



Unit 1

VETERINARY PUBLIC HEALTH AND FOOD SAFETY

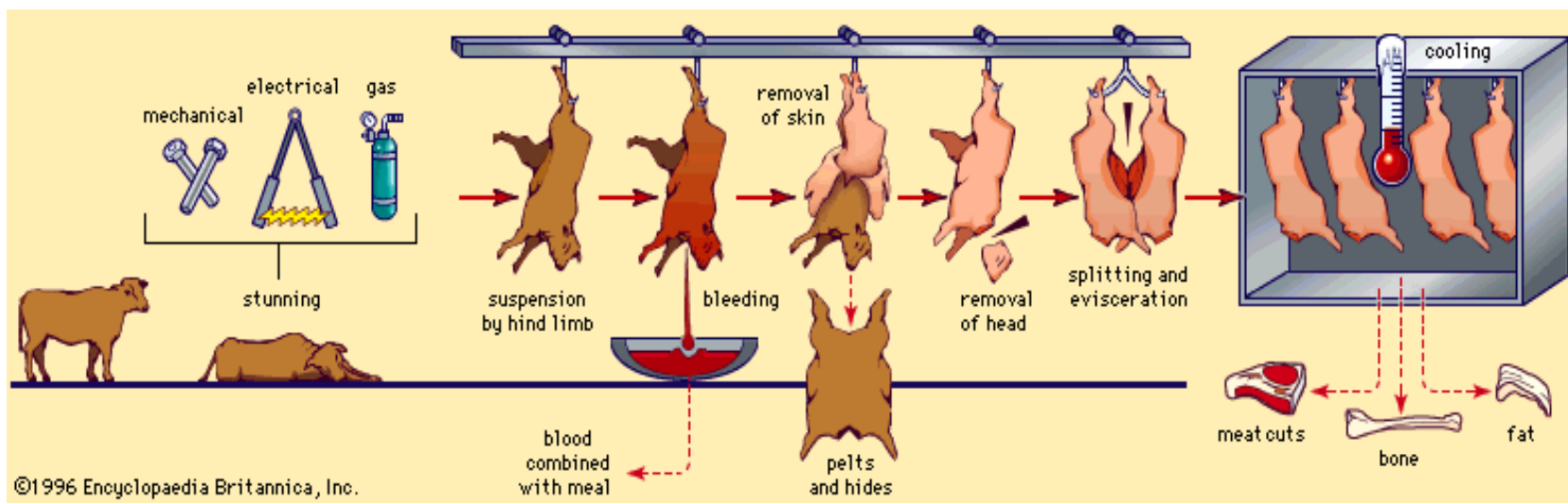
(Credit Hours 3+1=4)



Humane Slaughter



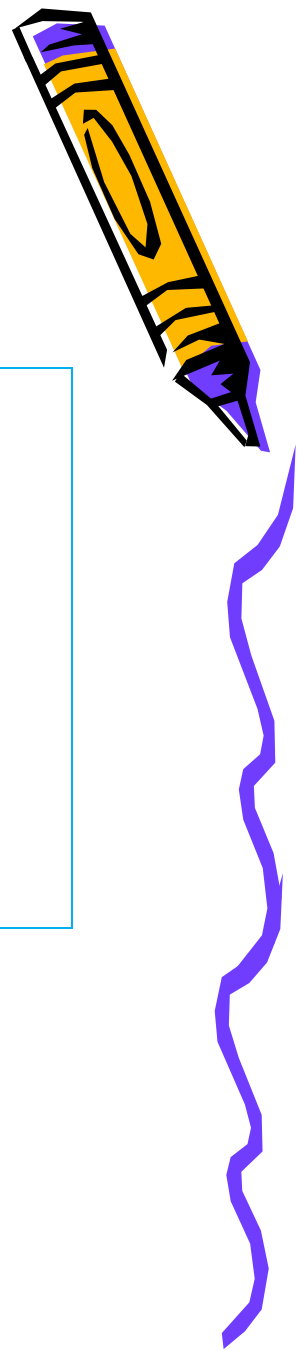
- According to the law, animals should be **stunned** for unconsciousness prior to their slaughter to ensure a quick, relatively painless death



Humane Slaughter

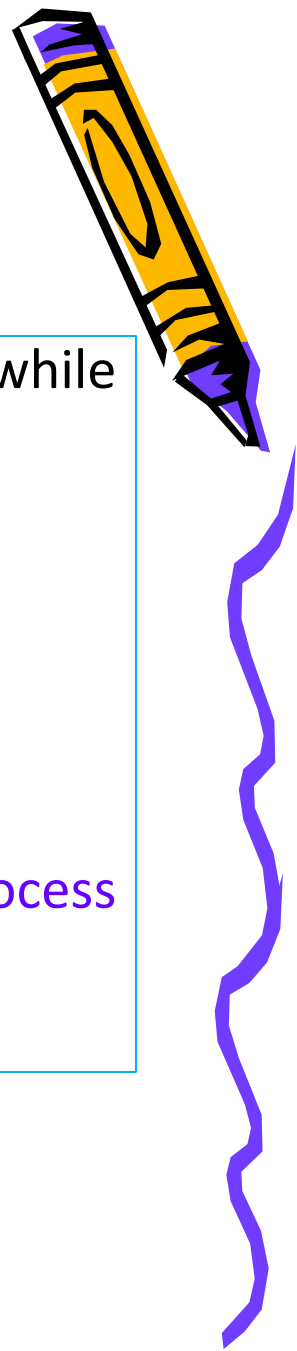
Modern abattoir

1. **Stunning** – Mechanical
Electrical
Chemical
2. **Bleeding / Sticking**

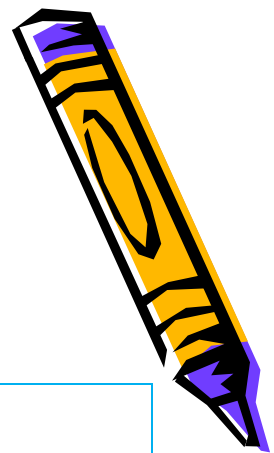


Stunning

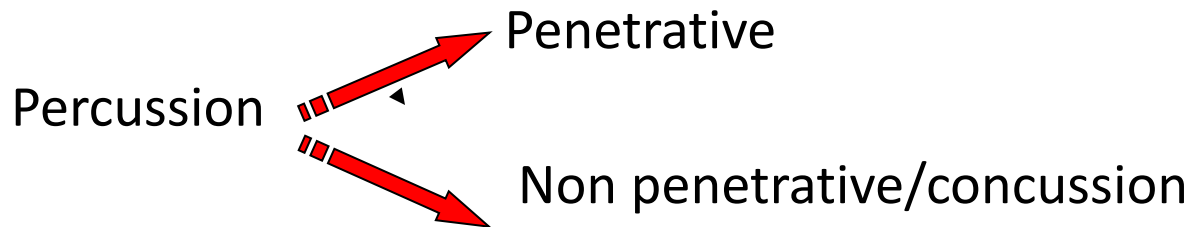
- Act of making animal insensible or unconscious to pain while killing slaughtering or sticking
- Promotes animal welfare & meat quality
- Stunning has two purpose:
 1. To induce an immediate state of insensibility
 2. To produce sufficient immobility to facilitate the sticking process to initiate bleeding



