

Design of an innovative microfluidic system chemotactic transmembranal migration of leukocytes

Introduction

microdevice, to be employed in studies of leukocytic chemotaxis, shear

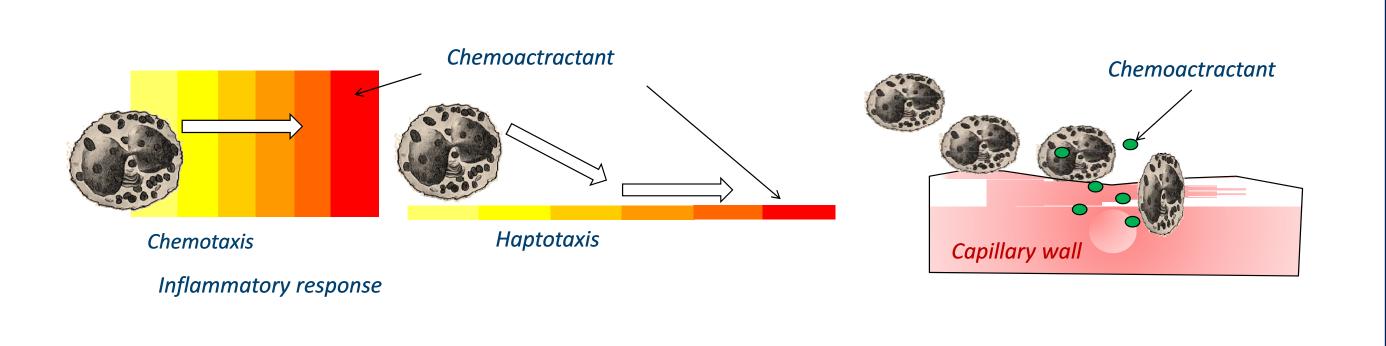
Central to the pathogenesis of many diseases, chronic inflammation can dysregulation of multiple higher order biological processes. Chronic inflammatory diseases represent one of the greatest collective burden of suffering and economic cost in the developed world:



Chronic inflammatory diseases comprise a eterogeneous group of disorders with unrelated etiologies but shared pathogenic mechanisms. A variety of "inputs" affect the recruitment and activation of immune and inflammatory cells, thereby amplifying and perpetuating the inflammatory state.

Leukocyte extravasation follows complex patterns that are affected by several microenvironmental cues, such as:

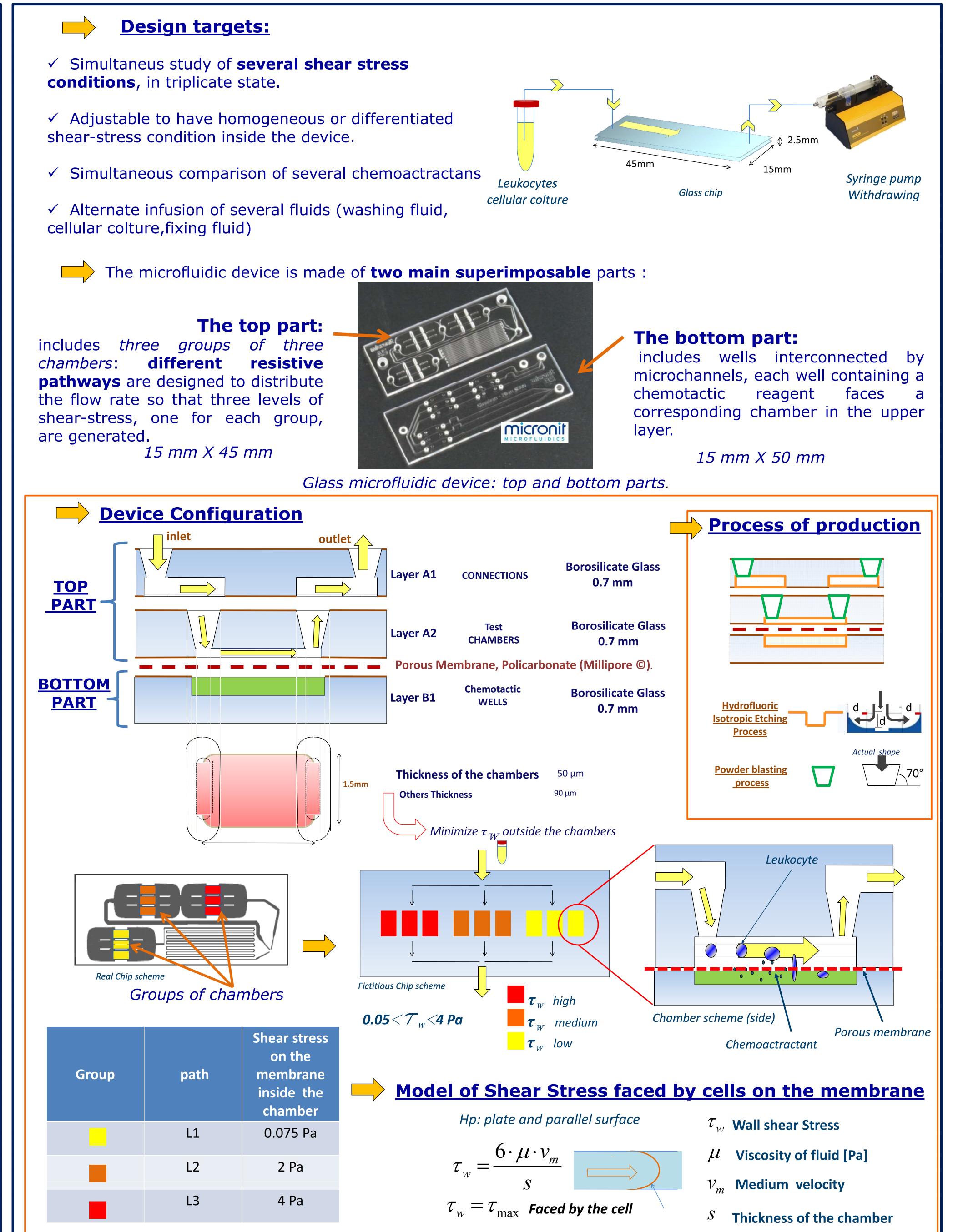
- relative densities and distribution of chemoattractants
- adhesion receptor *ligands*
- integrity of the endothelium and the subendothelial matrix
- □ local hemodynamic conditions imposing variable **shear forces** on the extravasating leukocytes [Kucik 2003 and Cuvelier SL 2005] As shear-stress stimulus Tw, wall shear stress, and Tm, shear stress on the cellular membrane are involved in that phenomenon and they are both due to the action of blood flow.



