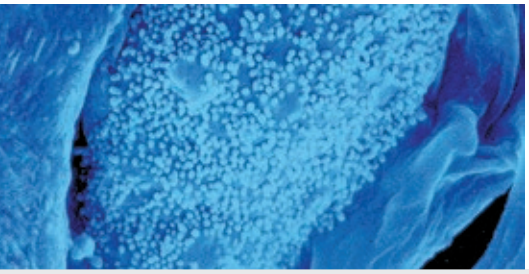
Advanced in vitro exposure systems

VITROCELL® VC 1 Smoking Machine and 12/6 CF Exposure Module



VITROCELL® SYSTEMS

E-cigarette options

- Square puff profiles
- Higher puff volumes
- Button actuator

VITROCELL® VC 1 Smoking Machine

Manual Smoking Machine with high tech features

The manual smoking machine VC 1 is specifically designed and manufactured to fulfill the requirements of *in vitro* experiments. Suitable for conventional and electronic cigarettes.

Optimal when researching side- and mainstream smoke, it offers significant advantages over other commercial smoking machines.

Generation of smoke with the shortest distance to cell cultures

For the success of an experiment with mainstream tobacco smoke it is vital that the distance between the smoke generation (cigarette holders) and the VITROCELL® cell exposure system is as short as possible to avoid aging and to guarantee authentic smoke-composition.

Open and flexible system / incorporation of other analytical tools

The VC 1 machine is designed to allow easy access to all tubes, filters and the pumping system. Additional analytical equipment relevant to the experiment can be easily and individually installed.

Freely programmable parameters

The computer system facilitates highly flexible programming of the smoking process. All parameters of the smoking process like puff duration, puff volume, puff frequency and exhaust duration can be defined according to experiment requirements.

High flexibility for all smoking regimes

ISO, Health Canada Intense, Massachusetts, Square and Human Puff Profile regimes (option) can be smoked. An upgrade for Shisha smoking is available.

Statistics

Smoking process data are logged into an Excel® sheet for further processing

Machine dimensions are suitable for constrained lab workplaces

The VC 1 machine is divided into 2 major components: computer, control box with smoking platform.

All components are easy to clean

In particular the work with unfiltered mainstream smoke demands frequent cleaning of all machine parts which come into contact with smoke. Cleaning must take place after each experiment to avoid any residual product contamination with subsequent experiments. Easy access to all component parts ensures quick and efficient cleaning.

Human puff profile capability

This optional feature offers the possibility to upload human puff-profile data registered by Smoking Puff Analyzers to the machine controls.

Compatibility with existing lab systems

The VC 1 machine can be integrated with and connected to other lab systems, e.g. analytical systems.

Compliance with ISO 3308:2012

The VC 1 machine meets the requirements of ISO 3308:2012, which assures compatibility with data generated for quality assurance purposes on other smoking machines.

Compliance with Health Canada / CRM 81 Conditions

The VC 1 machine meets the requirements of 55 ml/30 sec puff frequency for smoking combustion as well as electronic cigarettes.

Quality

The VC 1 machine is built to the highest standards using reliable and durable components. Precision of the process is ensured by a linear motor drive for the piston.

Service

All VC 1 machines are specifically designed to be exceptionally service-friendly and have a secure internet-based remote servicing module