Common methods of stunning

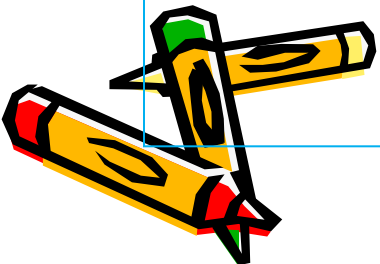


1. Mechanical methods



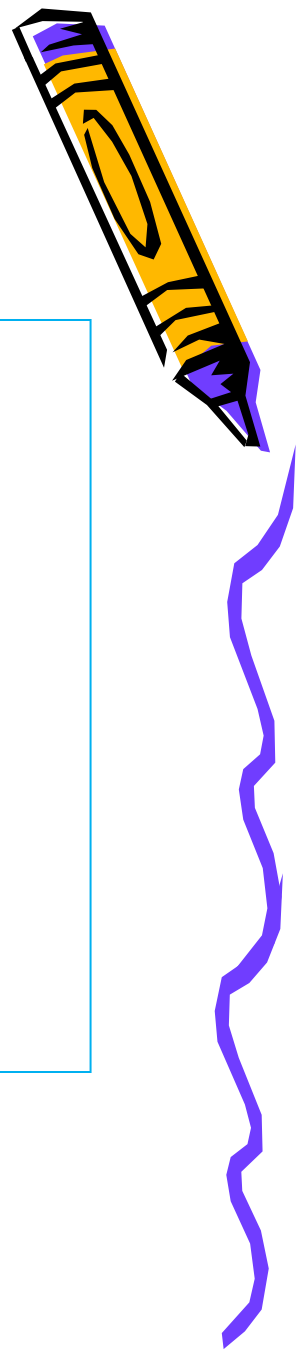
2. Chemical/gaseous method

3. Electrical method



Choice of methods of stunning

- Class of animals
- Intended line speed
- Humane aspects
- Capital and maintenance
- Ease of operation
- Safety of personnel
- Effects on carcass and brain
- Religious and legal requirements



Percussive stunning

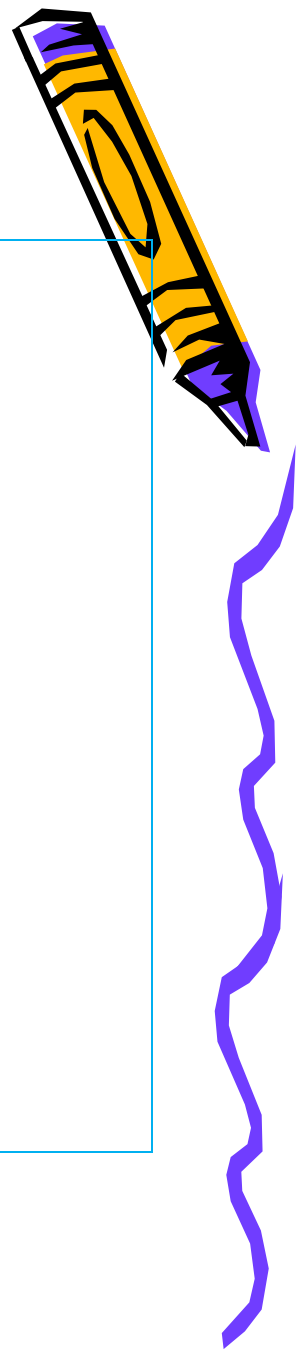
- ☀ 2 types
 - Penetrative (CBP, pneumatic & water jet stunning)
 - Non penetrative (mushroom head stunner)

- ☀ Captive bolt pistol- 2 types

- ❖ Help of trigger
- ❖ Contact type

Principle

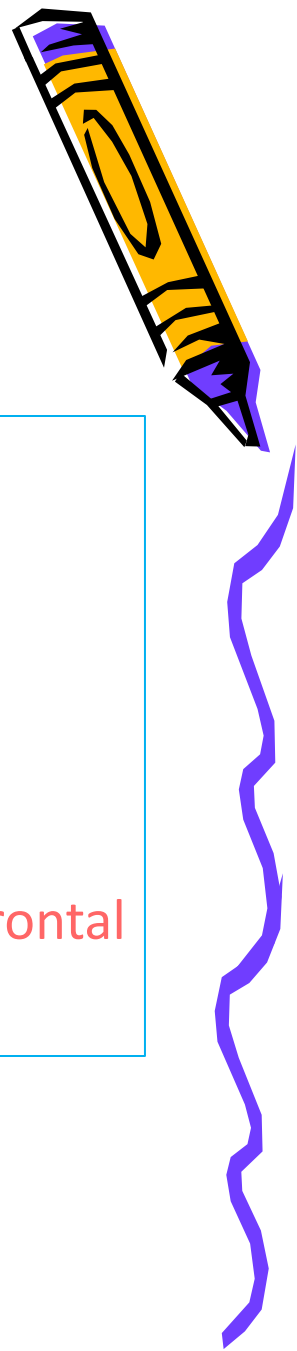
- ❖ Propels bolt forward by discharge of blank cartridge
- ❖ Automatically recoils back into the barrel



Strength of cartridge

- Different strength for different species
- Measured in grains (1 grain = 0.065 g)
- **Large cattle & mature bulls** → 3-4 grains
lambs → 1 grain
- Mostly 0.22 or 0.25 grain cartridge is used
- Used for stunning in cattle, sheep & calves

Less effective in bulls and pigs → massive skull & thick frontal bone



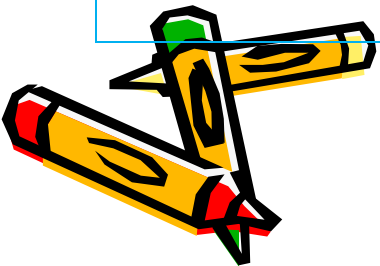
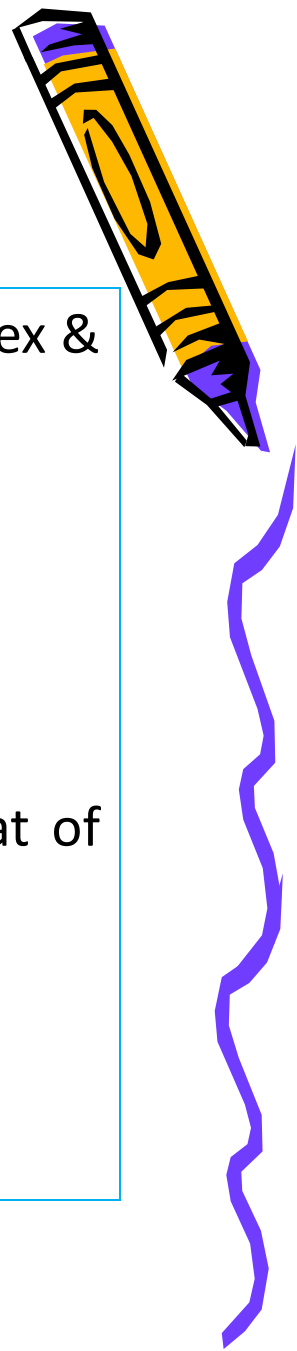
Mechanism of action

- Immediate & permanent insensibility by destruction of cortex & deeper parts of brain
- Rapid rise & fall in intracranial pressure
- Sudden jerk due to energy bolt imparts to head



acceleration concussion

- Results in depolarization of neurons in brain including that of cortex
- Imp. force in producing unconsciousness
 - Velocity of bolt
 - Speed with which it strikes brain

