



# Principles of Aseptic Surgery

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# Position Statement

- The American College of Laboratory Animal Medicine (ACLAM) recommends that all institutions that use animals in research, testing and training develop and implement written standards for performing surgical procedures on rodents. These standards must be approved by the Institutional Animal Care and Use Committee (IACUC). All survival surgical procedures should incorporate aseptic technique.
- Perioperative care should be described. Pain and distress should be minimized through appropriate use of anesthetics, analgesics, tranquilizers, nursing care and/or other treatment. The standards should be reviewed periodically and the effectiveness assessed using performance-based standards.



# Asepsis

- Aseptic techniques are designed to reduce bacterial contamination of the surgical wound to the lowest possible level. This can be achieved by:
  - cleaning and disinfection of the surgery room
  - aseptic surgical field preparation,
  - sterilization of all instruments and materials to be used in the procedure.
  - aseptic preparation of the surgical team



# SURGERY AREA PREPARATION

- For USDA regulated species, operating suites are required.
- These requirements do not apply for rats and mice. The following requirements are required for performing survival surgery in these species:
  - Clean, neat (uncluttered), disinfected area dedicated to rodent surgery.
  - Separation of functions of animal preparation, operating field and animal recovery.
  - Avoid locations that are beneath supply ducts to minimize contamination from dust.
  - Avoid high traffic areas such as those near doorways to prevent unnecessary interruptions and creation of air turbulence.



# ASEPTIC FIELD PREPARATION

Goal: Aseptic preparation is a process by which the number of surface contaminants in a region is reduced to a concentration below the threshold necessary to cause infection if introduced into deeper tissue layers.



# ASEPTIC FIELD PREPARATION

Steps: Remove hair from field

- By clipping with a #40 blade. Clean blades with clipper lube or by brush as needed while clipping and when finished.
- Use only immediately before a procedure. Studies indicate that shaving several hours or more before a surgery increases the skin infection rate due to microtrauma.
- For mice and rats, the intended incision site must have an additional margin of hair removal of about 0.5-1 cm or 1-2 cm, respectively, more for larger, long-haired species such as rabbits.



# SURGERY AREA PREPARATION

Steps: Remove hair from field

- Alternatively you can also use depilatory cream for hair removal but be sure to rinse the area thoroughly after using the cream as it can be an skin irritant.
- Change gloves between clipping the site and preparing the skin.



# ASEPTIC FIELD PREPARATION

Steps: Remove gross debris

- Gross debris must be removed before the actual aseptic preparation can begin.
- Use an antiseptic soap to clean the clipped field and clean or sterile sponges, moving from the center of the field to the periphery, until there is no visible dirt or discoloration on the sponge.
- Remove soap and debris with either water or alcohol, working from the center of the field to the periphery.





# ASEPTIC FIELD PREPARATION

Steps: Aseptically scrub the field

- Begins after the gross debris is removed.
- Maintain at least 5 minutes (preferably 10) of contact between the scrub solution (povidone iodine scrub or chlorhexidine scrub) and the surgical field.
- At least 3 scrubs of the entire field are completed and alcohol is used to remove (wipe) the surgical scrub solution.

# ASEPTIC FIELD PREPARATION



Chlorhexidine Scrub/Solution  
2 % or 4%



Povidone Iodine Scrub Solution



# ASEPTIC FIELD PREPARATION

Steps: Aseptically scrub the field

- All scrubs and wipes start at the center of the field and work outward. No scrub or wipe moves back toward the center from a more peripheral site.
- Be careful not to wet the entire animal while scrubbing the surgical site. Rats and mice are small animals with a high surface area to mass ratio, and are prone to hypothermia very quickly when wet.



# ASEPTIC FIELD PREPARATION

## Outcome:

After completion of an aseptic field preparation, the field should be considered clean, but not sterile. Drapes should be used to minimize contact between sterile gloves and instruments and the prepared skin surface, and between the prepared skin surface and deeper tissue layers, which may be sterile.



