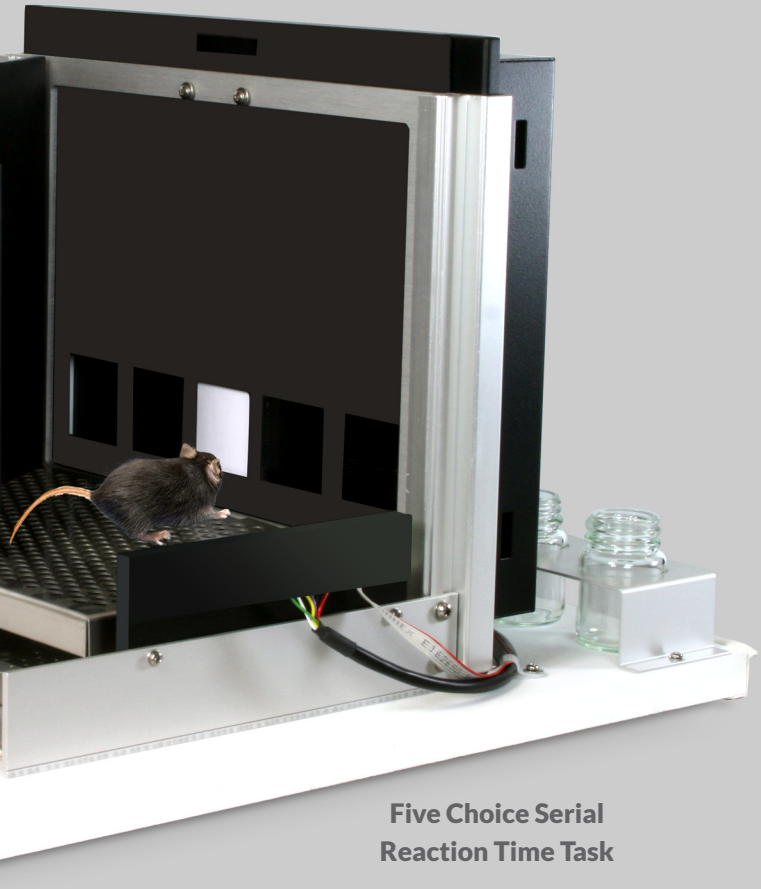
Bussey-Saksida

Touch Screen Systems for Rodents

A Translational Cognition Task Battery



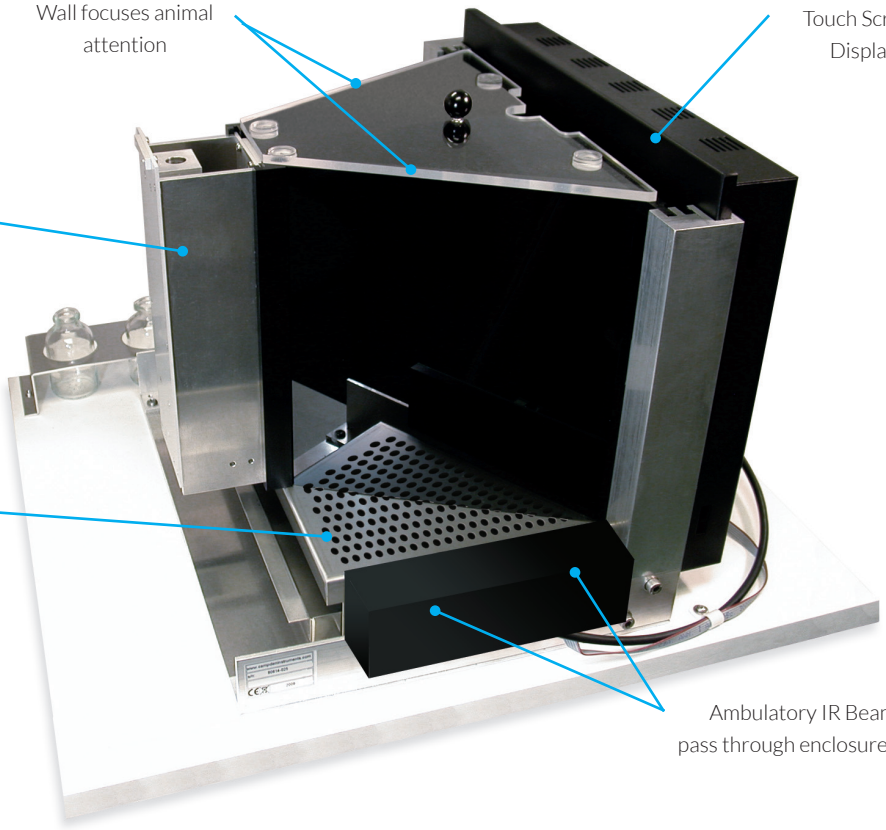
Five Choice Serial
Reaction Time Task

Paired Associate
Learning Task

Lafayette Instrument®

WHAT IS THE BUSSEY-SAKSIDA SYSTEM?

Modular, adjustable design allows for high throughput screening.



Bussey-Saksida Touch Screen Chamber for Mice

A Focused Approach

The Bussey-Saksida Rodent Touch Screen Chamber (TCN Lab: Cambridge; University of Western Ontario) is the evolution of the operant chamber. Our chambers are designed for the efficient and high-throughput cognitive evaluation of rodents. For these systems, we offer many standard paradigms, prewritten to include the entire battery of tasks necessary to habituate, shape, and bring the animal to criteria on that particular application, as well as collect and analyze prepared Data Analysis Sets.

- The Bussey-Saksida Chamber has a **unique trapezoidal wall shape that focuses the animal's attention** and is made from parts that simply slot together. The chamber can also be configured to a modular square chamber with panels, levers, lights, and a range of other operators.
- The reward tray can be moved to a position in front of the screen for tasks such as Pavlovian Autoshaping, and to the rear of the chamber for tasks such as Pairwise / Visual Discrimination.
- Not just a touch screen, this is **the ultimate modular chamber for high throughput**. For example, the system is easily reconfigured to do Visual Discrimination and Reversal in the morning and Five Choice Serial Reaction Time Task in the afternoon.

All Bussey-Saksida Touch Screen hardware conforms to a single technical standard. This standard defines all aspects of the animal's interactions. Due to the complexity of touch screen system hardware, electronics, and software this standard ensures conformity. Comparisons are valid and simple to carry out. **Full documentation for the CAMTOUCH Technical Standard is available upon request or by visiting our website.**

COMPLEXITY MADE SIMPLE

Delivered ready to work.

Easy-Install System

