal; blood; veterinary; body composition; Body Composition; motor activity; Motor Activity; anesthesia; examination; Disease; Anesthesia; exercise; Restraint, Physical; Animal Diseases; Snakes; snake; Hydrophiinae; sea snake; stranded.

Grego, K. F., Fowler, M. E., & Cubas, Z. S. (2001). Class Reptilia, order Squamata (Ophidia): Snakes. Ophidia—Restraint, anesthesia, medicine. In *Biology, medicine, and surgery of South American wild animals*. (pp. 43-48):[://ZOOREC:ZOOR13800006673](https://doi.org/10.1016/j.cbpa.2017.02.012)

Keywords: Anesthesia; Ophidia; reptiles; restraint; snakes; Squamata.

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[://ZOOREC:ZOOR14509060144](https://doi.org/10.1016/j.cbpa.2017.02.012)

Keywords: Anesthesia; snakes; surgery.

Jakobsen, S. L., Williams, C. J. A., Wang, T., & Bertelsen, M. F. (2017). The influence of mechanical ventilation on physiological parameters in ball pythons (*Python regius*). *Comparative Biochemistry and Physiology. Part A, Molecular & Integrative Physiology*, 207, 30–35. <https://doi.org/10.1016/j.cbpa.2017.02.012>

Keywords: Respiration; Oxygen/metabolism; *Ventilation; Blood Gas Analysis; Heart Rate/physiology; *Reptile; Boidae/*physiology; *Anesthesia; *Acid-base balance; *Isoflurane; *Python regius; *Respiration, Artificial; Anesthesia/*methods

James, L. E., Williams, C. J. A., Bertelsen, M. F., & Wang, T. (2017). Evaluation of feeding behavior as an indicator of pain in snakes. *Journal of Zoo and Wildlife Medicine*, 48(1), 196–199. <https://doi.org/10.1638/2016-0064.1>

Keywords: Behavior; feeding; nociception; pain; rodents; Pain Measurement; Feeding Behavior/*physiology; Pain/diagnosis/*veterinary; LL882; Veterinary Pharmacology and Anaesthesiology; LL070; Pets and Companion Animals; Animal Behaviour; LL300; Animal Nutrition (General); LL500; *Boidae; reptiles; snakes; reptile; Ball python (*Python regius*); Capsaicin/toxicity; Pythonidae; Python regius; Python

James, L. E., Williams, C. J., Bertelsen, M. F., & Wang, T. (2018). Anaesthetic induction with alfaxalone in the ball python (*Python regius*): Dose response and effect of injection site. *Veterinary Anaesthesia and Analgesia*, 45(3), 329–337.
<https://doi.org/10.1016/j.vaa.2017.12.003>

Keywords: Dose-Response Relationship, Drug; injection site; Injections, Intramuscular/veterinary; *Boidae; alfaxalone; snake; reptile; Anesthesia/methods/*veterinary; Anesthetics/*administration & dosage/pharmacology; Pregnanediones/*administration & dosage/pharmacology; gamma-aminobutyric acid-(A) agonist; injectable anaesthesia

Jekl, V., & Knotek, Z. (2006). Endoscopic examination of snakes by access through an air sac. *Veterinary Record*, 158(12), 407–410. Scopus. <https://doi.org/10.1136/vr.158.12.407>

Keywords: Immobilization; animal experiment; animal tissue; article; controlled study; ketamine; liver; Animalia; species difference; spleen; gastrointestinal disease; isoflurane; colon; anesthesia; medetomidine; oxygen; trachea; respiratory function; pneumonia; clinical feature; stomach; lung disease; assisted ventilation; snake; bronchoscopy; Boa constrictor; Pythonidae; Serpentes; air sac; drug dose regimen; gallbladder; gastrointestinal endoscopy; pancreas; *Phyton molurus bivittatus*; *Phyton regius*; *Python molurus*; *Python molurus bivittatus*; *Python regius*; stomatitis; tracheitis; zoletil

Kalita, D., Pachoni, A. K., Ali, S., Deori, P., & Kakati, P. (2015). Isoflurane anaesthesia in Wolf snake (*Lycodon aulicus*). *Indian Veterinary Journal*, 92(10), 68–70. Scopus.

Keywords: Isoflurane; Anaesthesia; Fracture immobilization; Wolf snake

Karklus, A. A., Sladky, K. K., & Johnson, S. M. (2021). Respiratory and antinociceptive effects of dexmedetomidine and doxapram in ball pythons (*Python regius*). *American Journal of Veterinary Research*, 82(1), 11–21. <https://doi.org/10.2460/ajvr.82.1.11>

Keywords: Respiration; *Boidae; *Dexmedetomidine/pharmacology; Analgesics/pharmacology; Doxapram/pharmacology

Kharbush, R. J., Gutwillig, A., Hartzler, K. E., Kimyon, R. S., Gardner, A. N., Abbott, A. D., Cox, S. K., Watters, J. J., Sladky, K. K., & Johnson, S. M. (2017). Antinociceptive and respiratory effects following application of transdermal fentanyl patches and assessment of brain μ -opioid receptor mRNA expression in ball pythons. *American Journal of Veterinary Research*, 78(7), 785–795. <https://doi.org/10.2460/ajvr.78.7.785>

Keywords: Administration, Cutaneous; RNA, Messenger/metabolism; Respiration/drug effects; Analgesics, Opioid/*pharmacology; Turtles; *Boidae; Brain/*drug effects/metabolism; Fentanyl/blood/*pharmacology; Receptors, Opioid, mu/genetics/metabolism

Larouche, C. B., Beaufrère, H., Mosley, C., Nemeth, N. M., & Dutton, C. (2019). Evaluation of the effects of midazolam and flumazenil in the ball python (*Python regius*). *Journal of Zoo and Wildlife Medicine : Official Publication of the American Association of Zoo Veterinarians*, 50(3), 579–588. <https://doi.org/10.1638/2019-0024>

Keywords: Cross-Over Studies; pharmacodynamics; sedation; *Boidae; Midazolam/administration & dosage/*pharmacology; Flumazenil/administration & dosage/*pharmacology; GABA Modulators/administration & dosage/*pharmacology;

Hypnotics and Sedatives/administration & dosage/*pharmacology; Muscle relaxation; paradoxical excitation; reptiles; snakes

Larouche, C. B., Johnson, R., Beaudry, F., Mosley, C., Gu, Y., Zaman, K. A., Beaufrère, H., & Dutton, C. (2019). Pharmacokinetics of midazolam and its major metabolite 1-hydroxymidazolam in the ball python (*Python regius*) after intracardiac and intramuscular administrations. *Journal of Veterinary Pharmacology and Therapeutics*, 42(6), 722–731.
<https://doi.org/10.1111/jvp.12806>

Keywords: Injections, Intramuscular; midazolam; Area Under Curve; pharmacokinetics; benzodiazepine; Hypnotics and Sedatives; Half-Life; ball python; Boidae/*blood; Central Venous Catheters/veterinary; Midazolam/*analogs & derivatives/blood/metabolism/*pharmacokinetics; reptile; sedative

Larouche, C. B., Mosley, C., Beaufrère, H., & Dutton, C. (2019). Effects of midazolam and nitrous oxide on the minimum anesthetic concentration of isoflurane in the ball python (*Python regius*). *Veterinary Anaesthesia and Analgesia*, 46(6), 807–814.
<https://doi.org/10.1016/j.vaa.2019.08.002>

Keywords: Cross-Over Studies; Dose-Response Relationship, Drug; Drug Interactions; inhalation anesthesia; snake; reptile; sedative; Anesthetics, Inhalation/administration & dosage/*pharmacokinetics/pharmacology; blood gas; Boidae/*physiology; Hypnotics and Sedatives/administration & dosage/*pharmacokinetics/pharmacology; Isoflurane/administration & dosage/*pharmacokinetics/pharmacology; Midazolam/administration & dosage/*pharmacokinetics/pharmacology; minimum alveolar concentration; Nitrous Oxide/administration & dosage/*pharmacokinetics/pharmacology

Lopes, I. G., Armelin, V. A., Braga, V. H. da S., & Florindo, L. H. (2017). The influence of midazolam on heart rate arises from cardiac autonomic tones alterations in Burmese pythons, *Python molurus*. *Autonomic Neuroscience: Basic & Clinical*, 208, 103–112.
<https://doi.org/10.1016/j.autneu.2017.10.008>

Keywords: Electrocardiography; *Boidae/physiology; Atropine/pharmacology; *Autonomic nervous system; *Benzodiazepine; *Heart rate; *Midazolam; *Python molurus; Autonomic Nervous System/*drug effects/physiology; Bradycardia/chemically induced/physiopathology; Cardiovascular Agents/*pharmacology; GABA Modulators/pharmacology; Heart Rate/*drug effects/physiology; Heart/drug effects/physiology; Hypnotics and Sedatives/pharmacology; Midazolam/*pharmacology; Propranolol/pharmacology

