教育局校本支援服務 (2022/23)
優質教育基金主題網絡計劃—學校

透過校本科學及生物科技課程
推行 STEM 教育

總結分享會

2023年7月7日

嗇色園主辦可譽中學暨可譽小學　　施瑪恩

網絡學校

中華基督教會蒙民偉書院

賽馬會體藝中學

順德聯誼總會鄭裕彤中學

嗇色園生物科技
流動實驗室計劃

1. DNA and Genetics (Molecular Biology) DNA與遺傳學（分子生物學）	
D01#	Paper DNA Model 摺紙DNA模型
D02#	Bitter Genes 吃苦的基因
D03	Candy DNA 美食DNA
D04	Extraction of Bacterial DNA 抽取細菌DNA
D05	Restriction Digestion Analysis 限制內切酶分析
D06A	Simulated DNA Fingerprinting 模擬DNA指紋分析
D06B*	DNA Fingerprinting DNA指紋分析
D07*@	Recombinant DNA Technology - Transformation of a Green Fluorescent Protein Gene DNA重組技術—轉移螢光基因
D08*	Effects of UV Light Exposure on DNA Damage 紫外光線對DNA受損的影響
D09*	Simulated CRISPR to treat Cystic Fibrosis 模擬CRISPR技術—治療囊性纖維化
D10*	DNA Fingerprinting - Amplification of DNA Samples by Polymerase Chain Reaction (PCR) DNA指紋分析—通過聚合酶鏈反應（PCR）擴增DNA樣本

2. Microbiology Exploration 探索微生物世界	
M01	"Glo" Hands – Illustration of Effectiveness of Hand-wash by Fluorescent Gel 「螢」之手—利用發光顯影劑測試洗手效能
M02	Where are the Germs? – Grow Germs from Hands and Environment 何處覓細菌?—培養手指與環境中的微生物
M03	Effects of Temperature on Bacterial Growth 溫度對細菌生長的影響
M04	Effects of Household Chemicals on Bacterial Growth 家居化學物質對細菌生長的影響
M05	Effects of Antibiotics on Bacterial Growth 抗生素對細菌生長的影響
M06	Determination of Bacterial Cell Number by Serial Dilution and Spreading 利用連續稀釋法及塗抹法量度細菌數量
M07	Determination of Turbidity by Spectrophotometry 利用光譜測定法量度細菌樣本的混濁度
M08*	Water Quality Test – Chromogenic Analysis of Water Contaminants 水質測試：水污染物顯色分析

3. Forensic Science 鑑證科學	
F01	Shoeprint Analysis 鞋印分析
F02	Fibre Analysis 衣物纖維分析
F03	Fingerprint Analysis 指紋分析
F04	Blood Splatter 血跡形態分析
F05	Paper Chromatography Analysis 過濾紙色層分析法
F06	DNA Analysis (Simulated) DNA分析（模擬）
F07*	DNA Analysis DNA分析
F08*	Blood Type Analysis (Simulated) 血型分析（模擬）

:Padlet

STEM • 7天

22-23_QTN 透過校本科學及生物科技課程推行STEM教育

預訂 Mobile Lab 表格

STEM 9月

注意事項

PDF

ApplicationNotes_July2020

♡ 0

STEM 9月

申請表

PDF

BML_RegistrationForm_July2020

♡ 0

實驗室安全手冊

STEM 9月

學校實驗室的
微生物及生物工程實驗
安全指引

PDF

EDB_微生物及生物工程實驗_安全指引_2021

♡ 0

STEM 9月

Biotech_EquipmentConsumableList

XLSX

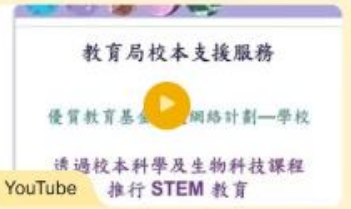
Biotech_EquipmentConsumableList_180906

♡ 0

溫度對微生物生長的影響 (可譽中學暨可譽小學)

STEM 7月

課堂影片



YouTube

QTN 溫度對微生物生長的影響 (可譽中學)

♡ 0

STEM 9月

工作紙

PDF

S1_公平測試_溫度對微生物生長的影響_WS

♡ 0

STEM 9月

教學簡報

迦密主恩中學分享

STEM 8月

迦密主恩中學分享PPT

STEAM @ CDGFSS

Ms Fung Mei Sze, Mr Cheung Enoch
31-10-2022

PDF

STEAM@CDGFSS

♡ 0

STEM 8月

S2 Biotechnology

PDF

Biotechnology (2122)

♡ 0

STEM 8月

S1 Learning Journal

溫度對微生物生長的影響 (體藝中學)

STEM 7月

課堂影片

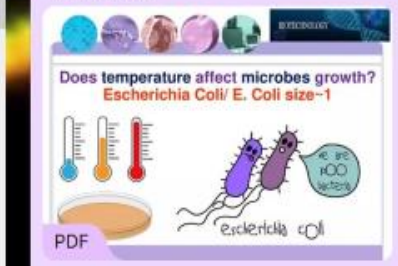
YouTube

QTN 溫度對微生物生長的影響 (體藝中學)

♡ 0

STEM 7月

教學簡報



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F1 Biotech_Temperature-JCTIC

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STEM 7月

課堂工作紙

食水的微生物檢測 (鄭裕彤中學)

STEM 7月

課堂影片

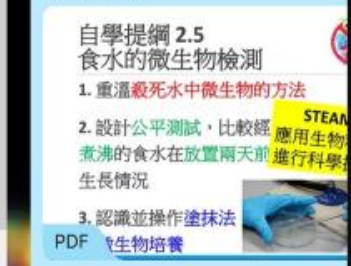
YouTube

QTN 食水的微生物檢測 (鄭裕彤中學)

♡ 0

STEM 7月

教學簡報



自學提綱 2.5 食水的微生物檢測

♡ 0

STEM 7月

課堂工作紙

網絡學校

中華基督教會蒙民偉書院

賽馬會體藝中學

順德聯誼總會鄭裕彤中學

持續的合作

Promotion of STEM Education Through the School-based Science and Biotechnology Curriculum

Carmel Divine Grace Foundation Secondary School
Ms FUNG Mei Sze

Lesson Planning

1st Double Lesson

Skills training

2nd Double Lesson

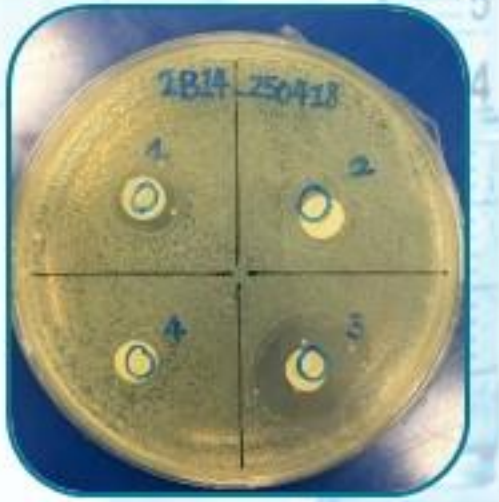
Bacteria killing ability of vinegar

3rd Double Lesson

Analysis and Report

4th Double Lesson

Bacteria killing ability of other materials



DNA Fingerprinting

Date: _____ Grade: _____

Understanding DNA

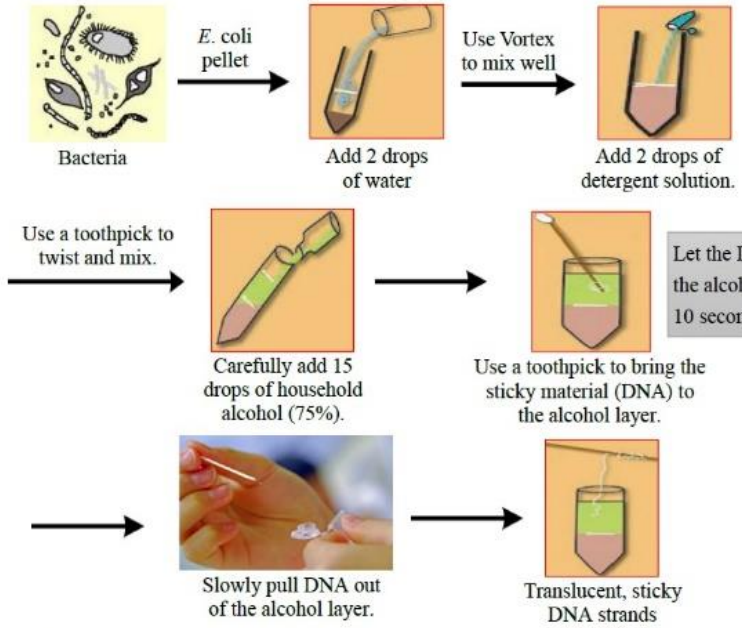
Write 'T' for a true statement or 'F' for a false statement in each box provided.

1. DNA is a molecule that carries the genetic instructions used in the growth, development, functioning and reproduction of a cell. ☐
2. DNA can be found in mature red blood cells. ☐
3. DNA can be found in animals only. ☐
4. The genetic code of a human being is unique. ☐
5. Humans have 28 pairs of chromosomes. ☐
6. Humans are surprisingly similar to each other as 99.9% of their genomes are the same for any two unrelated people. ☐
7. The two DNA strands twist around one another to form a double helix. ☐
8. If the sequence of bases on one DNA strand is known, the sequence of bases on the other strand can also be known. ☐
9. DNA is composed of A and G as well as T and C base pairing. ☐

Extracting DNA of *E. coli*

1. Add 2 drops of water into the solution of *E.* coli, use vortex to mix well.
2. Add 2 drops of detergent solution. Use a toothpick to twist and mix.
3. Carefully add 15 drops of household alcohol (75%).
4. Use a toothpick to bring the sticky material (DNA) to the alcohol layer. Let it stay in the alcohol layer for 10 seconds.
5. Slowly pull DNA out of the alcohol layer.

Flow Chart



Discussion

1. What is the use of detergent solution?

   _____

   _____

2. What is the use of adding alcohol?

   _____

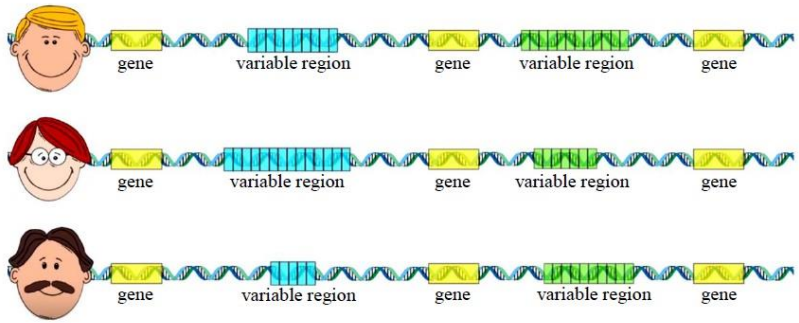
   _____

3. What is the importance of DNA to heredity? Fill in the blanks below.

   The _____ of bases on DNA acts as _____. Every three bases encode one 'message' that instructs the cell to make different types of _____. They are important chemicals that build cells. They also affect almost all activities of our cells and hence determine our _____.

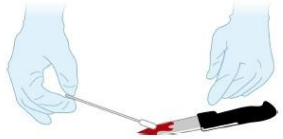
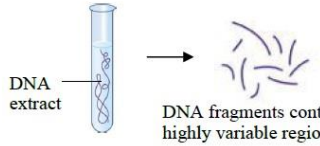
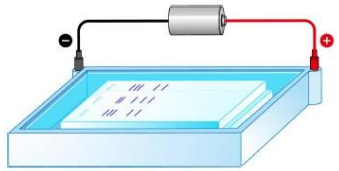
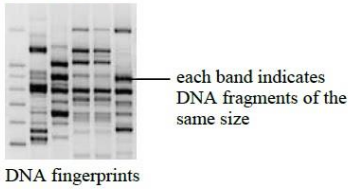
DNA Fingerprinting

- DNA fingerprinting is a technique used to identify individuals using their DNA. DNA fingerprints are unique for individuals (except identical twins).
- There are different **variable regions** with repetitive DNA base sequences that do not contribute to the function of a gene. The length of these regions varies between different individuals, except identical twins.



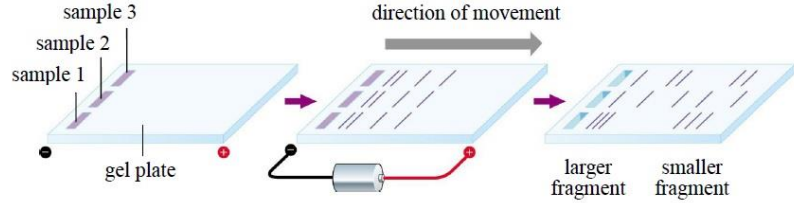
- As the DNA of everyone is unique, scientists can use DNA in blood, semen, skin, saliva or hair found at a crime scene to identify a matching DNA of an individual.

