Cancer Research

WPI Equipment for TEER, Live Cell Imaging, Fluidics & More

Basic Research

WPI supports both *in vitro* and *in vivo* model development to perform basic research in understanding physiological systems and identify complex biology and pathologies associated with human health and disease.

Early Drug Discovery

Our instrumentation is developed to meet the needs of early drug discovery, including the ability to do high throughput screening, automation of assays and micro-physiological systems, and standardization of cell sensing technologies like TEER measurement.

Preclinical Drug Development

Our technology supports complex model development, including animal models and organ-on-a-chip systems, providing you with tools to identify and validate drugs pre-clinically to understand mechanism of action, dosage, administration, drug-drug interactions, patient-specific reactions, pharmacokinetics, pharmacodynamics, safety and efficacy.

Clinical Development

WPI supports the development of preclinical models for identification and validation of prognostic and diagnostic biomarkers.

Enabling Cancer Research

WPI'S ROLE IN ONCOLOGY RESEARCH & DEVELOPMENT

World Precision Instruments (WPI) plays a significant role in oncology research and development by providing high-precision instruments that enable researchers to model disease environments, deliver targeted therapies, and monitor cellular behavior with accuracy and reproducibility.

TEER Measurement

One of WPI's core contributions to cancer research is through its TEER (Transepithelial/Transendothelial Electrical Resistance) measurement systems, such as the EVOM™ Auto for High Throughput Screening. These systems are vital for assessing the integrity of epithelial and endothelial barriers, allowing scientists to create *in vitro* models of the tumor microenvironment—including the blood-brain barrier (BBB) and intestinal linings. These models help evaluate cancer cell invasion, drug permeability, and the impact of therapeutics on barrier function.

Sub-Microliter Injection System

Complementing these capabilities, WPI's NanoFil™ Sub-Microliter Injection Syringes are designed for ultra-low volume delivery, often in the nanoliter range, which is essential for high-precision applications like orthotopic tumor cell injections, localized drug delivery, and gene editing with CRISPR or siRNA in cancer models. These gas-tight syringes ensure minimal dead volume and maximum accuracy, which is crucial when working with scarce or potent compounds.

Paired with the UMP3 Microinjection Syringe Pump and SMARTouch controller, WPI offers a programmable system that enables researchers to control infusion volumes and rates with extreme precision. This system is especially useful in oncology for tasks such as intratumoral injections, chronic drug delivery studies, and administering chemotherapeutic agents or contrast dyes directly into specific tissues or tumor sites in animal models. Together, the NanoFil™ and UMP3 system allow for consistent, repeatable, and minimally invasive dosing—key to maintaining model integrity and experimental accuracy.

Live Cell Imaging

In addition, WPI's Live Cell Imaging Systems provide researchers with tools to monitor dynamic processes in real-time under physiological conditions. This includes tracking cancer cell proliferation, migration, apoptosis, and responses to therapies. By enabling time-lapse imaging and environmental control, these systems are instrumental in understanding how cancer cells interact with their surroundings, including immune cells and stromal components. They are also valuable in high-throughput screening of drug candidates, offering insights into treatment efficacy and resistance mechanisms over time.

Collectively, WPI's technologies serve as a powerful toolkit for oncology researchers, facilitating the creation of robust disease models, precise delivery of therapeutic agents, and detailed observation of cancer biology. These tools not only enhance the reproducibility and relevance of experimental data but also accelerate the development of novel cancer therapies by enabling more accurate and insightful preclinical studies.

DELIVERING NANOLITER VOLUMES PRECISELY WITH UMP3T

Benefits

- Calibrate syringe to pump
- Accepts a wide variety of microinjection syringes
- Manual or automated injections
- Quiet operation for electrophysiology recordings
- Mounts directly on micromanipulator or stereotaxic frame
- Rapid setup with intuitive touchscreen controller

Applications

- Microinjection
- Neuroscience
- Microfluidics
- Micro delivery of biochemical agents or dyes

The UMP3T Microinjection Syringe Pump is a versatile pump which uses micro syringes to deliver nanoliter to milliliter volumes. The pump is optimum for applications that require injections of precise and small amounts of liquid. With its touchscreen controller, UMP3T can displace as little as 0.53 µL/step (using 10 µL syringe with 60 mm scale length).