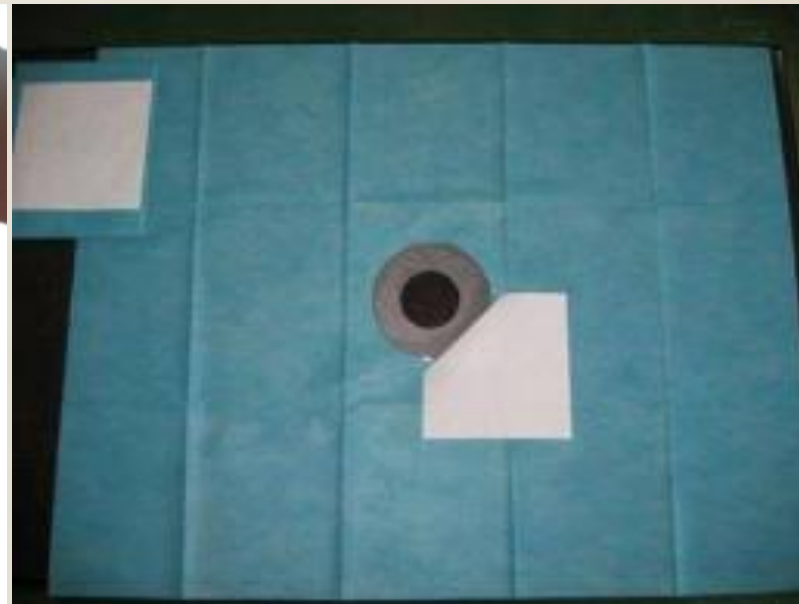
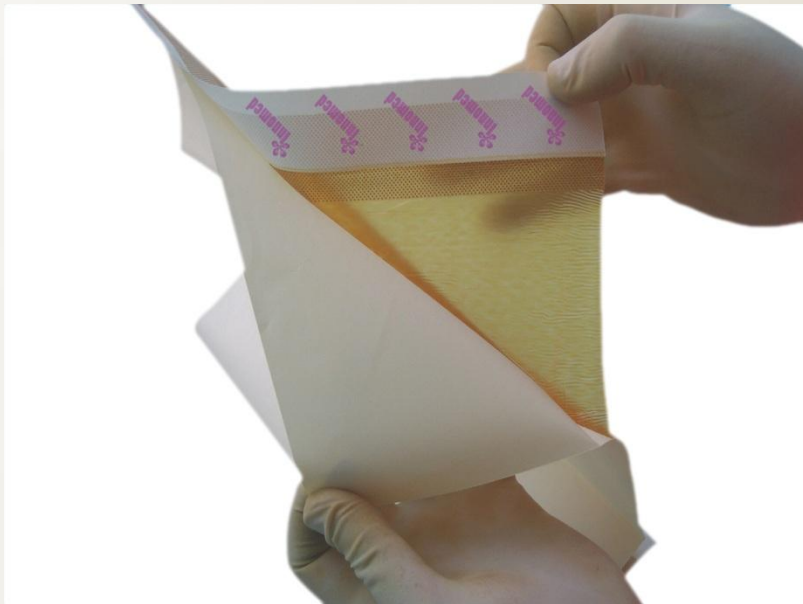
# ASEPTIC FIELD PREPARATION

## Surgical Drapes

- Draping is necessary when viscera or sterile instruments may come in contact with un-prepped skin and fur. Types of drapes that may be used are:
  - Surgical paper drape. (Precut or one in which you must cut a hole)
  - Plastic drapes.
  - Transparent, self-adhesive drapes (the animal must be dry).
  - Sterile gauze sponges can also be used for draping.
  - Autoclaved pre-cut pieces of aluminum foil.