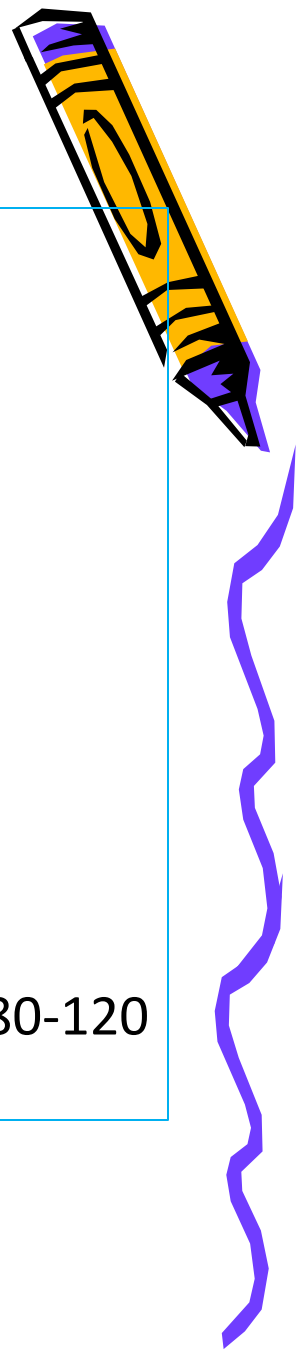


❑ Velocity in different species

- ✓ Steers , heifers & cow- **55 m/s**
- ✓ Young bulls- **65-70 m/s**

❑ Disadvantages of CBP

- ✓ Noise produced during operation
- ✓ Regular maintenance required
- ✓ Cannot be used when higher line speed is required
(240-250/hr)
- ✓ Destruction of brain & hence not edible
- ✓ Brain tissue embolism in pulmonary artery
- ✓ **Pneumatic stunner:** bolt activated under pressure of 80-120 psi

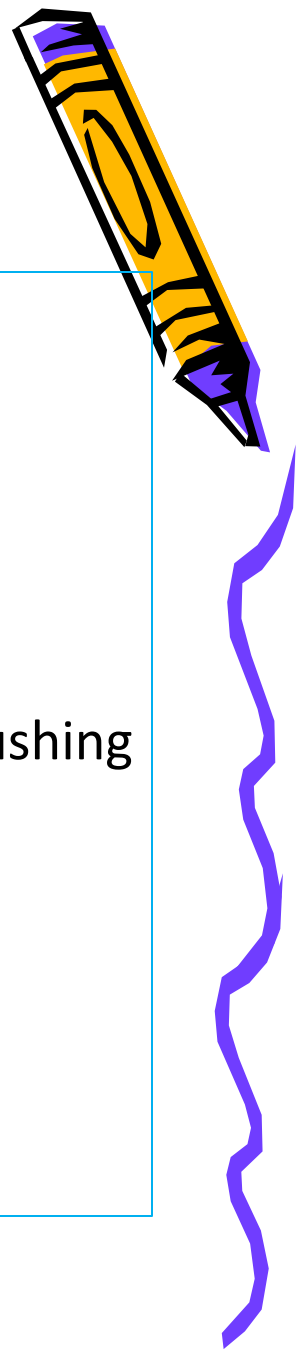


Water jet stunning

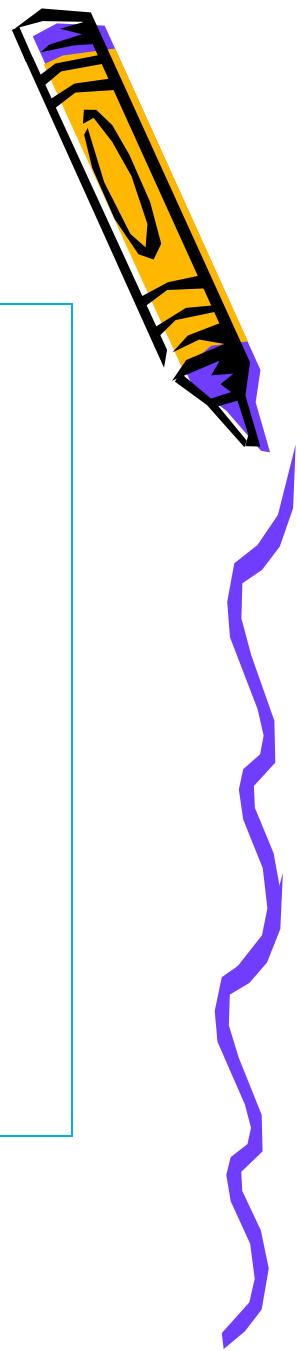
- ✓ Fine jet of water to penetrate skull
- ✓ Dia. 0.5mm jet at pressure of **3500 to 4000 bars**
- ✓ Drills through skin & skull in 0.2 -0.4 s

Mode of action

- ✓ Mechanically destroys brain by induction of laceration ,crushing & shock waves
- ✓ Results in immediate unconsciousness
- ✓ Causes convulsion due to destruction of brain
- ✓ Prevented by immobilizing current of 250mA & 40 volts
- ✓ Meat of superior quality than CO₂/electrical stunning



Non penetrative percussion stunner



- ❖ Stunner with mushroom head
- ❖ Used in calves
- ❖ Brain is edible

- ❖ Sticking to stunning interval
 - ✓ Non penetrative stunner- <30s
 - ✓ Penetrative stunner
 - Cattle- < 60s
 - Sheep & goat- < 15s
 - Calves- <10s



Typical signs in percussive stunning



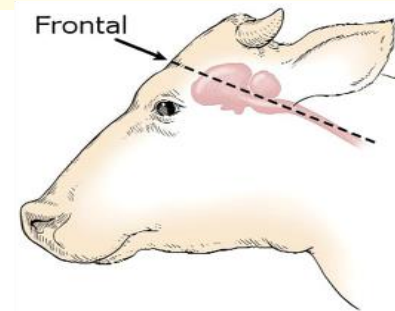
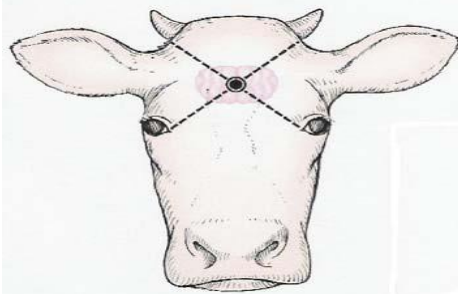
- Immediate collapse of animal by tonic spasm
- tonic spasm lasting 10 to 15s
- Slow clonic movement of hind leg & eventually vigorous hind leg movements
- Ceasing of rhythmic breathing
- Eyeball should face outward with a fixed gaze & not be rotated inwards



Head site for percussive stunning

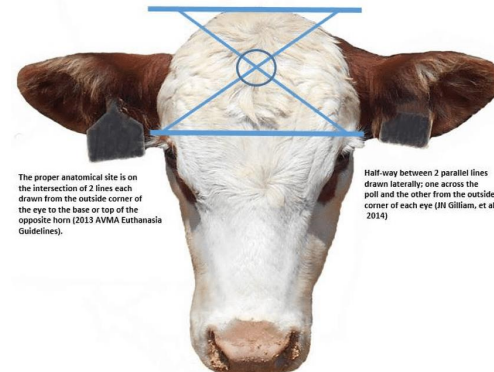
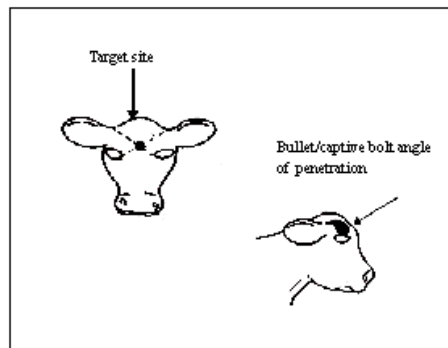
Cattle

Adult cattle –middle of forehead where 2 lines taken from median canthus of eye to base of opp. horn meet



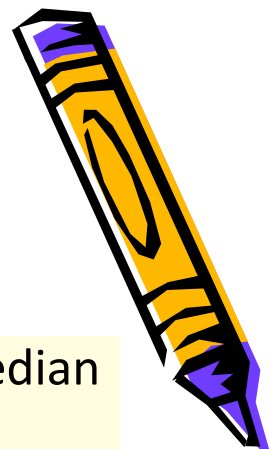
Bulls & old cows- 1.5cm to side of ridge running down center of forehead

Calves –slightly down on head than for adult cattle



The proper anatomical site is on the intersection of 2 lines each drawn from the outside corner of the eye to the base or top of the opposite horn (2013 AVMA Euthanasia Guidelines).

