



National Centre
for the Replacement
Refinement & Reduction
of Animals in Research

Evidence for refined mouse handling: Better for animals, science and people

优化小鼠操作的证据：更好的动物、科学和人

Dr Khia Dobbison

CALAS Animal Welfare Seminar, Hangzhou China (CALAS 动物福利论坛, 中国杭州)

October 2023 (2023年10月)

Refined mouse handling refers to the methods used to **pick up** mice

优化的小鼠操作指抓取小鼠的方法

Tunnel handling 管道操作

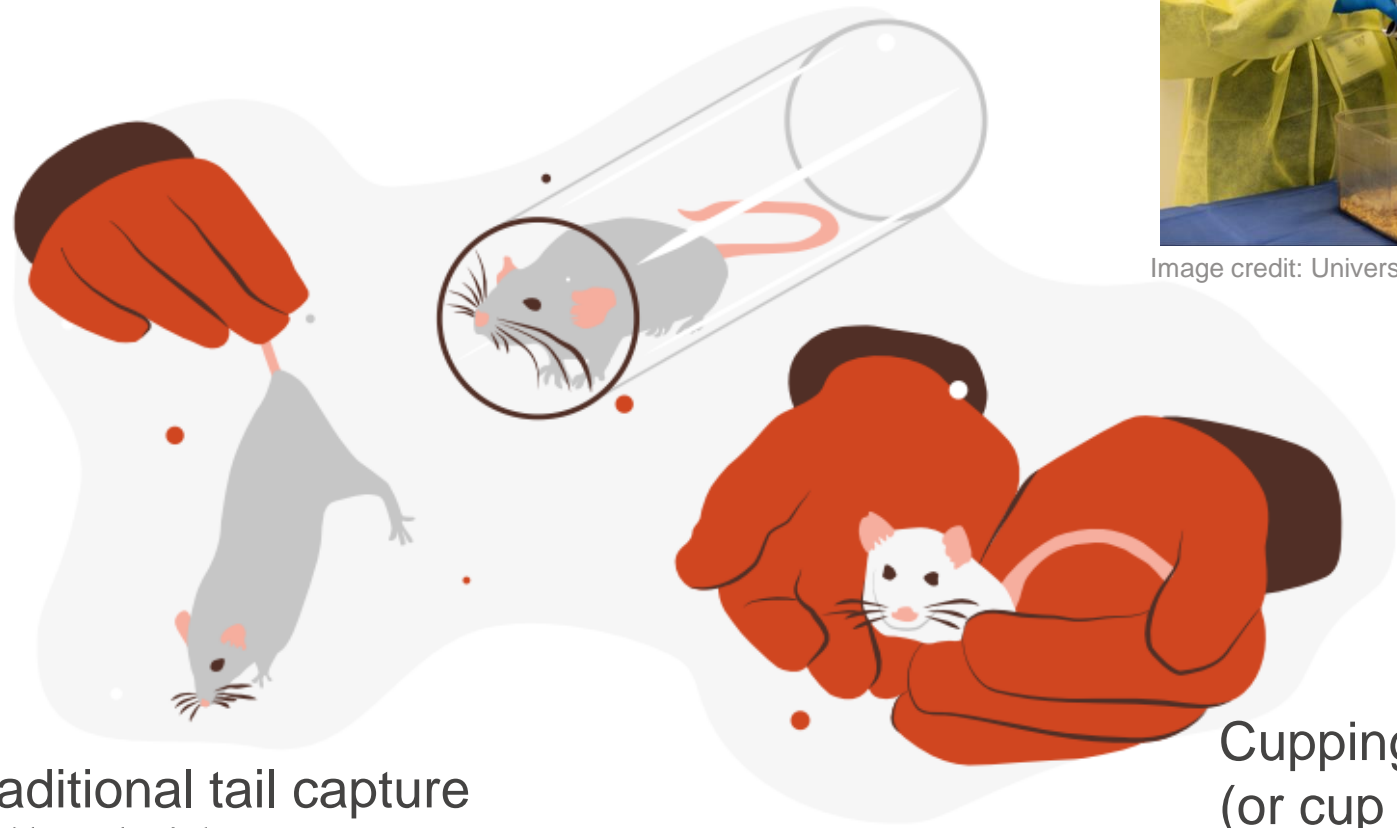
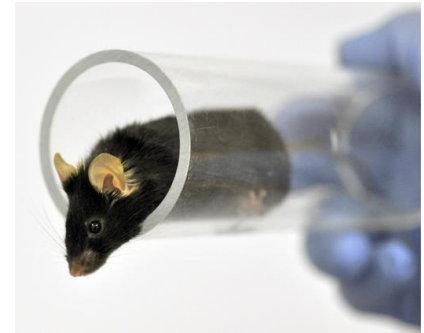