Major steps of DNA fingerprinting

◆ **Extract DNA** Extract DNA from the sample (e.g. hair, blood, saliva or semen). 	❖ **Obtain DNA fragments** Obtain DNA fragments containing different variable regions through proper processes. 
◆ **Separate DNA fragments** Separate the DNA fragments by gel electrophoresis according to their size. 	☒ **Generate DNA fingerprints** The pattern of DNA bands obtained is called a DNA fingerprint. 

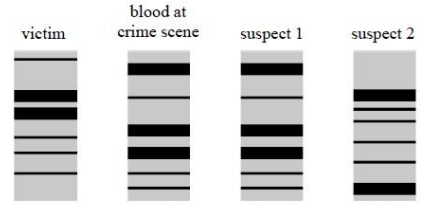
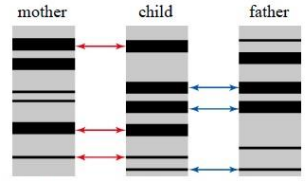
Gel electrophoresis

- Gel electrophoresis makes use of electricity to separate DNA fragments across a gel plate.
- DNA fragments are negatively charged; they are placed at the negatively charged end of the gel plate.
- When an electric current is applied, the DNA fragments move towards the positively charged end of the gel.
- The smaller DNA fragments can pass through the gel more easily and they travel faster than the larger ones. Eventually, DNA fragments are separated into bands according to their size.
- After the electrophoresis is complete, the DNA bands on the gel can be made visible by staining them with special dyes (e.g. methylene blue solution).



Applications of DNA Fingerprinting

DNA fingerprinting is considered the most accurate and reliable tool for identifying organisms with DNA. It has the following applications.

Forensic science	To provide forensic evidence on the identities of individuals in solving crimes.  ☊ The DNA fingerprint of suspect 1 matches that of the blood found at the scene. This suggests that the blood belongs to suspect 1.
Parentage testing	To prove family relationships.  ☊ The DNA bands of the child come from both the father and the mother.

Experiment

Objective

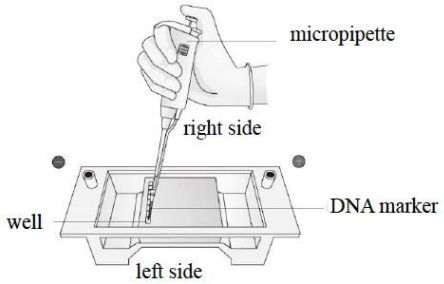
To separate DNA fragments by gel electrophoresis. In this practical, a gel electrophoresis kit is used for separating DNA fragments.

Procedure

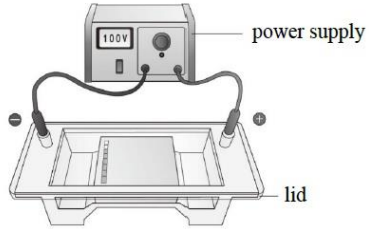
A. Gel electrophoresis for the separation of DNA fragments

1. Place the gel with the tray in the electrophoresis tank. Add buffer solution to the electrophoresis tank to cover the gel to a depth of about 1 mm.

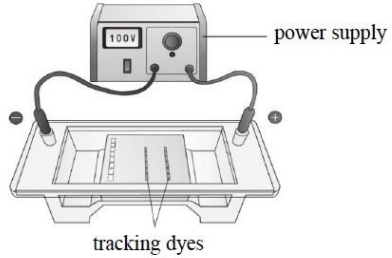
2. Load the DNA marker into the leftmost well of the gel slowly using a micropipette.



3. Load DNA samples A to E (containing colour dye) into separate wells of the gel from the left to the right respectively.
4. Cover the lid of the electrophoresis tank. Connect the electrodes to the power supply. Switch on the power supply and run the gel for about 1 hour.



5. When the tracking dyes have reached about half to two-thirds of the length of the gel, turn off the power supply.



B. Staining of the DNA fragments

1. Take out the tray together with the gel from the electrophoresis tank carefully.
2. Transfer the gel into a plastic box containing methylene blue solution. Cover the box with a lid and leave it overnight.
3. After destaining the gel, place the gel on a white tile for observation.

Results

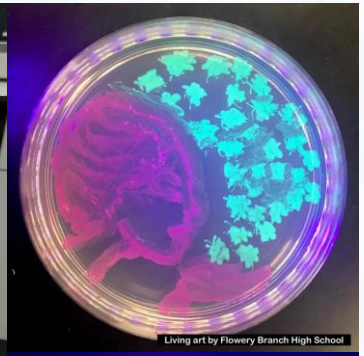
Stick and label a photograph of the stained gel in the space below.


EXIT

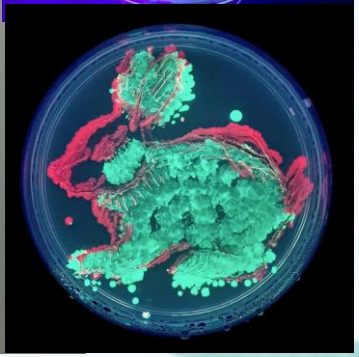
微生物彩繪


amino

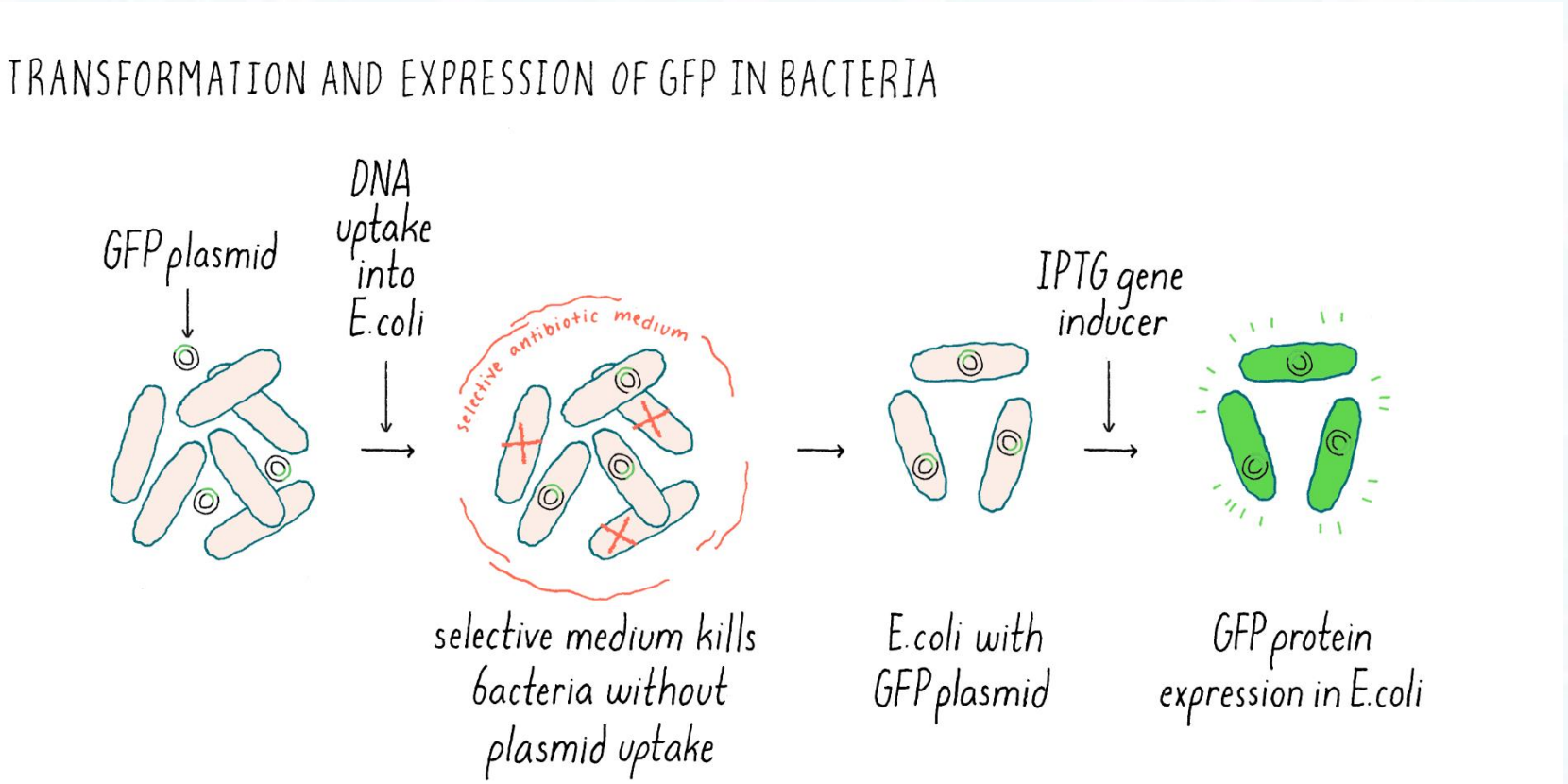

INCUBATOR
HOT & COLD
00:00:00
Incubator
25 5°C
Red
Green
Blue
0
0
0
30
37
42
START
STOP
START

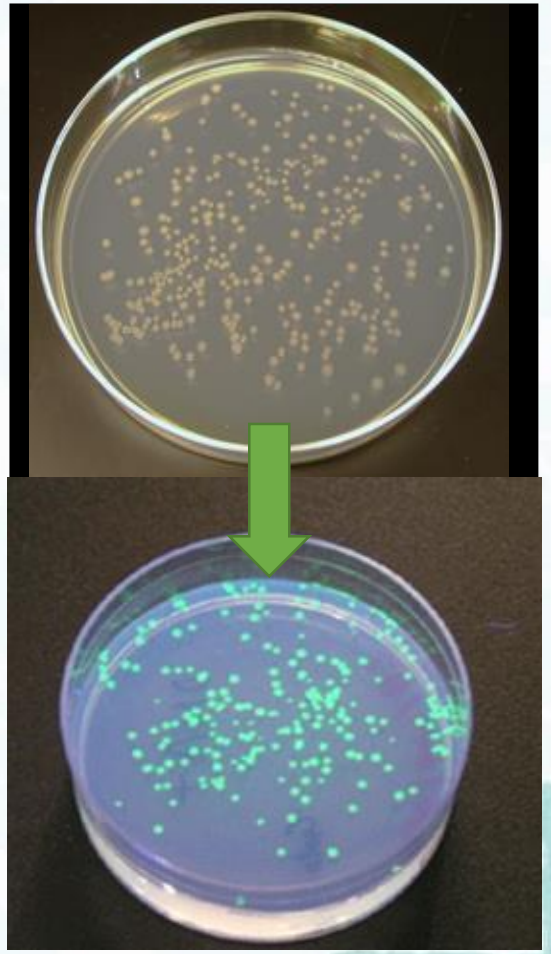

Living art by Flowery Branch High School


Organism:
Date:
www.amino.bio

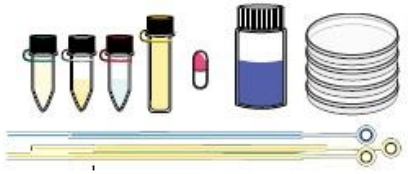


生物工程：轉化 (Transformation)





《中學實驗》



Pre-labs → Engineer-it Kit

Pre-lab(s)
Use the Virtual Bioengineer to prepare for the hands-on experience with theory and procedures
(30 minutes)

Day 1
Create petri dishes, LB agar, streak blank bacteria and incubate
(45 minutes)

Incubation
12-24 hours

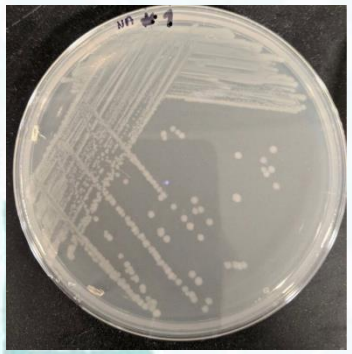
Day 2
Make cells chemically competent & transform with DNA plasmid. Start recovery
(45 minutes)

Recovery
12-24 hours

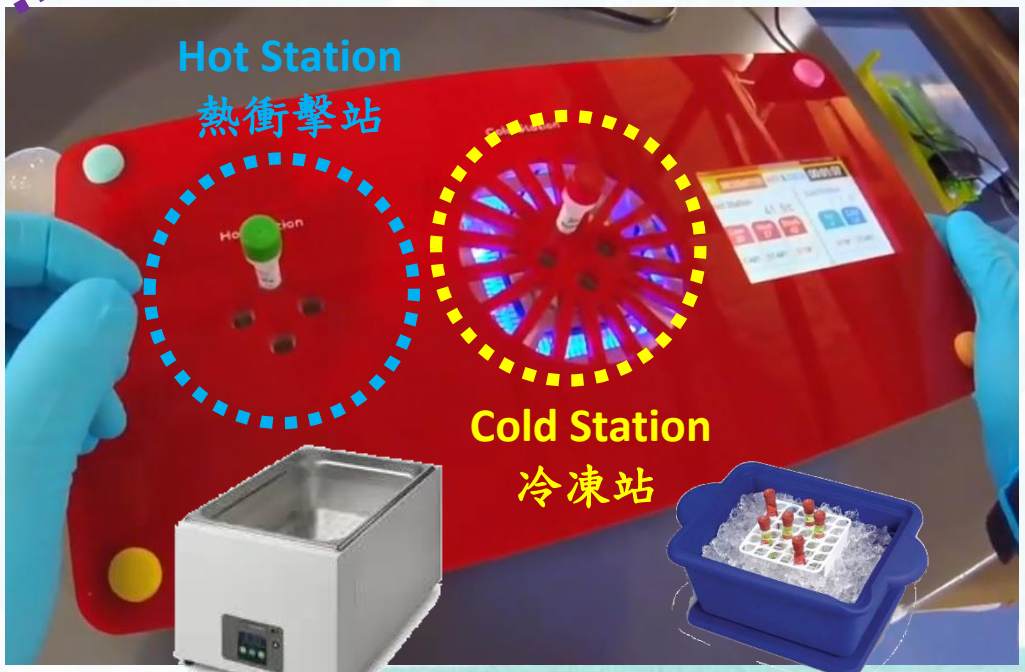
Day 3
Plate transformed cells and incubate
(45 minutes)

