

A photograph of a red mushroom with white spots, likely a fly agaric, resting on a bed of dry pine needles. The mushroom is the central focus, with its bright red cap and gills contrasting sharply with the dry, brownish needles. The text 'Neuromuscular Junction' is overlaid in a bold, yellow font across the middle of the image.

Neuromuscular Junction

A large, red, spotted mushroom with a white stem, growing in a field of dry grass. The mushroom has a bright red cap with numerous white spots and a thick, white, slightly textured stem. The background is a dense field of dry, yellowish-brown grass.

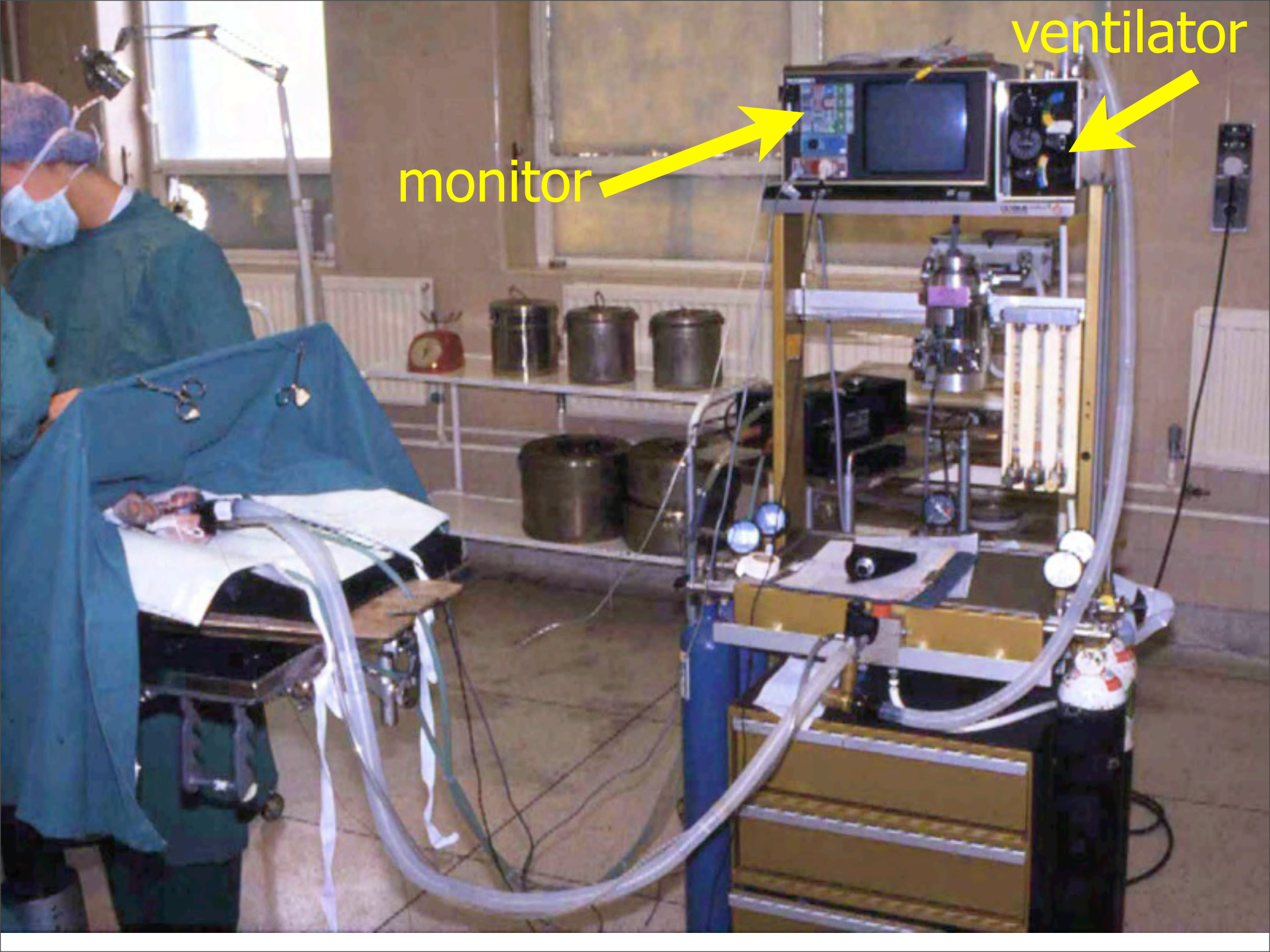
NMJ

- **muscle relaxation during anaesthesia**
- **myasthenia gravis**
- **poisoning**

balanced anaesthesia

A photograph of a red mushroom with white spots, likely a Amanita muscaria, growing on a bed of dry grass. The mushroom is the central focus, with its bright red cap and white spots contrasting against the dry, brownish grass. The lighting is somewhat dim, giving the scene a slightly somber or mysterious feel.

