SURGERY COMMANDMENTS

1. Thou shalt carefully plan all aspects of surgical procedures in advance
2. Thou shalt insure the animal is appropriately anesthetized
3. Thou shalt use aseptic techniques
4. Thou shalt minimize tissue trauma
5. Thou shalt minimize blood loss
6. Thou shalt keep the patient warm
7. Thou shalt insure personnel have been sufficiently trained for all procedures
8. Thou shalt provide post-operative monitoring and supportive care
9. Thou shalt monitor and track outcomes; taking corrective action as necessary
10. Thou shalt smile under your mask, even though no one can see you
**Objectives:**

1. General ideas to consider when planning survival surgery
2. Teach methods for instrument, patient and surgeon preparation
3. Perform surgery using aseptic techniques (from incision to suturing)
4. Teach anesthesia administration and monitoring
5. Teach proper post-surgical monitoring and recording

**Instruments:**

All instruments must be properly sterilized. Ensure the instruments are cleaned and free of all organic material before sterilizing. A sterility indicator must be placed inside or on the surgical pack to confirm proper sterilization. Acceptable methods include:

1. Autoclave
2. Gas sterilization with ethylene oxide
3. Cold sterilization (see the list below of FDA approved products)

 Instruments should not be used on more than one rodent without re-sterilization. A new sterile pack should be prepared for each additional animal. Alternately, instruments may be re-sterilized by using a hot bead sterilizer or flash autoclaving between rodents.

**Surgical Area:**

1. The surgical area should be isolated from active areas in the laboratory, doorways and ventilation supply ducts.
2. The area should be clean and uncluttered.
3. Surface areas should be easily sanitizable.
4. An animal preparation and recovery area, separate from the surgical area, should be provided. A heat source should be available at all times during the preparation, surgery, and recovery since rodents rapidly lose body heat under anesthesia. If a separate preparation area is not possible due to space constraints, cover the surgical area with a towel or drape and discard this after the animal has been prepared.
5. The surgery area should contain sufficient lighting.
6. Minimize the storage of cardboard and paper products directly above the surgery site. Sealable, plastic containers may be used for storage.
7. Chairs located in animal use areas should have an impervious, cleanable surface. No cloth chairs are allowed in areas animals will be used. Cloth chairs can be covered with disposable plastic bags when animals are present in the lab.

Animal Preparation:

1. Apply a veterinary or pharmaceutical grade, bland ophthalmic lubricant to the eyes, since the blink reflex is lost during anesthesia. For extended procedures, reapplication of the ophthalmic lubricant should occur as needed in order to keep the eyes from drying out.

2. The area around the surgical site must be devoid of hair, since hair around the surgical site can act as a wick for bacterial infection. Hair removal may be achieved by either using a #40 clipper blade or a depilatory. In mice, plucking to remove hair is relatively easy once the mouse is anesthetized.

3. Prepare the surgical site by using ethyl alcohol or isopropyl alcohol, followed by an Iodophor solution or Chlorhexidine scrub (Chlorhexidine is known to be irritating to skin).

4. Using cotton tipped applicators or gauze, start with the first alcohol application. Follow the alcohol application with the first Iodophor or Chlorhexidine application.

5. Starting in the center of the incision site, spiral outward in concentric circles toward the margins of the prepared area (never go back and forth over a cleansed area with the same gauze).

Surgeon Preparation:

Surgical personnel should wear a clean lab coat (coveralls and shoe covers if in a DLAM facility), mask, bouffant cap, and sterile gloves. If performing multiple surgeries, new gloves should be donned between animals. Most aseptic surgery requires sterile gloves to be worn.

- Some micro-surgery may not require the use of sterile gloves. (Some examples are blastocyst transfer, some stereotaxic procedures, and many mouse surgeries.)

Placement of Drape Material:

The use of a drape is recommended to prevent contamination of the disinfected surgical site. This is especially true for procedures that require exteriorization of the viscera. Positioning of the drape over the surgical area should proceed with sterile gloves or instruments in order to maintain sterility.

