Module 16

Livestock: Slaughter and Killing Animals for Disease Control Purposes

This lecture was first developed for **World Animal Protection** by Dr David Main (University of Bristol) in 2003. It was revised by **World Animal Protection** scientific advisors in 2012 using updates provided by Dr Caroline Hewson.

Free online resources

To get free updates and additional materials, please go to

www.animalmosaic.org/education/tertiary-education/

This module will teach you

What the potential causes of suffering during slaughter are

How to improve welfare through audits

Reasons for slaughter

Slaughter: the killing animals for food or to control animal disease

Meat consumption is a widespread dietary culture

- **Centralised commercial slaughter – to supply urban populations**
- **Subsistence slaughter (‘home killing’) –animals killed locally by farmers, for the local community**

‘Home-killed’ animals

Some slaughter methods have not changed for thousands of years

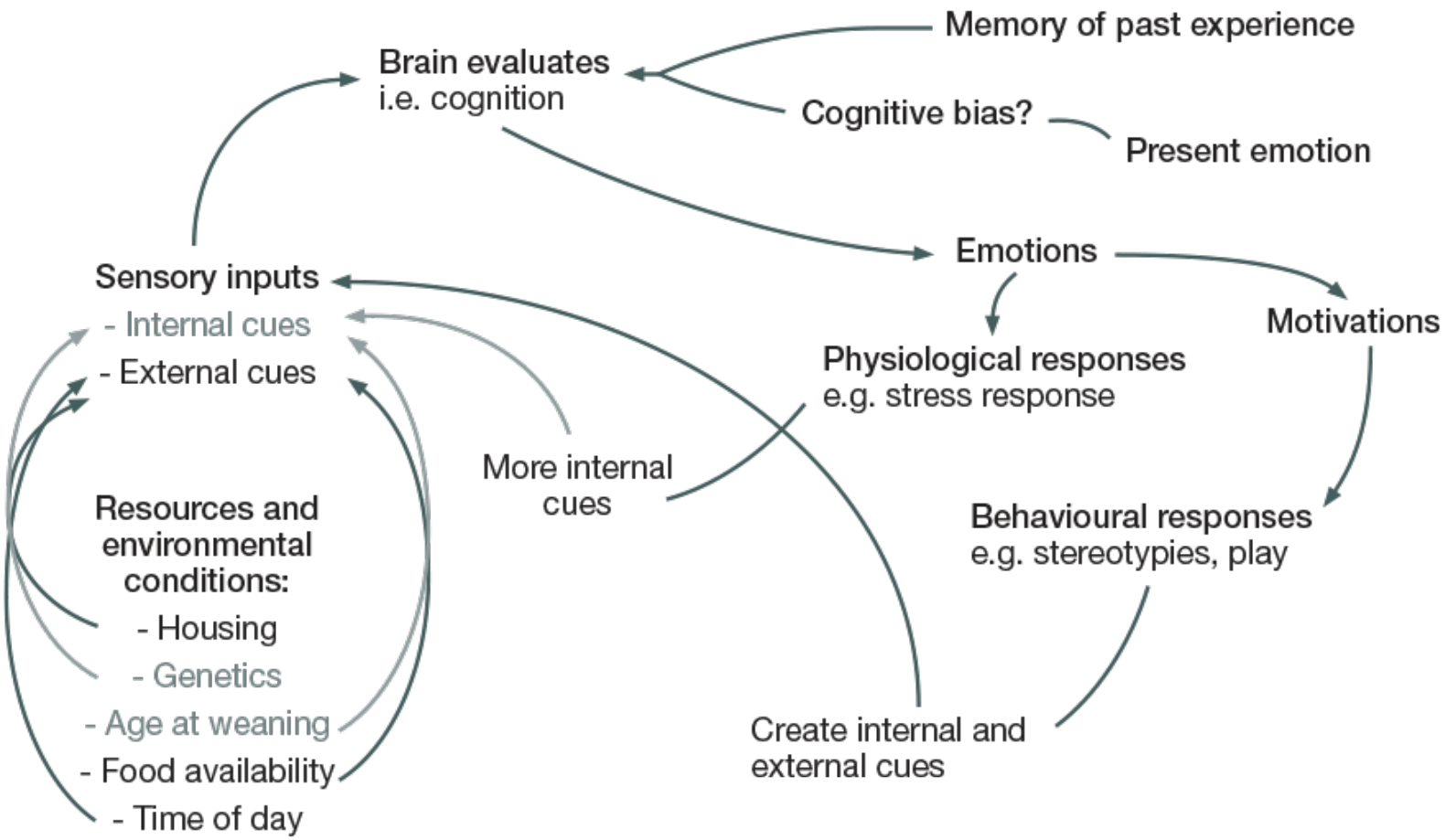
- Exsanguination
- Decapitation
- Shot in the head and then bled out
- ‘Puntilla’: severs the spinal cord in conscious animal (cattle, buffalo)
- May be restrained with ropes etc. to allow neck cutting and protect personnel

