

Neuromuscular Junction

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 dry, brownish-yellow grass. The text 'Neuromuscular Junction' is overlaid in a bold, yellow font across the middle of the image.

NMJ

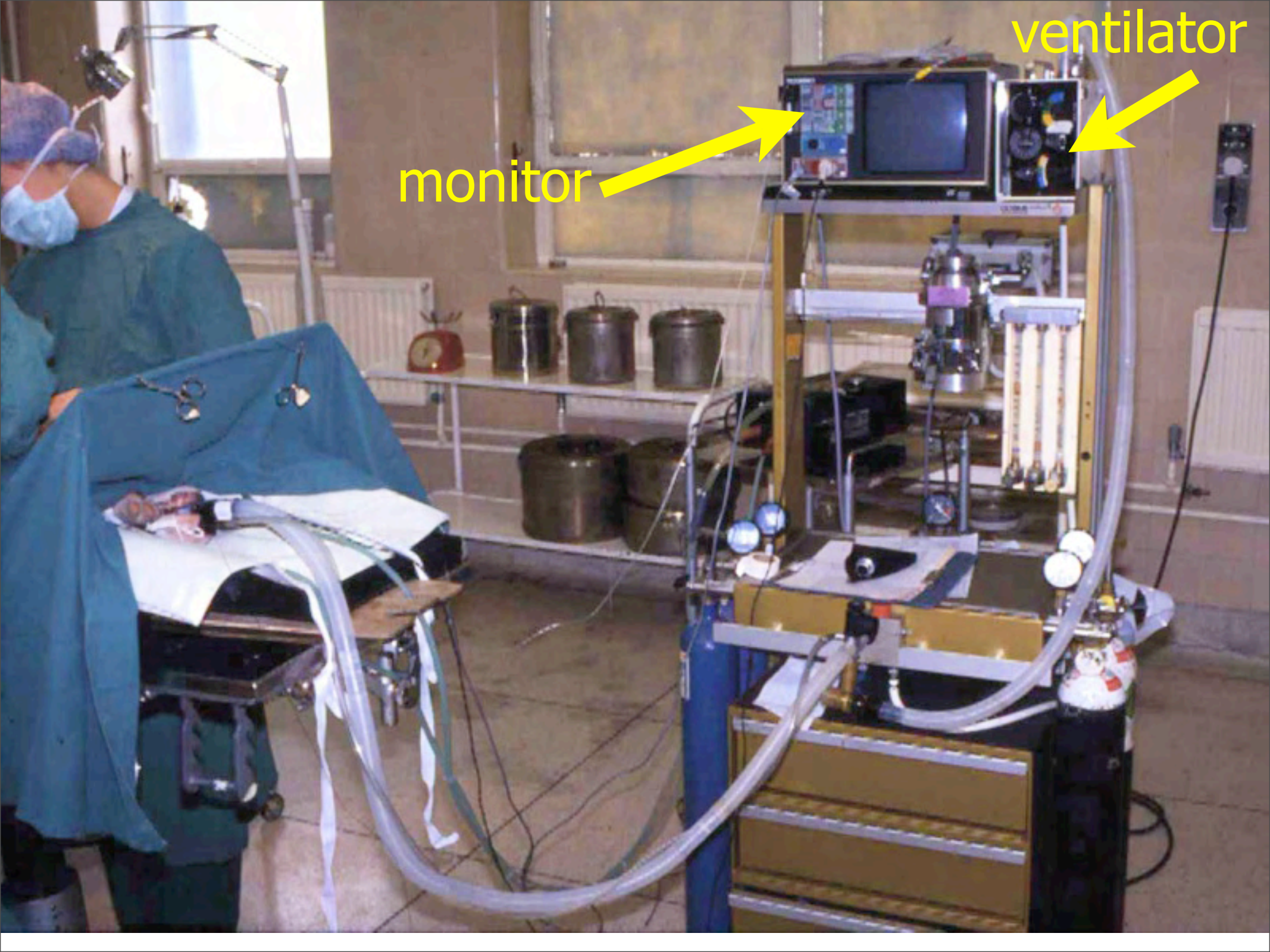
- muscle relaxation during anaesthesia
- myasthenia gravis
- poisoning



