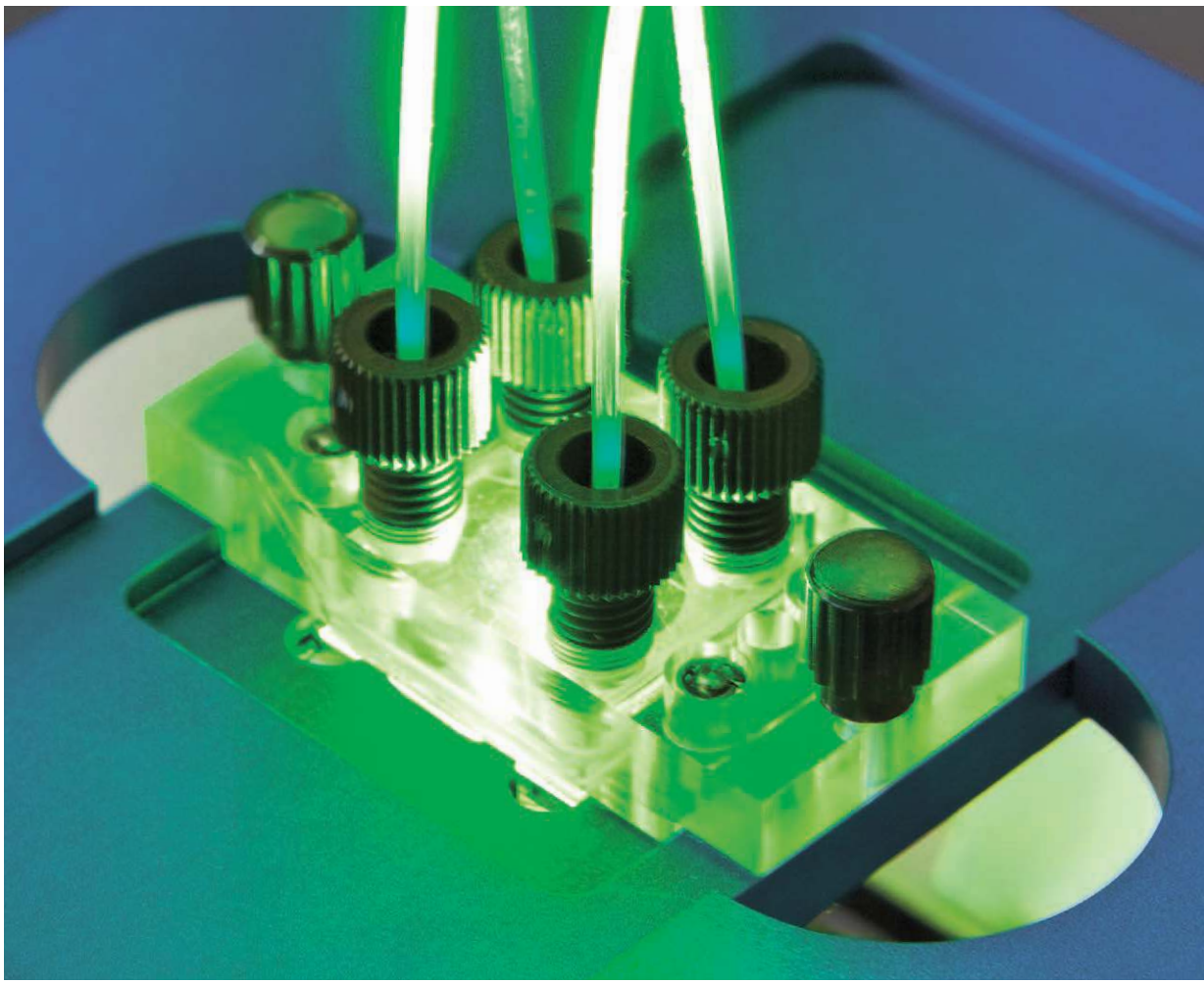
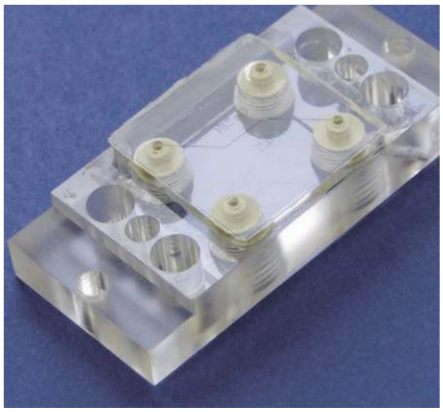
MicCell™