- **unconsciousness**
- **analgesia**
- **muscle relaxation**

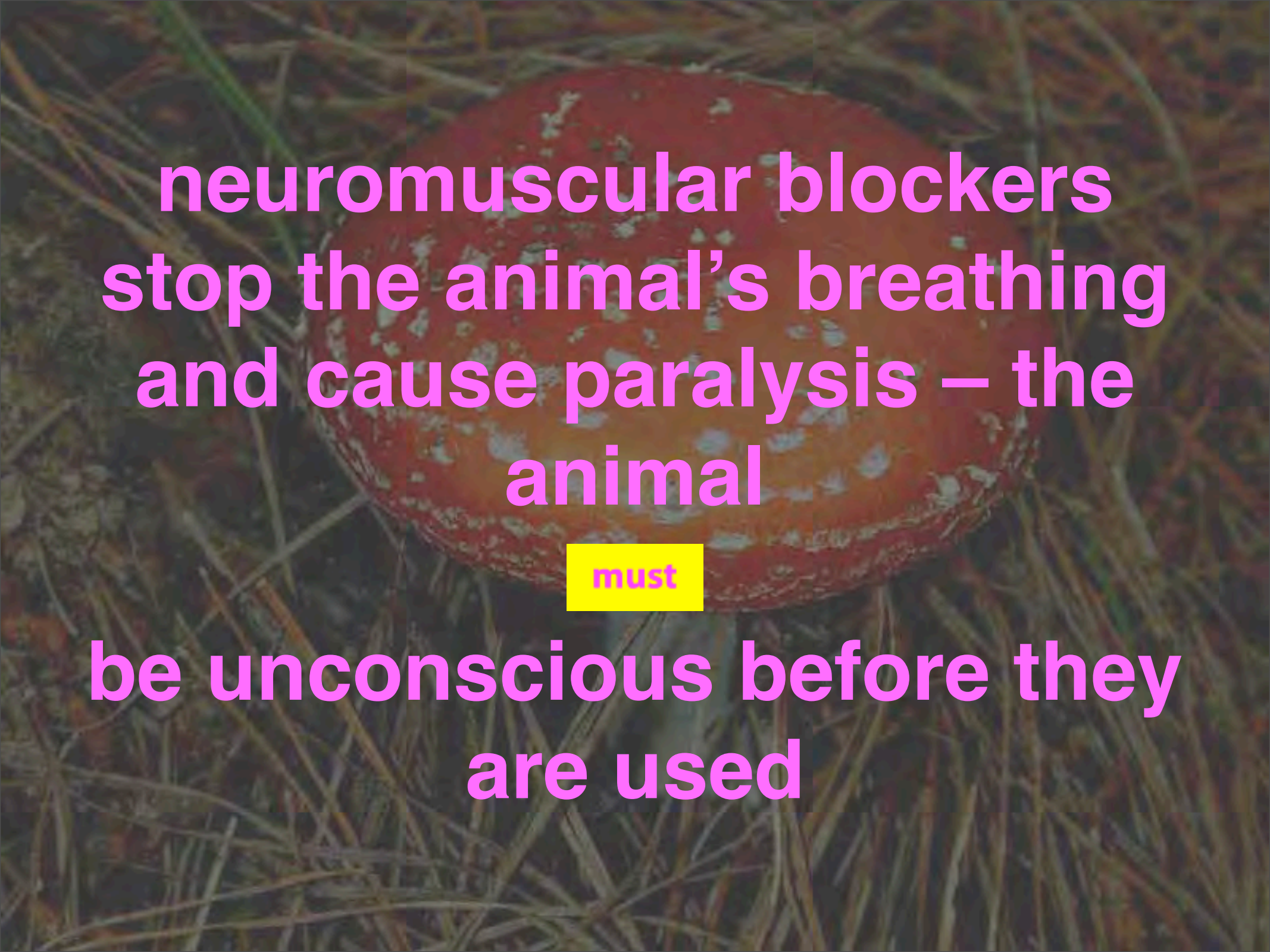


ventilator

monitor

neuromuscular blockers

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



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

must

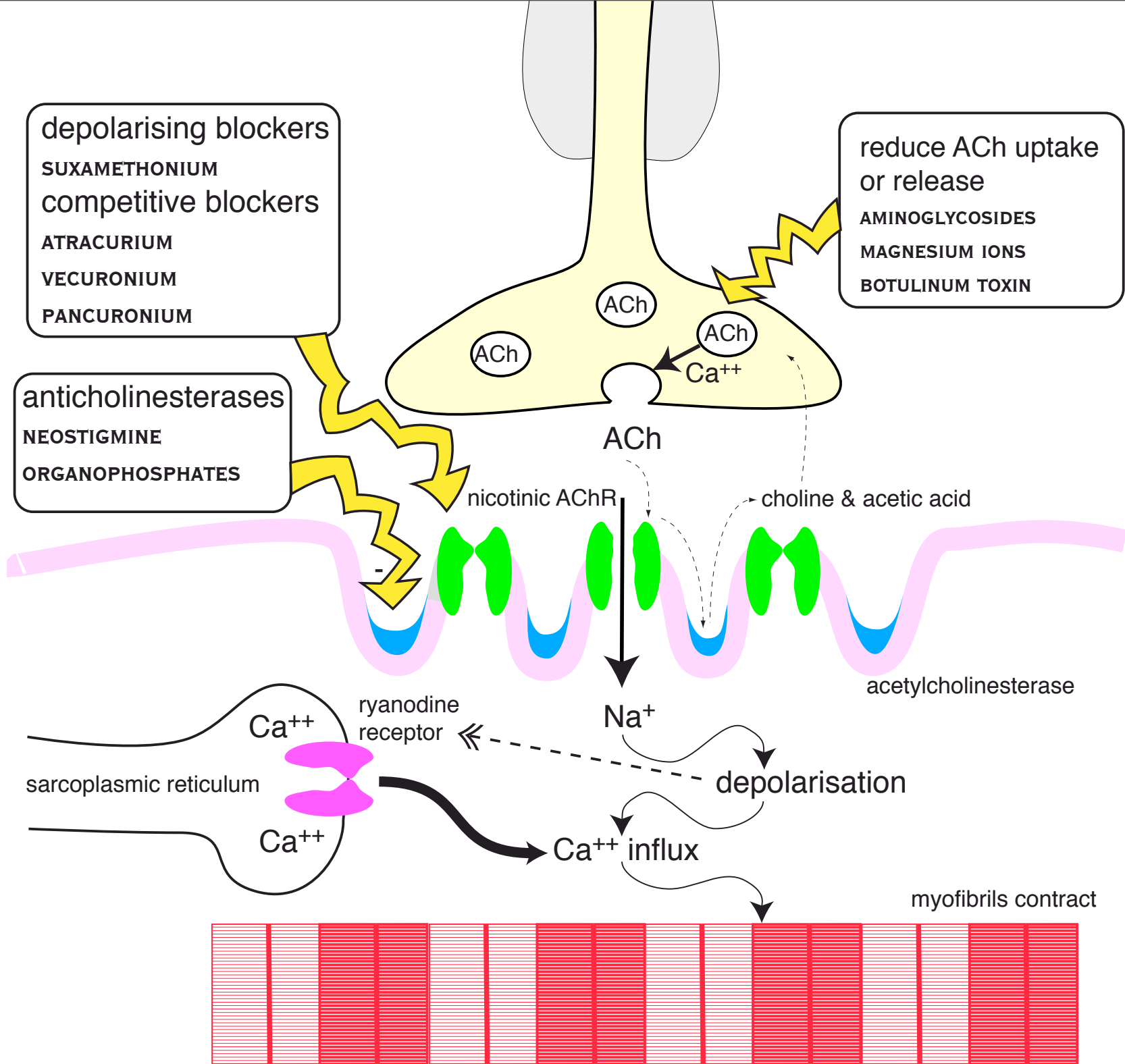
**be unconscious before they
are used**

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 photograph of a red mushroom with white spots, likely a Amanita muscaria, growing on a bed of pine needles. The mushroom is the central focus, with its bright red cap and white gills and spots. The background is a dense layer of dry, brown pine needles.

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

A red mushroom with white spots on a bed of dry grass. The mushroom is the central focus, with its cap showing a vibrant red color and several white, irregular spots. The background is a dense layer of dry, brownish grass, creating a textured and natural setting.

