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BIOSENSORS FOR PANDEMICS

SILICON NANOWIRE SENSORS FOR IMMUNOLOGICAL TREATMENT

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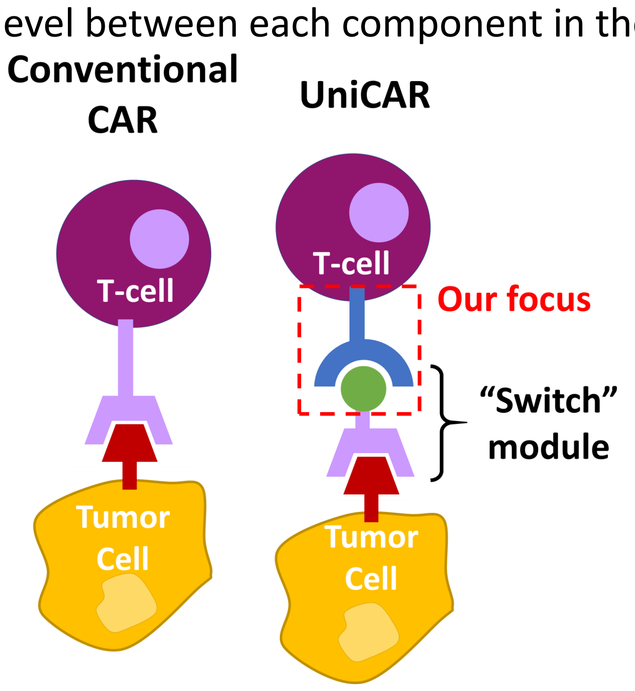
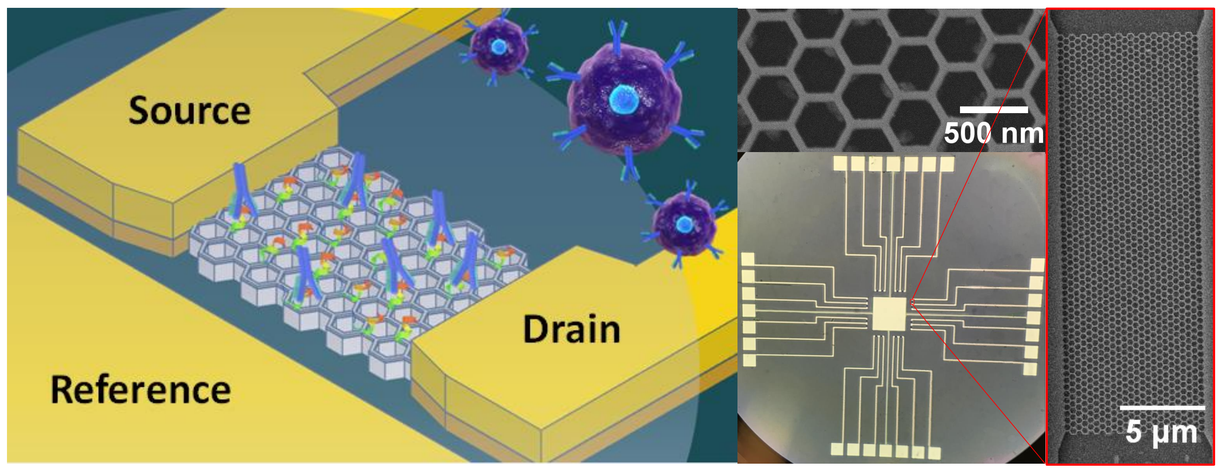
INTRODUCTION

To overcome fatal side effects might happen in CAR T-cell treatment, UniCAR platform adds "switch molecules" to the system which can cross-link tumor cells and T-cells and lead to destruction **[1]**. Interaction at molecular level between each component in the system can be explored by nanosensor with ease. In this study, we applied the silicon nanowire field effect transistor (FET) to investigate the affinity of potential T-cell receptor to a range of peptide derivatives in a process of constructing the most suitable target module.