Miller, L. J., Fetterer, D. P., Garza, N. L., Lackemeyer, M. G., Donnelly, G. C., Steffens, J. T., Van Tongeren, S. A., Fiallos, J. O., Moore, J. L., Marko, S. T., Lugo-Roman, L. A., Fedewa, G., DeRisi, J. L., Kuhn, J. H., & Stahl, S. J. (2018). A fixed moderate-dose combination of

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Keywords: Injections, Intramuscular; Heart Rate/drug effects; Drug Administration Schedule; Drug Combinations; Respiration/drug effects; *Boidae; Midazolam/administration & dosage/*pharmacology; Immobilization/methods/*veterinary; Anesthetics, Dissociative/administration & dosage/pharmacology; Tiletamine/administration & dosage/*pharmacology; Zolazepam/administration & dosage/*pharmacology

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Keywords: Article; animal behavior; animal housing; blood sampling; feces analysis; veterinary medicine; animal food; Animalia; species difference; animal husbandry; environmental temperature; humidity; anesthesia; obesity; animal care; dietary intake; illumination; urinalysis; blood cell count; feeding behavior; eating habit; gastrointestinal motility; anorexia; carnivore; snake; sex determination; Serpentes

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Keywords: Chemotherapy; nociception; analgesia; anesthetics; pain killers; pet animals; exotic organisms; exotic species; introduced organisms; non-indigenous organisms; non-indigenous species; non-native organisms; non-native species; nonindigenous organisms; nonindigenous species; LL860; LL882; Non-Communicable Diseases and Injuries of Animals; Veterinary Pharmacology and Anaesthesiology; LL070; Pets and Companion Animals; NSAIDS; reptiles; snakes; exotics; pain management

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Keywords: Chemotherapy; anesthesia; anesthetics; drug action; mechanism of drug action; pain killers; LL860; LL882; Non-Communicable Diseases and Injuries of Animals; Veterinary Pharmacology and Anaesthesiology; LL070; Pets and Companion Animals; reptiles; snakes

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Keywords: Anesthesia; Methohexital sodium; recovery time; snakes

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Keywords: Animal experiment; animal model; Article; controlled study; prospective study; randomized controlled trial; drug efficacy; heart rate; animals; veterinary medicine; monitoring; light dark cycle; analgesia; anesthesia; anesthetics; drug action; mechanism of drug action; pain killers; sedation; methods; drug screening; injection site; intubation; pets; tail; breathing rate; drug megadose; righting reflex; corn; physical examination; needlestick injury; standard deviation; cross-sectional study; freeze thawing; tongue; LL882; Veterinary Pharmacology and Anaesthesiology; LL070; Pets and Companion Animals; comparative effectiveness; alfaxalone; snake; reptiles; snakes; corn snake; escape behavior; mechanical stimulus test; *Pantherophis guttatus*; phase 2 clinical trial; tail length (animal); Colubridae; *Pantherophis*; respiratory rate

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Keywords: Article; controlled study; clinical article; animals; drug effect; anesthesia; Anesthetics; anesthetic agent; Reflex, Righting; righting reflex; stimulus response; tactile stimulation; LL882; Veterinary Pharmacology and Anaesthesiology; alfaxalone; snake; Pregnanediones; reptiles; snakes; Colubridae; pregnanedione; *Thamnophis sirtalis*; *Thamnophis*

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Keywords: Species Specificity; Phylogeny; Drug Resistance; Acetaminophen; Toxicity; Biotransformation; Mammalia; Toxicokinetics; *Phylogeny; Databases, Genetic; Acetaminophen/adverse effects/*metabolism/toxicity; Acetyltransferases/genetics/metabolism; Agkistrodon/genetics/physiology; Analgesics, Non-Narcotic/adverse effects/metabolism; Boidae/genetics/physiology; Colubridae/genetics/physiology; Crotalus/genetics/physiology; Environmental Pollutants/*metabolism/toxicity; Glucuronosyltransferase/genetics/metabolism; Glutathione Transferase/genetics/metabolism; Isoenzymes/genetics/metabolism; Liver/*enzymology; N-acetyltransferase; Reptilia; Reptilian Proteins/genetics/*metabolism; Snake; Snakes/genetics/*physiology; Sulfotransferases/genetics/metabolism; UDP-glucuronosyltransferase

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Keywords: Article; feces analysis; intestine mucosa; anesthesia; peritonitis; suturing method; recumbency; echography; radiography; anesthetic recovery; snake; aspiration cytology; colon intussusception; ileostomy; intestine surgery; mesentery; *Pituophis melanoleucus*; wound dehiscence

Yaw, T. J., Mans, C., Johnson, S., Bunke, L., Doss, G. A., & Sladky, K. K. (2020). Evaluation of subcutaneous administration of alfaxalone-midazolam and dexmedetomidine-midazolam for sedation of ball pythons (*Python regius*). *Journal of the American Veterinary Medical Association*, 256(5), 573–579. <https://doi.org/10.2460/javma.256.5.573>

Keywords: Cross-Over Studies; Prospective Studies; Random Allocation; Boidae/*physiology; Anesthesia/methods/*veterinary; Anesthetics/*administration & dosage/pharmacology; Injections, Subcutaneous/methods/veterinary; Pregnanediones/*administration & dosage/pharmacology

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Keywords: Cross-Over Studies; Dexmedetomidine; *Boidae/physiology; Conscious Sedation/methods/*veterinary; Hypnotics and Sedatives/*administration & dosage; Midazolam; Pregnanediones

Toads

13 citations



Cane or Giant marine toad (*Bufo marinus*)

Adami, C., d'Ovidio, D., & Casoni, D. (2016). Alfaxalone versus alfaxalone-dexmedetomidine anaesthesia by immersion in oriental fire-bellied toads (*Bombina orientalis*). *Veterinary Anaesthesia and Analgesia*, 43(3), 326–332. Scopus. <https://doi.org/10.1111/vaa.12290>

Keywords: Prospective Studies; Pilot Projects; controlled study; animal; procedures; prospective study; comparative study; pilot study; randomized controlled trial; veterinary; anesthesia; Alfaxalone; dexmedetomidine; anesthetic agent; Anesthesia; Anaesthesia; Dexmedetomidine; alfaxalone; Pregnanediones; Anura; Anesthetics, Combined; pregnanedione; Immersion technique; Toads

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Keywords: Cross-Over Studies; Prospective Studies; Pilot Projects; animal experiment; Article; controlled study; prospective study; comparative study; crossover procedure; pilot study; randomized controlled trial; heart rate; Random Allocation; drug effects; concentration response; randomization; experimental study; anesthesia induction; anesthesia; morphine; butorphanol; Alfaxalone; immersion; antinociception; breathing rate; anesthetic agent; Morphine; Heart Rate; alfaxalone; Pregnanediones; Anura; Anesthetics, Combined; pregnanedione; von Frey test; *Bombina orientalis*; Butorphanol; Immersion anaesthesia; myotatic reflex; Oriental fire-bellied toads

Adami, C., Spadavecchia, C., Angeli, G., & d'Ovidio, D. (2015). Alfaxalone anesthesia by immersion in oriental fire-bellied toads (*Bombina orientalis*). *Veterinary Anaesthesia and Analgesia*, 42(5), 547–551. Scopus. <https://doi.org/10.1111/vaa.12252>

Keywords: Prospective Studies; Treatment Outcome; Time Factors; treatment outcome; physiology; prospective study; time factor; veterinary; Animalia; anesthesia; Alfaxalone; immersion; Anesthetics; anesthetic agent; Anesthesia; Immersion; Nociception; alfaxalone; Pregnanediones; Anura; pregnanedione; *Bombina orientalis*; Immersion technique; Toads; *Bombina bombina*

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Keywords: Larva; Apoptosis; Fluoxetine; Development; Ibuprofen; Amphibians; **Bufo bufo*; *Water Pollutants, Chemical/toxicity; Fluoxetine/toxicity; Ibuprofen/toxicity; Tadpoles

Anderson, J. B., & Wang, T. (2002). Effects of anaesthesia on blood gases, acid-base status and ions in the toad *Bufo marinus*. *Comparative Biochemistry and Physiology A-Molecular and Integrative Physiology*, 131(3), 639–646. [https://doi.org/10.1016/s1095-6433\(01\)00498-6](https://doi.org/10.1016/s1095-6433(01)00498-6)

Keywords: Amphibians; anesthesia; *Bufo marinus*; Toad

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Keywords: Anesthetic recovery; animal experiment; animal tissue; apoptosis; article; autopsy; controlled study; epithelization; feces analysis; fibrosis; granulomatous inflammation; histology; histopathology; low level laser therapy; pilot study; punch biopsy; *Rhinella marina*; skin biopsy; sulfadiazine silver; tricaine; veterinary medicine; wound care; wound healing

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Keywords: Physiology; procedures; adverse effects; Dose-Response Relationship, Drug; dose response; nociception; anaesthesia; anesthesia; immersion; Anesthetics; anesthetic agent; Anesthesia; etomidate; Immersion; Anura; Etomidate; immersion technique; toads

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Keywords: Stress; Ketamine; Anaesthesia; *Syzygium aromaticum*; Anura; MS222; *Bufo marinus*; Cane toads; Clove-oil

