RECOMMENDED
ANIMAL HANDLING
GUIDELINES FOR
MEAT PACKERS

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Written by
Temple Grandin, Ph.D.
Assistant Professor
Colorado State University
Credits

Many people worked with the American Meat Institute (AMI) to develop this book. AMI extends special thanks to the AMI Animal Welfare Committee for initiating the idea, and to Dr. Temple Grandin, assistant professor in the Animal Science Department at Colorado State University, for writing the guidelines. AMI also thanks the many industry executives, USDA inspection officials and animal handling experts who reviewed the text.
Introduction

Proper livestock handling is extremely important to meat packers for obvious ethical reasons. Once livestock arrive at packing plants, proper handling procedures are not only important for the animals' well-being, but can also mean the difference between profits and losses due to meat quality or worker safety. The Humane Slaughter Act of 1978 dictates strict animal handling and slaughtering standards for packing plants. Those standards are monitored by some 7,000 federal meat inspectors nation-wide. The meat packing industry takes these standards very seriously.

For the best results in animal handling, plant management must make proper handling and stunning a high priority. Top management must play an active role. Plants with the best handling and stunning practices have managers who closely monitor stunning and handling practices. This manual provides employees and managers with information which will help them improve both handling and stunning. Employees handling hundreds of animals day after day sometimes need reminders from management that animals must always be handled carefully.

Healthy animals, properly handled, keep the meat industry running safely, efficiently and profitably. This handbook is designed to help ensure that proper handling guidelines and recommended practices are widely understood.
Guidelines for Livestock Holding Facilities and Trucking

**Preventing Injuries and Bruises** - Non-slip flooring is essential to prevent falls and crippling injuries. Humane, efficient handling is impossible on slick floors. All areas where livestock walk should have a non-slip surface. Existing floors can be roughened with a light jack hammer or a grooving machine. On scales, crowd pens and other high traffic areas, a grid of one-inch steel bars will provide secure footing. Construct a 12-inch by 12-inch grid and weld each intersection. Use heavy rod to prevent the grid from bending.

New concrete floors for cattle should have an 8-inch diamond or square pattern with 1 1/2 inch x 1 1/2 inch V grooves. For hogs and sheep, stamp the pattern of 1 1/2 inch raised expanded metal into the wet concrete. A rough broom finish will become worn smooth. Floors should be grooved. It is also essential to use the right concrete mix for maximum resistance to wear.

A good example of non-slip flooring

Gates, fences and chutes should have smooth surfaces to prevent bruises. Sharp edges with a small diameter, such as angle irons, exposed pipe ends, and channels, will cause bruises. Round pipe posts with a diameter larger than 3 inches are less likely to bruise. Vertical slide gates in chutes should be counter-weighted to prevent back bruises. The bottom of these gates should be padded with cut tires or conveyor belting. The gate track should be recessed into the chute wall to eliminate a sharp edge that will bruise. Gates in drive alleys should be equipped with tie backs to prevent them from swinging out into the alley. Livestock are easily bruised if they become caught between the end of the gate and the fence. This is a common cause of bruises in the valuable loin area.
Pressing up against a smooth flat surface such as a concrete chute fence will not cause bruises. However, a protruding bolt or piece of metal will damage hides and bruise the meat. Bruise points can be detected by tufts of hair or a shiny surface. Contrary to popular belief, livestock can be bruised moments before slaughter, and stunned cattle can be bruised until they are bled. The entrance to the restrainer should be inspected often for broken parts with sharp edges.

Surveys show that groups of horned cattle will have twice as many bruises as polled (hornless) cattle. A few horned animals can do a lot of damage and tipping horns does not reduce bruises.

**Improving Animal Movement** - Cattle, hogs and sheep have wide-angle vision and they can see behind themselves without turning their heads. This explains why they will often balk at shadows or puddles of water on the ground. Balking slows production and can be prevented. Drains should be located outside of the areas where animals walk. A drain or a metal plate running across an alley will cause balking. Flapping objects such as a coat hung over a fence will also make livestock balk. When wetting hogs in the chute, be sure not to spray the animals' faces with water, because they will back up.

Animals tend to move from a darker area to a more brightly lighted area. Lamps can be used to attract animals into chutes. The light should illuminate the chute up ahead and it should never glare directly into the eyes of approaching animals. Another approach is illuminating the entire chute area. This approach eliminates patches of light and dark which may confuse animals.

Solid sides which prevent the cattle from seeing outside the fence should be installed on the chutes which lead to the stunner and the crowd pen which leads up to the chute. Solid sides in these areas help prevent cattle from becoming agitated when they see activity outside the fence -- such as people. Cattle tend to be calmer in a chute with solid sides. The crowd gate on the crowd pen should also be solid to prevent animals from attempting to turn back, towards the stockyard pens they just left.

In some hog plants, one solid side and one open side on fences is useful, allowing employees to view hogs and correct problems if necessary. When one fence side is open, plants should restrict employee traffic on that side to reduce hog agitation.
It is important to reduce noise in the stunning area. Animals are more sensitive to high pitched noise than people. Animals will be calmer and easier to handle if noise levels are reduced. Install mufflers on air valve exhausts or put them outside. Rubber stops on gates can be used to stop clanging. Braking devices on the shackle return improve safety and reduce noise. Use large diameter plumbing and replace noisy pumps with quieter ones. Some brands of pumps are quieter than others. Rubber hose connection between the power unit and metal plumbing will help prevent power unit noise from being transmitted throughout the facility. Any new equipment that is installed in animal handling or stunning areas should be engineered for quietness.

**Improving Meat Quality and Animal Welfare -** All livestock must have access to clean drinking water. During hot weather (over 70 degrees Fahrenheit), hogs should be sprinkled with water in the stockyard pens. For maximum cooling effect, the sprinklers should have a coarse enough spray to wet the animals. Sprinklers that make a fine mist should not be used because they tend to increase humidity rather than cool the hogs. Sprinkler water should flow intermittently to keep hogs wet at all times. Keeping hogs cool is very important because a hot hog will have more PSE (pale, soft, exudative, stressed pork). Hogs become over heated easily because they are covered by a layer of fat and they do not sweat. All hog plants should have a heated staging area prior to the stunning chute where hogs can be showered prior to stunning during cold weather.

**Using Prods and Persuaders Properly -** Electric prods should be used sparingly to move livestock. They must never be wired directly to house current. A transformer must be used. Hogs require lower voltages than cattle. A doorbell transformer works well for hogs. Low prod voltages will help reduce both PSE and blood spots in the meat. Fifty volts is the maximum voltage for prods hooked to an overhead wire. Battery-operated prods are best from a livestock handling standpoint because they provide a localized directional stimulus between two prongs.

