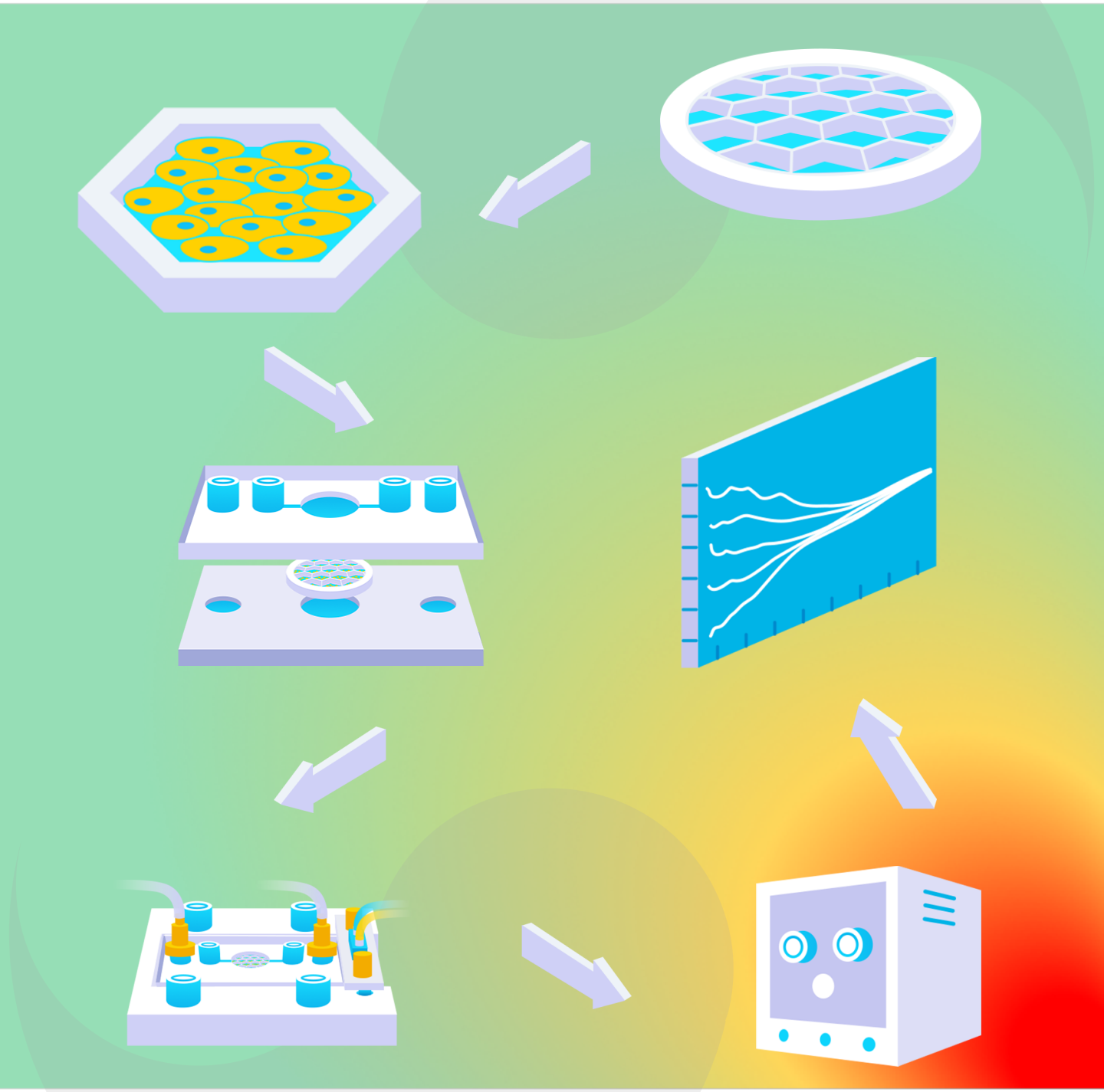
Integrative solutions for innovation

MesoBioTech



PRODUCT CATALOG *2022*

www.mesobiotech.com

About MesoBioTech

MesoBioTech is a spin-off of the microfluidics laboratory at the Ecole Normale Supérieure (ENS) of Paris with the participation of PSL foundation (Paris Science Letter Research University). The ENS laboratory itself is a part of the Institute of Pierre De Gennes for Microfluidics and the UMR 8640 of CNRS, ENS and Sorbonne University .

Solutions and applications

*Patented technology

Microfluidic solution
- Integrated chips
- Integration chips
- Chip clamp
- Flow controller
- Micro filter
- Debubbler
- High resolution imaging
- Electrochemical sensing

Organ chip solution
- Artificial basement membrane
- Cell patch
- Tissue patch
- Organ chip
- Culture automation
- Fluorescence microscopy
- Microphysicology measurement
- In-situ TEER monitoring

Bioproduction solution
- Organoids
- Tumor spheroids
- Alveolar mimics
- Cardiac tissues
- 3D neural networks
- Functional droplets
- Platelets

Smartplatform
- Membrane permeability test
- Membrane stiffness test
- Rare cell capture
- Metastasis modeling
- Cell culture platform
- iPS long term differentiation
- Microfluidic drug screening





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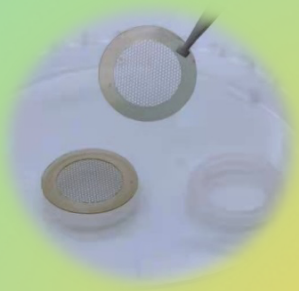

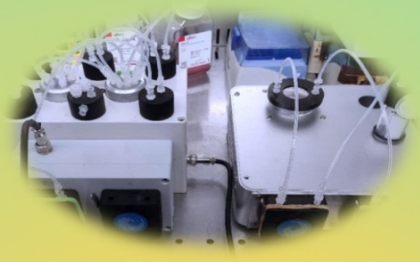

STEM CELL DEVICES & SYSTEM

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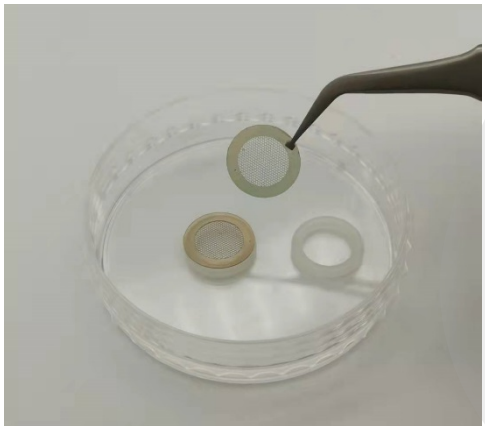
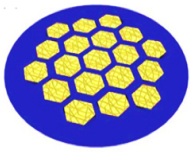
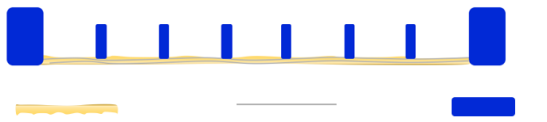
Culture Patch



Culture patch are designed for 3D cell culture to reconstitute basement membrane in vitro. The culture patch was was obtained by self-assembling type IV collagen and laminin with a monolayer of crosslinked gelatin nanofibers and a patterned honeycomb microframe. Compare to conventional 2D culture devices (culture dish, flasks etc.), It allows generating stable and functional 3D cell/tissue assays in vitro.