Image credit: University of Washington



Traditional tail capture
传统尾部抓取

Cupping
(or cup handling)
杯状手
(或杯状操作)



Image credit: University of Washington



Image credit: University of Washington

Background to refined mouse handling

优化小鼠操作的背景

Refined mouse handling was
优化小鼠操作

- **Initially developed to handle jumpy and nervous wild mice for research.**
最初开发用于操作用于研究的跳跃和紧张的野生小鼠
- **Then applied to inbred domestic mice to improve ease of handling and engagement with behavioural tasks.**
然后应用于近交系家鼠，以提高行为学观察操作和参与的便利性。

Taming anxiety in laboratory mice

Jane L Hurst & Rebecca S West



Jane Hurst



John Waters

Since the 2010 publication, the evidence for refined handling has grown 自2010年发表以来，优化操作的证据不断增长

- **The NC3Rs compile and summarise refined handling publications into a summary table.**
NC3Rs将优化操作出版物汇编并总结成汇总表。
- **As part of this, experimental design experts assess of study reliability and limitations.**
作为其中的一部分，实验设计专家评估研究可靠性和局限性
- **There are currently 24 published, peer reviewed articles in the mouse handling research papers table.**
小鼠操作研究论文表中目前有24篇已发表的、同行评议的文章。
- **One paper summary is in draft waiting to be added (Davies et al. 2022) but has been included in this overview.**
一份论文总结正在等待添加的草案中 (Davies et al.2022)， 但已纳入本概述中。
- **Two papers have been omitted from this overview because they do not directly compare traditional and refined methods (Ueno et al. 2020; Swan et al. 2023).**
本综述中略掉了两篇论文，因为它们没有对传统和优化的方法作直接比较 (Ueno et al.2020;Swan et al.2023) 。

Comparing refined handling methods to
traditional tail handling

- *a (very quick) overview of 23 papers*

优化操作方法与传统尾部操作的比较

- (非常快速) 概述23篇论文

Sixteen studies used **behavioural measures** to investigate the welfare impact of refined handling

16项研究对行为学考察来审查优化操作对福利的影响

Mouse welfare 小鼠福利		# of studies 研究数量
Increased增加	↑	14/16
Decreased减少	↓	0/16
No change无变化	—	2/16



Sixteen studies used behavioural measures to investigate the welfare impact of refined handling

16项研究对行为学考察来审查优化操作对福利的影响

Mouse welfare 小鼠福利		# of studies 研究数量
Increased增加	↑	14/16
Decreased减少	↓	0/16
No change无变化	—	2/16

- **Validated tests of anxiety and depressive-like behaviours.**
经验证的焦虑和抑郁样行为测试。
- **Masked (blinded) scoring of stress behaviours.**
应激行为的设盲（设盲）评分
- **Urination and defecation in response to handling.**
操作引起的排尿和排便反应。

Sixteen studies used behavioural measures to investigate the welfare impact of refined handling

16项研究对行为学考察来审查优化操作对福利的影响

Mouse welfare 小鼠福利		# of studies 研究数量
Increased增加	↑	14/16
Decreased减少	↓	0/16
No change无变化	—	2/16

- **Novel (unvalidated) test of affective state.**
情感状态的新（未经验证）测试。
- **Very short exposure to handling (e.g. handled once on day 1, tested on day 2); tube also used to induce stress.**
暴露于操作的时间很短（例如，第1天操作一次，第2天检测）；管道也用可能诱导紧张。

This is also supported by a **physiological** measure of mouse welfare
小鼠福利生理学指标也支持这一结果

Corticosterone 皮质酮		# of studies 研究数量
Plasma 血浆	↑	2/2
Faecal 粪便	—	0/2

- Stress hormone reduced in mice handled using refined methods in blood plasma but not faeces.