Kilburn, J. J., Bronson, E., Shaw, G. C., Labelle, P., & Weigt, A. (2019). Phacoemulsification in an American toad (*Anaxyrus americanus*). *Journal of Herpetological Medicine and Surgery*, 29(1/2), 17–20. CAB Abstracts. <https://doi.org/10.5818/18-03-149.1>

Keywords: Anesthesia; Amphibia; LL860; LL882; Non-Communicable Diseases and Injuries of Animals; Veterinary Pharmacology and Anaesthesiology; Animal Health and Hygiene (General); LL800; reptiles

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Keywords: Amphibians; anesthesia; Flunixin meglumine; Marine toads; *Rhinella marina*

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Keywords: Time Factors; animal experiment; article; Administration, Topical; motor activity; Air; sevoflurane; Anesthetics; recumbency; Reflex, Righting; righting reflex; anesthetic recovery; Anura; *Bufo marinus*; Dosage Forms; Methyl Ethers

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Keywords: Amphibians; anesthetic agents; *Bufo alvarius*; MS-222 (Tricaine methanesulfonate); Propofol; Sonoran Desert toads

Turtles and Tortoises (Terrestrial, Freshwater, and Sea)

91 citations



Red-eared slider turtle (*Trachemys scripta elegans*)

Adel, M., Sadegh, A. B., Arizza, V., Abbasi, H., Inguglia, L., & Saravi, H. N. (2017). Anesthetic efficacy of ketamine-diazepam, ketamine-xylazine, and ketamine-acepromazine in Caspian Pond turtles (*Mauremys caspica*). *Indian Journal of Pharmacology*, 49(1), 93–97. CAB Abstracts.

Keywords: Pilot Projects; Time Factors; ketamine; Dose-Response Relationship, Drug; Sex Factors; Injections, Intramuscular; diazepam; Anesthetics; Anesthesia Recovery Period; Testudines; LL882; Veterinary Pharmacology and Anaesthesiology; Physiology and Biochemistry (Wild Animals); YY400; Turtles; Aquaculture (Animals); Aquatic Biology and Ecology; MM120; MM300; Anesthetics/administration & dosage/pharmacology; reptiles; Acepromazine/*administration & dosage/pharmacology; Diazepam/*administration & dosage/pharmacology; Ketamine/*administration & dosage/pharmacology; *Mauremys caspica*; Xylazine/*administration & dosage/pharmacology; turtles; Geoemydidae; *Mauremys*

Adetunji, V. E., Ogunsola, J., & Adeyemo, O. K. (2019). Evaluation of diazepam-ketamine combination for immobilization of African land tortoise (*Testudo graeca*). *Sokoto Journal of Veterinary Sciences*, 17(1), 78–81. CAB Abstracts. <https://doi.org/10.4314/sokjvs.v17i1.10>

Keywords: Cheloniidae; Testudines; Biological Resources (Animal); PP710; LL882; Veterinary Pharmacology and Anaesthesiology; LL080; Zoo Animals; Testudinidae; reptiles; Chelonia; tortoises; *Testudo*; *Testudo graeca*

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Keywords: Testudines; LL860; LL882; Non-Communicable Diseases and Injuries of Animals; Veterinary Pharmacology and Anaesthesiology; Diagnosis of Animal Diseases; LL886; Animal Surgery and Non-drug Therapy; LL884; Testudinidae; reptiles; tortoises; *Testudo*; *Testudo horsfieldii*

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Keywords: Analgesia; oral administration route; Red-eared slide turtles; reptiles; subcutaneous administration route; Tramadol

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Keywords: Cross-Over Studies; resuscitation; Article; animal; physiology; crossover procedure; animals; Random Allocation; randomization; Isoflurane; isoflurane; vein puncture; Anesthesia; Anesthetics, Inhalation; inhalation anesthetic agent; echocardiography; recovery; Anesthesia Recovery Period; anesthetic recovery; Recovery; Cheloniidae; Testudines; turtle; LL882; Veterinary Pharmacology and Anaesthesiology; Turtles; Aquatic Biology and Ecology; MM300; *Caretta caretta*; Turtles/*physiology; alfaxalone; Pregnanediones; reptiles; Anesthetics, Inhalation/administration & dosage/*pharmacology; epinephrine; Epinephrine/administration & dosage/*pharmacology; inhalant; Isoflurane/administration & dosage/*pharmacology; Pregnanediones/administration & dosage/pharmacology; sea turtle; Sympathomimetics/administration & dosage/*pharmacology; pregnanedione; adrenergic receptor stimulating agent; cervicobrachial neuralgia; Epinephrine; gas analysis; heart septum defect; Inhalant; Sea turtle; Sympathomimetics; turtles

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Keywords: Anesthesia; reptiles; tortoises; turtles

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<https://doi.org/10.1590/1678-4162-11039>

Keywords: Developing Countries; America; Latin America; Threshold Countries; South America; Community of Portuguese Language Countries; Testudines; LL882; Veterinary Pharmacology and Anaesthesiology; reptiles; turtles; Chelidae; *Phrynops*; *Phrynops geoffroanus*

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Keywords: Anesthesia; fluid therapy; intraosseous administration route; reptiles; tortoises

Cerreta, A. J., Masterson, C. A., Lewbart, G. A., Dise, D. R., & Papich, M. G. (2019). Pharmacokinetics of ketorolac in wild Eastern box turtles (*Terrapene carolina carolina*) after single intramuscular administration. *Journal of Veterinary Pharmacology and Therapeutics*, 42(2), 154–159. Scopus. <https://doi.org/10.1111/jvp.12733>

Keywords: Animal experiment; priority journal; Article; controlled study; procedures; metabolism; Developed Countries; OECD Countries; America; blood; blood sampling; veterinary medicine; APEC countries; Injections, Intramuscular; intramuscular drug administration; analgesia; analgesic agent; Analgesics; Analgesia; single drug dose; Pharmacology; North America; USA; high performance liquid chromatography; Chromatography, High Pressure Liquid; pharmacokinetics; drug half life; ketorolac; Ketorolac; half life time; Half-Life; Injections, Intramuscular/veterinary; Testudines; turtle; volume of distribution; Techniques and Methodology; ZZ900; LL860; LL882; Non-Communicable Diseases and Injuries of Animals; Veterinary Pharmacology and Anaesthesiology; Southern States of USA; Animal Physiology and Biochemistry (Excluding Nutrition); LL600; Appalachian States of USA; HH000; Pathogen, Pest, Parasite and Weed Management (General); VV730; Turtles; South Atlantic States of USA; Turtles/blood/*metabolism; Analgesics/administration & dosage/blood/*pharmacokinetics; reptiles; Analgesia/methods/veterinary; Chromatography, High Pressure Liquid/veterinary; Ketorolac/administration & dosage/blood/*pharmacokinetics; *Terrapene carolina carolina*; triceps brachii muscle; *Terrapene*; turtles; Emydidae; *Terrapene carolina*

Cerreta, A. J., Walker, M. E., & Harrison, T. M. (2018). Evaluation of acupuncture points governing vessels 1 and 26 on anesthetic recovery of eastern box turtles (*Terrapene carolina carolina*). *Journal of Zoo and Wildlife Medicine*, 49(4), 870–874. CAB Abstracts.

<https://doi.org/10.1638/2018-0005.1>

Keywords: Animal experiment; Article; controlled study; ketamine; comparative study; heart rate; Developed Countries; OECD Countries; America; veterinary medicine; APEC countries; anesthesia; anesthetics; morphine; dexmedetomidine; North America; USA; clinical protocol; United States of America; acupuncture; Anesthesia, Inhalation; inhalation anesthesia; Anesthetics, Inhalation; inhalation anesthetic agent; motor performance; abscess; atipamezole; Anesthesia Recovery Period; North Carolina; anesthetic recovery; Cheloniidae; Testudines; turtle; electrostimulation; LL882; Veterinary Pharmacology and Anaesthesiology; Non-drug Therapy and Prophylaxis of Humans; VV710; Southern States of USA; Appalachian States of USA; LL822; Protozoan, Helminth, Mollusc and Arthropod Parasites of Animals; Turtles; Anesthetics, Inhalation/administration & dosage; limb movement; South Atlantic States of USA; reptiles; Anesthesia, Inhalation/*veterinary; *Acupuncture; *Acupuncture Points; *anesthesia; *Anesthesia Recovery Period; *eastern box turtle; *GV-1; *GV-26; *Turtles; Abscess/veterinary; Electroacupuncture/*veterinary; eastern box turtle; Doppler flowmetry; *Terrapene carolina carolina*; Abscess; Acupuncture; acupuncture point; Acupuncture Points; aural abscess; electroacupuncture; Electroacupuncture; governing vessel 1; governing vessel 26; governor vessel; GV-1; GV-26; *Terrapene*; turtles; injectable anesthetics; Emydidae; terrapins; *Terrapene carolina*