Culture patch

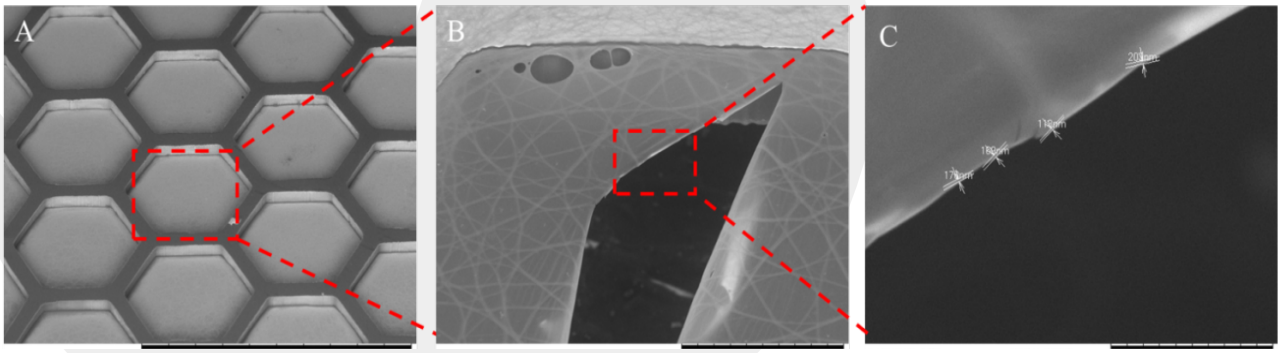


Main features

- Artificial basement membrane
- Nature biopolymer
- Appropriate physical properties
- Easy handling
- Easy device integration
- Compatible with conventional culture

Technical Specifications

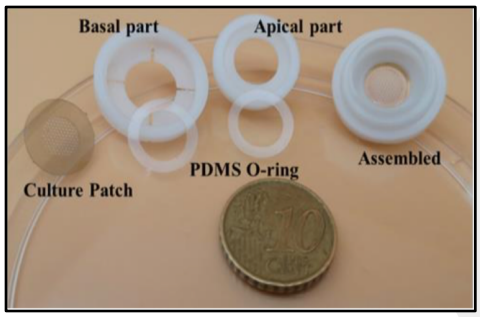
Patch size (Diameter)	13mm
Patch thickness	200um
Honeycomb size	500um
Well thickness	50um
Membrane thickness	100-200nm
Fibers	Gelatin
Membrane	Collagen IV +Laminin

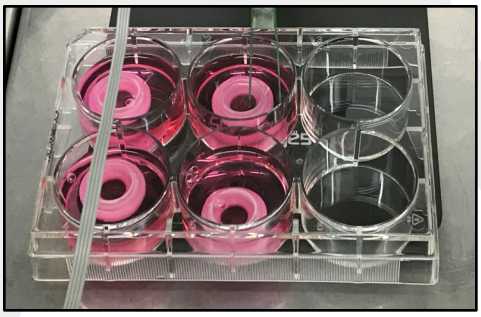


Scanning electronic microscopy of : A) arrays in culture patch B) and (C) self assembled Collagen IV+ Laminin with gelatin fiber backbone.

Culture Patch

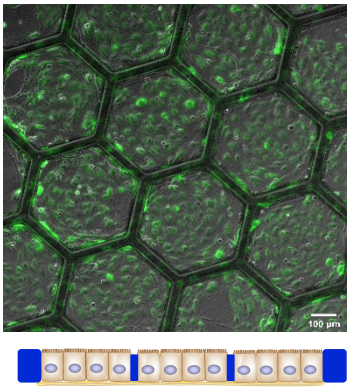
Culture patch can be simply placed in conventional Petri-dish/multi wells with specific patch holder for off-ground static cell culture.



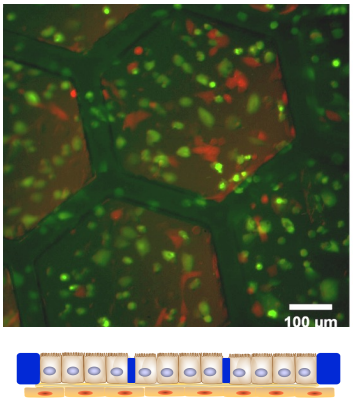


Cell culture

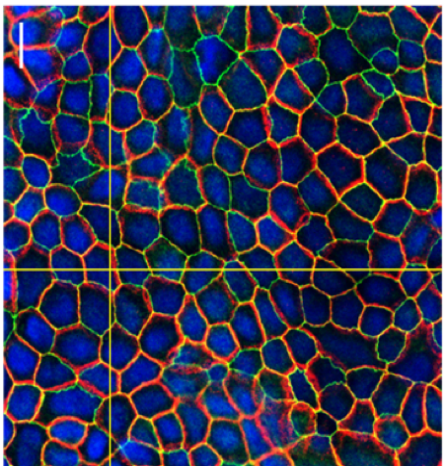
Culture patch is suitable for both mono cell type culture in the honeycomb wells and two types of cells co-culture. After culture, the patch can be treated for imaging and analyses.

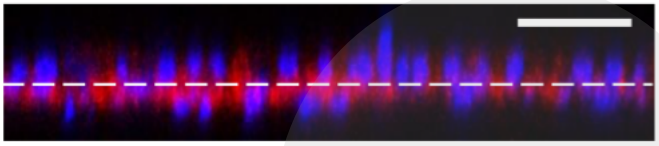


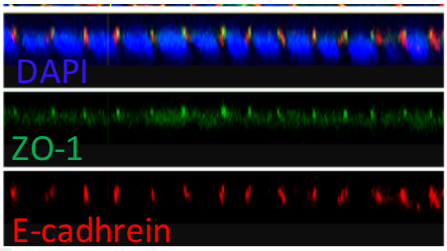
Mono cell type culture



Co-culture







For culture performance, the culture patch has been studied for MDCK, showing much improved performances in terms of cell polarity and homeostasis, tight junction forming.

Product code	Description
SC-CP11	PEGDA frame – gelatin fibers
SC-CP12	PEGDA frame –gelatin fibers-Collagen IV/Laminin
SC-PH00	Culture patch holder

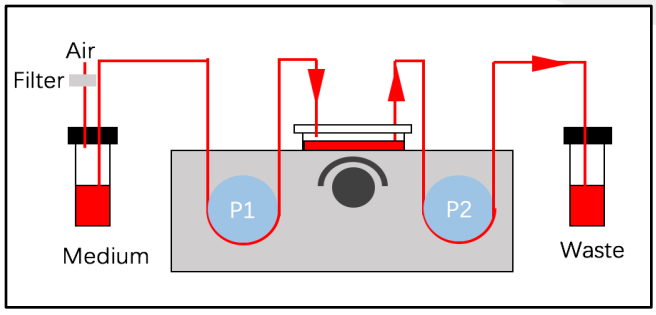
Advanced cell culture

Advanced cell culture system has been developed for automated cell culture and stem cells differentiation in order to reduce laborious efforts and decreasing risks of contamination. It is also flexible and robust for studying complex biological processes and building in vitro disease models by fluidic physiology condition mimicking.