balanced anaesthesia

- unconsciousness
- analgesia
- muscle relaxation



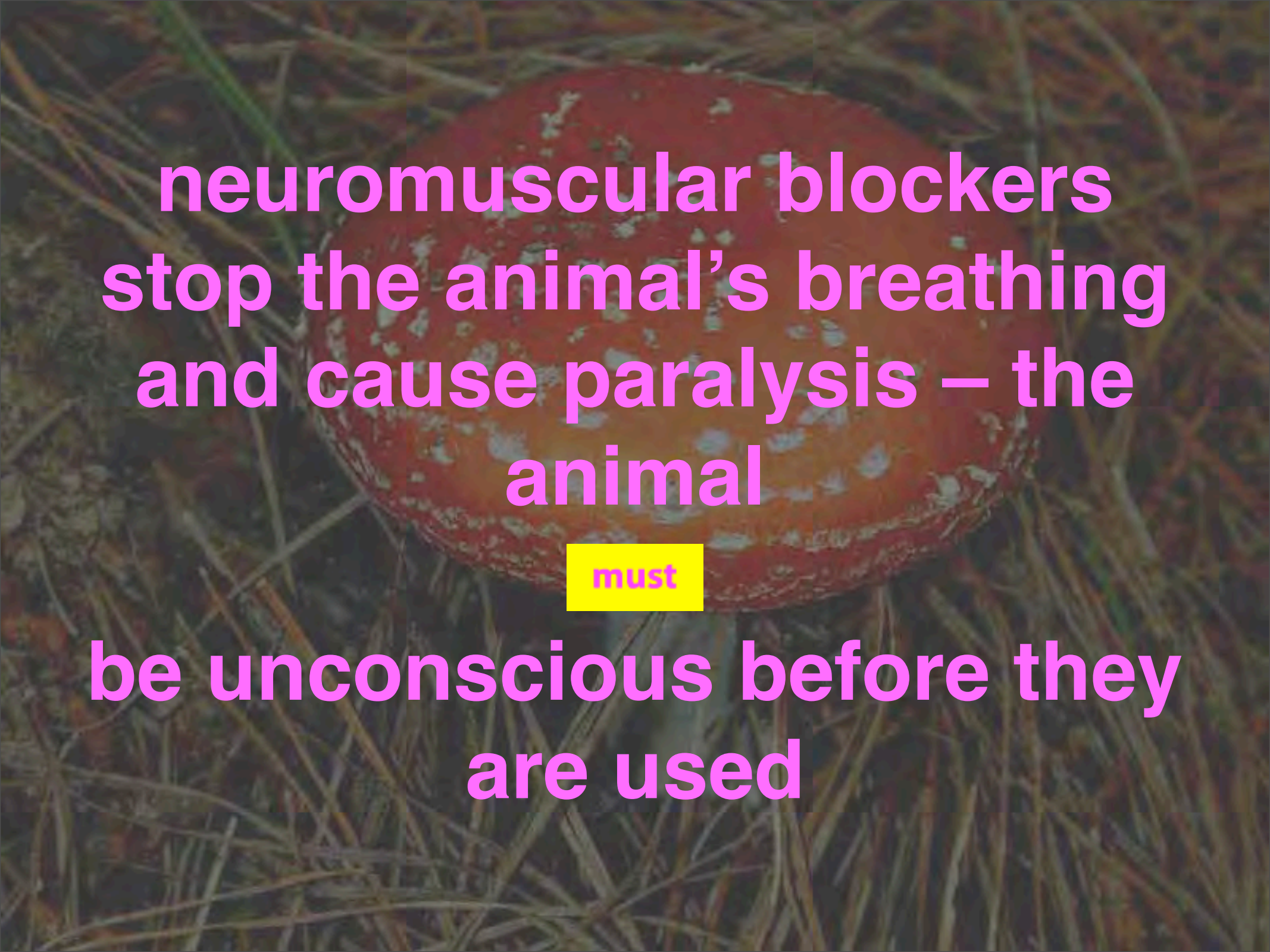


monitor

ventilator

neuromuscular blockers

- depolarising (non competitive)
- competitive (non depolarising)
- (inhibition of ACh synthesis)
- (inhibition of ACh release)
 - magnesium
 - aminoglycoside antibiotics
 - botulinum toxin

A red mushroom with white spots is centered in the background, surrounded by dry, brown grass. The text is overlaid on this image.