Chittick, E. J., Stamper, M. A., Beasley, J. F., Lewbart, G. A., & Horne, W. A. (2002). Medetomidine, ketamine, and sevoflurane for anesthesia of injured loggerhead sea turtles: 13 Cases (1996-2000). *Journal of the American Veterinary Medical Association*, 221(7), 1019–1025. Scopus. <https://doi.org/10.2460/javma.2002.221.1019>

Keywords: Animal experiment; article; surgical technique; ketamine; drug efficacy; anesthesia induction; anesthesia; medetomidine; sevoflurane; hemodynamics; drug safety; clinical protocol; atipamezole; Cheloniidae; Testudines; turtle; *Caretta caretta*; anesthesiological techniques

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Keywords: Parasitosis; parasitic diseases; parasitic infestations; dermatoses; aquatic species; anesthesia; surgical techniques; traumas; therapeutics; livestock husbandry; orthopedics; diarrhea; ulceration; Testudines; dyspnea; Biological Resources (Animal); PP710; LL860; Non-Communicable Diseases and Injuries of Animals; LL823; Veterinary Pests, Vectors and Intermediate Hosts; LL821; Prion, Viral, Bacterial and Fungal Pathogens of Animals; Diagnosis of Animal Diseases; LL886; LL822; Protozoan, Helminth, Mollusc and Arthropod Parasites of Animals; scouring; Aquatic Biology and Ecology; MM300; Animal Surgery and Non-drug Therapy; LL884; reptiles; turtles; tortoises; Chelidae; fresh water animals; fresh-water animals; glue ear; inappetence; lipins

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Keywords: Article; controlled study; metabolism; randomized controlled trial; blood; veterinary medicine; Injections, Intramuscular; intramuscular drug administration; sensitivity and specificity; analgesic agent; Analgesics; single drug dose; Injections, Intravenous; intravenous drug administration; high performance liquid chromatography; elimination half-life; pharmacokinetics; limit of quantitation; validation process; drug bioavailability; bioavailability; drug absorption; drug half life; mean residence time; limit of detection; measurement accuracy; Injections, Intramuscular/veterinary; water quality; turtle; pharmacokinetic parameters; signal noise ratio; Turtles; tolfenamic acid; Turtles/*metabolism; Analgesics/blood/*pharmacokinetics; Injections, Intravenous/veterinary; ortho-Aminobenzoates/blood/*pharmacokinetics; red-eared slider turtles; anthranilic acid derivative; ortho-Aminobenzoates; mean absorption time; tolfine; *Trachemys scripta elegans*

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Keywords: Animal experiment; animal model; article; treatment outcome; controlled study; oxygen therapy; ketamine; prospective study; heart rate; veterinary medicine; drug effect; body temperature; carbon dioxide; anesthesia; medetomidine; oxygen; hypotension; jugular vein; carotid artery; diastolic blood pressure; mean arterial pressure; systolic blood pressure; arterial pressure; atipamezole; anesthetic recovery; Testudines; turtle; assisted ventilation; hypoxemia; diagnostic procedure; Testudinidae; blood oxygen tension; *Gopherus*; blood pH; blood carbon dioxide tension; blood vessel catheterization; cardiopulmonary insufficiency; hypercapnia; hypoventilation

Donnelly, K. A., Papich, M. G., Zirkelbach, B., Norton, T., Szivek, A., Burkhalter, B., Impellizzeri, J. A., & Stacy, N. I. (2019). Plasma bleomycin concentrations during electrochemotherapeutic treatment of fibropapillomas in green turtles *Chelonia mydas*. *Journal of Aquatic Animal Health*, 31(2), 186–192. Global Health. <https://doi.org/10.1002/aah.10067>

Keywords: Pesticides and Drugs; Control; viruses; DNA Viruses; dsDNA Viruses; Cheloniidae; Testudines; Techniques and Methodology; ZZ900; HH405; Prion, Viral, Bacterial and Fungal Pathogens of Humans; VV210; Human Physiology and Biochemistry; VV050; Aquatic Biology and Ecology; MM300; Animal Surgery and Non-drug Therapy; LL884; *Chelonia mydas*; reptiles; *Chelonia*; turtles; Aquatic Sciences (General); MM000; Papillomaviridae

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Keywords: Animal experiment; animal model; nonhuman; Article; ketamine; physiology; skin incision; vascularization; anatomy and histology; Developed Countries; Europe; European Union Countries; Mediterranean Region; OECD Countries; Developing Countries; America; Latin America; Threshold Countries; growth, development and aging; veterinary medicine; body weight; breeding; South America; lidocaine; clinical assessment; analgesic agent; Analgesics; anesthesia; Anesthesia/*veterinary; medetomidine; Analgesics/administration & dosage; Ketamine; Medetomidine/administration & dosage; testis; ovary; telemetry; neoplasm; recumbency; Anesthesia; general anesthesia; sexual maturation; endoscopy; Testis; Hypnotics and Sedatives; Sexual Maturation; atipamezole; morphology; Southern Europe; Ovary; Ketamine/administration & dosage; Medetomidine/pharmacology; Testudines; turtle; chlorhexidine; Biological Resources (Animal); PP710; Ecuador; Turtles; Turtles/physiology; Testudinidae; Reproduction, Development and Life Cycle (Wild Animals); YY200; *Sexual Maturation; Analgesics/administration & dosage/pharmacology; Hypnotics and Sedatives/administration & dosage/pharmacology; Ketamine/administration & dosage/pharmacology; Medetomidine/administration & dosage/pharmacology; Ovary/*anatomy & histology/growth & development; Testis/*anatomy & histology/growth & development; Analgesics/pharmacology; reptiles; Hypnotics and Sedatives/pharmacology; Hypnotics and Sedatives/administration & dosage; caudate nucleus; field study; gender identity; global positioning system; gonad; hypnotic sedative agent; kidney hypertrophy; lethargy; Medetomidine; oviduct; primordial follicle; Ringer lactate solution; sex determination; tortoise; tortoises; Ketamine/pharmacology; Ovary/*anatomy & histology; Ovary/growth & development; Sexual Maturation*; Testis/*anatomy & histology; Testis/growth & development; Anatomy and Morphology (Wild Animals); Andean Group; *Chelonoidis*; Genetics and Molecular Genetics (Wild Animals); YY100; YY300

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Keywords: Article; inguinal region;; behavior; Developing Countries; America; Latin America; Threshold Countries; veterinary medicine; hindlimb; Brazil; South America; lidocaine; Lidocaine; Anesthetics, Local/*administration & dosage; convalescence; Community of Portuguese Language Countries; Anesthetics, Local; local anesthetic agent; sensory nerve; Animals, Wild; wild animal; veterinary surgery; nerve block; forelimb; Cheloniidae; Testudines; turtle; case report; Skin Neoplasms; skin tumor; Biological Resources (Animal); Other Wildlife Diseases; PP710; YY800; LL882; Veterinary Pharmacology and Anaesthesiology; Diagnosis of Animal Diseases; LL886; Turtles; Aquatic Biology and Ecology; MM300; Animal Surgery and Non-drug Therapy; LL884; limb movement; Anesthesia, Spinal/*veterinary; Animals, Wild/surgery; *Chelonia mydas*; *fibropapillomatosis*; green turtle; Lidocaine/*administration & dosage; Papilloma/surgery/*veterinary; Skin Neoplasms/surgery/*veterinary; spinal anesthesia;

Turtles/*surgery; reptiles; *Chelonia*; Anesthesia, Spinal; carapace; fibroma; habitat; head movement; motor nerve; nerve fiber; papilloma; Papilloma; skin papilloma; turtles

Giorgi, M., De Vito, V., Owen, H., Demontis, M. P., & Varoni, M. V. (2014). PK/PD evaluations of the novel atypical opioid tapentadol in red-eared slider turtles. *Medycyna Weterynaryjna-Veterinary Medicine-Science and Practice*, 70(9), 530–535.

Keywords: Anesthesia; opioids; pharmacokinetics/pharmacodynamics; red-eared slider turtles; reptiles; Tapentadol

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Keywords: Intramuscular administration route; pharmacokinetics/pharmacodynamics; *Trachemys scripta*; Tramadol; yellow-bellied slider turtles

Goe, A., Shmalberg, J., Gatson, B., Bartolini, P., Curtiss, J., & Wellehan, J. F. X. (2016). Epinephrine or GV-26 electrical stimulation reduces inhalant anesthetic recovery time in common snapping turtles (*Chelydra serpentina*). *Journal of Zoo and Wildlife Medicine*, 47(2), 501–507. Scopus. <https://doi.org/10.1638/2015-0264.1>

Keywords: Cross-Over Studies; controlled study; physiology; crossover procedure; randomized controlled trial; veterinary; Isoflurane; isoflurane; acupuncture; Anesthesia; Anesthesia, Inhalation; inhalation anesthesia; Anesthetics, Inhalation; inhalation anesthetic agent; Electric Stimulation; Anesthesia Recovery Period; anesthetic recovery; Testudines; turtle; electrostimulation; Techniques and Methodology; ZZ900; LL860; LL882; Non-Communicable Diseases and Injuries of Animals; Veterinary Pharmacology and Anaesthesiology; Animal Nutrition (General); LL500; Turtles; Farm and Horticultural Structures; NN300; reptiles; epinephrine; Acupuncture Points; GV-26; Epinephrine; *Chelydra serpentina*; common snapping turtle; recovery.; turtles; *Chelydra*; Chelydridae

Gorman, E. (2012). Parallel session: Nursing non-domestic species surgery and anaesthesia of a Home's hingeback tortoise with a prolapsed oviduct. In *British Veterinary Zoological Society Proceedings of the Autumn Meeting 2012, Edinburgh Zoo, Edinburgh, UK, 10-11 November 2012. Anaesthesia and surgery* (V. Roberts, Ed.; p. 31). Romford, UK: British Veterinary Zoological Society; CAB Abstracts.