- Some micro-surgery may not require the use of drapes.
To determine if your micro-surgery requires the use of sterile gloves and/or drapes, please contact The Office of Animal Care and Use at 966-5569 for further information.

**Equipment Manipulation:**
During some rodent surgeries there may be a need to manipulate certain types of equipment (microscopes, anesthetic machines, drills, etc.). Such equipment should be disinfected before surgery. If you are wearing sterile gloves to maintain asepsis and touch objects outside of the sterile field; your gloves are no longer sterile. Once surgery commences, adjustments and handling of equipment outside of the sterile field must be made using a piece of sterilized gauze, aluminum foil or commercially available sterile sleeve.

**Surgical Closure:**
The abdominal muscle/peritoneal layer and the skin must be closed separately. Appropriate suture material for each layer should be used. For closure of surgical incisions on the ventral surface (i.e. "underneath"), an interrupted suture pattern should be used in the muscle layer. When using sutures to close skin incisions, a monofilament material should be used (braided sutures used in skin tend to promote wound infection). An interrupted suture should also be applied when closing the skin.

Wound clips or surgical staples may be used in the skin. However, clips or staples should not be solely used for closing skin on the ventral surface, since they may become contaminated with bedding. If clips, staples, or non-absorbable sutures are used to close the skin, they should be removed seven to ten days after surgery. Commercially available tissue adhesive products for skin closure work well on small skin incisions which would normally require one or two clips or sutures.

If you need further information or if you need to review aseptic techniques, reference the [IACUC website](http://www.iacuc.unc.edu) or call the Office of Animal Care and Use at 966-5569.
Post-operative Monitoring and Supportive Care:

1. Recover the patient in an area where it can be monitored until sternal recumbency has been achieved and the patient is ready to be returned to a clean housing cage.
2. Ensure that recovery occurs in a clean cage lined with a paper towel (rodents under the influence of anesthesia can aspirate corncob bedding and perish).
3. Keep the patient warm until ambulation.
4. Provide all analgesics and fluid therapy as approved in your animal application.
5. Monitor all animals for any visible signs of pain (e.g. hunched posture, ruffled fur, lethargy, resentment to being handled, and decreased appetite).
6. Monitor animals for any signs of infection (e.g. swelling and redness around incision site, subtle change in behavior)
   ◆ [NOTE: Some anesthetics (eg: Xylazine, Medetomidine, and barbituates) may be reversed by administration of an anesthetic/sedative antagonist (e.g. Yohimbine, Naloxone, or Atipamezole)].

Suture Selection:

<table>
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<tr>
<th>SUTURE</th>
<th>CHARACTERISTICS</th>
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<tbody>
<tr>
<td>Vicryl, Dexon</td>
<td>Absorbable – 60-90 days. Suture tissues</td>
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<tr>
<td>PDS or Maxon</td>
<td>Absorbable – 6 months. Suture tissues</td>
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<tr>
<td>Prolene</td>
<td>Non-absorbable - Inert</td>
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<tr>
<td>Nylon</td>
<td>Non-absorbable – Inert. General Closure</td>
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<tr>
<td>Silk</td>
<td>Non-absorbable – Tissue reactive. May wick microorganisms into wound. Easy to use and knot. NOT ACCEPTABLE FOR SKIN SUTURE.</td>
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<tr>
<td>Chromic Gut</td>
<td>Absorbable – Versatile. Causes mild inflammation, yet rapidly absorbed. NOT ACCEPTABLE FOR SKIN SUTURE</td>
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<tr>
<td>Staples and wound clips</td>
<td>Non-absorbable – Requires special instrument for removal.</td>
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**Suture Gauge Selection:** Use smallest gauge suture material that will perform adequately.

