Preface
One of the major requirements of the Animal Welfare Act is to ensure that steps are taken to minimize pain and distress in animals insofar as allowed by the approved research protocol. Exceptions to this requirement must be scientifically justified by the investigator, in writing, and approved by the Institutional Animal Care and Use Committee (IACUC). (Section 13 (a)(3)). One of the methods used to accomplish this requirement is the provision of adequate veterinary care for the animals including the appropriate use of anesthetics, analgesics, tranquilizers or euthanasia.

The Animal Welfare Information Center (AWIC) was established by the 1985 amendments to the Act (Sect. 13(e)) and is required, by law, to provide specific information to the research community. As stated above, one of these requirements is minimizing pain or distress in the animals used in research when possible. This publication provides a list of published reference sources on analgesia and the use of analgesics in animals. While this publication is not meant to be a complete resource on the subject of analgesia and analgesics in animals it is hoped that it will be useful to those involved with animal research and will be of assistance to the investigators, veterinarians, and in the reduction of pain and distress to these animals.

Richard L. Crawford, DVM
USDA, NAL, AWIC

General


Descriptors: over-the-counter-drugs, analgesics, respiratory, dermatologic.

Descriptors: alleviation of pain, species differences.


Descriptors: animals, pain, trauma.

Descriptors: laboratory animals, local anesthetics, ointments, lidocaine.

Descriptors: laboratory animals, anaesthetics, breathing, techniques.

Descriptors: laboratory animals, pain, improvement, analgesics, anesthetics.

Descriptors: pain, distress, assessment, alleviation, animals.


Descriptors: anaesthesia, administration, dosage, animals, surgery.

Descriptors: pain management, profit, service.

Descriptors: small animal, anaesthesia, analgesia.

Descriptors: epidural, analgesia, anesthesia.

Descriptors: analgesia, therapy, critical ill.

Descriptors: pain, surgical, oncology, management.

Descriptors: anesthesia, analgesia.


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**Amphibians & Reptiles**

Aguilar, N.G.; Palacios, C.A.M.; Ross, L.G., (1999), Controlled anaesthesia of Rana catesbeiana (Shaw) and Rana pipiens (Schreber) using xylocaine delivered by spray. *Aquaculture Research*. v. 30 (4), p. 309-311. ISSN: 1355-557X. NAL Call no: SH1.F8 Descriptors: frog, anesthesia.


Downes, Hall; Koop, Dennis R.; Klopfenstein, Beth; Lessov, Nickola, (1999), Retention of nociceptor responses during deep barbiturate anesthesia in frogs. *Comparative Biochemistry and Physiology Comparative Pharmacology*
NAL Call no: QP901.C6
Descriptors: frogs, barbiturate anesthesia, responses.

NAL Call no: 396.8 J82
Descriptors: amphibians, pain, opioids, amphibians.

NAL Call no: QP901.E8
Descriptors: analgesia, opioids, amphibians.

NAL Call no: QP901.E8
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NAL Call no: QP901.E8
Descriptors: analgesia, opioids, amphibians.

NAL Call no: QP901.E8
Descriptors: analgesia, opioids, amphibians.
NAL Call no: QP901.P4
Descriptors: frogs, analgesia, opioids, hypothenmia.

NAL Call no: SF405.5.A23
Descriptors: analgesic effects, xylazine, flunixin, frogs.

NAL Call no: 442.8 L62
Descriptors: amphibians, opioids, effects.

NAL Call no: 442.8 L62
Descriptors: amphibians, opioid, adrenergic effects.

Avian


NAL Call no: 41.8 AC83
Descriptors: injectable anaesthetics, dosage, ketamine, peafowl.

NAL Call no: 410 Z73
Descriptors: birds, avian, analgesics.

NAL Call no: QL55.15
Descriptors: anaesthesia, analgesia, drug combinations, avian species.

