## **Electrical Detection of Amyloid Prion Protein Using FET Biosensor**

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In this study, we developed a label free and simple electrical detection technique for amyloid prion protein using field effect transistor (FET) biosensor. We used two types of small probe molecules, congo red<sup>[1]</sup> and thiamine<sup>[2]</sup>, to detect the amyloid prion in the different protein form. The probe molecule was chemically immobilized on the aldehyde-terminated surface of the FET gate. We can obtain an electrical signal of FET responses by monitoring a voltage shift in the gate voltage  $(V_g)$ drain current  $(I_d)$  curve after introduction of target molecule to the probe-immobilized surface. Firstly, we have demonstrated the relationship of electrical signal of congo red-immobilized FET biosensor on the protein aggregation of Sup35NM as a model of amyloid prion. On the other hand, we performed the diagnosis of human prion protein oligomer (PrP<sup>c</sup>, 23-231) utilizing thiamineimmobilized FET. The comparison of electrical FET responses to the amyloid prion proteins as a positive control and human serum albumin as a negative control has shown that these FET biosensors possess high specificity. In addition, atomic force microscopy (AFM) was employed to characterize the change in surface morphology of FET gate before and after the reaction with target molecule. Furthermore, in order to enhance the sensitivity for the detection of prion oligomer, we have proposed two strategies of signal amplification through improving the charge of prion proteins adsorbed on the gate surface. Such signal amplifications have resulted significant enhancement in the electrical signal of FET response. Overall, both congo red-immobilized surface and thiamineimmobilized surface have shown great sensitivity, specificity and stability to detect amyloid prion proteins. Thus, this FET biosensor is promising for further development into practical application.



**Figure 1**: The specificity performance of congo red-immobilized FET (a), and thiamineimmobilized FET (b).

## **Reference:**

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