Highly sensitive silicon nanowire biosensor devices for the investigation of UniCAR platform in immunotherapy

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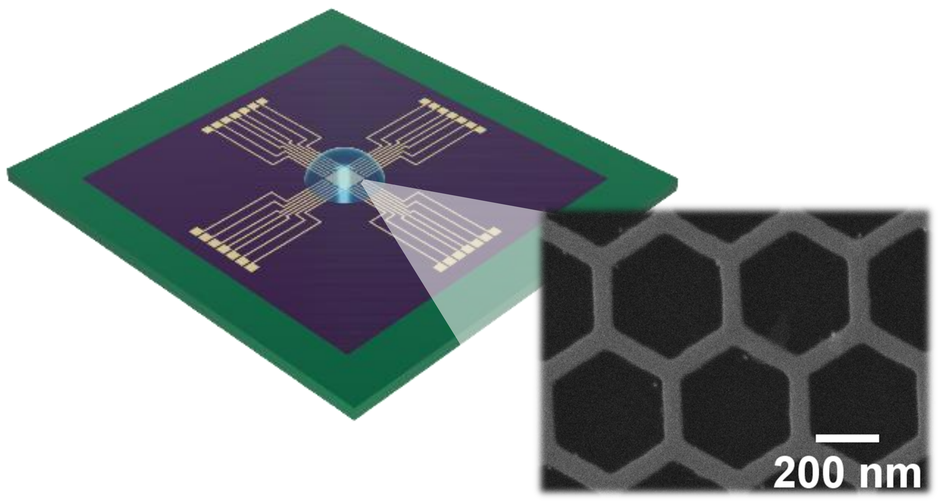
INTRODUCTION

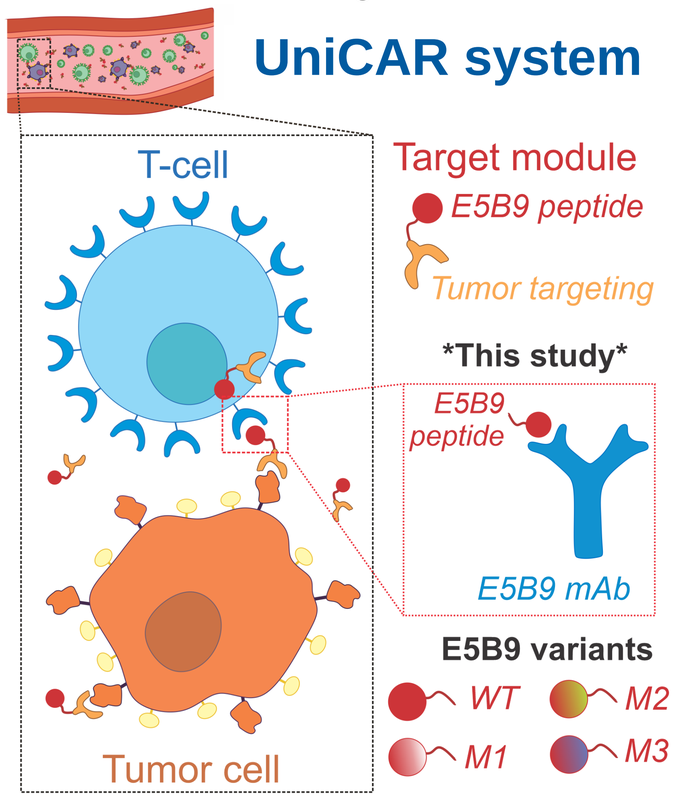
Previous studies have shown notable advantages of silicon nanowire field effect transistor (SiNW FET) in biosensing application. Here we apply the use SiNW FET in detection of the binding of UniCAR receptor and different variants of E5B9 peptides in order to select a best candidates for construction of target modules (TMs).



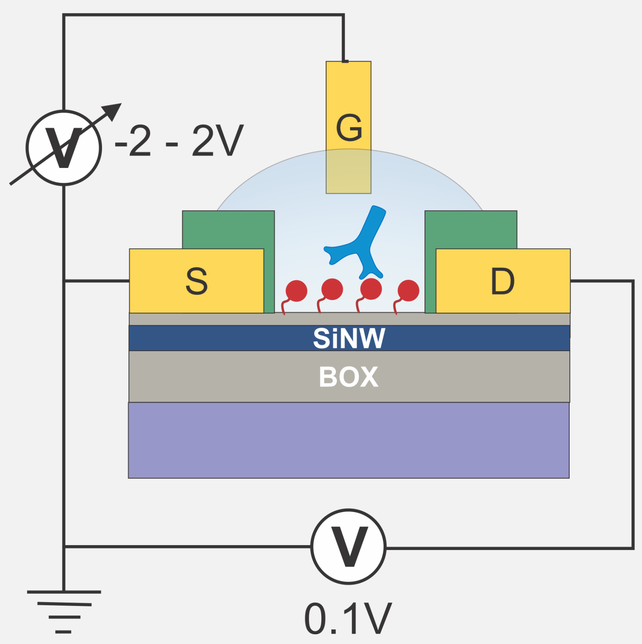
MATERIALS & METHODS

In UniCAR immunotherapy, the target module acts as a switch to control the on/off state of the system, thus decides the safety of the treatment. Finding the E5B9 peptide that has good binding to UniCAR T-cell is important. Here, we immobilized four E5B9 peptide variants on different SiNW FETs and record the current change of the SiNW FET when titration against E5B9 Antibodies.