Half-way between 2 parallel lines drawn laterally; one across the poll and the other from the outside corner of each eye (IN Gilliam, et al. 2014)

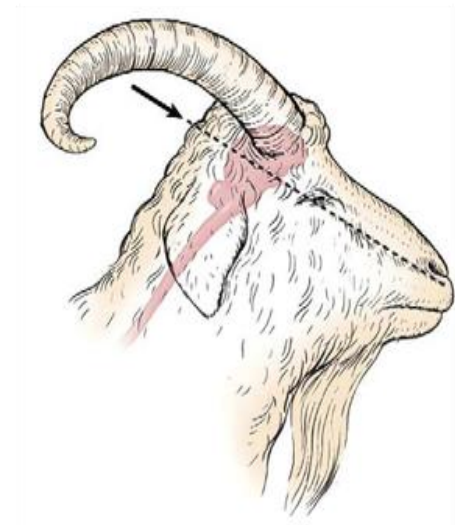
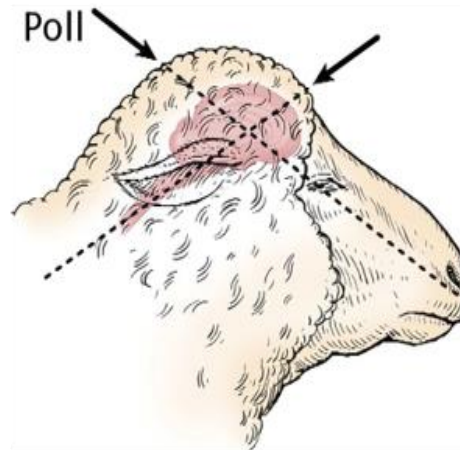
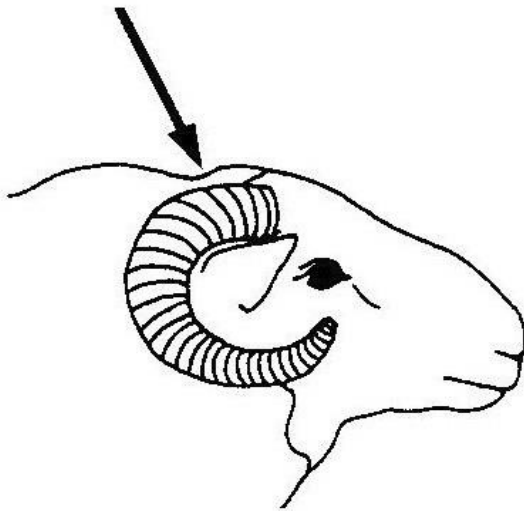


Head site for percussive stunning

Sheep & Goats

Hornless sheep & goat - top of head aimed towards gullet (esophagus)

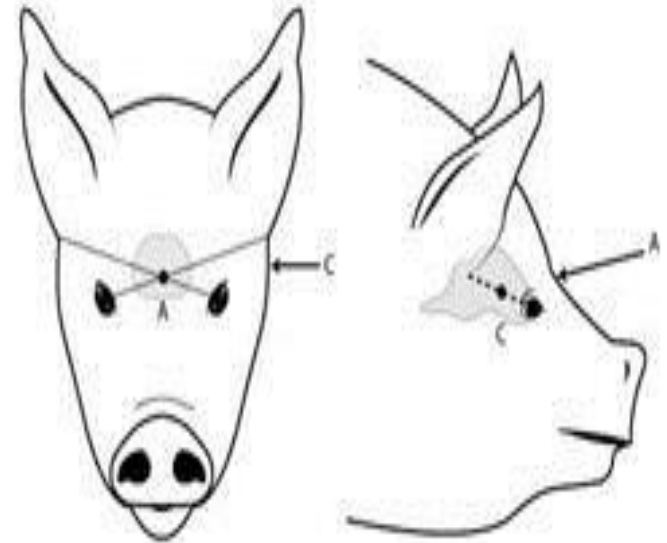
Horned sheep & goat – behind ridge running between horns



Head site for percussive stunning

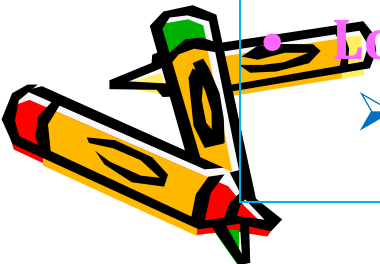
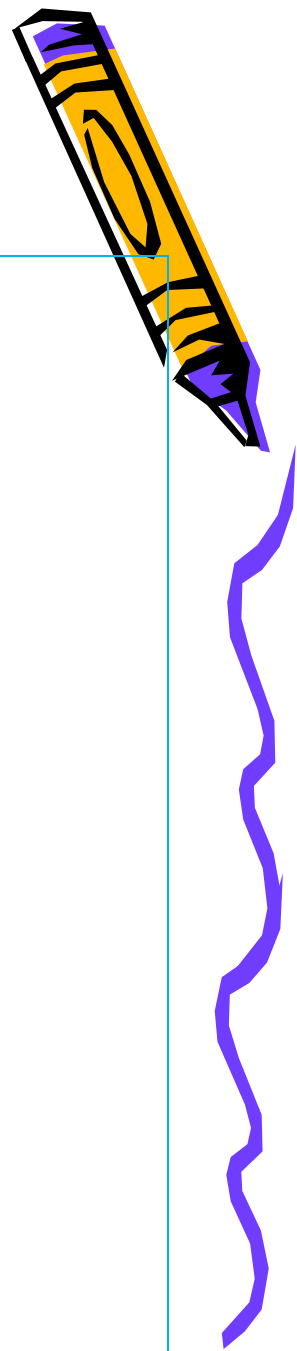
Pigs

