Surgical Manual:
Epoch Transmitters for EEG

Implanting an Adult Rat with the Single-Channel Epoch Transmitter for Recording EEG

November 21, 2013

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Recommended Surgical Tools

A. Scalpel handle
B. Scalpel blade (#15)
C. Fine scissors
D. Burr tool
E. Fine burr (FST #19007-09 or equivalent)
F .4x Hemostats (curved)
G. Toothed forceps
H. Absorbent spears or cotton-tipped applicators
I. Needle drivers
J. Accelerant (Loctite 7452 or equivalent)
K. Cyanoacrylate (Loctite 4541 or equivalent)
L. Suture (Vicryl 4-0)
M. Electrocautery unit

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Sterilize Transmitter

Ethylene Oxide
- Place transmitter in Tyvek pouch
- Gas for a complete Kill cycle
- Off-gas for at least 24 hours

Isopropyl Alcohol
- Soak in 70% ethanol for 1 minute
- Rinse in sterile saline

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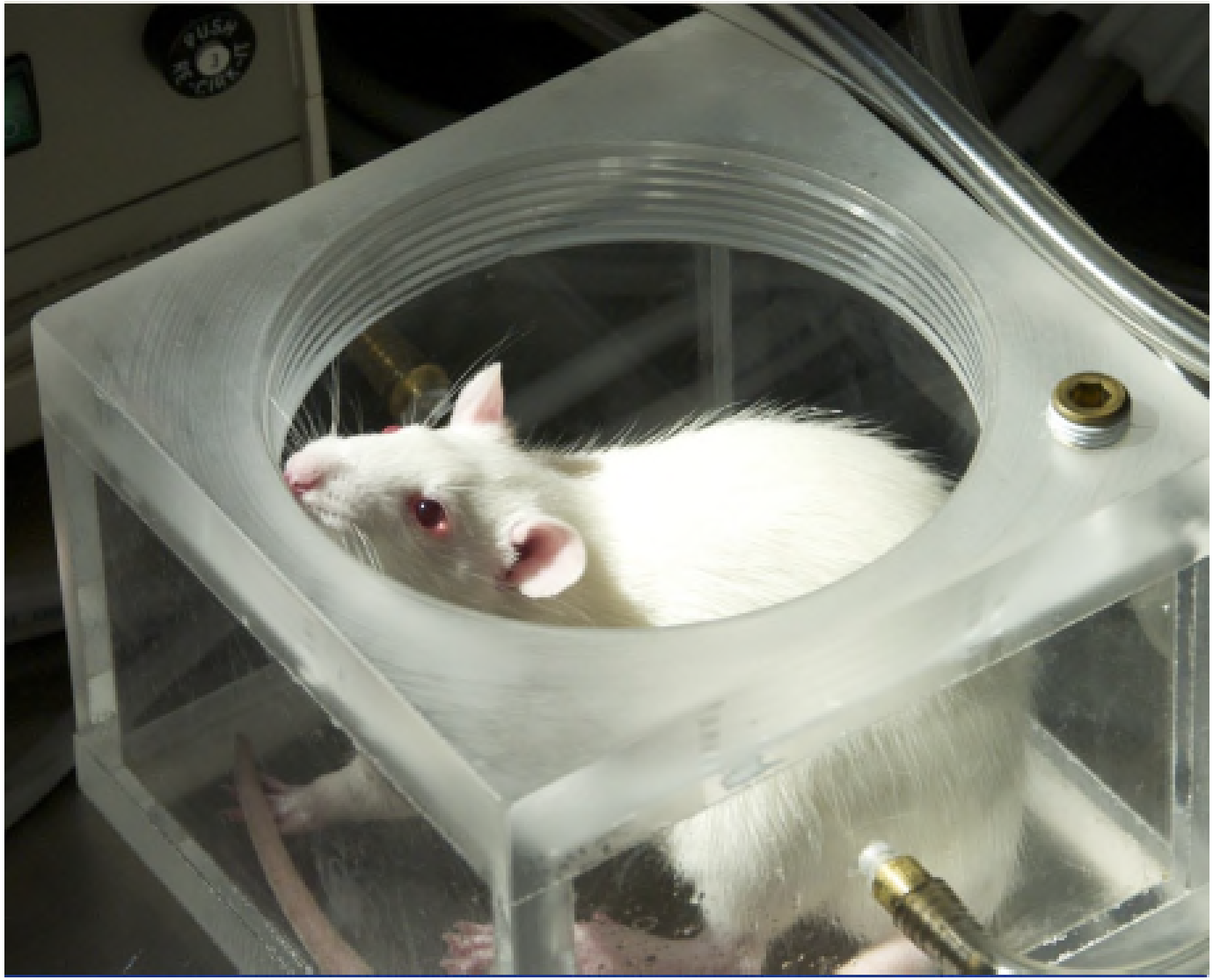
Anesthesia

- Anesthetize animal and maintain anesthesia according to IACUC-approved protocol