The use of electric prods can be greatly reduced by using other driving aids such as plastic streamers or strips cut from garbage bags attached to a stick. The plastic can be clamped in a mop handle. Cattle can be easily turned and moved in the crowd pen by shaking the streamers near their heads. Canvas slappers can be used for moving hogs. Rattles work well for moving sheep.

Truck drivers should be careful with prods. Rushing livestock during unloading is a major cause of bruises. Serious loin bruises are often caused by two cattle wedged in a truck door. Management should closely supervise truck unloading.

**Providing Adequate Pen Space -** Stockyards at packing plants should have sufficient capacity so that animals can be promptly unloaded from trucks. Heat builds up rapidly in a stationary vehicle. To reduce PSE, hogs should be rested two to four hours prior to stunning. In large plants, pens should be designed to hold one or two truckloads. A few smaller pens will also be required for small lots. Pen space allocations may vary depending upon weather conditions, animal sizes and varying holding times. As a guideline, 20 square feet should be allotted for each 1,200-pound steer or cow, and six square feet per hog. These stocking rates will provide adequate room for “working space” when animals are moved out of the pen. If the animals are stocked in the pen more tightly, it will be more difficult for the handler to empty the pen. The recommended stocking rates provide adequate space for all animals to lie down.
**Recommended Handling Facility Layout** - This diagram illustrates a modern cattle stockyard and chute system. All the animal movement is one-way and there is no cross traffic. Each long narrow pen holds one truckload. The animals enter through one end and leave through the other. The round crowd pen and curved chute facilitate movement of cattle to the stunner.

Facility Layout - Modern cattle facility with many good features. The unloading ramps have a 10-foot level dock for the animals to walk on before they go down the ramps. Each unloading pen can hold a full truck load. Unloading pens are recommended for both hog and cattle facilities to facilitate prompt unloading. Long, narrow diagonal pens eliminate sharp corners and provide one-way traffic flow. The round crowd pen and curved single file chute take advantage of the natural tendency of cattle to circle.

A curved chute is more efficient for cattle because it takes advantage of their natural circling behavior. It also prevents them from seeing the other end while they are standing in the crowd pen. A curved chute should be laid out correctly. Too sharp a bend at the junction between the single file chute and the crowd pen will create the appearance of a dead end. All species of livestock will balk if a chute looks like a dead end.
Round crowd pens are efficient for moving all species into a single file chute.

Round crowd pen with correct number of cattle.

Crowd gate lengths for hog operations may vary based on line speeds and plant sizes. As a guideline, the recommended radii (length of crowd gate) are: Cattle, 12 feet; hogs, seven feet; and sheep, eight feet. The basic layout principles are similar for all species, but there is one important difference. Cattle and sheep crowd pens should have a funnel entrance and hog crowd pens must have an abrupt entrance. Hogs will jam in a funnel. A crowd pen should never be installed on a ramp because animals will pile up in the crowd pen. If ramps have to be used, the sloped portion should be in the single file chutes. In hog facilities, level stockyards and chute systems with no ramp are most efficient.

Unloading Animals Properly - For all species, a plant should have sufficient unloading ramp capacity so trucks can be unloaded promptly. In large plants, at least two and preferably three ramps are required. Unloading ramps should have a level dock before the ramps go down so that animals have a level surface to walk on when they exit the truck. The slope of the ramp should not exceed 20 degrees. On concrete ramps, stairsteps are recommended because they provide better traction than cleats or grooves when ramps become dirty.

Well-designed unloading ramp.
For cattle, the recommended stair step dimensions are 3 1/2 inch rise and a 12-inch long tread. If space permits, an 18-inch long tread will create a more gradual ramp. For hogs, a 2 1/2 inch rise and a 10-inch tread works well. On adjustable ramps, cleats with eight inches of space between them are recommended. All flooring and ramp surfaces should be non-slip. Many animals are injured on slippery unloading ramps.

**Recommended Trucking Practices** - Trailers should be kept in good repair. To comply with environmental regulations, truck floors should be leak-proof to prevent urine and manure from dripping onto the highway. With today’s modern taller cattle, it is essential that semi-trailers have sufficient height between decks to prevent back injuries. Overloading of trucks will increase bruising. In one survey, overloading two extra head of cattle increased bruising. Overloading of hog trucks will increase death losses and PSE. To prevent skin blemishes, hog trucks should be cleaned after each load.

When the temperature is over 60 degrees, use wet sand or wet shavings to keep hogs cool. If the temperature is over 80 degrees, sprinkle hogs with water prior to loading at buying stations or on the farm. Never bed hogs with straw during hot weather. When the temperature is below 60 degrees, bed hogs with straw or deep, dry shavings to keep them warm. In the northern regions, approximately half of the air holes in aluminum trailers transporting hogs should be covered with plywood when the temperature drops to 10 degrees.

Veal calves can require special care in transport because they are so young. Take care in cooler temperatures (below 60 degrees) to provide straw bedding and plug some airholes in trucks so the calves do not become too cold.

People trucking and handling animals need to understand both wind chill factors and heat stress. Wind chill can kill livestock. Wetting the haircoat on cattle destroys its ability to insulate the animal’s body. Death losses in cattle are often greatest when the temperatures are near freezing and either rain or freezing rain blows into a truck. Dry cold weather is less hazardous to cattle because the coat retains its ability to insulate. Wind chill can make the back of a trailer very cold. When a truck is moving 50 mph on a 20-degree day, the wind chill factor for hogs is minus 23 degrees.

The combination of high temperature and humidity is especially detrimental for hogs. When the Livestock Weather Safety Index is in the Danger and Emergency zone, try to schedule hog shipments for the early morning.

**Heat Stress Chart** - The chart provides a guide for plant managers and truckers to help reduce heat stress on livestock. Hazard to the animal increases when both temperature and humidity increase. When conditions are in the alert zone, truckers need to be careful to keep hogs cool. When conditions get into the danger and emergency zone, try to schedule as many hog shipments as possible in the early morning or at night. (From Livestock Conservation Institute Livestock Trucking Guide.)
If this is not possible, trucks should be kept moving and drivers should not be allowed to stop at the coffee shop with a loaded trailer. When the trucks reach the plant, they must be unloaded promptly.

