

A close-up photograph of a red mushroom with white spots, likely a fly agaric, growing in a field of dry grass. The mushroom has a bright red cap with numerous white, irregular spots. The background is a dense field of dry, yellowish-brown grass.

Pain & Analgesia

A red mushroom with white spots growing in dry grass. The mushroom has a bright red cap with numerous white, irregular spots. It is growing in a field of dry, yellowish-brown grass. The background is slightly blurred, showing more of the same grass.

analgesia

- αν – negative prefix
- αλγεσκειν – to feel pain

A red mushroom with white spots on a bed of dry grass.

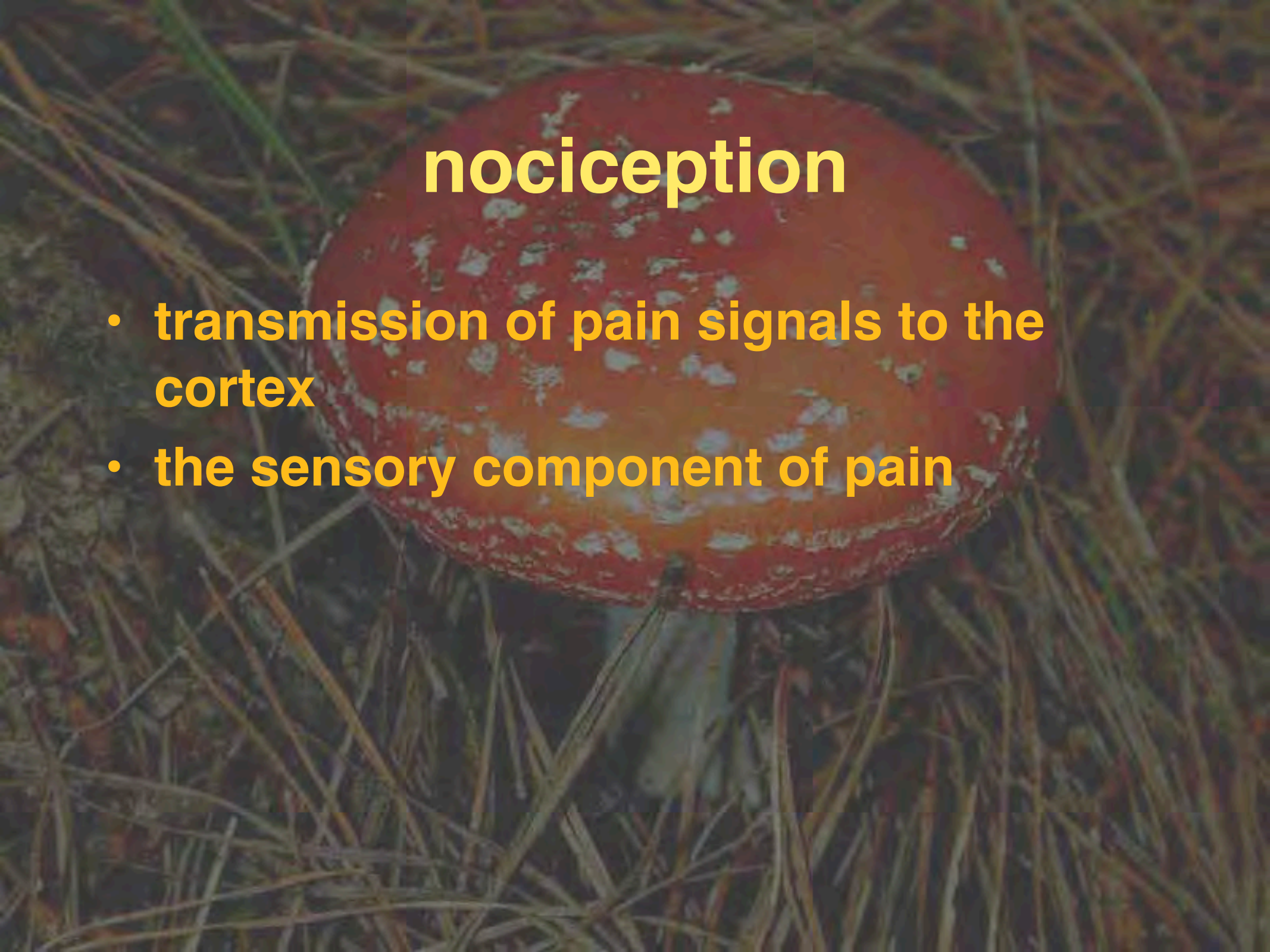
pain

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

A close-up photograph of a red mushroom with white spots, likely an Amanita muscaria, growing in a field of dry grass. The mushroom has a bright red cap with numerous white, irregular spots. The stem is white and appears to be partially buried in the grass. The background is a dense field of dry, yellowish-brown grass.

