Graphene Biosensor for Saliva Protein Adsorption

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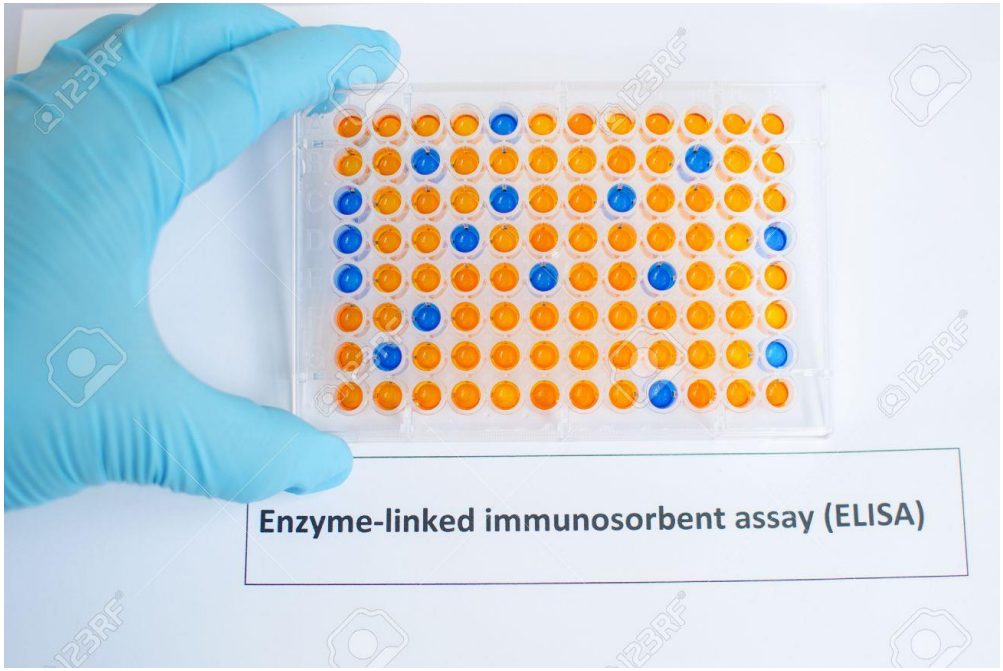
Research Background ELISA

- **ELISA is a useful tool for determining serum antibody concentrations.**
- **Because of its high sensitivity, it has been widely used for HIV and cancer detection.**

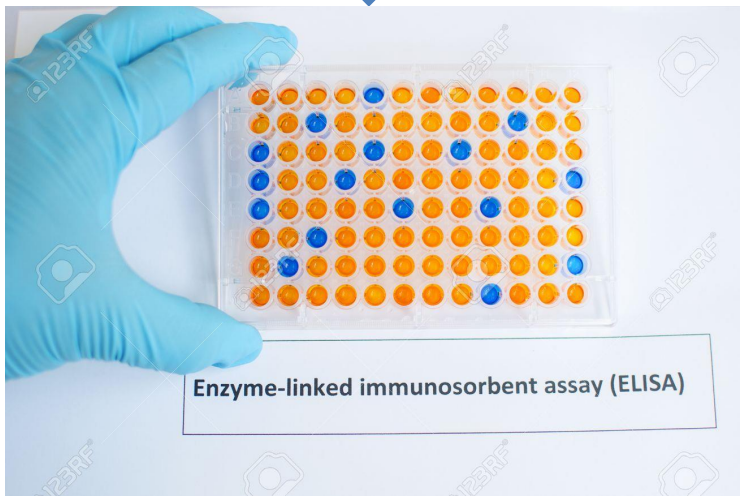


Research Background ELISA

- **But it can not implement real-time detection, because it will take 24 hours at least in clinical.**