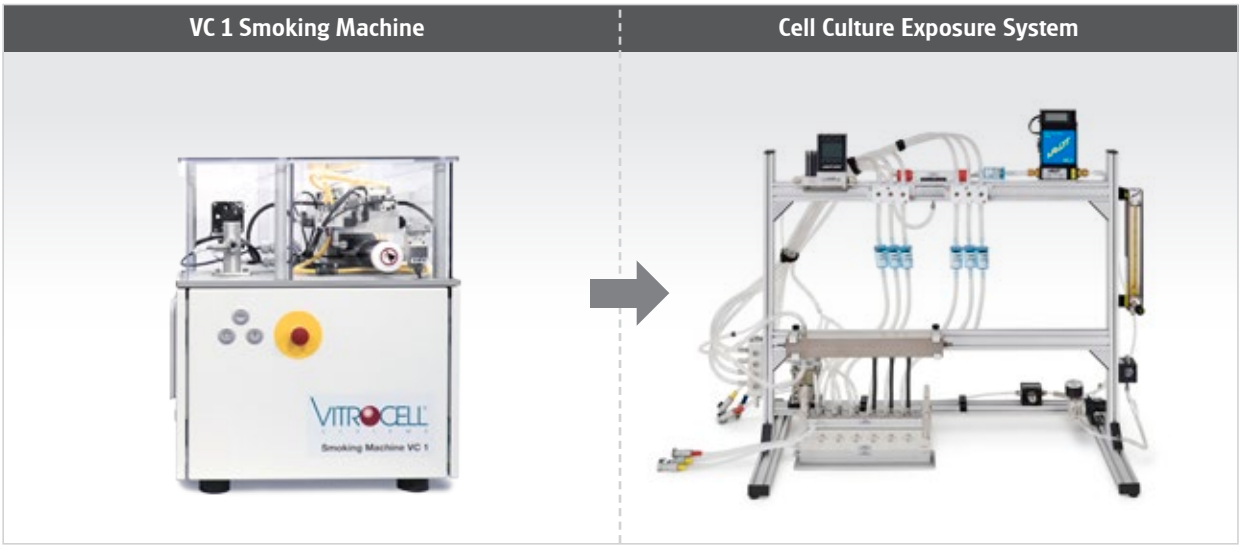
Software Control

Input is communicated via PC or laptop (part of delivery).

Scalability

Pooling to multiple machines possible.

Setup for Cell Culture Exposure



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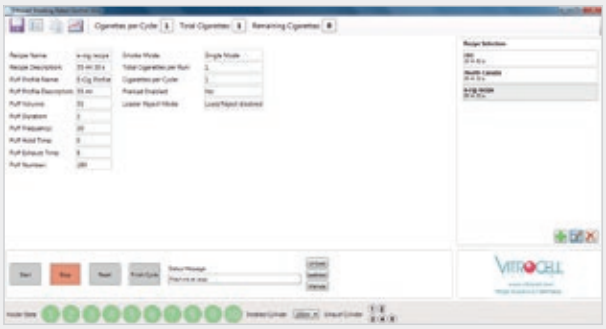
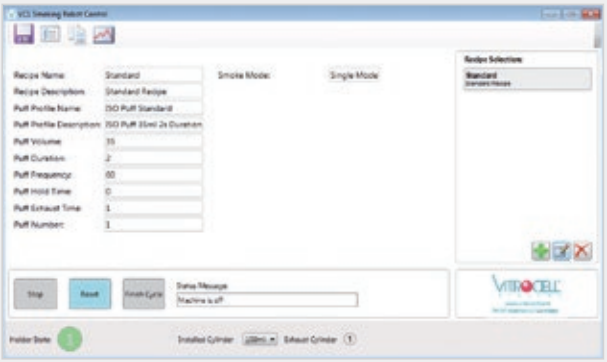
State of the art controls for highest precision



Software & Controls

The operation is controlled by Beckhoff software in conjunction with Microsoft Windows 10®. This setup offers extensive possibilities for integration with common Microsoft Office® applications and the exchange of data with Excel®-sheets.



Smoking parameters

The following parameters can be adjusted according to the needs of the experiment:

- Puff and exhaust duration
- Puff frequency
- Puff volume
- Puff profile
- Flow rate
- Clearing puff number
- Puff duration hold time
- Butt length via sensor

VITROCELL® Holder System for e-cigarettes

Secure and tight connection of any puff-actuated device to Smoking Machine

New designs of ENDS (Electronic Nicotine Delivery Systems) products lead to a large variety of different shapes which make the insertion into conventional holders with labyrinth seals impossible.

VITROCELL® has developed a new holder system which is flexible to adjust to different shapes. It is compatible with all VITROCELL® Smoking Machines & Robots.
In most cases the exchange of the inner sealing is sufficient to adjust for a specific shape.

VITROCELL® Vapestarter

For automatic button activation of e-cigarettes

This automated solution is designed to press the button in a precise manner and synchronized with the puff regime. The trigger function is controlled by the software of the smoking machine.

The system consists of an e-cigarette holder and different Vapestarter units which are tailor-made to fit tank products having different diameters as well as square shapes.