### Recommended Truck Loading Densities

(Livestock Conservation Institute)

<table>
<thead>
<tr>
<th>Feedlot Fed Steers or Cows, Avg. Weight</th>
<th>Horned or Tipped or more than 10% Horned and Tipped</th>
<th>No Horns (polled)</th>
</tr>
</thead>
<tbody>
<tr>
<td>800 lbs.</td>
<td>10.90 sq. ft.</td>
<td>10.40 sq. ft.</td>
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<tr>
<td>1000 lbs.</td>
<td>12.80 sq. ft.</td>
<td>12.00 sq. ft.</td>
</tr>
<tr>
<td>1200 lbs.</td>
<td>15.30 sq. ft.</td>
<td>14.50 sq. ft.</td>
</tr>
<tr>
<td>1400 lbs.</td>
<td>19.00 sq. ft.</td>
<td>18.00 sq. ft.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Market Weight Hogs</th>
<th>Winter</th>
<th>Summer (Temp.is 75+ degrees)</th>
</tr>
</thead>
<tbody>
<tr>
<td>200 lbs.</td>
<td>3.50 sq. ft.</td>
<td>4.0 sq. ft.</td>
</tr>
<tr>
<td>250 lbs.</td>
<td>4.26 sq. ft.</td>
<td>5.00 sq. ft.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Slaughter Weight Lambs and Sheep</th>
<th>Shorn</th>
<th>Full Fleece</th>
</tr>
</thead>
<tbody>
<tr>
<td>60 lbs.</td>
<td>2.13 sq. ft.</td>
<td>2.24</td>
</tr>
<tr>
<td>80 lbs.</td>
<td>2.50</td>
<td>2.60</td>
</tr>
<tr>
<td>100 lbs.</td>
<td>2.80</td>
<td>2.95</td>
</tr>
<tr>
<td>120 lbs.</td>
<td>3.20</td>
<td>3.36</td>
</tr>
</tbody>
</table>

**Livestock Facility and Trucking: Safety Tips for Workers**

1. Prods must always be wired through a transformer. A light bulb wired in series is dangerous to both people and livestock.

2. Mangates and other devices must be installed so people can easily escape from agitated cattle. This is especially important in areas with solid fences. In concrete fences, toe holds can be formed in the walls.

3. Be alert around the unloading dock. A truck driver backing in may not be able to see you.

**Recommended Basic Livestock Handling Principles**

The principles of good livestock handling are similar for the different species. All livestock are herd animals and will become agitated when separated from the herd. If a lone animal becomes agitated, put some other
animals in with it. Never get in the crowd pen or other confined space with one or two agitated, excited cattle. Animals will remain calmer when they are in a group.

Be gentle with them. Cattle, hogs and sheep become agitated and stressed when they are poked with electric prods or hit with a stick. Many people ask, “Do they know they are going to be slaughtered?” Animals behave in the same manner in a packing plant and in the veterinary chute at the farm. They have no concept of being slaughtered. They know they are being handled and they probably think they are getting on a truck. In one study, cattle actually had calmer behavior at the slaughter plant compared to a squeeze chute back at the feedlot.

Livestock may become agitated or balk at strange sounds or the smell of the rendering plant. They are reacting to the strangeness of the smell. They do not know what it is, because they have never smelled these smells before.

Understanding Flight Zone and Point of Balance - Handlers who understand the concepts of flight zone and point of balance will be able to move animals more easily. The flight zone is the animal’s personal space, and the size of the flight zone is determined by the wildness or tameness of the animal. Completely tame animals have no flight zone and people can touch them. An animal will begin to move away when the handler penetrates the edge of the flight zone. If all the animals are facing the handler, the handler is outside the flight zone.

To keep animals calm and move them easily, the handler should work on the edge of the flight zone. He penetrates the flight zone to make the animals move and he backs up if he wants them to stop moving. The best positions are shown on the diagram. The handler should avoid the blind spot behind the animal’s rear. Deep penetration of the flight zone should be avoided. Animals become upset when a person is inside their personal space and they are unable to move away. If cattle turn back and run past the handler while they are being driven down a drive alley in the stockyard, overly deep penetration of the flight zone is a likely cause. The animals turn back in an attempt to get away from the handler. If the animals start to turn back, the handler should back up and increase the distance between himself and the animals. Backing up must be done at the first indication of a turn back. If a group of animals balk at a smell or a shadow up ahead, be patient and wait for the leader to cross the shadow. The rest of the animals will follow. If cattle rear up in the single file chute, back away from them. Do not touch them or hit them. They are rearing in an attempt to increase the distance between themselves and the handler. They will usually settle down if you leave them alone.
The point of balance is at the animal's shoulder. All species of livestock will move forward if the handler stands behind the point of balance. They will back up if the handler stands in front of the point of balance. Many handlers make the mistake of standing in front of the point of balance while attempting to make an animal move forward in a chute. Groups of cattle or hogs in a chute will often move forward without prodding when the handler walks past the point of balance in the opposite direction of each animal in the chute. It is not necessary to prod every animal. If the animals are moving through the chute by themselves, leave them alone. Often they can be moved by tapping the side of the chute.

Using Animals' "Follow the Leader" Instinct - Livestock will follow the leader, and handlers need to take advantage of this natural behavior to move animals easily. Animals will move more easily into the single file chute if it is allowed to become partially empty before attempting to fill it. A partially empty chute provides room to take advantage of following behavior. Handlers are often reluctant to do this because they are afraid the line will run out and miss notches on the power chain. Once a handler learns to use this method, he will find that keeping up with the line will be easier. As animals enter the crowd pen they will head right up the chute.

One of the most common mistakes is overloading of the crowd pen. Crowd pen sizes and densities in hog operations may vary depending on the size and line speeds of plants. In cattle plants, 18 cattle is the maximum number which should be placed in the crowd pen.
In hog plants, 15 hogs is the recommended maximum for chain speeds under 300 an hour and 25 hogs for chain speeds over 800 per hour. Handlers must also be careful not to push the crowd gate up too tightly. Animals need room to turn. The crowd gate should be used to follow the animals and should never be used to forcibly push them. The handler should concentrate on moving the leaders into the chute instead of pushing animals at the rear of the group.

One-way or sliding gates at the entrance to the single file chute must be open when livestock are brought into the crowd pen. Cattle will balk at a closed gate.

One-way flapper gates can be equipped with a rope to open them by remote control from the crowd pen. Less prodding will be required if a stick with plastic streamers is used to turn cattle towards the chute entrance. To turn an animal, block the vision on one side of its head with the streamers. If the leader balks right at the chute entrance, a single poke with the prod may be required. Once the leader enters, the rest of the animals will follow.
Dealing with Excitable Hogs - During the last five years, there have been increasing problems with highly excitable hogs which are difficult to drive at the packing plant. These animals squeal, bunch and pile up. It is difficult to make these hogs separate and walk up the chute. They will constantly balk. Only five percent of the hogs in the Midwest have this problem, but about 10 to 20 percent of the hogs in the Southeast are overly excitable. It is caused by a combination of genetic selection for rapid weight gain and a lack of stimulation in confinement buildings.