The new SMARTouch™ controller for the UMP3T features technology which includes:

- Total system calibration – Calibrate the syringe and the controller together as a system. This feature eliminates the variability of the syringes and delivers the calibrated volume.
- Smart smoothness – The controller can be set to automatically adjust microstepping according to the injection rate to deliver the smoothest flow.

- User defined travel limits – Set the limits for a specific syringe in the software. This prevents the pump from over-driving the plunger into the syringe, potentially causing syringe breakage.

Get more details at wpi-europe.com/ump3t.

EVOM™ AUTO SYSTEM FOR HIGH THROUGHPUT SCREENING OF TEER MEASUREMENT

EVOM™ Auto with 24- and 96-well plate capability is the latest generation of WPI's automated TEER measurement system to analyze samples in high throughput screening (HTS) 24 and 96 transwell plates. Using a multi-electrode array, software interface, and control system, it delivers our fastest workflow solution while improving TEER measurement accuracy.

In Vitro Cell Culture Models

In vitro models of endothelial and epithelial monolayers serve as validated platforms for therapeutic delivery, transport, and toxicity. Findings of the *in vitro* models are also translated to ascertain the metabolic and physiological functions of a particular pharmacological entity. The most commonly used endothelial/epithelilal *in vitro* models are:

- Blood-brain barrier (BBB) model
- Gastrointestinal tract (GIT) model
- Pulmonary models (including viral infection model, such as COVID-19)

These are used for understanding the absorption and transport of drugs, as well as associated cytotoxicities. The EVOM™ Auto autosampler is a unique TEER measurement system that is considered highly reliable for evaluating the integrity of *in vitro* epithelial barrier models including blood-brain barrier, gastrointestinal tract, and pulmonary model.

TEER Measurement with EVOM™ Auto (HTS TEER Measurement System)

The EVOM™ Auto measures the electrical resistance across layer of epithelial and endothelial cells grown on semi-permeable membranes on high throughput screening (HTS) 24 and 96-well microplates. The system is automated, which minimizes errors associated with a user's manual handling, generating highly reliable data and enhanced reproducibility. The system operation is controlled with an iPad tablet and a local wireless network. Automated measurement of tissue resistance in high throughput (HTS) transwell plates provides the critical advantages of speed, precision, decreased chances of introducing contamination, and the instant availability of measured resistance or TEER data. These measurements are useful in applications, such as evaluating drug toxicity, and bioavailability studies. A GxP module is also available for regulated industries like pharmacology.

Drug Discovery/Toxicology

The epithelial membranous structures separate individual compartments of the human body, besides shielding the organs (like, brain, intestine, and lungs). They also play a crucial role in tissue homeostasis. The toxic effect of newly developed/already existing drug formulations on these biological barriers is an active area of research. The *in vitro* barrier models are providing a wealth of information for evaluating the distribution of pharmacological agents and their relevant toxicity. To assess the barrier properties of cultured cells, it is critical to establish intercellular junctions similar to *in vivo* tissues.

The TEER method is considered fast, accurate and non-invasive, the prime choice of all the available methods. Notably, for evaluating pharmacological transport across these barriers, this method does not add any additional molecule or chemical in the system. The EVOM™ Auto has the capability to measure the electrical resistance of transepithelial/transendothelial cellular layers growing to confluence on microporous filters. For high throughput screening (HTS), the instrument has the versatility for use in 24 and 96-well HTS transwell plates.