Pigs - 2.5cm above level of eyes & fired upward cranial cavity



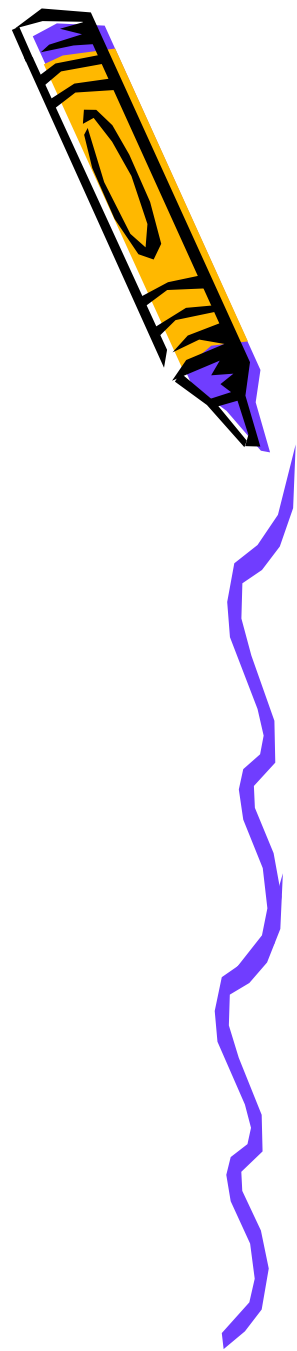
Gaseous or chemical stunning

- Most commonly used gas is CO₂
- CO₂ concn.: 80 % to 95 % (most suitable)
- Period of exposure - 45s
- Recovery time - 90s
- Bleeding to be done within 30s
- **High concentration causes:**
 - Stiff carcass
 - Reflex muscular activity
 - Poor bleeding
- **Low concentration causes:**
 - Improperly stunned
- **Long exposure**
 - Superficial congestion of skin



Types of apparatus

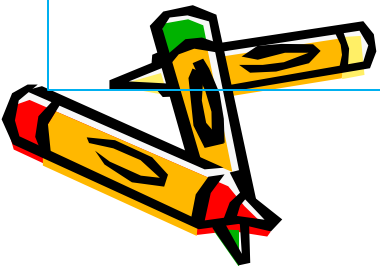
1. Oval tunnel/combi
2. Dip lift
3. Compact CO₂immobiliser/ferri's wheel



Types of apparatus

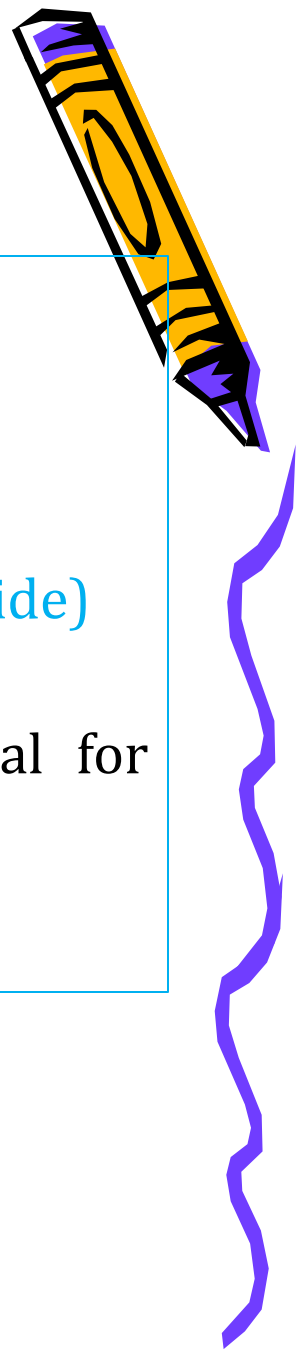
1. Oval tunnel/combi

- ✓ Used when line speed is up to **600 pigs/hr.**
- ✓ Tunnel in the form of oval through which slot conveyer carries the pig
- ✓ Tunnel sloping down at an angle of 30 to anesthetic chamber
- ✓ Actual conveyer divided into 10 compartments pigs up to 113kg can be handled



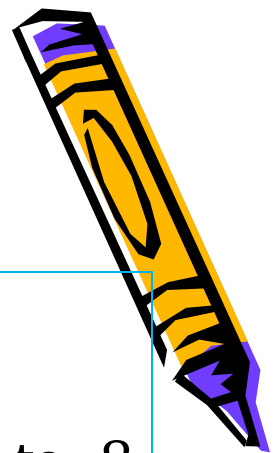
2. Dip lift

- ✓ Suitable to pig of any size
- ✓ Also suitable for sheep & calves
- ✓ It contains cage(213cm length 68cm height & 53cm wide)
- ✓ Descent to CO₂ pit & remain for preset time
- ✓ Return to ground level ejecting unconscious animal for shackling & bleeding
- ✓ Suitable for small meat plants



3 Compact CO₂ immobiliser/ferri's wheel

- ✓ Horizontally revolving apparatus divided into 4 to 8 compartments
- ✓ When 1 section is uppermost for loading the other section are rotating to submerge in gas chamber
- ✓ Suitable when line speed up to 300 pigs/hr.





- **Advantages of CO₂ stunning**

- Relaxed carcass allowing easy de-hairing & dressing

- Less noise & reduced labour requirements

- Increased blood yield by 0.75%

(as CO₂ stimulates respiration thus favoring circulation & better bleeding)

- Bone fractures & muscular haemorrhages reduces

- PSE condition is reduced greatly

- **Disadvantages of CO₂ stunning**

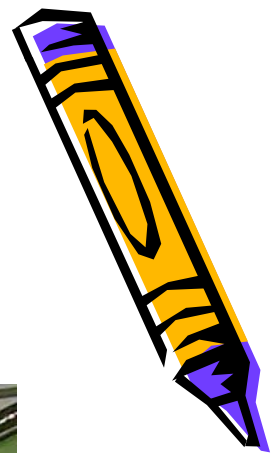
- Needs more room ,

- High capital investment

- Unsuitable for small plants

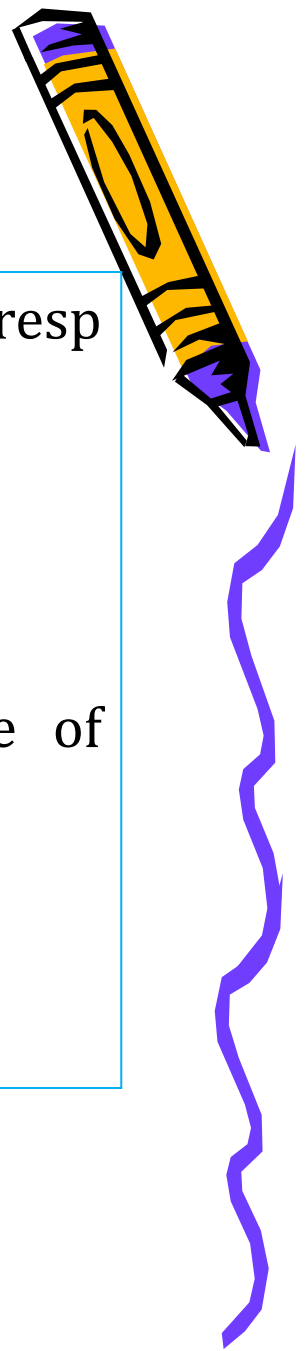


Apparatus for CO₂ stunning

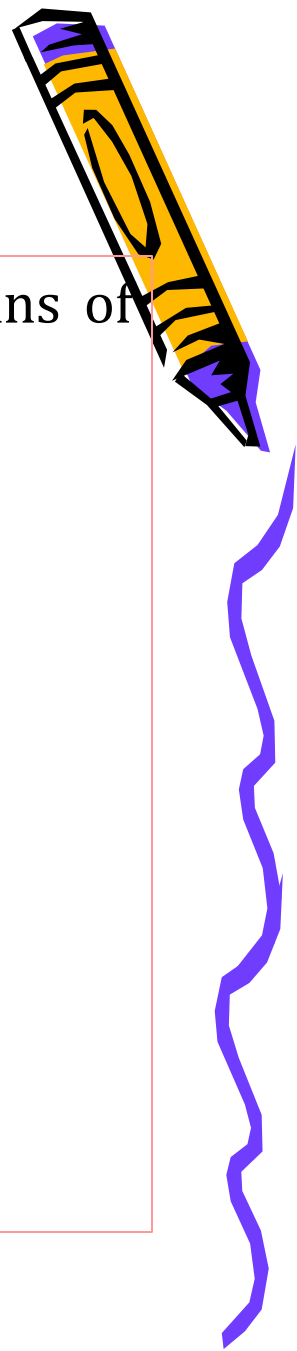


Typical signs in CO₂ stunning

- Period of increased respiratory rate followed by slow resp movement & final dyspnoea
- Corneal & palpebral reflex are absent
- Extreme muscle flaccidity
- Limbs & jaws are consequently relaxed
- Most reliable sign of loss of sensibility is absence of respiratory activity
- Gagging respiratory movement is the sign of imminent brain death



