

Pain & Analgesia

analgesia

- αν – negative prefix
- αλγεσσειν – to feel pain

pain

- Pain is an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage.
 - International Association for the Study of Pain

nociception

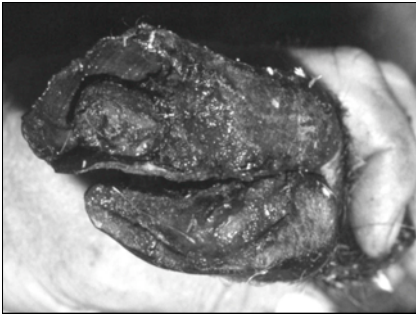
- transmission of pain signals to the cortex
- the sensory component of pain

definitions

- **hyperalgesia**
 - sensation which would normally be slightly painful being very painful
- **allodynia**
 - sensation which would not normally be painful being painful

Do animals feel pain?





Do animals feel pain?

- all mammals have similar
 - nervous structures
 - neurotransmitters
 - responses to noxious stimuli
 - responses to analgesic drugs

pain criteria

- peripheral nociceptors
- cortex or something similar
- opioid receptors in CNS
- response to analgesics
- aversive reaction to noxious stimuli
- aversion not overcome by reward
- response to noxious stimuli persists
- learning
- ie, all vertebrate animals!

invertebrates

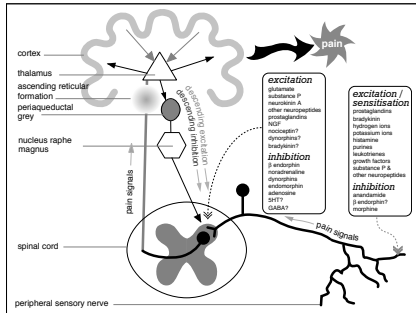
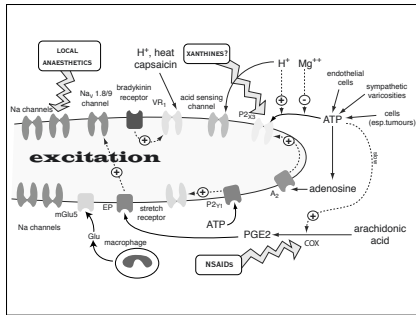
| | cephalopod | insect | earthworm |
|--------------|------------|--------|-----------|
| nociceptors? | - | - | ? |
| cortex | ? | - | ? |
| opioid R | + | + | + |
| analgesics | + | ? | ? |
| persistence | + | - | - |
| learning | + | + | - |

assessing pain

- behaviour
- Not autonomic function
 - only measures stress
- response to analgesics



pain pathways



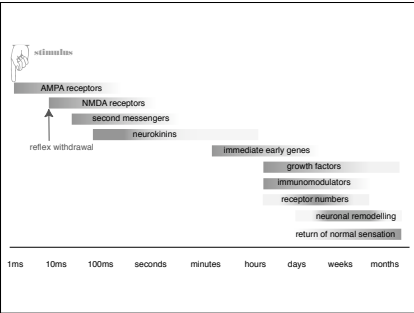
response to injury

- direct stimulation of nociceptors
- descending inhibition & release of inflammatory mediators
- sensitisation of nerve endings
- central sensitisation
- recovery of normal sensation

response to injury

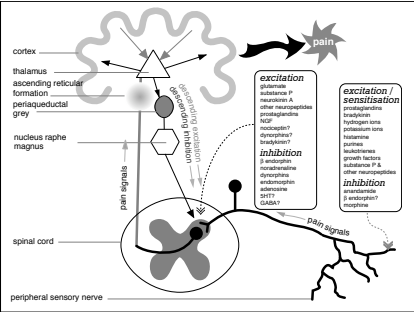
- analgesia?
- acute pain
- chronic pain
- resolution

pain is plastic!



gate theory

- afferent pain signals are not just passed on up the spinal cord
- pain signals are depressed or amplified



gate theory

| transmission | transmitter | receptor | analgesic |
|--------------|---------------|----------|-------------|
| normal | glutamate | AMPA | local |
| enhanced | glutamate | NMDA | ketamine |
| | substanceP | NK1 | capsaicin |
| reduced | encephalins | μ & κ | opioids |
| | endomorphin | μ | opioids |
| | noradrenaline | α2 | α2 agonists |

pain

- nociceptive
- neurogenic

pain

- acute
 - traumatic
 - post-operative
- chronic
 - arthritis
 - tumours

acute pain

- evolutionary advantage
 - promotes learning to avoid harm
- but
 - massive sympathetic stimulation

chronic pain

- immobility can promote healing

analgesia

- treat condition causing pain
- good nursing
- analgesic drugs
- anaesthesia
- euthanasia

analgesia??

- acupuncture
- TENS

pain intensity

pre-operative analgesia

- prevents wind up
 - analgesics more effective
 - longer post op analgesia
 - smoother anaesthetic

analgesic drugs

- opioids
- NSAIDs
- local anaesthetics
- $\alpha 2$ agonists

minor drugs

- NMDA blockers
- anticonvulsants
- capsaicin
- etc, etc

balanced analgesia

- combinations of drugs
- more later

clinical use

- mild pain
 - NSAIDs
- inflammatory pain
 - NSAIDs
- severe pain
 - opioids \pm local
- surgical pain
 - opioids + local + NSAIDs depending on op

What would you do?



- 9 month old cat
- admitted for spay
- fit and healthy
- analgesia?

pain & analgesia

- pain signals are carried from the periphery to the brain by a number of routes
- pain signals are modulated in the spinal cord
- most analgesics interfere with endogenous modulation systems
- pain changes over time – so must treatment
- give drugs before pain starts
- good nursing is very important!
- **If in doubt, give it morphine!**