POSTER PRESENTATIONS

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Hands-on refinements: establishing improved husbandry processes for aged C57BL/6 mice

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Introduction

Ageing is defined as a deterioration of physiological functions which subsequently leads to age-related illnesses and clinical frailty. To study the ageing process, it is important to look at the cumulative effects on the body.

Research into ageing is essential to provide a better understanding of the biological processes and offer possible advancements.[4]

Mice are a good model of ageing as they are physiologically similar and share approximately 95% of their genome to humans.[1]

In terms of clinical frailty, mice also age in a comparable way and show many of the same clinical signs such as reduced muscle mass, weight loss, changes of gait and the development of age-related illnesses.[2]

The main aim of this project was to review the husbandry processes in place for the colony of aged C57BL/6 mice at the Babraham Institute, establish a refined husbandry process and improve local guidance. Secondly, by analysing fate and clinical observation data between 2021 and 2023 this project aimed to assess the impact of these improved routines on the identification of health concerns and the number of mice found dead at routine health checks.

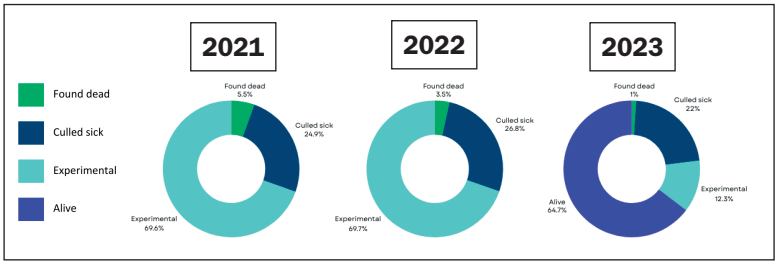
Establishing a process

As humans age, they rely more on doctors, community nurses and other healthcare professionals to monitor their health and assist them where necessary.[4] Those that provide this care are often considered experts in their field and have a high level of understanding regarding clinical frailty in humans. When considering the use of animal models in ageing research it is therefore important to ensure that those caring for the animals also use the appropriate welfare indicators to assess the signs of frailty and have a good understanding of the difference between a sign of ageing and a sign of ill health.[5] A healthy aged mouse will often begin to show subtle signs of frailty from around 17 months old.[3] Some key signs of frailty in mice are changes in coat colour, stiffening of the tail, changes in gait and curvature