GxP Compliance for Pharmaceutical Research

- EVOM™ GxP Compliance Module powered by TotalLab
- Able to meet regulations related to electronic records and signatures of US: 21 CFR Part 11, subparts B and C and EU: Annex 11
- EVOM™ GxP software can be adopted to address GLP/GMP requirements

TotalLab
LIFE SCIENCE ANALYSIS

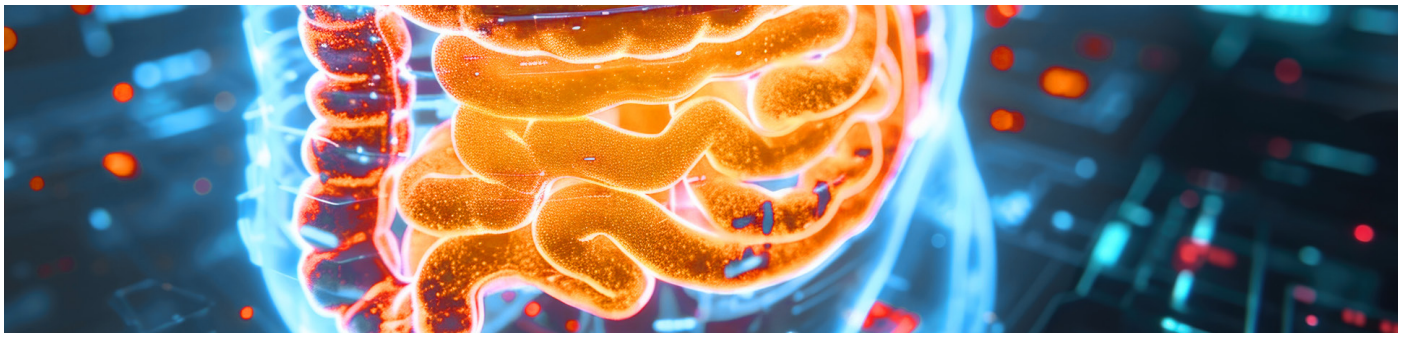
The electrode array positions eight pairs of electrodes precisely in the wells and measures a column at a time, each well sequentially. As measurements are made, they appear on the iPad screen in real time.

Get more details at wpi-europe.com/teer-evom.

Enabling Cancer Research

UTILIZING EVOM™ AUTO FOR HTS AUTOMATED TEER ANALYSIS

Rapid & Reliable Approach for Therapeutic Screening & Diarrhea Risk Assessment Using *In Vitro* Human Intestinal Model



ABSTRACT

The ability to predict adverse effects of drugs in early stages of drug screening is critical for effective development of safe and effective drugs. Diarrhea induced by gastrointestinal toxicities (GIT) remains the most common adverse effect (AE) leading to significant dose limitations that often reduce the efficacy of a drug and lead to delays or failures in the clinic. The risk of GIT has historically been determined in preclinical animal models, yet many therapeutics still demonstrate profound AEs in clinical trials, despite being safe in animal models. GIT is characterized by a reduction in gastrointestinal barrier integrity and transepithelial electrical resistance (TEER) has been demonstrated to be a rapid and reliable measure of barrier function of the gastrointestinal tract. A major advancement in the ability to use TEER measurements for *in vitro* screening of drugs that cause GIT is the commercial availability of World Precision Instrument's EVOM™ Auto, a high-throughput TEER instrument that enables measurement of a 96-well plate in under 3.5 minutes. In this study, we demonstrate that the RepliGut® Planar model created by Altis, which integrates proliferative cell populations derived from human intestinal crypts can be used as a platform for screening of therapeutics for GIT using TEER measurements on the EVOM™ Auto. This study reports highly accurate predictions of diarrhea potential using TEER measurement across a group of human donors and a reference panel of 30 drugs. The need for more accurate models to predict adverse effects, coupled with efforts by regulatory agencies including Europe's EMA and the United States' FDA to replace animal models with more predictive and reliable methods, make this study highly impactful, as we have established a rapid, low cost, accurate, sensitive and specific assay for risk assessment in early stages of drug discovery, facilitating rapid and cost-effective screening for GITs. Early identification of AEs and toxicities enables preemptive reformulation of therapeutics or alternative dosing schedules to mitigate GIT and ultimately reduce the risk of dose limitations in clinical trials that impair the efficacy of drugs. Implementation of alternative models like Altis's RepliGut® Planar coupled with fast and easy measurements like TEER that give a quantitative readout of a critical cellular functionality like barrier integrity and makes for an ideal screening tool to identify safe and effective drugs that will improve the lives of patients.