spread onto substrates or cells expressing adhesion receptor ligands.

Commercial devices, available to investigate chemotactic adhesion and transmigration of cells, are called **Boyden chambers** [Chen 2005], as the membrane; cells are placed in the upper compartment (under shear-free conditions) and are allowed to migrate through the pores of the membrane into the lower compartment, in which chemotactic agents are present. High throughput devices exist, integrating more than one hundred shear-free chamber (Neuroprobe©). Devices integrating flow conditions are usually consists in a single chamber with one condition of shear stress. (Glycotech©).

Materials & Methods

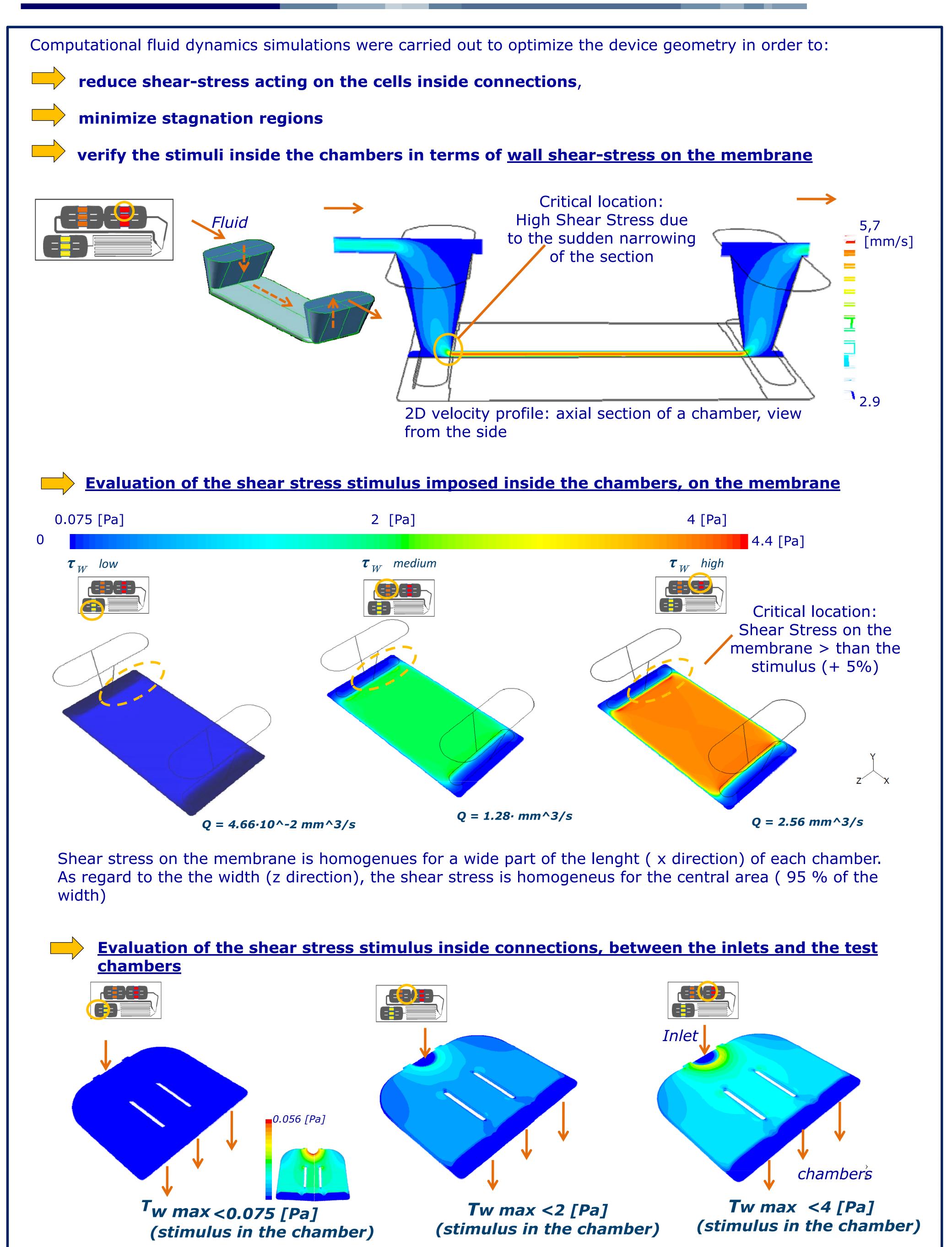


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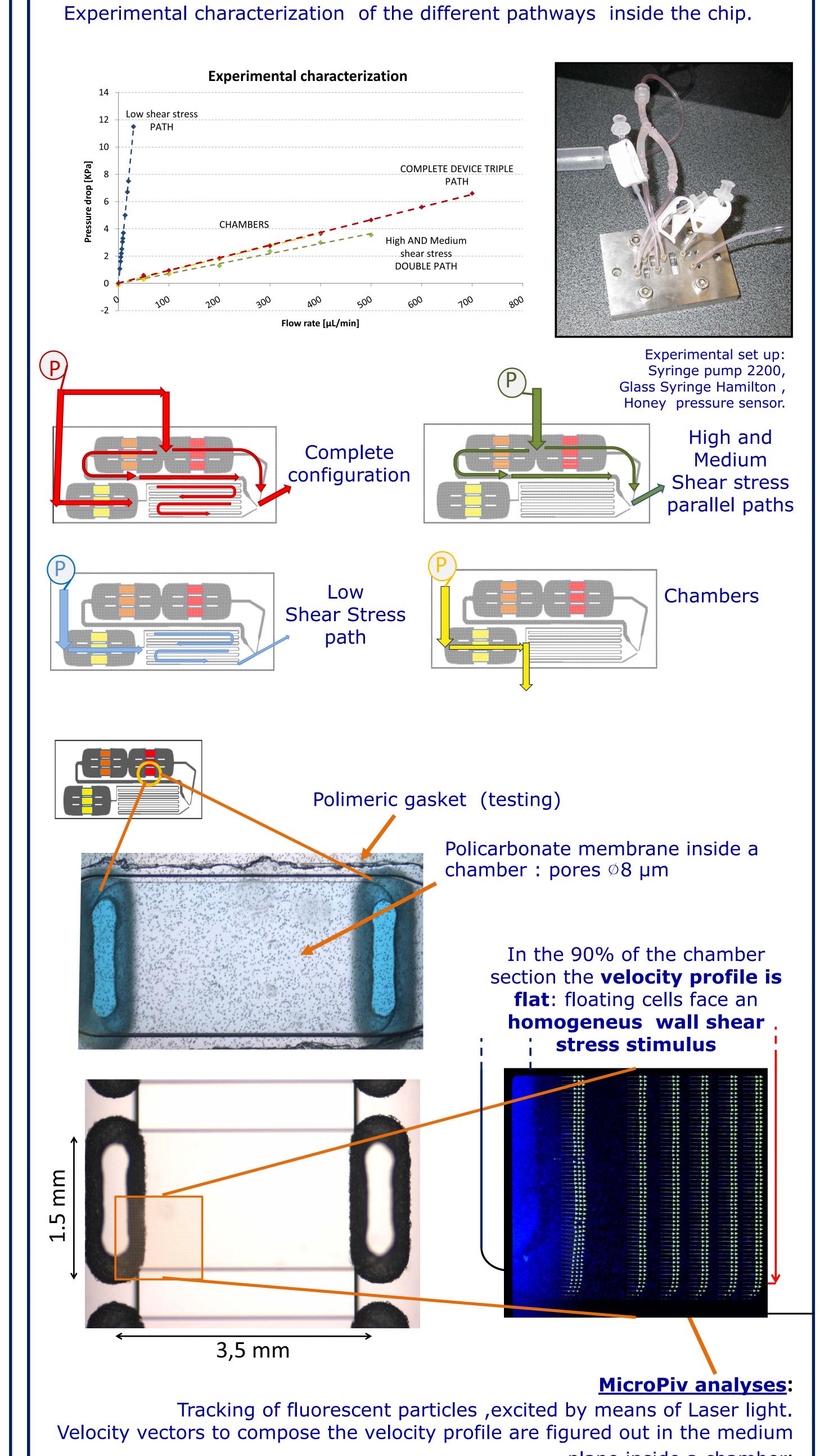
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Computational simulations for the design



Experimental characterization



plane inside a chamber:

TSI corporation – Laser Dual Yag, - $1\mu \varnothing$ particles – Niquyst algorithm.