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Abstract

Modelling an Artificial Synaptic Communications with Microfluidics

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Abstract:

Neurotransmission is the process by which signaling molecules, so called neurotransmitters are released by the membrane of a neuron (the presynaptic membrane) and react with the protein receptors embedded in the membrane of another neuron (the postsynaptic membrane). Using microfluidics, we are presenting a simplistic realization of this type of cell communication. For that instance, two free- standing bilayer are produced at desired positions in a microfluidic chip applying the DiB (droplet interface bilayer) method. This means in our case that we contact three aqueous buffer droplets into an oily phase where we have dispersed lipidic molecules. Upon contacting the surfaces of the lipid decorated droplets, bilayer are formed within a short time. Two of these bilayers are positioned face-to-face, separated by a distance of a few hundreds of microns, representing the presynaptic and the postsynaptic model membranes. Small unilamellar vesicles are injected near the presynaptic membrane and fuse with it, releasing the vesicle content (i.e model neurotransmitter). This model neurotransmitter is then analyzed by the proteins receptors that are embedded in our postsynaptic model membrane. This model cell communication is recorded in situ by electrophysiological measurements (patch-clamp amplifier) and by direct optical inspection.

Biography:

Harwey Tawfik is professor at the Experimental Physics and Center for Biophysics, Saarland University, Saarbrücken, Germany.

Recent Publications:

1. Bessis M. Red cell shapes. An illustrated classification and its rationale. Nouv Rev Fr Hematol 1972; 12: 721– 745.
2. Chien S. Red cell deformability and its relevance to blood flow. Annu Rev Physiol 1987; 49: 177– 192.
3. Buffet PA, Safeukui I, Deplaine G, et al. The pathogenesis of plasmodium falciparum malaria in humans: Insights from splenic physiology. Blood 2011; 117: 381– 392.
4. MacDonald IC, Schmidt EE, Groom AC. The high splenic hematocrit: A rheological consequence of red cell flow through the reticular meshwork. Microvasc Res 1991; 42: 60– 76.
5. Ballas SK, Larner J, Smith ED, et al. Rheologic predictors of the severity of the painful sickle cell crisis. Blood 1988; 72: 1216– 1223.

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