NAL Call no: SF914.A53 1990
Descriptors: birds, laboratory animals, anesthesia.

NAL Call no: 410 J825
Descriptors: avian, chemical irritants, prostaglandin, analgesics.

NAL Call no: SF96.Z66 1999
Descriptors: birds, avian, analgesia.

Descriptors: birds, analgesia, avian.

NAL Call no: 41.8 Am3A
Descriptors: chickens, opium alkaloids, analgesics, drug combinations.

NAL Call no: 41.8 V641
Descriptors: birds, steroid anaesthetic.

NAL Call no: 410 Z73
Descriptors: isoflurane, butorphanol, flunixin, Psittiformes.

NAL Call no: SF911.V43
Descriptors: anaesthesia, inhaled, isoflurane, cockatoos.
NAL Call no: SF911.V43
Descriptors: analgesia, cockatoos, butorphanol.

NAL Call no: SF605.A4
Descriptors: anesthesia, companion birds.

NAL Call no: QP351.N3
Descriptors: chicken, analgesia.

NAL Call no: QP901.P4
Descriptors: articular pain, domestic fowl, opioid.

Descriptors: birds, animal welfare, pain.

NAL Call no: 41.8 AU72
Descriptors: analgesia, chickens, beak trimming.

Descriptors: pigeons, fentanyl, morphine treatment.

NAL Call no: SF994.A95 1997
Descriptors: avian, anesthesia, analgesia.

NAL Call no: 41.8 R312
Descriptors: local analgesics, pretreatment, domestic fowl, articular pain.

NAL Call no: 41.8 V641
Descriptors: anesthesia, owls, Strigiformes.

Descriptors: morphine, hypo and hyperalgesia, domestic fowl.

NAL Call no: QP901.P4
Descriptors: morphine, heat, pain perception, analgesia, fowl.

Descriptors: poultry, ketamine, medetomidine, injectable anaesthetics.

Descriptors: analgesia, ducks, intravenous.

NAL Call no: 41.8 V641
Descriptors: carprofen, chickens, lameness, analgesia.

NAL Call no: 41.8 Am3A
Descriptors: chicken, ketamine, dose response.

Descriptors: analgesics, African grey parrots.

Descriptors: analgesics, African grey parrots.

Descriptors: pain, analgesia, drugs, birds.

Descriptors: analgesics, pigeons, discrimination learning.

NAL Call no: 41.8 Am3A
Descriptors: ketamine, great horned owls, response, anaesthesia.

NAL Call no: 310.9 P94
Descriptors: butorphanol, anesthetic, turkeys.

NAL Call no: SF601.A47
Descriptors: anaesthesia, broiler chickens.

Descriptors: ketamine, diazepam, combination, chickens, anaesthetic.


Fish/ Crabs/ Snails/ Shrimp/ Molluscs/ Shellfish

NAL Call no: QP1.P4
Descriptors: pain suppression, chicken, naloxone, reversal.
NAL Call no: SH1.B78
Descriptors: anesthesia, stress, trout.

NAL Call no: SH1.C32
Descriptors: anaesthetics, Salmonidae.

NAL Call no: QL64.4J68
Descriptors: anaesthesia, rainbow trout, respiration.

NAL Call no: SH1.A6
Descriptors: anesthesia, squid, transportation.

NAL Call no: QL55.A1L3
Descriptors: anaesthesia, circulation, fish.

NAL Call no: SF601.V523
Descriptors: tropical fish, anesthesia.

NAL Call no: QL55.A1L3
Descriptors: anesthesia, recirculating systems.

NAL Call no: QP901.C6
Descriptors: oxygen consumption, anesthetic, ketamine, fish.

NAL Call no: SH1.A6
Descriptors: anaesthetics, lidocaine, fish.

Descriptors: tropical fish, anesthesia, cold.

NAL Call no: SH1.A6
Descriptors: oysters, anesthesia.