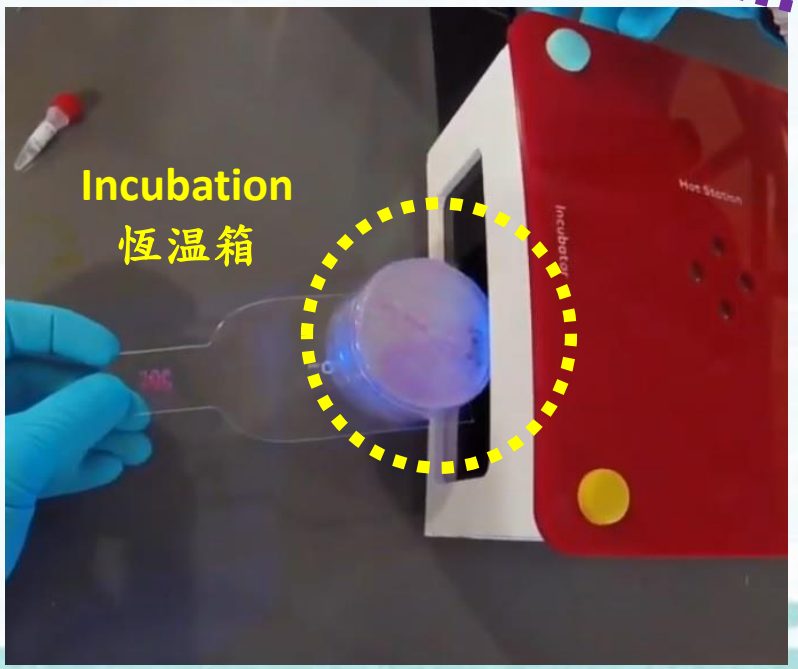
Incubation
24-48 hours

Day 4
View colonies and analyze results.
(10-45 minutes)

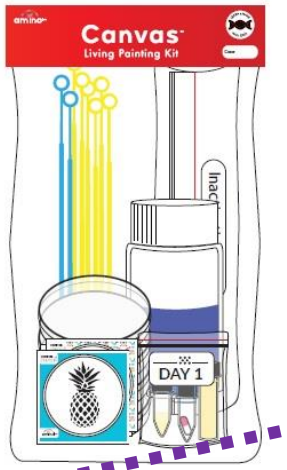


劃線法 (streak-plate method)





《中小學實驗》



Canvas Kit

Day 1

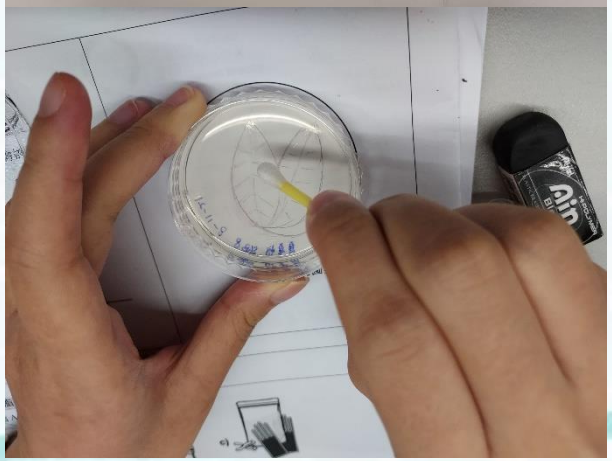
Create painting palette(s)
Each student group or individual makes LB agar plates with antibiotics (selective plates) and streaks each of the colored bacteria paints from the tubes included in the kit onto one of these selective plates. This amplifies the colorful bacteria so there is enough to paint with. Incubate it so that it becomes the painting palette.
(60+ minutes)

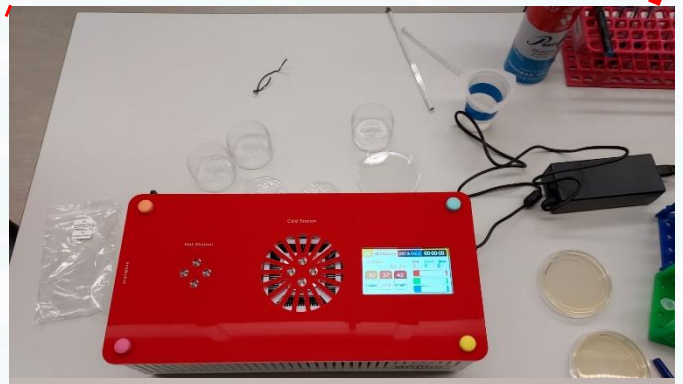
Day 2

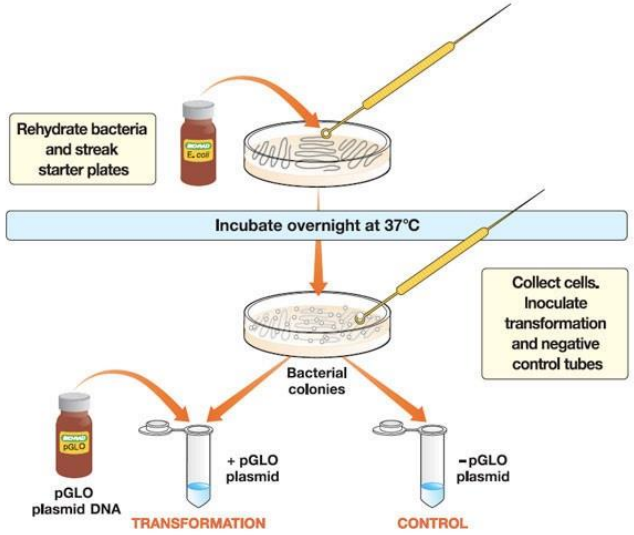
Paint your bioart
Each student or individual can use a blank stencil to draw their picture that will become the bioart. Set the stencil under the petri dish in order to trace it using the bacteria paintbrushes and the painting palette. Incubate the petri dish(es).
(30+ minutes)

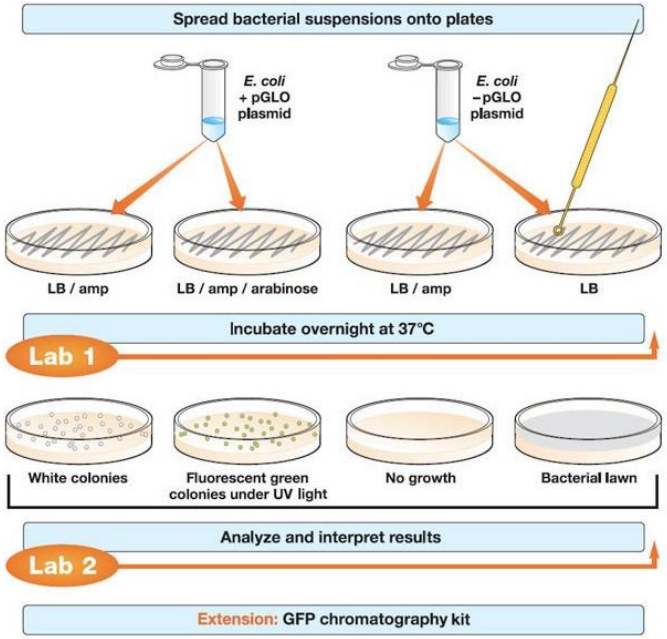
Day 3

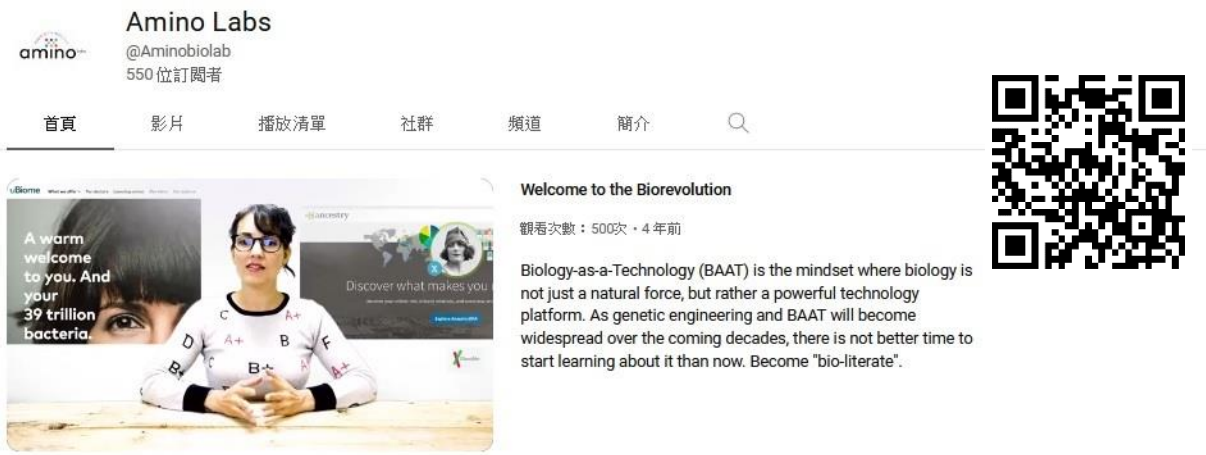
See your bioart
View the living art grow and change color over the next 24-72 hours. Use natural and UV light to see the different colors and photographs!
(10+ minutes)



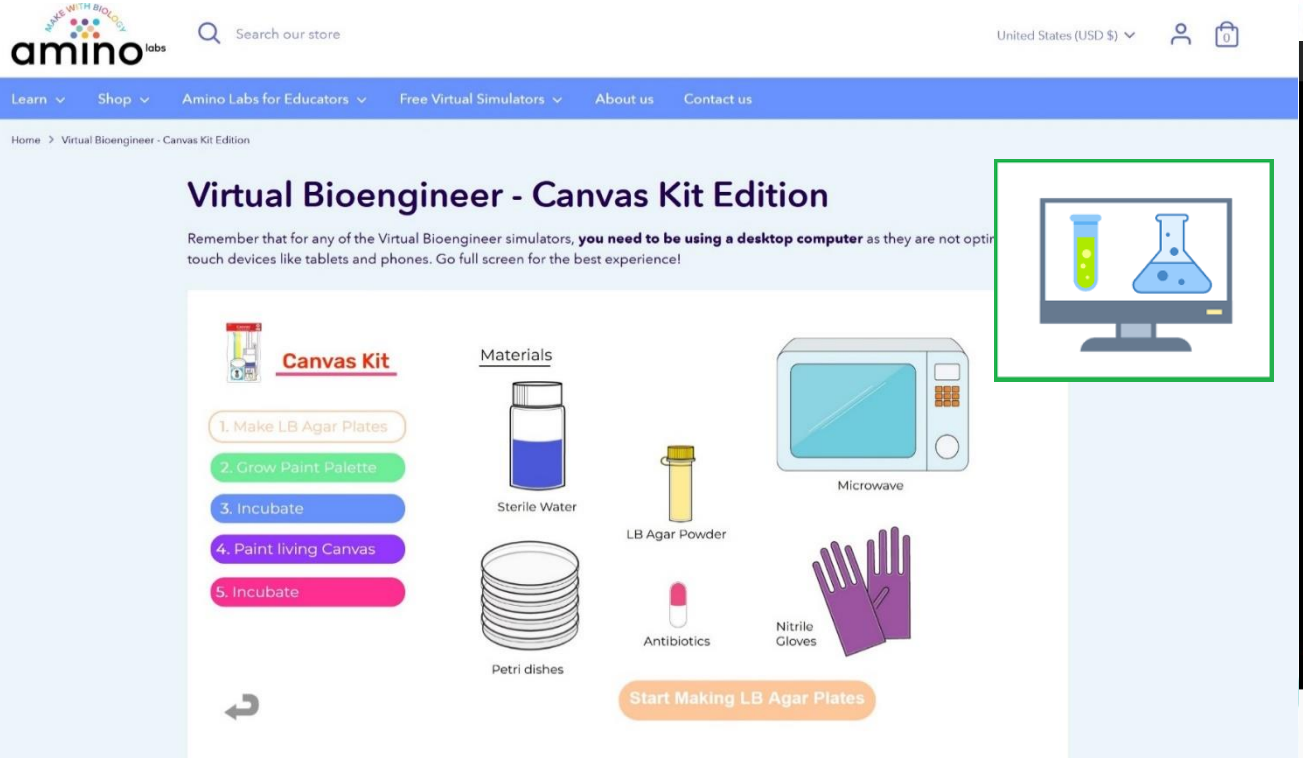



Rehydrate bacteria and streak starter plates
Incubate overnight at 37°C
Collect cells. Inoculate transformation and negative control tubes
Bacterial colonies
pGLO plasmid DNA
+ pGLO plasmid
−pGLO plasmid
TRANSFORMATION
CONTROL
Incubate both tubes on ice for 15 minutes
Heat shock at 42°C for 50 seconds, place on ice for 2 minutes
Add nutrient broth and incubate at room temperature for 10 minutes


Spread bacterial suspensions onto plates
E. coli + pGLO plasmid
E. coli −pGLO plasmid
LB / amp
LB / amp / arabinose
LB / amp
LB
Incubate overnight at 37°C
Lab 1
White colonies
Fluorescent green colonies under UV light
No growth
Bacterial lawn
Analyze and interpret results
Lab 2
Extension: GFP chromatography kit


Amino Labs
@Aminobiolab
550 位訂閱者
首頁
影片
播放清單
社群
頻道
簡介
A warm welcome to you. And your 39 trillion bacteria.
Welcome to the Biorevolution
觀看次數：500次・4 年前
Biology-as-a-Technology (BAAT) is the mindset where biology is not just a natural force, but rather a powerful technology platform. As genetic engineering and BAAT will become widespread over the coming decades, there is not better time to start learning about it than now. Become "bio-literate".


