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January 7, 2003

Dr. Thomas Waßmer
Institut für Physiologische Chemie
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Dear Dr. Waßmer:

Enclosed are the reviews of your manuscript (BRG-110e), "Influence of housing conditions on the hibernation patterns of European hamsters (*Cricetus cricetus*)". I am sorry that I cannot recommend the manuscript for publication in Journal of Mammalogy.

I hope that the reviewers' comments and my edited copy of the manuscript are helpful to you as you try to find a suitable outlet for your research findings. Please feel free to contact me if you have questions concerning the reviews.

Thank you for considering Journal of Mammalogy.

Ron Gettinger
Associate Editor

Cc: B. Blake, Journal Editor
Encl.: edited mss., Reviewer Comments

JOURNAL OF MAMMALOGY

REVIEWER'S COMMENTS

Note to reviewers: Comments on this sheet will be sent to the author(s). If you wish your identity to be known to the author(s), then sign both copies of this form. Please return both copies of this form, the confidential rating form, and the copy of the manuscript to the Associate Editor **within TWO WEEKS**.

Manuscript No. BRG-110e

Reviewer No. 1

Author(s): Wassmer

Title: Influence of housing conditions on the hibernation patterns of European hamsters (*Cricetus cricetus*)

Reviewer's Comments:

The author implies that the results of laboratory studies of hibernation often are applied erroneously to animals in the wild, and thus he conducted this study to "assess the artifacts provoked by laboratory housing" (last paragraph of Introduction). To do this, the hibernation patterns of European hamsters kept in the laboratory were compared to those kept under "semi-natural conditions" in outdoor enclosures.

It has been long known, from laboratory studies, that a variety of factors affect hibernation performance. Such variables as ambient temperature, energy supply (food storage in this species), and disturbances are known to alter the frequency and duration of torpor bouts throughout the winter. The author's statement at the end of the Abstract (pg 2 line 3) that his results "indicate a significant influence of housing conditions on the hibernation patterns of experimental animals" is not surprising and could be expected. The magnitude of those differences in performance should be related to the magnitude of the differences in environmental conditions that are important to the animals. I author recognizes this (see last paragraph of introduction; line 1, page 3).

Although it is not explicitly stated, I believe the author was trying to set up environmental conditions in the laboratory as close as possible to those the animals would experience in nature. If there were no differences in temperature, energy supply, photoperiod, etc. and if there still were differences in hibernation patterns between the two groups, then the author would have to conclude that there is some subtle factor (level of disturbance?, biases in sex ratio or ages of the animals?) in the laboratory that impacts on hibernation performance. If so, laboratory *studies per se* would have questionable applicability to the real world until the causes of such differences were elucidated.

1. If the above is, in fact, the goal of the study, then this goal needs to be stated as clearly as possible. If the lab studies were not designed to mimic the real world, then the differences found between the groups are to be expected and are trivial.

2. If the lab studies were to mimic the real world as closely as possible then it is important to describe exactly the hibernation conditions for hamsters in the wild. This is important, because I am not convinced that the hamsters kept in outdoor enclosures experienced the same conditions as free-ranging animals. For example:

At what depth do hamsters make their dens in nature? What is the temperature profile over the winter at that depth? How does this compare with that at the 0.6 meter depth available in the outdoor enclosures?

What sort of nests do hamsters have in nature, and how does this insulation compare to what was available to the captives?

What is the range in food reserves available to free-ranging hamsters? Do they ever forage for more food during the winter, or do they subsist entirely on underground larders?

3. The author needs to describe food availability in much more detail before a reader can make a meaningful interpretation of his results. It is possible - actually likely - that the differences in the number of short and long hibernation bouts between the two experimental groups of hamsters was a response to differing feeding regimes. It has been long known that the amount of time spent in torpor can be influenced by both the amount of food and the way it is given. Kangaroo mice, *Microdipodops pallidus*, will undergo short daily bouts of torpor if they are fed a small amount of food each day. However, if a week's worth of food is given all at once and not spread out over 7 days, the mice will undergo long torpor bouts and spend much more time in torpor (Brown and Bartholomew, 1969 *Ecology* 50:705-09). Likewise, chipmunks *Tamias striatus* are noted for their frequent short (<24 hr) bouts of torpor in captivity when food is constantly available to them from a feeding hopper or tray. However, these chipmunks have long multi-day bouts of torpor when they do not have access to "new" food from a hopper, but instead must rely on food cached prior to the start of the hibernation season (French, 2000. *Journal of Mammalogy* 81: 979-985).