NAL Call no: SH157.7.I58 no. 87
Descriptors: Benzoica, anaesthetic, fish.

NAL Call no: QP901.P4
Descriptors: naloxone, analgesia, pain perception.

Descriptors: anaesthesia, Pinctada, oysters, MS 222.

NAL Call no: QL76.5.U6A472
Descriptors: anesthetic, fish, quinaldine.

NAL Call no: QL336.Z6
Descriptors: benzoica, freshwater fish, anesthetic.

NAL Call no: QP901.C6
Descriptors: anaesthetics, marine mollusces, squid.

NAL Call no: SH157.7.I58 no.49
Descriptors: quinaldine, fish, anesthetic.
Descriptors: anaesthetics, octopuses.

NAL Call no: SH1.A6
Descriptors: anaesthetics, salmonids, ketamine hydrochloride.

Descriptors: salmonids, electrical anestheisa.

NAL Call no: QH541.5.W3A6
Descriptors: benzocaine, catfish, disposition.

NAL Call no: SH157.7.I58 no. 29.
Descriptors: anesthetics, salmonids, anesthesia, methylpentynol.

NAL Call no: SH219.N66
Descriptors: anesthesia, fish, fish biology.

NAL Call no: SH1.F8
Descriptors: anesthetics, effects, rainbow trout.

Descriptors: anaesthesia, lake trout, MS 222.


NAL Call no: SHI1.F8
Descriptors: anaesthetics, sedatives, fish.

NAL Call no: SHI1.F8
Descriptors: anaesthetics, sedatives, fish.

Descriptors: anaesthesia, lobster, transportation.

NAL Call no: TC1505.P33 1995
Descriptors: anaesthetic, fish.

Descriptors: fish, anaesthetic, sedative.

NAL Call no: QP901.C6
Descriptors: fish physiology, anaesthetics.

NAL Call no: SF601.V535
Descriptors: fishes, anesthesia.

NAL Call no: SH157.7 no. 22 ISBN: 0901636525
Descriptors: quinaldine, anesthetic, fish.

ISSN: 0022-1112.
NAL Call no: QL614.J68
Descriptors: fish physiology, anaesthetics.

Descriptors: clove oil, anesthetic, fish.

NAL Call no: SHI1.F8
Descriptors: anaesthetics, sedatives, fish.

NAL Call no: TC1505.P33 1995
Descriptors: anaesthetic, fish.

NAL Call no: QP1.P4
Descriptors: magnetic fields, analgesia, snail.

NAL Call no: Film S-1779
Descriptors: analgesia, crab.

Descriptors: medetomidate, anesthetic, fish.


Mice


Banerjee, Dhirit; Sarkar, Nimral Kumar, (1997), Haematological changes in buprenorphine-treated mice. Folia Biologica Cracov. v. 45 (3-4), p. 157-162. ISSN: 0015-5497. NAL Call no: 442.8 F71 Descriptors: buprenorphine, haematology, mice.


Agonist effects and mu receptor involvement. Butorphanol-mediated antinociception in mice: Partial
Stoner, Joanne M.; Wessinger, William D., (1997), Garner, H.R.; Burke, Timothy F.; Lawhorn, C. David;
Descriptors: propofol, ethanol, anesthetic, mouse.

Pertussis toxin blockade of the opioid analgesia in mice. Alfaro, M. Jose; Martin, M., (1999),
Goicoechea, Carlos; Ormazabal, M; Jesus; Abalo, Raquel;
Descriptors: butorphanol, mice, effects, mu receptors.

Acute ethanol exposure decreases the analgesic potency of morphine in mice. Duttaroy,
Alokesh; Kirtman, Randi; Farrell, Frank; Phillips, Mark; Phillipe, Jacques; Monderson, Thesselon;
NAL Call no: QP901.P4
Descriptors: morphine, mice, cumulative dosing.