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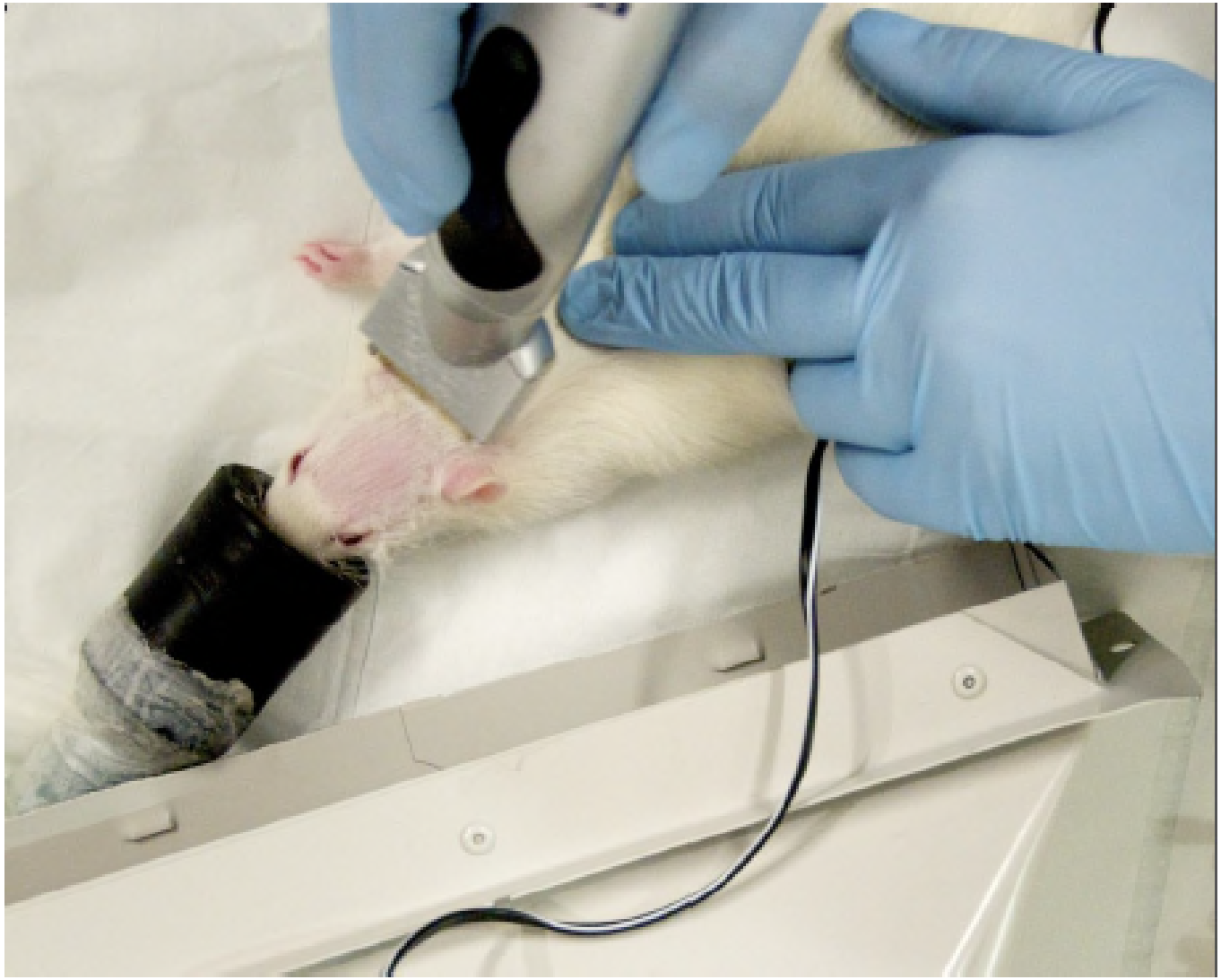
Shave Scalp

- Shave the scalp of the animal over the skull and remove excess hair



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Fix Position in Stereotaxic frame

- Each ear bar tip must be properly positioned in auditory meatus
- Do not excessively tighten ear bars
- Make sure anesthesia nose cone is secure
- A heated water blanket or heating pad is used under the animal to keep it warm during surgery
- Periodically check depth of anesthesia with corneal reflex, limb pinch, or pulse oximetery.

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Protect the Animal's Eyes

- Apply lubricant eye ointment to each eye
- A mixture of mineral oil (20%) and white petrolatum (80%)

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Sterilize Incision Site

- Swab the scalp with alternating applications of 70% ethanol and betadine.
- Start in the center of the scalp and make increasingly wider concentric circles.