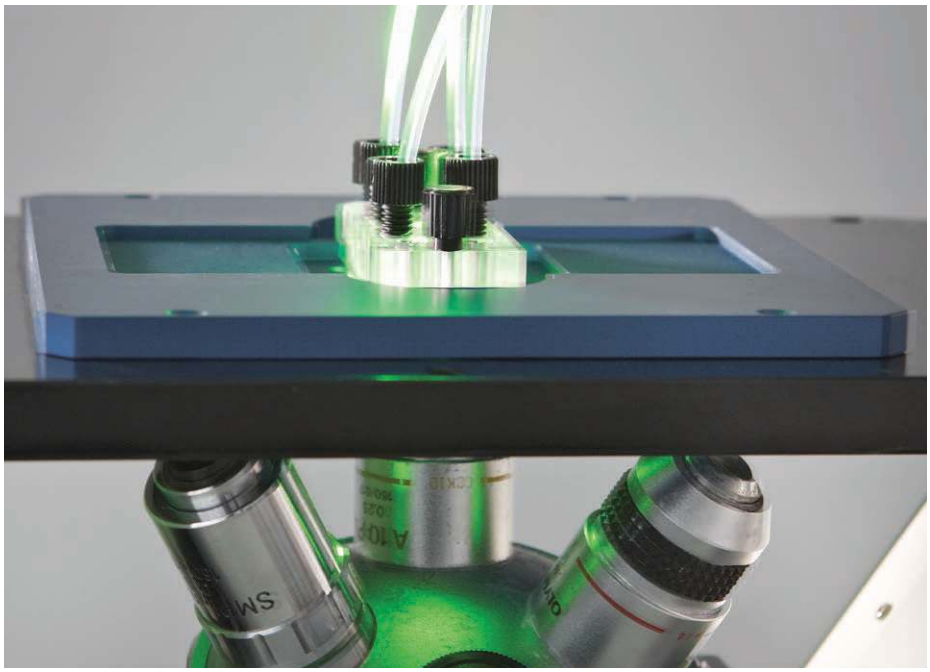
Easy to Use All-Purpose Microfluidic System



GESIM

MICROFLUIDICS



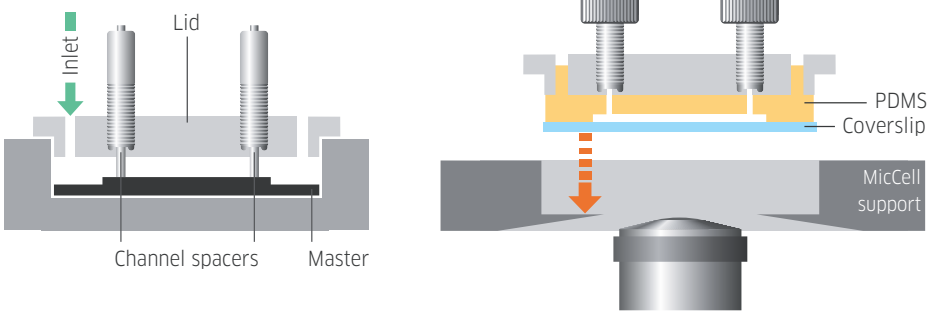


- **Versatile, modular, expandable and customized micro-flow systems**
- **Standardized “chip-to-world” interface**
- **Choose between PDMS channels, glass channels and foil-based microfluidics**
- **Peripherals (pumps, valves, tubes, fittings) are reused, making it simple and cost-effective**
- **Option: all external devices (pumps, valves etc.) in one PLC-controlled box and easy to use software with automatic tool detection**

The MicCell is set up by casting a polymer channel plate, adding a coverslip, mounting it in the support and doing experiments under microscope control. The MicCell is ideal for rapid prototyping; making a new channel requires only a new silicon master that you can order from GeSiM.