Working principle

Depending on culture conditions , three models have been proposed: 1) AC-121; 2) AC-126 and 3) AC-621. the working principles were illustrated as following :

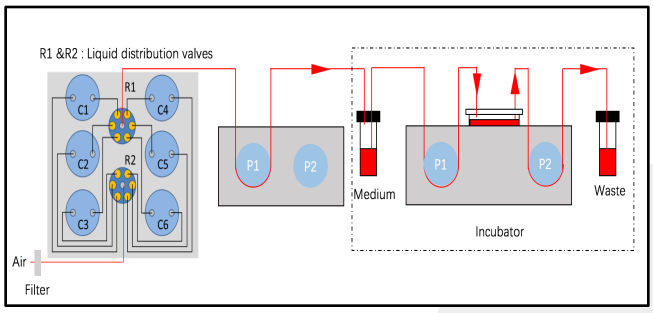
AC-121

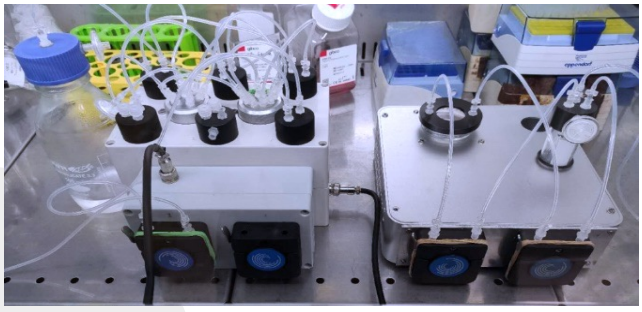


Main features

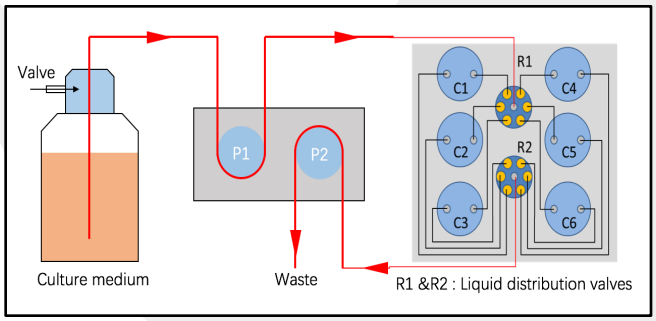
- Automated medium exchange
- Impulsed nutrient feeding
- High temporal resolution
- Longterm stability
- Flexible processing
- Compatible with dish culture
- Reliable for organ chip assays

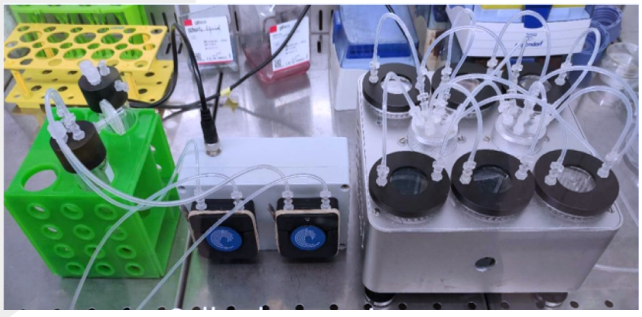
AC-621





AC-126





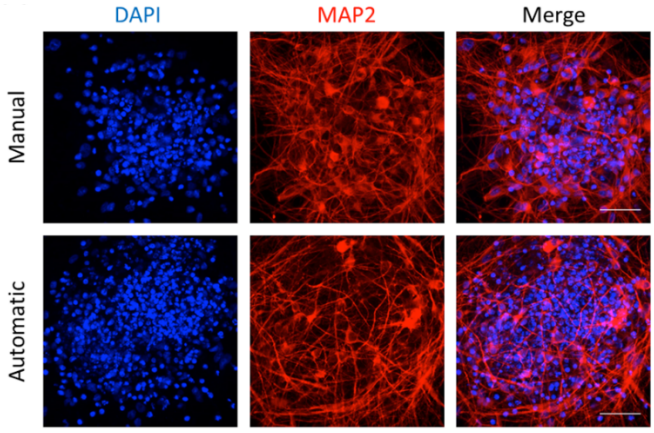
Advanced cell culture

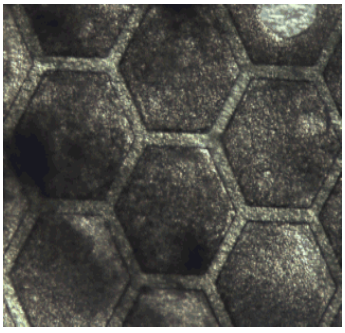
Technical Specifications

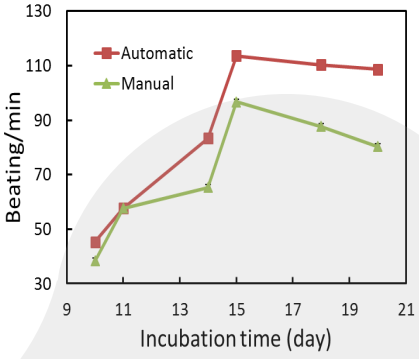
Configurations& parameters	Peristaltic pump: 0-300rmp/min
	Rotary valve: 8 channels, response time 1s
	Flow speed: 3ul/min-40ml/min
	Interface communication: RS485
General parameters	Gas fittings: Luer
	Dimensions: 155×175×100 mm
	Weight: 1Kg

Applications

Advanced cell system is particularly suited for automated long-term differentiation of stem cells. For example, AC-126 system could be worked to generate mature neurons differentiated from iPSCs for 78 days. The results are comparable with that obtained by manual processing.







AC-621 system could be use for differentiation of iPSCs toward cardiomyocytes which involved six types of culture media exchange during 20 days.

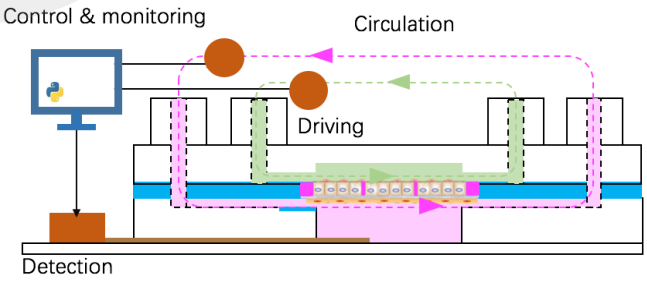
Product code	Description
AC-121	One medium exchange for one dish
AC-621	Multi medium exchange for one dish
AC-126	One medium exchange for six dish
AC-CAP-01	Dish adaptor

Organ on chip system

Organ-on-a-chip is a high potential technology allowing simulating the mechanics and physiology of human organs in vitro. It turns out the powerful tools which can be used for acceleration of drug development: Faster, lower cost and more accurate.

Main features

- Easy organoid integration
- Easy body on chip assays
- Flexible flow control
- Flexible chip configuration
- Easy takeoff for analyses
- Standard and low cost
- Compatible with conventional assays



Working principle

A typical OOC system has four major components including microfluidic chip, culture patch with cells, flow control and detection modules:

- The microfluidic chip was used to integration culture patch with living cells, to circulate culture fluid input and discharge waste, to generate chemical gradient and shear force during the culture process;
- The culture patch was used for 3D cell culture or tissue formation with appropriate materials, structures and other physical specificities including stiffness, permeability, etc;
- The detection module are sensors allowing real time characterization the metabolites released, monitoring the function as feed back for adjusting;
- The control system enables system automation to control environment at spatial & temporal resolution, to stimulate fluidic force , to maintain system for long time stability.