# ASEPTIC FIELD PREPARATION

## Surgical Drapes





# Instrument Sterilization

- Other important aseptic surgery component are using sterile instruments and maintaining a sterile working surface on which your instruments, suture material, and other surgical supplies are placed.
- Always autoclave instruments prior to use and handle them during surgery in a manner that maintains their sterility.
- A piece of sterile draping material or a sterile metal tray or pan will hold the instruments and other materials while you are working.



# Instrument Sterilization

- Before autoclaving instruments, make sure they are clean and free from blood or tissue debris. Bacteria remain within any debris on the instruments, and they will not be sterile after autoclaving.
- If you are performing multiple surgeries, the instruments must be disinfected between animals.
  - Use a hot bead sterilizer to re-sterilize the instrument tips between animals. Remove the blood and tissue debris before using the sterilizer and dip the instrument tips in sterile saline prior to touching the animal's tissues to ensure they are cool.



# Instrument Sterilization



Hot Bead Sterilizers



# Instrument Sterilization

- If you do not have a hot bead sterilizer, disinfect the instruments thoroughly with a suitable disinfectant before commencing surgery on the next animal.
- If you are performing surgery on any other species besides rodents, you must use a new set of autoclaved instruments for each animal.

# SURGICAL TEAM - PREPARATION

- Use sterile surgical gloves, mask, surgical gown (for regulated species or for rodents could use a clean lab coat)





# SURGICAL TEAM - HAND PREPARATION

## 1. Foremost - Set up surgical field

- When working alone, you need to open surgical packs and set out any equipment that you need before you begin to scrub. Once you complete the surgical scrub, you won't be able to touch any non-sterile areas. If someone else sets the surgical field, you need to ensure that the materials and equipment that you need are readily available.



# SURGICAL TEAM - HAND PREPARATION

2. Set out and open the pack containing surgical gloves, sterile towel and surgical gown.

- The packages should be opened on a clean, dry surface with room to unfold the folded glove envelope inside. If no help is available, open the sterile towel and the outside package of surgical packs before scrubbing.
- Either before or after scrubbing, open the folded sterile glove cover (like opening a book). Use the inside folds to open the covering surfaces without touching the inner surfaces. Only touch the outside of the package with your hands.
  - Important - even if you have scrubbed, the hands are considered clean but not sterile as are the gloves.



# SURGICAL TEAM - HAND PREPARATION

- Surgical hand preparation is a process by which the number of surface contaminants on the hands is reduced to a concentration below the threshold necessary to cause infection if exposed to patient tissues.
- The threshold is commonly estimated to be  $<10^6$  pathogenic organisms/gram of tissue in a healthy host, but can vary by host immune status, organism pathogenicity, and the combination of organisms present.

# SURGICAL TEAM - HAND PREPARATION

3. Remove debris from your hands and forearms
  - Thoroughly wash hands and forearms with an antiseptic scrub solution to remove gross debris. Repeat as necessary.





# SURGICAL TEAM - HAND PREPARATION







# SURGICAL TEAM - HAND PREPARATION

## 4. Surgical scrub of hands and forearms

- Open sterile brush and nail pick pack to ensure sterile access. It might be difficult to open the pack with wet hands without tearing the pack.
- Apply the scrub solution to hands and forearms all the way to the elbow.
- Keep your hands higher than your elbows so gravity carries debris away from your hands. Keep your elbows below your shoulders, or water runs into your armpits. Not a pleasant sensation 😊.
- Contact time is one of the most important ways to decrease the bacterial load. Lather all parts as soon as possible and keep the suds on as long as you can. Either betadine or chlorhexidine scrub is appropriate for surgical preparation.