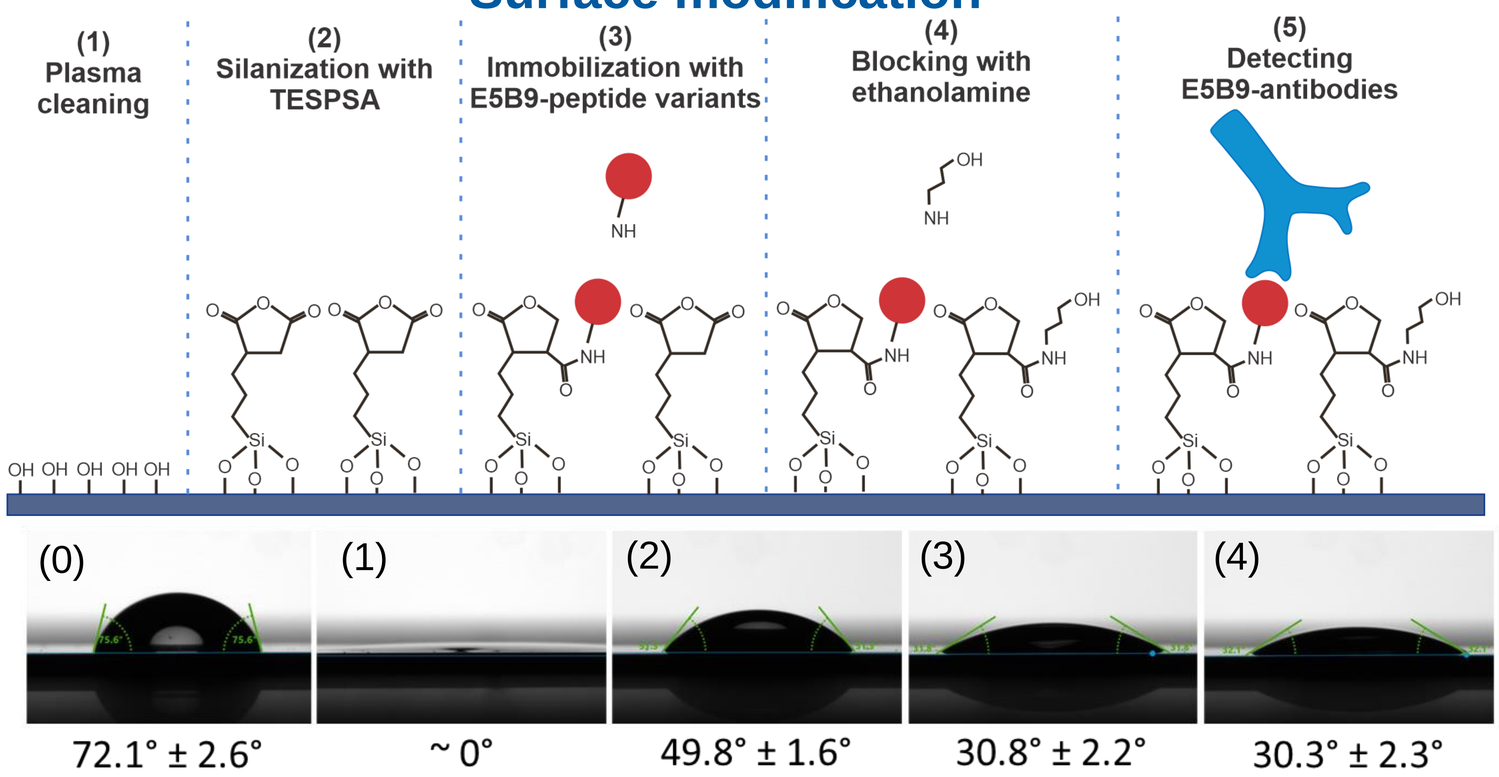
UniCAR system



Working principle



Surface modification

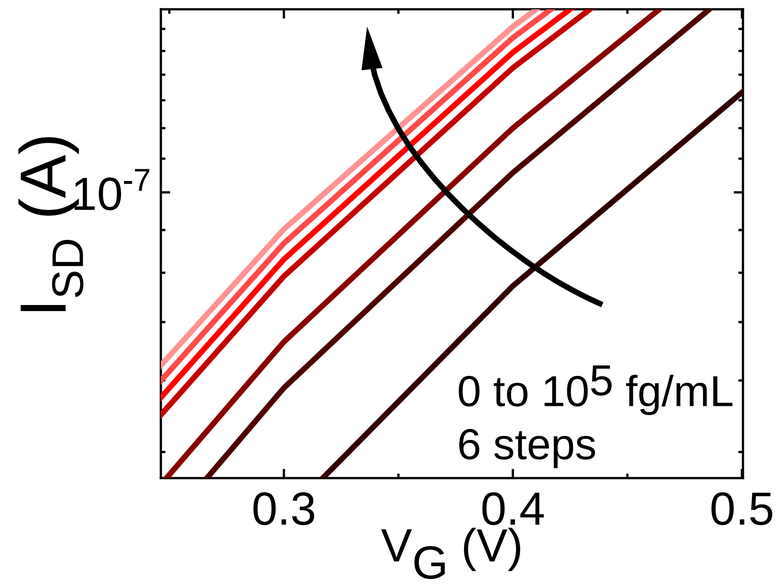


CONCLUSION

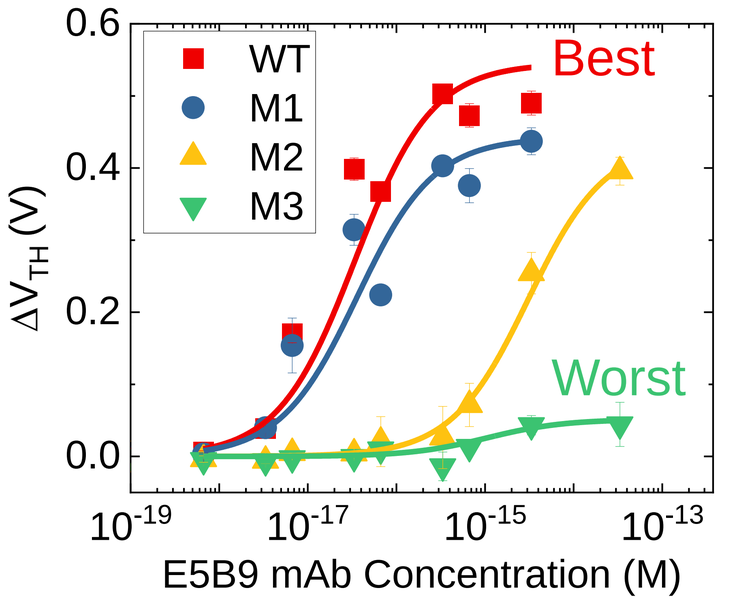
The results underline advantage of SiNW sensor over ELISA method in term of ease of preparation, speed and sensitivity. The method is able to evaluate binding affinity of UniCAR to different TMs and open a potential to quantify the number of active UniCAR T-cells in in-vivo-sample in later stage.