Commercial slaughter and the animal's experience

Chain of events

- Collection on farm
- Loading
- Transport
- Rest breaks
- Unloading
- Lairage
- Movement to restrainer
- Restraint
- Slaughter: stunning and killing

Review: animals' experience



Slaughter and the animal's experience
(Ferguson & Warner, 2008)

Sensory inputs that may reduce welfare

- Handling and increased human contact
- Unfamiliar environments
- Lack of food and water
- Climatic variation
- Changed social structure

Resulting experiences

- Fear
- Dehydration and hunger
- Fatigue
- Pain

Effect of stress on meat quality
(Ferguson & Warner, 2008)

pH and water-holding capacity

- **High pH ⇨ dark firm dry (DFD)**
- Ruminants and poultry: glycogen depleted by pre-slaughter stress, e.g. extreme cold
- **Low pH ⇨ pale soft exudative (PSE)**
- Pigs: pre-slaughter stress ⇨ increased glycolysis post-mortem
- Genetic predisposition
- High voltage electrical stunning may increase occurrence (Gregory 2008)

Palatability

- **Reduced in beef and lamb stressed by goads despite a normal pH**

Effect of stress on meat quality

Review: collection on farm, loading, transport

Collection and Loading (Grandin, 2010a), e.g.

- **Handling – flight distance**
- **Design – non-slip flooring, ramp angle**

Transport (Cockram, 2007)

- **Animals fit for transport**
- **Environmental conditions e.g. driving style, road conditions, vehicle design and operation, space allowance**

Review: unloading at abattoir
(Grandin, 2010a)

Vehicle design – non-slip flooring, ramp angle

Handling – flight distance; restraint to check identification

Importance of local research, e.g.

- **US and Canada** (Schwartzkopf-Genswein et al., 2012);
  Namibia (Hoffman & Lühl, 2012);
  Brazil, Chile & Uruguay (Paranhos da Costa et al., 2012)

Lairage (animals in holding pens)

Stressors

- Mixing of unknown animals / fighting
- Lack of food / water / shade / opportunities to hide from other animals
- Heat and cold stress
- Noise

It is recommended to keep animals in lairage for as short a time as possible.

Movement

Important to apply principles of flight zone and point of balance

Group handling principles (gregarious animals)

Non-slip floors

No sharp corners

Avoid visual and audible distractions at the high throughput areas

No prodding, shouting or dragging

Mechanical Restraint

Comfortable, upright

Fully supported body

Non-slip flooring

Even pressure, not too tight

Block vision (solid sides)

- **Avoid sudden, jerky movements**

Restraint: shackling

Mechanised electrical stunning and bleeding of poultry

Slaughter

Stunning must cause immediate unconsciousness – ideally within 200 milliseconds

Irreversible

- Captive bolt (penetrative)
- Gas (depending on mixtures concentrations and time of exposure)

Reversible

- Electrical: recovery in ~20-60 seconds
- Captive bolt (concussive)
- Gas (depending on mixtures, concentrations and time of exposure)

Killing

- Typically: exsanguination (bleeding)
- Other methods: cardiac arrest by electrocution/anoxia by gas

Electrical stunning

Electricity induces uncoordinated electrical activity (grand mal seizure) in the brain → unconscious

It is reversible

Can reduce meat quality (blood splash)

Electrical stunning: water bath for birds

The head of each bird passes through a ‘water bath’

Credit: Dr N. Gregory

Captive bolt and concussive stunning

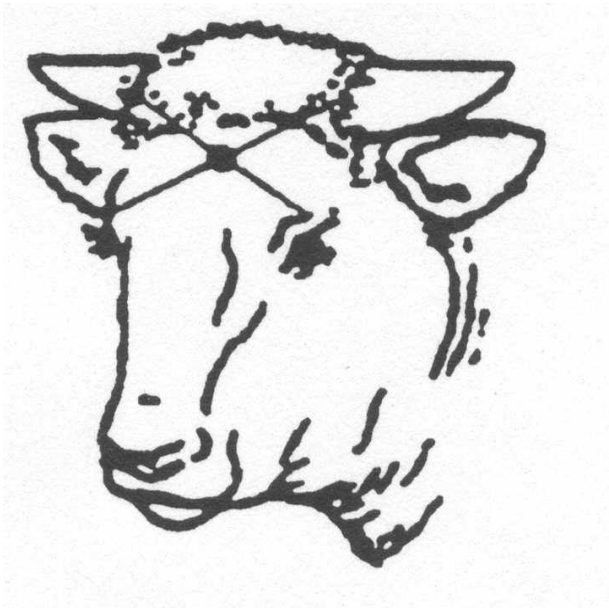
If applied correctly, can induce insensibility within 15 milliseconds

