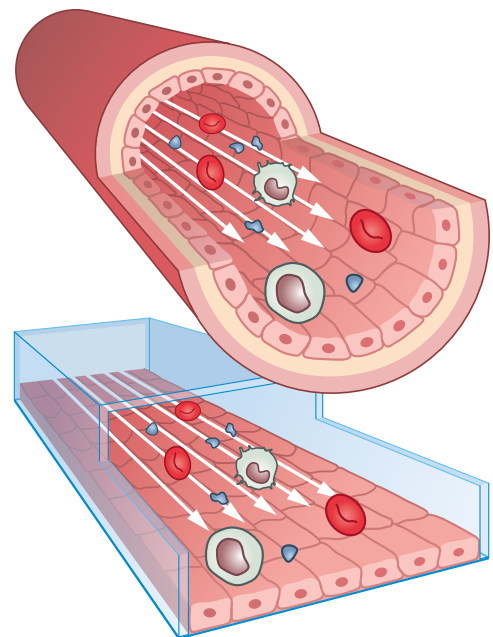




Cell Culture Under Flow

Mimic Physiologic Conditions
With the ibidi Pump System

- ✓ Long-term cell culture with defined shear stress
- ✓ Software-based flow programming with shear stress and shear rate calculation
- ✓ Compatible with all μ -Slides that have Luer adapters and many others
- ✓ Works with all cell culture incubators, all inverted microscopes, and ibidi Stage Top Incubators



“

*We've been working with the **ibidi Pump System** for over 5 years now and have recommended it to numerous colleagues.*

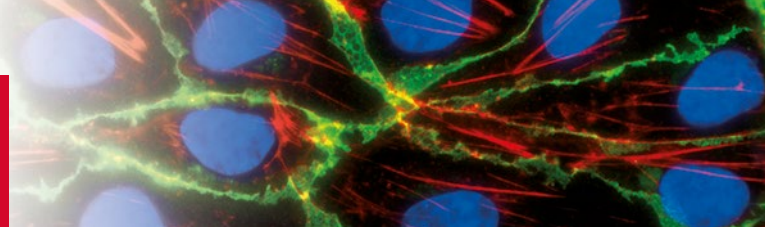
*In fact, the **ibidi Pump System** makes the endothelial cell under flow **the default** of our lab!*

*Nynke van den Akker, PhD
Maastricht University, The Netherlands*

Download a detailed
Application Guide at:
ibidi.com/FlowGuide

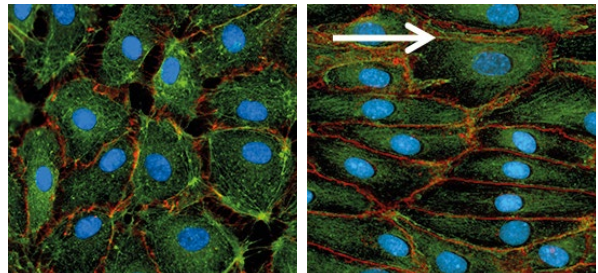


The Impact of Flow and Shear Stress on Cells



Many cell types are surrounded by moving fluids, such as vascular and lymphatic endothelial cells or epithelial cells of the kidney and the lung. This liquid flow causes shear stress, a mechanical force that has a significant impact on the physiological behavior, structural properties, and the function of cells.

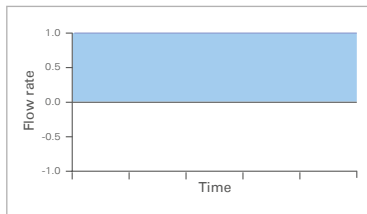
Cultivating cells under flow *in vitro* enables studying endothelial and epithelial cells in a more physiological, *in vivo*-like environment.



Different arrangement of HPMECs after 72 h of static (left) and flow culture (right) at 2.3 dym/cm². Green: β -actin, red: VE-cadherin. D. Bourquain, RKI, Berlin, Germany.

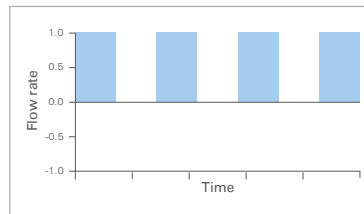
Types of Laminar Flow

Laminar flow is defined as the movement of liquids without turbulence. The fluid flows in parallel layers with no disruption between them. These types of flow can be achieved using the ibidi Pump System in combination with the ibidi Channel Slides.



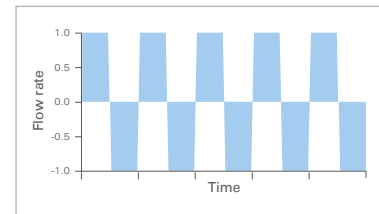
Unidirectional

Found in most small healthy biological vessels, such as small arteries and veins; constant flow direction and flow rate



Pulsatile

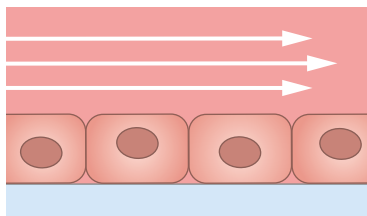
Occurring in large arterial vessels due to the fluctuations caused by the heartbeat; constant flow direction with periodically changing flow rate



Oscillatory

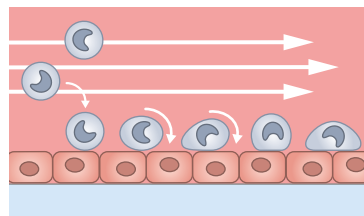
A means of simulating turbulence to mimic pathophysiological processes *in vitro*; changing flow direction at regular intervals and constant flow rate (except during valve switching)