The Easy-Install keeps your lab organized by hiding the many cables in trunking and the whole system easily moveable for cleaning. **Designed as a factory built, pre-cabled system that can be taken from a transit crate in one piece and wheeled into place**, the Easy-Install eliminates the effort needed to handle, move, and install individual stations and their connections to the system interface and control.

Computer and Interface connections are easily made as all cables are routed to the PC location, above the cubicles. The user's monitor, keyboard and mouse can be located away from the system as needed. *Note: Computer and Interface are not part of the Easy-Install these are purchased separately. Workstation monitor, keyboard, and extra length cables are also sold separately.*

Our Isolation Chambers **were designed in consultation with the Institute of Sound and Vibration at the University of Derby England** to provide a controlled environment for sound, light, and electromagnetic interference. Ergonomically designed for ease of animal handling and welfare with a ventilation fan and optional rolling shelf, these chambers can be configured with a house light, speaker, and camera observation/recording system that uses visual or IR illumination. Audible transmission measurements were performed on sound pressure z-scale. Attenuation level ensures that sound between chambers is attenuated to around 35 DB which approximates to the background noise in a quiet room.

Isolation Chambers are optionally available with built-in electromagnetic compatibility, to ensure artifact free in-vivo recording. Potential artifacts are eliminated at the source by shielding against electromagnetic output or by reducing the emissions at the component level on the printed circuit board. This is achieved by **superior electronic engineering** design and testing with a spectrum analyzer. Other Features include:

- Faraday cage built into the sound isolation cubicle, with emc gasketed door and baffles at the air vent apertures
- Low emission electronic components and p.c.b. design to reduce electromagnetic emission at source
- EMC Shielded touch screen: no loss of sensitivity or image clarity

Customized system integrations are available upon request.