- **Novel rapid detection method is needed to complement it.**

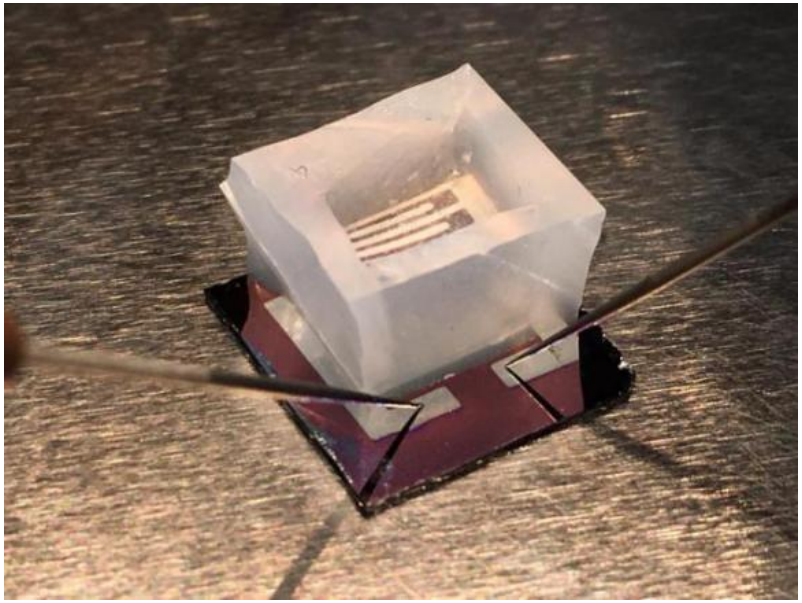
high sensitivity (24 hours)



rapid detection (1 second)

Research Objective

Development of
Rapid quantitative detection of proteins
in biology solutions using graphene biosensors



I made it !

Research Objective

Development of
Rapid quantitative detection of proteins
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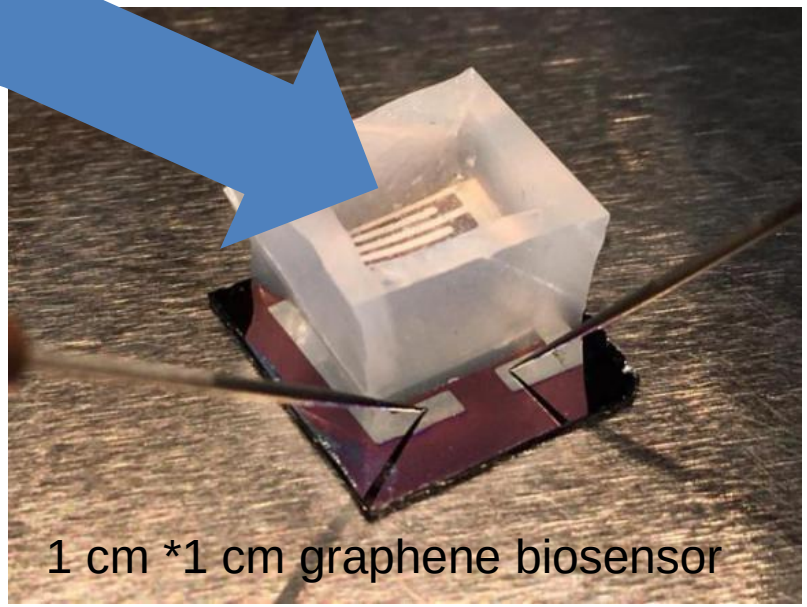
Blood

Urine

Saliva



the actual experiment situation

Graphene Biosensor Manufacture Method

- Interdigital electrode manufacture
- Graphene transfer
- Graphene modification
- Real-time detection

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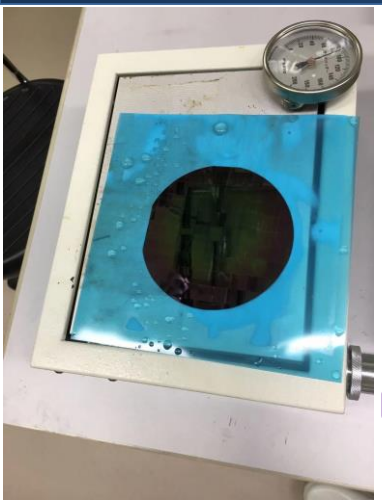
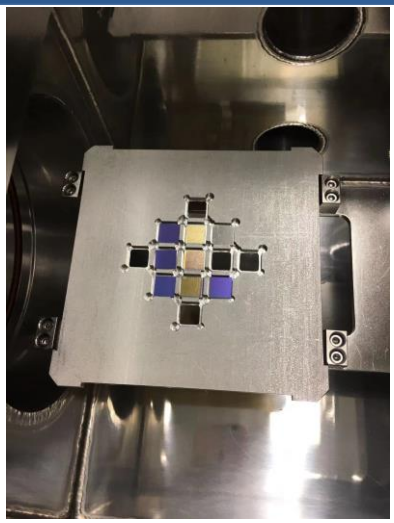
Interdigital Electrode Manufacture