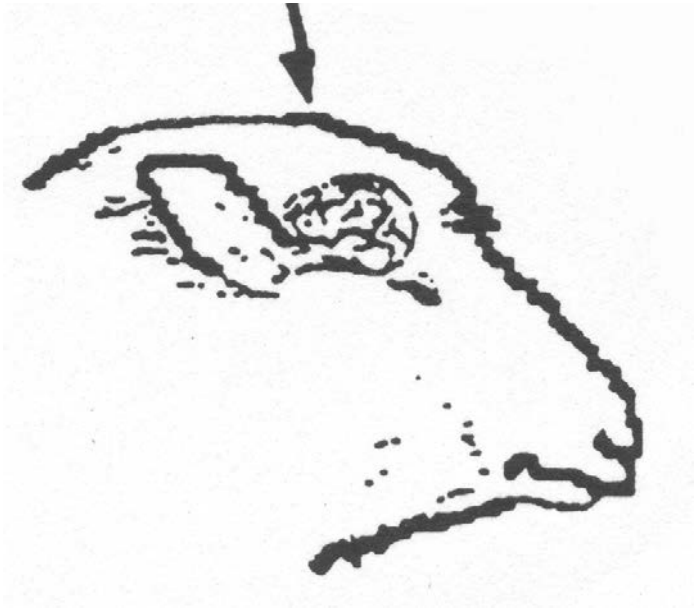
Credit: Dr N. Gregory

Credit: Dr N. Gregory

Positioning is important

Positioning varies according to species, horns and age





Gas stunning / killing

Also known as controlled atmosphere killing

Poultry and pigs

High concentrations of inert gases (argon, nitrogen) or carbon dioxide, e.g.

- High argon (90%), low oxygen (2%) in some mixtures

Carbon dioxide can be very aversive

- Breathlessness before losing consciousness
- Convulsions with very low oxygen concentrations

Research continues into correct combination of gases

Signs of effective stunning

Focus on the head

- Absence of eye reflexes (corneal reflex) and blinking when eye is touched
- Head hangs straight down

Body hangs straight down (poultry) – no arching of the back or struggling; the legs may move/tremor of wings

Gasping and gagging reflexes possible, but no rhythmic breathing or vocalisation

No peripheral body reflexes, i.e. when pricking nose

Killing methods: exsanguination

Religious slaughter

Jewish method = *shechita*

- ⇨ kosher meat
- Stunning not permitted

Muslim method = *dhabh* or *zabiha*

- ⇨ Halal meat
- Some authorities permit stunning before or just after the bleeding

Was considered best practice when introduced

- Very strict rules re sharpness of knife, treatment of animals etc.

Slaughter without stunning (1)

Concerns today = pain, fear, distress

- Additional pressures at the large throughput operations
- From restraint
- From cut
- When blood clotting occurs during bleeding it can take too long for the animal to become unconscious
- Blood may be aspirated into trachea and lungs

Slaughter without stunning (2)

Restraint causes distress?

- Yes if animals are rotated in a restraint pen

Pain from cut?

- It is important that knife is long and skin does not close over the knife during the cut
- Guidelines very clear on knife being sharp and smooth
- EEG in veal calves suggests cut very painful in conscious animals (Lambooij et al., 2012)

Slaughter without stunning (3)

Too long to lose consciousness?
(Gregory et al., 2008; Grandin, 2010b; Gregory et al., 2010; Gregory et al., 2012)

- **Anecdotal: 94% lose consciousness within 17 seconds – sheep sooner than cattle**
- **Cutting the neck (halal, schechita, secular):**
- False aneurysms in cephalic ends of severed carotid arteries
- Develop within 7 to 21 seconds of the cut (in stunned cattle too)
- ⇨ protracted perfusion of brain in ~ 5 to 14% of animals e.g. more than 60 seconds to lose consciousness
- Minimise by making cut at C1, not traditional C2–C5

Slaughter without stunning (4)

Pain because blood aspirated?

(Gregory et al., 2009a, 2012)

- **Blood flows onto glottis and enters trachea and alveoli**
- **Cut traditionally severs recurrent laryngeal nerve and vagus nerves so cannot feel blood or cough in response?**
- Glottal sensations could be transmitted by cranial laryngeal nerve (level of C2)

Credit: Dr N. Gregory

Summary so far

Chain of experiences leading to slaughter

Concerns

- Pre-slaughter handling
- Effectiveness and duration of stun
- Religious slaughter
- Seeing slaughter?