**Cutting and Reverse-Cutting Needles:** Provides edge to cut through dense, difficult to penetrate tissue (e.g. skin)

**Non-cutting, taper point or round needles:** No edges for cutting. Used for easily torn tissue (e.g. peritoneum, intestine).
Factors influencing possibility of Infection:

1. Foreign materials (e.g. non-absorbable suture, implants)
2. Increased surgery time
3. Use of incorrect suture (e.g. silk and cotton suture may act as a wick for bacteria into incision site)
4. Skin damage at surgical site (e.g. razor, dull clippers)
5. Not irrigating wound with sterile saline or antibiotic solution (this decreases the number of bacteria as well as removes blood clots and necrotic tissue)
6. Patient health (e.g. malnutrition, obesity, diabetes)
7. Tissue damage (e.g. improper instrument handling, heavy use of electro-cautery)

Relevant Links:

Survival Surgery, Rodents

Identification of Pain and Distress in Laboratory Animals

Pain Relief in Animals

Post-anesthesia Monitoring

Sterilants and Disinfectants

FDA-Cleared Sterilants and High Level Disinfectants:

Alcohol is acceptable as a skin disinfectant, however is generally not recommended for the preparation of surgical instruments: AAALAC Connection 2001

Chlorhexidine Gluconate Scrub is an antiseptic/antimicrobial skin cleanser:
e.g. http://www.hibiclens.com/

Spor-Klenz is a hard surface antimicrobial product:

MB-10 is a hard surface disinfectant product:
For any further assistance or information, please contact an Office of Animal Care and Use Training and Compliance Coordinator at 966-5569.


GLOSSARY:

Antimicrobial: “destroy or inhibit the growth of microorganisms”

Antiseptic: “preventing the growth of microorganisms”

Asepsis: “state of being free of pathogenic organisms”

Bactericide: “destroy bacteria”

Contamination: “process of infecting by contact or association”

Disinfect: “to free from infection especially by destroying harmful microorganisms”

Pathogen: “a specific agent (bacterium or virus) of disease.”

Sanitize: “to make more acceptable by removing unpleasant or undesired features”

Disinfectant: “a chemical that destroys vegetative forms of harmful microorganisms (as bacteria and fungi) especially on inanimate objects”

Sterilant: “to free from living microorganisms”

Sterile: “free from living organisms and especially microorganisms”

Sterilization: “to make sterile”
Supply and Vendor Information

Isoflurane can be purchased from the UNC CH Hospital pharmacy: Call 919-966-1366 for more information or go to Ground Floor, room NG10B. A grant number and department number is required for purchase.

Braintree Scientific  781-843-2202  www.braintreesci.com
Instruments, lab equipment, isothermal pads, tattoo paste

Fisher Scientific  800-766-7000  www.fishersci.com
Lab equipment, chemicals, instruments, pharmaceuticals

Henry Schein  800-872-4346  www.henryschein.com
Veterinary supplies, instruments, pharmaceuticals
Need Vet License or Researcher DEA license

JA Webster  800-225-7911  www.jawebster.com
Veterinary supplies, instruments, pharmaceuticals
Need Vet License or Researcher DEA license

Kent Scientific  888-572-8887  www.kentscientific.com
Surgical equipment, telemetry equipment

Med-Vet International  800-544-7521  www.shopmedvet.com
Veterinary supplies and instruments (discounted)
Need Vet License

National Band and Tag  859-261-2035  www.nationalband.com
ID tags, ear tags

Roboz  800-424-2984  www.roboz.com
Specialize in instruments

TW Medical  888-787-4487  www.twmedical.com
Veterinary supply (Bill Forrester)

UNC-CH Materials Management and Distribution  966-5671
Scientific Storeroom, General Storeroom, Chemical Storeroom

Veterinary Medical Supply  800-533-8674
Veterinary Supplies out of Zebulon, NC
Need Vet License

Southern Anesthesia  800-456-0757  http://www.sasvet.com/
This is a human source company that has a Veterinary division, will set up an account without a vet license.
### The University of North Carolina at Chapel Hill
### IACUC Training Record

#### Aseptic Techniques

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Please add email address if you are a Lab Animal Coordinator: ____________________________

Phone #: ________________________________

I certify that I have received the above training:

Signature: ________________________________  PID: ______________

Print Name: ________________________________  PI: ______________

Instructor Signature: ________________________  Date: ______________