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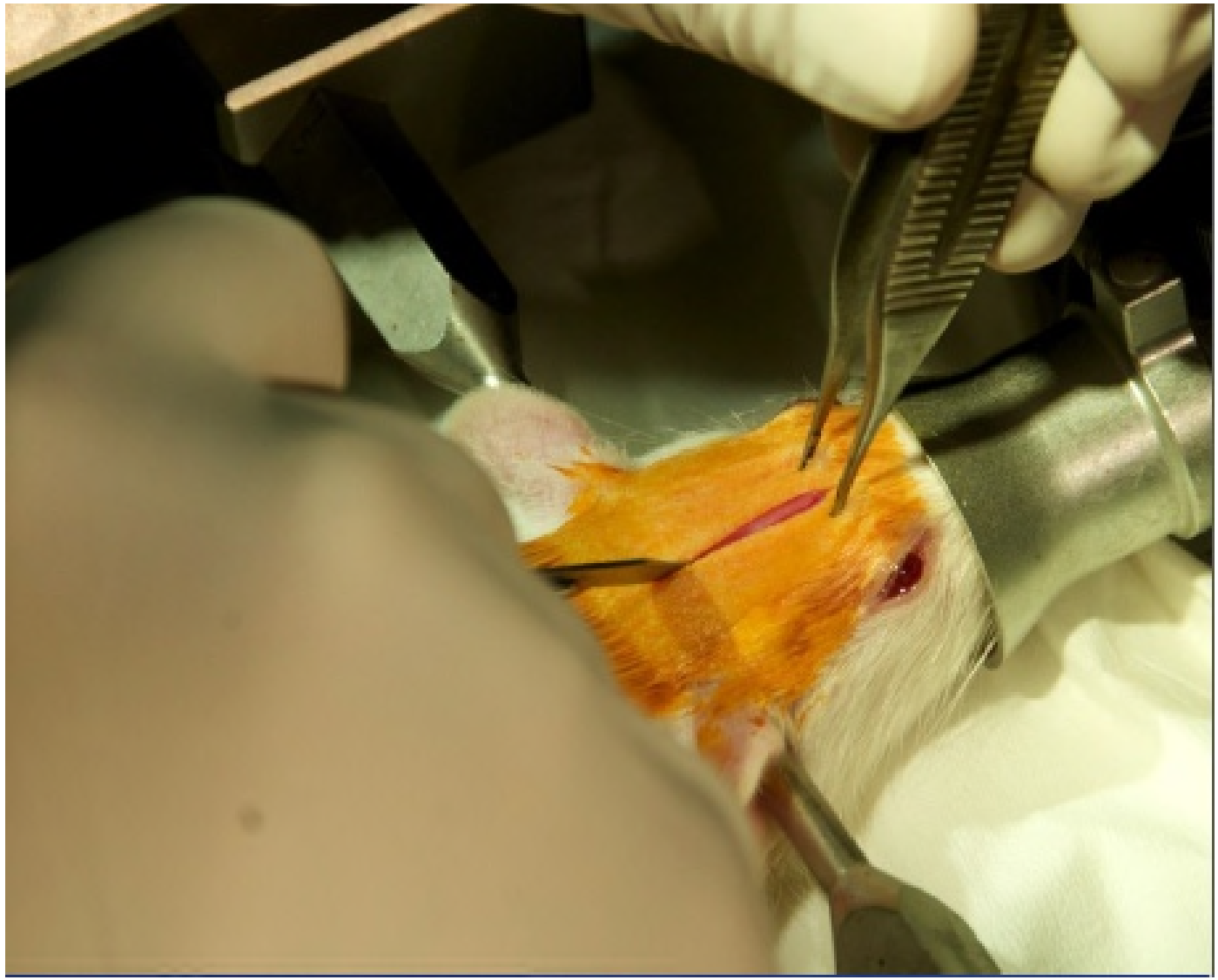
Scalp Incision

- Incision is made slightly behind the eyes along the midline, approximately ¾”.
- Try to make a single cut, which results in better healing.