**neuromuscular blockers
stop the animal's breathing
and cause paralysis – the
animal**

must

**be unconscious before they
are used**

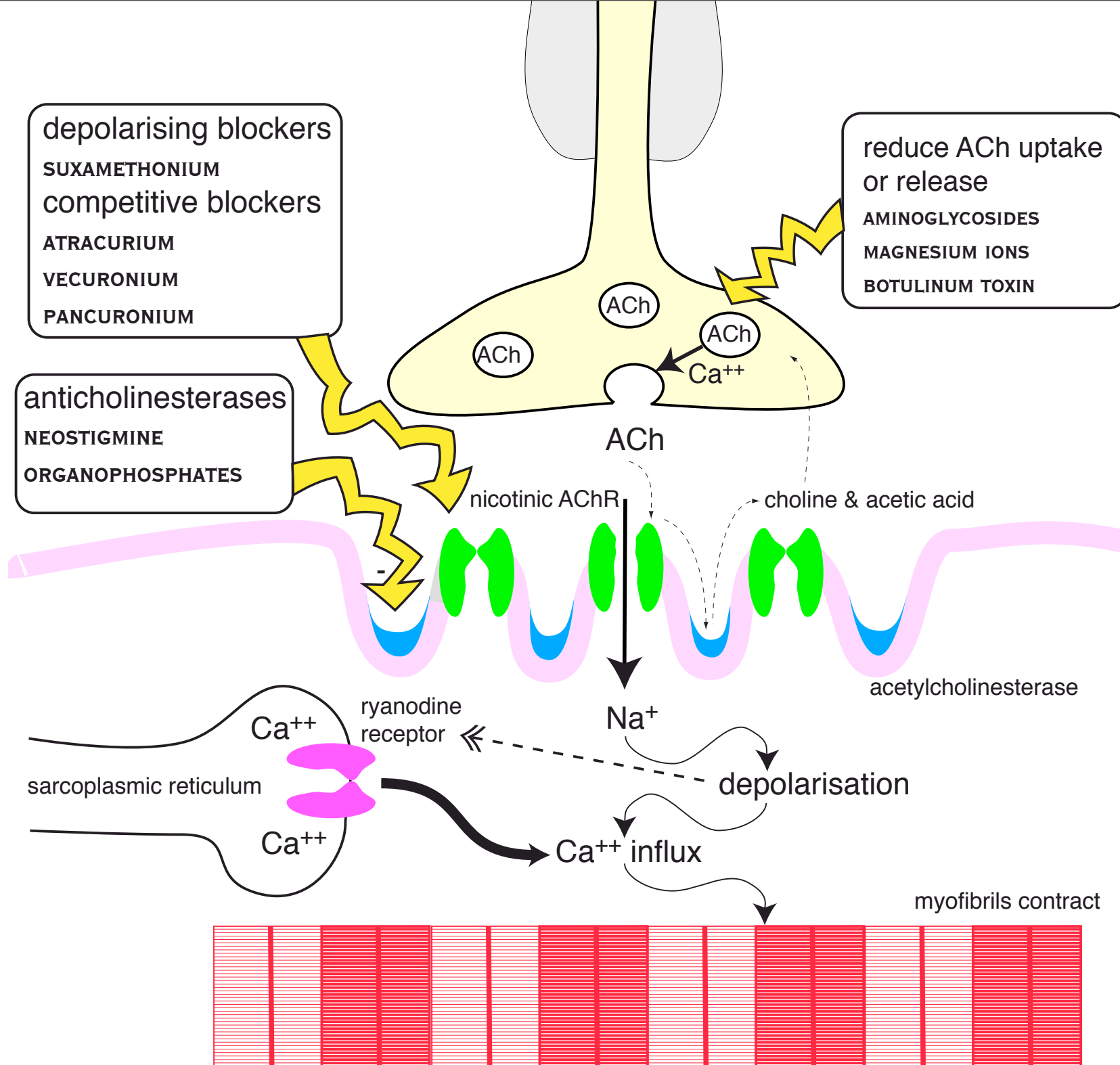
A red mushroom with white spots, likely a fly agaric, is centered in the background. The text is overlaid on the image.

anaesthesia

- given iv **after** anaesthetic
- ventilation required
- degree of blockade monitored

onset of blockade

- 1 tail & face
- 2 limbs
- 3 swallowing
- 4 abdominal muscles
- 5 intercostal muscles
- 6 diaphragm



suxamethonium

- succinylcholine USAN
- depolarising blocker
- acts like ACh
- 2 ACh molecules joined
- hydrolysed by plasma cholinesterase
- succinylcholine USAN

suxamethonium

- depolarises muscle fibre
- fasciculation
- effects not reversible



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 standing out against the muted, brownish-green background of the grass. The text 'side effects' is overlaid on the upper part of the mushroom's cap.

