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Rationally designed peptides modulate the activity of *Bacillus anthracis* MoxT ribonuclease

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Bacillus anthracis MoxXT is a Type II proteic Toxin–Antitoxin (TA) module wherein MoxT is a ribonuclease that cleaves RNA specifically while MoxX interacts with MoxT and inhibits its activity. Disruption of the TA interaction has been proposed as a novel antibacterial strategy. Peptides, either based on antitoxin sequence or rationally designed, have previously been reported to disrupt the MoxXT interaction but cause a decrease in MoxT ribonuclease activity. In the present study, we report the crystal structure of MoxT, and the effect of several peptides in disrupting the MoxXT interaction as well as augmentation of MoxT ribonuclease activity by binding to MoxT *in vitro*. Docking studies on the peptides were carried out in order to explain the observed structure activity relationships. The peptides with ribonuclease augmentation activity possess a distinct structure and are proposed to bind to a distinct site on MoxT. The docking of the active peptides with MoxT showed that they possess an aromatic group that occupies a conserved hydrophobic pocket. Additionally, the peptides inducing high ribonuclease activity were anchored by a negatively charged group near a cluster of positively charged residues present near the pocket. Our study provides a structural basis and rationale for the observed properties of the peptides and may aid the development of small molecules to disrupt the TA interaction.

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Highly efficient bio-functionalized nanostructured hafnia based non-invasive biosensor for oral cancer detection

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We report results of the studies relating to the fabrication of novel nanostructured immunosensor platform (BSA/anti-CYFRA-21-1/APTES/HfO2/ITO) for efficient detection of oral cancer biomarker (CYFRA-21-1) in saliva. Nanostructured hafnia has been synthesized via low temperature hydrothermal process and surface modified with 3-aminopropyltriethoxy silane (APTES) for covalent immobilization of monoclonal anti-CYFRA-21-1. The fabricated platform has been characterized using atomic force microscopy (AFM), photo-electron spectroscopy (XPS), FT-IR and electrochemical techniques. The results of the electrochemical response studies reveal that the BSA/anti-CYFRA-21-1/APTES/HfO2/ITO immunoelectrode can be used to estimate the CYFRA-21-1 with high sensitivity (9.2 mA mL ng^{-1} cm^{-2}) and wide linear detection range (LDR) of 2 to 18 ng mL-1. The limit of detection (LOD) obtained as 0.143 ng mL-1 and shelf life of 7 weeks indicates that this stable immunoelectrode can be efficiently be used in the detection of concentration of protenaceous CYFRA-21-1 antigen in saliva samples. The observed results validated using ELISA reveal that this biosensor can be used as a point-of-care device for oral cancer monitoring.

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