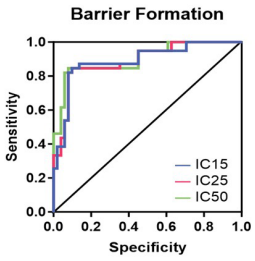
CONCLUSION

TEER measurement can be used as a functional parameter to determine altered epithelial barrier function, which correlates with GIT and the potential of drugs to cause diarrhea, a potential dose-limiting AE. Thus, TEER measurement by EVOM™ Auto provides an efficient, high-throughput screening tool to predict GITs by chemotherapeutic drugs and has the potential to be useful for predicting safety and efficacy on many other platforms for many other types of therapeutics.

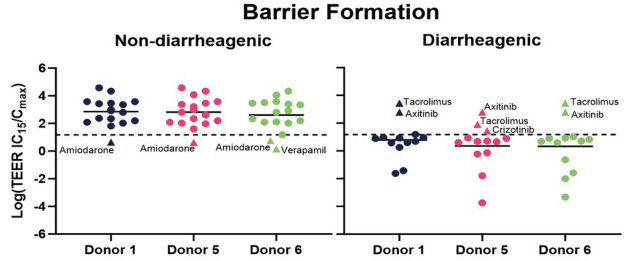
REFERENCES

1. Pike, Colleen M., et al. "Characterization and optimization of variability in a human colonic epithelium culture model." *ALTEX - Alternatives to animal experimentation*, 41(3), pp. 425–438..
2. Pike, Colleen M., et al. "High-throughput assay for predicting diarrhea risk using a 2D human intestinal stem cell-derived model." *Toxicology in Vitro*, Volume 106, 2025, 106040.
3. Srinivasan, Balaji, et al. "TEER measurement techniques for *in vitro* barrier model systems." *Journal of laboratory automation* 20.2 (2015): 107-126.

A



B



TEER measurements were collected for all three donor cell lines using the panel of 30 reference drugs (Pike et al. 2024). The diagnostic accuracy of TEER was 88%, with 82% sensitivity and 92% specificity. Below the TEER data is shown in (A) as the receiver-operator curved of IC15, IC25, and IC50 and in (B) as the response to the 30-drug reference panel plotted as IC15/Cmax ratios. Dashed line indicates the threshold for a diarrheagenic or non-diarrheagenic outcome. Black lines indicate mean. n = 3 technical replicates.

ACCELERATE YOUR DRUG DISCOVERY WITH OUR NEW EVOM™ AUTO SYSTEM WITH BOTH 24 AND 96 HTS MULTIWELL PLATE CAPABILITY

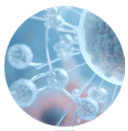
EVOM™ Auto with both 24 and 96 HTS multiwell plate capability is a high throughput screening (HTS) platform offering fast, non-invasive sample scanning by comparing electrical resistance measurements (transepithelial/transendothelial electrical resistance: TEER). TEER measurement experiments are simple to set up and less time consuming than more complex molecular studies. TEER measurement can be used as the primary scanning method to identify any physiological changes that can then be further evaluated by other methods. EVOM™ Auto can capture TEER measurements in 24 and 96 HTS multiwell plates from Corning, Millipore, or MatTek. The sample preparation time in these HTS plates is efficient, allowing for fast, multi-channel pipetting options. Additionally, the EVOM™ Auto electrode disinfection capability during measurement minimizes sample cross-contamination. Its wireless device control offers the convenience of operating the instrument from a distance, and the small footprint of EVOM™ Auto enables you to use it inside a sterile cell culture hood or an incubator. The EVOM™ Auto provides a fast and efficient platform for early drug discovery, by narrowing down drug targets and drug concentrations through automated, non-invasive sample scanning.