You can indeed use other channel materials in the MicCell. Very interesting are foil-based microchannel systems. Glass and silicon channels are also possible; a version for upright microscopes is available. Please inquire.

Complete the system with a ready-to-use macrofluidic environment (“F-Box”) using various materials, pumps, valves, mixers, microelectrodes and much more. Process electrical signals or add optical fibres. And control everything with an intuitive software.



Moulding of the PDMS channel plate in the casting station (left) and mounting it in an inverted microscope (right). PDMS can be replaced by other materials, e.g. foils.

Possible applications

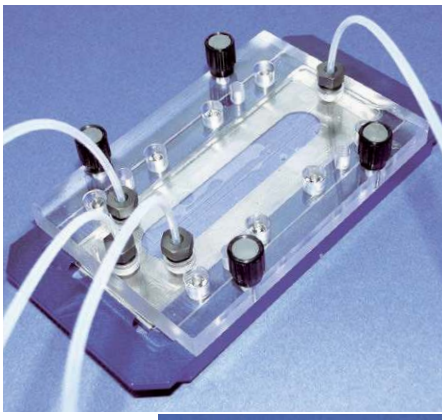
- Adherent/immobilized cells or tissue slices (interaction studies, viability or adhesion tests, shear stress, electrical activity etc.)
- Suspended cells in the flow (optical tweezers, optical stretcher to measure cell rigidity, transfection)
- Bead/cell size detection and sorting
- Single-molecule detection (multi-colour fluorescence, receptor-ligand binding and other kinetics, etc.)
- Hydrodynamic flow fields, generation of chemical gradients and applying them to cells or single molecules
- Surface plasmon resonance (SPR) or other sensors with flow injection analysis
- (Capillary) electrophoresis

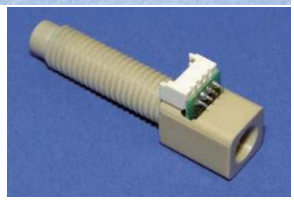
Assembly

The MicCell is composed of:

- the Channel Plate from PDMS (silicone) with all connections in the PC body (lid)
- the coverslip that closes the channel
- the MicCell support

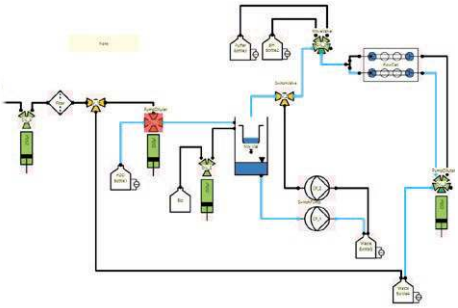
The coverslip is tightly pressed on the channel plate when mounted in the spring-loaded support. The easy fluidic connection of the microchannel to the outside (“chip to world”) via standard fittings and tapped holes through the channel plate is ground-breaking. Reliable syringe pumps (“macrofluidics”) produce the flow. [Price-concious researchers can use their own macrofluidics, but then lose the comfort of easy and programmable operation.]

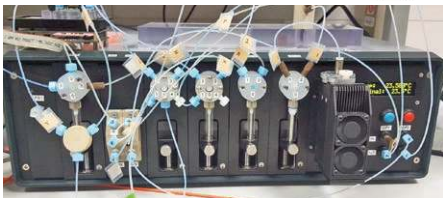




MicCell 25 mm x 75 mm (top) and PV6 hydrogel microvalve in standard UNF fitting (right)

Foil chips for gradients made of four foils (22x22, front/rear view), pore membrane (top right) and PC body with O-rings on the MicCell support (bottom)





Detail of the GeSiM Fluidics software (example) and corresponding F-Box with selector valves, syringe pumps and Peltier cooler with temperature control

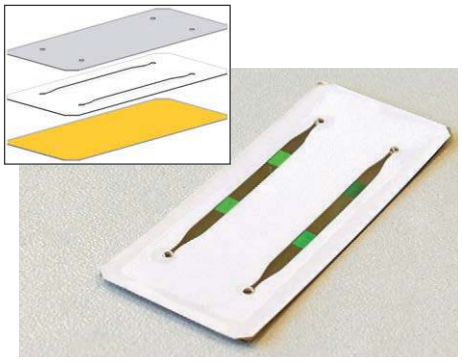
Different size, different features

Different sizes and layouts are available, also customized. Standard sizes are 22x22, 22x50, and 25x75 (mm x mm).