Packers and producers need to work together to produce hogs which will have both rapid weight gain and good meat quality. Highly excitable hogs have severe PSE due to agitation during handling. PSE levels will be high even though these hogs are negative on the halothane test for FSS (Porcine Stress Syndrome). Quiet, calm handling is almost impossible due to their bad temperament.

Excitability problems can also be reduced by providing confinement hogs on the farm with rubber hoses to chew on, greater contact with people in their pens and a radio. Playing a radio in the finishing barn gets the animals accustomed to different kinds of sounds. Bad flooring in the finishing barn can also cause problems. Hogs finished on metal or plastic floors will have excessive hoof growth. These animals will balk constantly in the plant.

Recommended Basic Livestock Handling: Safety Tips for Workers

1. A single, lone, agitated steer is very dangerous. Many serious cattle handling injuries are caused by a single agitated steer or cow. One man received twenty-seven stitches after he got in the crowd pen with a lone animal and teased it.

2. Escaped cattle must never be chased. An animal which is loose on the plant grounds will return to the stockyard if it is left alone. If an animal gets loose inside the plant, employees should stay quiet while one designated person either stuns it or eases it out a door.

3. Stay out of the blind spot behind a steer's rear end. If he cannot see you, he is likely to kick you.

4. Install a safety fence consisting of upright posts around the cattle shackling area to prevent cattle from entering other parts of the plant.

Recommended Stunning Practices

Stunning an animal correctly will provide better meat quality. Improper electric stunning will cause bloodspots in the meat and bone fractures. Good stunning practices are also required so that a plant will be in compliance with the Humane Slaughter Act and for animal welfare. When stunning is done correctly, the animal feels no pain and it becomes instantly unconscious. An animal that is stunned properly will produce a still carcass that is safe for plant workers to work on.

Captive Bolt Stunning - To produce instantaneous unconsciousness, the bolt must penetrate the brain with a high concussive impact. The correct positions for stunner placement are shown in the diagram. For cattle, the
stunner is placed on the middle of the forehead on an "X" formed between the eyes and the base of the horns. Some plants which save brains, place the stunner on the hollow behind the animal's poll on the back of the head. This position is less effective, therefore the frontal position on the forehead is recommended.

Proper captive bolt stunner placement positions.

For sheep, a captive bolt is placed on the top of the head. This position is more effective for sheep because they have a very thick skull over the forehead. For hogs, the captive bolt is placed on the forehead.

Captive bolt stunner placed on the head of a steer in the correct position.

A good stunner operator learns not to chase the animal's head. Take the time and aim for one good shot. The stunner must be placed squarely on the animal's
Well-designed cattle stunning box.

Poor maintenance of captive bolt stunners is a major cause of bad stunning. Pneumatic captive bolt stunners require cleaning and seal replacement every night in large plants. For example, a cattle plant which is double shifted and has a chain speed of 250 head per hour will require two to three pneumatic stunners to be completely serviced every night. It is important to keep stunner cartridges dry and the correct cartridge strength must be used.

Eye reflexes should be checked often to insure that stunning is making the cattle unconscious. When the eyelid or cornea is touched there should be no response. An animal that blinks is not properly stunned. Breathing should have stopped and there should be no indication of a righting reflex when the animal is hanging on the rail. Reflexes may cause a stunned animal’s legs to move, but the head should hang straight down and be limp.

Proper Cattle Restraint for Stunning - If a stunning box is used, it should be narrow enough to prevent the animal from turning around. The floor should be non-slip so the animal can stand without losing its footing. It is much easier to stun an animal that is standing quietly. Only one animal should be placed in each stunning box compartment to prevent animals from trampling on each other.

Most large plants restrain cattle in a conveyor restrainer system. There are two types of conveyor restraints, the V restrainer and the new center track system. In a V restrainer system, the cattle are held between two angled conveyors. In the center track system the cattle ride astride a moving conveyor. The center track system provides the advantages of easier stunning and improved ergonomics because the stunner operator can stand closer to the animal. Either type of restrainer system is much safer for workers than a stunning box. Restrainer conveyors are recommended for all...
plants which slaughter over 100 head per hour. Stunning boxes are difficult and dangerous to operate at higher speeds. In a plant which slaughtered 160 cattle per hour, replacement of multiple stunning boxes with a conveyor restrainer eliminated at least one serious accident each year.

![V restrainer system for cattle.](image1)

Lighting in the restrainer room over the top of the conveyor will help induce cattle to raise their heads for the stunner. Cattle should not be able to see light coming up from under the restrainer because it may cause balking at the entrance. Restrainer systems should be equipped with a long, solid hold-down rack to prevent rearing. The hold-down should be long enough so that the animal is fully settled down onto the conveyor before it emerges from under it.

![Center track restrainer for cattle.](image2)
Electric head-to-back stunner placed in the correct position on a hog in V restrainer.

Recommended Captive Bolt Stunning Techniques: Safety Tips for Workers

1. Cartridge-fired stunners must ALWAYS be uncocked before they are set down.
2. NEVER, NEVER throw a cartridge-fired stunner to another person.
3. Inspect latches on stunning boxes to make sure they latch securely. Before the next animal is admitted to the box, check the latch.
4. All guards must be kept in place over exposed pinch points which could be easily touched by employees during normal operation of the restrainer system equipment.
5. If a worker has to get inside a restrainer conveyor system to unjam it, lock it out first to prevent somebody else from turning it on.
6. Cartridge-fired stunners must always be kept unloaded when they are carried away from the stunning area.
7. Good maintenance is essential on pneumatic stunners to prevent excessive recoil which can strain and injure the operator's hands, arm or back.

Electric Stunning of Hogs and Sheep - To produce instantaneous, painless unconsciousness, sufficient amperage (current) must pass through the animal's brain to induce an epileptic seizure. Insufficient amperage or a current path that fails to go through the brain will be painful for the animal. It will feel a large electric shock or heart attack symptoms, even though it may be paralyzed and unable to move. When electric stunning is done correctly, the animal will feel nothing.

