

BEST PRACTICES FOR OPTIMIZING MOUSE BREEDING PROGRAMS

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Background

The following strategies for maintaining breeding colonies of mice are a compilation of best practices and industry standards. For additional questions, please contact the Office of Laboratory Animal Care (OLAC).

General Tips

- Minimize the amount of noise and traffic in your mouse room. Try to always have the same person(s) take care of your mice. Ultrasonic noise, in particular, can disrupt normal mouse behavior (including mating behavior), and can be produced by something as innocuous as a dripping faucet.
- Don't bang cages around or jostle the mice any more than necessary. Handle them calmly and quietly.
- Give your mice nesting material and environmental enrichment. Nestlets with Envirodry is an excellent choice - these are compressed cotton squares and sterile paper strips that mice love to tear apart and fluff up into a warm nest. Other options include plastic or cardboard Shepherd Shacks.
- Pup production may improve if cages are placed low on racks, far from room doors, and in rooms with limited traffic and no cage or rack disruption.

Mating

- Allow male mice a little time (e.g., a day) to get used to a new cage before expecting them to mate successfully. Males prefer to have their territory scent-marked before they will breed efficiently.
- Use dirty bedding from a male's cage to stimulate estrus in females. Females group-housed for long periods can go into anestrus, i.e., they will stop cycling normally. This is reversed by exposure to male pheromones present in the urine.
- Provide females with high fat content "Breeders Chow." This can be provided by OLAC.
- Mouse reproductive behavior is governed to a large extent by pheromones. Three important effects of pheromones are described here.
 - Lee-Boot Effect: Housing female mice in groups will result in synchronization of their estrus cycles. Prolonged absence of male pheromones results in a state of anestrus (lack of a normal estrus cycle).
 - Whitten Effect: Estrus can be induced in most group-housed females by adding male mouse urine (or dirty bedding from a male's cage) to their cage.
 - The Lee-Boot and Whitten Effects can be utilized to produce closely synchronized pregnancies. After group-housing females separately from males for some time, put them in a male's cage. Generally, at least 75% of the females will become pregnant within 3 days.
 - Bruce Effect: Pheromones from a strange male can prevent the implantation of embryos into the uterine walls of a recently bred female. This is why one should not move a female from one male's cage to another.
- Cycle females through a male's cage to maximize production from a small number of males. Don't cycle males through a female's cage.
- Maximize production of pups by replacing your breeders with younger mice on a regular schedule. Mice should normally be placed for breeding by 6-8 weeks of age. Females should usually be replaced at 8 months (6 months for many transgenic lines). Males should be replaced by 1 year of age (8 months for some transgenic lines).
- First litter females (dams) often have small litters. Stressors that exacerbate this low production can reportedly reduce the dam's production throughout her life.

- Females that kill at least 2 successive litters or fail to produce litters in 3 successive breedings should normally be replaced. Keep in mind some transgenic lines are difficult breeders and this standard may have to be adjusted accordingly.
- Keep records of breeding performance so time and resources aren't wasted on unproductive mice. Not all mice will breed successfully, even among standard strains. You should consider replacing breeders if:
 - they have not produced a litter in more than two months
 - they are producing litters much smaller than the strain is expected to produce (e.g., 1-3 pups per litter)
 - they are killing their pups

Gestation and Post-Parturition

- Don't disturb gestating females any more than necessary, especially a few days before and after birth.
- Avoid changing cages with new litters for minimum of 3 days after birth. Identify the cage with the blank card provided by OLAC. Write "New Litter – Do not change. Lab will change on [date]." Remember that **you** will be responsible for changing the cage.
- If you see dead or cannibalized pups, check to see if pups are nursing. Pups that nurse will have milk visible in their stomachs, a so-called milk spot. Pups may fail to nurse if they are weak or if the dam does not have adequate milk supplies.

Light Cycles

- Keep your mice on a regular light/dark cycle. OLAC's default light setting is 12-hour light/12-hour dark cycle although some rooms are on a 14/10 light/dark cycle to encourage breeding. Periodically check that the lights actually come on and go off as scheduled. Avoid entering mouse rooms during dark periods.
 - If you need to enter a room during the dark period, talk with OLAC about using red light instead of white lights. Thus minimizing the impact on the mice if you have to work in the room during dark hours.

Cross-fostering of Mouse Pups

- Donor and recipient litters should be within 2 days of age, and neither litter should be more than 4 days of age, for best results.
- If possible, use a recipient strain with a different coat color from the donor strain, for easier identification of the cross-fostered pups.
- Remove the recipient mom from her cage. When you pick her up, try to get her to urinate on your gloves, and wipe the urine on the pups you are transferring. Most mice will urinate if turned upside down.
- Remove some (or most) of the recipient's pups if she has a large litter. After cross-fostering, the total number of pups in her cage should be 5-10.
- Mingle the transferred pups with the recipient's pups and rub them with dirty bedding to give them the same scent as the recipient's pups. Add nesting material if necessary.
- Observe the recipient mom's behavior after a few minutes. If she settles down to nurse the pups, or is grooming them, she will probably accept the transferred pups. If she scatters them around the cage, it is unlikely she will take care of them.

References

- University of California, Irvine
Transgenic Mouse Facility
Mouse Husbandry, Breeding and Development Guidelines
<http://www.research.uci.edu/tmf/husbandry.htm>
- The Jackson Laboratory
Mouse Breeding Strategies for Maintaining Colonies of Laboratory Mice (pdf)
http://jaxmice.jax.org/manual/breeding_strategies_manual.pdf