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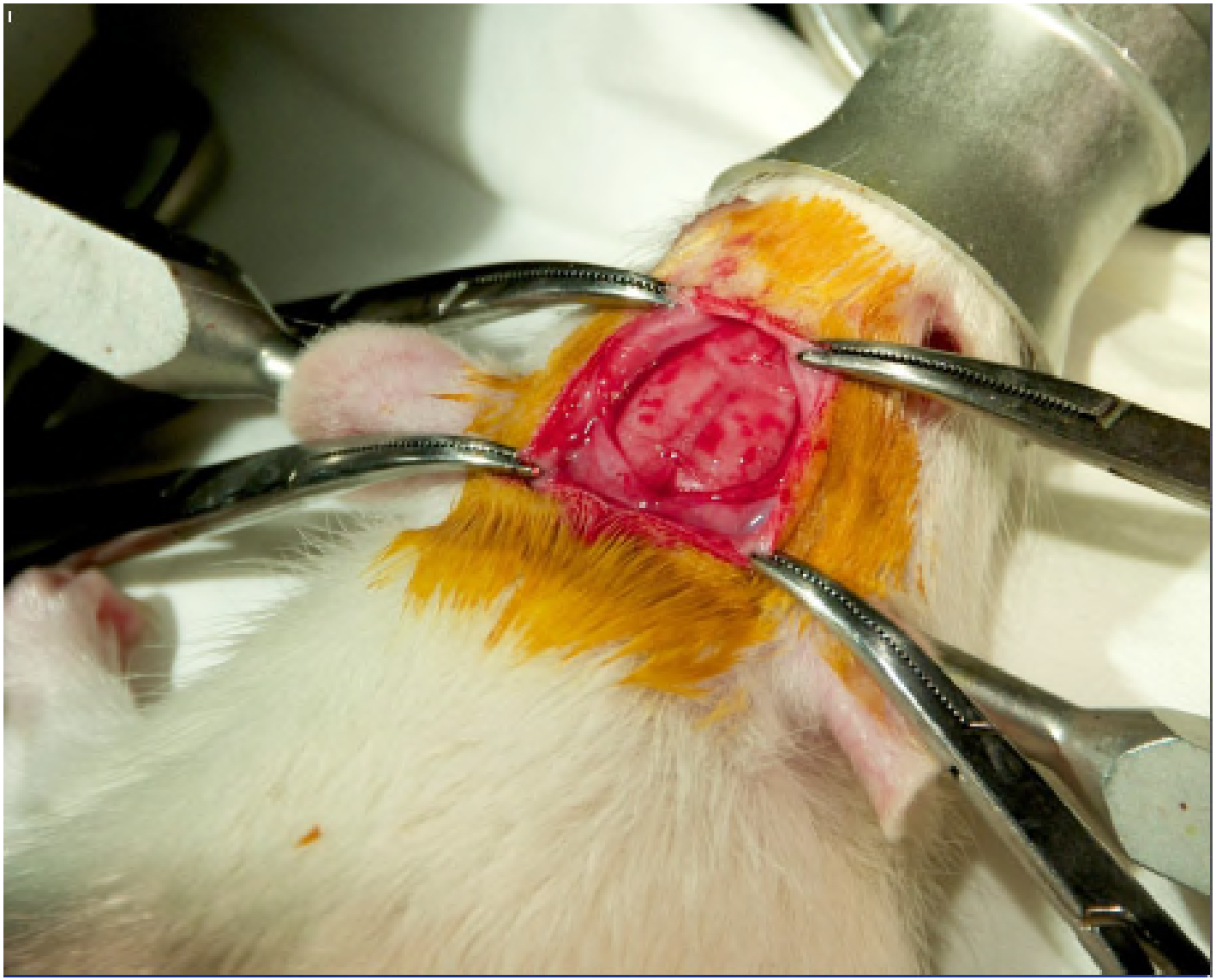
Exposing the Scalp

- Use hemostats to grasp scalp.
- Gently pull scalp away from midline at four corners.
- Look for anatomical landmarks in the skull such as Bregma and Lambda.



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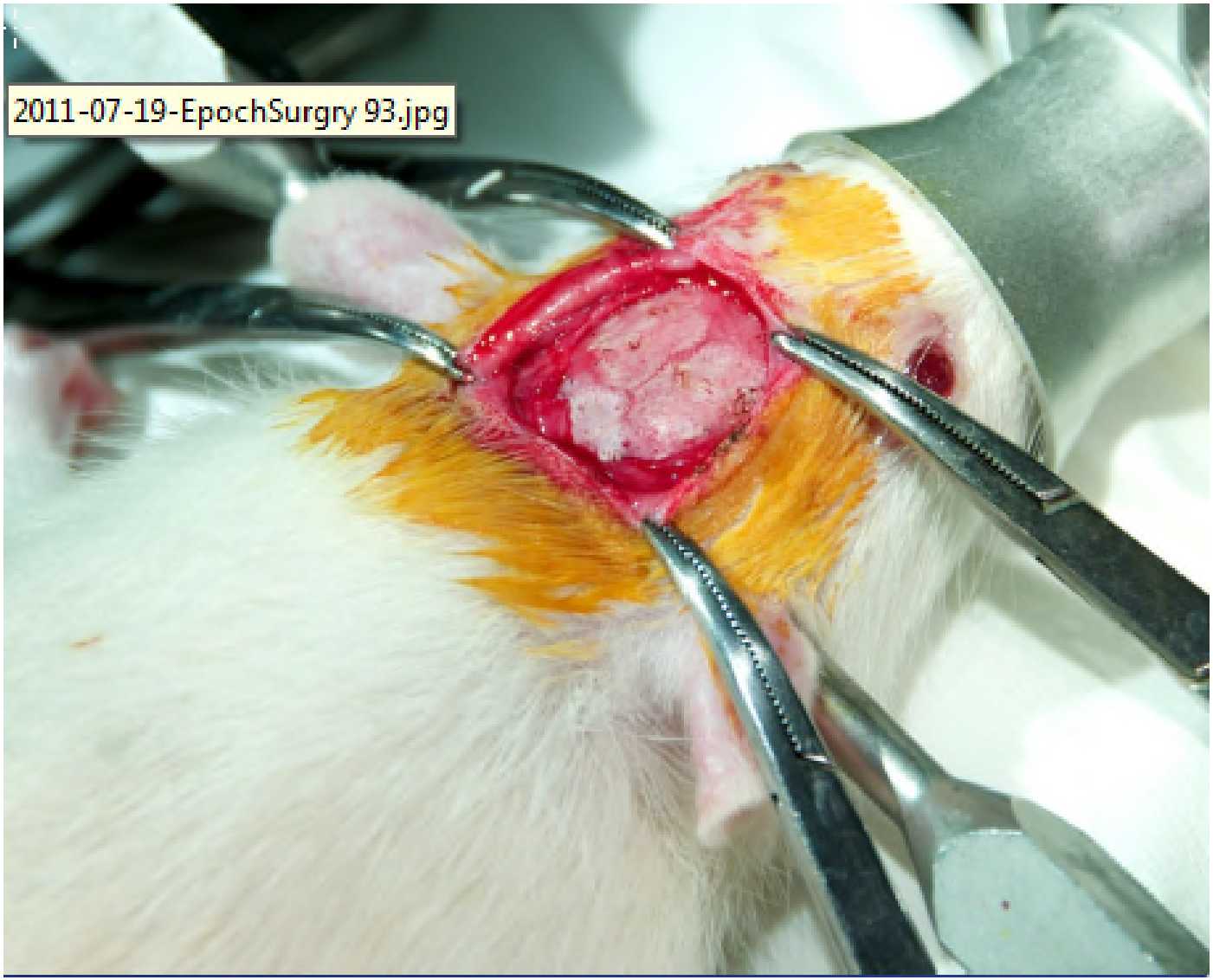
Clean and Dry the Skull

