Double-perfusion slice chamber

This type of chamber for electrophysiology and in vitro imaging developed by Femtonics Ltd offers increased oxygen concentration and better fluorescent signal detection. The dual perfusion chamber keeps the physiological tissue healthier to save neuronal network in the living tissue thus allowing the recording of spontaneous network oscillations.

This chamber is delivered from earlier developments with (Hajos et al., European Journal of Neuroscience, Vol. 29, pp. 319-327 (2009) & Chiovini et al. Neurochem. Res. V35, N12, 2086-2095 (2010)). We introduced further modifications to the chamber to reach better condition. These include a newly developed bubble trap, a modified chamber shape, improved slice holder mesh, while we also changed the inlet and outlet system to increase the perfusion flow rate and decreased the slice vibration during the physiological measurements.

Two photon microscope used for imaging is equipped with a double-perfusion chamber and a dual bubble trap. Supertech dual-channel heater is fixed on a magnetic holder and placed before the bubble trap. The lower outputs of the bubble trap connect to the chamber inlets. The whole perfusion system is built up with Teflon tubing which hinders the leaking of Oxygen from the perfused solution. We use silicone tubing only to connect the inlet air vents with the vent syringes.
Femtonics double perfusion chamber is made of non-conductive polycarbonate. There are two inlets and one outlet for the perfusion. Besides the inlets, there are two vent connection tubes which help to eliminate the bubbles from the chamber. The slices are placed on a thin, mobile polypropylene mesh which divides the chamber into two parts. There are two polycarbonate inserts in the chamber shaped to divide the laminar flow.

Schematic diagram of the fluid flow in the dual perfusion chamber designed for the wide field of view of two-photon imaging. The fluorescent signal was detected through a high NA condenser and objective lenses. Whole-cell patch-clamp and field recordings were performed simultaneously. Slices were placed on a thin polypropylene mesh (Chiovini et al. Neurochem Res. 2010 Dec;35(12):2086-95.). To minimize the slice vibration, a harp should be used on the slice.
The newly developed bubble trap is made of polycarbonate. It improves both the electrophysiological recording and the imaging detection by serving as a pulse dampener. The arrangement of the upper inlet and lower outlet help the elimination of the bubbles and reduce the pulsation of the perfusion fluid. The easily removable, mobile cap on the top facilitates easy cleaning. There are vent tubes on the cap which connect to a syringe via silicone tubing, which helps to set the liquid level in the bubble trap and also serves as an air vent to eliminate the accumulated bubbles.