Product code	Description
SC-CP12	Culture patch
P1P-34-200	Integration chip
OOC-AC-100	Flow control system
OOC-KIT	Accessories for OOC system

Integrative solutions for innovation

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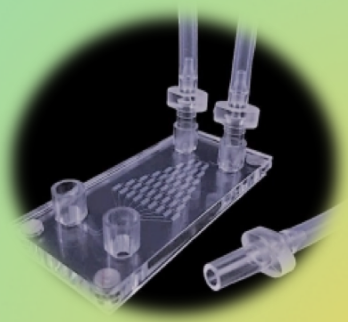

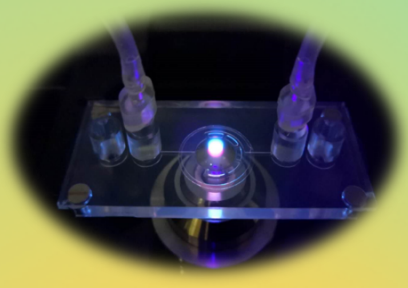

GENERAL MICROFLUIDIC TOOLS

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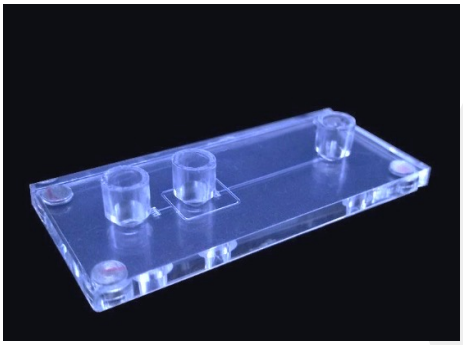
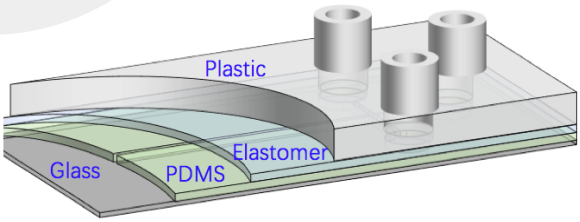
Integrated chips



Integrated chips are manufactured by mass production. The basic element of the chip (upper part) is a plastic plate with standard Luer connectors and an elastomeric thin film for conformal contact with the lower part in which microfluidic circuits can be patterned. The lower part can be a sheet in plastic, elastomeric, glass, silicon or other materials.

Main features

- Integrated patterns (see next page)
- Standard Luer connectors
- Plug-and-play configuration
- Different substrate choices
- Users may define their patterns
- Users may engineer their patterns
- Mass production

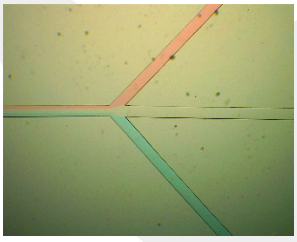


Technical Specifications

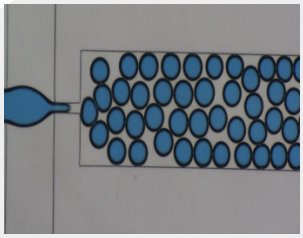
Chip size	55 mm x 25 mm x 4 mm
Channel depth	50/100um
Channel width	50-200um
Substrate	Glass or PDMS
Materials	Polycarbonate/silicon film
Connectors	Luer (1/16)

Applications

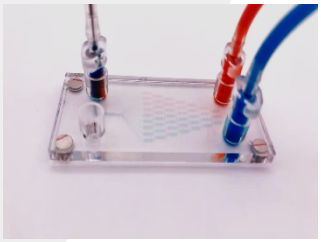
Integrated chips were designed for plug & play. Common patterns could be used for fast microflow manipulation including laminar flow formation, droplet production, chemical gradient generation, electrophoresis etc.



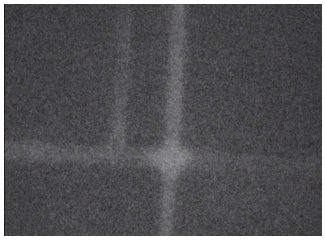
Laminar fow formation



Droplet production



Gradient generation

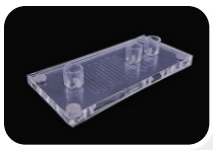


Electrophoresis

Integrated chips

Devices with common patterns (below) are available. Otherwise, customized patterns can be ordered or defined by users.

Droplet1
P1E-13-001



Droplet2
P1E-13-002

Shear Chip
P1E-13-003

Centrifuge
P1E-13-004

lamina flow
P1E-14-005

Xmax tree
P1E-14-006

Mixing
P1E-14-007

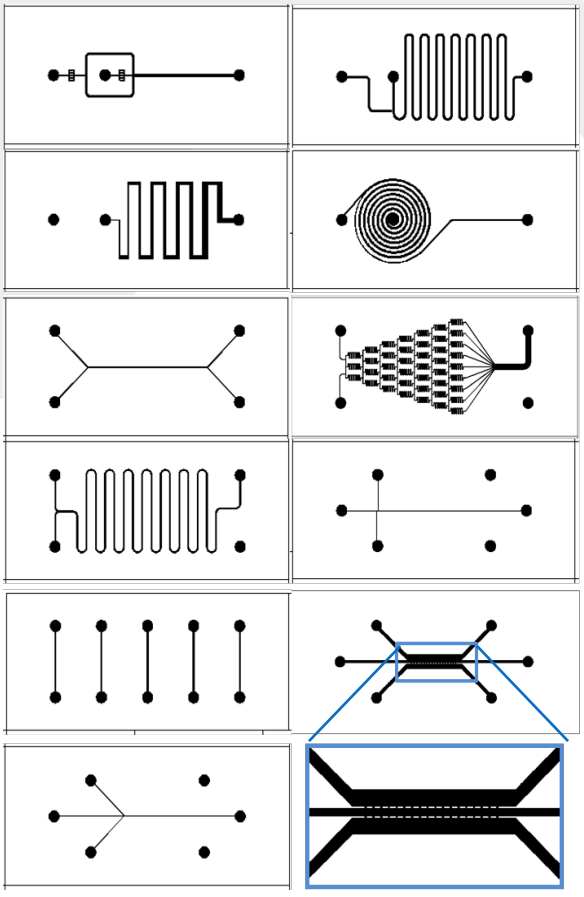
Electrophoresis
P1E-16-008

Flow Focus
P1E-14-009

Drug screening
P1E-1X-010

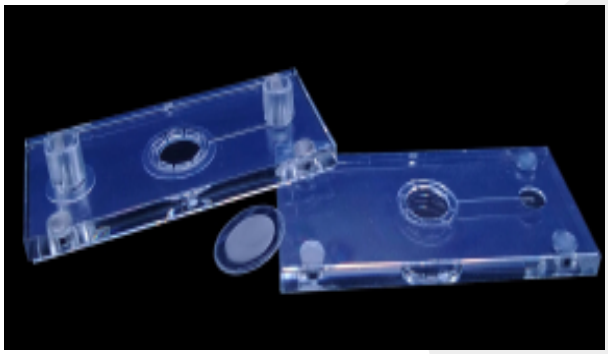
Migration
P1E-16-011

Filter integration
P1P-32-100



Product code	Description
P1E-13-001	Droplet1
P1E-13-002	Droplet2
P1E-13-003	Shear chip
P1E-13-004	Centrifuge
P1E-14-005	Lamina flow
P1E-14-006	Xmax tree
P1E-14-007	Mixing
P1E-16-008	Electrophoresis
P1E-16-009	Flow Focus
P1E-1x-010	Drug Screening
P1E-16-011	Migration
P1P-14-012	High resolution imaging

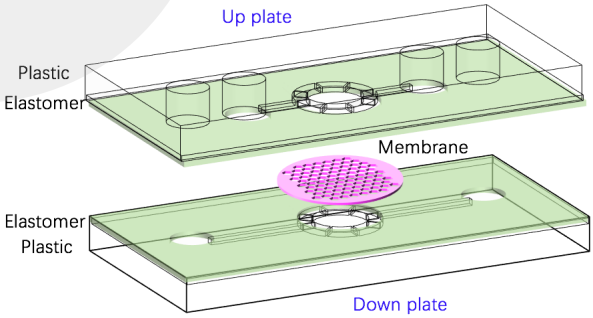
Integration chips



The **integration chips** are designed for filter/membrane or customized elements integration. An elastomeric thin film on the pre-patterned plastic plates could ensure good sealing without leakage when clamped. It can also be used to incorporate micro electro arrays/optical fibers for detection due to the flexibility of reversible assembling.