- Remove all periosteum from the exposed surface of the skull.
- Cauterize any bleeding sections of bone.
- Skull must be completely dry.



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Drill two holes in the skull over desired electrode locations

- Recommend using Dremel-type tool with a burr-type drill bit
- Practice drilling burr holes in a block of wood before attempting in a rat.
- Holes should be bigger than 300 µm in diameter.
- Burr sizes of 0.9 mm produce clean holes.
- Alternatively, no holes need to be drilled for stable EEG recordings.

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Check Spacing

- EEG from each electrode is subtractive (electrode 1 – electrode 2).
- Holes can be within a hemisphere or between hemispheres.
- Alternatively, no holes need to be drilled for stable EEG recordings.

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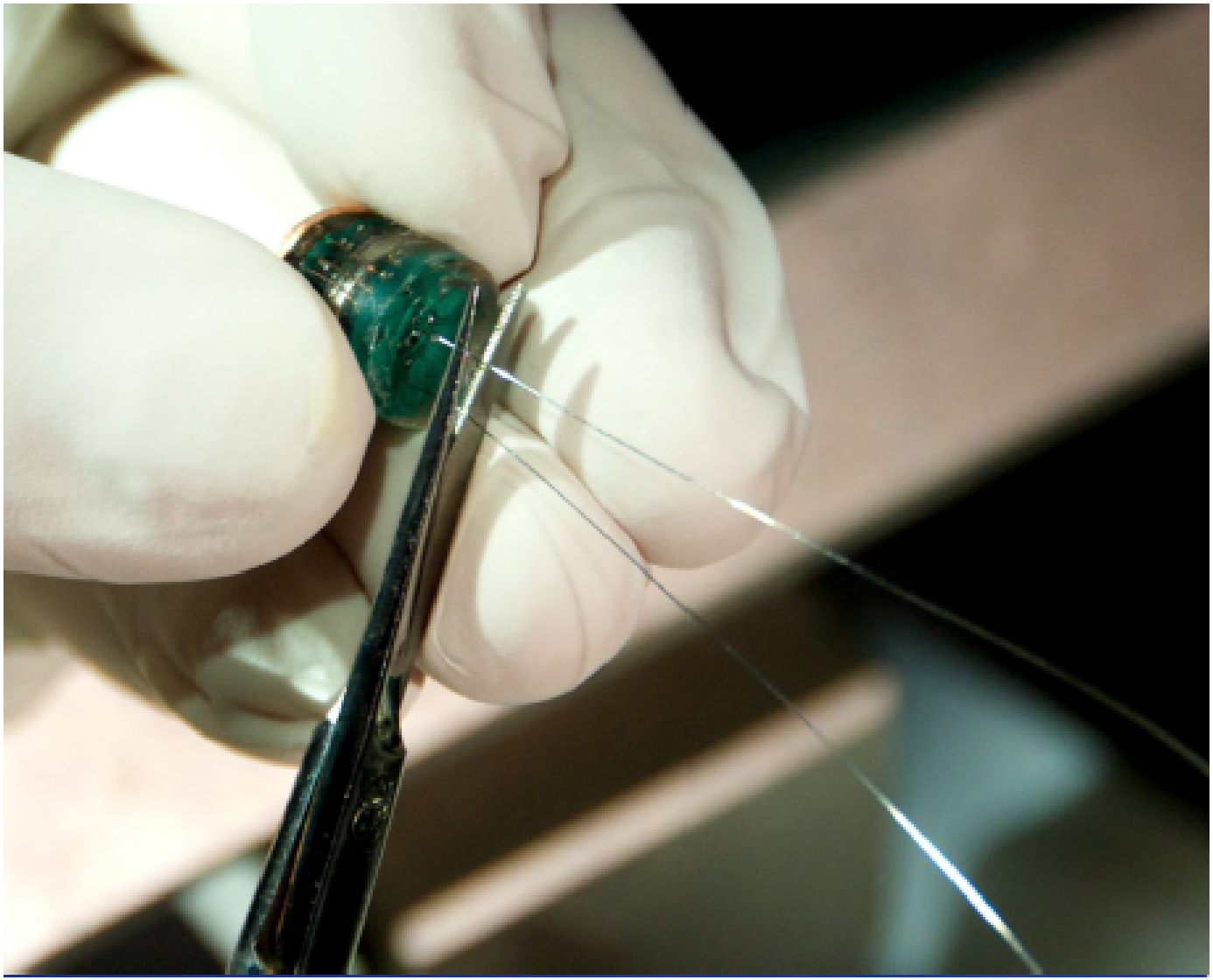
Trim Electrode Leads