shadow mask

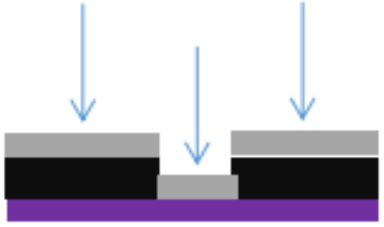
SiO2/Si substrate

shadow mask + substrate



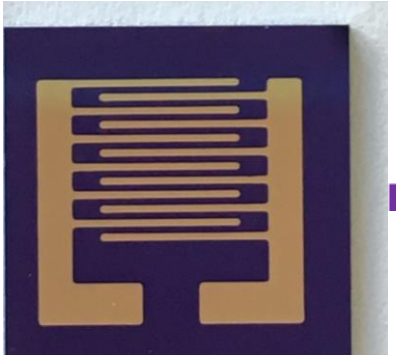
Cr sputter deposition

shadow mask + electrode + substrate



complete

electrode + substrate



Graphene Biosensor Manufacture Method

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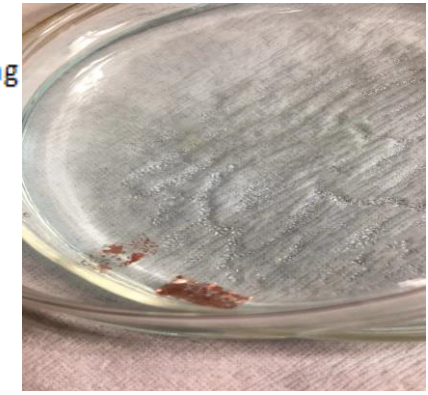
Graphene Transfer