Main features

- Pre-patterned channels & chambers
- Standard Luer connectors
- Easy filter/membrane integration
- Customized elements integration
- Electrodes /optical fibers integration
- Reversible assembling
- Flexible flow passages

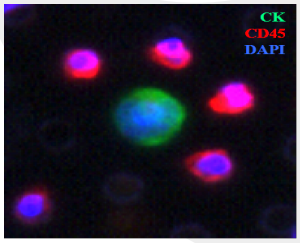


Technical Specifications

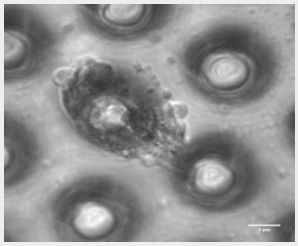
Upper plate size/Lower plate size	55 mm x 25 mm x 3 mm
Channel & chamber depth	500um
Channel width	1000um
Chamber inner diameter	8mm
Dimension for membrane insert	Φ 13 X 0.2 mm^2
Materials	Polycarbonate/silicon film
Connectors	Luer (1/16)

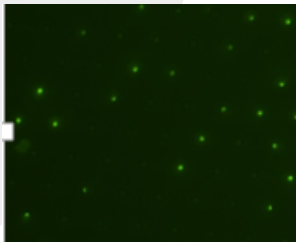
Applications

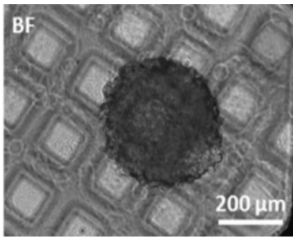
Integration chips were designed for reversible assembling of micro devices for specific applications such as trapping, separation, 3D culture etc. It is robust and flexible to integrate with different types of elements. By this method, we can avoid complicate chip design and fabrication thereby to reduce the cost.



Rare cell isolation


Platelets production

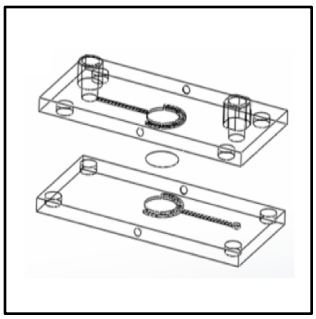

E. coli detection



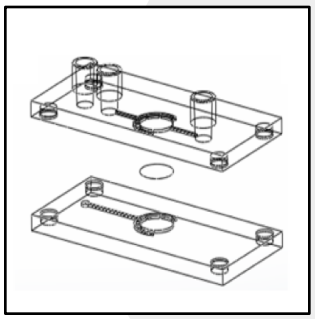
Tumor spheroids formation

Integration chips

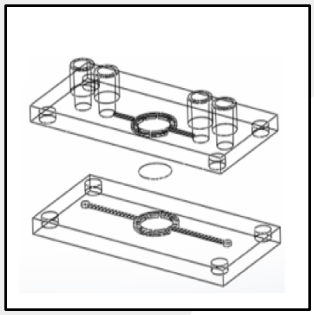
Depending on applications, four types of channel configurations can be used as illustrated below:



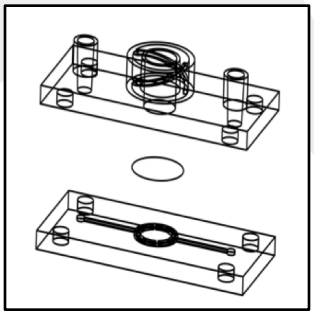
P1P-32-100



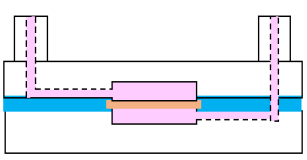
P1P-33-100

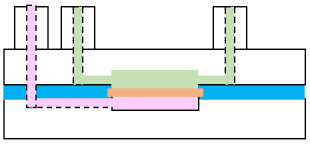


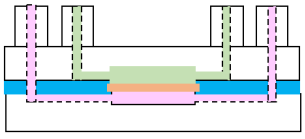
P1P-34-200

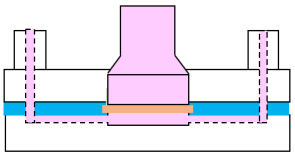


P1P-32-101



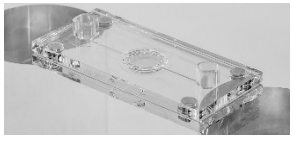






Quick installation

Good sealing is achievable with a open-screwing clamp. The working flow is illustrated demonstrated below. After on chip operation, the integrated elements can be released for more conventional analyses.



① Assembling

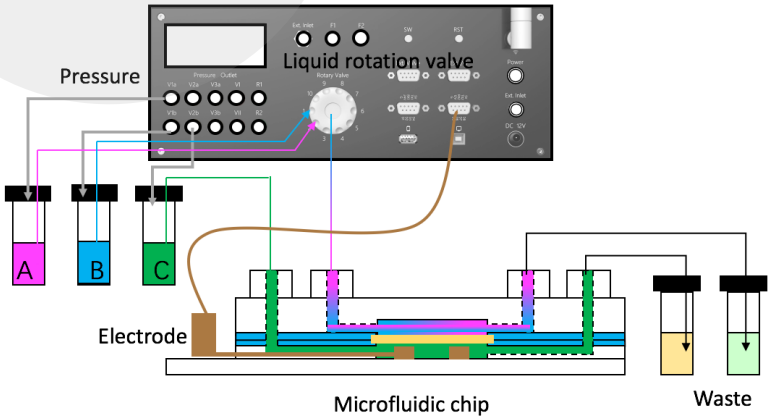
② Insert

③ Screwing

Product code	Description
P1P-32-100	Integration chip (2 connectors)
P1P-33-100	Integration chip (3 connectors)
P1P-34-200	Integration chip (4 connectors)
P1P-32-101	Integration chip (2 connectors+ open reservoir)
MC-4A	One chip clamp
MC-4B	Four chip clamp

Multi function flow controller

FC-PVL multi function flow controller was designed for experimentation in physics, chemistry, biology, biomedicine and different engineering fields. It is versatile and flexible, allowing easy and automatic control of complex fluidic (gas, liquid, electric) processes. It is a compact and open source platform for professional system development.



Main features

- Built-in pressure & vacuum generators
- Inlet for external pressurized sources
- High precision pressure regulators
- Multichannel pressure switches
- Multichannel liquid distributors
- Multichannel control of external valves
- Multichannel Analogical &digital in/out
- Pre-programed off-line operation
- Graphic users interface
- Integrated Wifi/Bluetoutch modules

Working modes

Offline operation: All internal and some of the external elements can be controlled with the front panel buttons and knobs. The user defined program sequences or algorithms can also be chosen for automatic operations.