The Vapestarter unit for different dimensions of tank products

Features

- Integration into software of VC 1
- Vapestarters available for all sizes of tank products
- Inclination angle from 0-90°
- Quick-change mechanism for easy exchange of test products

Technical Data

Dimensions:	605 x 455 x 533 mm (L x W x H)
Voltage:	1 x 208-240 V, 50/60 Hz, 4 A
Compressed air:	4 bar (58 psi) min.
Remote service module:	Included / Internet access mandatory

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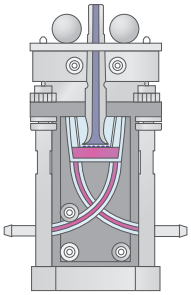
VITROCELL® 12/6 CF Stainless Steel Exposure Module

For 6 cell culture inserts (12-well size)

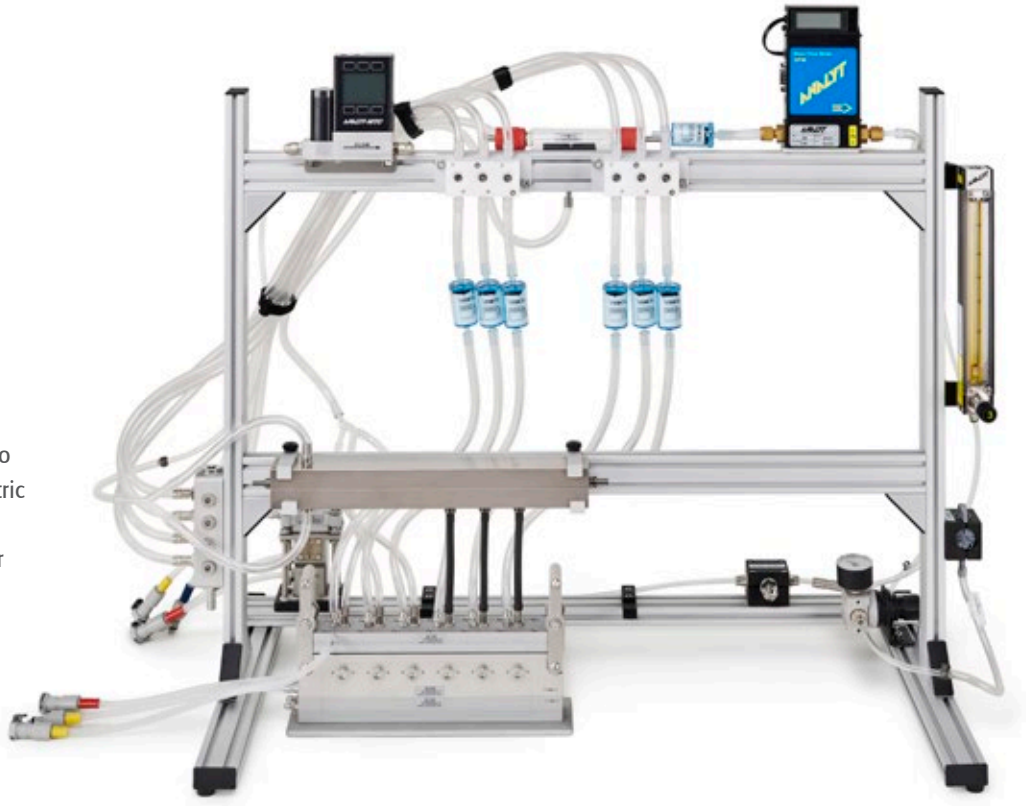
The VITROCELL® 12/6 CF module system has been specifically designed and engineered to facilitate the research of human cell cultures in direct exposure to airborne substances such as gases, complex mixtures, nanoparticles and fibers. The system authentically simulates the conditions of human physiological exposure.

Normally 3 compartments are used for exposure to the substances and 3 compartments for clean air control. The capacity can be easily increased by adding more modules. Each module can receive a different dose concentration, so that a complete dose / response profile is obtained in one experiment.

The cells are exposed at the air / liquid interface on 6 cell culture inserts using low flow rates of the aerosol. After exposure, the cells are further processed to measure a wide range of endpoints, e. g. cytotoxicity, genotoxicity, proliferation, cellular and oxidative stress as well as inflammation (see also VITROCELL® assay guide).concentration, so that a complete dose / response profile is obtained in one experiment.



Culture media supply
The media is supplied to the module by gravimetric method, syringe or using a media pump for intermittent / continuous media exchange.