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	+	+	-

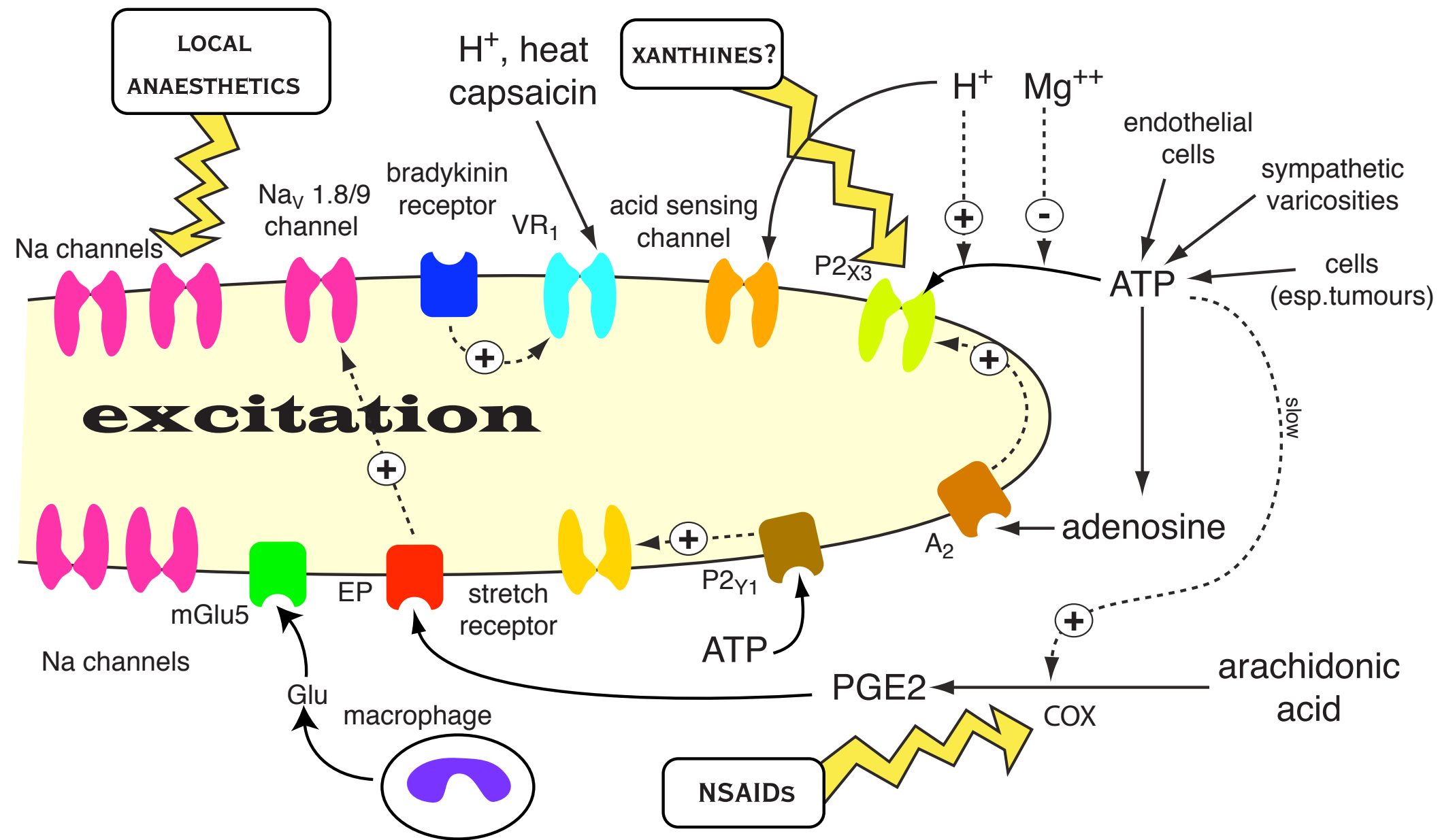
assessing pain

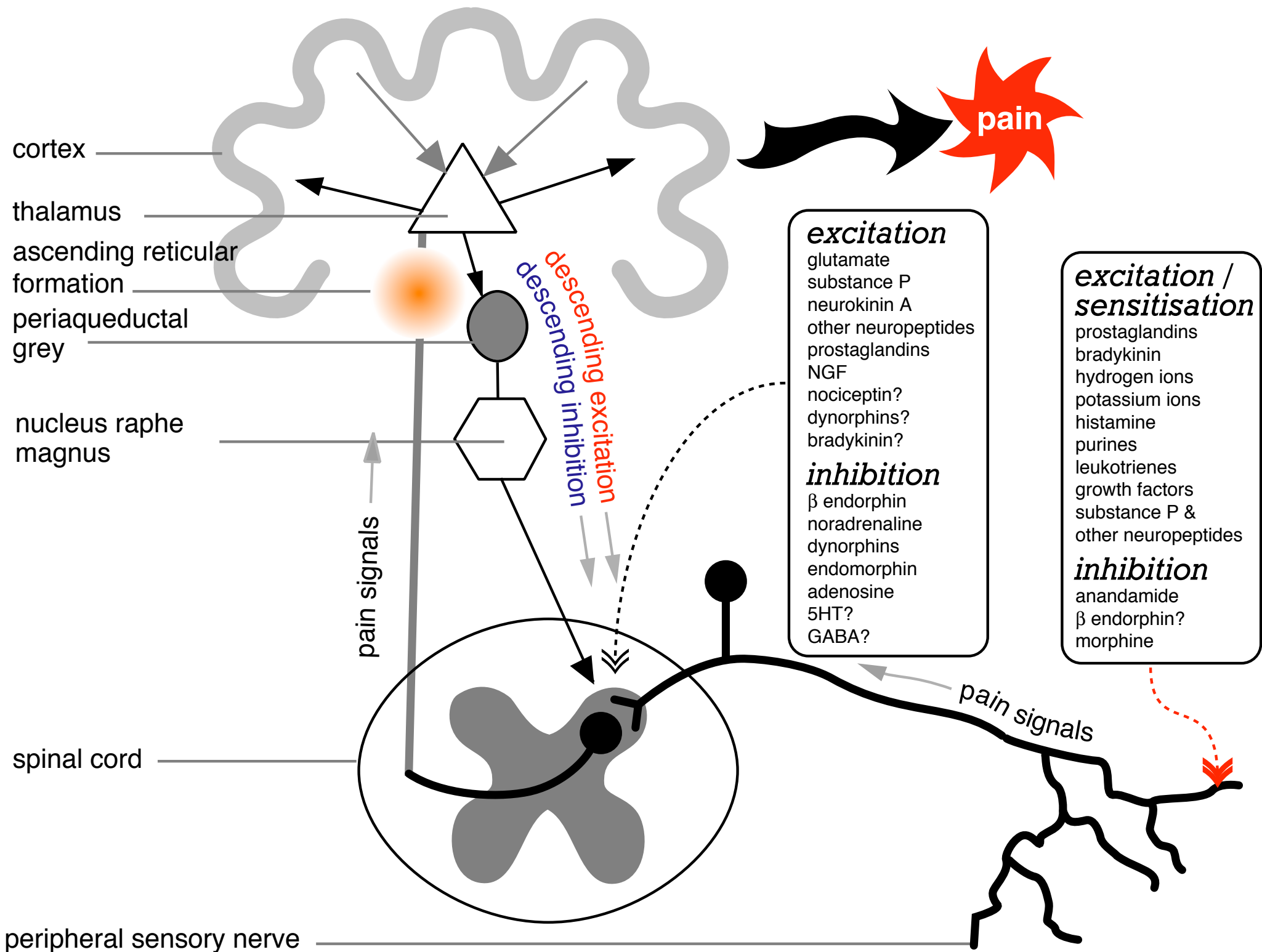
- behaviour
- **Not** autonomic function
 - only measures stress
- response to analgesics



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!