# SURGICAL TEAM - HAND PREPARATION

## 4. Surgical scrub of hands and forearms

- Use the nail pick to remove debris under nails and discard pick when finished.
- Begin scrubbing with the brush at the fingertips on one hand and work toward the elbow. The brush should contact all surfaces of the hands and forearms by going at least 10 strokes back and forth per area in a pattern such as the following: all fingertips; 4 sides of each finger; each web between fingers; each edge of the hand; medial and lateral half of the palm; medial and lateral half of the back of the hand; 6-8 surfaces of the wrist; 8 surfaces of the mid-forearm; 8 surfaces of the proximal forearm.
- Never move back from a more proximal region (ex. wrist) to a more distal one (ex. palm) during one pass from finger tips to elbow.
- After one arm is scrubbed, rinse the brush off and repeat the process for the other arm. You may add more soap to the brush if needed.



# SURGICAL TEAM - HAND PREPARATION

## 4. Surgical scrub of hands and forearms

- Once scrubbing is finished, rinse the soap off of both arms.
- While rinsing, keep hands above elbows and elbows below shoulders. This will allow the water to run off of your hands down your forearms and off at your elbows and maintain flow from "more" to "less" critical areas.
- Do not to touch anything while you rinse or you will have to start the whole scrub over again!
- When rinsing is finished the entire scrub may be repeated from lather to rinse (except the nail pick). The total scrub time should be close to 2-3 minutes per hand and arm.



# SURGICAL TEAM - HAND PREPARATION

## 4. Drying hands and forearms

- Following a surgical scrub, pick up a corner of a sterile hand towel with one hand and let the other end hang free, taking care not to touch any non-sterile surfaces with the towel. The towel can be either in a package of sterile gowns, or in a separate sterile wrap.
- Hold one end of the towel in one hand and begin drying the opposite hand beginning with the fingertips. Use only one half of the towel to dry the forearm, keeping the right hand on one side and the left on the other.
- The hands should always be held higher than the elbows so that water runs from the area with the highest need for sterility (fingers) to the area with the least need (elbow).



# SURGICAL TEAM - HAND PREPARATION

## 4. Drying hands and forearms

- Be sure to dry the finger tips completely before moving to the fingers.
- You should never move back to an area that you have passed.
- When you have completely dried the first arm, take the dry hand and pick up the lower and previously unused towel half. This is done by placing the dry hand at the bottom of the towel on the same side as the wet hand, lifting the lower end with the dry hand and then dropping the end in the wet hand. This reverses the ends of the towel and leaves the clean end in the dry hand at the top and the previously used end hanging.
- The process of drying the second hand from finger tips to elbow will be repeated. When drying is complete, drop the towel away from any sterile surfaces.

# SURGICAL TEAM - HAND PREPARATION

## 4. Drying hands and forearms

- Outcome: After completion of a surgical preparation, your hands and forearms should be considered clean, but not sterile. Ungloved hands should not touch any sterile field.



# OPEN DONNING OF SURGICAL GLOVES

Goal: To maintain the sterility of the external glove surfaces while placing them on uncovered hands.





# OPEN DONNING OF SURGICAL GLOVES

Steps:

1. Open the glove envelope.
2. Pick up the right glove with the left hand on the folded cuff and slip the right hand into the glove. Make sure that all fingers line up inside the glove.





# OPEN DONNING OF SURGICAL GLOVES

## Steps:

3. Use the left hand to pull the right glove onto the right hand, touching only the folded cuff. Leave the cuff in a folded position on your right hand. Don't worry if there are wrinkles at the ends of the fingers at this point.
4. Place the right gloved hand inside the fold of the folded left glove cuff and slip the left hand in the glove, being sure that the ungloved surface of the left hand does not touch the gloved surface of the right hand. Keep the gloved fingers of the right hand inside the fold of the left cuff until you have the glove all of the way on. You can then release the left hand cuff onto the left wrist, without touching skin with a gloved surface.



# OPEN DONNING OF SURGICAL GLOVES

Steps:

5. Place the now gloved left hand into the inside of the still folded cuff on the right hand and unfold the cuff, being sure that the gloved left hand never touches the right forearm.
6. Remove any glove powder from the glove surfaces before surgery using a sterile 4X4 sponge and sterile saline.