There are two types of electric stunning, head only and cardiac arrest stunning which stops the heart. Most large plants use cardiac arrest head to back or head to side of body stunning. It produces a still carcass that is safer and easier to bleed. Cardiac arrest stunning requires the use of a restraining device to prevent the animal from falling away from the stunning wand before it receives the complete stun. Cardiac arrest stunning kills the animal by electrocution. Head only stunning is reversible. Hogs and sheep which are stunned with a head only stunner must be bled within a maximum interval of 30 seconds to prevent them from regaining consciousness. An interval of 10 to 17 seconds is recommended.
When cardiac arrest stunning is used, one electrode must be placed on either the forehead or in the hollow behind the ears, and the other electrode is placed on either the back or the side of the body. The head electrode should not be allowed to slide back onto the neck. When head only stunning is used, the electrodes may be either placed on the forehead or clamped over around the sides of the head like ear muffs. Hogs should be wetted prior to stunning. The stunning wand must be applied to the animal for two to three seconds to stun properly. Stunners should be equipped with a timer.

Meat packers should use amperage, voltage and frequency settings which will reliably induce unconsciousness. Both properly and improperly stunned cardiac arrested animals can look similar (Gilbert and Devine, 1991). Current flow through the spine masks the epileptic seizure. If there is any question, electrical parameters should be verified by scientifically valid measurements.

To prevent bloodspots in the meat and pain to the animal, the wand must be pressed against the animal before the button is pushed. The operator must be careful not to break and make the circuit during the stun. This causes the animal's muscles to tense up more than once and bloodspots may increase. Stunning wands and wiring should be checked often for electrical continuity. A worn switch may break the circuit enough to cause bloodspots. Electrodes must be kept clean to provide a good electrical contact. Operators must never double stun animals or use the stunning wand as a prod.

Modern stunning circuits use a constant amperage design. The amperage is set and the voltage varies with hog or sheep resistance. Older style circuits are voltage regulated. These circuits are inferior because they allow large amperage surges which can fracture bones and cause bloodsplash. The distance between the head electrode and the back electrode should not exceed 14 inches. Hog stunners should be equipped with blunt electrodes which do not stick into the animal. The most modern sheep stunners from New Zealand utilize water jets to conduct electricity down through the wool.

Preventing Bloodsplash (Bloodspots) - Handle animals gently. Gentle handling prevents damage to small blood vessels caused by excited animals jamming against each other or equipment. Electric prod usage should be kept at a minimum. Animals should never be left in the restrainer system during breaks and lunch. Bloodsplash may also be increased if one side of a V restrainer runs faster than the other. This causes stretching of the skin which damages blood vessels. Both sheep and hogs should be bled within 15 seconds after stunning to minimize meat damage. The slats on the V restrainer and hold-down rack should be insulated to prevent current leakage which can cause bloodsplash.

Rapid temperature fluctuations and periods of extremely hot weather can greatly increase the incidence of bloodsplash. In these circumstances, plants should take extra care in handling animals to minimize bloodsplash problems.

Electric Stunning of Sheep and Hogs: Safety Tips for Workers

1. The stunner operator's station must be kept dry.
2. Stunning wands should be designed so that they can be operated by one hand. Avoid designs where the two electrodes are held separately in each hand. These increase a shock across the chest electrocution hazard.
3. The operator should wear rubber boots and stand on non-conductive plastic grating.
4. The restrainer frame and worker walkway structure should be grounded to a perfect ground. However, the side of the restrainer that the stunner operator can touch should be covered with heavy insulating materials such as a plastic meat cutting board.
Recommended Ritual Slaughter Practices - For both humane and safety reasons, plants which conduct ritual slaughter should install modern upright restraining equipment. The practice of hanging live cattle and calves upside down should be eliminated. There are many different types of humane restraint devices available.

ASPCA Pen - This device consists of a narrow stall with an opening in the front for the animal's head. After the animal enters the box, it is nudged forward with a pusher gate and a belly lift comes up under the brisket. The head is restrained by a chin lift for the rabbi to perform shehita. Vertical travel of the belly lift should be restricted to 28 inches so that it does not lift the animal off the floor. The rear pusher gate should be equipped with either a separate pressure regulator or special pilot-operated check valves to allow the operator to control the amount of pressure exerted on the animal. The pen should be operated from the rear toward the front. Restraining the head is the last step. The operator should avoid sudden jerking of the controls. Many cattle will stand still if the box is slowly closed up around them, and less pressure will be required to hold them.

An ASPCA pen can be easily installed in one weekend with minimum disruption of plant operations. It has a maximum capacity of 100 cattle per hour and it works best at 75 head per hour. A small version of this pen could be easily built for calf plants.

Conveyor Restrainer Systems - Either V restrainer or center track restrainer systems can be used for holding cattle, sheep or calves in an upright position during shehita. The restrainer is stopped for each animal and a head holder holds the head for the rabbi. Research in Holland indicates that the center track design provides the advantage of reducing bloodspots in the meat.
Small Restrainer Systems - For small locker plants which ritually slaughter a few calves or sheep per week, an inexpensive rack constructed from pipe can be used to hold the animal in a manner similar to the center track restrainer.

Recommended Ritual Slaughter Practices:
Safety Tips for Workers
1. Shackling and hoisting large cattle and calves can be very dangerous. It has caused many serious accidents such as loss of an eye, permanent knee damage and head injuries from kicking and falling shackles. In one plant, replacement of the shackle hoist with a restrainer resulted in a 500 percent reduction in accidents. Shackling and hoisting of live sheep is also hazardous. There have been several incidents of teeth knocked out.

Recommended Handling of Disabled or Crippled Livestock

Although injured or incapacitated animals (sometimes called “downers”) represent less than .1 percent of all livestock arriving at packing plants, they are significant because they require special attention in the areas of handling, transporting, holding pens and inspection.

As a general principle, all disabled animals arriving at packing plants should be dispatched to slaughter as promptly as possible to minimize the animal’s suffering.

Offloading from Trucks -- All trucks carrying livestock should be unloaded promptly. Trucks carrying disabled animals should unload ambulatory animals first, then promptly unload the animals unable to walk. Delayed unloading can cause death losses and downer animals due to extreme temperatures and stress.
To offload a non-ambulatory animal from a truck, plants should use the truck exit nearest to the animal and should place as little stress as possible on the animal. In some cases, a slide board or cripple cart may be helpful. The board can then be dragged off the truck and the animal loaded into a suitable mechanical device for transport to an inspection area.

The Humane Slaughter Act prohibits dragging of downed or crippled livestock in the stockyards, crowd pen or stunning chute. By using slideboards and cripple carts, animals can be transported humanely and efficiently to a pen or other area where they can be examined by an inspector, stunned and moved to slaughter.