Sight of blood, slaughter or dead animals

Seeing or smelling blood does not seem to distress unless killed animal was distressed
(Grandin, 2010a)

Empathy (Edgar et al., 2012)

- Emotional reaction to observed experience of another
- Just general arousal or response to observer's own distress?

How to improve welfare

Auditing outcomes

- **Raises standards, e.g.**
- USA
- South America

Economics

- **Cost of improvements**

Auditing welfare at slaughter

Numerical scoring
(Grandin, 2010c; Paranhos da Costa et al., 2012)

- **Welfare outputs**
- **‘Yes/No’ questions**
- **100 animals ⇨ percentages**

Welfare Quality® project (Velarde & Dalmau, 2012)

- **12 criteria**
- **Welfare inputs and outputs: ‘Yes / No’ questions, or ‘0, 1, 2’**
- **Differing numbers of animals**

Numerical scoring (1)

Five animal-based measures

- **% effectively stunned at the first attempt**
- E.g. at least 95% of cattle
- **100 % must still be unconscious after they are hung on the rail**
- **% that vocalise during handling and stunning**
- E.g. 5% or less of the pigs squeal in the restrainer box or stunning pen
- **% that fall during handling**
- Handling practices or flooring need to be improved if more than 1% of the animals fall handling
- **% moved with an electric goad**
- i.e. less than 25%

Numerical scoring (2)

Prohibited practices

1. No dragging of animals
2. No dropping of animals
3. No throwing of animals
4. No use of puntilla (stabbing behind the poll) or cutting tendons to immobilise
5. No hoisting live animals before ritual slaughter

Numerical scoring (3)

Measures of welfare on-farm and during transport to the abattoir

- % of lame animals
- % of thin animals
- % of dirty animals
- % of animals with sores, bruises or lesions
- % that die before slaughter
- % morbidity (illness or injury)
- % of birds with broken wings and legs

Auditing: Welfare Quality® project
(Velarde & Dalmau, 2012)

Area	Criteria
1. Nutrition	Prolonged hunger
	Prolonged thirst
2. Housing (Comfort in terms of:)	Resting area
	Ease of movement
	Environmental temperature (not applied to beef cattle)
3. Health (absence of:)	Injuries
	Disease (not applied to beef cattle)
	Pain caused by procedures
4. Appropriate behaviour	Positive emotional state
	Good human–animal relationships

Examples of how you can use results from an audit

45% pigs moved using electric goads

- Slippery floors?
- Shadows?
- Noise?
- Gusts of air?
- A particular stockperson?—training?

15% cattle not stunned at first attempt

- Line throughput
- Maintenance e.g. dirty trigger
- Damp cartridges
- Wrong positioning

Welfare legislation on slaughter

OIE guidelines provide minimum standards (OIE, 2009)

Legislation may be ineffective for a number of reasons, including

- limited resources to enforce, train personnel
- relevant authorities not willing to consider slaughter as an area of welfare concern

Summary

Humane slaughter

- Improves meat quality ⇨ increased profit
- Minimises animal stress – gentle handling, rapid onset of unconsciousness
- Importance of research

How to improve welfare by audits

Feedback:
Please let us know what you think

- **How have you used this module?**
- **What did you like about it?**
- **What did you not like?**
- **Do you have any tips to share?**

Please take part in our 10 minute survey here:

https://www.surveymonkey.com/s/BKP3D6H

Your feedback will help other teachers like you

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Further reading and resources

South America

Guidelines on transport and slaughter of cattle in Brazil: available from Grupo ETCO (www.grupoetco.org.br)

Guidelines for Uruguay: available at www.bienestaranimal.org.uy

Guidelines for Chile: available at www.bienestaranimal.cl

International Resources

FAO (Food and Agriculture Organisation). Gateway to Farm Animal Welfare: available at http://www.fao.org/ag/againfo/themes/animal-welfare/en

OIE (Office Internationale des Epizooties). Terrestrial Animal Health Code: available at www.oie.int/index.php?id=169&L=0&htmfile=chapitre_1.7.5.htm

Welfare Quality Project www.welfarequality.net/everyone

Resources in English

Dr Temple Grandin's Web page: Livestock Behaviour, Design of Facilities and Humane Slaughter, available at www.grandin.com/

Grandin, T. (2000). Livestock Handling and Transport. Wallingford: CABI Publishing.

Humane Slaughter Association UK website, available from: www.hsa.org.uk