# OPEN DONNING OF SURGICAL GLOVES

## Outcome:

- When done correctly, all exposed surfaces of the gloves will be sterile.
- The exposed surface of the glove envelope may also be used as a temporary sterile surface for sterile instruments or catheter supplies.



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# CLOSED DONNING OF SURGICAL GLOVES

## Steps:

- Working through the gown sleeve, pick up one glove from the wrapper. Lay the glove palm down over the cuff of the gown with the thumb and fingers of the glove facing toward your elbow.
- Grasp the cuff of the glove with your index finger and thumb. With the other hand through the gown, lift the cuff on the glove up and over the gown cuff and hand. Proceed with the opposite hand using the same technique.



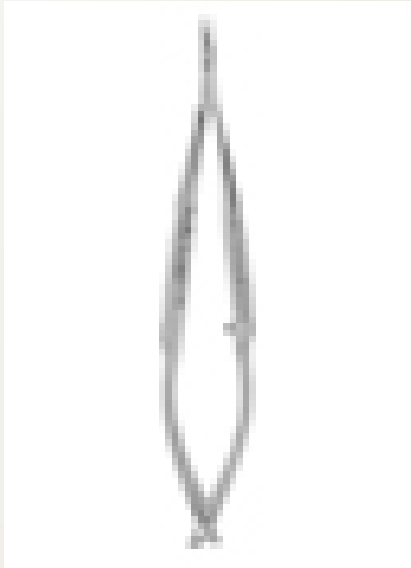
# Most Common Surgical Instruments

## Scissors:

- Come in a variety of sizes and shapes. Are generally classified according with the type of point (blunt-blunt, blunt-sharp and sharp-sharp), the blade shape (straight or curved) or the cutting edge (serrated or plain).
- Curved blades confer maneuverability and straight blades provide mechanical advantage (used for tough tissue).
- Scissors can be used also for blunt dissection.

# Most Common Surgical Instruments

## Scissors



Spring Scissors



Fine Scissors



Utility Scissors

# Most Common Surgical Instruments

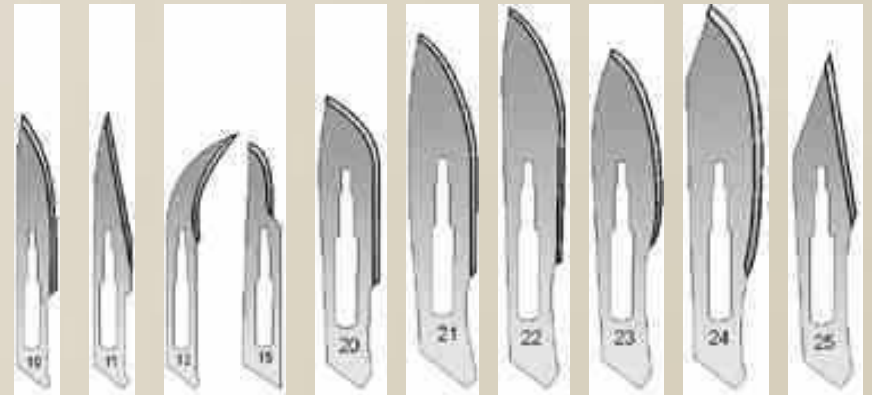
## Scalpel Blades and Handles

- There are currently 65 scalpel blade shapes (sizes) and 27 different types of handles. They're not all used for medical purposes. Mostly all of the scalpels are made of stainless steel, but some are made of titanium.