In all cases, disabled livestock should be handled and moved as little as possible. Trucks carrying downers should park as close to the slaughter area as possible, and disabled animals should be inspected by a USDA veterinarian, stunned and moved to slaughter as quickly as possible.

**Inspection and Slaughtering Considerations** -- USDA rules require that any "suspect" animal - an animal with signs of abnormalities or diseases - must be held separately and closely examined by a USDA inspection service veterinarian. For meatpackers, this means that downer animals must be held apart from other animals in a "suspect" pen for USDA inspection. "Suspect" animals must be slaughtered separately so inspectors can carefully examine the animals' carcasses and parts.

Plants should call for the USDA veterinarian as soon as a disabled animal arrives. Once the animal has been examined by the USDA inspector, plants should identify the earliest possible point in production when that animal may be slaughtered "separately." This separation point should be discussed with the USDA inspector. It should be noted that plants need not always wait until the end of a shift to slaughter a "suspect" animal. Waiting can prolong a disabled animal's suffering.

If a steer or cow goes down in the single file chute which leads to the stunner, it must be stunned prior to dragging. A cartridge-fired captive bolt on a long handle is recommended. If blood gets on the chute, wash it off to prevent balking. In hog plants, the stunning chute should be equipped with side doors so that stressed-out downer hogs can be easily removed.
Emergency Slaughter for Injured Animals -- If a suffering, injured animal arrives at a plant and a USDA inspector veterinarian is not available to examine the animal, it may be necessary to perform an "Emergency Slaughter." USDA regulation 311.27 allows plants to perform such an emergency act for humane reasons. The regulations requires that the carcass and all parts must be held for inspection, with the head and all viscera except the stomach, bladder and intestines held by the natural attachments. If all parts are not kept in this manner for inspection, the entire carcass will be condemned. When an inspector is available, the held carcass and viscera will be inspected and may be passed or condemned, depending on the evidence.

Animals that are sick, dying or have recently been treated with drugs or chemicals and are presented for slaughter before the required withdrawal period are not covered by emergency slaughter.

Handling Downer Hogs -- Many problems with splitter and downer hogs are genetic. Weak hindquarters in hogs is correctable by breeding. Hogs will sometimes collapse from PSS (Porcine Stress Syndrome). This is a genetic defect which make a hog prone to a heart attack. PSS downers will sometimes recover if they are left alone. Never throw cold water on a disabled hog, the shock to its system will kill it. Wet the floor around the hog and allow it to cool by evaporation.

Conclusion

By applying the principles you have learned in this manual, you can ensure that animal handling and stunning is more efficient and humane. These recommended practices will also help provide a safer work place.

Proper livestock handling is a critical element of good business management. It ensures that the animals, the workers and practices employed are treated with understanding and respect.
Humane Handling Remains Everyone's Job

Temple Grandin
Assistant Professor of Animal Science, Colorado State University

Many improved systems for handling livestock at slaughter plants have been developed over the past 15 years. New methods such as the center track restraining system and curved chute designs make it possible to handle and stun cattle more efficiently and humanely than before. But suitable equipment that makes good handling practices easier and more efficient is useless without management’s support.

Top managers in many meat companies are becoming more aware and understanding of the importance of good animal handling. The new Animal Handling Guide published by the American Meat Institute shows the level of this awareness. But, many low level managers and foremen don’t know the guide exists. Many of these people don’t read trade magazines and their driving goal is speed rather than quality.

Some kill floor foremen know little about costly meat quality defects, such as pale soft exudative (PSE) meat in hogs. They are unaware also that rough handling and poor stunning is a major cause of PSE and blood spots in the meat. In general, there is a shocking lack of understanding of the importance of the animal welfare issue.

Even when the managers know that rough handling causes meat quality defects, this information often fails to reach hourly employees. Within the last year, I’ve interviewed hourly employees who were driving animals in three large plants. In two of the plants, none of the employees knew anything about PSE or bloodsplash. Nobody had told them that rough handling and poor stunning damages meat quality.

Need to Train Managers

I can teach hourly employees how to handle animals properly, but the lessons won’t last unless management is also trained. I have seen untrained managers counterman what I had taught the employees and had workers back using rough methods.

In many situations it’s difficult to get foremen and mid-level managers to take the time to learn good handling methods. At one plant, the foreman refused to give me 30 minutes to show him how to operate a new piece of equipment. Not surprisingly, this foreman thought bloodsplash and customer complaints were not important.

Plants with good animal handling have managers who insist on it. But plants with rough handling have lax management. In general, if rough handling occurs in your plant, it’s management’s fault and not the employees.

Often there needs to be an incentive program for proper animal handling. For example, truckers that have the lowest levels of dead or crippled hogs could receive a substantial monetary reward. This program could reduce the number of “deads” and “cripples” by more than 100 percent.

Hourly employees who handle livestock could receive daily feedback on the incidence of PSE, bruises and bloodsplash. The numbers could then be posted and incentive pay given for low problem levels. Employees also could receive copies of customer complaints about PSE and bloodsplash to make them aware that these defects are costly.

Yet, even when middle management is properly trained, top management must make frequent unannounced checks on animal handling. People who handle thousands of animals can become numb. They need a strong manager to be their “conscience.” This person must be involved enough to care, but not so much to become numb.

While most plant managers know the importance of animal welfare, there are still a few who have no regard for animals. It is unbelievable that today some people think it’s acceptable to shackles hoist mature cattle by one back leg for kosher slaughter. One of these people said, “It’s just an animal and it does not matter.”

But even kosher slaughter can become more humane. Recently, I remodeled and converted a kosher plant’s shackle hoist to the ASPCA upright box. Engineering improvements done in the design of the controls gives the operator more precise control over the pressure applied to the animal.

I’ve spent many hours operating this equipment to learn how to hold the animal in a gentle way. Many people think they have to squeeze the animal hard to make the box work, which is nonsense. Yet, operating the box gently helps the bottom line. Gentle restraint of the animal will result in 100 percent reductions in bloodsplash.

The right equipment helps improve the handling of animals. But it takes people with the right attitude to get the job done right.

This is from a talk Grandin gave at the 1992 Western States Meat Association convention.

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Preventing bloodsplash in pork

THIS WINTER, in my area of Colorado, it has been warm one day and below zero the next. This is the kind of weather that increases bloodsplash losses in loins and hams. Hogs become more sensitive to stress when temperatures fluctuate so widely.