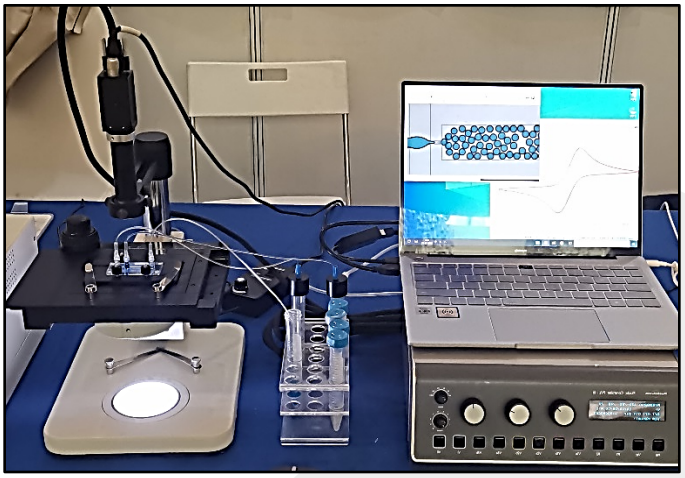
Online operation: Computer programs in C++, Matlab or Android are prepared with appropriate graphical interface to facilitate the control and monitoring or to download program sequences or algorithm into the apparatus for offline operations.

Network operation: The remote control is feasible with Bluetooth, wireless or Ethernet using smartphones, tablets and other terminals.

Multi function flow controller

Technical Specifications

Configurations& parameters	Built-in air pump : 5mbar/1000mbar, noise < 65 db
	Built-in vaccum pump : -0.5mbar/-500mbar, noise < 65 db
	4 high precision regulator: accuracy±1mbar
	8 solenoid valves & 2 pressure release valves: response time100ms
	1 rotary valve: 10 channels, response time1s
	8 channels of 12V voltage output
	4 analog outputs and 4 analog inputs
	3 digital outputs /inputs & 1 TTL serial output
	2 RS232 port
	4KB EPPROM (for numerical sequence storage) & 1GB SD card memory
	Bluetooth communciation module
General parameters	Gas fittings: Luer
	Dimensions: 275×250×110 mm
	Weight: 4.5Kg



Optional functions

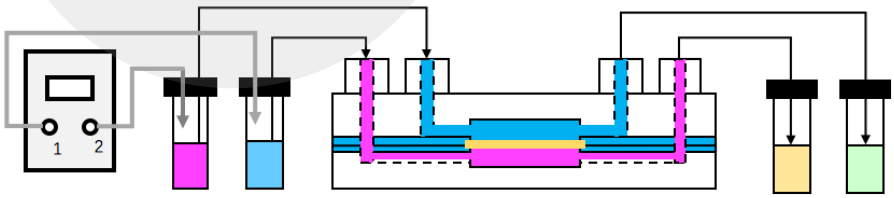
- Low noise pressure source
- Additional valve array
- Flow meter
- NI-Daq
- Portable power
- Microscope stage
- CCD camera
- Optical spectrometer
- Electrochemical workstation

Product code	Description
FC-PVL2	Multi function fluidic controller (Manual pressure regulator)
FC-PVL4	Multi function fluidic controller (Electronic pressure regulator)

*MesoBioTech will provide open sources or SDK for uses' development.

High precision pressure controller

FC-HPV high precision pressure controller was designed for experimentation in physics, chemistry, biology, biomedicine and different engineering fields. Compare to conventional fluid controller, it is simple and suitable routine fluid experiments. allowing quick installation and manipulation without using graphic interface.



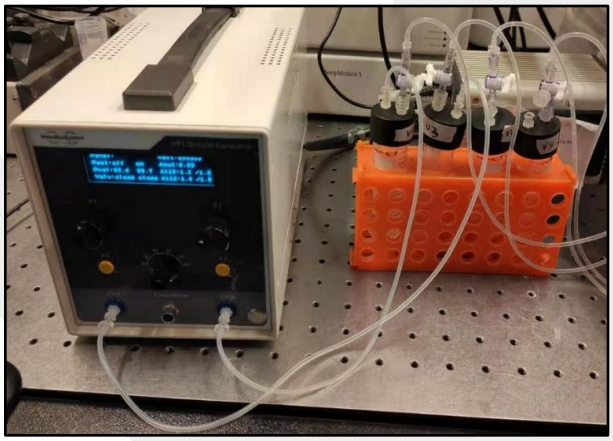
Main features

- High precision pressure regulators
- Flow rate monitoring
- Panel control of integrated element
- Programed off-line operation
- Graphic users interface
- Portable and easy to use

Working modes

Offline operation: Knobs and buttons on the front panel are used to adjust the working pressure and to switch the solenoid valves. The five-position switch is used to load and run systematically the pre-registered programs or sequences.

Online operation: Each fluid component can be controlled and monitored using a graphic users interface with a PC. One can easily change the program or parameters for offline operation.



Optional functions

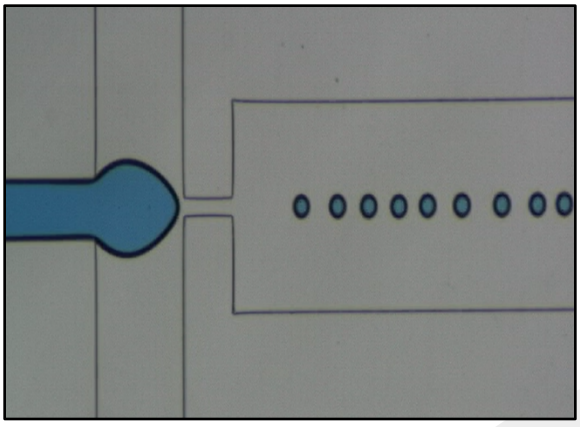
- Low noise pressure source
- Additional valve array
- Flow meter
- NI-Daq
- Portable power
- Microscope stage
- CCD camera
- Optical spectrometer
- Electrochemical workstation

High precision pressure controller

Technical specifications

Configurations& parameters	Built-in air pump : 0mbar/2000mbar, noise < 65 db
	2 high precision regulator: accuracy±1mbar
	2 solenoid valves: response time100ms
	1 flow meter connector
	1 RS232 port
	5V/24V output
General parameters	Gas fittings: Luer
	Dimensions: 150x280x160mm
	Weight: 1.5Kg

Application



In particular, FC-HPV controller could be used as an cost effective system for **droplet generation** with high speed and high stability.

It could also be extended to control with external balance for **membrane permeability estimation**

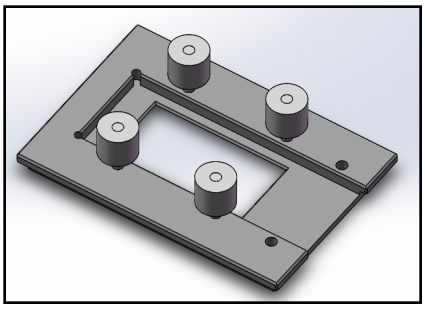
Product code	Description
FC-HPV1	High precision pressure controller (Manual pressure regulator)
FC-HPV2	High precision pressure controller (Electronic pressure regulator)

*MesoBioTech can provide open sources or SDK of FC-HPV & protocol for external common lab equipment communicatio for uses' development.