PMMA spin coat

Copper foil + graphene

Copper foil + graphene + PMMA

copper dissolving



Graphene + PMMA

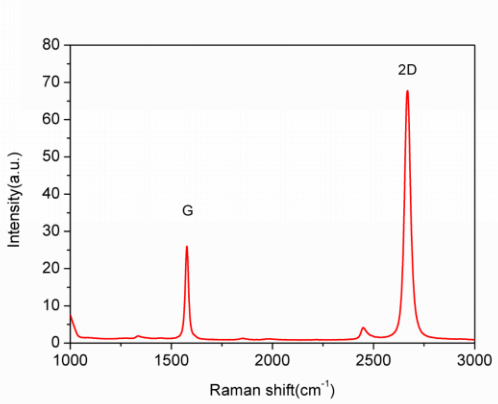
graphene transfer

electrode substrate + graphene + PMMA

PMMA remove

complete

electrode substrate + graphene



Graphene Biosensor Manufacture Method

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- Real-time detection

Graphene Modification

Specific detection

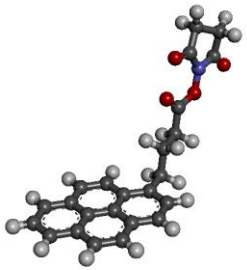
↓

Surface linker modification

↓

Non-covalent combination

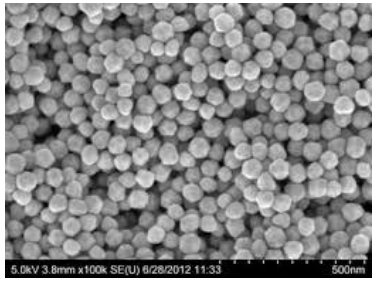
↓



PBASE

Covalent combination

↓

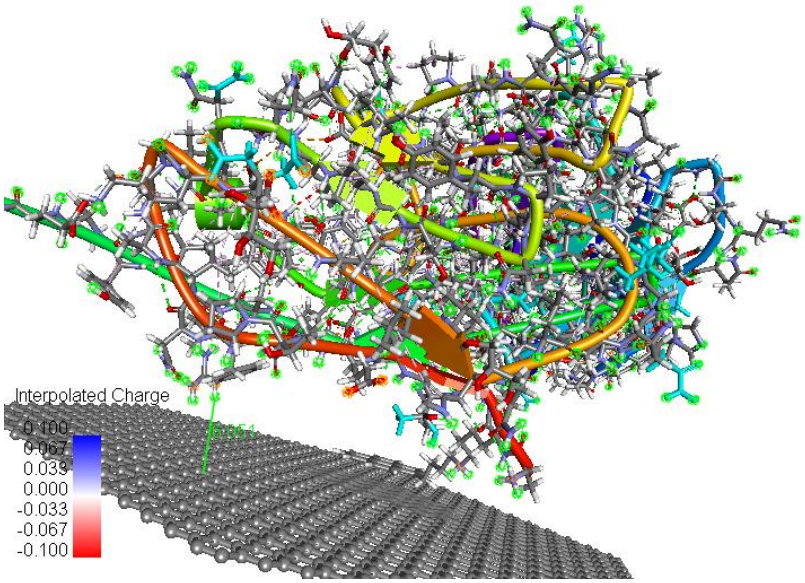


gold nanoparticles

Non-specific detection

↓

Surface linker modification



Graphene Biosensor Manufacture Method

- Interdigital electrode manufacture
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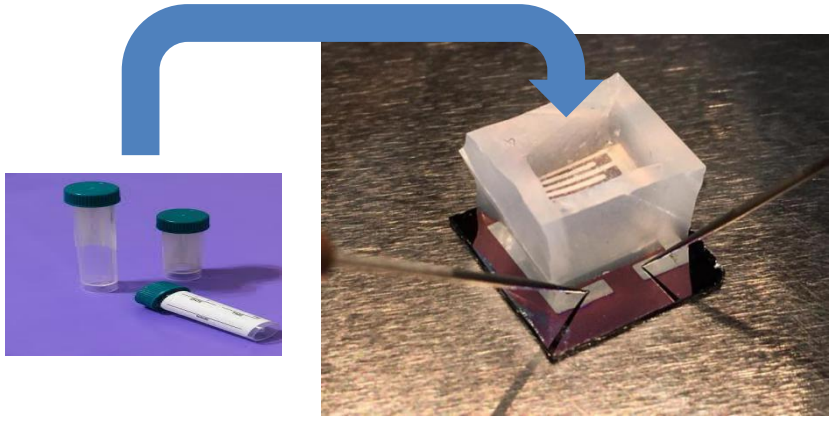
- Graphene modification
- Real-time detection

Real-Time Detection

Step

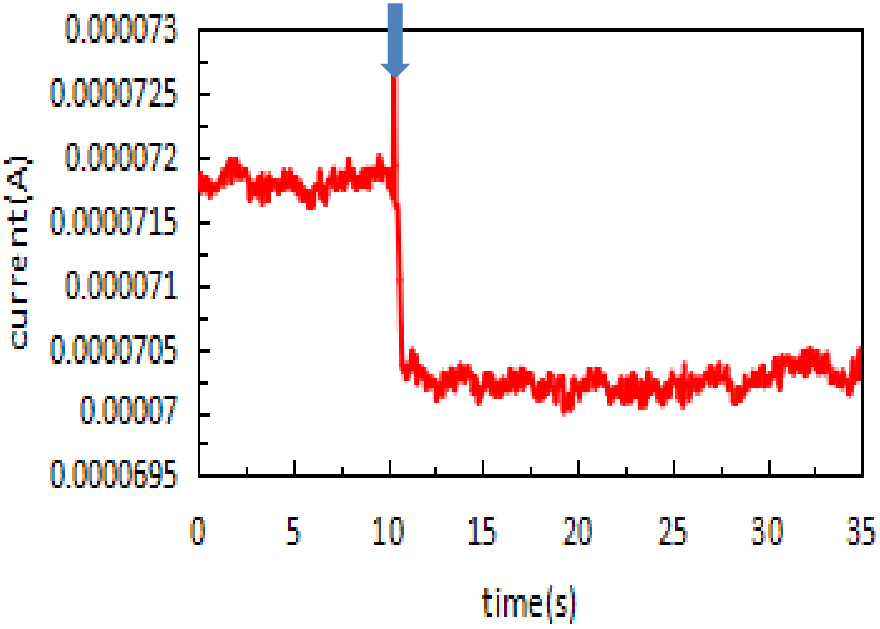
1. Adding the buffer solution, then start detection.
2. Mix saliva with the buffer in equal proportions
3. Then add the mix solution at the dropping time.