EVOM™ GXP Compliance Module
Powered by
TotalLab
LIFE SCIENCE ANALYSIS

EXPEDITE DRUG DEVELOPMENT & LIFE SCIENCE RESEARCH BY ACCELERATING:

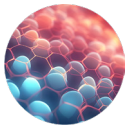
- *Hit Discovery Process*
- *Hit To Lead*
- *Target Screening, Identification and Validation*
- *Formulation Optimization & Improving Bioavailability*
- *Assay Development*
- *Safety Assessment: Toxicity*
- *Quality Control of 2-D and 3-D*
- *In Vitro Tissue Models in Drug Discovery*

Applications


Epithelial Barrier Function

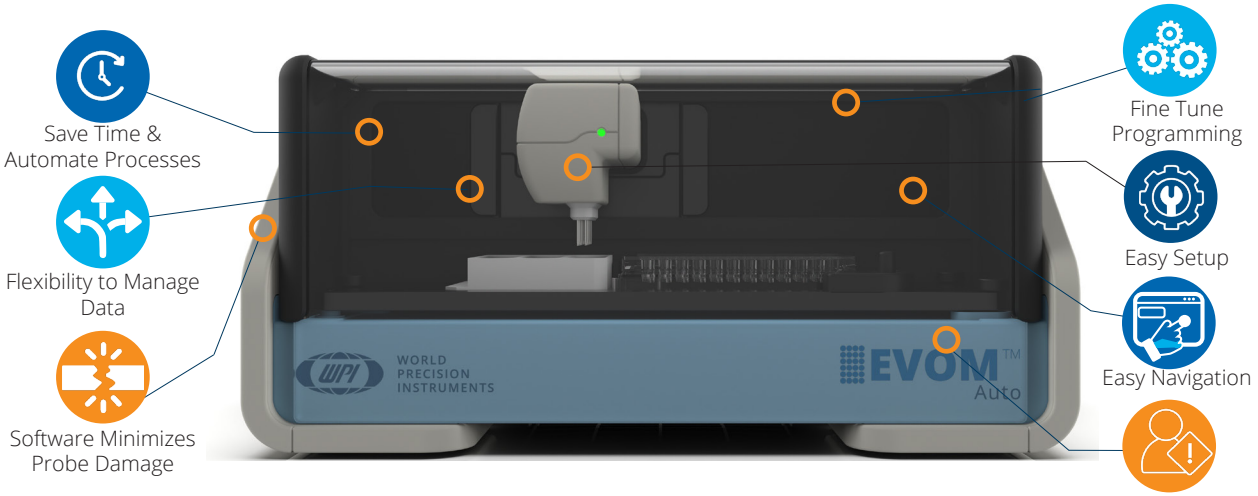

Drug Absorption Studies


Tissue Engineering/Cell Culture


Disease Modeling


QC in Cell-Based Assays & Cell Therapies


Manufacturing Quality Control



EVA-MT-03-XX

Enabling Cancer Research

ENHANCING LOCALIZATION OF AAV WITH A TRUE GAS-TIGHT SYSTEM FOR PRECISION DRUG DELIVERY

A 2023 study was conducted using an inhibitory DREADDS (Designer Drugs Exclusively Activated by Designer Receptors) virus carrying the inhibitory DREADDS receptor and florescent reporter (AAV5-hSyn-hM4D(Gi)-mCherry) or a control virus carrying a florescent reporter (AAV5-hSyn-eGFP) to target anterior dorsal thalamic neurons (ADN). The ADN has been shown to play a notable role in driving accurate spatial representations, projecting head direction information to update place cell representations of space via the hippocampus. Proper localization was critical to appropriately assess the relationship between the ADN and the CA1 of the hippocampus during spatial navigation, before, during and after silencing of the thalamic structure.

