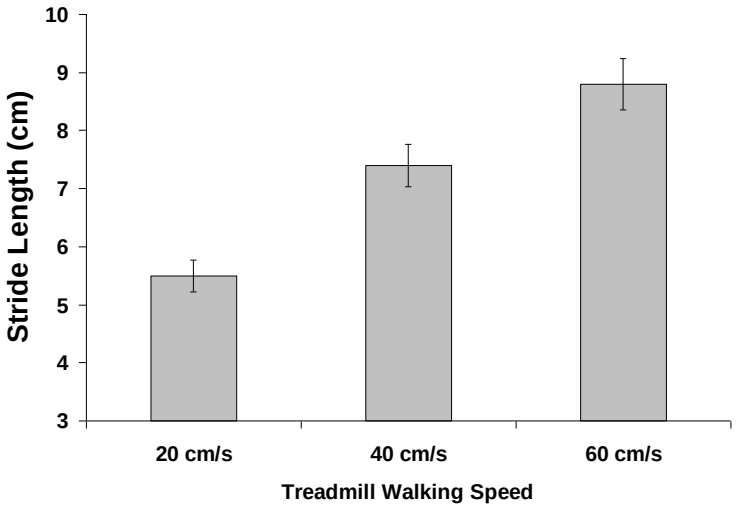
Title	Effects of Speed on Gait
Number of animals	3
Species/strain	CD1 mice recommended
Instrumentation needed	DigiGait Imaging System
Reagents required	none
Time to perform	45 minutes for 9 data points

This protocol answers the question of how mice or rats accomplish an increase in their walking speed. The investigator will gain an appreciation of how even small changes in speed can have a big impact on gait indices.

1. Place subject into walking compartment and turn treadmill on speed 1. Suggested speeds are 20, 40, and 60 cm/s.
2. Turn treadmill on and capture images of subject moving fluidly and maintaining treadmill speed. Aim to capture ~4 seconds of video.
3. Note: at the faster speeds, when the animal's stride frequency, or cadence is increased, a ~2 second video is sufficient.
4. After movie from speed 1 has been archived, increase treadmill speed to speed 2 and repeat.
5. After movie from speed 2 has been archived, increase treadmill speed to speed 3 and repeat. This approach minimizes handling of the animal and increases your throughput.
6. Repeat above steps for the other two animals.
7. Actual data collection should take <15 minutes for 3 animals at 3 speeds.
8. Analyze movies 9 movies via DigiGait. Computation time should take <30 minutes.
9. Using the Re-organize functionality, collect gait metrics from the 9 movies into one spreadsheet, and group each speed together.

Results:

Compare your findings with the data shown here in Figure 1.



Discussion: Study your spreadsheet and plot, for example, stride length as a function of speed. Do you notice that stride length [Column P] increasing with increasing speed? How about stride frequency? What can you say about the slope of the relationship between swing time and speed, in contrast to the slope of the relationship between stance time and speed? How do the observations reconcile with your own experiences, with the relative time of foot contact and swing time, as you change your gait from a casual walk from the coffee cart, to a fast run to your meeting?

The speed adjustments suggested here are fairly profound. However, even smaller increments of speed changes can significantly affect the gait metrics. This knowledge should help to clarify why the voluntary overground paradigm, in which the animals can go at any and many speeds, generates results with very high standard errors. Speed differences between subjects are the most important confounder in the interpretation of gait differences. It should come as no surprise, then, that a moribund mouse with Huntington's disease may have historically been characterized by a shorter stride length. Via the treadmill, you can minimize standard errors and increase repeatability by the appropriate speed selection for your model.