Tutorials
▶ 全部播放
EXTRACTING DNA FROM A STRAWBERRY
6:54
1:16:44
1:40:49
39:34
Extracting DNA from a
Canvas Kit for living
The Engineer-it Kit for
Smell-it Kit experiment video:
How to make a DIY incubator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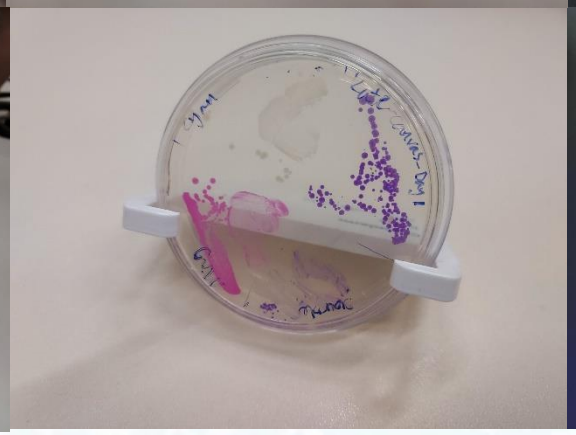
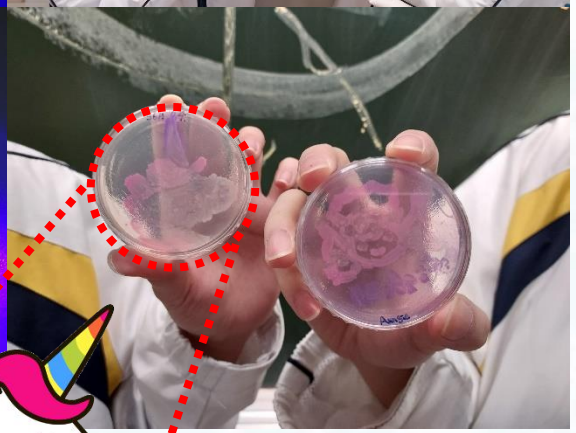
Virtual Bioengineer - Canvas Kit Edition
Remember that for any of the Virtual Bioengineer simulators, you need to be using a desktop computer as they are not optim
touch devices like tablets and phones. Go full screen for the best experience!
Canvas Kit
1. Make LB Agar Plates
2. Grow Paint Palette
3. Incubate
4. Paint living Canvas
5. Incubate
Materials
Sterile Water
LB Agar Powder
Microwave
Petri dishes
Antibiotics
Nitrile Gloves
Start Making LB Agar Plates


YouTube
DAY 1 ADD AGAR
2:13 / 13:00
Zero to Genetic Engineering Hero: Create Living Paintings with Canvas Kits
Amino Labs
524 位訂閱者
訂閱
12
不喜歡
分享
儲存
這部首播影片的聊天重播功能已經停用。



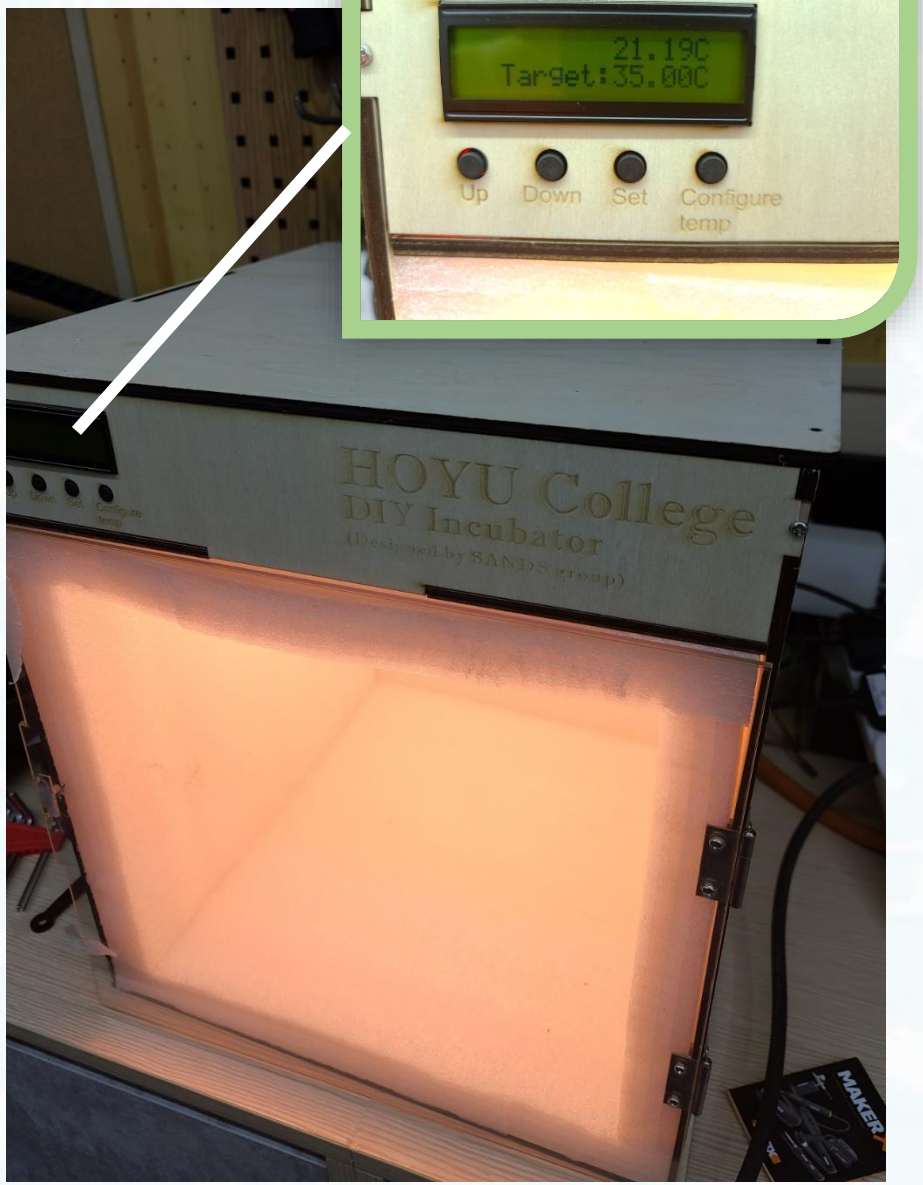


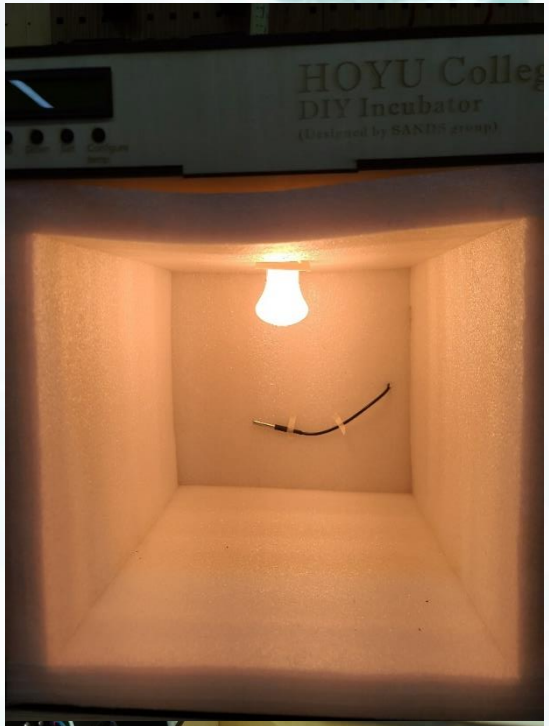


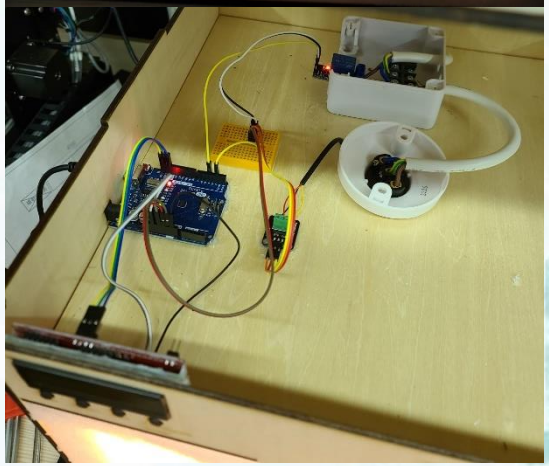


BINDER

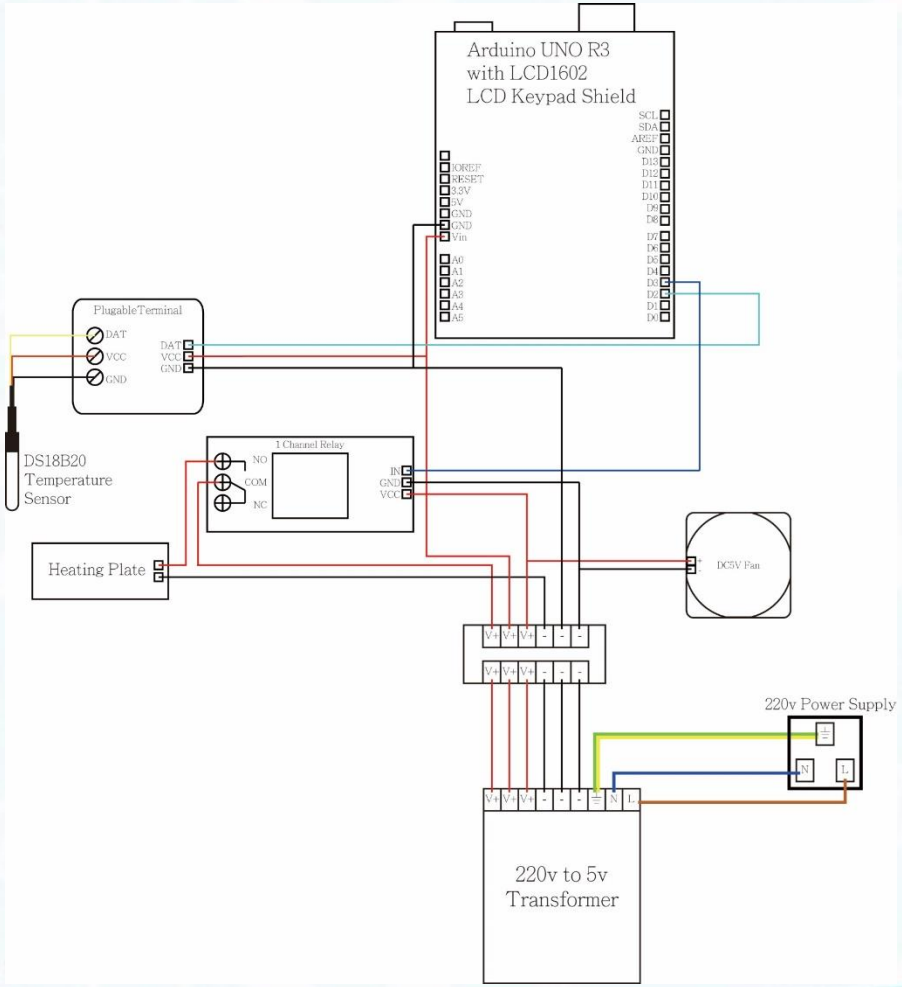

HOYU College
DIY Incubator
(Designed by SANDS group)