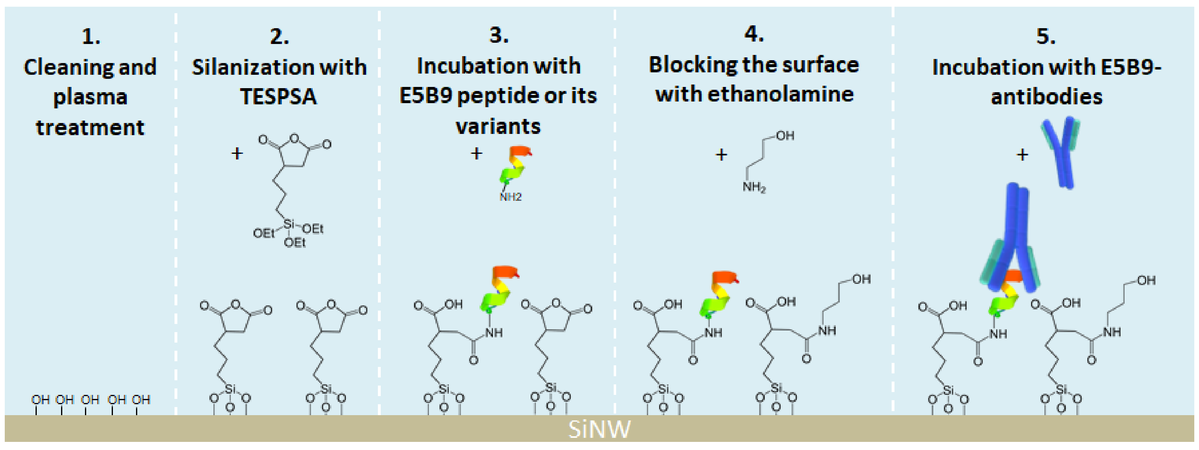


METHODS

The honeycomb silicon nanowire (SiNW) structures (~50nm width) were realized by electron beam lithography ensure reproducibility. They were highly doped with phosphorus (10^{14} cm^{-2}) and connected to Ag electrodes. Hard-baked SU-8 photoresist was used as a passivation layer. **[2]**

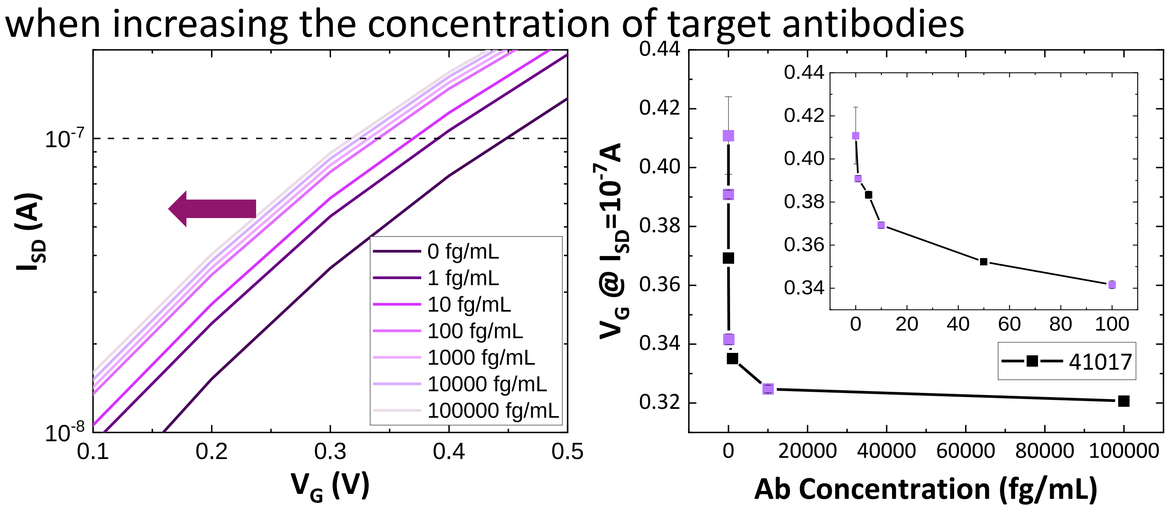


In total, seven peptide derivatives were investigated. Each was immobilized on a different sensor through a functionalization process **[3]** described in the below picture. After incubation with target antibody, all signal is measured in 0.01x PBS to overcome Debye effect.