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Keywords: Anesthesia; Home's hingeback tortoise; reptiles

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Keywords: Article; ketamine; physiology; heart rate; Random Allocation; Dose-Response Relationship, Drug; animal disease; dose response; drug effect; randomization; Injections,

Intramuscular; intramuscular drug administration; analgesic agent; anesthesia; medetomidine; Analgesics, Non-Narcotic; Ketamine; anesthetic agent; Anesthesia; Anesthetics, Dissociative; Heart Rate; atipamezole; Muscle, Skeletal; skeletal muscle; endotracheal intubation; turtle; Turtles; Medetomidine; imidazole derivative; Imidazoles; Intubation, Intratracheal; Adrenergic alpha-Agonists; alpha adrenergic receptor stimulating agent

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Keywords: Cross-Over Studies; Random Allocation; Electrocardiography; Magnetic Resonance Imaging; Heart/*physiology; Cheloniidae; Testudines; Techniques and Methodology; ZZ900; LL882; Veterinary Pharmacology and Anaesthesiology; Animal Physiology and Biochemistry (Excluding Nutrition); LL600; Diagnosis of Animal Diseases; LL886; reptiles; Anesthesia, Inhalation/*veterinary; *Turtles; Adjuvants, Anesthesia/administration & dosage; Anesthetics, Inhalation/*administration & dosage/blood; Atropine/administration & dosage; Isoflurane/*administration & dosage/blood; Pulmonary Artery/physiology; Pulmonary Circulation/physiology; tortoises

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Keywords: Surgery; procedures; veterinary; Injections, Intramuscular; intramuscular drug administration; anesthesia; medetomidine; Alfaxalone; Anesthetics; anesthetic agent; Anesthesia; Anaesthesia; Hypnotics and Sedatives; turtle; Turtles; Chelonian; alfaxalone; Pregnanediones; Anesthetics, Combined; hypnotic sedative agent; Medetomidine; pregnanedione; Tortoise; *Agrionemys horsfieldii*

Harms, C. A., Eckert, S. A., Jones, T. T., Dow Piniak, W. E., & Mann, D. A. (2010). A technique for underwater anesthesia compared with manual restraint of sea turtles undergoing auditory evoked potential measurements. *Journal of Herpetological Medicine and Surgery*, 19(1), 8–12.

Keywords: Anesthesia; restraint; reptiles; sea turtles

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Keywords: Anesthesia; *Dermochelys coriacea*; field anesthesia; leatherback sea turtles; reptiles

Harms, C. A., Piniak, W. E. D., Eckert, S. A., & Stringer, E. M. (2014). Sedation and anesthesia of hatchling leatherback sea turtles (*Dermochelys coriacea*) for auditory evoked potential

measurement in air and in water. *Journal of Zoo and Wildlife Medicine*, 45(1), 86–92. Scopus. <https://doi.org/10.1638/2013-0183R.1>

Keywords: Article; ketamine; physiology; clinical trial; Environment; animal disease; Drug Therapy, Combination; environment; anesthesia; midazolam; sedation; dexmedetomidine; Ketamine; Anesthetics; anesthetic agent; Anesthesia; drug combination; Hypnotics and Sedatives; Evoked Potentials, Auditory; Dexmedetomidine; turtle; Turtles; Midazolam; hypnotic sedative agent; auditory evoked potential; *Dermochelys coriacea*; evoked auditory response; leatherback sea turtle



Loggerhead sea turtles (*Caretta caretta*)

Harms, C. A., Ruterbories, L. K., Stacy, N. I., Christiansen, E. F., Papich, M. G., Lynch, A. M., Barratclough, A., & Serrano, M. E. (2021). Safety of multiple-dose intramuscular ketoprofen treatment in loggerhead turtles (*Caretta caretta*). *Journal of Zoo and Wildlife Medicine*, 52(1), 126–132. Agricola. <https://doi.org/10.1638/2020-0159>

Keywords: Medicine; veterinary medicine; gastrointestinal system; hematology; analgesia; ketoprofen; analgesics; wildlife; risk; pharmacokinetics; Drug Administration Schedule; chemical species; blood platelets; musculoskeletal system; zoos; *Caretta caretta*; Anti-Inflammatory Agents, Non-Steroidal/administration & dosage/adverse effects/*therapeutic use; Ketoprofen/administration & dosage/adverse effects/*therapeutic use; Thrombelastography; Turtles/*blood; kidneys

Hawkins, S. J., Cox, S., Yaw, T. J., & Sladky, K. (2019). Pharmacokinetics of subcutaneously administered hydromorphone in bearded dragons (*Pogona vitticeps*) and red-eared slider turtles (*Trachemys scripta elegans*). *Veterinary Anaesthesia and Analgesia*, 46(3), 352–359.

MEDLINE. <https://doi.org/10.1016/j.vaa.2018.12.002>

Keywords: Cross-Over Studies; animal experiment; nonhuman; Article; controlled study; animal; metabolism; crossover procedure; Random Allocation; veterinary medicine; randomization; plasma (blood); analgesia; anesthesia; Anesthesia/*veterinary; pain killers; sedation; Injections, Subcutaneous; lizard; solid phase extraction; Pharmacology; high performance liquid chromatography; area under the curve; maximum plasma concentration; time to maximum plasma concentration; antinociception; subcutaneous drug administration; Analgesics, Opioid; narcotic analgesic agent; mean residence time; Anesthesia; Lizards; half life time; Half-Life; Hydromorphone/administration & dosage; hydromorphone; maximum concentration; Testudines; turtle; quadrupole mass spectrometry; pharmacokinetic parameters; LL882; Veterinary Pharmacology and Anaesthesiology; Physiology and Biochemistry (Wild Animals); YY400; VV730; Turtles; Animal Health and Hygiene (General); LL800; *Trachemys scripta*; Turtles/*metabolism; reptiles; reptile; Analgesics, Opioid/*pharmacokinetics; bearded dragon; Hydromorphone/administration & dosage/*pharmacokinetics; Lizards/*metabolism; opioid; red-eared slider; lizards; lethargy; *Pogona vitticeps*; *Trachemys scripta elegans*; elimination rate constant; Hydromorphone; *Trachemys*; Sauria; turtles; Agamidae; Emydidae; *Pogona*; terrapins; Hydromorphone/*pharmacokinetics

Hernandez-Divers, S. J., Stahl, S. J., & Farrell, R. (2009). An endoscopic method for identifying sex of hatchling Chinese box turtles and comparison of general versus local anesthesia for coelioscopy. *Journal of the American Veterinary Medical Association*, 234(6), 800–804. Scopus. <https://doi.org/10.2460/javma.234.6.800>

Keywords: Article; male; methodology; Random Allocation; animal disease; Animalia; randomization; postoperative complication; Postoperative Complications; local anesthesia; Anesthesia, General; general anesthesia; Anesthesia Recovery Period; laparoscopy; anesthetic recovery; Testudines; turtle; Sex Determination (Analysis); Turtles; sex determination; Anesthesia, Local; *Cuora flavomarginata*; Laparoscopy; *Murraya exotica*; *Terrapene*

Innis, C., Wilson, C., Seeherman, H., & Stacy, B. (2021). Effect of Bone Morphogenetic Protein on Experimental Carapace Defects in Turtles. *Journal of Herpetological Medicine and Surgery*, 31(1), 48–58. Agricola. <https://doi.org/10.5818/JHMS-12-2020>

Keywords: Surgery; cattle; medicine; inflammation; histology; models; anesthesia; collagen; turtle; carapace; *Trachemys scripta elegans*; turtles; bone morphogenetic protein; bone morphogenetic proteins; granulation tissue; osteonecrosis

Johnson, S. M., & Sladky, K. K. (2008). Opioid effects on respiration and analgesia in turtles. *Faseb Journal*, 22. [://WOS:000208467802040](https://doi.org/10.1096/faseb.2008.22.16.000208467802040)

Keywords: Analgesia; opioids; reptiles; respiration; turtles

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<https://doi.org/10.2460/javma.2003.222.1111>

