It is the policy of the IACUC that appropriate analgesic agents will be administered to animals utilized in approved research and teaching protocols. The analgesics listed in this SIG are guidelines from the DACT veterinary staff. We strongly recommend you discuss analgesic choices with the DACT veterinarians prior to submitting your protocol to determine the most effective analgesic regime for your project.

General Information

1. The process of pain stimulation, transmission, perception, and reaction is complex and varies greatly between species and even on an individual basis. Neuroanatomy and physiology is similar among most mammals. While the data for non-mammalian vertebrates is limited, it is best to assume that these species can also experience pain in a similar manner.

2. DACT veterinarians are available for consultation and training on proper analgesic usage and techniques.

3. According to the Animal Welfare Act (AWA), which covers mammals other than laboratory rats and mice, a painful procedure is defined as “...any procedure that would reasonably be expected to cause more than slight and momentary pain or distress in a human being to which that procedure was being applied.” The Office of Laboratory Animal Welfare’s (OLAW’s) Public Health Service Policy on Humane Care and Use of Laboratory Animals, which can cover all vertebrates, states that “unless the contrary is established, investigators should consider that procedures that cause pain or distress in human beings may cause pain or distress in other animals.” Many species of animals may not show obvious responses to painful stimuli, and the interpretation of the lack of such responses is difficult. Thus, it is best to use a generous assessment of the potential for a procedure to cause pain and to use analgesics when the presence of pain is uncertain.

4. Withholding the use of analgesic agents for procedures known or reasonably suspected to cause pain must be scientifically justified and approved by the IACUC. Even in cases where a scientific justification is provided and accepted by the IACUC, the experimental protocol that induces the pain and distress should be revisited on an annual basis to ascertain whether alternative approaches, drugs, or endpoints can be developed and implemented.

Choice of Analgesic Agents

1. The recommended analgesic agents, dosages, and routes of administration originate from a number of different sources including:

2. The tables below identify the analgesic agents (along with appropriate dosages, routes of administration, and duration of effect) recommended for the various species used in research/teaching protocols at ASU. Categories of analgesic agents include:

A. Narcotics (work at the level of the brain and spinal cord)
   a. opioid agonists
      i. provide substantial analgesia
      ii. depress cardiovascular and respiratory activity
   b. opioid agonist-antagonists
      i. provide moderate to substantial analgesia
      ii. do not depress cardiovascular and respiratory activity

B. Non-steroidal anti-inflammatory drugs (NSAIDs)
   a. provide mild to moderate analgesia
   b. may have antipyretic effects
   c. decrease inflammation

C. Local analgesics (works at the site of administration)
   a. Provides analgesia only at the site administered (unless used as a regional nerve block)

Note – because analgesics can work at different sites of the pain pathway (locally, spinal cord, brain), concurrent use of drugs acting at different sites (i.e., multi-modal analgesia) is highly recommended.