3. dropping into the pool



2.Mixing the saliva and the buffer

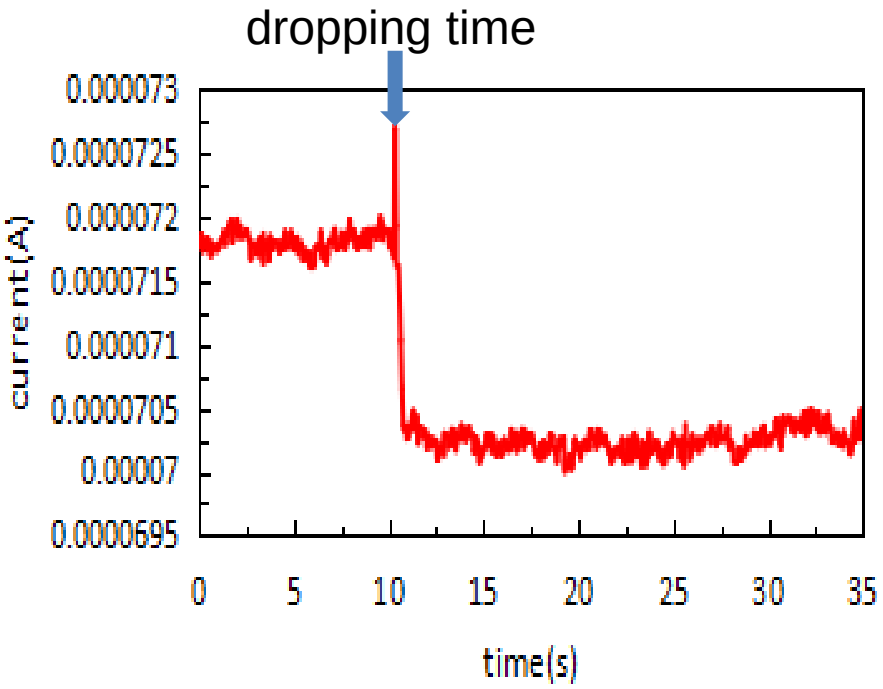
dropping time



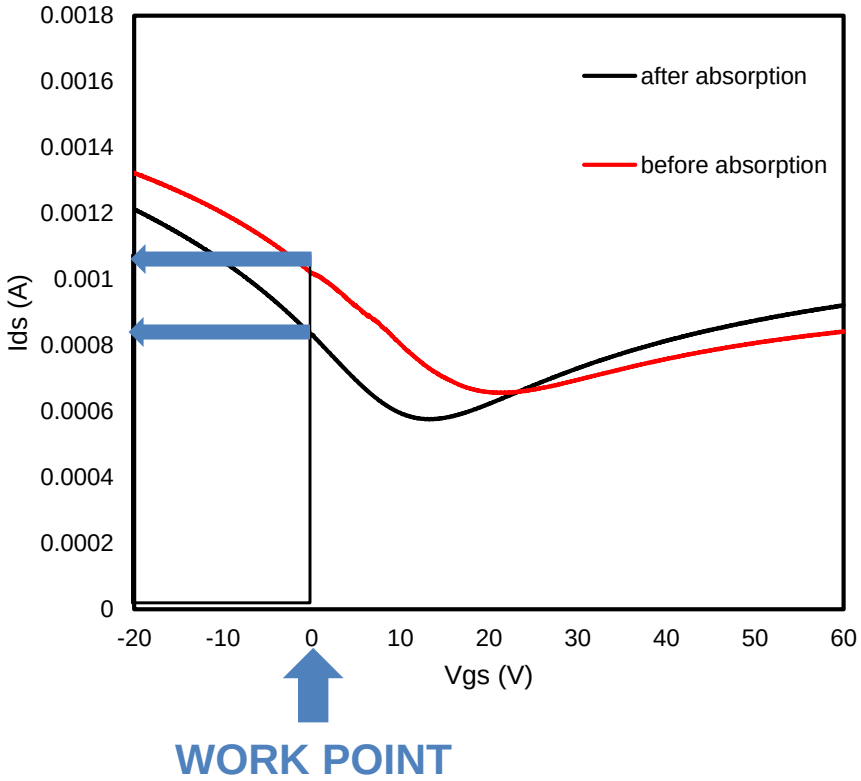
the actual current changing test result

Real-Time Detection

Actual test results

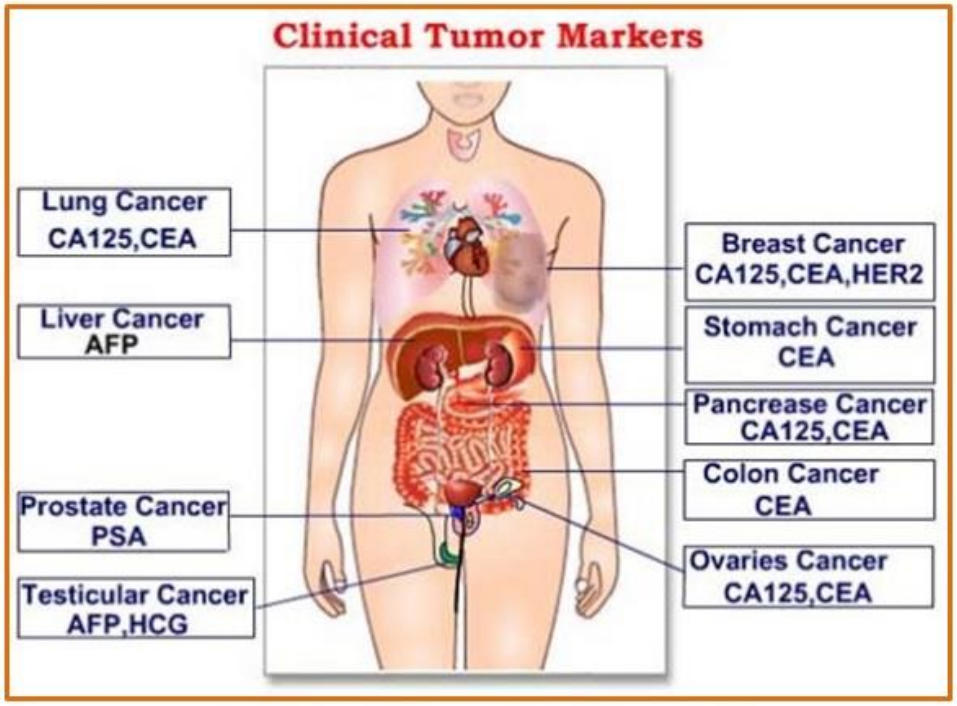


The dropping corresponding time is less than 1 second



The IV character of the graphene before and after absorption has been tested. At the 0V (WORK POINT) there is an obviously current down after absorption.

Summary



http://www.slulabservices.com/news/962/

- **By rapidly detecting specific cancer markers, graphene biosensors expect to achieve large-scale cancer screening for early detection of cancer.**