Keywords: Prospective Studies; Treatment Outcome; Time Factors; animal experiment; article; ketamine; prospective study; Dose-Response Relationship, Drug; dose response; Injections, Intramuscular; anesthesia induction; medetomidine; propofol; Safety; Immobilization; Animals, Wild; Heart Rate; atipamezole; endotracheal intubation; Neuromuscular Blockade; neuromuscular blocking; neuromuscular blocking agent; Neuromuscular Nondepolarizing Agents; Testudines; turtle; Turtles; Blinking; tiletamine; Terrapene; suxamethonium; zolazepam; Androstanols; atracurium; gallamine; glycopyrronium bromide; heart arrhythmia; Intubation, Intratracheal; neostigmine; pancuronium; rocuronium; *Terrapene carolina major*

Keifer, J., & Zheng, Z. (2017). Cold block of in vitro eyeblink reflexes: Evidence supporting the use of hypothermia as an anesthetic in pond turtles. *The Journal of Experimental Biology*, 220(Pt 23), 4370–4373. <https://doi.org/10.1242/jeb.168427>

Keywords: Animal Welfare; Cold Temperature; Euthanasia, Animal; *Animal welfare; Turtles/*physiology; *MS222; Hypothermia, Induced/*veterinary; Anesthesia/methods/*veterinary; *Anesthesia; *AVMA guidelines; *Reflex pathways; *Reptiles

Kelly, T. R., Walton, W., Nadelstein, B., & Lewbart, G. A. (2005). Phacoemulsification of bilateral cataracts in a loggerhead sea turtle (*Caretta caretta*). *Veterinary Record*, 156(24), 774–777. Scopus. <https://doi.org/10.1136/vr.156.24.774>

Keywords: United States; death; article; surgical technique; treatment outcome; autopsy; postoperative care; clinical examination; general anesthesia; vision; visual system examination; cataract; Testudines; turtle; *Caretta caretta*; ophthalmoscopy; biomicroscopy; cachexia; dying; phacoemulsification; slit lamp

Khan Sharun, Francis, C. J., & Ajith Pillai. (2021). Surgical management of oesophageal foreign body using a minimally invasive oesophagotomy technique (MIOT) in an Indian Flap-shell turtle (*Lissemys punctata*)—A case report. *Veterinarski Arhiv*, 91(2), 221–226. CAB Abstracts.

<https://doi.org/10.24099/vet.arhiv.0991>

Keywords: Asia; Commonwealth of Nations; Developing Countries; South Asia; anesthesia; Testudines; invasive organisms; invasives; LL860; Non-Communicable Diseases and Injuries of Animals; Animal Surgery and Non-drug Therapy; LL884; reptiles; esophagus; *Lissemys*; *Lissemys punctata*; Trionychidae; turtles

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unilateral gonadectomy. *Journal of Herpetological Medicine and Surgery*, 21(2/3), 54–62. Global Health. <https://doi.org/10.5818/1529-9651-21.2.54>

Keywords: Testudines; LL882; Veterinary Pharmacology and Anaesthesiology; LL070; Pets and Companion Animals; Non-drug Therapy and Prophylaxis of Humans; VV710; Animal Nutrition (General); LL500; CC700; Professions: Practice and Service; Animal Health and Hygiene (General); LL800; *Trachemys scripta*; reptiles; Trachemys; turtles; Emydidae

Knafo, S. E., Divers, S. J., Rivera, S., Cayot, L. J., Tapia-Aguilera, W., & Flanagan, J. (2011). Paper: Sterilisation of hybrid Galapagos tortoises (*Geochelone nigra*) for Island restoration. Part 1: Endoscopic oophorectomy of females under ketamine-medetomidine anaesthesia. *Veterinary Record*, 168(2), 47. Scopus. <https://doi.org/10.1136/vr.c6520>

Keywords: Treatment Outcome; article; treatment outcome; ketamine; physiology; methodology; animal disease; medetomidine; Ketamine; hybridization; Hybridization, Genetic; environmental protection; anesthetic agent; Anesthetics, Dissociative; ovariectomy; Ovariectomy; Hypnotics and Sedatives; Conservation of Natural Resources; turtle; Turtles; Testudinidae; hypnotic sedative agent; Medetomidine; *Geochelone nigra*; Extinction, Biological; species extinction

Knotek, Z. (2014). Alfaxalone as an induction agent for anaesthesia in terrapins and tortoises. *Veterinary Record*, 175(13), 327. Scopus. <https://doi.org/10.1136/vr.102486>

Keywords: Treatment Outcome; procedures; veterinary; Anesthetics; anesthetic agent; Anesthesia; turtle; Turtles; alfaxalone; Pregnanediones; pregnanedione; Preanesthetic Medication; premedication

Lai, O. R., Bello, A. di, Soloperto, S., Freggi, D., Marzano, G., Cavaliere, L., & Crescenzo, G. (2015). Pharmacokinetic behavior of meloxicam in loggerhead sea turtles (*Caretta caretta*) after intramuscular and intravenous administration. *Journal of Wildlife Diseases*, 51(2), 509–512. Global Health. <https://doi.org/10.7589/2014-03-069>

Keywords: Aquatic species; plasma (blood); adverse reactions; meloxicam; pain killers; Pharmacology; Cheloniidae; Testudines; LL882; Veterinary Pharmacology and Anaesthesiology; Pathogens, Parasites and Infectious Diseases (Wild Animals); Physiology and Biochemistry (Wild Animals); YY000; YY400; YY700; Zoology of Wild Animals (Vertebrates and Invertebrates) (General); VV730; medicines; pharmaceuticals; Aquatic Biology and Ecology; MM300; NSAIDS; *Caretta caretta*; marine species; reptiles; *Caretta*; turtles; antiinflammatory drugs; Toxicology and Poisoning (Wild Animals); YY900

Lamagna, B., Affuso, A., Micieli, F., Mennonna, G., Meomartino, L., Valle, G. D., Ciampa, M., Treglia, G., & Hochscheid, S. (2021). Comparison of intraocular pressure measurement using rebound and applanation tonometry in loggerhead (*Caretta caretta*) sea turtles. *Journal of Zoo and Wildlife Medicine*, 52(2), 604–609. Agricola. <https://doi.org/10.1638/2020-0070>

Keywords: Medicine; Developed Countries; Europe; European Union Countries; Mediterranean Region; OECD Countries; anesthesia; wildlife; confidence interval; calibration; dogs; local anesthesia; Southern Europe; intraocular pressure; cornea; Cheloniidae; Testudines; Techniques and Methodology; ZZ900; Physiology and Biochemistry (Wild Animals); YY400; Diagnosis of Animal Diseases; LL886; zoos; Aquatic Biology and Ecology; MM300; *Caretta caretta*; reptiles; tonometry; *Caretta*; turtles; eye cornea; sea turtles

Lima, M. S. C. S., Sousa, C. A. S., Pederassi, J., Sobrinho, J. M. F., Souza, C. A. D. S., de Abreu Júnior, A. N. G., de Abreu Amorim, I., & de Sousa Andrade, J. (2021). The Use Of Cooling And Freezing For Anesthesia Of *Phrynops Geoffroanus* Turtles (Pleurodira: Chelidae) And The Establishment Of Low Incipient Lethal Temperature. *Archives of Veterinary Science*, 26(2), 25–38. Scopus. <https://doi.org/10.5380/avs.v26i2.78134>

Keywords: Hypothermia; anesthetic degree; ectotherm; humanized management

MacLean, R. A., Harms, C. A., & Braun-McNeill, J. (2008). Propofol anesthesia in loggerhead (*Caretta caretta*) sea turtles. *Journal of Wildlife Diseases*, 44(1), 143–150. <https://doi.org/10.7589/0090-3558-44.1.143>

Keywords: Anesthesia; *Caretta caretta*; Loggerhead sea turtles; Propofol; reptiles

Makau, C. M., Towett, P. K., Abelson, K. S. P., & Kanui, T. I. (2017). Modulation of formalin-induced pain-related behaviour by clonidine and yohimbine in the Speke's hinged tortoise (*Kiniskys spekii*). *Journal of Veterinary Pharmacology and Therapeutics*, 40(5), 439–446. Scopus. <https://doi.org/10.1111/jvp.12374>

Keywords: Animal experiment; animal model; priority journal; treatment outcome; Article; controlled study; randomized controlled trial; Dose-Response Relationship, Drug; veterinary; dose response; locomotion; pain; Pain; formaldehyde; antinociception; treatment response; analgesic activity; clinical effectiveness; serotonergic system; Pain/prevention & control/*veterinary; turtle; Turtles; *Turtles; Clonidine/*therapeutic use; Formaldehyde/pharmacology; Yohimbine/*therapeutic use; tortoise; atlantooccipital joint; clonidine; Clonidine; Formaldehyde; *Kiniskys spekii*; methysergide maleate; neuromodulation; noradrenergic system; yohimbine; Yohimbine



Galapagos tortoise (*Geochelone nigra*)

Makau, C. M., Towett, P. K., Abelson, K. S. P., & Kanui, T. I. (2021). Modulation of nociception by amitriptyline hydrochloride in the Speke's hinge-back tortoise (*Kinixys spekii*). *Veterinary Medicine and Science*, 7(3), 1034–1041. Scopus. <https://doi.org/10.1002/vms3.444>

Keywords: Animal experiment; animal model; animal tissue; Article; controlled study; sodium chloride; animal behavior; hindlimb; calcium; nociception; neuropathic pain; alcohol; analgesic agent; sample size; formaldehyde; animal care; hyperalgesia; vocalization; formalin test; drug dose comparison; defecation; micturition; amitriptyline; Testudines; LL882; Veterinary Pharmacology and Anaesthesiology; LL070; Pets and Companion Animals; capsaicin; hot plate test; Testudinidae; *amitriptyline hydrochloride; *antinociception; *capsaicin test; *formalin test; *hot plate test; *hyperalgesia; reptiles; tortoise; amitriptyline hydrochloride; capsaicin test; colecalciferol; hindlimb withdrawal; nociceptive behavior; paw withdrawal threshold; speke hinge back tortoise; stopwatch; *Kinixys*; *Kinixys spekii*; tortoises

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Keywords: Testudines; Techniques and Methodology; ZZ900; LL882; Veterinary Pharmacology and Anaesthesiology; LL070; Pets and Companion Animals; reptiles; turtles; tortoises

Mans, C., Lahner, L. L., Baker, B. B., Johnson, S. M., & Sladky, K. K. (2012). Antinociceptive efficacy of buprenorphine and hydromorphone in red-eared slider turtles (*Trachemys scripta elegans*). *Journal of Zoo and Wildlife Medicine*, 43(3), 662–665. Scopus.