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

competitive blockers

A large, red mushroom with white spots, likely a Amanita muscaria, is the central focus of the image. It is growing on a bed of dry pine needles. The background is a dense layer of these needles, creating a textured, brownish-gold environment. The mushroom's cap is bright red with irregular white patches, and its stem is thick and white.

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

A photograph of a red mushroom with white spots, likely a Amanita muscaria, growing on a bed of pine needles. The mushroom is the central focus, with its bright red cap and gills contrasting against the dry, brown needles. The text is overlaid on the image in a yellow, sans-serif font.

atracurium

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

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vecuronium

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

pancuronium

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

A photograph of a red mushroom with white spots, likely a fly agaric, growing on a bed of pine needles. The mushroom is the central focus, with its bright red cap and gills contrasting against the dry, brown needles. The text 'mivacurium' is overlaid on the top part of the mushroom's cap.

mivacurium

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

rocuronium

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





do not use

- **no longer available in NZ**
- **tubocurarine**
 - **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)**

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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**

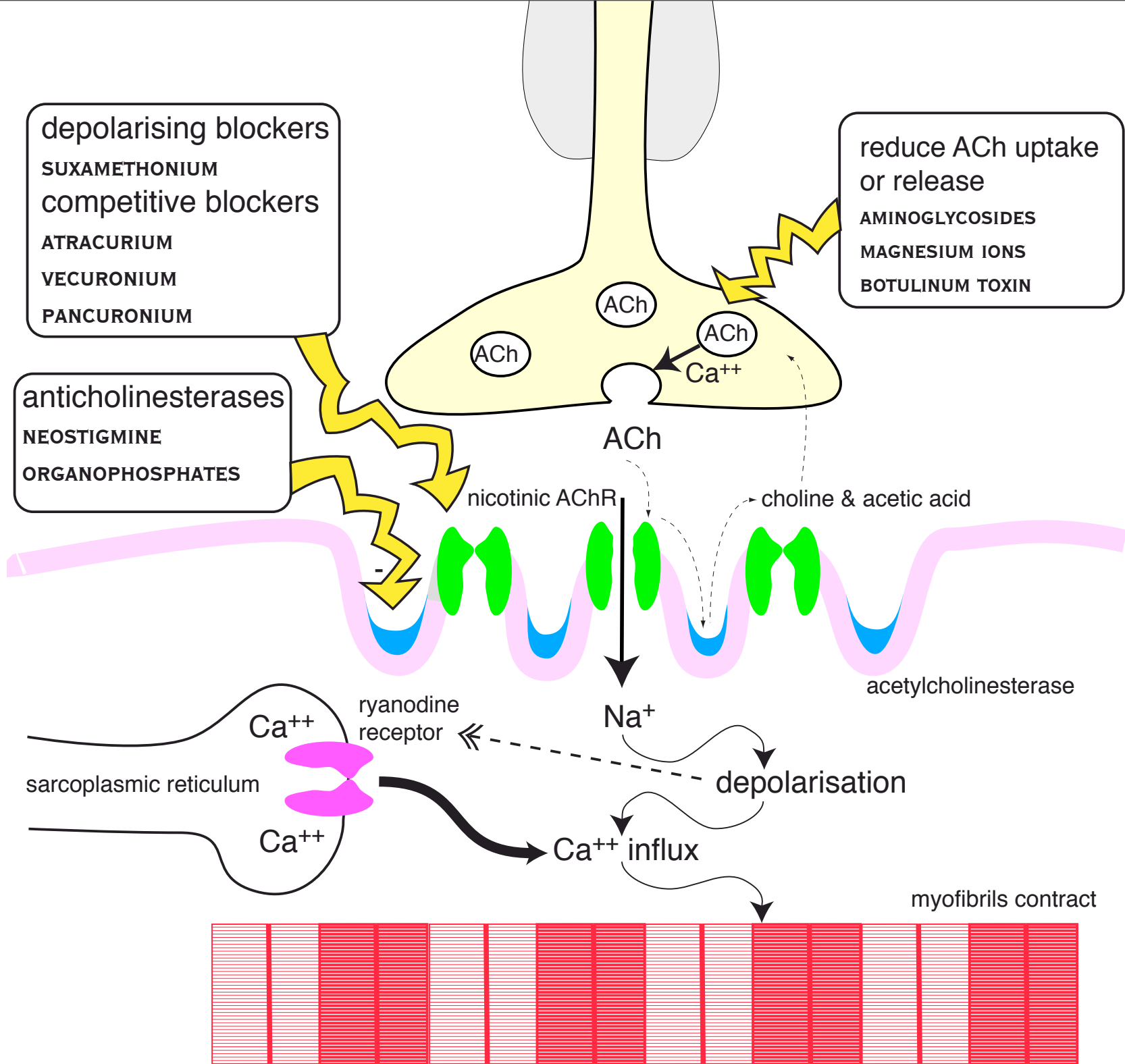


MH treatment

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

dantrolene

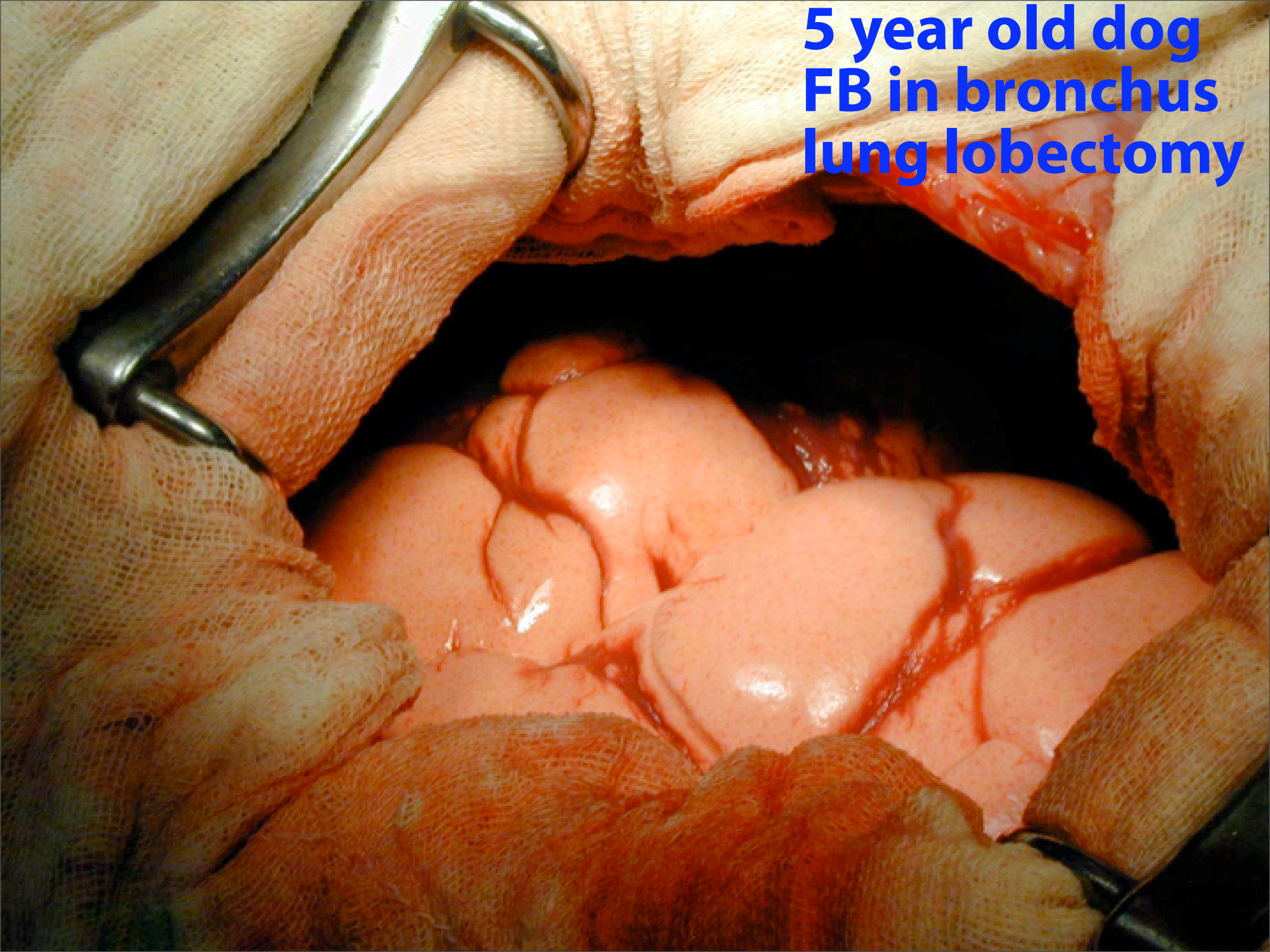
- **does not act at NMJ**
- **prevents calcium release from sarcoplasmic reticulum**
- **uncouples excitation and contraction**
- **used in malignant hyperthermia**
- **too expensive to use**



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