Flow an pressure in *ex vivo* tissue culture

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Focus on tissue microenvironment and prolonged tissue culture

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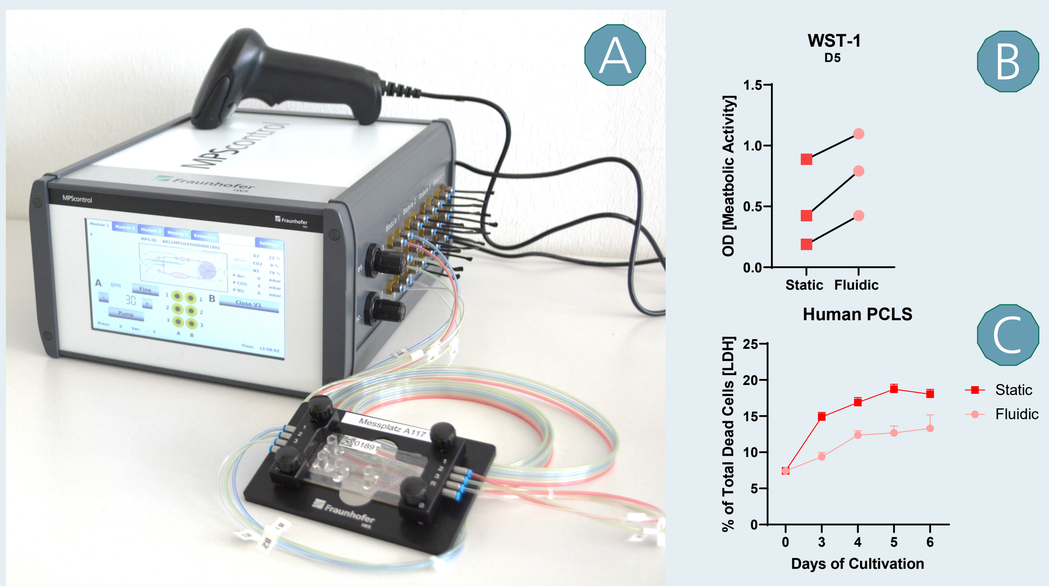
Maintaining the growth and survival of tissue and organoids *ex vivo* means ensuring viability and enabling a proper microenvironment. Perfusion and oxygenation is of major importance, as the high cell density of tissue or organoids requires constant nutrition to maintain tissue specific features during the whole culture. In addition, the pressure of the microenvironment represents a critical feature that is often neglected in cell culture. Nevertheless, many *ex vivo* tissue cultures, like bone, vasculature, heart and kidney, require the adoption of the *in vivo* pressure to resemble tissue features and morphology. Precise technical control of the aforementioned parameters requires advanced and easy to use equipment. Here, we present two novel controllers that enable the mimicking of in vivo like flow and pressure.

MPScontrol — a platform to manage perfusion in organoid and tissue culture

The *ex vivo* cultivation of tissue sections or organoids requires sufficient nutrition. Perfusion of the tissue or organoid with media can aid the supply with oxygen and help to increase nutritional uptake. This is especially necessary to preserve the cells in the inner region of the tissue or organoid. Micro physiological systems with integrated, pneumatically activated pumps offer the perfect tool to combine oxygen supply and perfusion. MPScontrol was designed to manage the volume flow of miniaturized, integrated micro pumps. The control unit can connect up to four micro pumps that can be driven independently [1].