Electrical stunning



Passing alternate electric current through brain by means of electrodes placed on either side of head using tongs

Mechanism of action

- Causes massive depolarization of neurons of brain
 - ✓ Resulting in an epileptic form seizure
- Poorly positioned electrodes: missed shock
 - ✓ Animal although paralyzed is fully conscious
- Aptly applied cause incoordination of nerve cells

❖ Electrical stunning mainly in pigs & poultry



Electrical stunning in pig



Criteria for production of genuine stun

- Sufficient electric current is required

- Animal remains insensible till bleeding or
- Killed outright by cardiac arrest

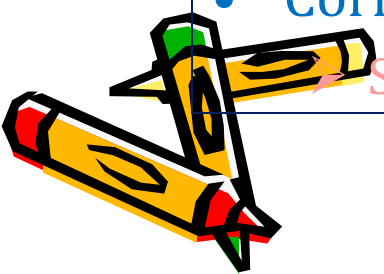
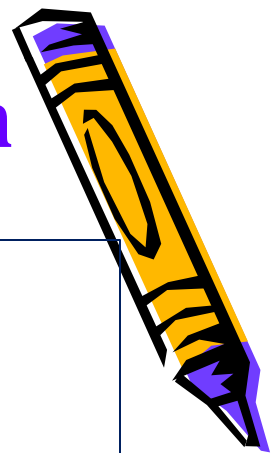
Current	➤ Too high → muscle haemorrhage → broken bones
	➤ Too low → animal paralysed but conscious

- Sufficient application time

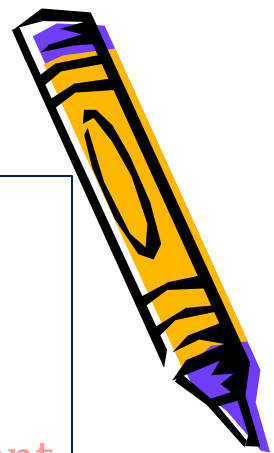
- To induce genuine electroplectic shock
- Min application time- 7s for low voltage (<150V)
-3s for high voltage (>300V)

- Correct positioning of electrodes

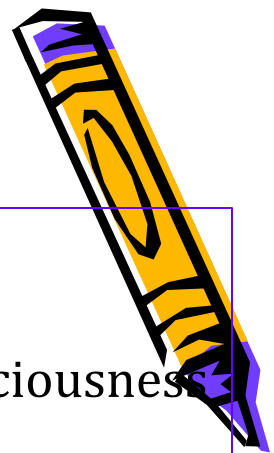
- So that current passes through thalamus & cortex



- Electrical resistance should be minimal
 - Keeping skin of head clean & dry
 - Keeping electrodes moist by immersion in brine
 - Wetting of body discouraged as it allows current passing through surface rather than brain
 - Not practiced in cattle due to insulating effect of fine hairs in head
- Passage of electric current facilitated if
 - Caloric intake of animal reduced
 - State of hydration is increased
- ✓ Efficiency of electric stunning not dependent upon voltage amperage & time but upon energy supplied



Positioning of electrodes



1. Head only

- ✓ Electrodes clamped around sides of head like earmuffs
- ✓ Bled within a max interval of 30s to prevent them regain consciousness

2. Head brisket system

- ✓ High voltage of 550v between nose & neck for 3s to stun animal
- ✓ Additional current between neck & brisket to produce cardiac arrest

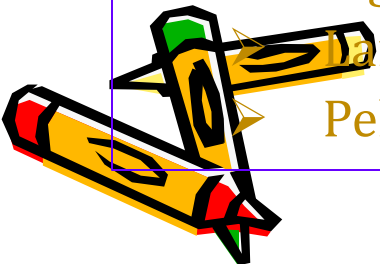
3. Head to back/leg stunning

- ✓ High voltage stunning with help of special tongs through which current is passed both to head & back
- ✓ Brain is anesthetized & heart put to arrest & cut supply to brain which suffers death before anaesthetic ends

➤ Pigs → 1.3A & 250V

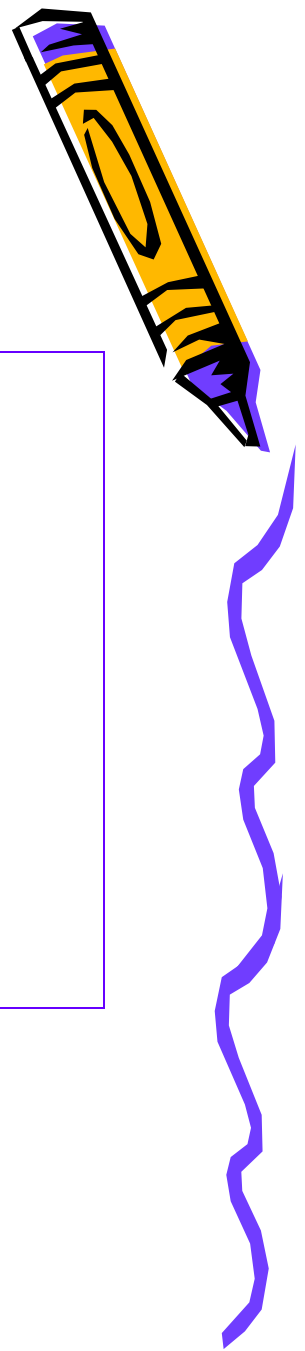
➤ Lambs → 0.1A & 375V

➤ Pelt burn in sheep



SIGNS OF EFFECTIVE STUN

- Immediate collapse of animal with flexion followed by
 - ❖ Extension of limbs
 - ❖ Opisthotonus
 - ❖ Downward rolling of eyeball
 - ❖ Tonic muscular spasm changing to clonic spasm
 - ❖ Muscle flaccidity
 - ❖ These signs termed as electroplectic fit



Stunning in poultry

1. Electrical Stunning

Several types of stunning device based on line speed

a. Hand stunning device

- ✓ Manually operated instrument fitted with step down transformer
- ✓ Birds weighing 2 kg → 70v for 1-3 s
- ✓ Turkeys (6.8-9)kg → 90v for 10s
- ✓ Suitable for low rate of kill (1000 birds/hr)

b. Automatic stunning device

- ✓ **High voltage** type 400 -1000V carried in grid over which shackled birds are conveyed

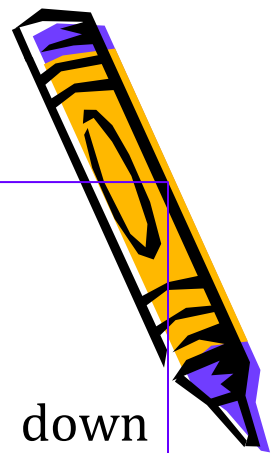
Disadvantages

Severe muscle contractions, fracture, Imperfect bleeding, Risk to employees

- ✓ **Low voltage: 50-60 v & 50 -60 hz**, Contact period -**5s**

Satisfactory narcosis with no pain or stress

Birds removed from line & not bled recover in 2-3 m



Stunning in poultry cont....