side effects

- potassium release
- bradycardia
- muscle pain later?
- can provoke malignant hyperthermia in pigs

phase 2 block

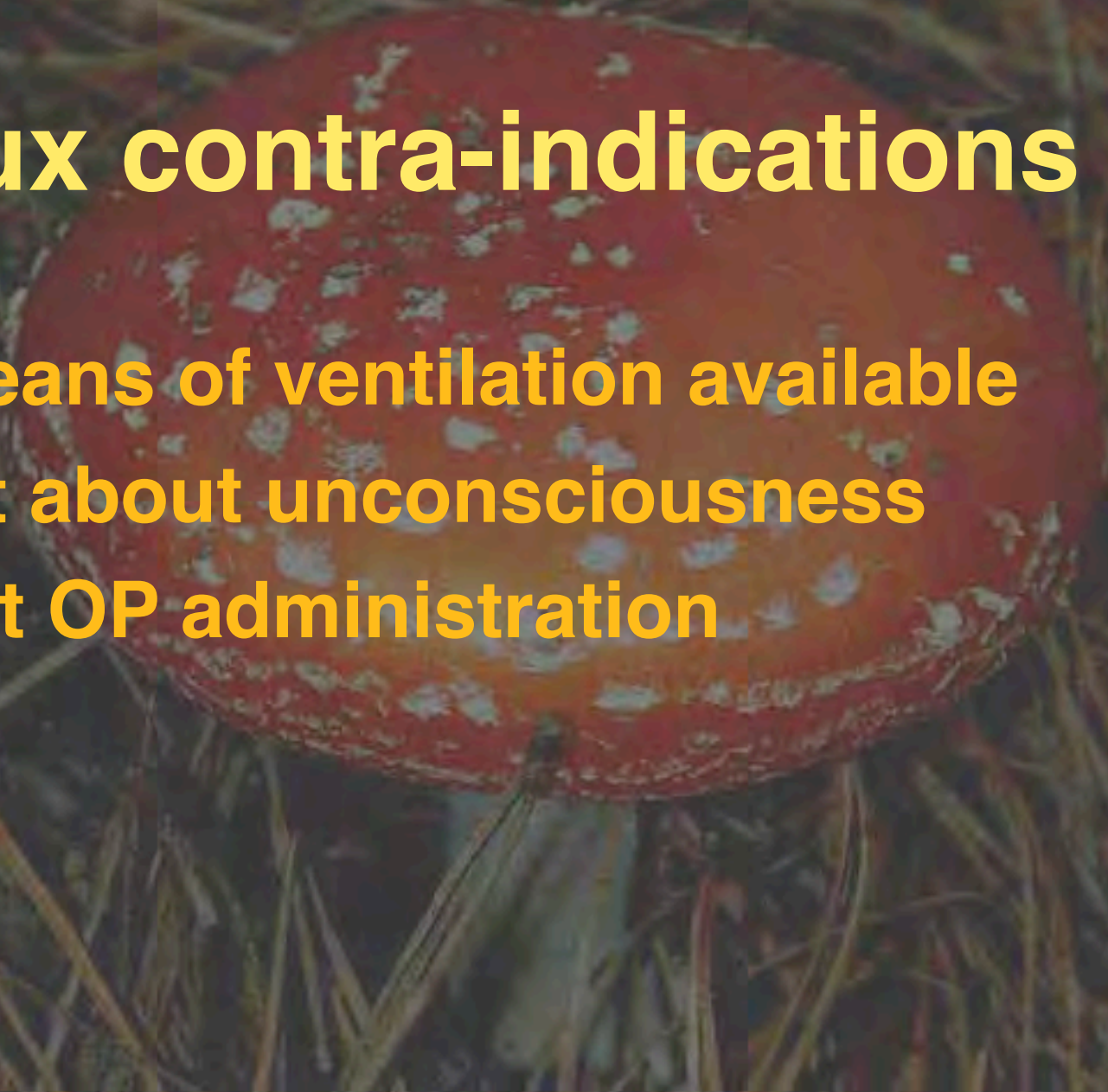
- prolonged blockade after several doses of suxamethonium
- competitive
- partially reversible
- receptor desensitisation?

sux indications

- muscle relaxation for intubation (crash induction)
- (relaxation for caesarian section)

sux contra-indications

- **no means of ventilation available**
- **doubt about unconsciousness**
- **recent OP administration**

