TSE
systems

MotoRater

Innovative Kinematic Movement & Gait Analysis for Mice & Rats

MotoRater
303030 series

TSE
systems
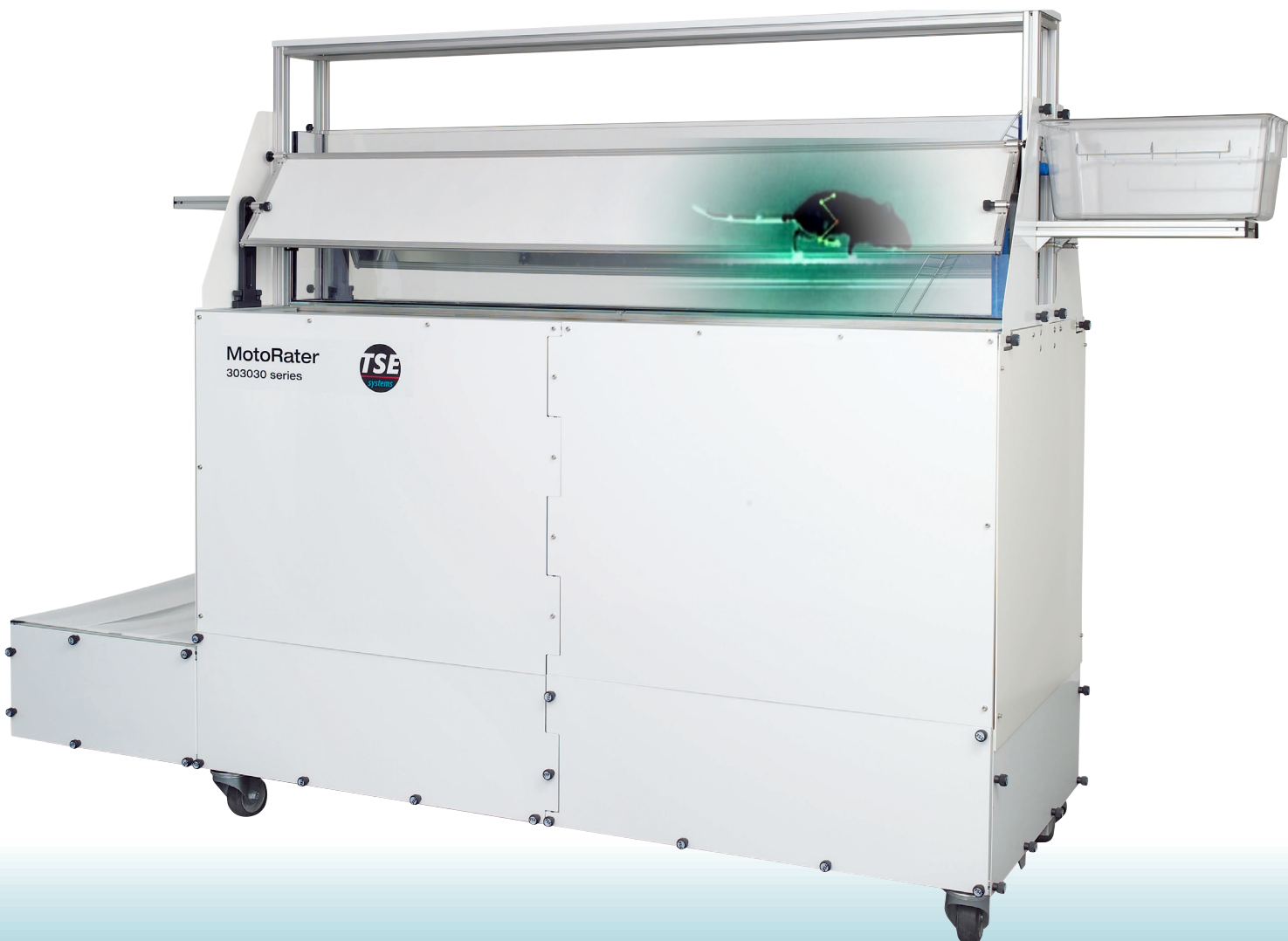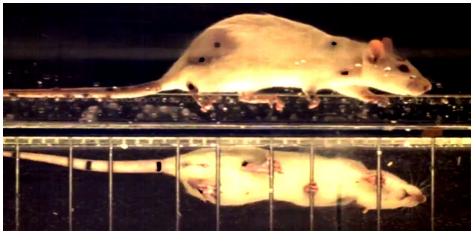
Skilled Ladder Walking
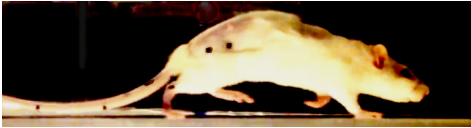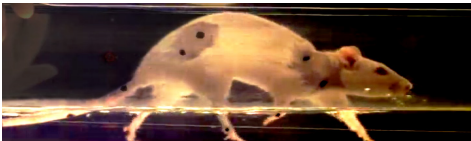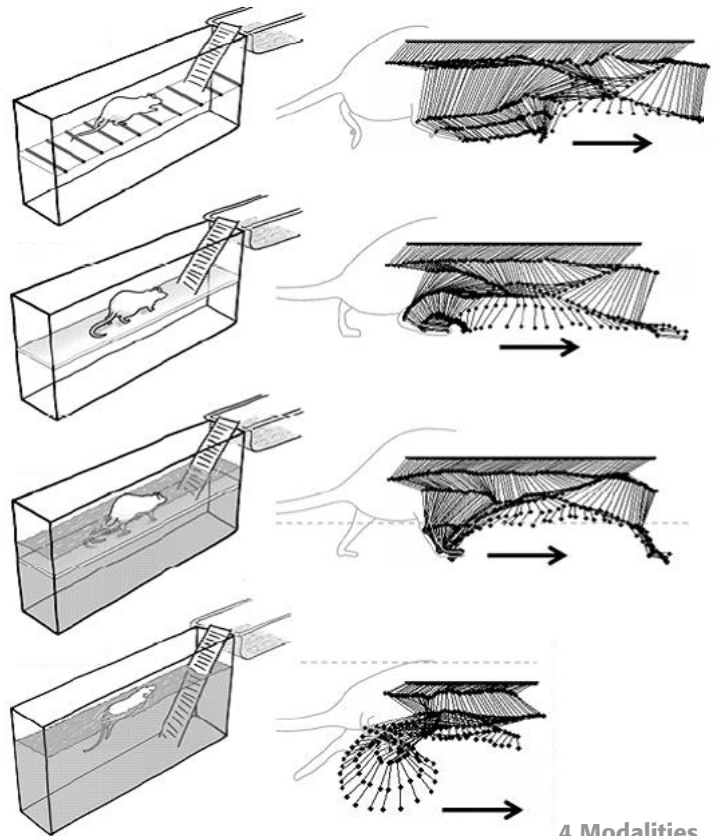
Overground Walking