VITROCELL® 12/6 CF Dynamic Dilution System and rack

Base module

The VITROCELL® 12/6 CF modules casing is made of electropolished stainless steel. It is designed with six compartments for 12-well cell culture inserts and is fully autoclavable at 121° C (250° F) for 20 min. Through the employment of a special adapter set, this module can also be flexibly combined for use with 24-well cell culture inserts. A constant unit temperature is guaranteed using a regulated flow of temperature-controlled water through the module. The media are supplied individually to each well compartment. Optionally, media exchange can be carried out on a continuous basis using a precision media pump.

This module is renowned in scientific circles for its reliability and durability.

Suitable for six cell culture insert (12-well size) – adaptor set for 24-well sized inserts available.

Aerosol exposure top with individual aerosol inlets

Special sealing and connection mechanisms guarantee a hermetic connection of the base module with the aerosol exposure top.

The aerosol inlet-stream flows through specifically shaped inlets. They are available in stainless steel or stainless steel with unique VITROGLIDE surface treatment for lowest adhesion results. The stainless steel / VITROGLIDE inlets are specifically designed for aerosols containing nano-particles.

The aerosol inlets are connected to the distribution or dilution systems. Extraction from the module takes place via small holes using a controlled vacuum flow. VITROCELL® calibration valves, which are connected to a vacuum pump, control flow rates effectively. The aerosol exposure top features an in/outlet for heating the water circuit, ensuring corresponding temperatures with the base module. It is made of high-quality anodized aluminum.

The module can easily be locked hermetically with the two levers attached to the base.

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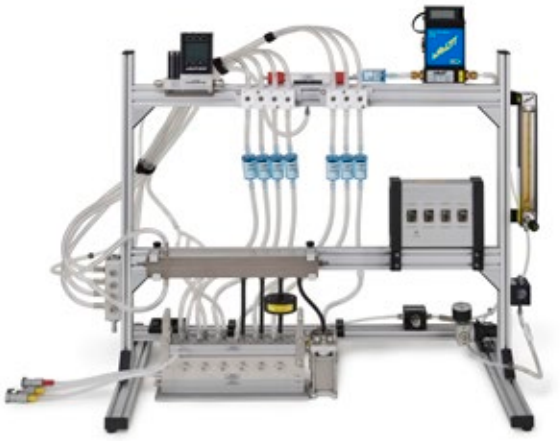
Option for microbalance sensor

The QCM sensor can be integrated in the VITROCELL® 12/6 CF exposure module. It is capable of measuring the deposited mass at a resolution of 10 nanogram/cm^2 per second. Results are reported online by the VITROCELL® Monitor software. Data is presented in graphs and stored in MS Excel®.

System available in different setups for dosimetry

The system can be combined with a separate single module for dosimetry. The dosimetry module can accomodate a stainless steel insert for trapping constituents of the aerosol in liquids. Alternatively it can be equipped with a microbalance sensor.

A photometer can be added either directly in the aerosol flow of the Exposure Module or at a seperate port of the main aerosol flow.



Rack with Dosimetry Module and Photometer connected to Exposure Module.

Rack with Dosimetry Module and Photometer connected to the main aerosol flow.

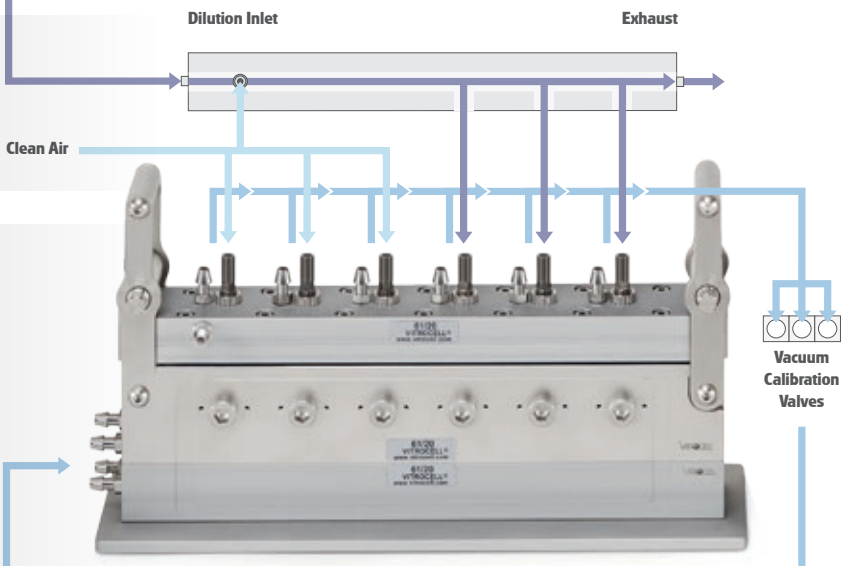
Features

- Suitable for COSTAR®, FALCON® and ThinCert® 12-well sized cell culture inserts
- For higher troughput
- Autoclavability of all components
- Base module made of electropolished stainless steel for extreme durability
- Base module with water heating base plate
- Hyperboloid geometry of inlets for optimized particle deposition and distribution
- Option: Quartz Crystal Microbalance