Acute ethanol exposure decreases the analgesic potency of morphine in mice. Life Sciences. v. 62 (2), p. 35-41. ISSN: 0022-3205.
NAL Call no: 442.8 L62
Descriptors: ethanol, analgesic potency, mice.

Descriptors: fentanyl, pain, mouse.

Propofol and ethanol produce additive hypnotic and anesthetic effects in the mouse. Anesthesia and Analgesia. v. 83 (1), p. 156-161.
Descriptors: propofol, ethanol, anesthetic, mouse.

NAL Call no: 396.8 J82
Descriptors: butorphanol, mice, effects, mu receptors.

NAL Call no: QP351.N3
Descriptors: calcitonin, pertussis toxin blockade, opioid analgesia, mice.

Descriptors: intrathecal, morphine, mouse.

NAL Call no: QP351.N3
Descriptors: non-opioid effects, kyotorphin, mice.

NAL Call no: 442.8 IN2
Descriptor: sumatriptan, antinociceptive effect, mice.

Descriptors: sch 32615, analgesia, mice.

Descriptors: doxapram, acetaminophen toxicity, mice.

NAL Call no: QP901.E8
Descriptors: dihydroetorphine, antinociceptive effect, diabetic mice.

NAL Call no: QP901.E8
Descriptors: matrine, mice, antinociceptive effects.

Stress induced opioid analgesia and activity in deer mice: Sex and population

Descriptors: circadian rhythm, mice, pain.


Descriptors: mu opioid receptors, mice, analgesia.


Descriptors: peripheral orphanin, analgesia, mouse.


Descriptors: circadian rhythm, mice, pain.


Descriptors: effects, methamphetamine, cocaine, morphine, mice.

Li, Jin; Li, Xin; Pei, Gang; Qin, Bo Yi (1999). **Analgesic effect of agmatine and its enhancement on morphine analgesia in mice.** *Acta Pharmacologica Sinica.* v. 20 (1), p. 81-85. ISSN: 0253-9756.

Descriptors: agmatine, morphine, enhancement, mice.

Loh, Horace H.; Liu, Hsien Ching; Cavalli, Antonella; Yang, Wanling; Chen Yuh Fung; Wei, Li Na (1998). **Mu opioid receptor knockout in mice: Effects on ligand-induced analgesia and morphine lethality.** *Molecular Brain Research.* v. 54 (2), p. 521-326. ISSN: 0169-328X.

Descriptors: mu opioid receptors, mice, analgesia.


Descriptors: mice, analgesics, pain, behavior, experiments.


Descriptors: morphine, analgesia, tolerance, mice.


Descriptors: analgesia, morphine, pain perception.


Descriptors: mice, analgesics, selective breeding.


Descriptors: induced analgesia, wild mice, laboratory mice.


Descriptors: analgesics, tetrahydrocannabinol.


Descriptors: new techniques, surgery, anesthesia, mouse.


Descriptors: mice, stress, morphine, analgesia, diurnal variations.

Nagata, Takahisa; Masaoka, Toshiro; Akabori, Fumiaki (1991). **Analgesia induced by various stress in mice:**
NAL Call no: SF600.A92
Descriptors: stress, analgesia, mice, opioid.

NAL Call no: RMI.C63
Descriptors: pupil diameter, pain, drugs, mice.

Descriptors: glaucine, rats, mice, effects.

Language: Japanese.
Descriptors: analgesics, mice, circadian rhythm.

NAL Call no: RMI.C63
Descriptors: procaine, lidocaine, dimethocaine, nociception, mice.

NAL Call no: 442.8 L62
Descriptors: morphine tolerant mice, antinociceptive synergism.

NAL Call no: 396.8 J825
Descriptors: transdermal delivery, analgesics, mouse skin, cadaver.

NAL Call no: Q1.14
Descriptors: analgesia, cold, oxygen/helium, mice.

Language: Japanese.
Descriptors: morphine, mu receptors, mice.