<https://doi.org/10.1638/2011-0260R.1>

Keywords: Cross-Over Studies; Time Factors; time; article; controlled study; crossover procedure; randomized controlled trial; clinical trial; Dose-Response Relationship, Drug; animal disease; dose response; Hot Temperature; heat; controlled clinical trial; pain; buprenorphine; Pain; Buprenorphine; Analgesia; Antinociception; hydromorphone; turtle; Turtles; *Trachemys scripta elegans*; Hydromorphone; Red-eared-slider turtle

Martinho, F. (2008). Spiny softshell turtle (*Apalone spinifera*, formerly *Trionyx siniferus*). *Exotic DVM*, 10(4), 33–34. Global Health.

Keywords: Anesthesia; anesthetics; pet animals; Testudines; zoonotic infections; exotic organisms; exotic species; introduced organisms; non-indigenous organisms; non-indigenous species; non-native organisms; non-native species; nonindigenous organisms; nonindigenous species; LL860; LL882; Non-Communicable Diseases and Injuries of Animals; Veterinary Pharmacology and Anaesthesiology; LL070; Pets and Companion Animals; Animal Reproduction and Embryology; LL250; Animal Behaviour; LL300; LL821; causal agents; etiology; LL500; Aquaculture (Animals); MM120; Animal Anatomy and Morphology; LL400; reptiles; Trionychidae; turtles; *Apalone*; *Apalone spinifera*

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<https://doi.org/10.1002/9780470698877.ch14>

Keywords: Anesthesia; analgesia; euthanasia; reptiles; tortoises; turtles

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Keywords: Pesticides and Drugs; feces; Control; chemotherapy; anesthesia; mercy killing; intubation; Testudines; rehydration therapy; LL860; LL882; Non-Communicable Diseases and Injuries of Animals; Veterinary Pharmacology and Anaesthesiology; HH405; LL821; Prion, Viral, Bacterial and Fungal Pathogens of Animals; Diagnosis of Animal Diseases; LL886; LL822; Protozoan, Helminth, Mollusc and Arthropod Parasites of Animals; Animal Genetics and Breeding; LL240; Animal Surgery and Non-drug Therapy; LL884; reptiles; turtles; tortoises; inappetence

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Keywords: Treatment Outcome; Hemodynamics; treatment outcome; computer assisted tomography; animal; ketamine; heart rate; veterinary medicine; drug effect; morphine; propofol; hemodynamics; dexmedetomidine; tidal volume; Letter; Anesthesia, General; general anesthesia; artificial ventilation; Doppler ultrasonography; end tidal carbon dioxide tension; Hemodynamics/*drug effects; turtle; case report; Turtles; Respiration, Artificial; Turtles/*surgery; sea turtle; Anesthesia, General/adverse effects/*veterinary; Intestinal Obstruction/surgery/*veterinary; Respiration, Artificial/adverse effects/*veterinary; anaestamine; colonoscopy; desflurane; Intestinal Obstruction; intestine obstruction; morphine sulfate; propoflo plus

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Keywords: Pilot Projects; Species Specificity; meloxicam; anesthesia; anesthetics; drug action; mechanism of drug action; Area Under Curve; Injections, Subcutaneous/veterinary; Half-Life; Cheloniidae; *Lepidochelys*; *Lepidochelys kempii*; Testudines; LL882; Veterinary Pharmacology and Anaesthesiology; Aquatic Biology and Ecology; MM300; *Caretta caretta*; Anti-Inflammatory Agents, Non-Steroidal/administration & dosage/blood/*pharmacokinetics; Meloxicam/administration & dosage/blood/*pharmacokinetics; Turtles/blood/*metabolism; *Chelonia mydas*; reptiles; *Chelonia*; *Caretta*; turtles

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Keywords: Cross-Over Studies; statistics; crossover procedure; clinical trial; blood; aquatic species; plasma (blood); adverse reactions; pain; Analgesia; pain killers; Statistics as Topic; tramadol; analogs and derivatives; Pharmacology; Analgesics, Opioid; narcotic analgesic agent; half life time; Half-Life; Cheloniidae; Testudines; turtle; LL882; Veterinary Pharmacology and Anaesthesiology; Animal Physiology and Biochemistry (Excluding Nutrition); LL600; VV730; Turtles; Aquatic Biology and Ecology; MM300; *Caretta caretta*; marine species; reptiles; opioid; Tramadol; *Caretta*; O-demethyltramadol; turtles

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Keywords: Cross-Over Studies; Treatment Outcome; controlled study; physiology; crossover procedure; randomized controlled trial; heart rate; Dose-Response Relationship, Drug; drug effects; dose response; Heart Rate/drug effects; Anesthetics, Intravenous; intravenous anesthetic agent; Animals, Wild; wild animal; Heart Rate; Wild/physiology; turtle; Turtles; Turtles/*physiology; alfaxalone; Pregnanediones; Pregnanediones/administration & dosage/*pharmacology; Anesthetics, Intravenous/administration & dosage/*pharmacology; pregnanedione

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Keywords: Developed Countries; Europe; European Union Countries; Mediterranean Region; OECD Countries; Italy; Southern Europe; Cheloniidae; Testudines; Biological Resources (Animal); Other Wildlife Diseases; PP710; YY800; LL882; Veterinary Pharmacology and Anaesthesiology; Diagnosis of Animal Diseases; LL886; Aquatic Biology and Ecology; MM300; Animal Surgery and Non-drug Therapy; LL884; *Caretta caretta*; reptiles; *Caretta*; turtles

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Keywords: Animal experiment; priority journal; Article; controlled study; blood; blood sampling; Injections, Intramuscular; intramuscular drug administration; analgesic agent; Analgesics; blood analysis; Analgesics/administration & dosage; Area Under Curve; Injections, Intravenous; intravenous drug administration; mathematical model; area under

the curve; drug blood level; pharmacokinetics; validation process; drug bioavailability; drug elimination; drug half life; half life time; Half-Life; liquid chromatography-mass spectrometry; turtle; LC-MS/MS; pharmacokinetic parameters; Turtles; Turtles/*blood; Analgesics/administration & dosage/blood/*pharmacokinetics; green sea turtles; ortho-Aminobenzoates/administration & dosage/blood/*pharmacokinetics; tolfenamic acid; anthranilic acid derivative; *Chelonia*; drug binding; noncompartment model; ortho-Aminobenzoates; vetoquinol lure; Analgesics/*pharmacokinetics; Analgesics/blood; ortho-Aminobenzoates/*pharmacokinetics; ortho-Aminobenzoates/administration & dosage; ortho-Aminobenzoates/blood

Raweewan, N., Laovechprasit, W., Giorgi, M., Chomcheun, T., Klangkaew, N., Imsilp, K., Poapolathep, A., & Poapolathep, S. (2020). Pharmacokinetics of tolfenamic acid in Hawksbill turtles (*Eretmochelys imbricata*) after single intravenous and intramuscular administration. *Journal of Veterinary Pharmacology and Therapeutics*, 43(2), 135–140.