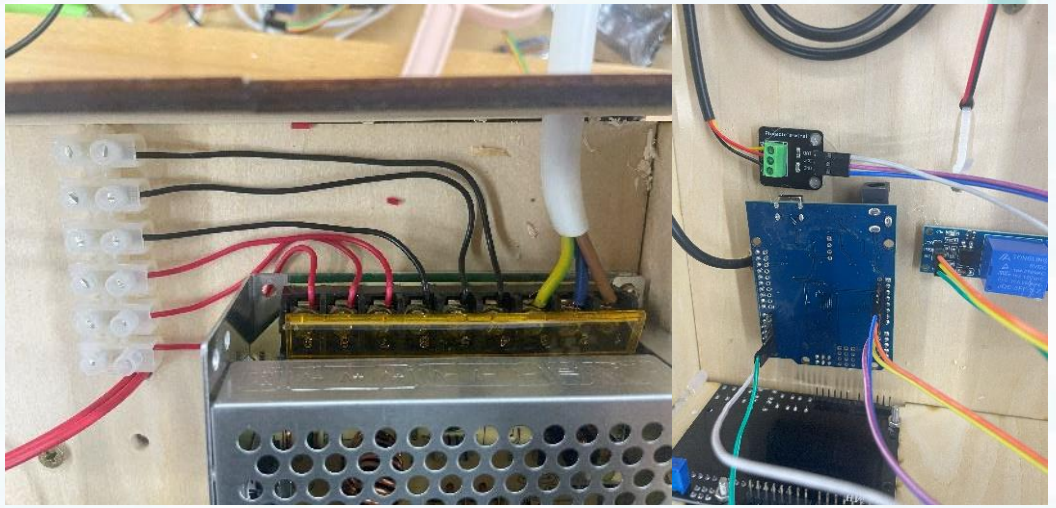
21.19C
Target:35.00C
Up
Down
Set
Configure temp


HOYU Colleg
DIY Incubator



電路圖 Circuit diagram





Setting(libraries, pins and variables setup)

```
#include <LiquidCrystal.h>          //LCD1602 Keypad Shield
#include <OneWire.h>                //DS18B20 Temp sensor with adapter
#include <DallasTemperature.h>      //DS18B20 Temp sensor with adapter
//#include <math.h>
//#include <Wire.h>

#define relayPin 3                  //attach relay IN to pin D3
#define ONE_WIRE_BUS 2              //attach temp sendor to pin D2

//LCD pin to Arduino
const int pin_RS = 8;
const int pin_EN = 9;
const int pin_d4 = 4;
const int pin_d5 = 5;
const int pin_d6 = 6;
const int pin_d7 = 7;
const int pin_BL = 10;

LiquidCrystal lcd( pin_RS,  pin_EN,  pin_d4,  pin_d5,  pin_d6,  pin_d7);
OneWire oneWire(ONE_WIRE_BUS);
DallasTemperature sensor(&oneWire);
DeviceAddress insideThermometer;

//double currentTemp;
double setPoint; //, Input, Output;
double setPoint_temp;
float tempCelsius;    // temperature in Celsius
```


DIY Incubator
DIY Incubator
DIY Incubator

嗇色園主辦可譽中學暨可譽小學

嗇色園生物科技
流動實驗室計劃

施瑪恩老師　2109 1001

smy@hoyu.edu.hk

SHARING OF QTN-S BIOTECHNOLOGY SUPPORT SCHEME 2022-2023

C.C.C. MONG MAN WAI COLLEGE

MR. FU MAN SING

AGENDA

- School-based Curriculum
- Biotech lesson designs
- Non-lesson learning activities

SCHOOL CURRICULUM

Level	Routine Biotech Program	No. of Lesson
S.1	DNA Extraction in fruits (I.S. Unit 4 – Cells and DNA)	2
S.2	How different pH affects the microbial growth (I.S. Unit 9 – Acids and Alkalis)	2
S.3	Food pigment analysis by gel electrophoresis (Bio – Food and Nutrition)	2
S.4-S.6	Basic Genetics Biotechnology	30

Other learning programs in school

-ROUTINE LESSONS IN IS CURRICULUM

- INCLUDED IN ASSESSMENT

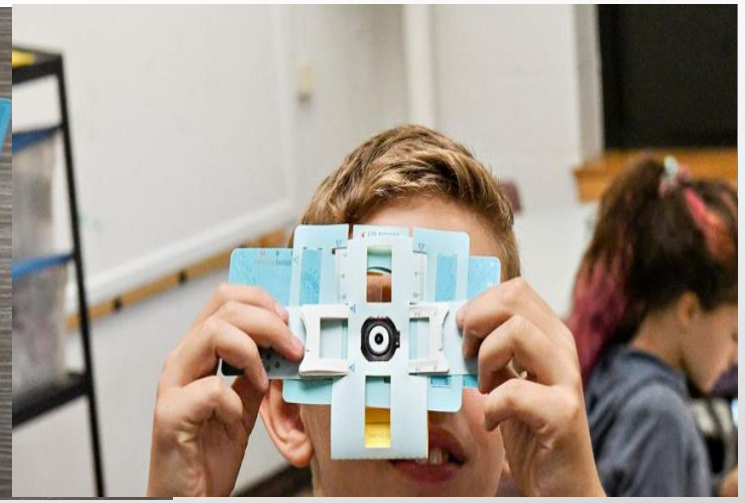
- PEER OBSERVATION

BIOTECH LESSON DESIGNS

- MAKE AND USE FOLDSCOPE IN MICROSCOPIC IMAGING (S.1 I.S.)
- MICROBIAL BIOTECHNOLOGY IN FLUORESCENCE ART (S.4 BIO)

S.1 FOLDSCOPE

- **LEARNING OBJECTIVES:**
  - HOW TO MAKE THEIR OWN MICROSCOPE AT HOME
  - SELF-DIRECTED LEARNING
- **LESSON:** STUDENTS WORK IN PAIR AND OBSERVE SOME ITEMS IN DAILY LIFE
- **EVALUATION:** OBSERVATION, PROJECT BOOKLET, SELF-EVALUATION, TEACHER'S FEEDBACK

Compare the differences between the observations between your bare eyes and using an Ipad microscope (6 marks @ row)

	Image with bare eyes	Image when using foldscope
Sugar granule		
Salt granule		
Screen of the Ipad		

✧ Students need to adjust the Ipad magnification according to the specimen. (4 marks)

Specimen	A	B	C	D
Total magnification (M)				
Magnification (M x I)				
Measured length (L_m)				
Actual length(L_a)				

Discussion

1. Compare the two microscopes. (4 marks @ row)

	Foldscope	Light microscope
Image magnification	bigger / smaller	bigger / smaller
Image resolution	high / low	high / low
Image brightness	brighter / dimmer	brighter / dimmer
Portability	high / low	high / low

Students can try to observe clearly the cells under a light microscope

After using a light microscope, please give *two differences* between an animal and plant cell.(2 marks)

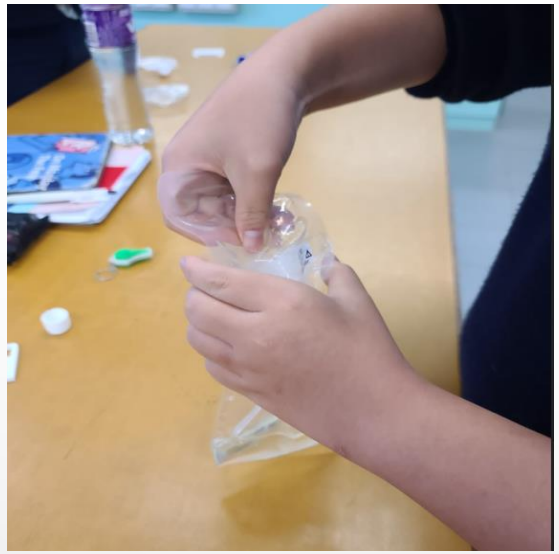
Identify the following samples if they are animal or plant cells (4 marks)

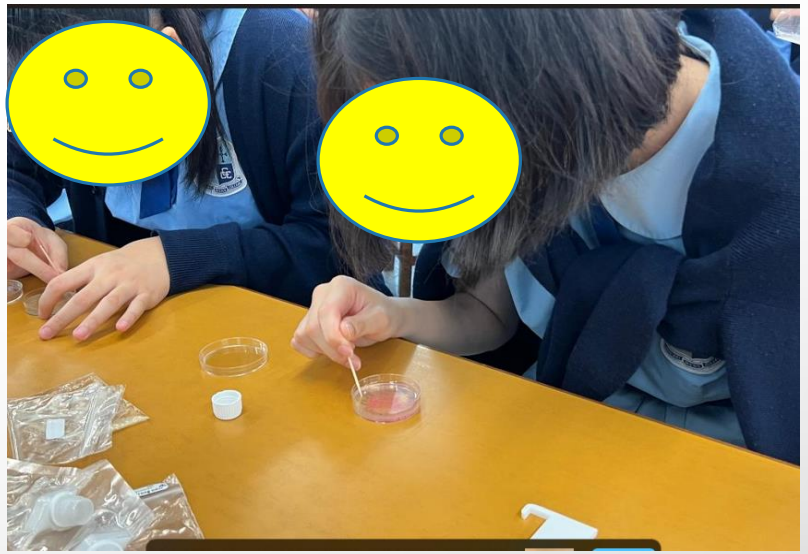
A: C:

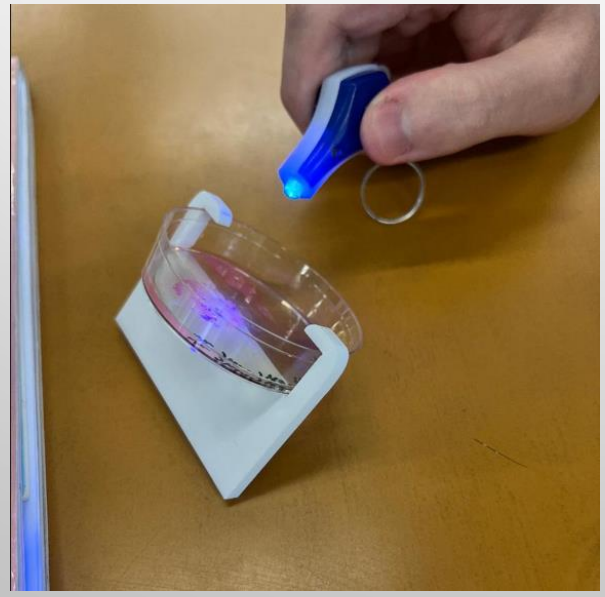
B: D:

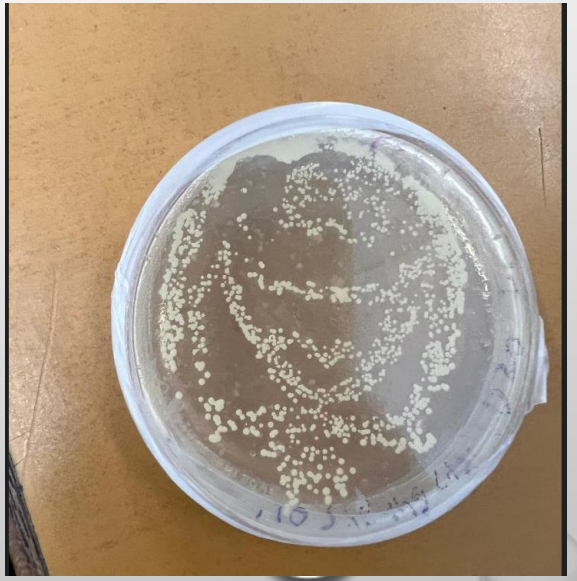
S.4 MICROBIAL ART

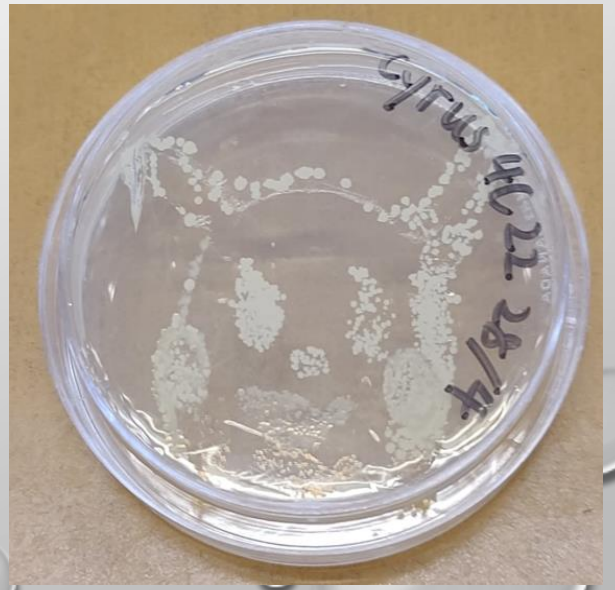
- **Learning Objectives**
  - How to practise microbial biotechnology technique
  - How to apply biotechnology into art and design
- **Lesson:** Students work individually to spread plates (design), pour resin and observe their artwork
- **Evaluation:** artwork and students' feedback