Stunning problems are a major cause of damaged hams and loins speckled with hemorrhages. Double-stunning is the worst offender, and you can be doing it and not even realize it. Double-stunning causes a hog's muscles to contract twice. To prevent this, the stunning wand must be held firmly against the animal. A faulty switch can also cause double-stunning. For a split second it makes and breaks the circuit more than once. Stunners should be equipped with a timer. The stun should not be started until the wand is in firm contact with the hog. Pulling the wand away before the stun cycle is finished can cause bloodsplash, and in some cases the hog may even start to revive.

To ensure that hogs are instantly made unconscious by the stun, a minimum of 1.25 amps is required. The current must pass through the brain, otherwise the hog will only be immobilized, and will still feel both the shock and the sticking, which is cruel and inhumane. Through the extraordinary stress placed on a hog in this situation, this can cause pale-soft-exudative (PSE) meat or other problems. Make sure that stunning is done correctly! One end of the wand must be on either the forehead or in the hollow behind the ears. Don't let it slide back on the neck.

Excessive amperage, on the other hand, can also cause severe bloodsplash, but a stunner with a constant amperage circuit will reduce bloodsplash. The amperage is set at 1.25, and the voltage varies with hog resistance. Some of the best constant-amperage stunners for hogs are made in New Zealand, but presently they are not available in the U.S. that I know of. Unfortunately, many stunning units sold in this country are voltage- rather than amperage-regulated: They allow amperage to skyrocket, resulting, as I have mentioned, in bloodsplash. Precise control of amperage is very important to control bloodsplash and to make stunning as humane as possible, which must be the goal of every hog-packing plant.

Quick-sticking will also greatly reduce bloodsplash. Bleeding hogs within 10 seconds of the stun is recommended. This can be accomplished by converting to prone-bleeding. To ensure success, you must have a highly skilled prone-sticking person to train your employees.

Resting hogs for two-to-four hours prior to stunning will also reduce bloodsplash. Hogs slaughtered immediately after arrival at the plant will probably have more bloodsplash and a higher incidence of PSE. And don't forget gentle handling! When hogs pile up and wedge against chutes, small capillaries become damaged. During stunning, these damaged capillaries burst. Electric prods should be used sparingly and operated at the lowest possible power output. A doorbell transformer set at 18 volts or less is recommended. A good test to check whether or not your prods are set too high is to listen for hog squeals: A properly adjusted electric prod will not cause a hog to squeal when the hog is touched. There is also some evidence that battery-powered prods may cause less bloodsplash than electric models. A prod connected to an overhead wire has only one contact point. Electricity from the prod flows through the hog to the ground. If the prod is too powerful, it will cause the hog's muscles to tense up. This, too, may damage capillaries.

The restrainer can also be a factor. All surfaces coming into contact with the hog should be insulated. Current flow from the hog out through an exposed metal part can cause damage. There should also be no struts under the restrainer which contact the hog's legs during the stun. During the stun a hog has an intense muscular spasm, and if the legs are wedged against an obstruction, capillary damage can result. Capillary damage and speckled loins may also occur if one side of the restrainer runs faster than the other. For this same reason, hogs should never be left in the restrainer during employee breaks.

The new center-track restrainer may help reduce bloodsplash. Tests in Holland indicate hogs stunned on a center-track system have less bloodsplash than hogs stunned in a standard V-restrainer. A hog's legs can move more freely during the stunning spasm on a centertrack. This would help reduce capillary damage.

Diet can also be a factor, believe it or not. Hogs from selenium-deficient areas such as Sweden and eastern Canada seem to be more sensitive to bloodsplash.

A final factor is new product development. Many plants have had bloodsplash problems for years but never knew it, or understood how to prevent it. When a new pork product was under development, bloodsplash was discovered when the meat was cut into small test pieces.

Written exclusively for MEAT&Poultry by Dr. Temple Grandin, a livestock handling consultant with offices in Ft. Collins, Colo., and an assistant professor of animal science at Colorado State University.
Stunning

Many people inside and outside the industry misinterpret the leg movements of properly stunned animals. Both veterinarians and ranchers have mistaken reflexes for conscious animals. Properly applied captive bolt and electrical stunning will induce instantaneous unconsciousness.

When a standing animal is stunned with a captive bolt gun it should instantly drop to the floor. In cattle, the neck and legs will contract in a spasm for five to 10 seconds. Hogs will often go into violent convulsions after they are shot. This is a normal reaction indicating the animal is unconscious. Properly stunned cattle in a restrainer conveyor will have a neck spasm, and the head may remain raised for five to 10 seconds. If the spasm lasts longer the animal may be poorly stunned. Cattle stunned correctly will often pull their legs up; however, excessive kicking which makes shackleing difficult may be an indication of stunning problems.

After the animal is ejected from the stunning box or restrainer it is normal for the legs to move. The neck should be limp and floppy, and eye reflexes should be absent. If the animal blinks or the eye responds to touch it may still be conscious. Rhythmic breathing and vocalizations must also be absent. If the stunned animals moan, bellow or squeal they are probably still conscious, but gasping and gagging reflexes are permissible. Neville Gregory, stunning expert from England, explains that gasping is a sign of a dying brain.

Poor gun maintenance is the number one cause of captive bolt stunning problems. Pneumatic captive bolt guns require servicing and maintenance every day. In large, high-speed plants maintenance personnel time must be dedicated to servicing stunners.

Cattle and calves should be shot in the forehead. Shooting cattle in the hollow behind the poll should be avoided — the frontal position is more effective. In sheep, the animal should be shot on the top of the head. Sheep have a thick skull, and shooting in the forehead does not work. Hogs and sows should also be shot in the forehead.

People have been disturbed by leg movements on the bleeding conveyor. After an animal is hung upside down, the methods for determining unconsciousness are the same for both electrical and captive bolt stunning. All eye reflexes and blinking must be absent. In electrically stunned animals, eye reflexes should be checked 20 to 30 seconds after stunning. Prior to this time, eye reflexes will be masked by the seizure.

In both cattle and hogs, the legs will move, but this should be ignored. Instead, look at the heads — they should hang straight down, and the necks should be floppy. The tongue should hang out and the ears droop down. Gasping and gagging reflexes are permissible, but rhythmic breathing and vocalizations must be absent. The animals must not have an arched back-righting reflex; it should hang straight down. Fully conscious cattle and hogs will arch their backs and bend their heads in an attempt to right themselves. In summary, the head should be "dead." Ignore the body.

When hogs and sheep are stunned with electricity, there is an initial spasm during which the carcass will stay still and rigid for 10 to 20 seconds. After this period, kicking will start. Hogs stunned with cardiac arrest equipment will kick less than those stunned with tongs applied to the head.