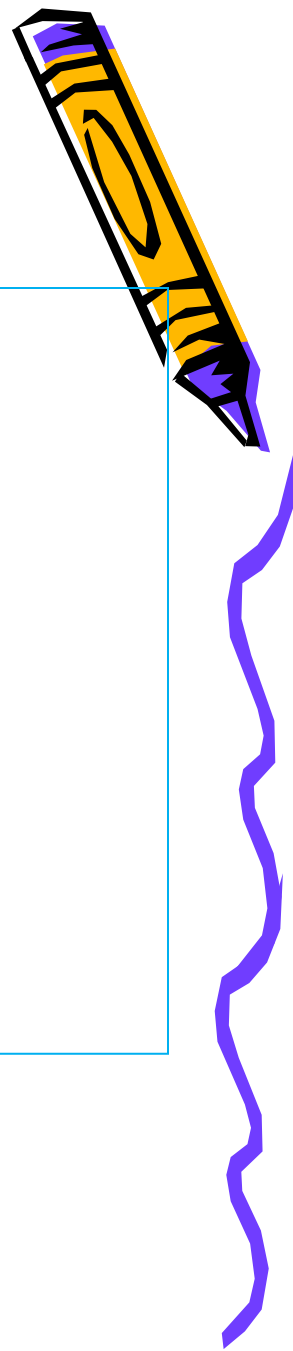


Water bath stunner

- Electrically charged water bath by dragging head of birds through water in which electrode is submerged
- Shackles of killing line touches earth electrode causing electric current to run through body of birds
- **Current not less than**
 - 130 mA in ducks
 - 120 mA in chicken
 - 150 mA in turkey



TYPICAL SIGNS IN BIRDS



- Head arched back
- Eyes widely open
- Legs rigidly extended
- Body showing repeated muscle tremor
- Wings with flight feathers spread
- Tail feathers turned up
- Corneal reflex may be absent

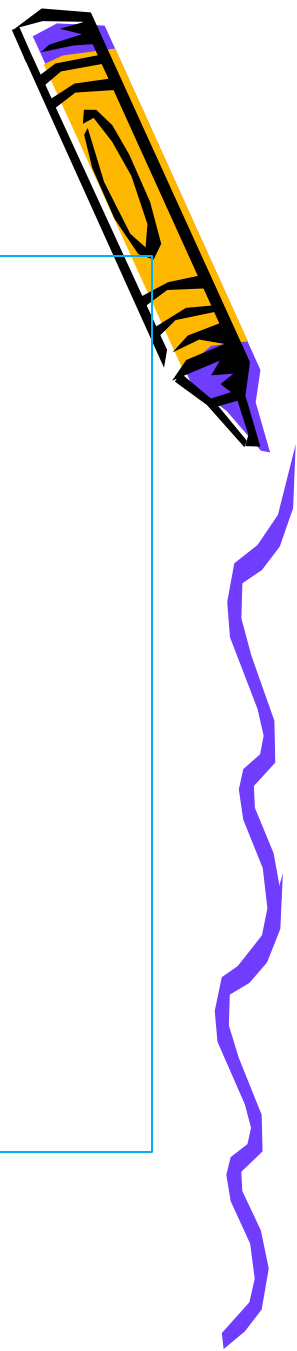


Gas stunning

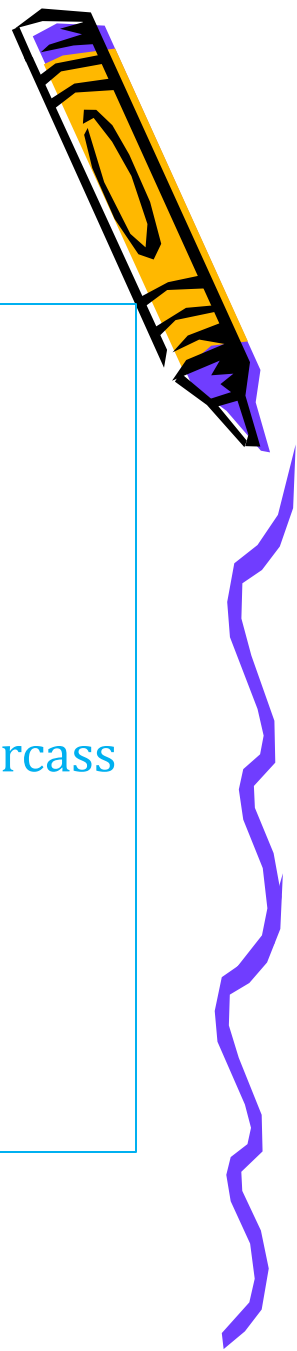
- 30% CO₂ & 60% argon is used
- Hang the birds & cut neck within 3 m
- Will avoid defects like
 - red wing tips
 - wing vein engorgement
 - hemorrhages

Advantages

- Fewer broken bones
- No breast muscle hemorrhage
- Accelerates the PM pH fall in poultry



Effects of stunning on meat quality

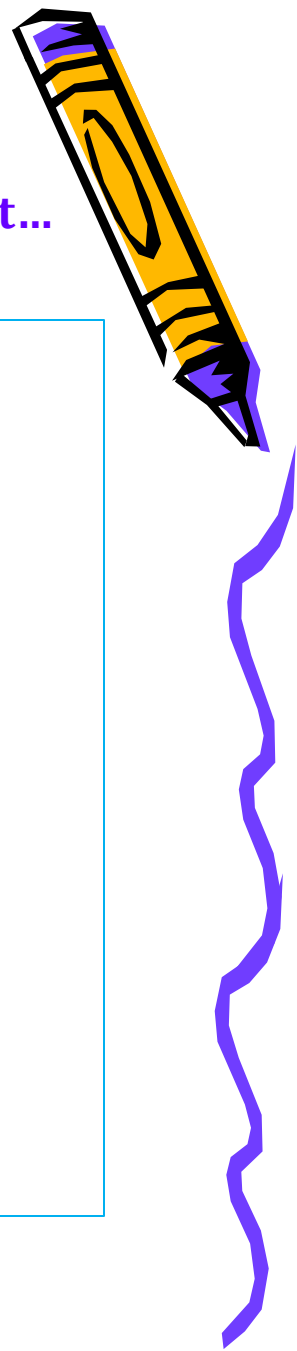


- **Problem with percussive penetrative stunning**
 - Undue delay in stun –stick interval
 - Inadequate penetration of bolt
- **Blood splashing**
 - Presence of blood spot or streaks of diff size in carcass musculature
 - Occurs due to increase in arterial blood pressure
 - Highest case: in head only electrical stunning
 - low incidence: Head to back/leg electric stunning