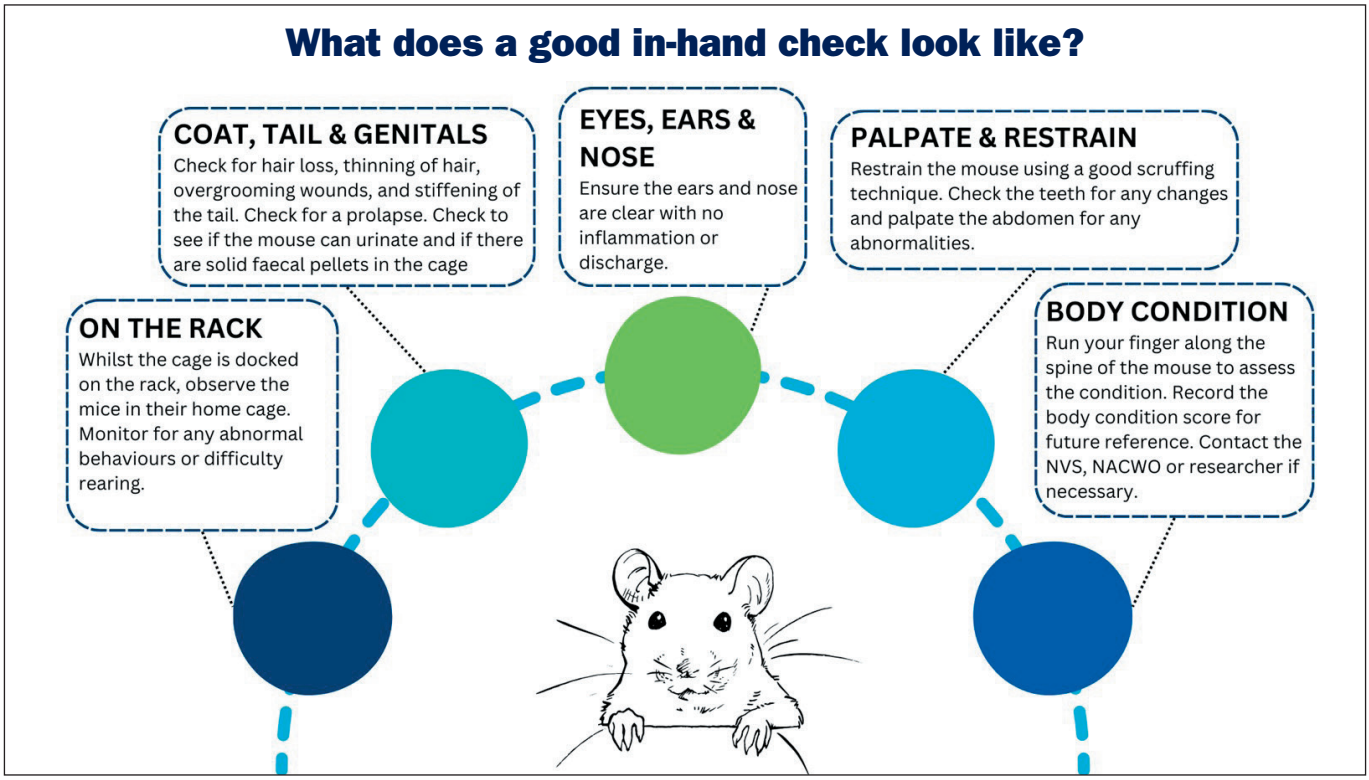
The process	Then	Now
Identification	Mice were not individually identifiable as standard. If a health concern was observed, then the mouse was ear marked.	All mice are individually identifiable by 12 months old at the latest.
Baselines	Baseline bodyweights were not taken. If a health concern was observed, then the mouse was weighed.	Baseline bodyweights are recorded at both 12 months and 15 months old. If a mouse has a change in body condition or a health concern identified, then weights are taken.
Husbandry	Cage cleaning and in-hand checks were completed fortnightly. The aged colony racks were housed in a high traffic area. No specific aged mouse checking process was in place.	Cages are cleaned out fortnightly. However, if the NVS deems it necessary, the length between clean out can be increased or reduced. Mice are in-hand checked **each week**. The aged colony is now housed in a quieter area. Specific aged mouse checking processes are now in place, with body condition scoring and palpation.

of the spine. If an unfamiliar technician were to observe an aged mouse and only have knowledge of younger mice, it is likely that they would have trouble determining if the mouse is sick or just showing signs of frailty. Therefore it is important that those caring for aged mice are aware of age-related changes and typical signs of frailty to monitor.[5]

Fate of mice with an aged procedure



What does a good in-hand check look like?



The cohorts were grouped by the year in which the ageing procedure was added. The data shows the final fate recorded for all aged mice in the 2021 and 2022 cohort. The 2023 cohort shows that there are a number of mice still alive at the time of data collection. However it is still consistent with the 2022 data showing a reduced number of mice found dead.

Results

- All data was collected from the Mouse Colony Management System (MCMS) in January 2024.
- The fate data was grouped by the year in which the ageing procedure was recorded between 2021, 2022 and 2023.
- The health observation data was grouped by the year in which the observation was recorded.

Fate data

A comparison of the fate data revealed a significant change in the number of mice found dead and culled sick between the aged cohorts of 2021, 2022 and 2023. In the 2021 cohort, 14 mice were found dead. This decreased to 10 mice found dead in the 2022 cohort. Further reduction was observed in the 2023 cohort where only 4 mice were found dead.