stimulus

AMPA receptors

NMDA receptors

second messengers

neurokinins

immediate early genes

growth factors

immunomodulators

receptor numbers

neuronal remodelling

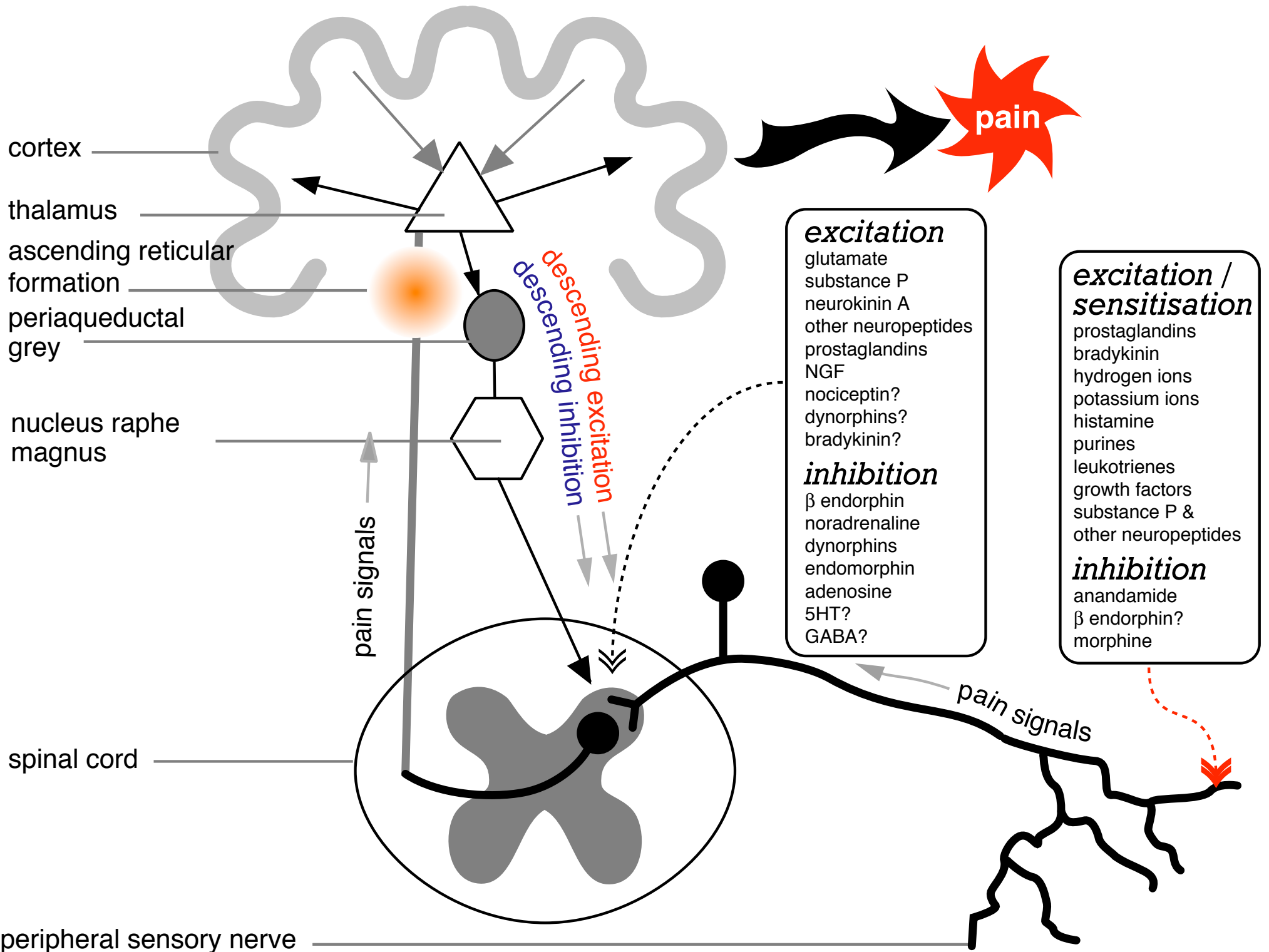
return of normal sensation

reflex withdrawal

1ms 10ms 100ms seconds minutes hours days weeks months

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

A photograph of a red mushroom with white spots, likely an Amanita muscaria, growing in a field of dry grass. The mushroom is the central focus, with its bright red cap and white spots contrasting against the brownish-yellow grass. The text 'pain' is overlaid on the upper part of the mushroom cap.

pain

- **nociceptive**
- **neurogenic**

A red mushroom with white spots, likely an Amanita muscaria, is growing in a field of dry grass. The mushroom has a bright red cap with numerous white, irregular spots. The background is a dense field of dry, yellowish-brown grass.

pain

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

A red mushroom with white spots, likely an Amanita muscaria, is the central focus of the image. It is growing in a field of dry, brown grass. The mushroom's cap is bright red with numerous white, irregular spots. The stem is white and appears to have some fine hairs. The background is a dense field of dry grass, slightly out of focus.

acute pain

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

A red mushroom with white spots, likely an Amanita muscaria, is growing in a field of dry, yellowish-brown grass. The mushroom has a bright red cap with numerous white, irregular spots. Its stem is thick and appears to be a pale, almost white color. The background is a dense field of dry grass, some of which is green at the base. The overall lighting is soft, suggesting an overcast day or a shaded area.

chronic pain

- **immobility can promote healing**

A red mushroom with white spots, likely a fly agaric, is growing in a field of dry grass. The mushroom is the central focus of the image, with its bright red cap and white spots contrasting sharply with the dry, brownish-yellow grass. The text 'analgesia' is overlaid on the upper part of the mushroom's cap in a bold, yellow font.

analgesia

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

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analgesia??