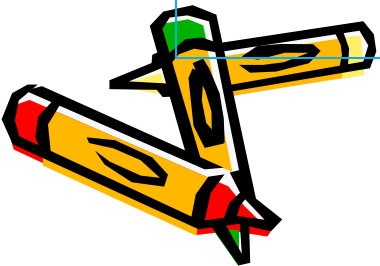


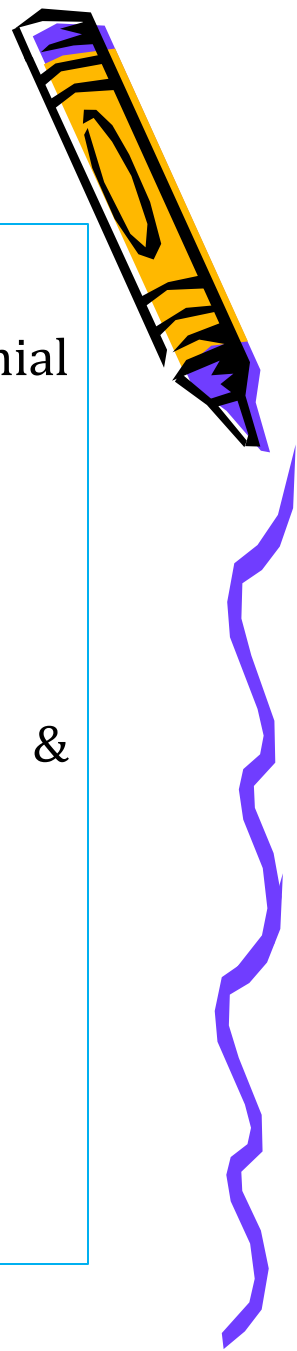
Effects of stunning on meat quality

Cont...



- **Common sites of splashing are:**
 - ✓ Diaphragm
 - ✓ Inner aspect of thoracic & abdominal wall
 - ✓ Loin
- **Factors responsible**
 - ✓ Delay between stunning & sticking
 - ✓ Violent uncoordinated muscular contraction
 - ✓ Long journey & fatigue
 - ✓ Animal dying of asphyxia
 - ✓ Excitement before slaughter





- **Petechial hemorrhage**

- ✓ High voltage head only stunning result in petechial hemorrhage throughout loin

- **Fracture of bones**

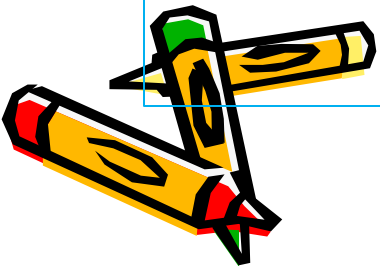
- ✓ Occurs in high voltage electric stunning
- ✓ Due to force of tonic convulsion induced during & immediately after stunning

Mainly in → Scapula

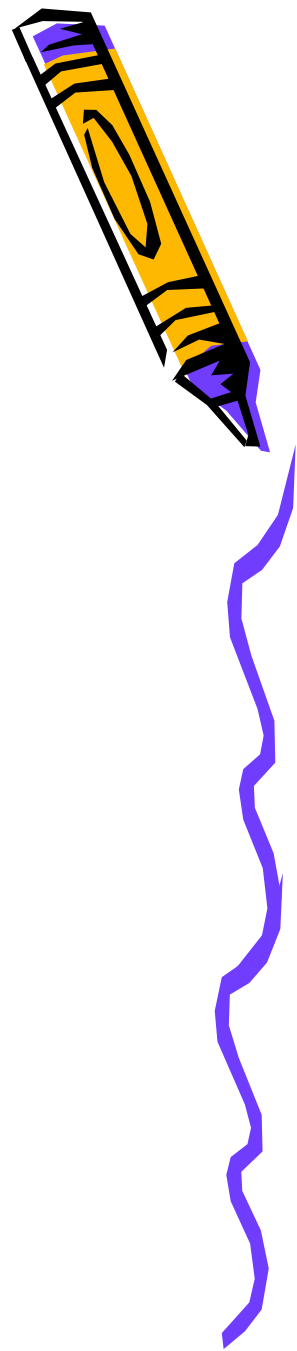
→ Neck of femur

→ Pelvis

→ 5 or 6th thoracic vertebrae



BLEEDING



Two methods of bleeding

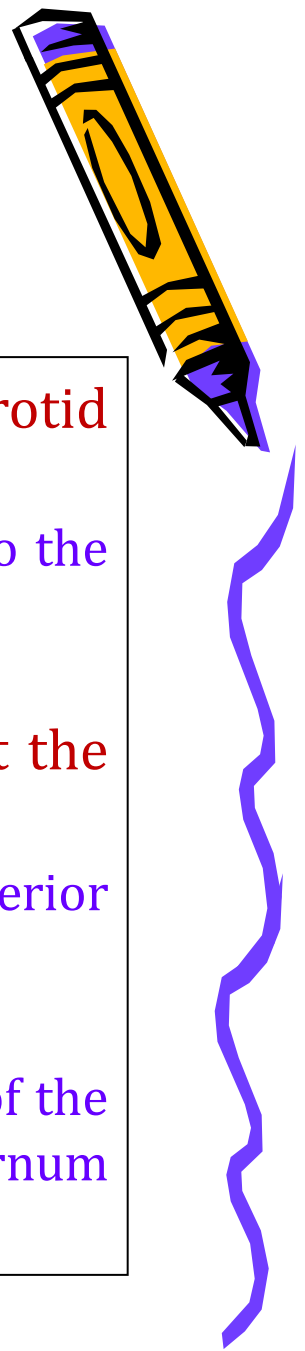


1. Bilateral severance of the carotid arteries and jugular veins-
by insertion across the throat, caudal to the larynx (in ritual method)

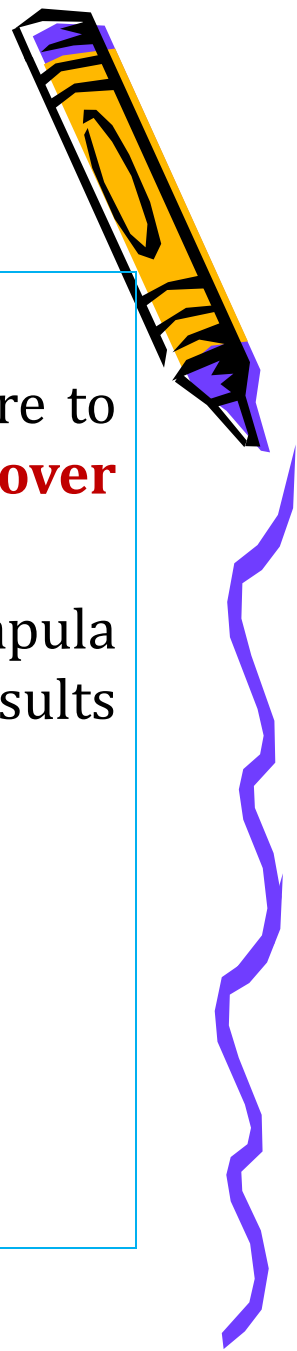


2. Insertion in the jugular furrow at the base of neck and
sever the brachiocephalic trunk and anterior vena cava

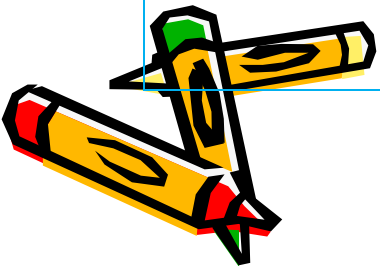
In pig: knife is inserted in the middle of the neck at the depression in front of sternum and sever the anterior vena cava



Precaution must be taken



- The knife should not be passed too far
- It may puncture the pleura, blood comes out & adhere to the thoracic cavity produce **back bleeding** or **over sticking**
- In pig over sticking may produce pocket beneath scapula (during scalding blood & water accumulate) & results cooked appearance
- **Bleeding time:** Cattle-6 min (yield is 13.6 kg),
Sheep-5 min (1-2.5 kg),
Pig-6 min (2.2 kg)





THANK YOU