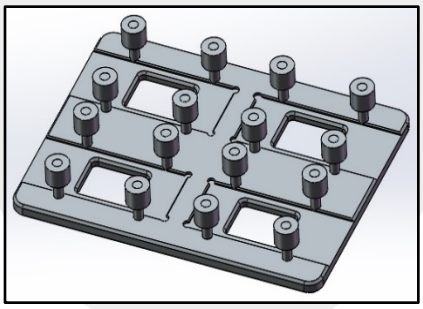
Module for chip interface

Chip Clamp

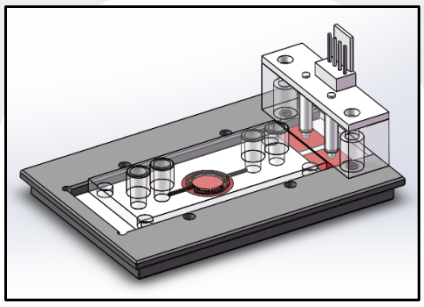
Multi type chip clamps were designed to cooperate with our integration chips for different purpose applications. Quick assembling /disassembling and good sealing can be achieved with our chips with help of these clamps.



Clamp for one chip



Clamp plate



Clamp for electrode integration

Main features

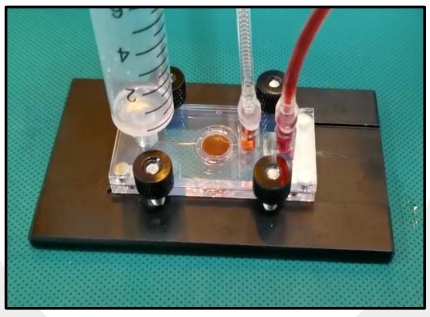
- Fasten with hand screw
- Microscope imaging compatible
- Multi chip in one clamp
- Plug& play electric connector
- Extension flexibility

Technical Specifications

Dimension	80mm x 55mm x 5.5 mm
Chip holder dimension	75mm x 25 mmx 3mm
Open window	40mm x 20 mm
Materials	Hard aluminium

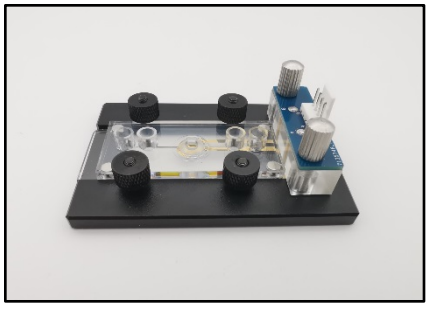
Applications

With help of these clamps, microfluidic experiments could be realized in short time with all standard and separate modules (chips, substrate and micro components, etc.) It is easy to use especially for peoples who have no experience in microfluidic.



Blood filtration

Organ on chip



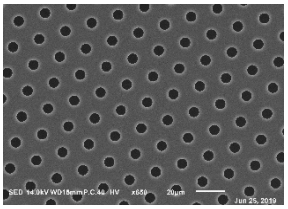
Electrochemical detection

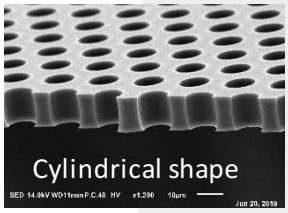
Product code	Description
MC-4A	chip clamp
MC-4B	Clamp plate
MC-4C	Electrode integration clamp

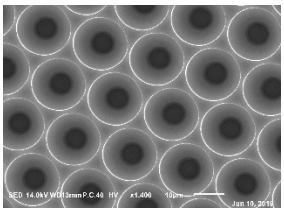
Module for chip interface

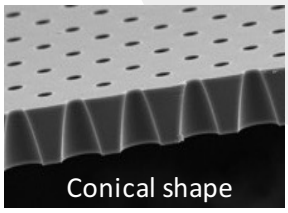
Micro filter

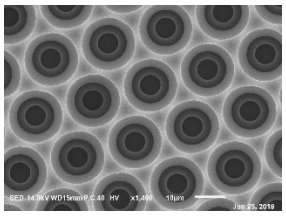
Micro-engineered filters were designed and fabricated with different shape, size and density of the holes. The micro holes are highly regular distributed with high precision size definition allowing filtration with high throughput.

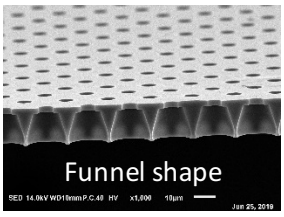












Main features

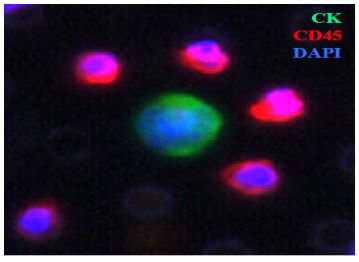
- Highly transparent
- Low background fluorescence
- High precision holes arrays
- Biocompatible
- Easy for manipulation with ring

Technical Specifications

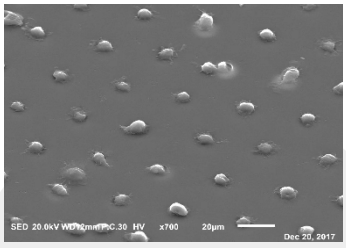
Filter size	13mm
Area with holes	9mm
Thickness	20um
Hole shape	Cylindrical/Conical/Funnel
Hole size	5-20um
Hole numbers	$2*10^5$

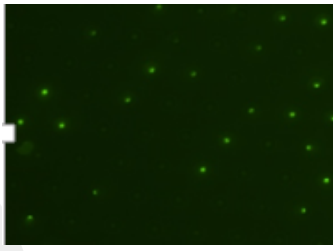
Applications

The micro engineered filter could be applied in many areas including micro organism separation, micro objet production, etc.



CTC isolation from blood



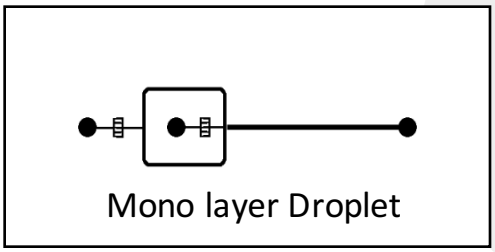


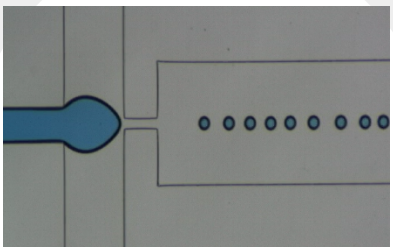
E. coli from polluted water

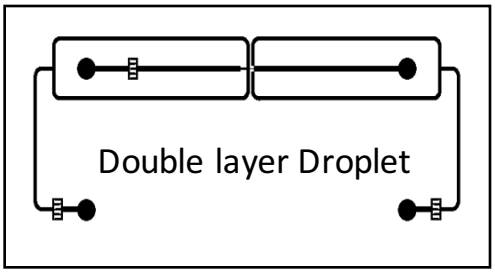
Product code	Description
MF-CL10P20	Cylindre holes filter: 10um diameter, 20um period
MF-CL20P40	Cylindre holes filter: 20um diameter, 40um period
MF-CN6P20	Conical holes filter: 6um diameter, 20um period
MF-CN8P20	Conical holes filter: 8um diameter, 20um period
MF-FU6P20	Funnel holes filter: 6um diameter, 20um period
MF-CN8P20	Funnel holes filter: 8um diameter, 20um period

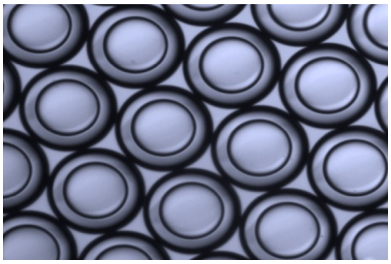
Droplet generation pack

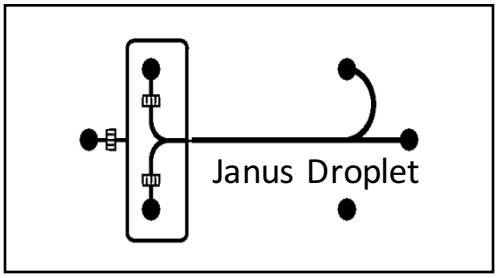
Droplet-based microfluidics manipulate discrete volumes of fluids in immiscible phases with low Reynolds number and laminar flow regimes. Micro droplets offer the feasibility of handling miniature volumes of fluids allowing mixing, encapsulation, sorting.