优化方法操作小鼠血浆而非粪便紧张应激激素减少



Increase in welfare 福利增加



Decrease in welfare 福利减少

— No change in welfare 无变化

Overall, this evidence indicates that using refined methods to pick up mice instead of traditional tail handling improves mouse welfare.

总的来说，这一证据表明，使用优化的方法来抓取小鼠，而不是传统的尾部操作，改善了小鼠福利。

Overall, this evidence indicates that using refined methods to pick up mice instead of traditional tail handling improves mouse welfare.

总的来说，这一证据表明，使用优化的方法来抓取小鼠，而不是传统的尾部操作，改善了小鼠福利。

Animal welfare and high-quality science go hand-in-hand

动物福利和高质量科学携手并进

Stress can result in abnormal behaviour and physiology 紧张可导致行为和生理异常

- **Handling stress can lead to false negatives in behavioural research, using refined handling methods addresses this.**
- 应对紧张会导致行为研究中的假阴性，使用优化操作方法解决这一问题



Stress can result in abnormal behaviour and physiology

紧张可导致行为和生理异常

Measure 指标	# studies 研究数量	
Body temperature 体温	1/3	! ———
Kidney pathology 肾病理	1/1	!
Glucose homeostasis 葡萄糖稳态	1/1	!
Adrenal weight 肾上腺重量	1/2	! ———
Tumour growth 肿瘤生长	0/1	———
Blood pressure 血压	0/1	———



Stress can result in abnormal physiology and behaviour

紧张可导致行为和生理异常

Measure 指标	# studies 研究数量
Body temperature 体温	1/3
Kidney pathology 肾病理	1/1
Glucose homeostasis 葡萄糖稳态	1/1
Adrenal weight 肾上腺重量	1/2
Tumour growth 肿瘤生长	0/1
Blood pressure 血压	0/1

This overview is simplified to allow for a concise overview.

本概述进行了简化来扼要说明。

For additional context and details on these studies please visit

有关这些研究的更多信息和详细信息，请访问

www.nc3rs.org.uk/mouse-handling-research-papers



NC
3RS



Effect of handling method reported 报告的操作方法的影响



No effect of handling method reported 报告未受操作方法的影响

Stress can result in abnormal physiology and behaviour

紧张可导致行为和生理异常

Measure 指标	# studies 研究数量
Body temperature 体温	1/3
Kidney pathology 肾病理	1/1
Glucose homeostasis 葡萄糖稳态	1/1
Adrenal weight 肾上腺重量	1/2
Tumour growth 肿瘤生长	0/1
Blood pressure 血压	0/1

- The findings are more mixed than the behavioural evidence, but they still warrant caution.

研究结果比行为证据更混杂，但它们仍然值得谨慎考虑。

- Are stress related confounds being introduced into your study?
您的研究是否引入了紧张相关的混杂因素？



Overall, if we reduce exposure to stressors
**we lower the risk of stress-related
confounds.**

总的来说，如果我们减少对紧张的暴露，
我们就会降低应激相关混杂因素的风险。

There are many things that may cause stress to mice in a research environment.
在研究环境中有许多事情可能会给小鼠造成紧张。

Some of these are unknown and some are unavoidable.
其中一些是未知的，一些是不可避免的。

The good news is that we can reduce the stress caused to mice when they are picked up.
好消息是，我们可以减轻小鼠被抓起时给它们带来的紧张。

Reducing exposure to stressors can also
improve breeding outcomes
减少暴露于紧张也可以改善育种结果

Two studies have looked at the impact of handling method on breeding outcomes 两项研究比较了操作方法对育种结果的影响

Measure of breeding success 育种成功率指标		# of studies 研究数量
Litter size 窝产仔数	↑ —	1/2
Weaning success 断奶成功率	↑	1/1



One study showed that refined handling meaningfully improved breeding outcomes

Measure of breeding success 育种成功率指标	# of studies 研究数量
Litter size 窝产仔数	1/2
Weaning success 断奶成功率	1/1

- Averaged one extra pup per pair born and weaned.
平均每对出生和断奶的幼仔多出1只。
- Averaged fewer litter losses prior to weaning.
断奶前窝仔平均丢失较少。
- Had a 20% lower risk of recurrent litter loss.
反复胎仔丢失的风险降低20%。

Refined handling is better for the mice and the science

优化操作对小鼠和科学更好

It is also better for people who handle the mice.