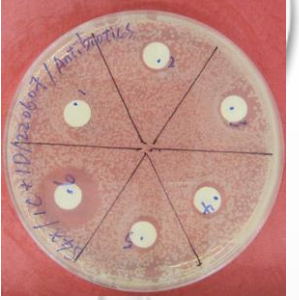






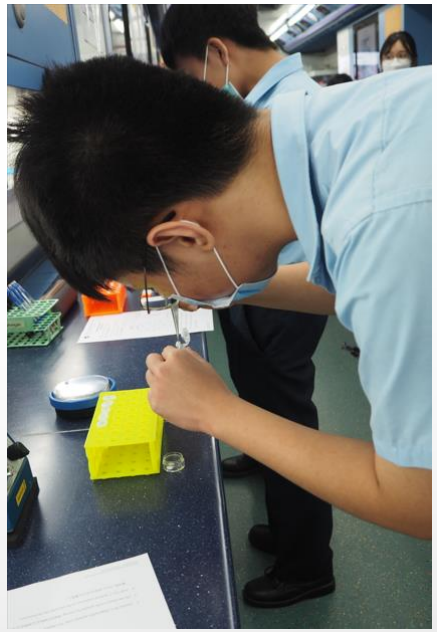




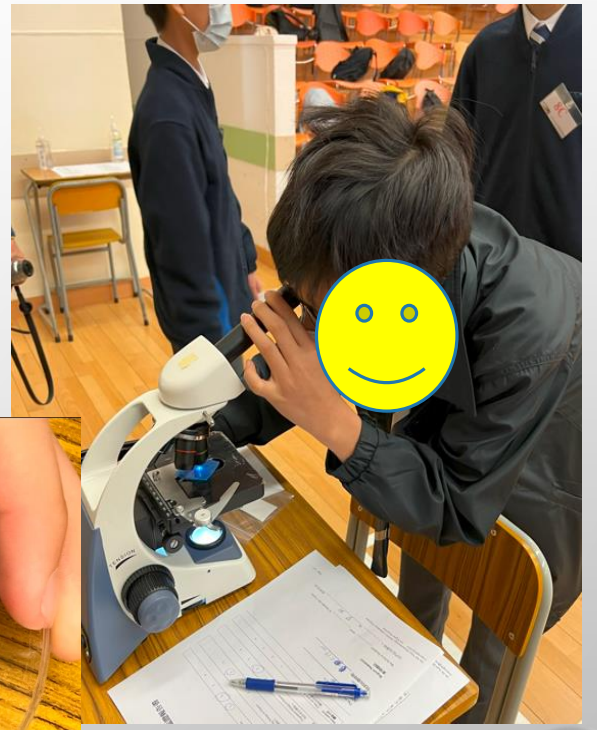


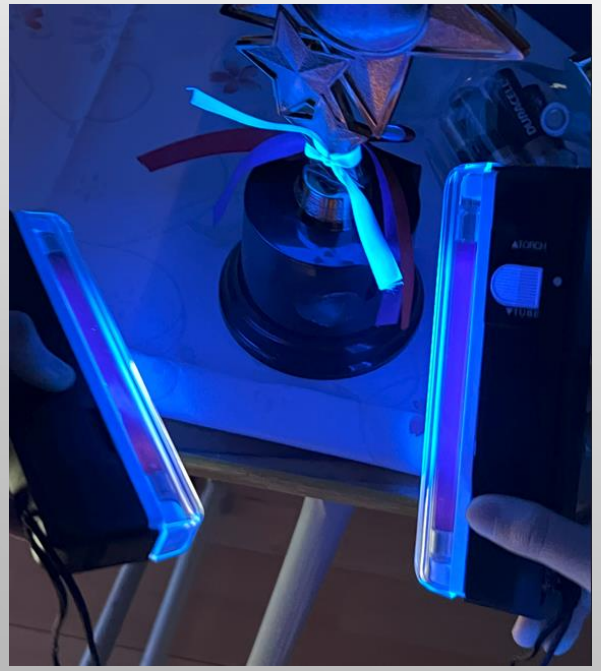
OTHER S.4-S.6 BIOTECH PROGRAMS (BIOTECH MOBILE LAB)

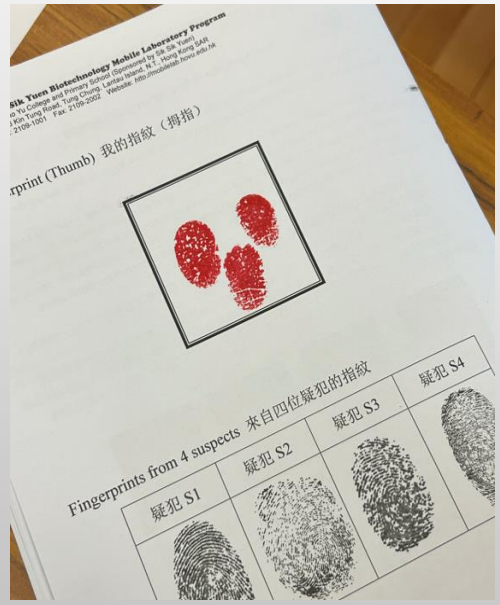
- BIOTECHNOLOGY WORKSHOP
- CRIME SCENE INVESTIGATION DAY
- BIOTECH MOBILE LAB
- VISIT BIOTECHNOLOGY ORGANIZATION/PLACEMENT

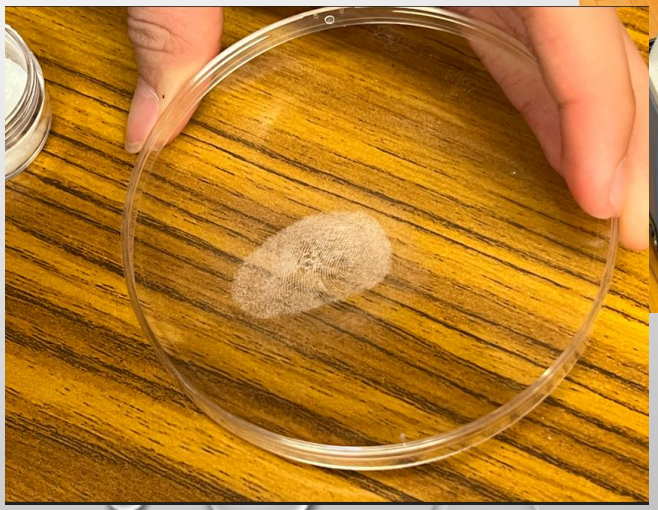


OTHER BIOTECH PROGRAMS (FORENSIC SCIENCE)

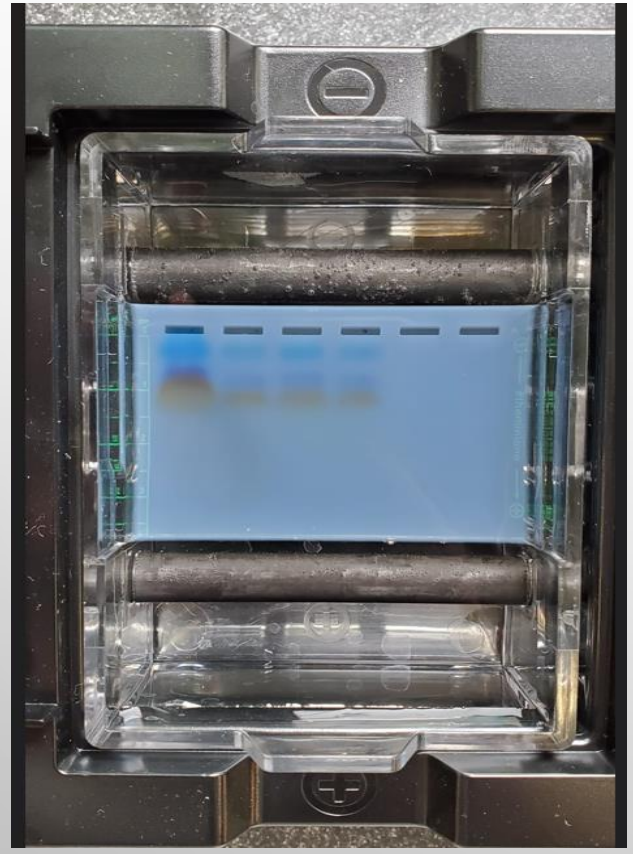








OTHER S.4-S.6 BIOTECH PROGRAMS (BIOTECH WORKSHOP)



OTHER S.4-S.6 BIOTECH PROGRAMS (COMPANY VISIT)

PEER OBSERVATION

- ONE TERM ONE VISIT
- SHARING OF THE LESSONS
- SUPPORT
- FACILITATE PROFESSIONAL DEVELOPMENT
- EXCHANGE IDEAS AND OPINIONS
- ENHANCE TEACHING EFFICACY

END

THANK YOU

順德聯誼總會鄭裕彤中學

綜合科學科 張淑麗老師

推行方法

- **自然連繫初中科學課程**

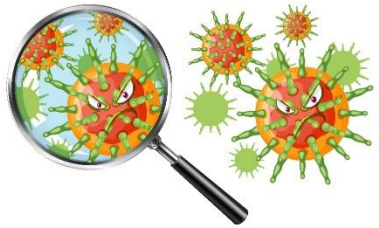
	課題	探究活動
中一級	水	食水的微生物生長情況
	觀察生物	**不同物件表面的微生物**
中二級	生物與空氣	微藻的光合作用
	酸和鹼	**酸和鹼對微生物生長的影響**

- **自學提綱**

回顧溫習 → 預習展示 → 探究導學 → 延伸學習

中一級：比較不同物件表面的微生物含量

- **課時：40 分鐘**



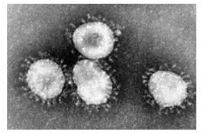
- **課堂目標**
  1. 明白生物的種類繁多，當中包括不同種類的微生物
  2. 利用**微生物培養技術**，**比較實驗室不同物件表面的微生物含量**
  3. 明白微生物可以為我們帶來**好處**或**壞處**

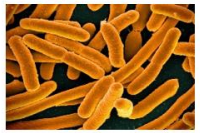
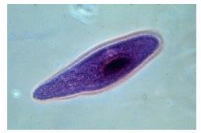
預習展示

- 通過文章閱讀，
  認識微生物的分類

微生物的種類

- 微生物非常微小，要用顯微鏡才能觀察
- 微生物也有很多種類
- 猜猜以下微生物屬於哪一類



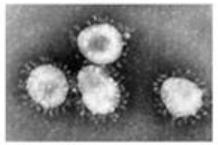
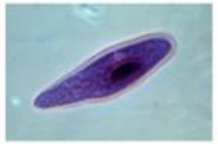




回顧溫習 及 預習展示

地球上的生物種類繁多，當中包括不同大小的植物與動物及微小的微生物。

什麼是微生物

微生物包含很多不同種類，試猜猜以下微生物屬於哪一個種類：

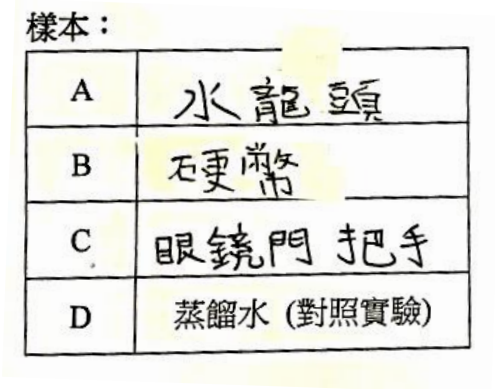
種類	例子
細菌 (bacteria)	 SARS 冠狀病毒
真菌 (fungi)	 大腸桿菌
藻類 (algae)	 黴菌
原生生物 (protozoa)	 草履蟲

引入 (從日常生活出發)

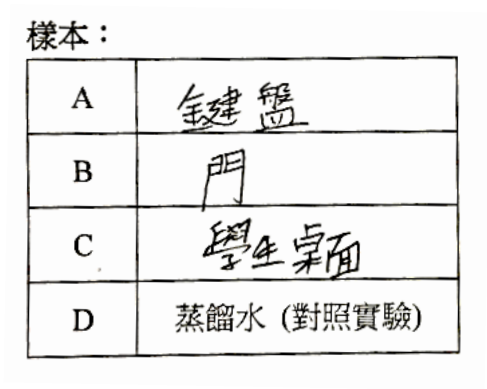
兩則剪報

探究導學

- **比較實驗室不同物件表面的微生物含量**
  - 兩位同學一組，操作一個培養皿
  - 每組選擇 3 個不同的物件表面
    及 1 個對照樣本進行測試


樣本：

A	水龍頭
B	石更幣
C	眼鏡門把手
D	蒸餾水 (對照實驗)


樣本：

A	鍵盤
B	門
C	學生桌面
D	蒸餾水 (對照實驗)