Using a competitor 10µL syringe with a needle (non-insertable to the syringe barrel body), showed significant inconsistency in delivering AAV vectors across a sample of C57BL/6J mice (*n* = 29) versus AAV delivery utilizing WPI's NanoFil™ Gas-Tight Syringe system (*n* = 32). Using the competitor syringe, marketed as gas-tight, was found to carry about 10µL of dead volume between its coupling mechanism of the plunger to needle base. The NanoFil™ system was identified as having zero dead volume, where the needle inserts directly into the syringe barrel for a true gas-tight system. Using the competitor syringe model, the success rate of AAV localization to the ADN was ~28%, where 8 of 29 subjects showed positive ADN localization. 21 of the total subjects either showed complete leakage of the viral vector, unilateral expression, or total absence of positively tagged neurons. All priming and loading steps remained consistent between use of the competitor syringe model versus the NanoFil™ Gas-Tight Syringe system. Success rate of AAV localization using the NanoFil™ syringe resulted in an 87% success rate of localized vector into the ADN, where 28/32 subjects showed positive localization of AAV to the ADN—a roughly 59% increase in targeting success using the NanoFil™ Gas-Tight system.

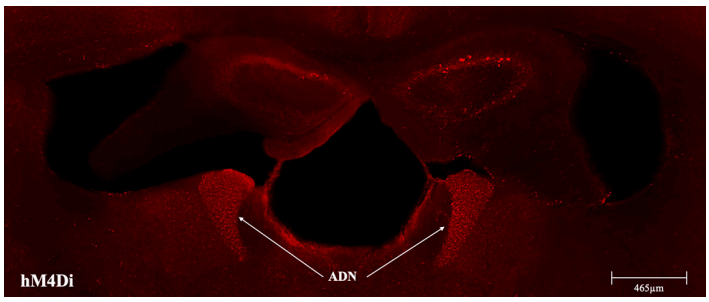


Fig. 1—**Expression of Fluorescent Reporter in Anterior Thalamic Nuclei (ADN): hM4Di Localization.** *Histological verification of bilateral infusion of experimental DREADD virus AAV5-hSyn-hM4D(Gi)-mCherry placement into the anterior thalamic nuclei using a NanoFil 10µL syringe (World Precision Instruments, LLC). Arrowheads indicate the bi-lateral localization of the fluorescent tag in the anterior dorsal region of the thalamus (-2.50mm V). 50µm slice, -1.01mm from bregma.*

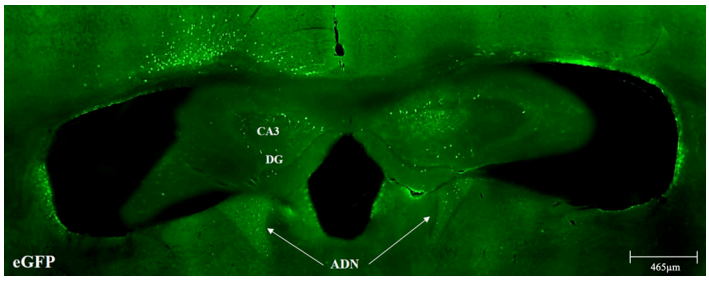


Fig. 2—**Expression of Fluorescent Reporter in Anterior Thalamic Nuclei (ADN): eGFP Localization**. *Histological verification of bilateral infusion of control AAV5-hSyn-eGFP placement into the anterior thalamic nuclei using a NanoFil 10µL syringe (World Precision Instruments, LLC). Arrowheads indicate the bi-lateral localization of the fluorescent tag in the anterior dorsal region of the thalamus (-2.50mm V). 50 µm slice, -0.98mm from bregma.*

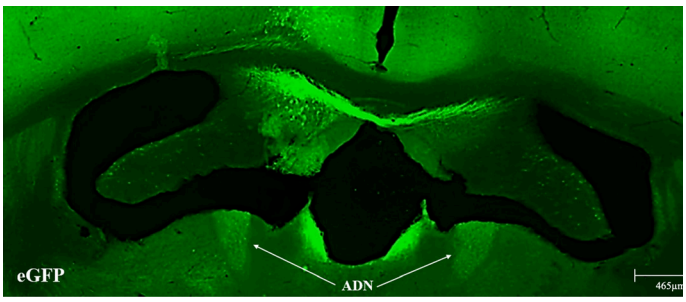


Fig. 3—**Off-Target eGFP Expression of Fluorescent Reporter in Anterior Thalamic Nuclei.** *eGFP subject that was included in the study displaying viral leakage during histological analysis. Occurring in the hippocampal region, leakage of viral vector using a popular competitor gas-tight syringe, with ~10µL dead volume. While anterior dorsal thalamus had been targeted, a majority of control virus had dispensed superiorly into hippocampus. 50 µm; -0.92mm from bregma.*