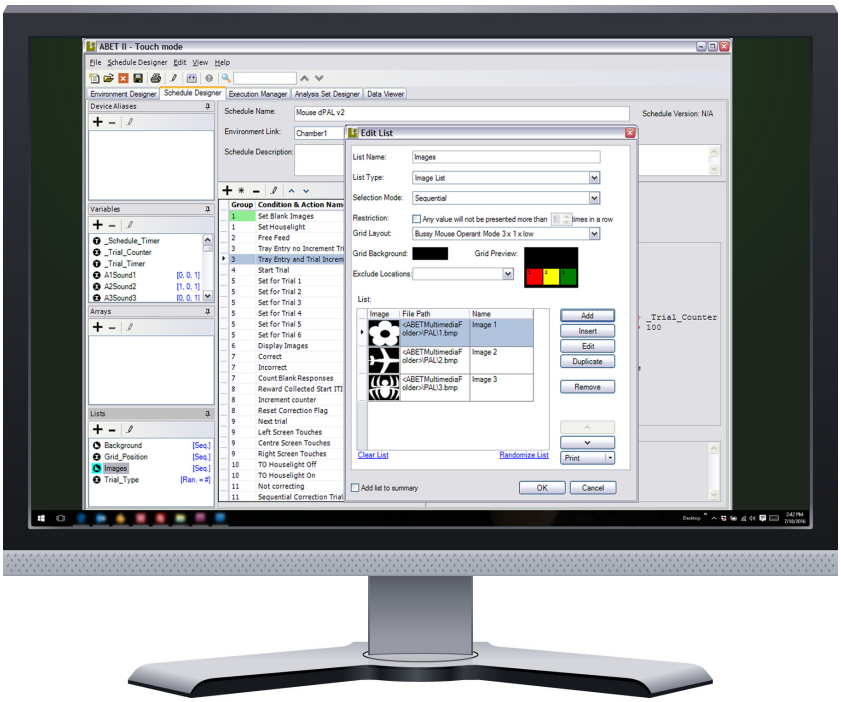
Need to Know More?

Touch Screen Webinar

Our full Touch Screen webinar entitled **"Using Touchscreen Operant Systems to Study Cognitive Behaviors in Rodents"** is available from InsideScientific, by scanning this code on your mobile device or visiting this link: **https://youtu.be/JBh5BJ-kUuA**

OPERANT CONTROL SOFTWARE

Sophisticated and user-friendly software makes controlling your chamber easy!



- Designed to be **easy to use and intuitive** for building Behavioral Studes
- Flexible Software controls **Acquisition, Control, and Data Analysis**
- Use pre-written tasks, write your own tasks, or adapt pre-written tasks for your needs

ABET II Touch and ABET II VideoTouch Operant Control Software

The standard Bussey-Saksida applications have been created using ABET II series of software. Standard paradigms or schedules are packaged in a format that the user may edit and modify. The images used in the standard applications are also available for use in new schedules created by the user, or user generated images **(or videos)** may be added to the image list. Every effort has been made to make this intuitive and logical to the non-programmer, but we are on stand by, ready to assist in your efforts to produce original research.

Virtual Interface

Install ABET II Touch on your laptop, office computer or any computer not connected to hardware and use the Virtual Interface as a duplicate of the environment that you have in your lab. Write/program, review, and test schedules or analyze lab data while disconnected from the lab hardware or offline. Schedules and data are easily passed to and from your lab via a network connection or any removable media.

Contact us for a demonstration!

Translational to NHP and Human Tasks with Whisker® Multimedia

ABET II Touch and ABET II VideoTouch rely on the Whisker operating system to control the advanced graphical output on multiple screens, and touch screen input from multiple chambers when running the Bussey-Saksida Rodent Test Chambers. This is the same underlying platform used in primate and human CANTAB touch screen stations for translational cognitive testing. **Whisker has been cited in over 142 publications across more than 34 journals.**

BENEFITS OF STANDARD PARADIGMS

Prewritten Standard Paradigms with established neuro-pathological relevance.