樣本：

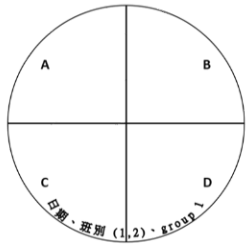
A	
B	
C	
D	蒸餾水 (對照實驗)

知識和技能

- **微生物培養技術**
  - 標示培養皿 → 採樣 → 塗抹 → 觀察菌落

1. 標示培養皿

- 根據下圖所示，在盛有瓊脂的培養皿**底部**寫上日期、班別 (各學號)、組別



新經驗

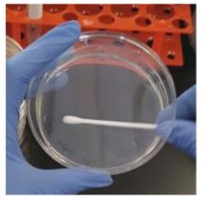
2. 採樣

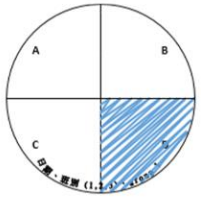
- 將無菌棉花棒**浸入蒸餾水**中
- 將沾濕的棉花棒在要測試的表面上來回**滾動**幾次，確保整個棉花球均沾有樣本

新經驗

3. 塗抹

- 把培養皿的蓋打開至**約45°**
- 以「之」字形來回拖動棉花棒，將樣本均勻塗抹在瓊脂平板相應的區域上



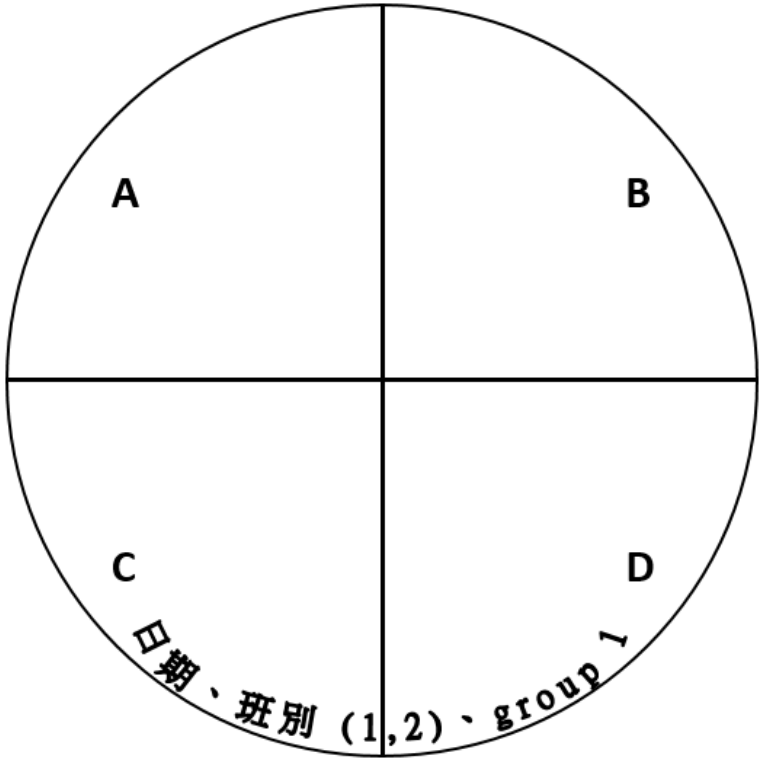


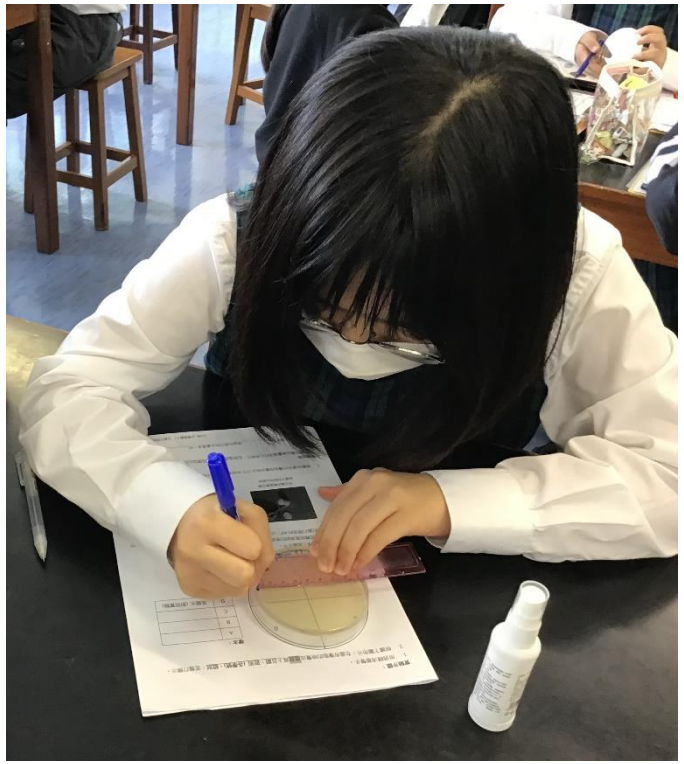
4. 觀察菌落 (**單一微生物**生長的菌塊)

- 進行觀察時，應小心留意菌落的大小、**形狀**、**邊緣**、**顏色**等

實驗過程：標示培養皿

- 在工作紙提供 1 : 1 的標示圖



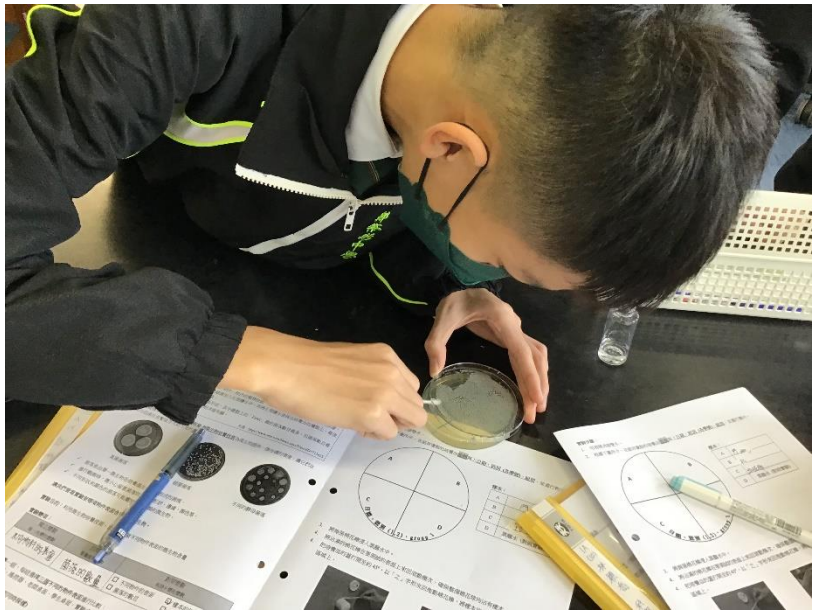


實驗過程：利用棉花棒採樣

- 沒有限制
- 學生感到有趣，表現投入

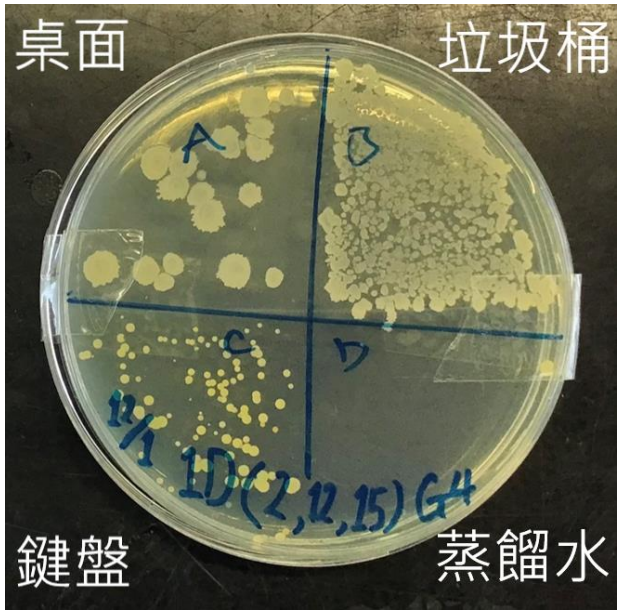
實驗過程：塗抹樣本

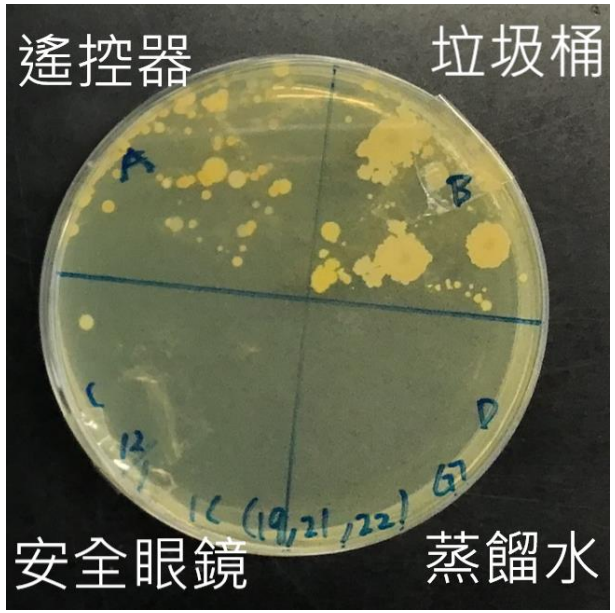
- 已有經驗：用 L 型棒進行塗抹
- 新經驗：以之字形來回拖動棉花棒進行塗抹



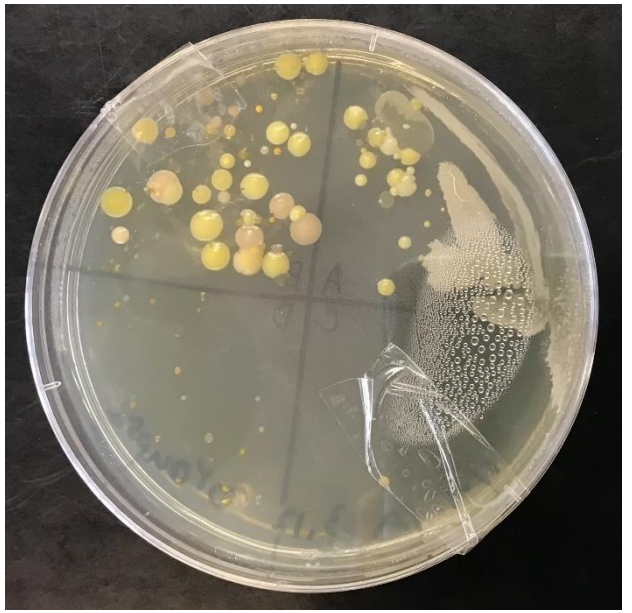
實驗結果 (37 °C / 48小時)

- 實驗結果明顯，超乎學生想像
- 學生能感受微生物的存在





不同顏色和形狀的菌落



延伸學習

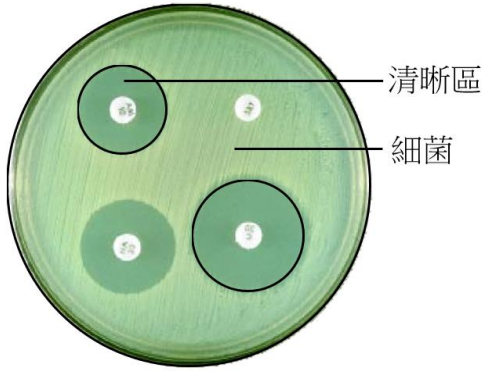
- 認識日常生活常見的微生物
- 明白微生物可以為我們帶來好處或壞處

超級食物螺旋藻

藍紋芝士上的青黴菌

中二級：酸和鹼對微生物生長的影響

- **課時：1 小時**



- **課堂目標**
  1. 設計公平測試，比較**不同濃度**的酸性和鹼性家居化學物品對微生物生長的影響
  2. 操作「塗抹法」作微生物培養
  3. 觀察**清晰區**，比較不同樣本的殺菌能力