Foil-based microfluidics

As an alternative to PDMS, GeSiM now offers custom microfluidic systems with laser-cut adhesive foils. They can be ordered in small and large quantities (as disposable), snugly fit in the MicCell chamber (reliably sealed by O-rings), and allow intricate multi-layer setups so that numerous analytical applications, e.g. point-of-care diagnostics, become feasible.

Interesting accessories are highly selective **nanopore membranes** with defined cylindrical holes produced by beaming with heavy ions. This allows e.g. the safe encapsulation of cells.



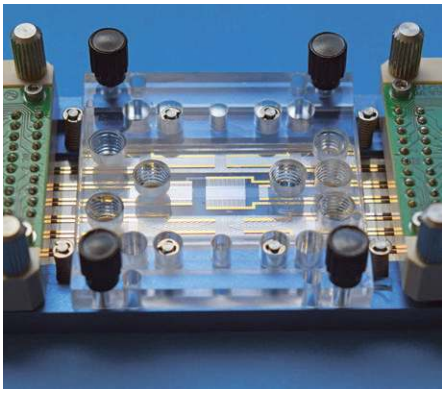
Biosensor cell made of three foils: transparent cover foil with holes, white channel foil, PC foil with four sensor pads (nanoimprinted in a GeSiM µCP4.1 and gold-coated). Used in a MicCell with near-infrared LEDs and wavelength-dependent photodiodes.

Hydrogel microvalve

The dead-volume-free valve for aqueous solutions is packed with hydrated PNIPAM hydrogel particles. The chip in a standard fitting is screwed into an inlet hole. To open the valve, Pt conductors heat the chamber to more than 34 °C, thus shrinking the hydrogel. [Heating power max. 250 mW, switching time 1 – 3 seconds, watertight up to 600 kPa (6 bar)]

Microelectrodes

They are manufactured in our cleanroom; conducting paths to them are insulated by SiO_2 vapour deposition. For electrical connection, spring contacts are pressed on metal pads in the assembled MicCell. Designs for heating, temperature sensing, capillary electrophoresis, impedance measurements and more are available; microelectrode arrays can measure or apply electrical potentials while cells are inspected in a microscope.



MicCell with microelectrodes structured on a 25x75 coverslip and connected via spring-loaded contacts

F-Box and control software

All macrofluidic tools (e.g. syringe pumps, multi-port selector valves, 2/2-way valves, mixers, liquid level sensors) and controllers of internal devices (hydrogel valves, temperature and flow sensors, voltages/impedances) are mounted in a single box (F-Box) that also contains a programmable logic controller (PLC).

We have developed an intuitive user interface that automatically detects devices in the F-Box, allowing you to quickly configure (via drag & drop) and run any microfluidic setup. You can also compile automatic procedures.

More accessories

- **Casting station** to mould PDMS channel plates; the PC body (lid) is also used in the microscope as chip-to-world interface
- Others: micro-mixer, thin film heater, thermal sensor, flow sensor (GeSiM specialty), pressure sensor, microelectrode array, impedance sensor, “sample carrier” (to observe opaque objects in the flow)

Literature

Gast, F.-U., et al., Microfluid. Nanofluid., 2006, 2, 21–36 (DOI: 10.1007/s10404-005-0047-6)

Injection of PDMS into the casting station. The silicon master lies under the transparent lid. Please note the channel spacers (brown fittings).

2019

Gesellschaft
für Silizium-Mikrosysteme mbH
Bautzner Landstraße 45
01454 Radeberg, Germany
Tel. +49-351-2695 322
Fax +49-351-2695 320
info@gesim.de

For more information (applications, systems, distributors etc.) please visit **www.gesim.de**

Specifications subject to change without notice

GESIM