

UCAR Policy on Mouse Tail Tip Biopsy

Genetically engineered mice may be genotyped through collection of distal tail tissue (tail biopsy).

Whenever possible, the method of genotyping selected should meet both goals of collecting a DNA sample and individually identifying the animal, to minimize stressful handling and avoid the use of multiple invasive techniques (Bonaparte 2013)

Ear biopsy is the method of choice to achieve these goals without inducing signs of discomfort (Bonaparte 2013). A sufficient sample size can be obtained using 2mm punches and can be collected starting at 14d of age for most strains.

Alternatives to tail biopsy must always be considered for genotyping (see “Alternative Genotype Sample Options” below).

Age & Anesthesia

Anesthesia is **required** for mice 22 days old or older, or if > 2mm of tissue needs to be taken. See SOP below for suggested anesthetics.

Anesthesia is not required for mice less than 22 days old when the amount of tissue is \leq 2mm given the lack of vertebral ossification and periosteal & endocortical innervation¹.

Post-biopsy analgesia is not required but may be used.

Biopsy Length

No more than 2mm maximum length at tail tip may be taken. If greater than 2mm length must be taken, it must be described and justified in the protocol, and anesthetics/analgesics must be used.

Alternative sampling methods should be used for repeat genotyping. Repeat tail biopsies, if required, must be described and justified in the protocol. Repeat sample collection require the use of anesthesia/analgesia since cumulatively >2mm of tissue will be removed. No more than 5mm of tail cumulatively may be collected from an individual animal.

Summary Table

| Age | Sample size | Use of anesthesia/analgesia |
|------------|---------------------|------------------------------|
| \leq 21d | \leq 2mm | Not required but recommended |
| > 21d | \leq 2mm | Required |
| Any age | >2mm, up to 5mm max | Required |

NOTE: This policy does not apply to blood sampling methods that involve tail tip transection. Such procedures must be described and justified in the approved protocol.

DCM Recommended SOP

Administer anesthetics/analgesics as required for the age and intended sample size (see below for recommendations).

Use a sterile, straight edge blade to transect up to the distal 2 mm of the tail resting on a cushioned material (e.g. a Nestlet™ or paper towel). An unused section of the same blade may be used on all mice in the same cage.

Apply direct pressure to stop tail tip bleeding. If bleeding continues, dip the tail tip in a styptic powder (copper- or ferric-based or antibiotic powder).

Return the mouse to the cage after confirming hemostasis.

Anesthesia & Analgesia Recommendations

- Mice of any age
 - 0.75% bupivacaine immersion of the tail for 30 seconds **after** biopsy (Jones 2012, Dudley 2016)
 - 0.05 mg/kg Buprenorphine HCl **before** biopsy (Jones 2012)
- Mice ≤21d old
 - Immersion of the tail in ice-cold 70% ethanol for 10 seconds **immediately before** biopsy (Dudley 2016)
- Mice >21d old
 - Isoflurane anesthesia (Hankenson 2011, Braden 2015)

The following anesthetics have been deemed inappropriate for tail biopsies in mice: ethyl chloride, ethylene chloride (vapocoolant sprays), topical cetacaine, topical 2.5% lidocaine-2.5% prilocaine cream (Braden 2015, Dudley 2016, Jones 2012, Matthias 2013).

Advantages of Pre-Weaning Genotyping

- Animals are easy to handle (Bonaparte 2013)
- Genotyping results are available before weaning → more efficient use of cage space
 - Better experimental planning
 - Better colony management
 - Group housing by genotype at the time of weaning, etc.
 - Decreased housing costs
 - Surplus animals can be managed before weaning

Alternative Genotype Sample Options

- [Genotyping Center of America](#) offers commercially available non-invasive genotyping
- Ear biopsy
 - Chen et al (2023), <https://doi.org/10.30802/AALAS-JAALAS-23-000022>
 - Ren et al (2001), PMID: 11300684
 - Gaw et al. (1995), <https://doi.org/10.1258/002367795780739944>
- Feces
 - Hamann et al. (2010), <https://doi.org/10.14573/altex.2010.3.185>
 - Broome et al. (1999), [https://doi.org/10.1016/S0014-5793\(99\)01516-1](https://doi.org/10.1016/S0014-5793(99)01516-1)
- Blood
 - Gross & Rotzer (1998), PMID: 9502758

