

Correspondence

Not so nuanced: Reply to the comments of Gaskill and Garner [1] on 'Not so hot: Optimal housing temperatures for mice to mimic the environment of humans'^{*}


Dear Editors,

We welcome the comments of Gaskill and Garner [1] on our previous paper, which concerned the optimal temperatures at which mice should be housed to best mimic the ambient environment routinely experienced by humans [2]. We are glad that they agree, from their behavioural perspective, with our detailed physiological analysis, that keeping mice at 30 °C to achieve this aim, as has recently been advocated, is 'unwise'.

We do, however, take issue with several of their arguments, in particular the suggestion that we stated 'mice are most comfortable at 20–22 °C', that our arguments are 'empirically incorrect, obfuscating and highly detrimental to the welfare of mice', and that we made an 'overly simplistic presentation of the underlying biology'.

For some unknown reason Gaskill and Garner [1] have assumed that the aim in our paper was to deduce the temperature that minimises 'stress'. This was absolutely not our aim. Rather, as is clearly indicated in the title and the final sentence of paragraph 2 of our paper, we aimed to deduce the temperature that best mimics the temperatures experienced by humans, so that physiological studies might be best able to use the mouse as a model for human physiology. Clearly, with this aim in mind, if humans routinely experience temperatures slightly below their thermoneutral zones, then it would be best to keep mice at a similar temperature. If you want to call this temperature 'mild cold stress', and then argue stress has not been minimised, that is fine, but that was not our terminology, or our aim. Consequently, we did not make a fundamental error of assuming that because animals are 'coping' they are not under some form of stress. At no point in our paper do we state that mice are 'most comfortable' at 20–22 °C, and the contention of our article was not, and was never stated to be, that 'there is no distressing impact of cold temperatures on mice': both erroneously claimed by Gaskill and Garner [1]. Falsifying these statements with evidence is easy, and Gaskill and Garner [1] do an excellent job of so doing, but since we never made these statements, the relevance of this falsification to our paper is unclear.

In fact, we state in our paper that we consider, on physiological grounds, that the temperatures that best mimic the situation in humans are around 23–25 °C for single housed mice (which is often necessary in practice for energy balance studies and to quantify individual food intake [3]), and might be as low as 20–22 °C for group housed mice, or with the provision of nesting material. Gaskill and Garner [1] point out, that if given a choice of temperatures, this might not be what the mice would choose. But again, really that is not the issue, and by trying to make it so Gaskill and Garner [1] seem to have fundamentally misunderstood the aims of our paper—and the aims of

animal experimentation in general. For sure we should not needlessly stress animals. But equally we should not shy away from attempting to mimic the situation in humans, on the grounds that the mice would not choose this temperature themselves. As noted in our paper, humans routinely occupy temperatures about 3 °C below their lower critical temperatures. There are good thermal reasons for this, as clarified in our paper, as it balances heat production that is routinely greater than the basal rate of metabolism, which is used to define the lower critical temperature. We should keep mice at the same temperatures, relative to their lower critical temperatures, if we want to do the best job of mimicking human physiology. The fact mice would not choose this temperature themselves is not a solid argument. Doubtless there are many aspects of animal experimentation that mice would not choose if they were given the option.

We note at the end of their paper Gaskill and Garner [1] do not actually make any recommendations about the temperatures at which mice should be housed—stating only that they should have control over their microclimates, and that 30 °C is too high. This is not really very useful advice for someone in an animal facility who needs to set a thermostat to regulate the room temperature. In the absence of such a recommendation, our advice to keep single housed mice at 23–25 °C or at 20–22 °C when grouped, or with bedding, remains unchallenged. As these conditions are more benign than the situation in which the vast majority of mice are currently housed, we do not see how this recommendation could be misconstrued as 'highly detrimental to the welfare of mice'.

Finally, as to the claims that our paper is 'empirically incorrect and obfuscating' and that our presentation of the underlying biology was 'overly simplistic' the authors do not return to these issues, so we cannot make further comments. We will leave readers to judge for themselves if the arguments by Gaskill and Garner [1] are 'considerably more nuanced' than our own.

REFERENCES

- [1] Gaskill, B.N., Garner, J.P., 2014. Letter-to-the-editor on "Not so hot: optimal housing temperatures for mice to mimic the thermal environment of humans". *Molecular Metabolism*, 3:335–336.
- [2] Speakman, J.R., Keijer, J., 2013. Not so hot: optimal housing temperatures for mice to mimic the thermal environment of humans. *Molecular Metabolism* 2: 5–9.
- [3] Tschöp, M.H., Speakman, J.R., Arch, J.R., Auwerx, J., Brüning, J.C., Chan, L., et al., 2012. A guide to analysis of mouse energy metabolism. *Nature Methods* 9:57–63.

Sincerely

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