Descriptors: modulation, morphine, mice, analgesia.

NAL Call no: Q935.L3
Descriptors: venlafaxine, mice, opioid, adrenergic, mechanisms.

NAL Call no: Q930.1.P4
Descriptors: morphine, mice, behavior.

NAL Call no: Q930.1.P4
Descriptors: intracellular calcium, morphine tolerance, mice.

NAL Call no: 450.P697
Descriptors: analgesics, smilaxin, medicinal plants, mice.

NAL Call no: RMI.C63
Descriptors: hydrocortisone, effects, aspirin, mice.

Tayfun, Uzbay; Cinar, Mehtap G.; Aytemir, Mutlu; Tuglular, Isik, (1999), Analgesic effect of tianeptine in mice. Life Sciences. v. 64 (15), p. 1313-1319. ISSN: 0022-3205.
NAL Call no: 442.8 L62
Descriptors: tianeptine, analgesic effect, mice.
Rabbits & Rodents


Descriptors: rabbits, hyoscymamine, conjunctival reflex test.


NAL Call no: SF914.A53 1990

Descriptors: rabbits, anesthetics, analgesics.


NAL Call no: 41.8 AM3A

Descriptors: rabbits, sheep, rabbits, analgesics, species differences.


Descriptors: rabbits, lower esophageal sphincter, relaxation.


NAL Call no: QL55.A1L3

Descriptors: rabbits, mice, rabbits, pain, analgesics, anti-inflammatory agents.


NAL Call no: 410.9 P94

Descriptors: New Zealand white rabbits, anesthetics, ketamine, fentanyl, propofol.


NAL Call no: 410.9 P94

Descriptors: anesthetics, fentanyl, intravenous, rabbits, analgesia, assessment.


ISSN: 0023-6772.

NAL Call no: QL55.A1L3

Descriptors: new zealand white rabbits, anesthesia, ketamine, propofol, potency.


NAL Call no: 41.8 AM3A

Descriptors: rabbits, analgesics, pharmacokinetics, half-life, injection.


NAL Call no: 410.9 P94

Descriptors: rabbits, anesthetics, ketamine, xylazine, drug combinations, duration.


NAL Call no: QL55.A1L3

Descriptors: rabbits, buprenorphine, disease, effect.


NAL Call no: 41.8 IN2

Descriptors: rabbits, anaesthesia, ketamine, medetomidine.


Descriptors: rabbits, epidural anesthesia, prolongation, lidocaine.


Descriptors: rabbits, electro-acupuncture, analgesia.


Descriptors: pain, analgesia, rabbits.

ISSN: 0023-6772. Ref.
NAL Call no: QL55.A1L3
Descriptors: rabbits, anesthesia, neuroleptics, drug combinations.

NAL Call no: QL55.A1L3
Descriptors: rabbits, analgesia, analgesics, dosage effect.

NAL Call no: SF407.R6R63 1994

Rats

NAL Call no: 41.8 V641
Descriptors: rats, pain, analgesics, drug effects.

NAL Call no: RS164.P59
Descriptors: medicinal plants, edema, analgesics, rats, pain, rubiaceae.

NAL Call no: RB127.P34
Descriptors: morphine, local, infant rats, effect.

NAL Call no: QL55.A1L3
Descriptors: injectable anaesthetics, rats.

Descriptors: intrathecal ketamine, rat, decrease, neuropathic pain behavior.

NAL Call no: RB127.P34
Descriptors: rats, analgesics assays, animal behavior.

NAL Call no: Film S-1779
Descriptors: analgesia, rats, opiate, NMDA process.

NAL Call no: 410.9 P94
Descriptors: analgesics, rats, pica, buprenorphine.

NAL Call no: SF405.5 A23
Descriptors: rats, acetaminophen, analgesics, drinking water.

NAL Call no: RB127.P34
Descriptors: rats, analgesics, diabetes, pain drug effects.