- Use surgical scissors to trim the electrodes to the desired length.



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Check Electrode

- Check the fit of the transmitter and gently bend electrodes to line up over the intended sites for burr holes.
- Trim excess electrode length.

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Drill Anchoring Screw Holes

- Create two additional burr holes outside of the footprint of the transmitter.

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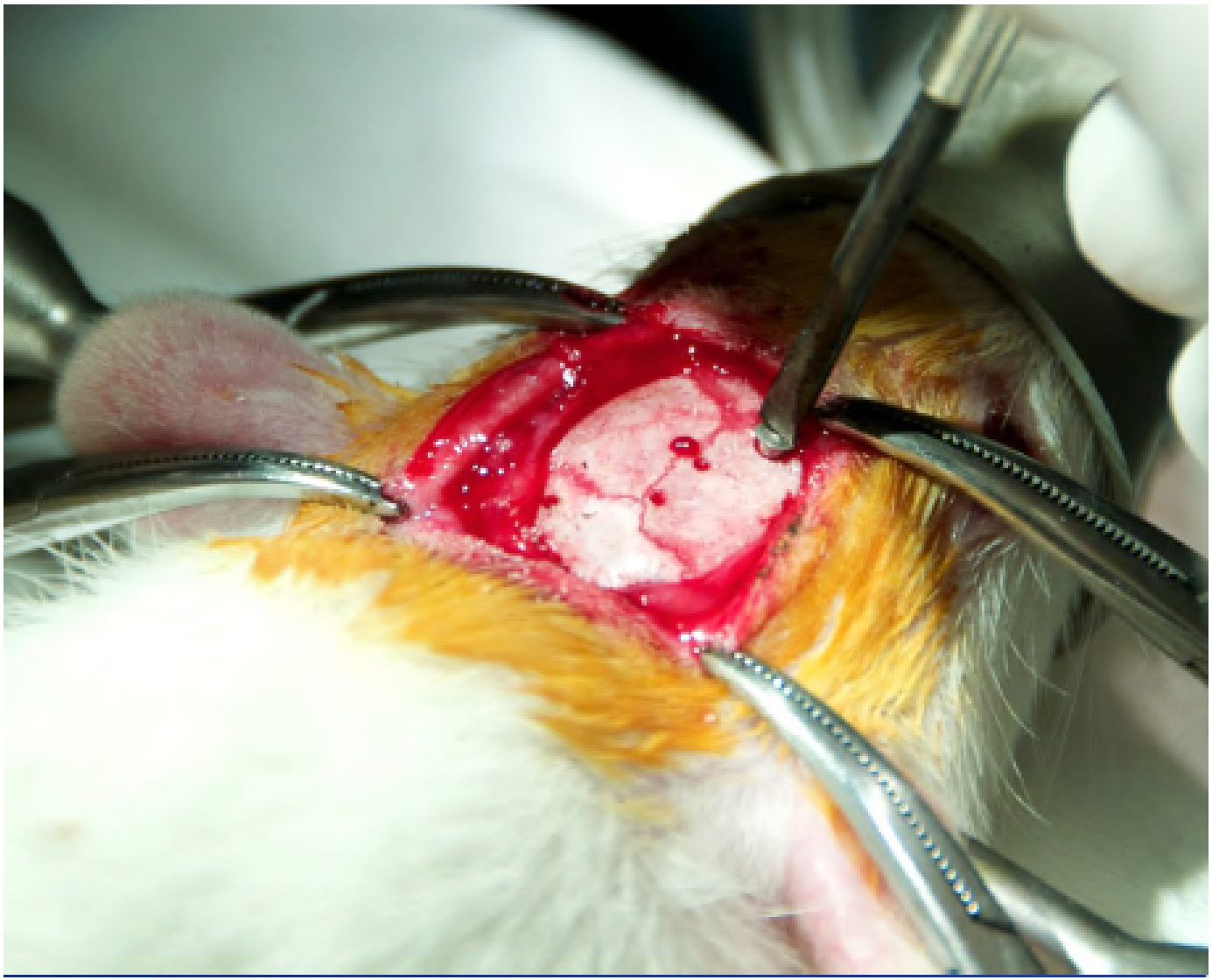
Insert Anchoring Screws

- Use sterile self-tapping wood screws.
- Use “0” x 1/8 inch 303 stainless steel screws or equivalent.
- Insert screws with sterile “jewelers” screw driver.
- Screws should be snug with the head of the screw and one or two threads exposed.