**Size 3 fits #10, #11, #15 blades**



**Size 4 fits blades #20, #21, #22, #24**







# Most Common Surgical Instruments

## Scalpel Blades and Handles

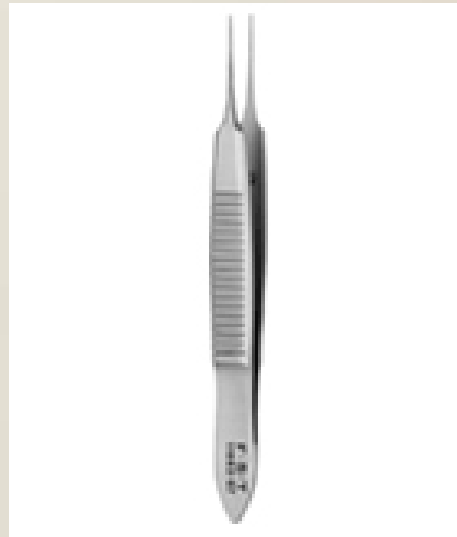
- Scalpels are the primary cutting instrument.
- When incising skin, the scalpel blade should be kept perpendicular to the skin surface.
- Scalpels should be preferably held with a pencil grip for precise incisions and fingertip grip for long incisions.
- Disposable scalpels are commonly used.

