AdaptoCell – a protein analysis microfluidic flow-cell for MAX IV users

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Deeper understanding of *in vivo* dynamics, functions of proteins and their interactions are contemporary scientific challenges. MAX IV Laboratory, the Swedish synchrotron facility for research, enables time-resolved *in situ* studies of proteins by several X-ray techniques. Balder, CoSAXS and MicroMAX beamlines are state-of-the-art in their respective method(s): X-ray Absorption/Emission Spectroscopy (XAS/XES), Small Angle X-ray Scattering (SAXS), and Serial Synchrotron Crystallography (SSX). The goal of the SSF funded project (SSF ITM-17) is to deliver, for MAX IV users, an adaptable microfluidic flow-cell platform, AdaptoCell, for integration at beamlines and adapted to each analysis method. The devices will expand the possibilities for investigating proteins in solution and facilitate serial crystallography with micro crystals.

The year-one project goal is the delivery of an integrated microfluidic device for XAS (AdaptoCell-XAS). Year two will add on-chip UV-vis spectroscopy (AdaptoCell-SAXS) for time-resolved data collection. Year-three will see adaption of the device for handling microcrystals during time resolved crystallography. The initial research in year one has been to design and fabricate a customized microfluidic chip for XAS at the Balder beamline; which enabled the analysis of protein samples in solution. First model iteration of a microfluidic chip to support hydrodynamic focusing was developed and tested offline proving the desired hydrodynamically focussed sample width of 100 um[i], and currently improving on the next X-ray compatible model.

Further design refinement and theoretical calculations are required to obtain optimal results in choice of material conducive for x-ray studies, fabrication protocol, design and assembly of layers for robust devices. The key aspects of the device design are: ease of assembly, reliability, chemical inertness, minimal dead volume, ability to operate over a range of flow rates and affordability[ii]. The devices are expected for release to Swedish academic and industry users for sample delivery after each finished development stage of the AdaptoCell project.

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[i] Diploma work of K. Samaan Vucetic, fall 2017 LiU "Microfluidic chip for protein analysis at MAX IV Laboratory"

[ii] LabSmith. (2017, October 15). Retrieved from http://products.labsmith.com/captiteconnectors/#.WnHrujt8X8s