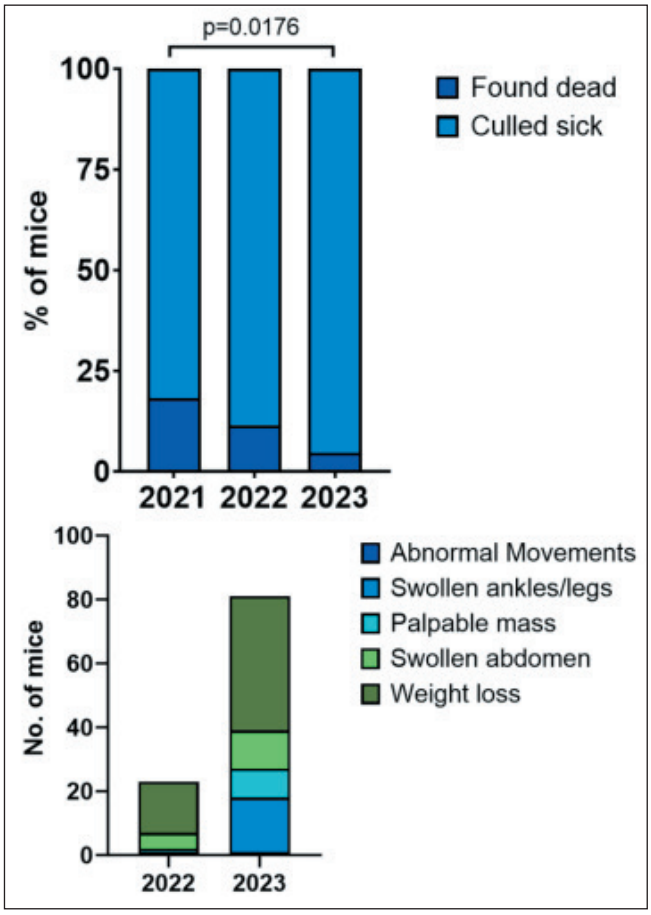
The number of mice culled sick showed an increase over the cohorts. In the 2021 cohort, 63 mice were culled sick. This increased to 77 mice were culled sick in the 2022 cohort. Finally, in the 2023 cohort 84 mice were culled sick.

A Chi-squared test was conducted to examine the association between the cohort year and the number of mice found dead and culled sick. The results indicated a statistically significant association ($\chi^2 = 7.752$, df = 2, $p = 0.0207$), suggesting that the probability of finding mice dead or culled sick varied significantly across the different cohorts.

Health Data

A comparison of the health data revealed a significant change in the number and type of health concerns identified in 2022 and 2023. The data demonstrate a considerable increase in the incidence of several health observations from 2022 to 2023. Specifically, there was a significant increase in the observation of swollen ankles (0 in 2022 to 17 in 2023), palpable masses (1 in 2022 to 9 in 2023), swollen abdomens (5 in 2022 to 12 in 2023), and weight loss (16 in 2022 to 42 in 2023). However there was no difference in the number of abnormal movements recorded (1 in both 2022 and 2023).

A Fisher's Exact Test was conducted to examine the association between the health observation categories and the years 2022 and 2023. The results of the test indicated a statistically significant association ($p = 0.0387$, at a statistically significant level of $p < 0.05$), suggesting that the probability of observing these health concerns varied significantly between the two years.



Discussion

The findings of this project show that there have been significant changes in the fates recorded of aged C57BL/6 mice between 2021 and 2023. Alongside this, there was a notable increase in the number of health concerns recorded. These findings underscore the importance of continually refining husbandry processes and highlight the potential for even small changes to have a significant impact on mouse colony management.

The observed reduction in the number of mice found dead over the cohorts suggests that by refining the in-hand checking process, we have been able to increase early identification of health observations leading to quicker intervention. This claim is also supported by the overall trend in health observations. In 2023, the number of health observations recorded in specific categories increased dramatically following the introduction of weekly in-hand checks.

Future planned projects in this area will continue to assess the impact of daily routines on aged mice. Factors such as noise levels in the room, equipment e.g. change stations, enrichment and chemicals used to disinfect hands will be considered. By conducting comprehensive evaluations of these factors, Animal Technicians can identify additional opportunities for improvement in husbandry practices and further enhance the welfare of aged mouse colonies.

Conclusion

These findings highlight the importance of continually reviewing and refining husbandry processes in mouse colony management. The observed changes in this project demonstrate the significant impact that small changes can make. Moreover, the commitment to honesty and improvement underscores the ethical responsibility of Animal Technicians to prioritise Animal Welfare and strive for excellence in animal research practices.

Acknowledgement

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References

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