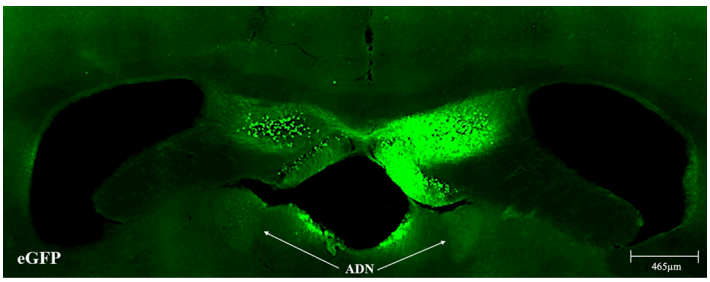


Fig. 4—**Off-Target eGFP Expression of Fluorescent Reporter in Anterior Thalamic Nuclei.** *eGFP subject that was included in the study displaying viral leakage during histological analysis. Occurring in the hippocampal region, leakage of viral vector using a popular competitor gas-tight syringe, with ~10µL dead volume. While anterior dorsal thalamus had been very minimally targeted, a majority of the control virus had dispensed superiorly into hippocampus. 50 µm; -0.94mm from bregma.*

Conclusions

With limited success using the competitor syringe system, the performance inconsistency extended the study timelines due to the failure rate of placement, primarily with the compromised gas-tight design. WPI's NanoFil™ Gas-Tight Injection System needles insert directly into the syringe barrel, making 1:1 contact between the syringe plunger and needle base—creating a virtually *zero dead volume system*. The control and precision of low-volume sample delivery was significantly improved, allowing accelerated application timelines, as well as decreased failure rates for desired sample localization. Try WPI's NanoFil™ Gas-Tight Injection System for results you can trust, time and time again.

Reference

Crafton, B. & Stackman, R. (2023). *Head direction cell network and spatial navigation: effects of silencing anterodorsal thalamic neurons using DREADDS* [Unpublished manuscript]. Charles E. Schmidt College of Science: Department of Psychology, Florida Atlantic University.

LIVE CELL IMAGING & REAL-TIME CELL MONITORING

WPI proudly partners with Curiosis to offer their Celloger® line for automated live cell imaging featuring advanced fluorescence and bright field microscopy, autofocusing, and real-time, multi-position imaging technology. The Celloger® Pro is equipped with state-of-the-art cell imaging technology and user friendly software, enabling various types of research and applications in a streamlined workflow, when compared to the conventional live cell imaging process. Additionally, it was designed to be rigid and robust, withstanding the temperature and humidity suitable for the growth of cells, making it compatible with CO_2 incubators. It provides you all the tools you need to acquire the best quality images and accurate research results. Various cell-based research work and applications can be done with this all-around system.

Benefits of Celloger® Pro

- Fully automated, multi-position imaging for high resolution analysis
- Compatible with various cell & tissue culture vessel types
- Compact size that easily fits into standard CO_2 incubators
- Z-stacking captures multi-focal planes for high dynamic range images
- Stitching combines images for analysis of high resolution composite
- Increased focus speed & reproducibility with reliable auto-focusing function
- Intuitive Interface to capture & analyze data

Applications

- Wound Healing Assay
- Cell Migration
- Cell Morphology
- Cell Confluency
- Cell Proliferation
- Cytoxicity Assay
- Co-Culture Monitoring
- Multi-Point Cell Monitoring

Get more details at wpi-europe.com/lci.