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Keywords: Treatment Outcome; article; treatment outcome; physiology; lidocaine; Lidocaine; environmental protection; Anesthetics, Local; local anesthetic agent; Conservation of Natural Resources; turtle; Ecuador; Turtles; Testudinidae; Genitalia, Male; *Geochelone nigra*; male genital system

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Keywords: Developed Countries; Europe; European Union Countries; OECD Countries; Western Europe; Commonwealth of Nations; Developing Countries; ACP Countries; Africa; Africa South of Sahara; Francophone Africa; UK; British Isles; Testudines; Biological Resources (Animal); PP710; LL882; Veterinary Pharmacology and Anaesthesiology; Animal Reproduction and Embryology; LL250; East Africa; Least

Developed Countries; Testudinidae; Reproduction, Development and Life Cycle (Wild Animals); YY200; reptiles; tortoises; *Astrochelys*; *Astrochelys yniphora*; Indian Ocean Islands

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Keywords: Anesthesia; comparative study; Ketamine; Medetomidine; Propofol; red-eared slider turtles; reptiles; Sevoflurane; *Trachemys scripta elegans*; turtles

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Keywords: Prospective Studies; Article; ketamine; prospective study; drug efficacy; heart rate; temperature; materials; potassium; blood sampling; hematocrit; veterinary medicine; Injections, Intramuscular; intramuscular drug administration; experimental design; calcium; biochemistry; anesthesia; Anesthesia/*veterinary; intramuscular injection; blood gases; medetomidine; glucose; tramadol; Ketamine; drug safety; biochemical analysis; carbon; breathing rate; anesthetic agent; Anesthesia; anesthesiological procedure; blood gas analysis; apnea; atipamezole; protocols; duration; Injections, Intramuscular/veterinary; eyelid reflex; water quality; drug administration route; chloride; urea nitrogen blood level; Cheloniidae; Testudines; turtle; hatchling; LL882; Veterinary Pharmacology and Anaesthesiology; water temperature; Turtles; Aquatic Biology and Ecology; MM300; bicarbonate blood level; *Chelonia mydas*; reptiles; Anesthetics, Combined; Medetomidine; *Chelonia*; anion gap; atipamezole; blood oxygen tension; green sea turtle; Tramadol; cloaca; turtles; Ketamine*; Tramadol*; Turtles*; respiratory rate; prospective studies; reflexes; depth of anesthesia

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Keywords: Anesthesia; red-eared slider turtles; reptiles; *Trachemys scripta*; turtles

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Keywords: Cross-Over Studies; animal experiment; article; controlled study; male; female; sodium chloride; drug effect; Hot Temperature; hindlimb; withdrawal reflex; Sodium Chloride; antinociception; Analgesics, Opioid; stimulus response; Testudines; turtle; Turtles; *Trachemys scripta*; mu opiate receptor; Receptors, Opioid, mu; thermal stimulation; Nociceptors; 3,4 dichloro n methyl n [2 (1 pyrrolidiny]cyclohexyl]benzeneacetamide; Benzeneacetamides; delta opiate receptor; Enkephalin, Ala(2)-MePhe(4)-Gly(5)-; Enkephalin, D-Penicillamine (2,5)-; Enkephalin, Leucine-2-Alanine; enkephalin[2 dextro alanine 4 methylphenylalanine 5 glycine]; enkephalin[2 dextro alanine 5 dextro leucine]; enkephalin[2,5 dextro penicillamine]; kappa opiate receptor; n methyl n [7 (1 pyrrolidiny] 1 oxaspiro[4.5]dec 8 yl]benzeneacetamide; naltrindole; Pyrrolidines

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Keywords: Developed Countries; Europe; European Union Countries; Mediterranean Region; OECD Countries; America; Pesticides and Drugs; Control; APEC countries; North America; USA; Italy; Southern Europe; Cheloniidae; Testudines; LL882; Veterinary Pharmacology and Anaesthesiology; LL070; Pets and Companion Animals; Gulf States of USA; Southern States of USA; HH405; LL821; Prion, Viral, Bacterial and Fungal Pathogens of Animals; East South Central States of USA; Animal Health and Hygiene (General); LL800; Animal Surgery and Non-drug Therapy; LL884; *Trachemys scripta*; South Atlantic States of USA; reptiles; *Pseudemys*; *Trachemys*; turtles; Emydidae; Delta States of USA; *Graptemys*; *Graptemys pseudogeographica*; *Pseudemys nelsoni*; Southeastern States of USA

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Keywords: Anesthesia; female genital system; Testudines; LL882; Veterinary Pharmacology and Anaesthesiology; Animal Reproduction and Embryology; LL250; Nutrition Related Disorders and Therapeutic Nutrition; VV130; Testudinidae; reptiles; tortoises; inappetence; fallopian tube; salpinges; uterine tubes; *Geochelone*; *Geochelone elegans*

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Keywords: Asia; Commonwealth of Nations; Developing Countries; India; South Asia; Uttaranchal; pain killers; clinical picture; Testudines; Biological Resources (Animal); Other Wildlife Diseases; PP710; YY800; Diagnosis of Animal Diseases; LL886; Animal Surgery and Non-drug Therapy; LL884; reptiles; turtles; Geoemydidae; *Pangshura*; *Pangshura tentoria*; *Pangshura tentoria circumdata*; penile prolapse

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Keywords: Ketoprofen; Pharmacology; pharmacokinetics; Injections, Intramuscular/veterinary; Cheloniidae; Testudines; LL882; Veterinary Pharmacology and Anaesthesiology; Human Physiology and Biochemistry; VV050; VV730; Aquatic Biology and Ecology; MM300; *Caretta caretta*; Turtles/*metabolism; reptiles; Injections, Intravenous/veterinary; Anti-Inflammatory Agents, Non-Steroidal/administration & dosage/*pharmacokinetics; Drug Administration Schedule/veterinary; Ketoprofen/administration & dosage/*pharmacokinetics; loggerhead; nonsteroidal anti-inflammatory; *Caretta*; turtles

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Keywords: Testudines; LL882; Veterinary Pharmacology and Anaesthesiology; LL070; Pets and Companion Animals; reptiles; lizards; Sauria; turtles

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Keywords: Developing Countries; America; Latin America; Threshold Countries; South America; anesthesia; anesthetics; clinical picture; surgical techniques; therapeutics; Testudines; LL860; LL882; Non-Communicable Diseases and Injuries of Animals; Veterinary Pharmacology and Anaesthesiology; LL070; Pets and Companion Animals; Diagnosis of Animal Diseases; LL886; Animal Surgery and Non-drug Therapy; LL884; Testudinidae; reptiles; tortoises; *Chelonoidis*; *Chelonoidis chilensis*

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Keywords: Anesthesia; Isoflurane; red-eared slider turtles; reptiles; *Trachemys scripta elegans*

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Keywords: Surgery; Article; follow up; Asia; Commonwealth of Nations; Developing Countries; India; South Asia; anesthesia; clinical picture; general anesthesia; Eye; eyeball; abscess; pet animals; Testudines; Biological Resources (Animal); exotic organisms; exotic species; introduced organisms; non-indigenous organisms; non-indigenous species; non-native organisms; non-native species; nonindigenous organisms; nonindigenous species; PP710; LL860; Non-Communicable Diseases and Injuries of Animals; LL070; Pets and Companion Animals; Diagnosis of Animal Diseases; LL886; Animal Surgery and Non-drug Therapy; LL884; Testudinidae; recurrence of disease; relapses; reptiles; tortoise; Abscess; bulbar conjunctiva; eye swelling; Tortoise; tortoises; exotic pets; *Geochelone*; *Geochelone elegans*; Indian Punjab

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Keywords: Anesthesia; anesthetics; drug action; mechanism of drug action; pain killers; high performance liquid chromatography; Testudines; LL882; Veterinary Pharmacology and Anaesthesiology; LL070; Pets and Companion Animals; *Trachemys scripta*; reptiles; tapentadol; *Trachemys*; turtles; Emydidae; *Trachemys scripta scripta*

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Keywords: Fracture Fixation; article; fracture fixation; injury; fracture; Fractures, Bone; methodology; bone; animal disease; instrumentation; analgesia; Analgesia; Radiography;

Bone and Bones; radiography; Testudines; turtle; antibiotic prophylaxis; Turtles; Antibiotic Prophylaxis

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Keywords: Physiology; Anatomy; Analgesic techniques; Chelonian species; Preanesthetic assessment

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Keywords: Animal experiment; animal model; article; priority journal; controlled study; animal behavior; Dose-Response Relationship, Drug; drug effect; nociception; analgesia; pain; Pain; Pain Measurement; morphine; Vertebrata; formaldehyde; pethidine; Analgesics, Opioid; Morphine; naloxone; Narcotic Antagonists; defecation; micturition; turtle; Turtles; Testudinidae; Meperidine; Naloxone

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Keywords: Surgery; animal experiment; animal model; animal tissue; Article; computer assisted tomography; controlled study; rehabilitation care; ketamine; clinical evaluation; antimicrobial therapy; cytology; phosphorus; calcium; anemia; meloxicam; single drug dose; histopathology; immunohistochemistry; sodium; sevoflurane; butorphanol; glucose; dexmedetomidine; tramadol; bladder; ampicillin; uric acid; immunoreactivity; biochemical analysis; echography;

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Keywords: Sampling techniques; anesthetics; pet animals; Testudines; exotic organisms; exotic species; introduced organisms; non-indigenous organisms; non-indigenous species; non-native organisms; non-native species; nonindigenous organisms; nonindigenous species; LL882; Veterinary Pharmacology and Anaesthesiology; LL070; Pets and Companion Animals; Diagnosis of Animal Diseases; LL886; reptiles; turtles; tortoises



Indian star tortoise (*Geochelone elegans*)