ABET II Touch allows usage of standard, original, and customized paradigms. Standard Task Paradigms are available by arrangement with the University of Cambridge. Standard tasks include popular tasks such as PD, PAL, 5CSRT, Location Discrimination, and many more. All paradigms include training routines as well as the main experimental paradigm and the data analysis sets. **Full descriptions of our standard paradigms are available upon request or by visiting our website.**

NHP/Human CANTAB Equivalent	Standard Tasks	Typical time to reach baseline (post-pretraining) RATS	Typical time to reach baseline (post-pretraining) MICE*	Example neural systems involved	Clinical area showing impairment
NHP	**Pretraining to touch an image and initiate a trial (PD, PAL, LD, VMCL & TUNL)**	1-2 weeks	1-2 weeks (e.g., 7-8 week old C57BL6J mice: 5 days)		
Human/NHP	**Pairwise / Visual Discrimination (PD)**	5-7 days	5-7 days for young mice	Prefrontal Cortex, Perirhinal Cortex, Striatum, Dopamine system, Cholinergic system, NMDA receptors	Huntington's, Schizophrenia, Parkinson's
Human/NHP	**Paired Associate Learning (PAL)**	35-45 sessions to 80%	35-45 sessions to 70%	Hippocampus, Cholinergic system, NMDA Receptors, AMPA Receptors	Alzheimer's, Schizophrenia
NHP	**Visuomotor Conditional Learning (VMCL)**	Approximately 20 sessions	Approximately 20 sessions	Dorsal Striatum, Posterior Cingulate Cortex	Huntington's, Parkinson's
NHP	**Location Discrimination Learning (LDL)**	2-4 weeks	2-4 weeks	Hippocampus, Neurogenesis	Alzheimer's, Schizophrenia, Depression
Human/NHP	**Trial-Unique Nonmatching-to-Location (TUNL)**	Approximately 4 weeks	6-24 Sessions to acquire the basic task	Hippocampus, Cholinergic system, NMDA Receptors	Alzheimer's
Human/NHP	**5 Choice Serial Reaction Time (5CSRT)**	30 sessions	Pretraining (ave 10 days) + 3 weeks to 80% @ 2 sec baseline	Prefrontal Cortex, Basal Forebrain, Cholinergic (Accuracy), Serotonin (Impulsivity), Noradrenaline (Distraction), Dopamine (Motivation)	Alzheimer's, Depression, Huntington's, Schizophrenia, ADHD, OCD
	Autoshaping (AUTO)	Several sessions	Several sessions	Ventral Striatum, Amygdala, Anterior Cingulate Cortex	Huntington's
NHP	**Extinction (EXT)**	Approximately 4 days training + a few days extinction	Approximately 4 days training + a few days extinction		ADHD, OCD
	5-Choice Continuous Performance Task (5C-CPT)**	Approximately 24 weeks (based on training in 5-hole box)	Approximately 13 weeks (based on training in 5-hole box) after training to 5-CSRTT	Dopamine, Serotonin, Colinergic, Parietal, Muscarinic.	Schizophrenia, ADHD, OCD, Alzheimer's
Human/NHP	**Rodent Continuous Performance Task (rCPT)**	Approximately 20 days	Approximately 35 sessions	Dopamine, Serotonin, Colinergic, Parietal, Muscarinic	Schizophrenia, ADHD, OCD, Alzheimer's
Human	**4-Choice Gambling Task (4C-GT)*****	Approximately 20 sessions (based on training in 5-hole box)	Training times to be confirmed	Dopamine, Serotonin	Bipolar Disorder, Gambling
NHP	**Progressive Ratio (PR) Task**	Results for rats not yet available	16 days from first habituation to reach stable PR performance	Dopamine	Motivation

* Depends on strain and age

** Young et al, The 5-Choice Continuous Performance Test: Evidence for a Translational Test of Vigilance for Mice. *Plosone,* January 19, 2009 DOI: 10.1371/journal.pone.0004227
Barnes et al. D_1 receptor activation improves vigilance in rats as measured by the 5-choice continuous performance test. *Psychopharmacology* (Berl). 2012 Mar;220(1):129-41

*** Zeeb et al. Sertonergic and Dopamine Modulation of Gambling Behaviour as Assessed Using a Novel Rat Gambling Task. *Neuropsychopharmacolgy* 2009 34,2329
van Enkhuizen et al. Differential effects of dopamine transporter inhibitors in the rodent Iowa Gambling Task: Relevance to mania. *Psychopharmacology* (Berl). Feb 2013; 225(3): 661–674

Full Paradigm Task Reference and Bibliography is available upon request or by visiting our website.