- Campbell & Hess (1997), [https://doi.org/10.1016/S1385-299X\(96\)00019-0](https://doi.org/10.1016/S1385-299X(96)00019-0)
- Hofstetter et al. (1997), <https://doi.org/10.1006/bmme.1997.2637>
- Ohhara & Esumi (1994), PMID: 7833036
- Saliva
 - Irwin et al. (1996), [10.1038/nbt0996-1146](https://doi.org/10.1038/nbt0996-1146)
- Buccal swab
 - Lui et al (2024), <https://doi.org/10.30802/AALAS-JAALAS-23-000045>
 - Meldgaard et al. (2004), <https://doi.org/10.1258/0023677041958981>
 - Zimmermann et al (2000), PMID: 10894499
- Rectal swab
 - Lahm et al. (1998), [10.1023/a:1008824509988](https://doi.org/10.1023/a:1008824509988)
- Hair
 - Otano-Rivera et al. (2017), <https://doi.org/10.1177/0023677216646088>
 - Schmitteckert et al. (1999), <https://doi.org/10.1258/002367799780487922>
 - Ohhara & Esumi (1994), PMID: 7833036

Mouse Identification Options

- Ear biopsy
- Ear tag
 - Can be performed as early as 14 days of age in most strain
 - [RapID Lab](#)
- Microchip placement
 - [UID](#)
 - Digitail RFID tag ([Somark](#))
- Tattooing
 - [Labstamp](#) (Somark) tattoo service available through the Animal Resource
- Temporary marker
- Toe clipping
 - If scientifically justified in approved UCAR protocol and performed prior to PND7

References

Arras M, Rettich A, Seifert B, Käsermann HP, Rüllicke T. Should laboratory mice be anaesthetized for tail biopsy? *Lab Anim*. 2007 Jan;41(1):30-45. doi: 10.1258/00236770779399446. PMID: 17234048.

Bonaparte (Convenor) D, Cinelli P, Douni E, et al. FELASA guidelines for the refinement of methods for genotyping genetically-modified rodents: A report of the Federation of European Laboratory Animal Science Associations Working Group. *Laboratory Animals*. 2013;47(3):134-145. doi:[10.1177/0023677212473918](https://doi.org/10.1177/0023677212473918)

Braden GC, Brice AK, Hankenson FC. Adverse effects of vapocoolant and topical anesthesia for tail biopsy of preweanling mice. *J Am Assoc Lab Anim Sci*. 2015 May;54(3):291-8. PMID: 26045455; PMCID: PMC4460942.

Dudley ES, Johnson RA, French DC, Boivin GP. Effects of Topical Anesthetics on Behavior, Plasma Corticosterone, and Blood Glucose Levels after Tail Biopsy of C57BL/6NHSD Mice (*Mus musculus*). *J Am Assoc Lab Anim Sci*. 2016;55(4):443-50. PMID: 27423152; PMCID: PMC4943616.

Hankenson FC, Braden-Weiss GC, Blendy JA. Behavioral and activity assessment of laboratory mice (*Mus musculus*) after tail biopsy under isoflurane anesthesia. *J Am Assoc Lab Anim Sci*. 2011 Sep;50(5):686-94. PMID: 22330716; PMCID: PMC3189673.

Hankenson FC, Garzel LM, Fischer DD, Nolan B, Hankenson KD. Evaluation of tail biopsy collection in laboratory mice (*Mus musculus*): vertebral ossification, DNA quantity, and acute behavioral responses. *J Am Assoc Lab Anim Sci*. 2008 Nov;47(6):10-8. PMID: 19049247; PMCID: PMC2687139.

Jones CP, Carver S, Kendall LV. Evaluation of common anesthetic and analgesic techniques for tail biopsy in mice. *J Am Assoc Lab Anim Sci*. 2012 Nov;51(6):808-14. PMID: 23294888; PMCID: PMC3508186.

Matthias N, Robinson MA, Crook R, Lockworth CR, Goodwin BS Jr. Local cryoanalgesia is effective for tail-tip biopsy in mice. *J Am Assoc Lab Anim Sci*. 2013 Mar;52(2):171-5. PMID: 23562100; PMCID: PMC3624785.

USDA Bibliography on Alternative Methods of Genotyping Mice. October 2024.

https://www.nal.usda.gov/sites/default/files/page-files/AWIC_bibliography_alternatives_tail-biopsy_genotyping_mice_508.pdf

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