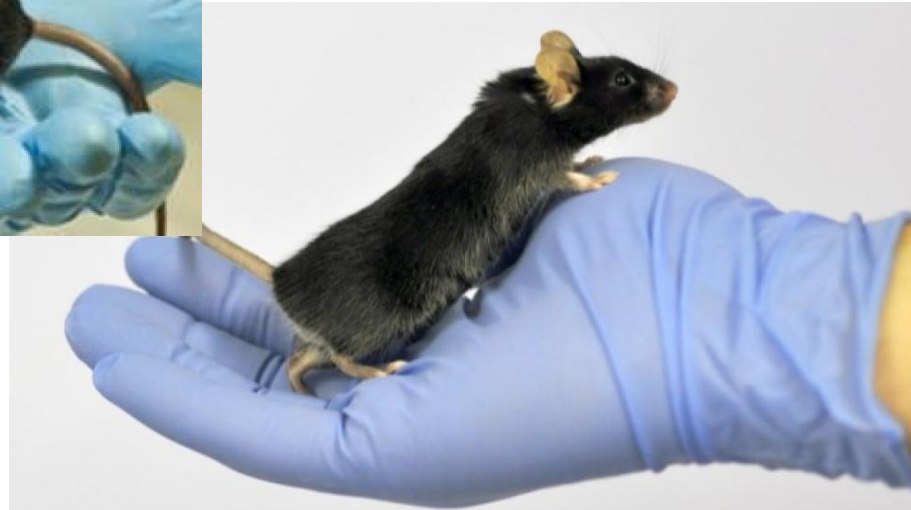
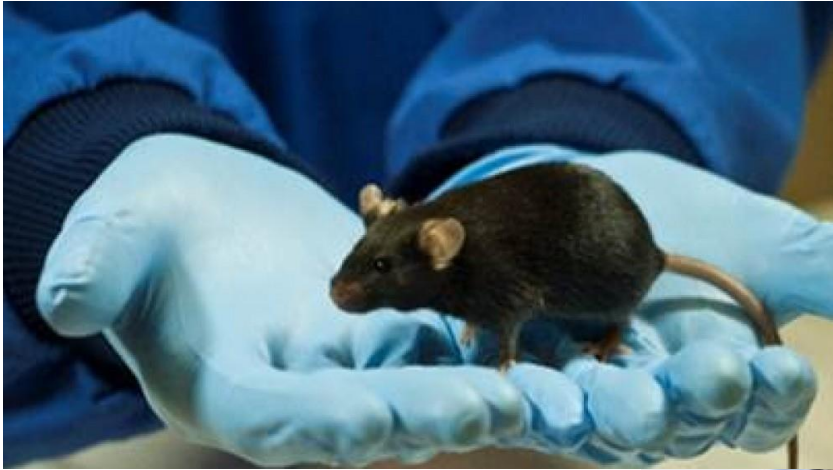
对操作小鼠的人也更好。

Nine out of 10 studies showed that using refined methods improves voluntary interaction

10项中9项研究表明，使用优化的方法可改善自愿互动

And the one study that didn't, found that refined handling increases ease of handling (e.g. calmer mice, fewer escape attempts).

而另一项研究没有发现，优化操作增加了操作的便利性（例如，平静的小鼠，更少的逃避尝试）。



Often the most impactful evidence is anecdotal...

最有影响力的证据往往是趣闻...

“We have seen a large reduction in aggression shown towards handlers...I have had researchers comment in amazement at how nice our animals are.”