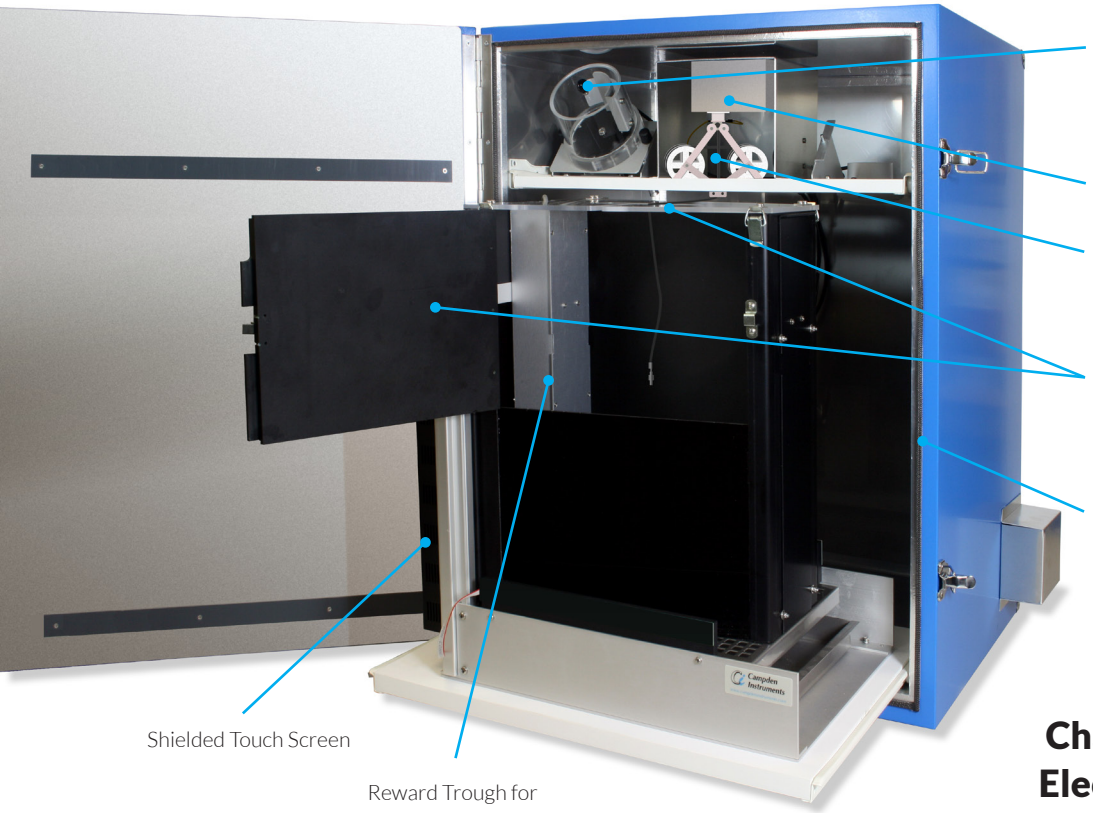
Selected References

Jared W. Young, J David Jentsch, Timothy J Bussey, Tanya L Wallace, and Daniel M Hutchenson. Consideration of species differences in developing novel molecules as cognition enhancers. *Neurosci Biobehav Rev*. 2013 Nov; 37(9 0 0).

Horner AE, Heath CJ, Hvoslef-Eide M, Kent BA, Kim CH, Nilsson SR, Alsiö J, Oomen CA, Holmes A, Saksida LM, Bussey TJ. The touchscreen operant platform for testing learning and memory in rats and mice. *Nat Protoc*. 2013 Oct;8(10):1961-84.

SYSTEM INTEGRATIONS

Turnkey Touch Screen solutions to accomodate every research need.



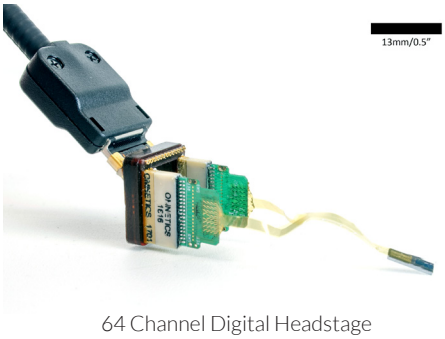
Rat Touch Screen Chamber with Shielding, Electrophsiology System, and Video Integration

Electrophysiology: Fully Integrated with Behavior

Electrophysiology starts with clean signals and animals that freely move due to minimal weight high channel headstages. Our Electrophysiology systems support both Wireless and Tethered Headstages.