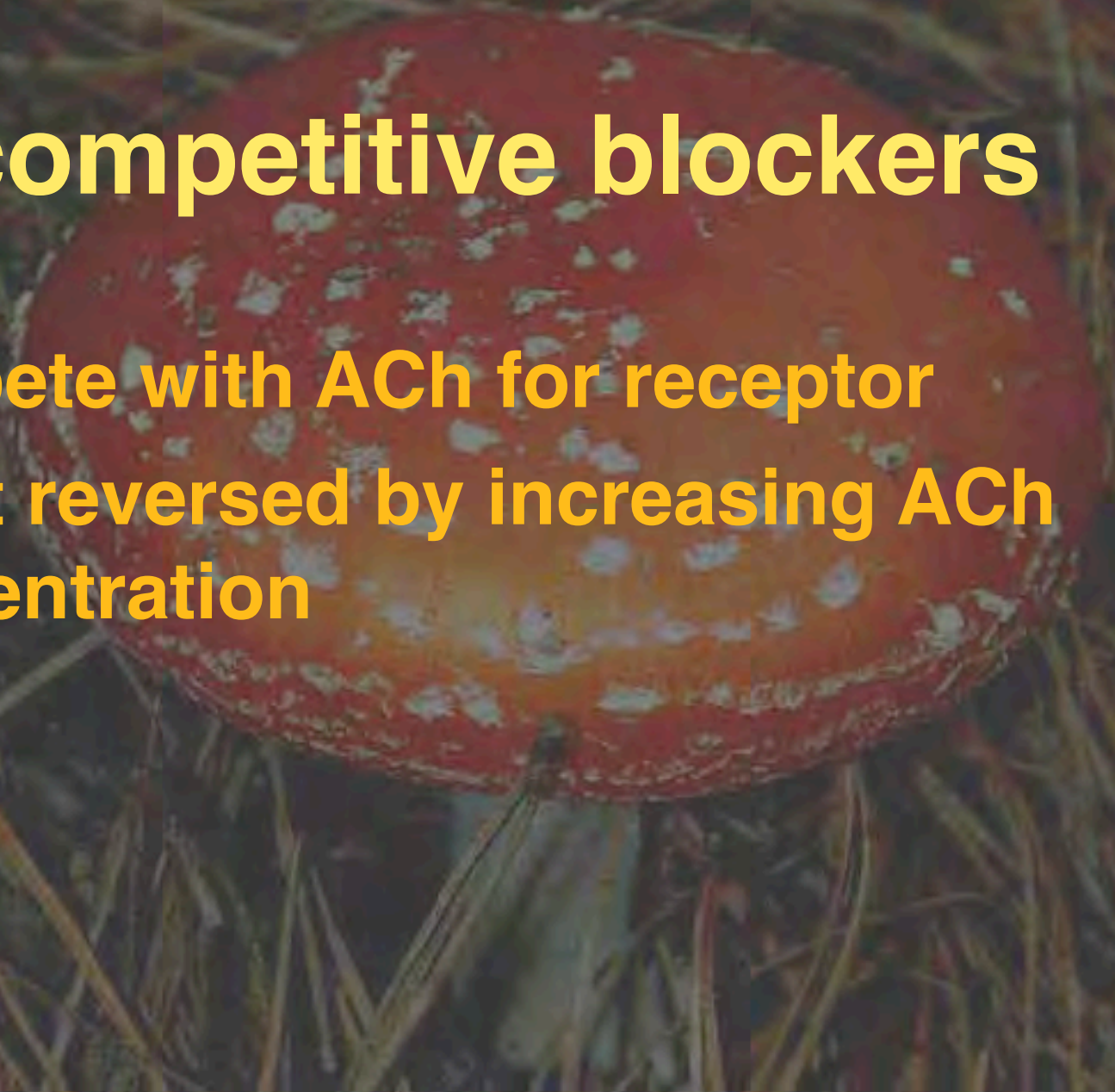


sux pharmacokinetics

- acts in one circulation time
- diffuses out of synapse
- metabolised by plasma cholinesterases
- effects wear off in 2 – 3 mins
 - dogs 20 mins
- anticholinesterases prolong effects
 - organophosphate insecticides

competitive blockers

- **compete with ACh for receptor**
- **effect reversed by increasing ACh concentration**



competitive blockers

- actions influenced by other drugs
 - inhalation anaesthetics
 - benzodiazepines
 - aminoglycoside antibiotics

competitive blockers

- **atracurium**
- **vecuronium**
- **pancuronium**
- **mivacurium**
- **rocuronium**



A photograph of a red mushroom with white spots, likely 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 is overlaid on the image.

atracurium

- acts for about 20 – 30 mins
- broken down by Hofmann degradation
 - liver function not necessary

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 stem is thick and white. The background is a dense field of dry, yellowish-brown grass.

vecuronium

- **lasts 15 – 20 mins**
- **non cumulative**
- **metabolised in liver**

pancuronium

- lasts 40 – 50 mins
- can cause tachycardia
- must be reversed



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 stem is thick and white. The background is a dense field of dry, yellowish-brown grass.

mivacurium

- **rapid block – 2mins**
- **short action – 10 – 15 mins**

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rocuronium

- rapid onset – 1 min
- duration 30 – 40 mins

A red mushroom with white spots, likely a fly agaric, is shown in the background. The text is overlaid on the image.

do not use

- **no longer available in NZ**
- **tubocurare**
 - **causes histamine release**
 - **kills dogs**
- **pipecuronium**
 - **similar to pancuronium but longer acting & more side effects**

indications

- **muscle relaxation during anaesthesia**
 - thoracotomy
 - ophthalmic ops
 - some abdominal ops
 - (reducing dislocations)