Recommended Analgesics by Species

<table>
<thead>
<tr>
<th>Species</th>
<th>Drug Type</th>
<th>Drug Name</th>
<th>Dose</th>
<th>Route</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>Opioid</td>
<td>Buprenorphine</td>
<td>0.05-0.10 mg/kg</td>
<td>IP, SC</td>
<td>q6-12h</td>
</tr>
<tr>
<td></td>
<td>Opioid</td>
<td>Buprenorphine SR</td>
<td>0.5-1.0 mg/kg</td>
<td>SC</td>
<td>Lasts 72 hrs</td>
</tr>
<tr>
<td></td>
<td>NSAID</td>
<td>Meloxicam</td>
<td>1-5 mg/kg</td>
<td>SC, PO</td>
<td>q24h</td>
</tr>
<tr>
<td></td>
<td>Local</td>
<td>Bupivacaine (Marcaine®) 0.25%</td>
<td>max of 2.5 mg/kg</td>
<td>topical, infiltrate</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>NSAID</td>
<td>Carprofen</td>
<td>5 mg/kg</td>
<td>SC</td>
<td>q24h</td>
</tr>
<tr>
<td></td>
<td>NSAID</td>
<td>MediGel CPF (carprofen)</td>
<td>5mg/kg/day</td>
<td>oral</td>
<td>ad lib</td>
</tr>
<tr>
<td>Rat</td>
<td>Opioid</td>
<td>Buprenorphine</td>
<td>0.02-0.5 mg/kg</td>
<td>IP, SC</td>
<td>q6-12h</td>
</tr>
<tr>
<td></td>
<td>Opioid</td>
<td>Buprenorphine SR</td>
<td>1.0-1.2 mg/kg</td>
<td>SC</td>
<td>Lasts 72 hrs</td>
</tr>
<tr>
<td></td>
<td>NSAID</td>
<td>Meloxicam</td>
<td>1-2 mg/kg</td>
<td>SC, PO</td>
<td>q24h</td>
</tr>
<tr>
<td></td>
<td>Local</td>
<td>Bupivacaine (Marcaine®) 0.25%</td>
<td>max of 2.5 mg/kg</td>
<td>topical, infiltrate</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>NSAID</td>
<td>Carprofen</td>
<td>5 mg/kg</td>
<td>SC</td>
<td>q24h</td>
</tr>
<tr>
<td></td>
<td>NSAID</td>
<td>MediGel CPF (carprofen)</td>
<td>5mg/kg/day</td>
<td>oral</td>
<td>ad lib</td>
</tr>
<tr>
<td>Macaque</td>
<td>Opioid</td>
<td>Buprenorphine</td>
<td>0.01-0.03 mg/kg</td>
<td>SC, IM</td>
<td>q6-12h</td>
</tr>
<tr>
<td></td>
<td>Opioid</td>
<td>Buprenorphine SR</td>
<td>0.2 mg/kg</td>
<td>SC</td>
<td>Lasts 72 hrs</td>
</tr>
<tr>
<td></td>
<td>Opioid</td>
<td>Oxymorphone</td>
<td>0.15 mg/kg</td>
<td>SC, IM, IV</td>
<td>q4-6h</td>
</tr>
<tr>
<td></td>
<td>Opioid</td>
<td>Hydromorphone</td>
<td>0.05-0.2 mg/kg</td>
<td>SC, IM, IV</td>
<td>q4-6h</td>
</tr>
<tr>
<td></td>
<td>Opioid-</td>
<td>Tramadol</td>
<td>2 mg/kg</td>
<td>PO</td>
<td>q12h</td>
</tr>
<tr>
<td>Species</td>
<td>Opioid</td>
<td>Dose Range</td>
<td>route</td>
<td>Duration</td>
<td></td>
</tr>
<tr>
<td>-----------------</td>
<td>-------------</td>
<td>------------------</td>
<td>-------</td>
<td>----------</td>
<td></td>
</tr>
<tr>
<td>Marmoset</td>
<td>Buprenorphine</td>
<td>0.005-0.01 mg/kg</td>
<td>SC, IM</td>
<td>q8-12h</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Oxymorphone</td>
<td>0.025-0.075 mg/kg</td>
<td>SC, IM</td>
<td>q4-6h</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tramadol</td>
<td>2 mg/kg</td>
<td>PO</td>
<td>q12h</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Meloxicam</td>
<td>0.2 mg/kg once, then 0.1 mg/kg</td>
<td>SC, PO</td>
<td>q24h</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Acetaminophen (Tylenol)</td>
<td>5-10 mg/kg</td>
<td>SC, PO</td>
<td>q6-12h</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bupivacaine (Marcaine®) 0.25%</td>
<td>1 mg/kg (max of 2.5 mg/kg)</td>
<td>topical, infiltrate</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Rabbit</td>
<td>Buprenorphine</td>
<td>0.01-0.05 mg/kg</td>
<td>SC, IP, IV</td>
<td>q6-12h</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Butorphanol</td>
<td>0.1-0.5 mg/kg</td>
<td>SC, IM, IV</td>
<td>q4-6h</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Meloxicam</td>
<td>0.2-0.3 mg/kg</td>
<td>SC, PO</td>
<td>q24h</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bupivacaine (Marcaine®) 0.25%</td>
<td>1 mg/kg (max of 2.5 mg/kg)</td>
<td>topical, infiltrate</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Guinea Pig/Chinchilla</td>
<td>Buprenorphine</td>
<td>0.05-0.1 mg/kg</td>
<td>SC</td>
<td>q6-12h</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Meloxicam</td>
<td>0.5 mg/kg</td>
<td>SC, PO</td>
<td>q24h</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bupivacaine (Marcaine®) 0.25%</td>
<td>max of 2.5 mg/kg</td>
<td>topical, infiltrate</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Cat</td>
<td>Buprenorphine</td>
<td>0.01-0.03 mg/kg</td>
<td>IM</td>
<td>q6-8h</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Buprenorphine SR</td>
<td>0.12 mg/kg</td>
<td>SC</td>
<td>Lasts 72 hrs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hydromorphone</td>
<td>0.05-0.1 mg/kg</td>
<td>SC, IM, IV</td>
<td>q4-6h</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Meloxicam</td>
<td>0.3 mg/kg</td>
<td>SC</td>
<td>Once</td>
<td></td>
</tr>
<tr>
<td>*Bird</td>
<td>Butorphanol</td>
<td>0.5-4.0 mg/kg</td>
<td>IM</td>
<td>q1-4h</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Meloxicam</td>
<td>0.1-0.2 mg/kg</td>
<td>IM, PO</td>
<td>q24h</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lidocaine gel</td>
<td>2%</td>
<td>topical</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>**Amphibians</td>
<td>Butorphanol</td>
<td>0.2-0.4 mg/kg</td>
<td>IM</td>
<td>q4-6h; efficacy uncertain</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lidocaine gel</td>
<td>2%</td>
<td>topical</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>**Reptiles</td>
<td>Bupivacaine (Marcaine®) 0.25%</td>
<td>1-2 mg/kg (max of 4 mg/kg)</td>
<td>topical, infiltrate</td>
<td>N/A</td>
<td></td>
</tr>
</tbody>
</table>
* There is wide variation in drug dosages depending on different bird species. Consult with the DACT veterinarians for dosages specific to your project.

**The effectiveness of analgesics in amphibians and reptiles is poorly known, and many doses in the literature have limited, if any, evidence to support them as being safe and effective. Consult with the DACT veterinarians for the appropriateness of analgesics for your specific project.

Drug Enforcement Agency (DEA) schedule for controlled substances listed in the table:
- Buprenorphine schedule 3
- Buprenorphine SR schedule 3
- Butorphanol schedule 4N
- Hydromorphone schedule 2
- Oxymorphone schedule 2
- Tramadol schedule 4

Other drugs listed in the table are not DEA-controlled substances.