Wading

Swimming

4 Modalities

MotoRater

TSE Systems MotoRater – The innovative automated tool for standardized quantitative and objective evaluation of fine motor function and kinematic analysis in small laboratory animals. Movement analysis is not restricted to foot prints - mere motion endpoints! The MotoRater observes the animal from 3 sides simultaneously and provides sensitive, specific and detailed readouts for movements of all relevant body parts, i.e. limbs, joints, tail, etc. - this makes MotoRater a unique translational tool given that motor (dys)function in humans is assessed the same way. More than that, the modular set up allows evaluating all movements during 4 movement modalities providing a highly differentiated analysis of the animal's motor performance. The option to test animals in water provides the unique opportunity to evaluate motion patterns of severely impaired animals, which would not be able to support their body weight on solid ground.

Benefits

- Automated kinematic movement and gait analysis
- A single system tests 4 different movement modalities
- Simultaneous observation and analysis of 3 animal sides
- Virtually unlimited number of parameters
- Suitable for many (incl. severely impaired) animal models

Acquisition

- The animal is placed into and freely moves through the long activity runway (either dry or containing water) towards a home cage or goal box (serving as motivator); the long runway favours natural gait and allows recording of several gait cycles
- All animal movements are followed and recorded by a high speed video camera setup

TSE Motion Analysis

TSE Motion High-Speed Video Analysis Software for kinematic image-based motion and gait analysis offers maximal variability, ease-of-use and high data quality.

Body Point Tracking

- TSE Motion Analysis Software tracks any type and number of body points during 4 different movement modalities:
  - Overground locomotion (different gaits at various speeds)
  - Skilled ladder walking
  - Wading in shallow water
  - Swimming
- Kinematically meaningful connections btw. two or more body points can be defined for calculation of joint angles, distances, etc

Body Point Tracking (continued...)