“我们看到了对操作者的攻击性大幅减少.....我的研究人员反映我们的动物有多好相处。”

“We now find tunnel handling as quick as tail capture, although initially there is a time investment. We’ve seen a huge improvement in interaction between mice and handler and definitely wouldn’t want to go back to tail capture.”“我们现在发现管道操作与尾部抓取一样快，尽管最初有些时间投资。我们已经看到小鼠和操作者之间的互动有了很大的改善，肯定不再想回到尾巴抓取。”

“Happier mice and happier techs...I particularly like the interaction when the mice voluntarily climb on to an offered hand...”“更快乐的小鼠和更快乐的技术人员.....我特别喜欢小鼠自愿爬上提供的手掌时的互动.....”

“Happier mice are more manageable mice, making procedures easier and safer.”
“更快乐的小鼠是更易于管理的小鼠，使操作过程更容易、更安全。”



Refined handling eLearning course 优化操作电子学习课程



Learn about the background and practical applications of using refined methods to pick up mice.

了解使用优化方法抓取小鼠的背景和实际应用。

Refining how we pick up mice

优化我们如何抓取小鼠

This free online course is aimed at anyone who works with mice in research. The eLearning course should take no longer than 45 minutes and covers:

这个免费的在线课程是面向任何用小鼠作研究的人。eLearning课程不应超过45 min, 涵盖：

- The background and evidence behind refined mouse handling.
优化小鼠操作背后的背景和证据
- How to pick up mice using a tunnel and cupped hands.
如何使用管道和杯状的手来抓小鼠
- How using refined methods to pick up mice is compatible with restraint, procedures, efficient day-to-day operation and maintaining biosecurity.
如何使用优化的方法来抓取小鼠，与保定、操作程序、高效的日常操作和维持生物安全性相容。

www.mousehandling.org



Search the NC3Rs website for 3RS resources

www.nc3rs.org.uk/3rs-resources



Refine the use of head fixation and fluid control in rodents 优化啮齿类动物头部固定和液体控制的使用



www.nc3rs.org.uk/3rs-resources/refining-use-head-fixation-and-fluid-control-rodents

Set up a rat playpen 设置大鼠围栏



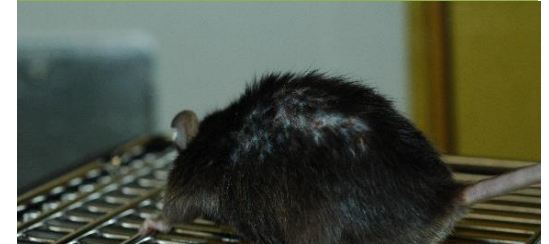
www.nc3rs.org.uk/rat-playpens

Refine the way you genotype zebrafish 优化斑马鱼基因型研究的方式



www.nc3rs.org/zebrafish-swabbing

Manage mouse aggression 管理小鼠攻击行为



www.nc3rs.org.uk/mouse-aggression

Use best practice in colony management 在群落管理中使用最佳实践



www.nc3rs.org.uk/3rs-resources/breeding-and-colony-management

Recognise and assess pain in mice, rats and rabbits 识别并评估小鼠、大鼠和家兔的疼痛

兔子痛苦表情评分

研究表明面部表情的改变可以作为评估兔子疼痛的一种方法。

以下所显示的特征面部行为单位可用于制定兔子痛苦表情分级。行为单位仅用于描述目的。每一个动物应观察足够长的时间，以记录行为单位的频率和处理并准确记录增加。可以结合其它有效、被发表与动物福利无冲突的新的面部表情变化的输入。面部表情应作为临床评估的一部分。

	行为单位		
	轻度呈现 "0"	中度呈现 "1"	明显呈现 "2"
眼眶发紧			
• 眼睑闭合 (眼眶面积变窄)			
• 眼角可能看到一皱纹			

www.nc3rs.org.uk/3rs-resources/grimace-scales

Watch webinars on a range of topics 观看各种主题的网络教程



www.nc3rs.org.uk/handling-and-training-mice-and-rats-low-stress-procedures

Design robust experiments 设计稳健的实验



www.eda.nc3rs.org.uk

NC
3R^s

National Centre
for the Replacement
Refinement & Reduction
of Animals in Research

Thank you for listening 感谢聆听

www.nc3rs.org.uk/mouse-handling-research-papers

www.mousehandling.org