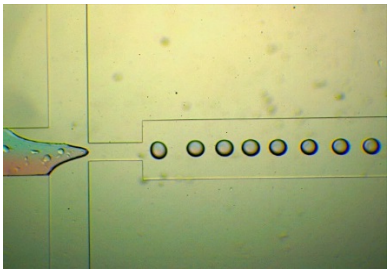










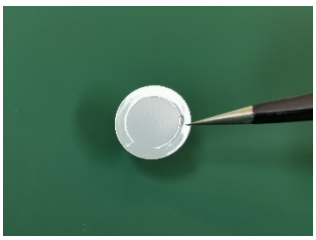


We propose different kinds of droplet generation chips which are standardized and suitable for for high throughput droplet production. Monodispersed, double emulsion and Janus droplet could be generated by combining our flow control systems.

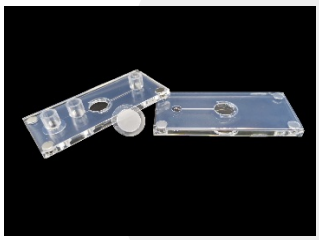
Product code	Descriptions
Droplet generation pack	2 chips of choices below, flow Controller & accessories
P1E-13-001	Mono layer droplet generation chip
P1E-14-001	Double layer droplet generation chip
P1E-16-001	Janus droplet generation chip
FC-HPV	High precision pressure controller

Micro filtration pack

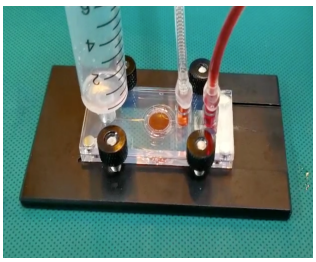
Microfiltration is a type of filtration physical process where a contaminated fluid is passed through a special pore-sized membrane to separate microorganisms and suspended particles from process liquid.



Micro filter



Filter integration chip



Device assembling

Control processing

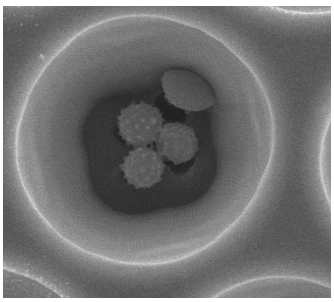
The micro filtration package is a simple kit designed for high through filtration within microfluidic chip. Specific micro holes arrays filter could be adapted. The filtration process could be adjusted precisely and the whole process could be programmed automatically.

Main features

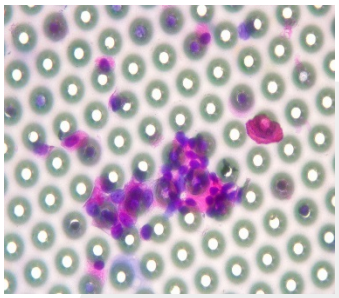
- Membrane integration chips
- Reversible assembling with screw clamp
- High precision filtration flow control
- Filtration & labelling in one chip
- Regular & high pore numbers filter

Applications

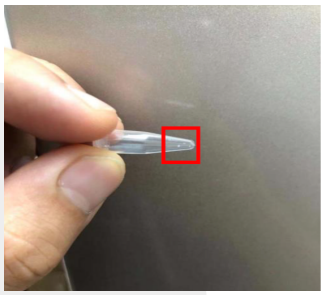
This filtration package could be applied to isolate rare cell by size from bio-liquid such as blood, urine, Pleural fluid, etc. After enumeration, the filter could be taken out for in situ downstream analyzing including stainning for indentification, nuclei acid extraction for PCR amplification or culture for proliferation.



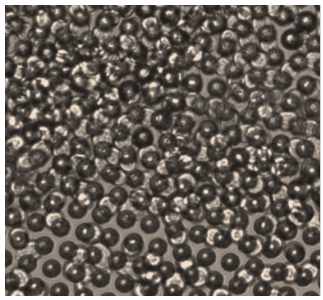
Isolation



Stainning



PCR

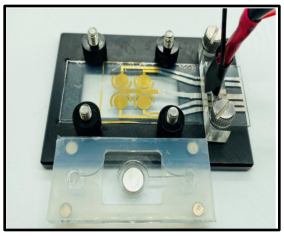


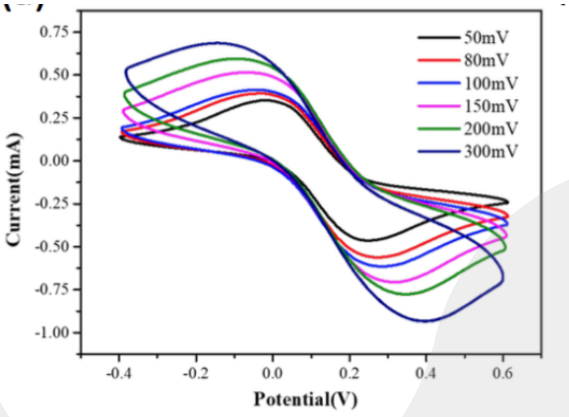
Culture

Product code	Descriptions
Microfiltration pack	Micro filter integrated chips, flow Controller & accessories
P1P-32-100	Integration chip
MF-CL/CN/FU *	Micro engineered filter, please find details in corresponding page
FC-HPV	High precision pressure controller
MC-4A	Clamp for chip & filter assembling

Electrochemical detection pack

Electrochemical methods are simple, sensitive, low-cost, and applicable to such as environmental monitoring, early screening of diseases, food quality control, etc. The integration of electrochemical sensor into a microfluidic device allows performing in situ, continual and low-volume biomarker analyses.





The electrochemical detection pack proposed is based on module (chip, electrode, connectors) separation and standardization with low cost and high flexibility. We can reversible assembling all elements step by step through simple screwing, plug in and playing. In addition, a pocket electrochemistry station were designed for suitable electrochemical detection, sample screening combination.

Specifications of EC station

Potential range	±5 V
Compliance voltage	±5 V
Maximum current	±50mA
Current range	1 nA to 10 mA (6 ranges)
Current resolution	1 nA
Mode	CV/ LSV/i-t
Size	8.0 x4.6x2 (cm)
Weight	80g

Main features

- Chip, electrodes separate
- Reversible assembling with screw clamp
- Pocket electrochemical station
- High flexibility and low cost

Product code	Description
Electrochemical detection pack	chips , EC arrays, EC station, flow controller & accessories
FC-EC-1550A	Pocket Electrochemical station
P1P-EC-100	Microfluidic chip
E1E-EC-100	Electrodes arrays
MC-4C	Clamp with electric connetor

Challenging the simplicity!

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