# Most Common Surgical Instruments

## Forceps



Dumont Forceps



Fine Forceps



Standard Forceps

# Most Common Surgical Instruments

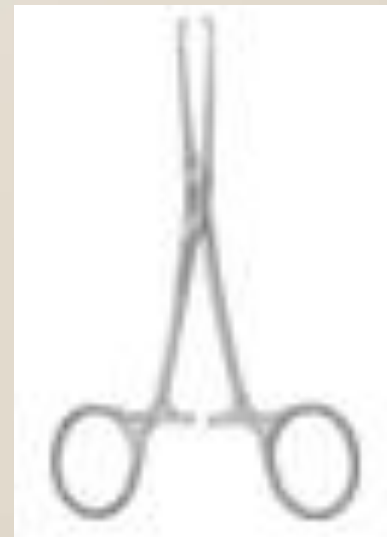
## Hemostats



Kelly



Mosquito



Allis



Backhaus

# Most Common Surgical Instruments

## Retractors



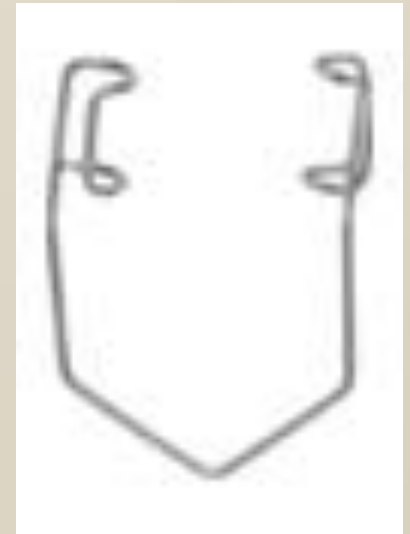
Alm



Gelpi



Weitlaner



Colibri

# Most Common Surgical Instruments

## Needle Holders



Castroviejo



Mayo-Hegar



Olsen-Hegar



Halsey

# Most Common Surgical Instruments

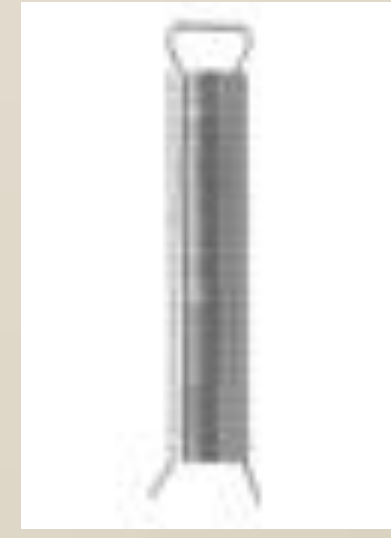
## Staple System & Clips



Reflex



Automated  
Stapler



Michel





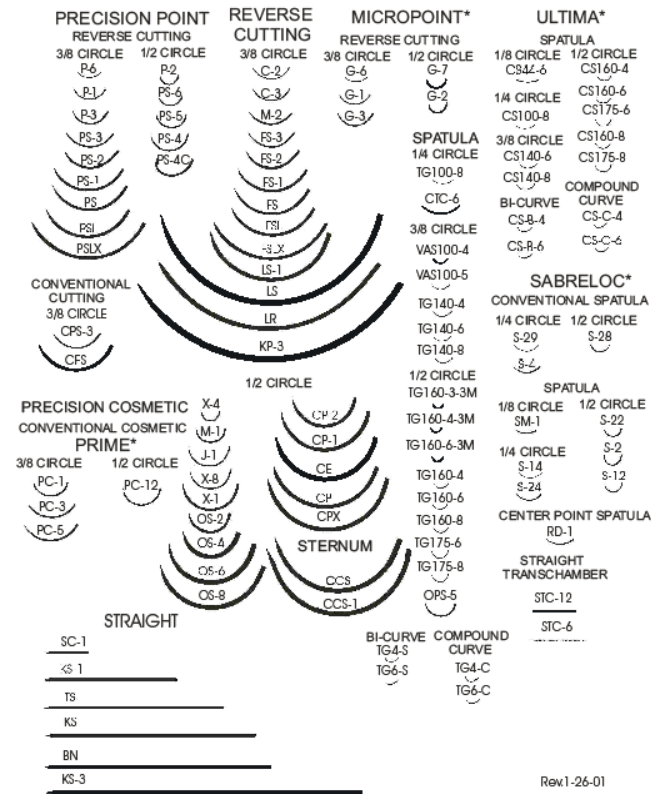
# Sutures – basic info

- Suture size: the smallest diameter suture that will hold the tissue should be used. The most common standard for suture is USP with a numeric scale for most used suture from 2-0 to 4-0. The smallest suture is 10-0 and you will need magnifying loupes to use it.
- Most common absorbable sutures: polyglycolic acid, polyglactin 910, polyglyconate.
- Needles: large variety of shapes and sizes.
- Suture material: monofilament versus polyfilament.
- Cyanoacrylates are becoming commonly used for tissue adhesion.

# Needles – basic info

## ETHICON NEEDLE SALES TYPES

### CUTTING EDGE



Rev1-26-01

\*Trademark





# Suture Patterns

- Interrupted Suture Pattern
  - Simple Interrupted
  - Horizontal Mattress
  - Cruciate
  - Vertical Mattress
- Continuous Suture Pattern
  - Simple Continuous
  - Running
  - Ford Interlocking



# Pain or distress - recognition and alleviation

## During Surgery

- Recognition:
  - Reflex evaluation such as toe pinch, palpebral reflex and jaw tone should be used to assess the depth of anesthesia and to ensure an adequate plane is achieved before surgery commences. During surgery, routine monitoring of respiratory rate and depth should be performed.
- Alleviation
  - Animals should be maintained under surgical anesthesia during surgery. If the animal becomes light, additional isoflurane will be administered to maintain an appropriate surgical anesthetic plane.



# Pain or distress - recognition and alleviation

## Post-Surgery

- Recognition
  - Pain in rodents usually results in decreased activity, piloerection, and an un-groomed appearance. There can be excessive licking and scratching, which can progress to self-mutilation. Animals may also adopt an abnormal stance or a hunched posture. Respiration can be rapid and shallow, with grunting or chattering on expiration. Pupils may be dilated. In albino animals, porphyrin secretion can be seen around the eyes and nose. Inappetence or a change in feeding activity can be noted.
- Alleviation
  - Post operative pain and distress must be relieved by administering Meloxicam (NSAID with Cox-2 inhibitory activity) or Buprenorphine (opioid) before commencement of surgery and at regular schedule afterwards. If pain cannot be relieved after repeated analgesic administrations, the animal should be euthanized.