Flow Chart of VITROCELL® VC 1 with 12/6 CF Stainless Steel Exposure Module

Smoking Machine VC 1

Dilution System



Module 12/6

Temperature Control

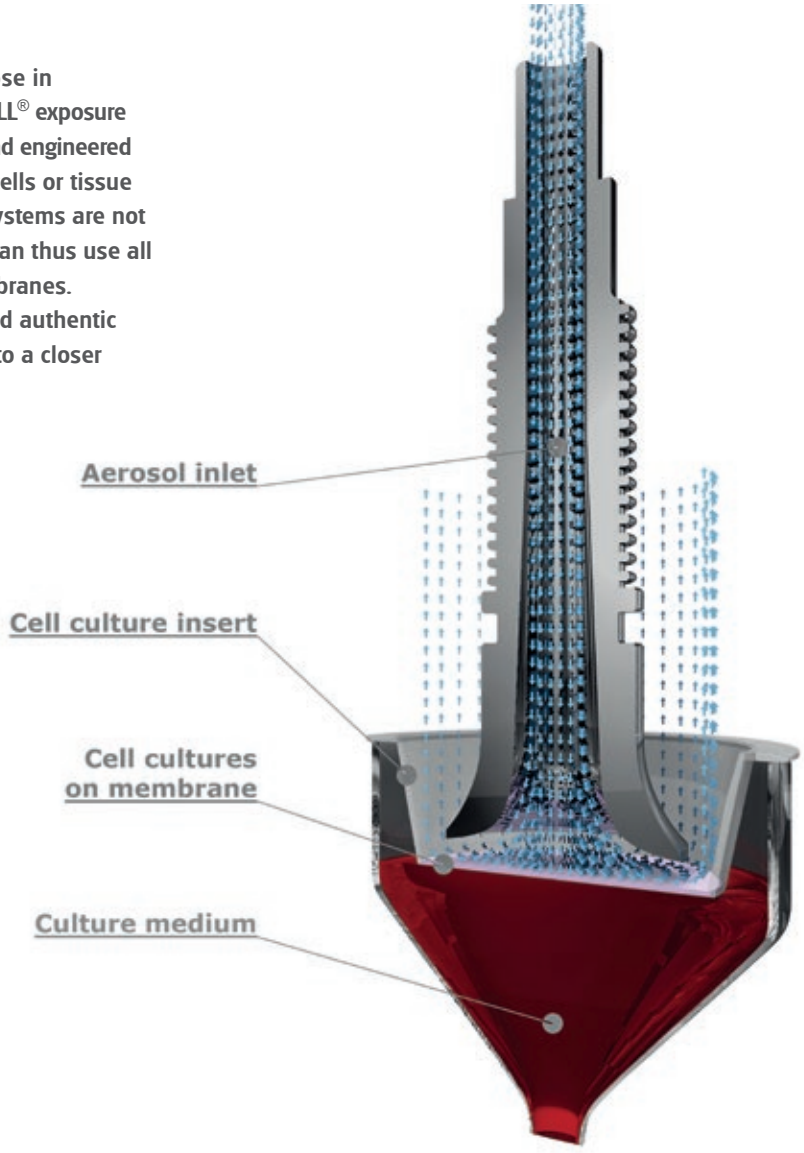
Vacuum Pump

VITROCELL® SYSTEMS

VITROCELL® Exposure Systems for Inhalation Toxicology

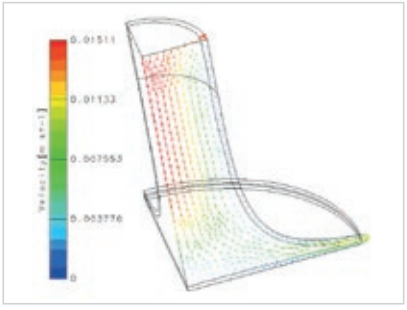
Direct Exposure Technology at Air/Liquid Interface

In response to the scientific need to expose in physiologically relevant conditions, VITROCELL® exposure modules have been specifically designed and engineered to enable direct exposure of mammalian cells or tissue at the air/liquid interface where the cell systems are not covered with culture media. Researchers can thus use all cell types cultivated on microporous membranes. This approach allows for more credible and authentic results than by submerged exposure due to a closer replication of the human physiology.



