Pain & Analgesia

analgesia

- αν – negative prefix
- αλγεσειν – 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

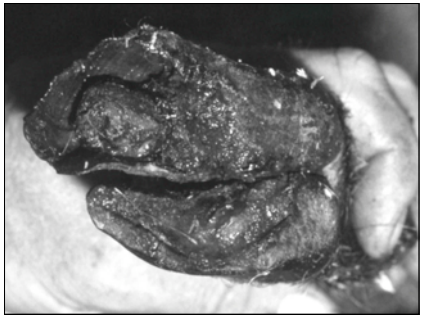
nociception

- 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!

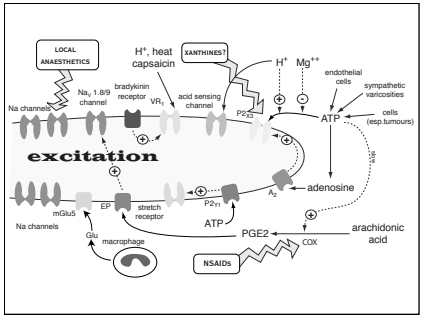
invertebrates

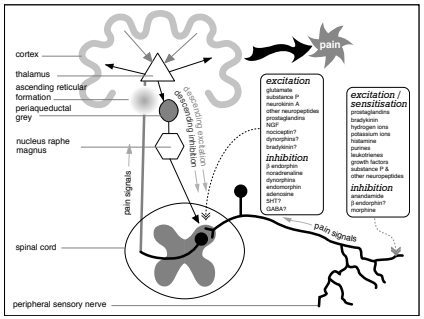
	cephalopod	insect	earthworm
nociceptors	?	-	?
cortex	?	-	?
opioid R	+	+	+
analgesics	+	?	?
persistence	+	-	-
learning	+	+	-

assessing pain

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

pain pathways





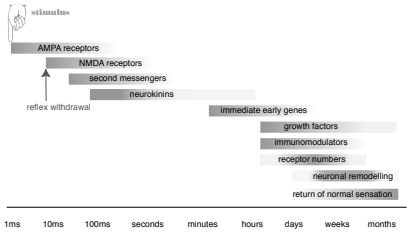
response to injury

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

response to injury

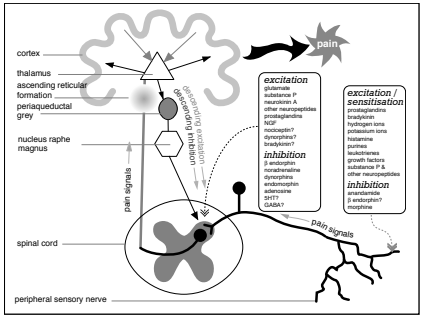
- analgesia?
- acute pain
- chronic pain
- resolution

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	α_2	α_2 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
- α2 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 ± 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!**