NAL Call no: 396.8 B77

Descriptors: rats, surgery, anesthesia, halothane, locomotion, food and water intake.


Descriptors: analgesia, pain perception, drug tolerance, hypoalgesia, rats.


Language: German with a summary in English.

NAL Call no: DISS F1994069

Descriptors: rat brain, neurotransmitters, dopamine, noradrenaline, effects.


Descriptors: rats, analgesics, pain, ketoprofen, oral administration.


Descriptors: rats, surgery, anesthesia, halothane, locomotion, food and water intake.


Descriptors: analgesia, pain perception, drug tolerance, hypoalgesia, rats.


Language: German with a summary in English.

NAL Call no: DISS F1994069

Descriptors: rat brain, neurotransmitters, dopamine, noradrenaline, effects.


Descriptors: rats, anesthetics.


NAL Call no: Film S-1779

Descriptors: rat, sex differences, cocaine, nicotine, analgesics.


Descriptors: rats, alcohol, analgesia.


NAL Call no: Film S-1779

Descriptors: pain, analgesia, sensory systems, rat.
NAL Call no: 41.8 V64
Descriptors: rats, analgesics, audible, ultrasonic, pain.

NAL Call no: QP901.P4
Descriptors: physical activity, sensitivity, morphine tolerance, rats.

NAL Call no: 410.9 P94
Descriptors: rats, flunixin, overdoses, drug toxicity, adverse effects.

NAL Call no: QP901.C6
Descriptors: method, analgesic effect, detecting, pain, rat.

Descriptors: rats, analgesic, agmatine, morphine, enhancement.

NAL Call no: 442.8 L62
Descriptors: morphine, tolerance, rats, arthritic.

NAL Call no: QL55 A1L3
Descriptors: rats, morphine, naltrexone, oral administration, analgesia, pain.

NAL Call no: SF915.J63
Descriptors: rats, flunixin, analgesics, pain, laparotomy, drug combinations.

NAL Call no: 41.8 V64
Descriptors: pain, surgery, rats, analgesics.

NAL Call no: QL55 A1L3
Descriptors: rats, anesthesia, halothane, analgesics, food and water consumption.

NAL Call no: RM300.J6
Descriptors: analgesic drugs, effects, rat, pain.

NAL Call no: 396.8 J82
Descriptors: pain, inflammation, rats, kappa-opioid, agonist, effects.

Infant rats II: Responses to carrageenan and capsaicin.

Fitzgerald, Maria, (1999),
Marsh, Deborah; Dickenson, Anthony; Hatch, David;
Fitzgerald, Maria, (1999),

Nal Call no: RB127.P34

Descriptors: infant rats, opioid, analgesia, response.

Infant rats I: Mechanical and heat responses.

Fitzgerald, Maria, (1999),
Marsh, Deborah; Dickenson, Anthony; Hatch, David;
Fitzgerald, Maria, (1999),
Rats, traditional medicine, Brazil.

Descriptors: rats, traditional medicine, Brazil.

Descriptors: analgesia, non-steroidal, anti-inflammatory, combinations, rats.


NAL Call no: QP1.P4

Descriptors: rats, suckling, undernutrition, analgesics.


NAL Call no: QL737.R666 W38

Descriptors: surgical techniques, experimental techniques, rat.


NAL Call no: QL55.A1L3

Descriptors: anaesthesia technique, rats, mice, etorphine-methotrimeparazine, midazolam.


NAL Call no: QL785.A725

Descriptors: pain, rats.


NAL Call no: RB127.P34

Descriptors: rats, oxytocin, pain, drug effects, heat.


NAL Call no: RS122.A115

Descriptors: prolonged local anesthetic, bupivacaine, rats.


NAL Call no: RB127.P34

Descriptors: morphine, analgesia, rats.

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Disclaimers

The Animal Welfare Information Center, awic@nal.usda.gov
May 23, 2002