A red mushroom with white spots growing in grass. The mushroom is the central focus, with its cap showing a vibrant red color and several white, irregular spots. It is surrounded by dry, yellowish-brown grass. The text is overlaid on the image in a yellow, sans-serif font.

after use

- effects can be reversed with anticholinesterase
- anticholinesterase increases ACh which competes with blocker

anticholinesterases

- **edrophonium**
 - short acting, no longer available in NZ
- **neostigmine**
 - medium duration of action
- **pyridostigmine**
 - long acting, inj not available in NZ
- **all must be given with atropine**

myasthenia gravis

- autoantibodies to nACh R (& thymus in man)
- muscle weakness, megoesophagus
- diagnosis – improvement with neostigmine (+ atropine)
- treatment – pyridostigmine po

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others

- **reduce ACh release**
 - magnesium
 - streptomycin
 - botulinus toxin
- **compete with Ca in muscle**
 - magnesium

malignant hyperthermia

- **defect in gene for ryanodine receptor**
- **common in pigs**
- **probably occurs in most species**
- **usually triggered by halothane**
- **can be triggered by suxamethonium**

malignant hyperthermia

- **pig goes rigid**
- **temperature goes up**
- **tachycardia then tachyarrhythmias**
- **cyanosis**
- **acidosis**
- **later**
 - **all the signs of muscle breakdown**

