



# MOUSE FRAILTY SCORING

Created by: Christian Schultz and Erica DeJong

Date: December 2018

Bowdish Lab, McMaster University  
Hamilton, ON, Canada  
[www.bowdish.ca](http://www.bowdish.ca)

## Adapted from:

Whitehead, Jocelyne C., Barbara A. Hildebrand, Michael Sun, Michael R. Rockwood, Robert A. Rose, Kenneth Rockwood, and Susan E. Howlett. 2014. "A Clinical Frailty Index in Aging Mice: Comparisons With Frailty Index Data in Humans." *The Journals of Gerontology: Series A* 69 (6). Oxford University Press: 621–32. <https://doi.org/10.1093/gerona/glt136>.

## EQUIPMENT & MATERIALS:

- 4 x 500 ml beakers
- Scale with clean room plastic weighing bottle?
- Metal Grate (pictured below in notes)
- 70% Ethanol
- Absorbent Sheet diapers
- Timer
- 1.5ml tubes and rack
- Ice box
- Fine Tip Sharpie for tubes
- Scoring Sheet attached at the end of the protocol
- Extra clean cage bottom

## PROTOCOL:

- 1) Prep your work station
  - a. Disinfect all the beakers, the mouse weighing entity, and the grate; make sure the beakers are dry before starting – be sure to clean the beakers between cages
  - b. Lay out the absorbent diaper and place the beakers at the back of the hood and place the clean cage bottom to the side of the hood with the wire grid placed on top of the cage bottom.
  - c. Label each beaker with each ear notch – L, R, N, B, LL (left, right, none, both, left left)
    - i. or however your mice are individually tracked.

- 2) Get a cage to start working with mice
  - a. Note – always start with youngest males to oldest males then work on your female mice. The males will be more likely to fight if they smell the female mice.
  - b. Weigh each mouse (be sure to tare the scale beforehand), record the weight on the scoring sheet, and place in appropriate beaker according to ear notch
    - i. Placing in the clean beaker allows time for the mouse to provide you with some fecal samples – ideally you want 3 pellets
    - ii. Collect the fecal pellets into 1.5ml tube by scooping into the tube with your gloved fingers or with tweezers. Label tube with AC number, notch, FP (for fecal pellet) and date of collection. Store samples on ice. Then store at -20 in the lab.
  - c. If mice are not ear notched before this assessment, they should be notched afterwards. It should be done after as to not have stress confounding any behaviours of the mouse.
  - d. Begin the frailty assessment by placing the mouse on the grate and look for changes in all the factors. Each factor is scored as 0 – not present, 0.5 - present or 1 – predominant presence.
    - i. At the end of this protocol there is a glossary of all the terms describing what and how to look for each condition
    - ii. Following the glossary is the scoring sheet
  - e. Assess abdomen, genitals and anus by holding the mouse upside down by the tail
    - i. Lift the mouse completely by the tail and observe for a few seconds. Let them sit back on the grate or in their beaker for at least a minute before starting hang test.

### **Hang Test**

- 3) Place cage bottom in front of you – provides a contained space for the mouse to fall and softens their landing
- 4) Place the mouse on the grate and flip upside down for 60 seconds – hold your arm up so the mouse is hanging from  $\frac{3}{4}$  of the height of the inside of the hood
  - a. If the mouse crawls onto the top side, flip grid over to accommodate
  - b. Record the amount of time the mouse is able to hold on for
  - c. If they do not make it the 60 seconds, they get another 2 attempts – give them at least a minute break between trials. Record all three times. The max time is always used in any analysis.

d. Once they have made it the 60 seconds they are done and 60 is recorded

### Notes:

- Christian Schultz did most of his scorings in the mornings around 8am
- Most mice do not score highly on frailty scoring
- Male fur coats are generally not as nice as black as female mice for the C57BL/6
- To normalize frailty scores. Tally up the score you get per mouse and divide by the number of parameters you are looking at. If your mice never get certain things they can be removed from the scoring list.

