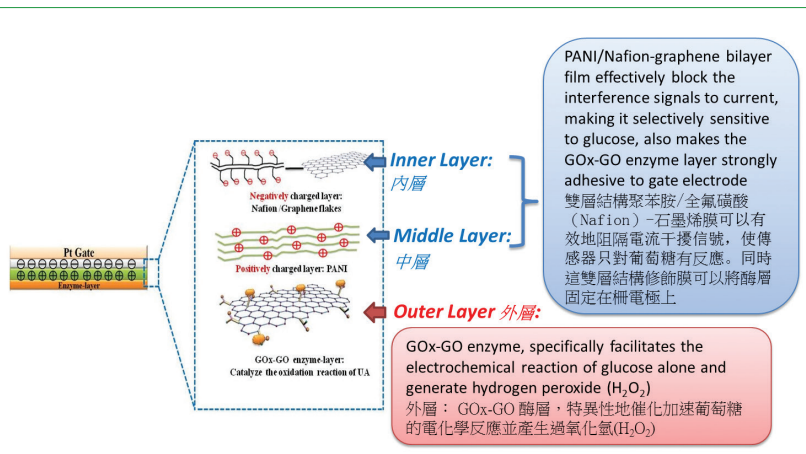
THE HONG KONG POLYTECHNIC UNIVERSITY
香港理工大學

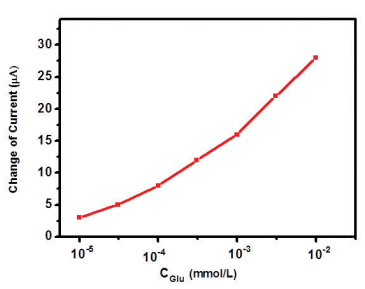
高敏感度唾液糖份測試生物傳感器
Highly Sensitive Biosensor for Measuring Glucose in Saliva

以無創傷方法準確地量度唾液內糖份的水平
A non-invasive way to measure the level of glucose in saliva accurately

這嶄新設計的高敏度半導體生物傳感器，與葡萄糖氧化酶結合，只對葡萄糖有反應，透過量度唾液中電流的大小，檢測唾液的糖份水平，以反映用家體內糖份水平，免除了以傳統抽血方法度量時帶來的痛楚。這生物傳感器能度量低至每升10^{-5}毫摩爾的葡萄糖水平，其靈敏度比傳統驗血糖儀器高出近千倍。這生物傳感器不單製造成本相宜，更可組裝在柔韌基板上，以緊貼彎曲和移動的表面，包括人體皮膚、智能紡織品及醫療繃帶等可穿戴式電子設備。



用於提高生物傳感器選擇性和靈敏度的高效多層修飾技術
The optimized multi-layer modification technique used to improve the sensitivity and selectivity of the biosensor



Change of current signals 電流改變信號 μA	Glucose level 葡萄糖水平 mmol/L
3	10^{-5}
5	3×10^{-5}
8	10^{-4}
12	3×10^{-4}
16	10^{-3}
22	3×10^{-3}
28	10^{-2}

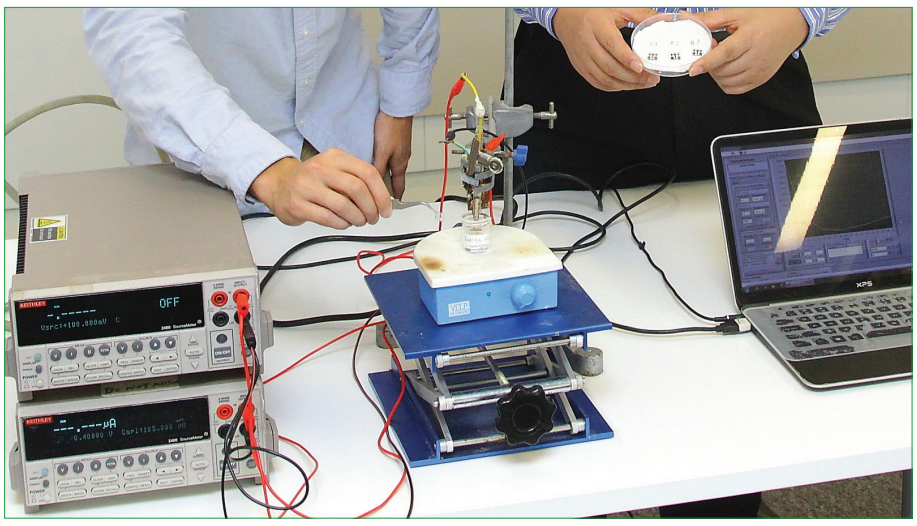
生物傳感器在各葡萄糖水平的表現
Performance of the biosensor in different glucose level

特色與優點

- 此高性能柔性葡萄糖傳感器可以選擇性地檢測人體唾液中微量的葡萄糖成份
- 高準確度和合理的低製造成本
- 在一個很廣的葡萄糖溶度範圍內顯示很好的線性響應性（大約10^{-5} mmol/L 到 10 mmol/L 範圍，等於在標準泳池內放 5g 至 140Kg葡萄糖）
- 可以緊貼在各種彎曲和移動表面

應　用

- 家用無創血糖機
- 採用類似的柵電極修飾技術，基於相同測試平台可開發出其它幾類重要的生物傳感器，如：尿酸傳感器、膽固醇傳感器



生物傳感器示範實驗
Laboratory Demo of the biosensor system

This new ultra-sensitive transistor-based biosensor can measure the level of glucose in saliva. Fabricated by using a glucose oxidase enzyme layer, the biosensor is sensitive only to glucose. It simply measures the glucose level by detecting the electric current in saliva, which reflects glucose level in human body. Comparing to conventional blood-glucose measuring device, this biosensor can detect glucose level as low as 10^{-5}mmol/L. That is a thousand times more sensitive than conventional measurement. Apart from being inexpensive to manufacture, the biosensor can be fabricated with flexible substrates to apply on curved and moving surfaces, including human skin and such wearable electronics as smart textiles and medical bandages.

Special Features and Advantages

- A high-performance flexible glucose biosensor, which is sensitive to specifically detect trace amount of glucose level in human saliva
- Highly accurate and low in cost
- Demonstrate a good linear response in a wide glucose level range (approximately 10^{-5} mmol/L to 10 mmol/L , i.e. from 5 g to 140 Kg glucose in a standard swimming pool)
- Can be adhered to a variety of curved and moving substrates

Applications

- Portable non-invasive glucose level meter for home use
- Based on the same gate electrodemodification techniques, several other important biosensors can be developed using this transistor platform, including uric acid sensor & cholesterol sensor

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Note: Subject to data charges by mobile operators

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