User-Friendly Software

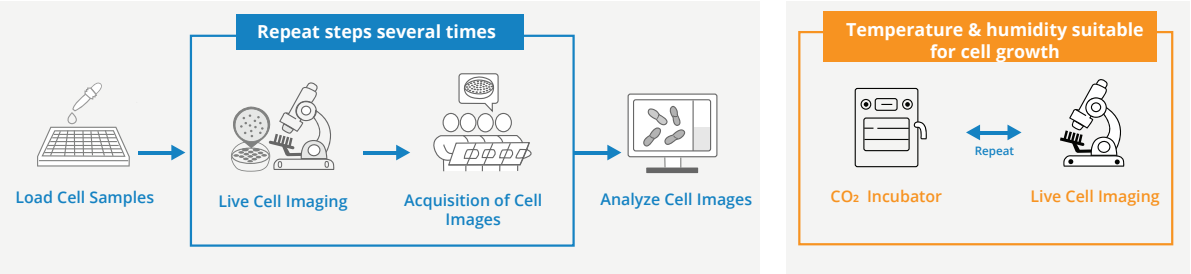
Analysis Application

A variety of tools in the analysis application simplify the analytic process, reducing errors and saving time. You get tools like Intensity Histograms, Confluency Graphs, Channel Merge, Video Creation, Manual Counting, Measurement & More.

Scanning Application

The scanning application is used for capturing images and video. You can preview cells, schedule image capture, adjust light and contrast, and monitor time lapse progression from one intuitive screen. It includes auto-focusing technology that finds a clear focal plane of cells and has excellent repeatability. Video capture is available at 8 frames/second.

Drawbacks of the Conventional Method of Cell Imaging Overcome by Celloger® Systems



Disadvantages of Conventional Method

Labor Intensive | **Prone to Human Error** | **Hard to Find Same Position** | **Unstable Environment**

FLUORODISH™ GLASS BOTTOM DISH FOR OPTIMAL CELL INTEGRITY IN IMAGING RELATED RESEARCH

FD35-100

FD5040-100

FD3510-100

WPI's FluoroDish™ Ideally Suited for Live Cell Imaging

Benefits of FluoroDish™

- Optical quality glass bottom for shorter working distances, larger numerical aperture and higher magnification
- Non-fluorescent glass so you can discern weaker signals
- Allows the use of immersion objectives with a medium such as water, glycerin or oil for the highest magnification possible
- Bottom is flush (flat) with the microscope stage or heating unit, eliminating the air gap to optimize heat exchange
- Less optical distortion and superior UV transmission (30% transmission at 300 nm, compared to less than 7% for the most popular German glass)
- Low cytotoxicity adhesive to ensure cells' survival
- Individually packaged and gamma sterilized
- Coated dishes available for better cell adhesion
- Blackwall dishes are available to block stray lights and reduce background noise.

WPI's **FluoroDish™** tissue culture dishes are now available in a larger range of sizes and coatings. Cited in 575 reference articles (in the NIH PubMed Central® alone), our optical grade, glass bottom culture dishes are unique in the marketplace and conform to strict quality control standards.

Get more details at wpi-europe.com/fluorodish-imaging.

Coated Dishes

- Collagen promotes cell adhesion and growth of fibroblasts, endothelial cells, and epithelial cells.
- Poly-L-lysine enhances cell adhesion for neurons, glial cells, and other cell types.
- Fibronectin binds to membrane-spanning receptor proteins called integrins.
- Vitronectin is a glycoprotein found in the extracellular matrix and blood plasma.
- Poly-D-Lysine is for primary neuronal cultures and cell adhesion supports neurite outgrowth.

Exceptional Imaging Quality & Low Toxicity

These dishes provide exceptional imaging quality for many applications requiring the use of inverted microscopes such as high resolution image analysis, microinjection, and electrophysical recording of fluorescent-tagged cells. FluoroDish™ uses a adhesive that is optically clear, durable, and with extremely low toxicity. Independent laboratory tests show that the 96-hour surviving rate of embryos is 100% when kept in FluoroDish™, substantially better than other brands.

Each WPI dish has a flat (0.17 mm thick) optical quality glass bottom, allowing the use of a much shorter objective working distance, larger numerical aperture (NA), and a higher magnification (up to 100x). The larger NA and higher magnification provide superior quality imaging for both classical and fluorescence microscopy. Higher effective NA yields brighter images for fluorescence and higher resolution in image analysis.