- Image properties can be adjusted permitting optimal tracking performance for various acquisition conditions and animal color
- Body points can be tracked in all frames or only a selection of relevant frames
- Automated or manual point-and-click tracking (relevant if only one or a few selected frames are of interest)

Data Analysis

- Highly precise & standardized analysis protocols can be created, saved and applied to tracking data maximizing data reliability across animals and minimizing group size
- Objective and unbiased analysis
- Uniquely comprehensive calculation options (incl. distances, angles, mean, max and min values, etc.) for:
  - General locomotor function
  - Basic and skilled limb movement
  - Intralimb coordination
  - Whole body coordination
  - Tail coordination
  - Body weight support
- Data smoothing and filtering options
- Elaborate options for graphical data representation incl. stick figures, phase model diagrams, statistic plots, and more

Data Analysis (continued...)

- Dynamic video and diagram animation
- Programming of analysis templates; standard templates (e.g. gait analysis) are available on request
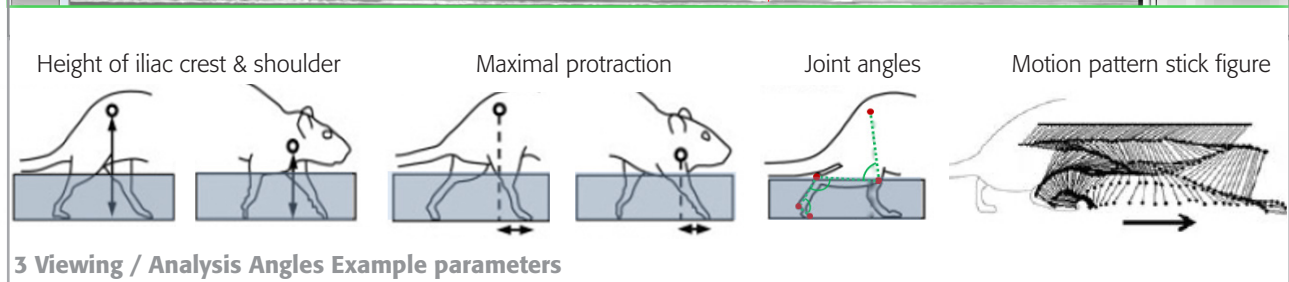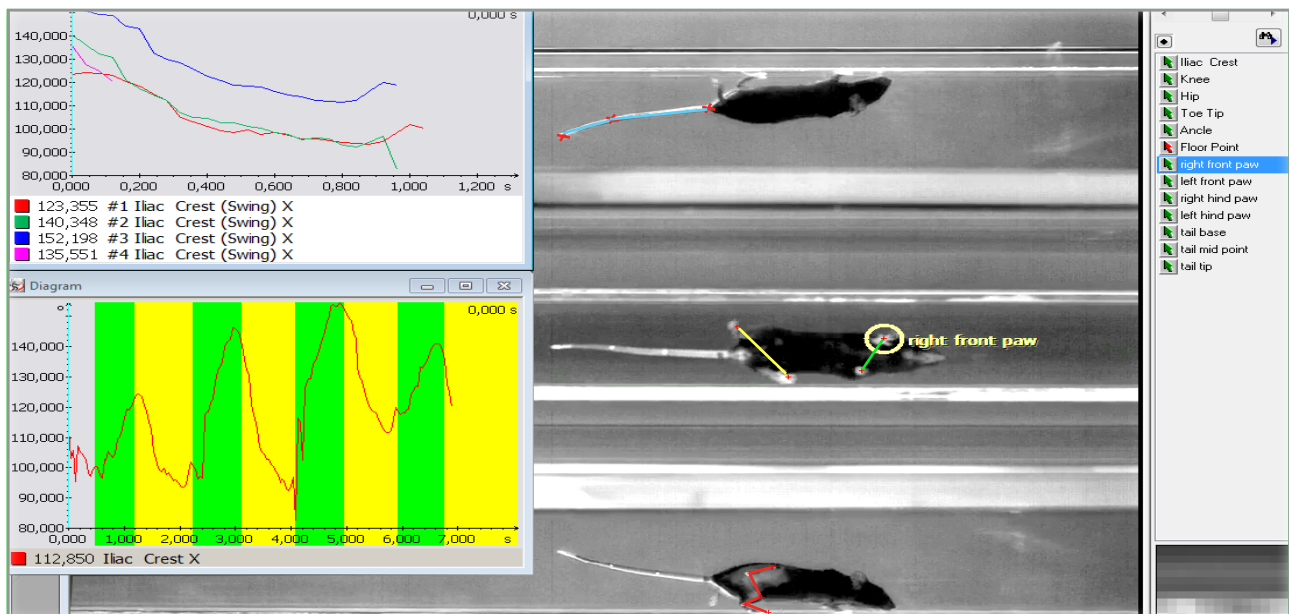
Application

