INTEGRATING NANOMEMBRANE SEPARATION WITH PLASMONIC DETECTION FOR REAL-TIME CELL CULTURE MONITORING

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To further understand cellular responses to drug treatment the dynamics of a reduced secretome shall be investigated. Currently there is no method for the detection of secreted small molecules in real time, label-free and with a high resolution. We present a novel design, which integrates nanopore filtration technology with highly sensitive plasmonic detection that allows real time monitoring of filtered molecules with a high spatial resolution and label free. The cell culture chamber is separated from the site of detection only by our biocompatible nanomembrane filter with a thickness of less than 100 nm to exclude the majority of background signals from the cell culture. The fast filtration of the cell culture constituents through the nanomembrane to the detector allows the observation of the dynamics of secreted molecules during cell culture and/or drug application. The setup offers new possibilities for drug screening and cell assays and may reveal new insights into cell signaling and drug responses. This setup shall be used to monitor cell culture or tissue culture without the necessity of labeling. This can be particularly important for the very popular “organ-on-a-chip” or “patient-on-a-chip” approaches to monitor tissue reactions to drug treatments with a high spatial resolution.

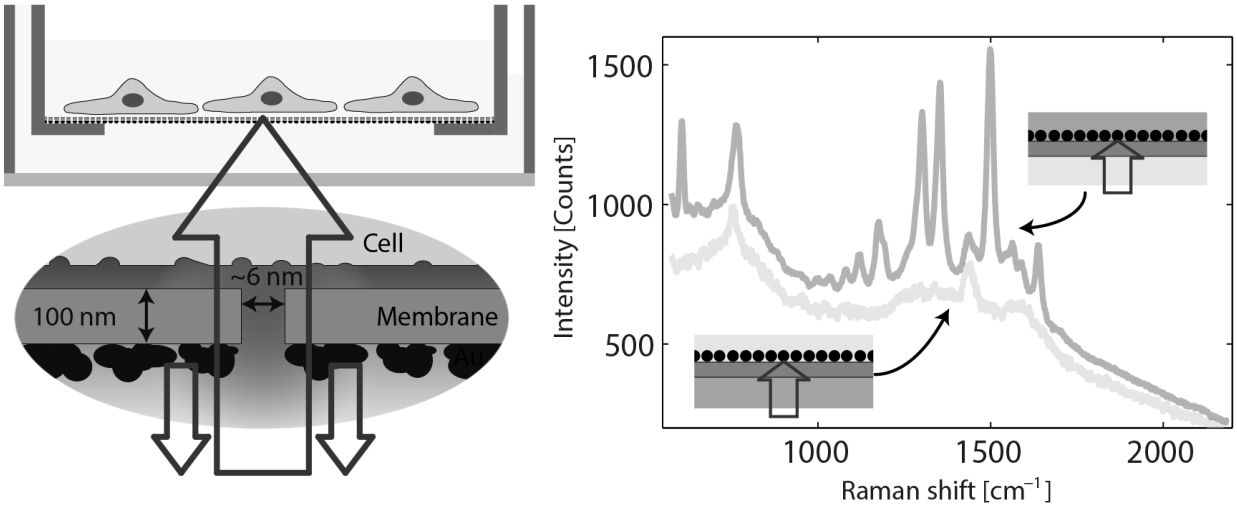

Figure 1: Left: Cells are grown on top of our large freestanding porous nanomembrane. On the bottom side, a sensor for “Surface enhanced Raman scattering” is attached to the membrane. Molecules coming from the cell and its surrounding can diffuse through the pores of the membrane, if they are smaller than the defined cutoff size. A Raman spectrum can be obtained very sensitively on the bottom side of the membrane. Right: It is proven that only molecules, which are on the same side as the sensor are measured (dark: analyte, light: water). This is not self-evident because of the very thin membrane. The arrows depict the incoming laser beam (upward) and the scattered light (downward), which is detected.