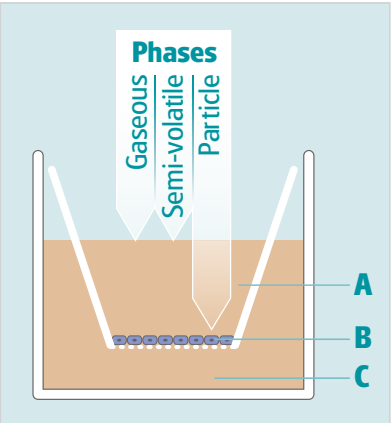
The advantages:

- No losses
- No dissolution
- No reaction of constituents with culture media
- High sensitivity



Optimized flow dynamics

VITROCELL® EXPOSURE AT THE AIR/LIQUID INTERFACE

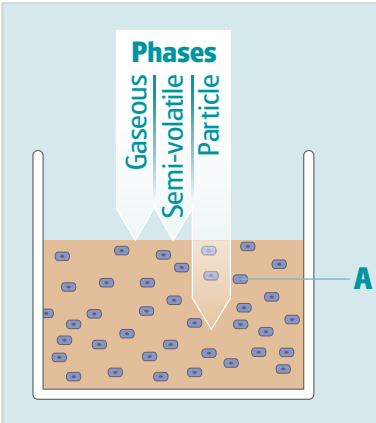


Submerged Cultivation and Exposure in Incubator

A Media above cells
B Cells on membrane
C Media below cells

Interaction of test components with culture media

Low sensitivity

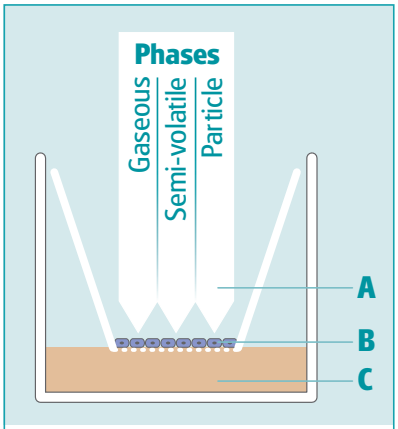


Suspension Cultivation and Exposure in Incubator

A Cells in media

Interaction of test components with culture media

Low sensitivity



Air / Liquid Cultivation and Exposure in Exposure Module

A Direct and controlled exposure of test atmosphere to cells
B Cells on membrane
C Media below cells

No losses
No reaction of principle components with culture media

High sensitivity of system

The exposure of mammalian cells or tissues to airborne substances is frequently performed under submerged conditions. In doing so, the test substances are dosed into the culture media. This procedure results in an undesired interaction of the formerly airborne substances with the media, causing limitations for authentic analysis.
Therefore VITROCELL® recommends the air/liquid interface exposure technology.

VITROCELL® SYSTEMS

About VITROCELL®

VITROCELL® exclusively concentrates on the developing, producing, installing, training and servicing of advanced *in vitro* exposure systems.

The VITROCELL® Systems' team is driven by their vision for new in-vitro standards through state-of-the-art technology, highly qualified workmanship and absolute client dedication. VITROCELL® has successfully collaborated with clients from leading research institutes, contract research organizations, regulatory authorities or industrial laboratories across the world. Working with our team experts, all modules have been tailored to create durable and complete turnkey-systems for ***in vitro*** inhalation toxicology. Gases, environmental atmospheres, nano particles and complex mixtures are analyzed on lung cells at the air/liquid interface using these systems. VITROCELL® technologies are also applicable to solutions for skin research.

Over a decade of devotion to research in this specific field has given our team of design & precision manufacturing specialists the opportunity to mentor highly diversified and complex projects **from conception to completion**. We strive to become a constructive member of each research team, providing support when it is needed, advice when it is required and modules of the highest quality, which are even polished by hand before leaving here to be integrated into your workspace. Every piece of our German engineered equipment is manufactured to the highest of standards – yours.

For more information
please scan the QR-Code:

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