- **This is NOT possible with ELISA technology.**

Future work

PBS-buffer

Blood+PBS buffer

Urine+PBS buffer

Saliva+PBS buffer

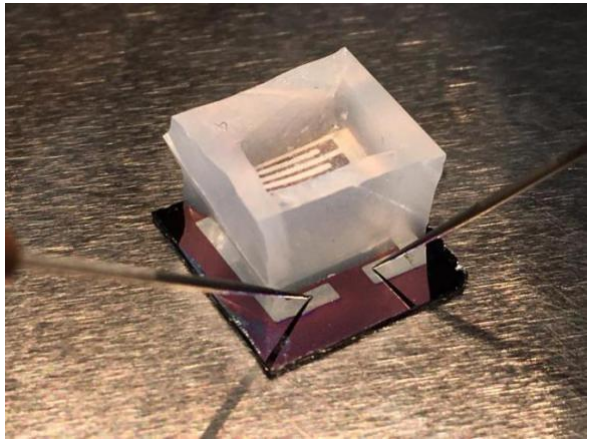
Clinical application

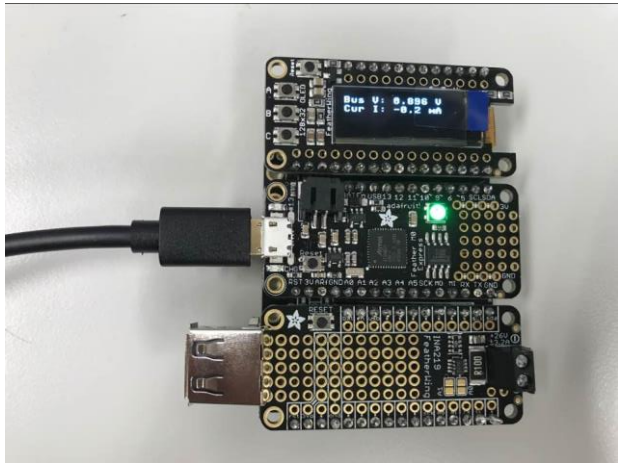
Now

2020

2021

Future Work





Rapid, portable cancer detection equipment

- Development of the graphene biosensor device for detecting concentration of cancer markers from saliva, blood, and urine.
- This detection system will monitor cancer situation of the patient in real-time;
- Hopefully improve survival rate of cancer patients.

Acknowledgement

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Thanks for your listening.