### Glossary of Terms

Condition	Definition	0.5	1	Notes
Alopecia	Hair Loss – patches of missing fur not caused by fighting or barbering	1 or 2 patches	>2	
Dermatitis	Inflammation of the skin – red and inflamed Skin lesion	0.5 cm width red area no skin breaking Very small lesion and contribute in coat condition too	>1 cm <sup>2</sup> width or bigger red area, no skin Lesion that's larger, count with coat condition too	Double count for lesion in to attempt to account for the impact lesions have on the mouse
Loss of Whiskers		Some are missing	Most are missing	
Coat condition	Fur condition itself – thickness	Looking at the mouse from the back up towards its head – and you see the skin quite well but not from other angles	See the skin through the fur easily in most angles	Note that males generally have poorer condition
Tumors	Solid mass below skin	Palpable but not easily visible	Easily visible and many or large	Often noted after death and mouse will likely have many other signs
Distended Abdomen	Accumulation of fluid in abdominal cavity	Start of tumor growth – not typically visible so you won't be able to notice early enough for a 0.5 score	Looks pregnant No fat pads are on their back, can easily feel bones. Visibly enlarged abdomen.	To differentiate between fluid and fat, feel the mouse back. If the bones are easily palpable the belly is fluid filled, if its not easily felt its fat
Kyphosis	An abnormal convex curvature of the	Not super prominent, visible if	Very obvious, larger, visible in	Feel along the spine of the

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	spine with a resultant bulge at the upper back	mouse is still but not if they are moving around.	most positions of the mouse	mouse with your finger to identify its presence. You will feel the curve even when mouse spine is "straight"
Tail Stiffening		Minimal curving	No curve Doesn't try to use tail to help it balance	
Gait Disorders		1 leg paralyzed or Active mouse but the mouse struggles to move as a normal mouse Rocking side to side as the mouse walks.	Inactive, every step is very difficult and labored	
Tremor			Shaking mouse or Seizures upon handling	Not common – will not have 0.5 Male TNF KO tend to be more likely to have seizures
Forelimb grip strength		Between 2 and 9 seconds	Normal weight 25 – 40g mouse with cage hang of 0-1 or 2 seconds	Overweight mouse, over 40g – test with grid by letting them hold it and pull back <ul style="list-style-type: none"> <li>- No holding or 1 or 2 seconds = 1</li> <li>- Released in under 10 seconds = 0.5</li> <li>- Any holding on more than 10 seconds = 0</li> </ul> Pull the mouse back slowly by the tail
Body Condition score	Overview of the body	Skinny mouse – under ~28g If you can feel the bones on the back	Lesion presence – regardless of the size, open bloody skin. Or Tumor Doesn't look like normal mouse – shaking and/or	

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			general weakness	
Vestibular Disturbance	Look in the ears for blood, scab			Never seen in our colony
Hearing loss				Cannot do this test
Cataracts	Opacity of the lens Middle of the eye dried out and no recovery – more localized point in the eye Eye integrity maintained	1 eye	Both eyes or 1 eye has ulcerated  Ulcerated – white, integrity has been lost → this results in emergency sac due to the pain of the ulcer	You should be able to see the normal colour of the eye at the edges of the eye Circle shape until it becomes an ulcer then it can be a variety of shapes
Corneal opacity	Covers the iris and pupil – opaque Whole eye is cloudy and white Eye integrity maintained	1 eye	Both eyes	
Eye discharge	Fluid from side of eye	One eye	Both	
Microphthalmia	Abnormal smallness of the eye	One eye	both	
Vision loss	Cannot see	One eye missing or blind	Both missing or blind	Even if birth defect
Nasal Discharge		Dried up	Actively discharging	
Rectal Prolapse	Falling down of the rectum from its normal position	Partial prolapse	Blood present, full prolapse	
Vaginal/uterine/penile prolapse	Falling down from their normal positions	Partial prolapse	Full prolapse	
Diarrhoea		Partial – runny stool but still has some solidness to it	No solid stool	
Breathing rate/depth		Irregular breathing patterns. Labored.	Endpoint breathing patterns	
Mouse grimace scale		Partway up scale. Refer to posters.	Endpoint pain	
Piloerection	Fur standing on end	Part of body	Whole body	

