Breathing Rate
MEASURE CHANGES IN BREATHING.

Measuring changes in breathing rate can lead to the early detection of disease³ and is key in evaluating the safety profile of novel therapeutics²,³. A range of conditions including exercise, stress, lung disorders, cardiovascular disease, metabolic acidosis, drug overdose, and central nervous system abnormalities can all manifest in alterations in breathing rate¹,³-⁵.

VIUM BREATHING RATE
The Vium Breathing Rate™ (breaths per minute) is derived from continuous video streams of animals in the home cage. Computer vision algorithms search for regions of time when animals are stationary, and identify periodic motion that falls within a frequency band containing known rodent breathing rates⁶. The peak RMS power is compared to a threshold to determine whether the periodic motion is significant.

METRIC VALIDATION
The Vium Breathing Rate™ was compared to breathing rate measured by “gold standard” whole-body plethysmography of awake mice with known differences in baseline breathing rate³.

Preclinical researchers use this metric to:
• Compare baseline and post-therapeutic intervention breathing rates
• Evaluate drug efficacy in models that use breathing rate as a readout
• Obtain an early indication of off-target effects and/or potential safety signals
• Track breathing rate over time to assess disease progression and acute conditions

Methods. Six-week old male C57BL/6J and C3H/HeJ mice were acclimated to the Vium Digital Vivarium™ for a total of one week prior to commencing the study. Animals were singly housed three days prior to study start. Unrestrained animals were placed in a whole-body plethysmograph (EMKA technologies), and breathing rate was simultaneously collected via plethysmograph and the Vium Breathing Rate algorithm.

Results. Our breathing metric was compared to breathing rate measured by the plethysmograph (Fig. 1, R² = 0.981; RMS error = 3.7%). In this validation, we demonstrated that the Vium Breathing Rate has a 95% confidence interval of -2.9% to +8% of the breathing rate observed by plethysmograph. Consistent with the literature⁶ we observed that C3H/HeJ mice had a significantly lower breathing rate (136.344 +/- 3.21) than C57BL/6J animals (180.662 +/- 3.74) [ANOVA: F(1,27) = 65.99; p < 0.0001].
Discussion. We have successfully demonstrated that our digital breathing metric accurately measures breathing rate. The Vium platform provides unprecedented access to breathing rate data throughout the entire duration of a study, and without the need for human intervention. Detection of changes in breathing rate can be used as a direct measure of therapeutic efficacy at various time points pre- and post-treatment, and as an indicator of potential safety issues.

REFERENCES