RESULTS

E5B9-mAb sensing



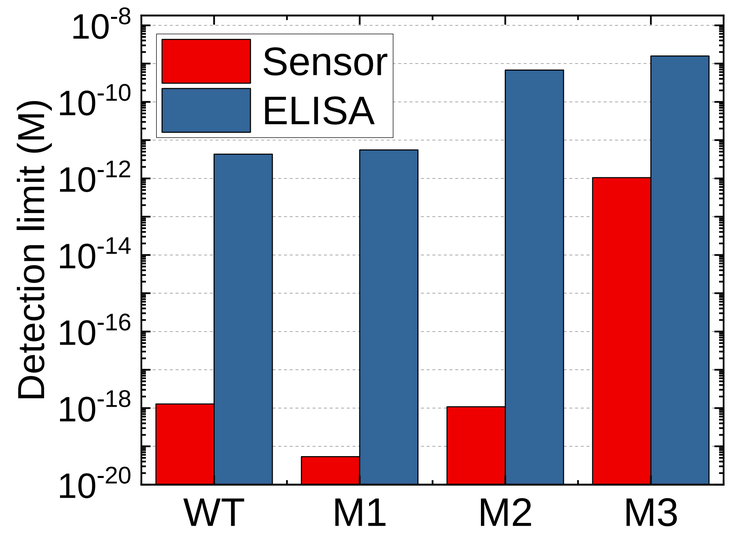
Screening E5B9 peptide variants



Comparison to gold standard

	SiNW FET	ELISA
Method	Electrical	Optical
Labeling?	No	Yes
Volume	5-10 µL	50 – 100 µL
LOD	10^{-19} - 10^{-16} M	10^{-11} - 10^{-5} M
Speed	20 mins	95 mins

LOD between nanosensor and ELISA



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complex nano materials

DRESDEN concept