Hardware

- Shielding and faraday cage and emission free electronics
- Digital headstages, multiplexed and shielded
- Unique 64 channel headstage weighs only 1.82g
- Microdrives always accessible
- Stimulation lines and LED's
- Integrated time-stamped video: Scroll, play, and pause each of 4 chambers
- Reciprocal correlation of electrophysiology and behavioral data

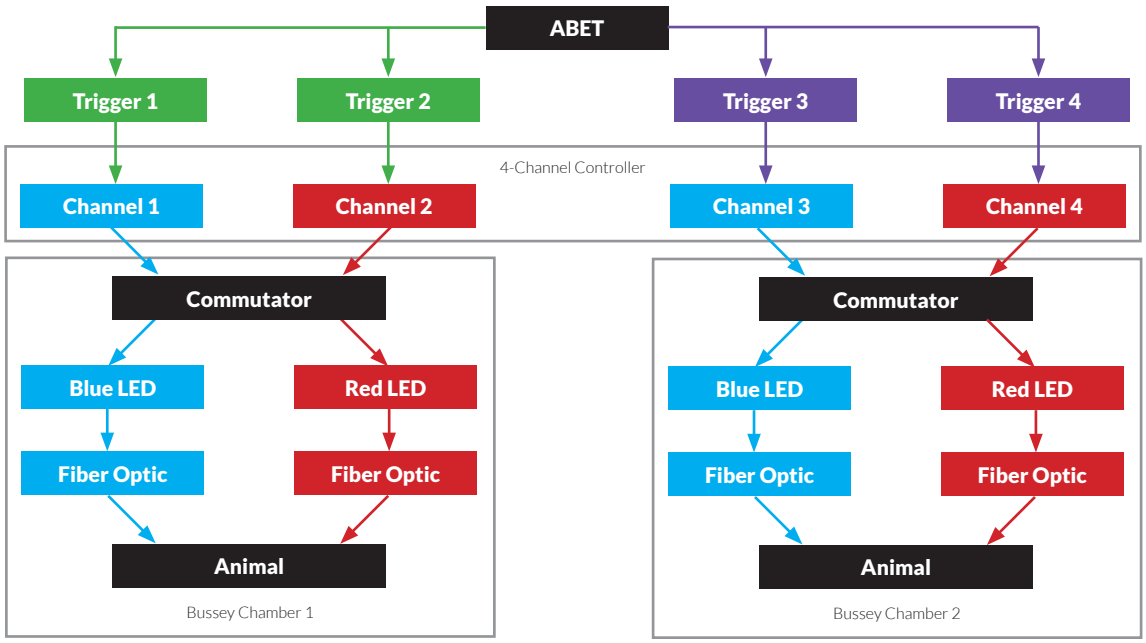


64 Channel Digital Headstage
with microdrives always accessible

3rd Party Integration

- Display EEG data for correct and incorrect touch
- Export data for Spike sorting
- Analysis of overlapping regions
- Signal-to-noise computations
- Available digital referencing

