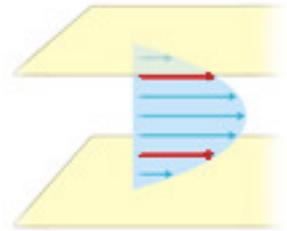




The Segre Silberberg effect

Why use laminar slide designs and why record filling time?

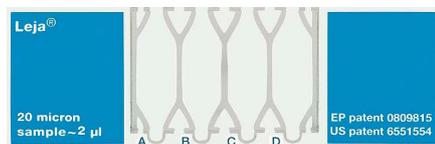
Capillary flow into a 20 μm counting chamber follows a classical Poiseuille flow. The flow of the fluid is dominated by its viscosity. A maximum velocity is reached at exactly half the depth of the chamber (see diagram) while the velocity at the chamber walls equals 0 $\mu\text{m sec}^{-1}$.



One can image that the sperm-cells in the middle of the chamber-height move faster than the ones near the wall. It has been shown that all sperm-cells move to two planes at equidistance from each chamber wall (depicted by the red arrows in the diagram). The distance of these planes from the wall (β) is depending on a few parameters:

- development of full Poiseuille flow
- chamber height
- surface properties of the counting chamber
- surface tension
- fluid viscosity
- flow velocity
- diameter of sperm-cell head

Because the sperm-cells in the two Segre Silberberg planes move faster than the average fluid velocity, there is an accumulation of sperm-cells at the filling front. When measuring the sperm concentration in the centre of the Leja[®] slide, an underestimation of the concentration takes place. Luckily, this is a constant underestimation that can be corrected for. The only not constant parameter is the fluid viscosity, which is linearly dependant on the filling time of the slide. So the correction factor for the Segre Silberberg effect can be read from the filling time of the slide (see Leja[®] 20 μm manual).



The correction factor is only a constant when using a linear flow slide like the Leja[®] new design 2 chamber and the Leja[®] 4 chamber slides. Working with these slides will yield in an exact count that matches haemocytometer counts.

Rule of thumb for human sperm:

- | | |
|-----------------------------------|--|
| • semen diluted in culture medium | correction factor \cong 1.23 |
| • normal liquefied semen | correction factor \cong 1.1 (filling \approx 7 – 9 sec.) |
| • very viscous semen | correction factor \cong 1 (filling $>$ 30 sec.) |

References (to download at www.leja.nl):

Douglas-Hamilton, D.H.; Smith, NG; Kuster, C.E.; Vermeiden, J.P.W.; Althouse, G.C.: Particle Distribution in Low-Volume Capillary-Loaded Chambers, *Journal of Andrology*. 2005;26(1):107-114
Douglas-Hamilton, D.H.; Smith, NG; Kuster, C.E.; Vermeiden, J.P.W.; Althouse, G.C.: Capillary-Loaded Particle Dynamics: Effect on Estimation of Sperm Concentration, *Journal of Andrology*. 2005;26(1):115-122

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