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Maintain a Dry Skull

- Be certain that the skull is dry before gluing the transmitter to the skull.

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Check Fit

- Check the fit of the transmitter.
- Electrodes should guide through the holes in the skull.
- Transmitter should fit between the two anchoring screws.

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Apply Cyanoacrylate

- Liberally apply cyanoacrylate on the base of the transmitter around the outside edge.
- Make sure to avoid coating the electrodes

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Apply Cyanoacrylate

- Cyanoacrylate will flow to the center of the transmitter when placed on the skull.

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Apply to Skull

- Thoroughly dry skull before placing transmitter to ensure strong adhesive bond.
- Apply transmitter coated with cyanoacrylate to the skull.
- Take care to align electrodes with corresponding burr holes.
- Try to avoid piercing major vascular structures.
- Hold the transmitter in place for one minute.

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Apply Accelerant

- Apply accelerant through a syringe around the cyanoacrylate at the base of the implanted transmitter.
- Use accelerant sparingly, taking care not to apply to adjacent tissue.
- Cyanoacrylate accelerant is useful to speed curing of adhesive, but is not necessary.

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Apply Additional Adhesive

- Apply additional cyanoacrylate around the base of the transmitter.
- Thoroughly cover both anchoring screws.
- Push cyanoacrylate up the sides of the transmitter.

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Apply Accelerant

- Apply accelerant through a syringe around the cyanoacrylate at the base of the implanted transmitter.
- Use accelerant sparingly, taking care not to apply to adjacent tissue.
- Wash away excess accelerant with sterile saline.

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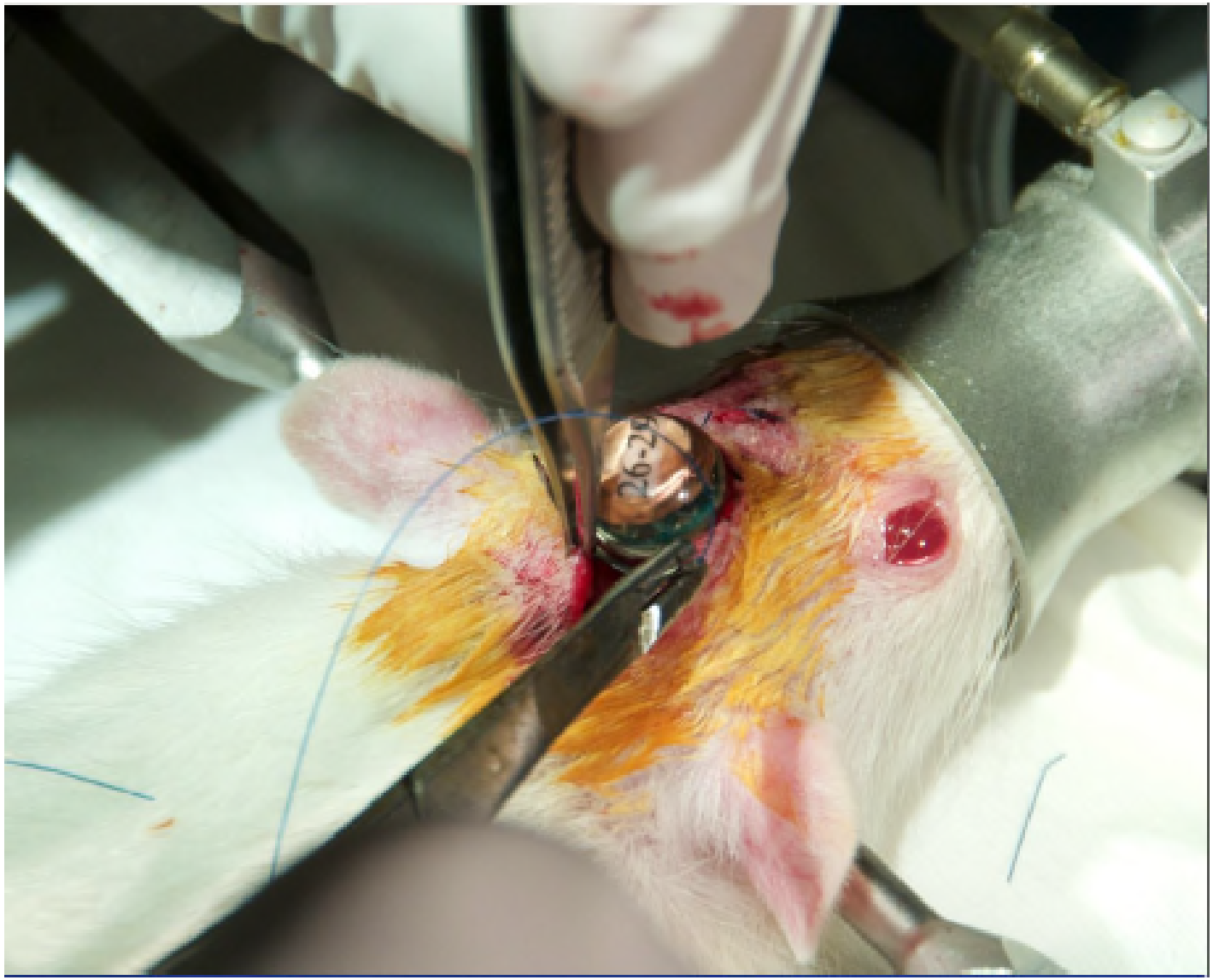
Suture Skin