MH treatment



MH treatment

- stop giving halothane



MH treatment

- stop giving halothane
- ventilate with oxygen



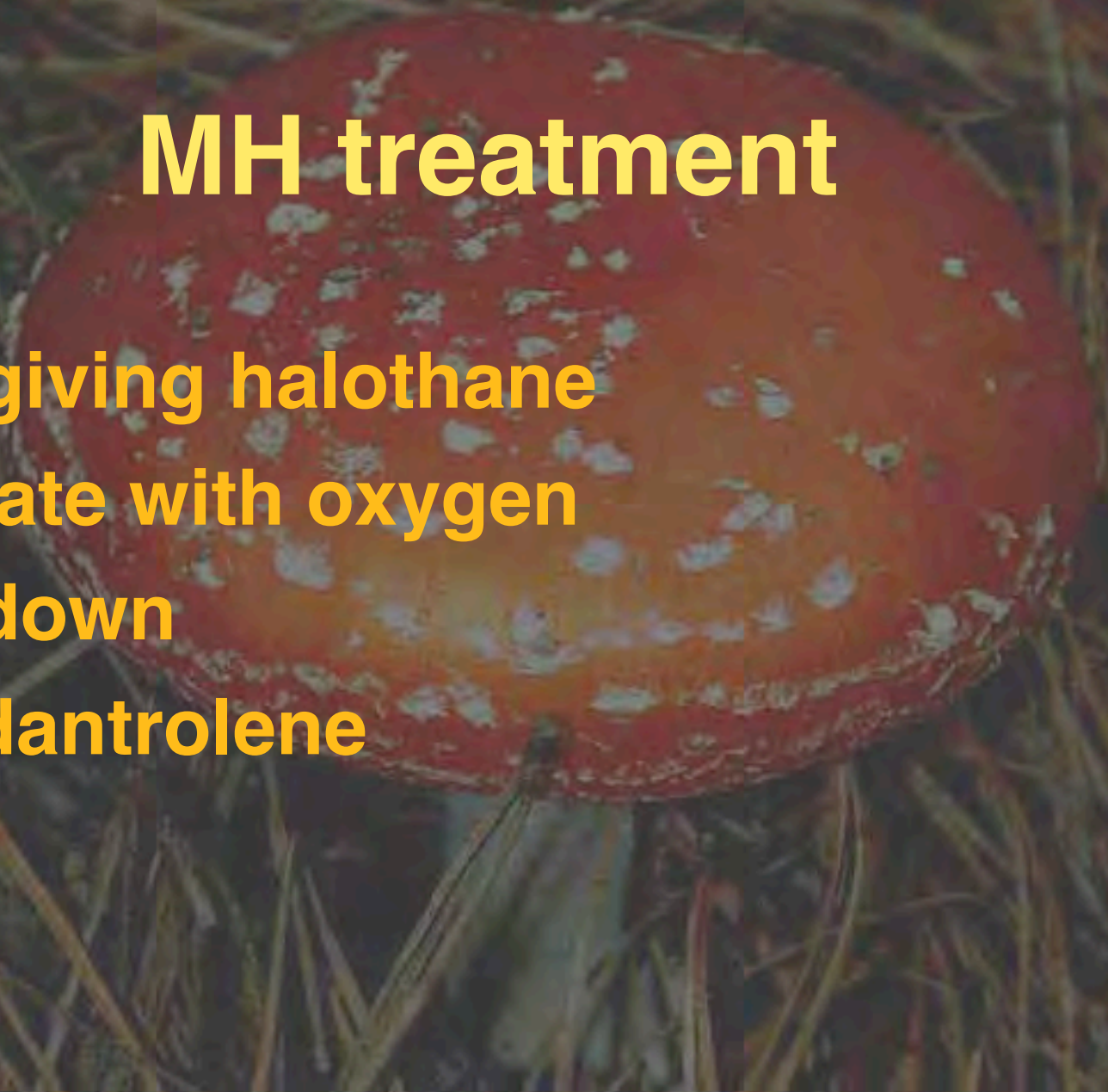
MH treatment

- stop giving halothane
- ventilate with oxygen
- cool down



MH treatment

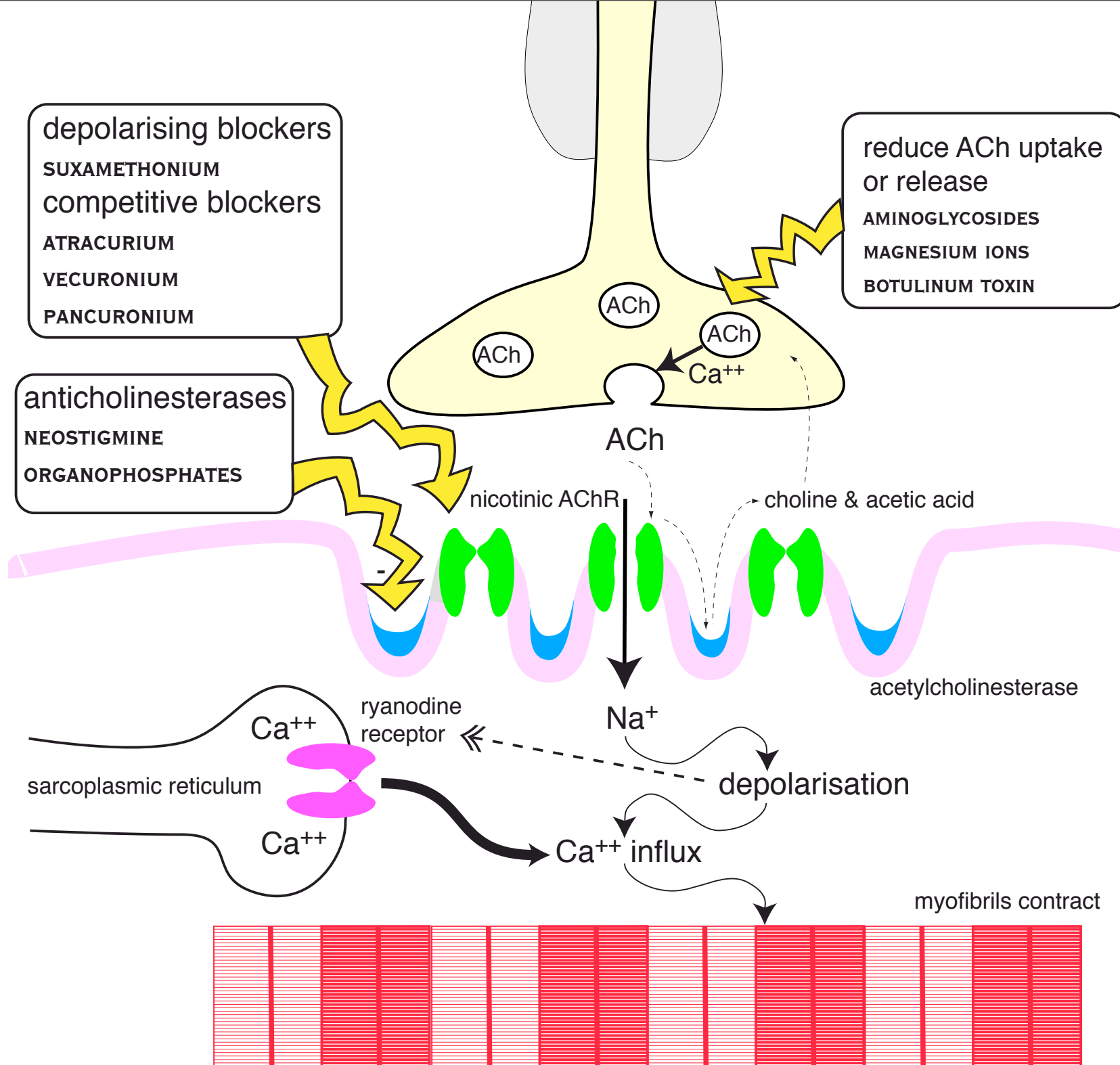
- stop giving halothane
- ventilate with oxygen
- cool down
- give dantrolene