The author needs to report on the amount of cached food and on the extent of "foraging" for new food supplies throughout the winter in his two groups of hamsters. The pattern of frequent short bouts of torpor in the laboratory suggests that those hamsters collected new pellets throughout the winter (or at least saw that new food was available). The high frequency of longer torpor bouts in animals in the outdoor enclosures suggests that they did not dig out of their burrows to find food on a regular basis. The variability among individuals in the same regime might be due, in part, to differences in the amount of food the animals stored. The author states that grains were given to the animals in the outdoor enclosures on a feeding rack. He does not state how the pellets were given to the laboratory animals. He then states the feeding racks needed to be refilled only occasionally during the winter - line 9, page 4. I presume this refers to the outdoor enclosures, but it is not clear.

In any case, since food availability impacts hibernation performance in food-storing species, the size of food caches and the amount and frequency of food acquisition over the winter needs to be documented in the paper. If differences in food rations are documented, then the author should eliminate the paragraph on page 10 which suggests that the increased frequency of short torpor bouts in the lab must be due to disturbances (noise, air pressure, malfunctioning temperature control, etc.).

A few minor points

page 3 first sentence under "Animals and housing" subheading, eliminate the word "respectively".

page 6, line 7. The author states that the mean air temperature in the laboratory was 10.03 ± 1.42 °C, whereas in Table 1 the temperature is listed at $8 + 1$ °C.

page 7, line 2. the word "stepwise" implies that temperature falls, stabilizes, falls again, stabilizes again, etc. during a single torpor bout. Actually, what happens is that minimum body temperature is lower and torpor duration is longer in sequential bouts.

page 7, line 11. shouldn't "hamster" be "hamsters" ?

page 7, start of last paragraph. I do not know what is meant by "similar findings". Similar to the author's findings in hamsters? or those in *Tamias striatus*? or those in *Eutamias minimus*?

Larry Wang's study of hibernation in free-ranging Richardson's ground squirrels should be cited (e.g. on page 8, line 5) H71 *Can. j. Zool.* 57: 155-155

page 8, line 12 artifacts is misspelled

page 9 first paragraph of general discussion. The author states that hamsters are known to drop hibernation (i.e. not to hibernate?) under unfavourable (British spelling) conditions, e.g. in years of mass reproduction (gradations). I have no idea what this last clause means. What is a mass reproduction? What are gradations? and why are these unfavorable to hamsters?

For that matter, I am not sure why short torpors should be equated with unfavorable conditions, and long torpors be equated with optimal conditions (last sentences on page 9). It seems to me that if energetic conditions were "unfavorable", the animals would benefit by spending **more** time, not less, at low body temperatures.

page 9, line 23 "Presumptuously" is misspelled and misused. I think the author wishes to use "presumably"

Table 1 last column is listed as FG2. This is not defined in the Table legend, and the conditions listed in this column are all identical to those in the other column of semi-natural animals.

BRG-110e

Wassmer

Although the general theme of comparing hibernation patterns in a species kept under differing conditions could be interesting, the lack of specificity in questions, potentially confounding effects from differences in diets and season, the lack of field controls, and the general paucity of data are serious weaknesses of this ms.

There is an extensive literature on the effect on hibernation patterns in mammals of differences in diet content of saturated and unsaturated fatty acids. Since the groups compared here were fed different foods of unstated fat content and fat type, any differences in torpor patterns cannot be solely attributed to housing conditions.

Many rodent hibernators show spontaneous changes in their hibernation patterns from early to middle to late hibernation; yet in this ms. there was no parsing of the data according to season. When only partial records were recorded, was there a seasonal bias in drop outs?

The technology exists for recording long term records of body temperature patterns in free-living hamsters under natural conditions. In opinion, this comparison is necessary.

No detail on source of transmitters, calibration procedures and checks, details on receivers, frequency and consistency of recordings.

Were the location and depth of nests presumed? What among animal differences occurred in soil temperature (influenced by snowcover, soil type, burrow architecture, etc.)?

No analysis of persistence of diurnal or circadian rhythms in body temperature.

The writing is awkward and redundant. It needs improvement and more brevity. The tone of the ms., the introduction, the sophistication of the questions and the analysis, is not pitched at level commiserate with the Journal. As examples, the lead paragraph in the introduction suggests that readers of J Mamm are not aware that hibernation in small mammals is interrupted by periodic arousal; although there is mention of differences in expected hibernation patterns due to sex and age, there are no separate analyses provided and sex ratios between groups were not designed to reveal potential differences.