- Suture the skin around the base of the transmitter, but do not cover the transmitter.
- Top of transmitter must be above skin to efficiently transmit neural signals.
- Skin should be reasonably tight around the transmitter.



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Remove Animal

- Remove animal from stereotaxic frame and place on heated blanket for recovery.
- A triple antibiotic can be applied to the sutures and around the base of the transmitter.
- Animals should be warm and mobile before returning to their home cage.

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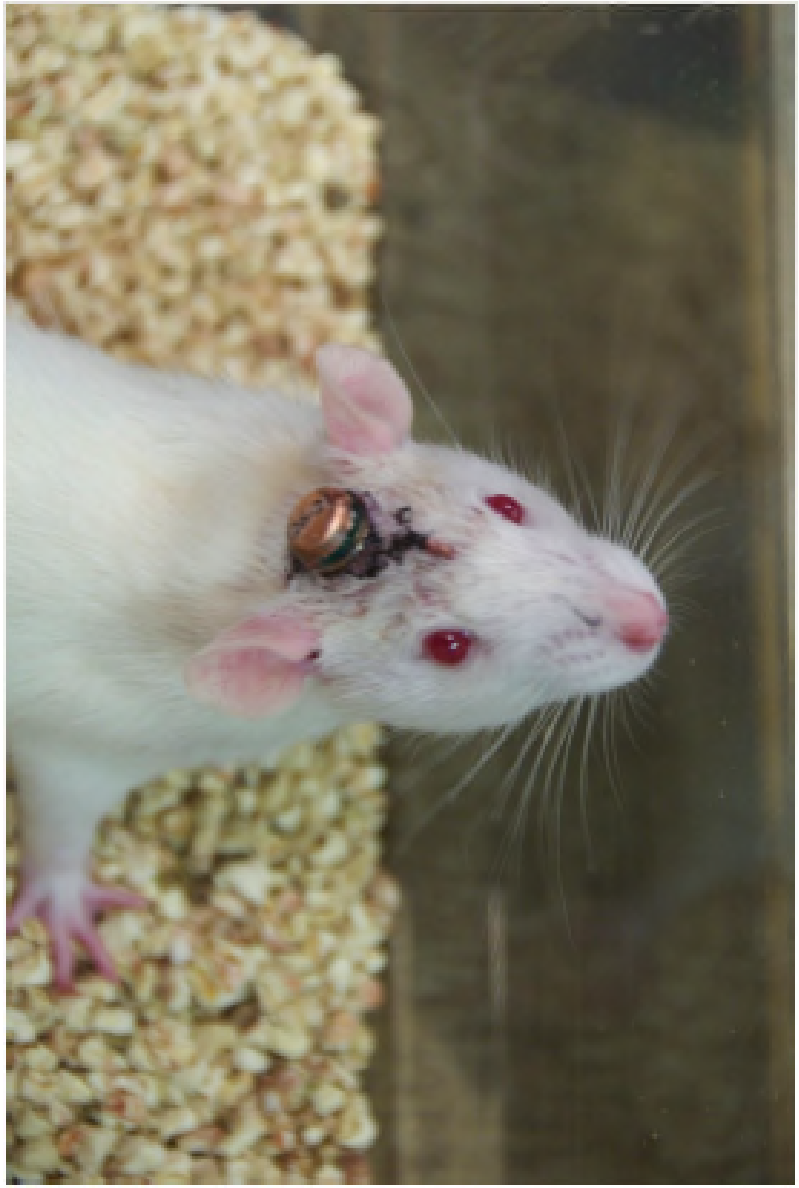
Recover Animal

- Once animal is active, moving around, and grooming, it can be returned to its home cage.



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Care and Housing

- Recordings may commence directly after animal has recovered from surgery.
- Sutures may need to be removed from the scalp after one week.
- Check for signs of necrosis around the transmitter and treat where needed.

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