A red mushroom with white spots is centered in the background of the slide. The mushroom is surrounded by dry, brown grass. The text is overlaid on the image.

dantrolene

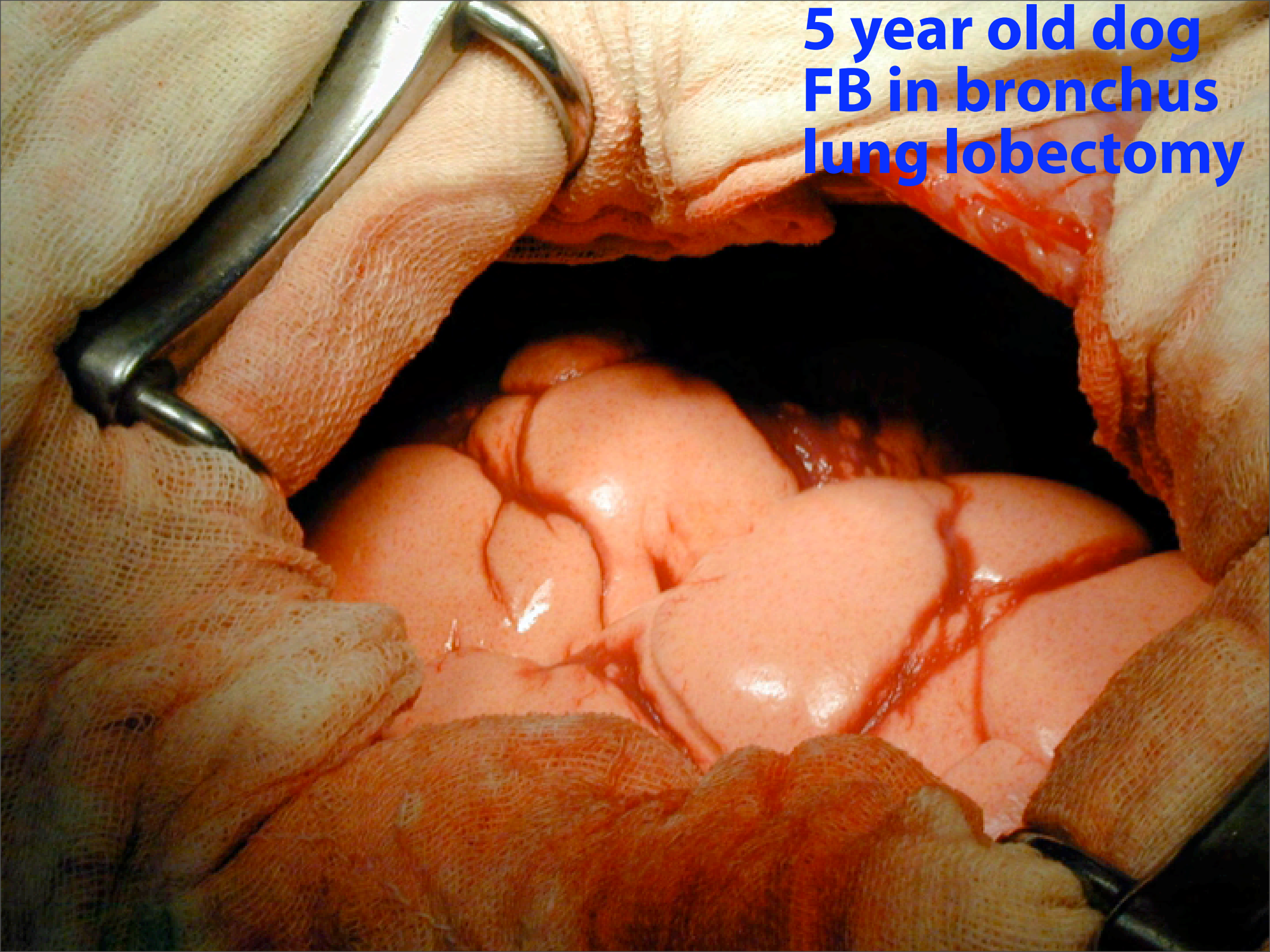
- **does not act at NMJ**
- **prevents calcium release from sarcoplasmic reticulum**
- **uncouples excitation and contraction**
- **used in malignant hyperthermia**
- **too expensive to use**



What would you do?



**5 year old dog
FB in bronchus
lung lobectomy**



neuromuscular blockers

- neuromuscular blockers used for anaesthesia for some ops
- they must not be given to conscious animals
- animals must be ventilated
- do not use these drugs unless you have equipment for IPPV and know what you are doing