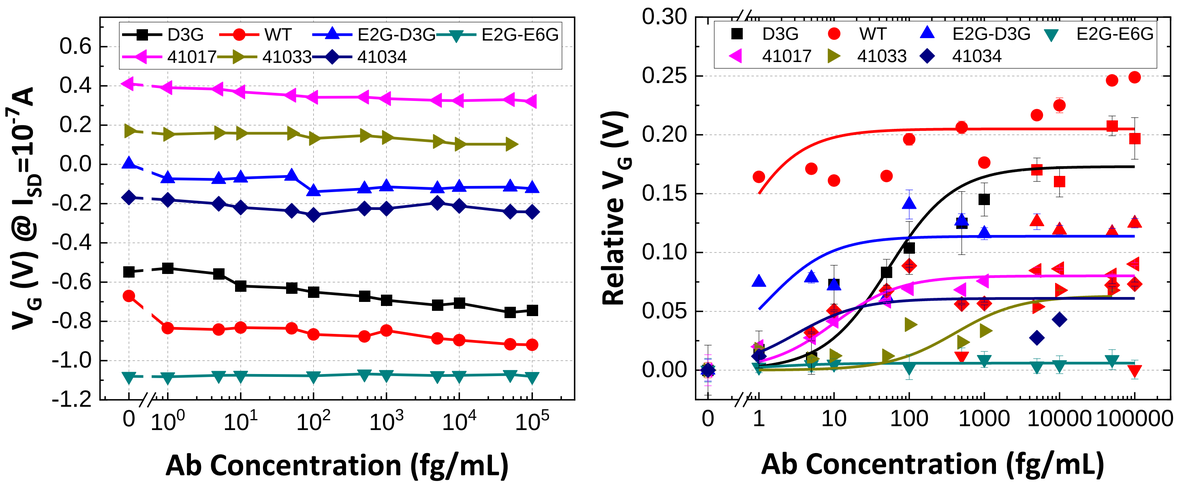


RESULTS

Transfer characteristics of the sensor reveal a unidirectional shift when increasing the concentration of target antibodies



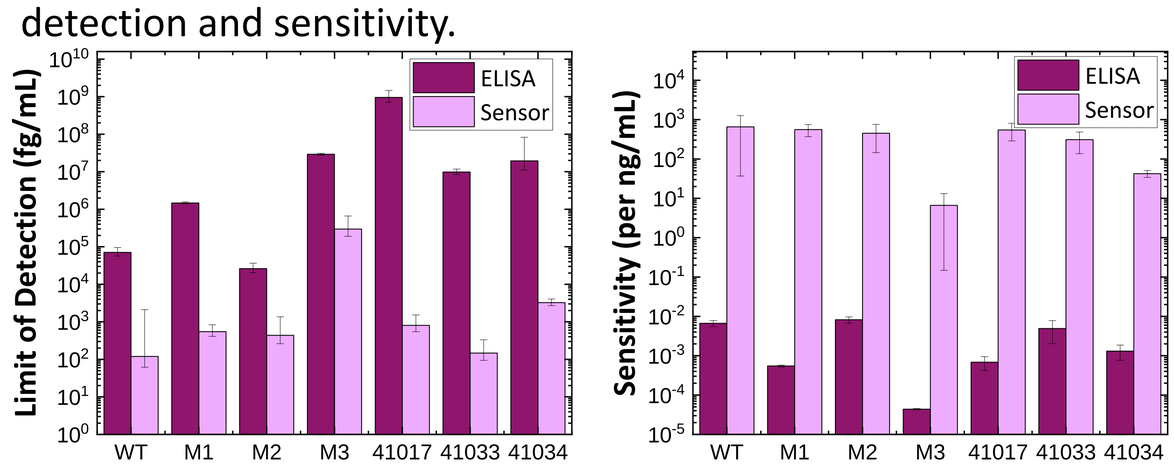
At fixed I_{sd}, V_g decreased when increasing the concentration of antibodies. Fitting the calibration curve of all derivatives help finding the peptide with highest affinity.



K_D from Michaelis Menten fitting. The smaller the K_D, the better the affinity.

Peptide			Peptide		
	WT	0.016 fM		**41017**	0.099 fM
	D3G	0.390 fM		**41033**	6.159 fM
	E2G-D3G	0.018 fM		**41034**	0.018 fM
	E2G-E6G	70.481 fM			

Compare to ELISA test, SiNW FET is superior in term of limit of detection and sensitivity.



CONCLUSION

This study successfully demonstrated the utilization of SiNW FET to determine an appropriate candidate for developing a good target module in UniCAR treatment. Thanks to its high sensitivity and low limit of detection, the sensor provides endless potential, not only low-concentration-detection but also therapeutic development.

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