Applications of Flow Assays



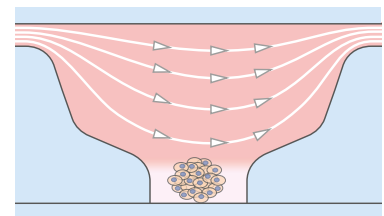
Cells Under Shear Stress

Defined shear stress in long-term cell culture (e.g., endothelium, kidney, or biofilm)



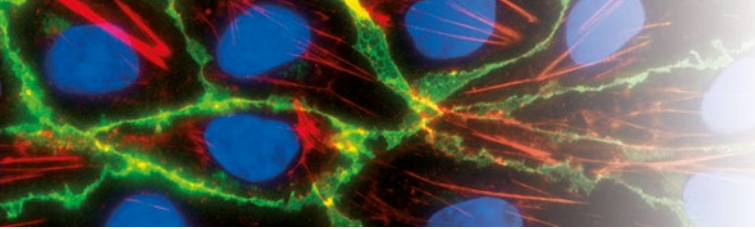
Rolling and Adhesion Assays

Rolling and adhesion of suspended cells (e.g., T cells) on substrates



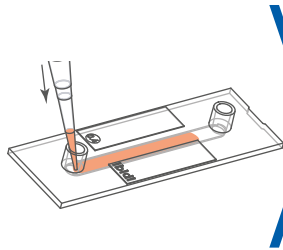
Perfusion of 3D Aggregates

Perfusion of cells, spheroids, and organoids in 2D and 3D for optimal nutrition



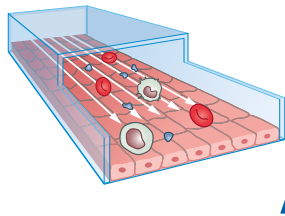
Experimental Workflow of a Flow Assay

ibidi Offers the Complete Solution for Your Flow Assay



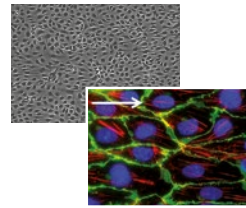
Sample Preparation

Setup your flow assay of choice and choose from our broad portfolio of channel slides.



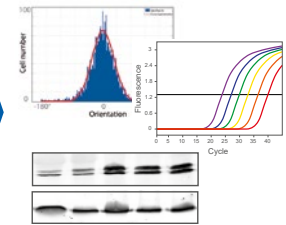
Flow Conditioning

Apply unidirectional, oscillatory, or pulsatile flow with the ibidi Pump System.



Staining and Microscopy

Image and stain cells directly in the channel.



Downstream Analysis

Easily analyze your cells with, e.g., Western Blot, qPCR, or FACS.

Selected ibidi Channel Slides for Flow Assays



μ-Slide I Luer Family

Slides with one channel for standard flow assays; available with an ibidi Polymer Coverslip or glass bottom, plus different channel heights and coatings

GLASS COVERSIP
POLYMER COVERSIP



μ-Slide III 3D Perfusion

A perfusable slide for optimal nutrient supply during long-term 3D culture of cells, tissue samples, organoids, spheroids, and small organisms

POLYMER COVERSIP



μ-Slide VI Family

Slides with six channels for parallel flow assays; available with an ibidi Polymer Coverslip or glass bottom, plus different channel heights and coatings

GLASS COVERSIP
POLYMER COVERSIP



μ-Slide Spheroid Perfusion

A perfusable channel slide with 3 x 7 wells for long-term spheroid or organoid cultivation

BIOINERT
POLYMER COVERSIP



μ-Slide I Luer 3D

A slide with one channel and three wells for culturing cells on a 3D gel matrix under defined flow

POLYMER COVERSIP



μ-Slide VI^{0.4} With μ-Pattern

Ready-to-use micropatterned slides; available for single cell or multi-cell assays

BIOINERT
POLYMER COVERSIP



μ-Slide y-shaped

A slide for modelling shear stress gradients, performing bifurcation studies, and simulating branching blood vessels

POLYMER COVERSIP

Order your **free sample** and test the ibidi microscopy chambers with your experiments.



The ibidi Pump System

The ibidi Pump System

Working under flow can be very important when using cells that exist in biofluidic systems (e.g., epithelial or endothelial cells). The ibidi Pump System simulates defined continuous and pulsatile laminar flow, and oscillatory flow to study cells in a more physiological environment.

Technical Details

- **Long-term cell cultivation under flow:** Sterile and defined conditions for up to several weeks
- **Automation:** Software-based flow programming including shear stress and shear rate calculation
- **Simulation of all physiological flow patterns:** Wide shear stress range (0.1–200 dyn/cm²)
- **Compatibility:** Works with a wide range of slides (e.g., μ -Slides with Luer adapters, customized slides)
- **Flexibility:** To be used with all cell culture incubators, all inverted microscopes, and ibidi Stage Top Incubators



*The system has allowed us to easily investigate **physiological shear patterns** in vitro without a background in engineering.*

Shane R. McSweeney, PhD
King's College London, United Kingdom



Contact ibidi for a **free demo** of the ibidi Pump System.



Selected Publications

D.C. 't Hart, et al. Laminar flow substantially affects the morphology and functional phenotype of glomerular endothelial cells. *PLoS One*, **2021**, 10.1371/journal.pone.0251129

I. Xanthis, et al. $\beta 1$ integrin is a sensor of blood flow direction. *J Cell Sci*, **2019**, 10.1242/jcs.229542

J. Mack, et al. NOTCH1 is a mechanosensor in adult arteries. *Nature Communications*, **2017**, 10.1038/s41467-017-01741-8

Live Cell Imaging: ibidi Stage Top Incubator and ibidi Pump System