Almost all large plants use cardiac arrest equipment, and many small locker plants use head-only stunning. Cardiac arrest stunning kills the animal by stopping the heart. Head-only stunning creates a short period of unconsciousness. The animal will revive if bleeding is delayed.

With both types of stunning, sufficient current must pass through the brain to induce a grand mal epileptic seizure. Insufficient current will result in a paralyzed hog which will feel everything. For market weight hogs, a minimum of 1.25 amps is required. Hogs stunned with a lower current may remain conscious. Inducing cardiac arrest requires less current than induction of unconsciousness.

A cardiac arrest stunner that has sufficient current will cause the hog to feel heart attack symptoms. Since cardiac arrest stunning masks the grand mal epileptic seizure, hogs stunned with insufficient current will look the same as hogs stunned with adequate current. To ensure a cardiac arrest stunner is inducing consciousness, a meter must be used to test the amperage.

To pass the electrical current through the brain, one electrode must be placed either on the forehead or in the hollow behind the ear. If the electrode slides too far back on the neck, the hog will be paralyzed, but able to feel the pain. When tong type stunners are used in small plants, both electrodes must be applied to the head. Do not apply them to the neck.

Many small plants use head-only reversible stunning because they lack restraint equipment. Bleeding has to be done quickly before the animal revives. Due to slow hoists, some animals revive prior to bleeding. Plants with this problem should convert to captive bolt. Written exclusively for MEAT & POULTRY by Dr. Temple Grandin, a livestock handling consultant with offices in Ft. Collins, Colo., and an assistant professor of animal science at Colorado State University.
How stressful is slaughter?

Our industry comes under greater scrutiny from the public and the animal welfare community every day. One of the questions which may need to be answered to satisfy some of these people is: How much stress and discomfort is caused by slaughter?

Several researchers in Europe, Australia and New Zealand (but few, unfortunately, in the U.S. and Canada) have conducted many studies to help answer this question. Their research indicates that in cattle and sheep, carefully-conducted slaughter under relatively quiet conditions is less stressful than many on-farm handling procedures such as restraint in a squeeze chute and shearing.

Cattle and sheep slaughtered under good conditions will have lower cortis­sol (stress hormone) levels than similar animals handled on the farm or ranch. However, recent research by English scientists M.S. Cockram and K.T. Corley indicates that when something goes wrong in the handling procedures just prior to slaughter, stress levels in animals can skyrocket. Slick floors and poorly designed chutes caused at least one bovine to have a cortisol reading almost three times higher than typical values for on-farm or ranch handling.

It is essential that equipment be properly designed. Another study conducted by the Universities Federation for Animal Welfare in England indicates that cortisol levels doubled when handlers had difficulty catching cattle in a poorly designed head-restraint device. To reduce stress, animals must enter a restraint device with a minimum of prodding, and must be caught quickly on the first attempt. Failure to restrain an animal on the first try and fumbling with restraint devices increases agitation and stress. To minimize stress when a head-restraint is used, the animal must be stunned or ritually slaughtered immediately after restraint. A properly designed and operated head-restraint will cause minimal stress.

Another English study indicates that a restraint device rotating cattle onto their backs was more stressful than restraint in an ASPCA-approved pen holding animals in an upright position (see "The way it's meant to be," MEAT & POUlTRY September 1991, p. 107). A study by scientists at the Univ. of Connecticut confirms that suspending live calves and sheep by a shackie attached to one rear leg was more stressful for the animal than restraint in an upright position.

Unfortunately, there has been very little research on hogs to determine stress and discomfort levels during slaughter and on-farm handling. It is likely, however, that slaughter is more stressful for hogs than on-farm practices due to genetic selection for lean­ness and rapid growth. This results in some hogs having very nervous and excitable dispositions. Remedy­ing this situation requires a change in hog gen­etics. Slaughter plants, in fact, may have to install two slaughter systems to overcome hog stress, which can lead to high PSE incidence.

But there is no need to go out and buy a lot of fancy equipment. The number one way to reduce stress on livestock is to properly train and supervise plant employees. Observations I have made in several beef plants indicate that reducing noise also reduces animal balking and agitation (see "Quiet plants = calm cattle," MEAT & POUlTRY November 1990, p. 18). Changing plant ventilation to prevent smells from blowing toward animals as they enter the stunning area will also help prevent balking, since animals balk at strange smells because of their novelty. A piece of paper tossed into a chute will have the same effect—an animal will balk because the paper is an unaccustomed sight.

Many people wonder if animals are afraid of blood. Observations I have made in many slaughter plants indicate that blood from animals that were relatively calm when slaughtered appears not to frighten other livestock. Cattle will walk very calmly into a kosher restrainer box that is stained with blood. They will voluntarily place their heads into a head-restrainer which is covered with the blood of other animals; some cattle will even lick this blood. In hog-slaughter plants, the animals will often lie down and actually wallow in the blood pit. They don't seem to know what it is.

However, cattle seem to be able to sense when the blood is from an agitated or stressed animal, and this will upset them. If an animal becomes agitated and stays frenzied for several minutes, the agitation will spread to other animals. Many animals will start balking and refuse to enter the slaughter area. Driving cattle for the rest of the day will be difficult. To prevent this, after equipment is washed, the animals will readily enter.

There is some evidence that a "smell of fear" substance may be secreted in animal blood and saliva. Research with rats indicates that blood from stressed rats is avoided by other rats, but blood from a human being or a guinea pig had no effect. The sight of blood had little effect on rats, but the smell of blood from stressed rats was avoided. The great animal behaviorist Eibele Eibesfeldt once observed that if a rat is killed instantly by a trap, the trap can be used again, but if the trap fails to kill instantly, it will be avoided by other rats because they seem to sense or smell the fear associated with it.

When an animal is stunned with either a captive bolt stunner or through electricity, a massive release of epinephrine (adrenaline) and norepinephrine is triggered. When the stunning method is applied correctly, the animal becomes instantly unconscious and does not feel any discomfort from this hormone release.

The bottom line is this: If cattle and sheep are walking quietly into your slaughter plant with no visible signs of agitation such as bellowing or struggling, they are probably experiencing less discomfort than they do on the farm. Several large beef slaughter plants have worked to reduce reliance on electric prods in order to reduce stress prior to stunning. Instead, they drive cattle by waving plastic bags or whips with yellow plastic streamers tied to them. In a well-managed beef plant with good facilities, cattle walk in quietly like cows going to the milking parlor.

Written exclusively for MEAT & POUlTRY by Dr. Temple Grandin, a livestock handling consultant with offices in Ft. Collins, Colo., and an assistant professor of animal science at Colorado State University.