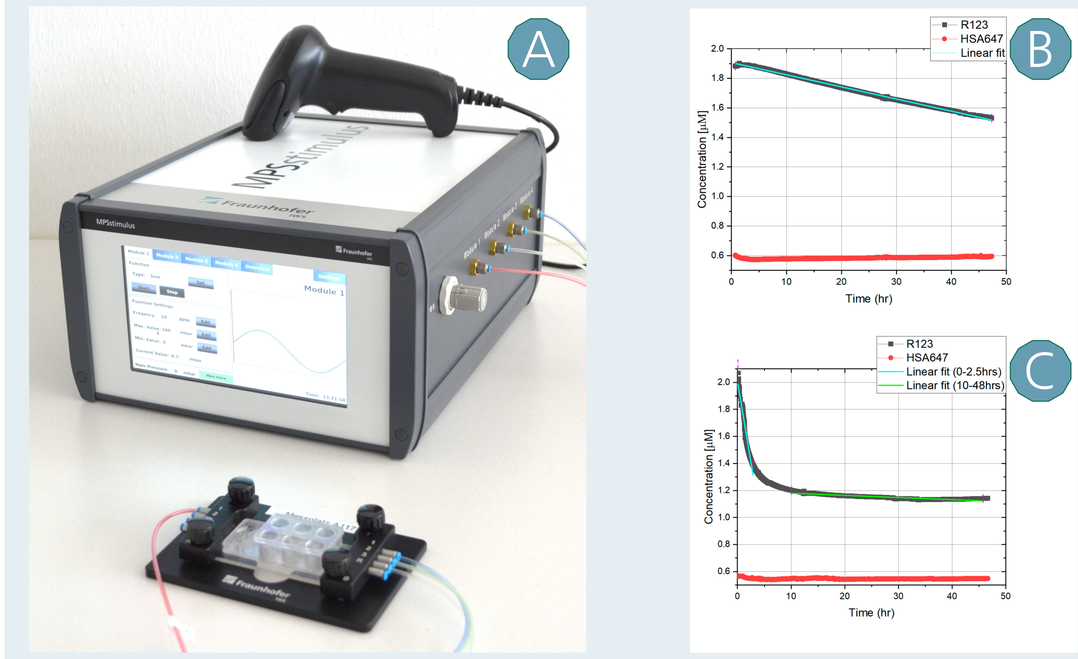
MPScontrol – A platform to manage perfusion in up to 4 microphysiological systems: (A) – Bird's-eye view; (B) – Cell proliferation of a lung tissue culture at day 6, from three different donors, compared in-between static culture and perfusion with MPScontrol; (C) – LDH release as marker of dead cells during 5 days of culture, in comparison in-between culture and perfusion with MPScontrol.

Features of the MPScontrol at a glance

Number of parallel microsystems	Up to 4
User Interface	10-inch touch display
Data logging (optional)	Cloud server via Ethernet
Media flow (depending on the micro-system)	0.05 µL/s up to 10 µL/s
Possible gas supply (2-8 bar)	Compressed air; CO_2; N_2
Supply Voltage	220 VAC
Max. power consumption	50 W
Max. compressed air consumption	

MPSstimulus – a platform to manage time-dependent pressure in organoid and tissue culture

The function of human organs, like the lungs, gut and heart, depends on the contractile movement of tissue. Beating hearts and contractile vessels are forming the blood pressure within the human body. This pressure ranges from 15 mmHg in small vessels to 120 mmHg in the left ventricle [2,3]. MPSstimulus supports your *ex vivo* tissue by managing the pressure within the culture system. This can be used for the periodic deflection of membrane based organ models, like lung or gut. Moreover, it can reflect the dynamic pressure of the cardiovascular system to emulate vascular microenvironments. Also, the pressure dependent excretion, like in the kidney, can be emulated.



MPSstimulus – a platform to manage the pressure in microphysiological systems. (A) – Bird's-eye view; (B,C) – Pressure dependent permeation of Rhodamine123 through an artificial tubular barrier. B – without pressure, C – 5 mbar [4].

Features of the MPScontrol at a glance

Number of parallel microsystems	Up to 4
User Interface	10-inch touch display
Data logging (optional)	Cloud server via Ethernet
Applicable pressure at the microsystem	1-150 mbar (0.75-112 mmHg)
Pressure oscillation modes	Fixed value, sine, rectangle
Possible gas supply (2-8 bar)	Compressed air; CO_2; N_2
Supply Voltage	220 VAC
Max. power consumption	40 W

See MPScontrol and its application in action:
https://www.mdr.de/video/mdr-videos/c/video-691540.html

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