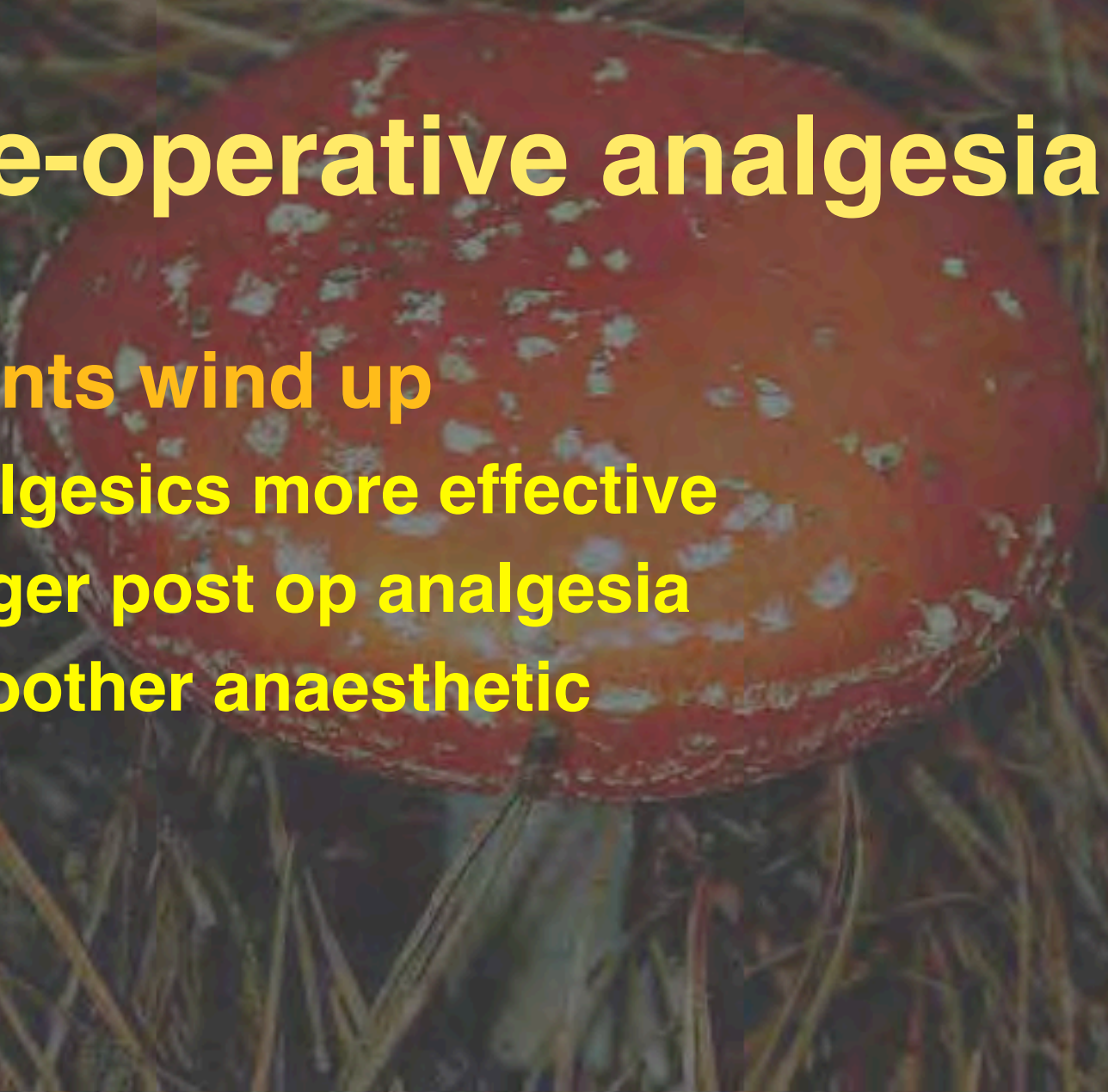
- acupuncture
- TENS

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



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minor drugs

- **NMDA blockers**
- **anticonvulsants**
- **capsaicin**
- **etc, etc**

balanced analgesia

- combinations of drugs
- more later



A red mushroom with white spots, likely a fly agaric, is the central visual element. It is positioned in the upper right quadrant of the slide. The background is a dark, textured surface of dry grass or straw. The text is overlaid on the left side of the image.

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!**