Animals are objectively and reliably screened for deficits in high-throughput fashion. Relevant disease models include:

- Ischemia / Stroke
- Parkinson's / Huntington's disease
- Amyotrophic Lateral Sclerosis
- Spinal cord injury
- Spasticity / Ataxia
- Pain / Arthritis
- Locomotor recovery / treatment / exercise efficacy
- Aging
- And many more...

Special Configurations

- External devices can be integrated & synchronized (e.g., EEG or EMG recordings, drug infusion, optogenetics, etc.)
- Modular add-ons can be implemented to evaluate kinematics of sophisticated motor skills (e.g., forelimb reaching, rotating beam and more)

3 Viewing / Analysis Angles Example parameters

Selected Publications

- **Bellardita C & Kiehn O (2015)** Phenotypic Characterization of Speed-Associated Gait Changes in Mice Reveals Modular Organization of Locomotor Networks. **Curr Biol** 25:1-11; Group of O Kiehn, Mammalian Locomotor Laboratory, Department of Neuroscience, Karolinska Institute, Stockholm, Sweden

- **Mihailovska E et al. (2014)** Neuromuscular synapse integrity requires linkage of acetylcholine receptors to postsynaptic intermediate filament networks via rapsyn-plectin 1f complexes. **Mol Biol Cell** 25(25):4130-49; Group of G Wiche, Department of Biochemistry and Cell Biology, Max F. Perutz Laboratories, University of Vienna, Vienna, Austria

- **Oksman J et al.** (2014) Novel Sensitive Kinematic Gait Analysis Reveals Early Motor Impairment in G93A SOD1 Mice of Amyotrophic Lateral Sclerosis. **Society for Neuroscience** Annual Meeting; Presentation Number: 696.13/G2; Charles River Laboratories Discovery Services, Kuopio, Finland

- **Zörner B et al. (2014)** Chasing central nervous system plasticity: the brainstem's contribution to locomotor recovery in rats with spinal cord injury. **Brain** 137(Pt 6):1716-32; Group of ME Schwab, Brain Research Institute, University of Zurich and Department of Health Sciences and Technology, ETH Zurich, Zurich, Switzerland

- **Talpalar AE et al. (2013)** Dual-mode operation of neuronal networks involved in left–right alternation. **Nature** 500(7460): 85-8; Group of O Kiehn, Mamalian Locomotor Laboratory, Department of Neuroscience, Karolinska Institute, Stockholm, Sweden

- **Filli L et al. (2011)** Motor deficits and recovery in rats with unilateral spinal cord hemisection mimic the Brown-Séquard syndrome. **Brain** 134:2261-2273; Group of ME Schwab, Brain Research Institute, University of Zurich and Department of Health Sciences and Technology, ETH Zurich, Zurich, Switzerland

- **Zörner B et al. (2010)** Profiling locomotor recovery: comprehensive quantification of impairments after CNS damage in rodents. **Nature Methods** 7(9):701-8; Group of ME Schwab, Brain Research Institute, University of Zurich and Department of Health Sciences and Technology, ETH Zurich, Zurich, Switzerland

Service & Warranty

TSE Systems offers a Two (2) Years ALL-IN Premium Warranty with all new products, including:

- 24/7 technical hotline
- Remote maintenance and update function
- On-site visits upon necessity
- Free replacement parts during warranty

After the expiry of the warranty period, TSE Systems offers comprehensive extensions of the warranty or economical maintenance and repair contracts to ensure the continued smooth running of your instruments. Please contact us for further details.

www.TSE-Systems.com   **Info@TSE-Systems.com**