Optogenetic Integration



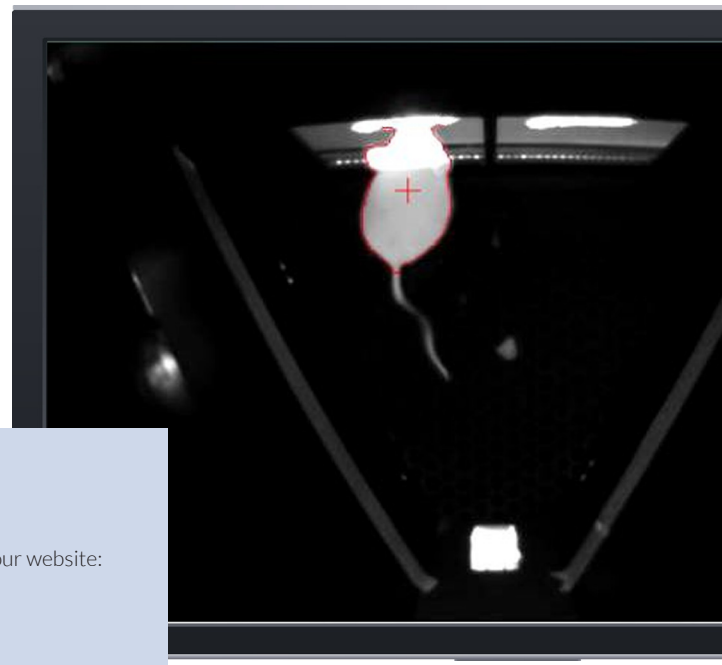
Example 2 Chamber Optogenetic Setup

New Optogenetic-Integrated Bussey–Saksida Touch Screen chambers are now available for single, dual, or four chamber Easy-Install systems. The system has been designed to minimize the torque experienced by the animal while maximizing the light at the end of the implanted ferrule. Each chamber has independent ABET II linked control over each Optogenetic LED with easily defined simple or complex light patterns in software.

- Single chamber or Four chamber systems
- Flexible 0.5MA fiber cables
- 0.66NA 200/230µm Fiber stubs
- Maximum LED Outputs measured at the end of a 1m 0.5NA fiber optic cable
- Response to Touch Screen: 4 per channel
- TTL inputs (START/STOP/PAUSE/UNPAUSE)

Video Tracking Integration

- Optimized IR lighting, illuminates subject but minimizes reflection
- Chamber design and materials for contrast as well as illumination
- No interference with other IR devices
- Software accounts for behavioral stim light
- Algorithms eliminate touch screen images and reflection
- Image contour is captured accurately and without distortion



Working Animal Videos

Many videos portraying various schedule types are available on our website:
https://campdeninstruments.com/downloads/videos

Contact Us for a Quotation or More Information

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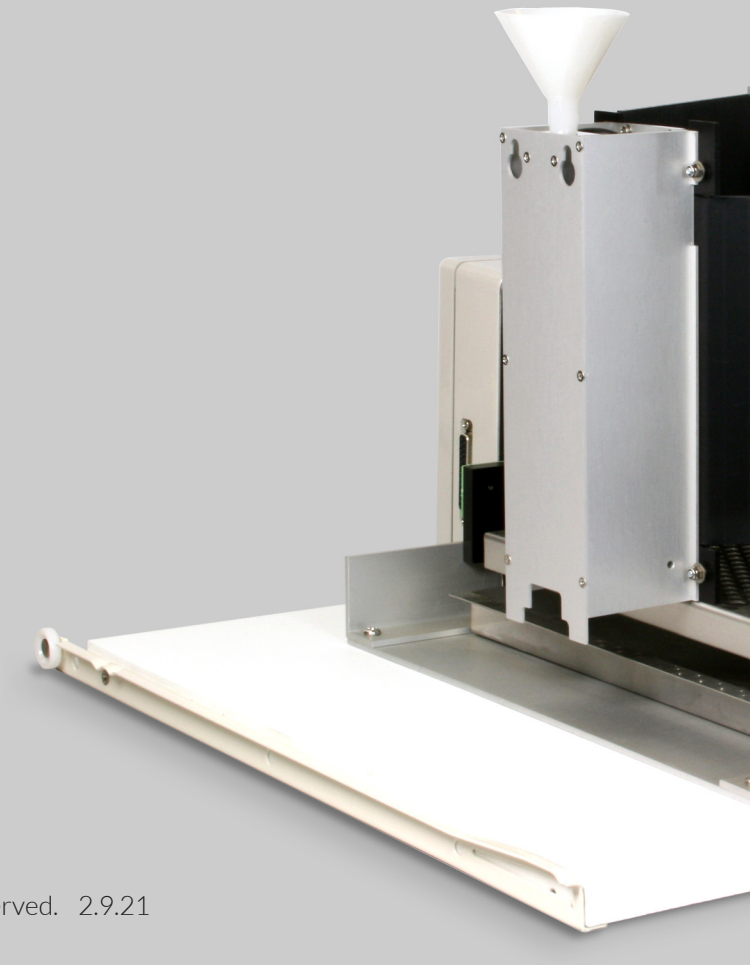

The Bussey-Saksida Chambers and WhiskerServer® originate from the department of Prof. Trevor Robbins, Experimental Psychology, University of Cambridge, England.

Lafayette Instrument®