Label-free histamine detection with nanofluidic diodes through metal ion displacement mechanism

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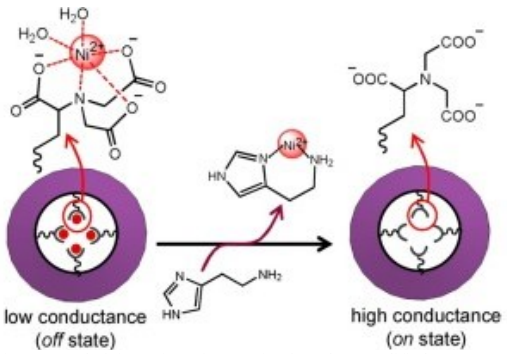

Figure 1: Label-free Histamine sensing based on modified Nanopore

Based on a metal ion displacement mechanism, a nanofluidic device is presented for the label-free detection of histamine neurotransmitters. The nanosensor consists of a PET-membrane with a conically shaped single-pore fabricated by ion track-etching technique. For sensor application the nanopore surface is at first functionalized with *N,N*-bis(carboxymethyl)-L-Lysine (BMCL) via carbodiimid coupling. Afterwards, the immobilization of metal ions onto the surface via complexation of the trinitriloacetic group (NTA) of BMCL with Ni^{2+}-ions leads to a surface containing metal-nitriloacetic (NTA-Ni^{2+}) chelates. Both steps change the surface charge, which can be determined by current-voltage-measurements (I-V) after each modification step. The surface-bonded metal ions can be displaced by adding histamine to form a stable histamine-metal-complex. This process leads to a regeneration of metal-free NTA groups on the surface within the pore and can also be detected by current-voltage-measurements. On one hand nanomolar concentrations of histamine can be detected, which allows the application as a sensor. On the other hand, other neurotransmitters such as glycine, serotonin, γ-aminobutyric acid and dopamine were tested without gaining significant changes in the I-V-measurements due to an insufficient ability to displace metal-ions from the stable surface NTA-Ni^{2+}-complex. This Poster illustrates how the modification of nanopore surfaces can lead to a nanofluidic sensor that exhibits sensitivity, selectivity, and reusability towards histamine as a neurotransmitter.

References

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