回顧溫習

- **已有知識**
  - 大部分微生物不能在酸性環境中生長
  - 酸可用作食物防腐劑

回顧溫習

參考下圖，回答問題。

以上食物加入了醋 (vinegar)，加入醋的目的是什麼？

醋含有_____，酸可用作食物_____以防止食物變壞。

大部分_____都不能在酸性環境中_____或繁殖，甚至可能被酸_____。

預習展示

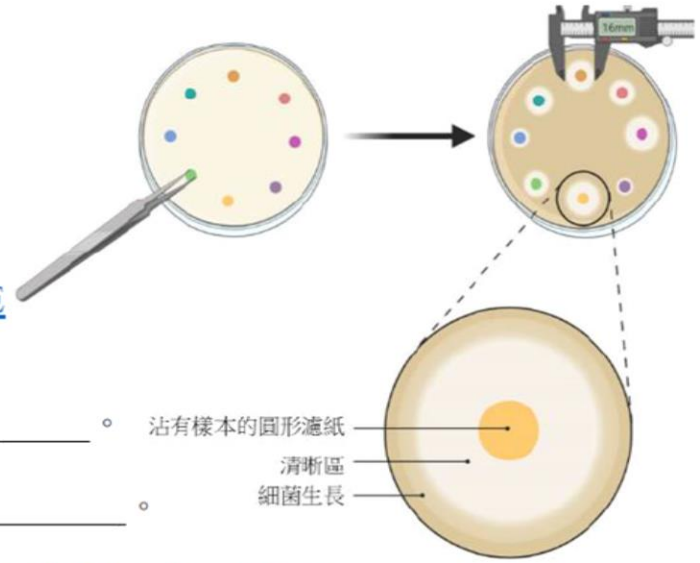
- **已備知識**
  - 微生物培養技術注意事項

思考題：微生物能在鹼性環境中生長嗎？

預習展示

觀看實驗影片，回答以下問題。

https://www.youtube.com/watch?v=HpCDdXm4FWE



1. 培養皿內的瓊脂為微生物提供生長所需的_____。
2. 進行實驗前，我們應該將標籤寫在培養皿的_____。
3. 獲取樣本時，如果圓形濾紙含有過量溶液，這對實驗有什麼影響？

   當濾紙放在已塗有細菌的瓊脂平板時，多餘的溶液有機會_____附近的細菌，形成_____的清晰區。
4. 完成實驗後，圓形濾紙附近出現的清晰區代表什麼？

   沾在圓形濾紙上的樣本能_____細菌或抑制細菌_____。

引入 (從日常生活出發)

#考考你：
一整瓶剛買的洗手乳（或洗碗精）
太濃了，
是否可以加自來水到瓶子裏稀釋後使用？
A: 可以
B: 不可以

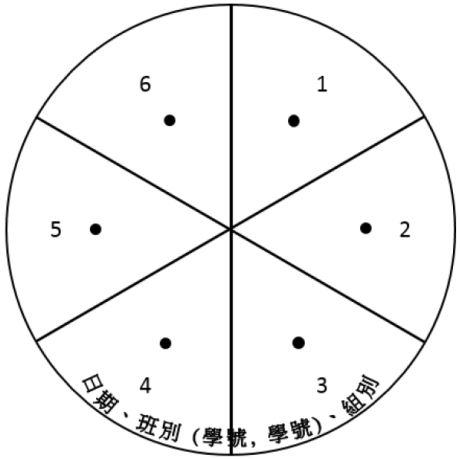
請在下方留言唷😀
明天早上九點公布答案唷！

71 51 9

【早安健康／吳慧禎報導】你一定也有這個經驗，洗澡時發現沐浴乳快用光了，但底部就是殘留一些很難「壓」出來的沐浴乳，雖然即將見底卻捨不掉直接扔掉，為了不要浪費，所幸加一些水進去搖一搖，又可以多用一陣子。

探究導學

- 比較不同濃度的家居化學物品對微生物生長的影響
  - 四位同學一組，操作兩個培養皿
  - 培養皿 (1)：6 個不同濃度的酸性清潔劑的樣本
  - 培養皿 (2)：6 個不同濃度的鹼性滴露樣本



樣本：*(圈出你的樣本)*

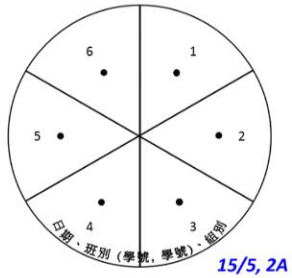
氫氯酸 (H) / 滴露 (D)

H/D	不同濃度的溶液
1	蒸餾水
2	1/16 X (最稀)
3	1/8 X
4	1/4 X
5	1/2 X
6	1 X (最濃)

知識和技能

- **微生物培養技術**
  - 標註培養皿 → 塗抹大腸桿菌 → 加入樣本 → 觀察清晰區

1. 標註
在培養皿底部進行標示



15/5, 2A (xx, yy), group 9

2. 加菌
將大腸桿菌塗抹在瓊脂上

把培養皿的蓋打開至約45°

一邊旋轉培養皿

一邊輕力前後推動 L 型膠棒

新經驗

3. 樣本
放置沾有樣本的圓形濾紙

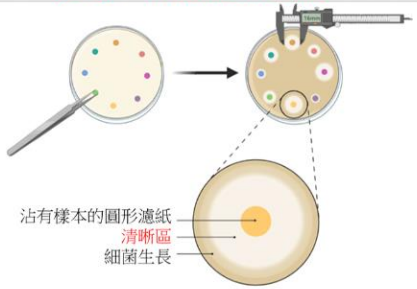
用鑷子夾著圓形濾紙的邊緣

把半張濾紙浸在樣本溶液中，讓溶液自行沾濕整張濾紙

放在相應培養格的黑點位置上

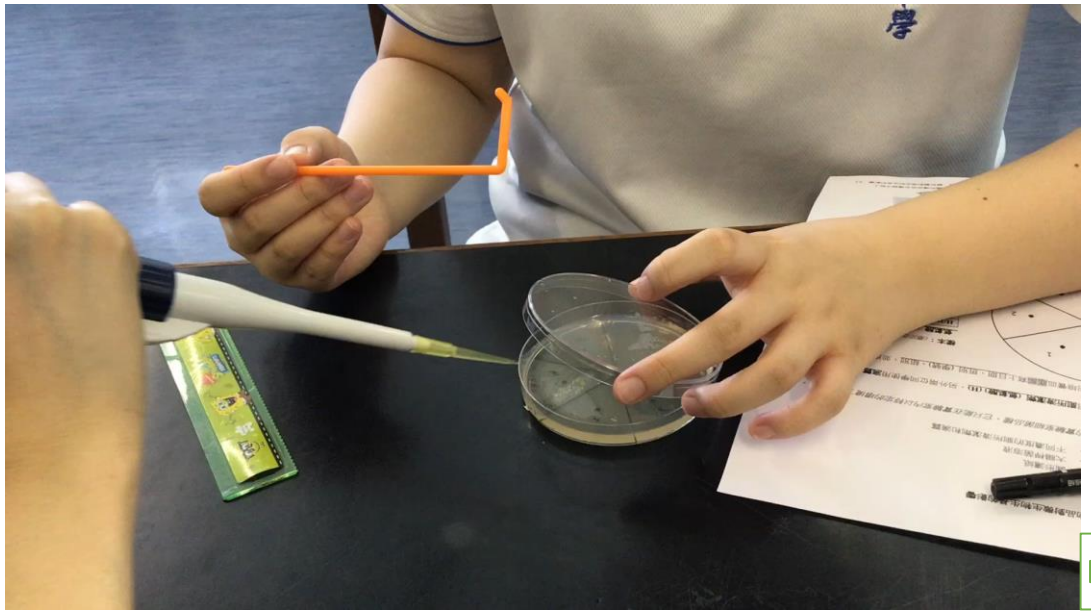
新經驗

4. 觀察清晰區
樣本能殺死或抑制細菌生長



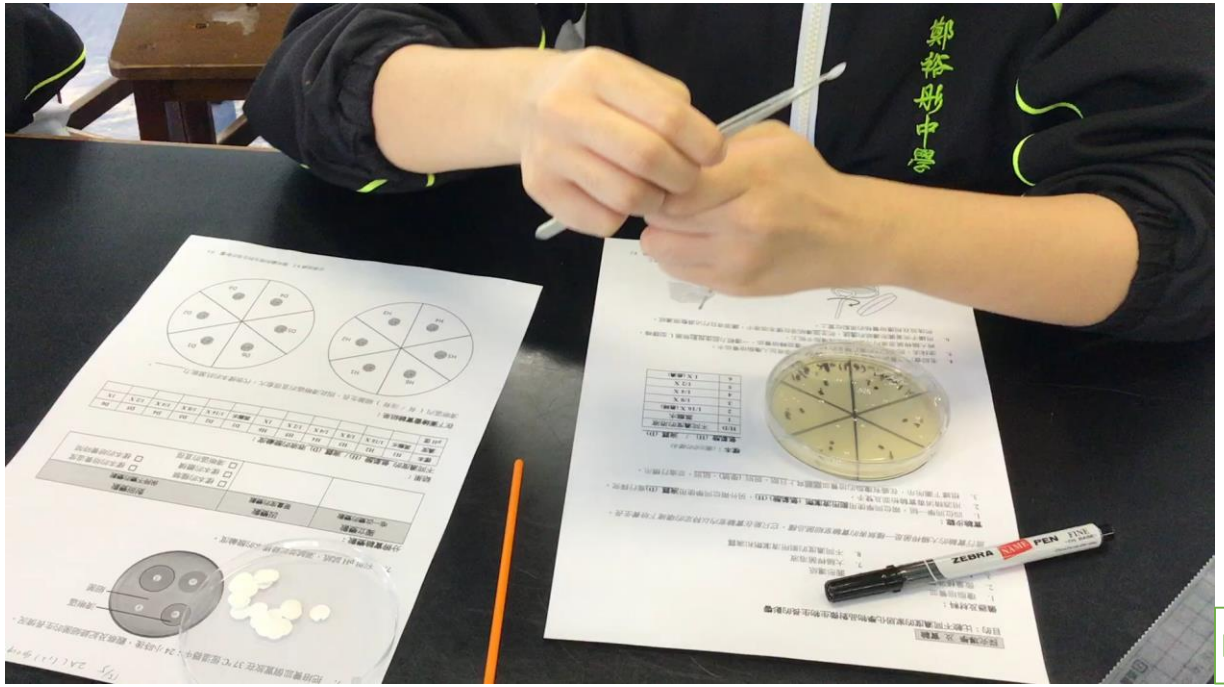
實驗過程：塗抹細菌溶液

- 老師 / 實驗室技術員：用微量移液管加入大腸桿菌溶液
- 學生：用 L 型膠棒將溶液均勻塗抹在瓊脂上



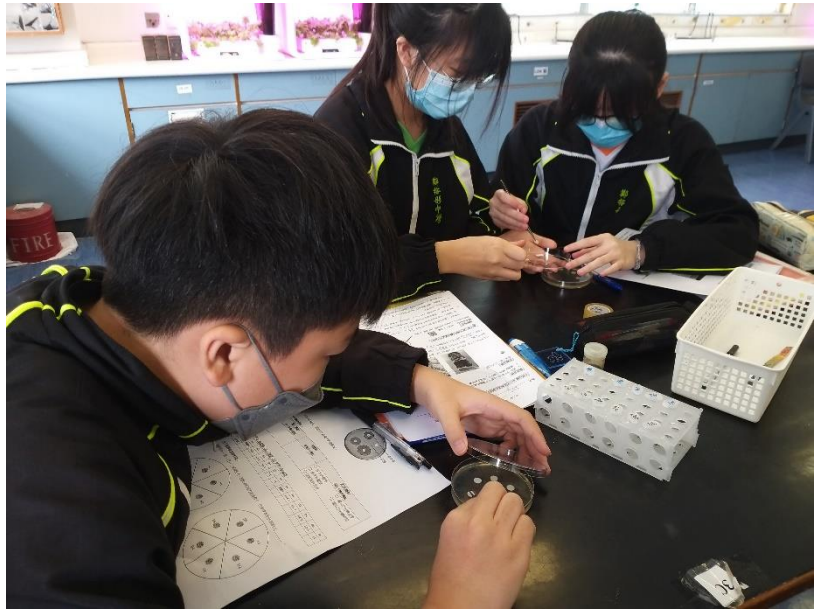
實驗過程：放置樣本

- 用鑷子把沾有樣本的圓形濾紙放在瓊脂平板上



實驗過程：注意事項

- 圓形濾紙多餘的溶液有機會沖走附近的細菌，形成假的清晰區



實驗結果 (37 ºC / 72小時)

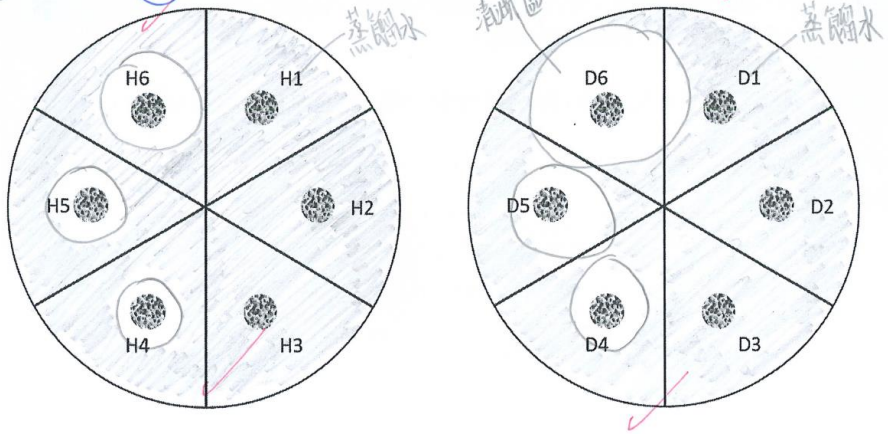
- 實驗結果明顯及符合預期

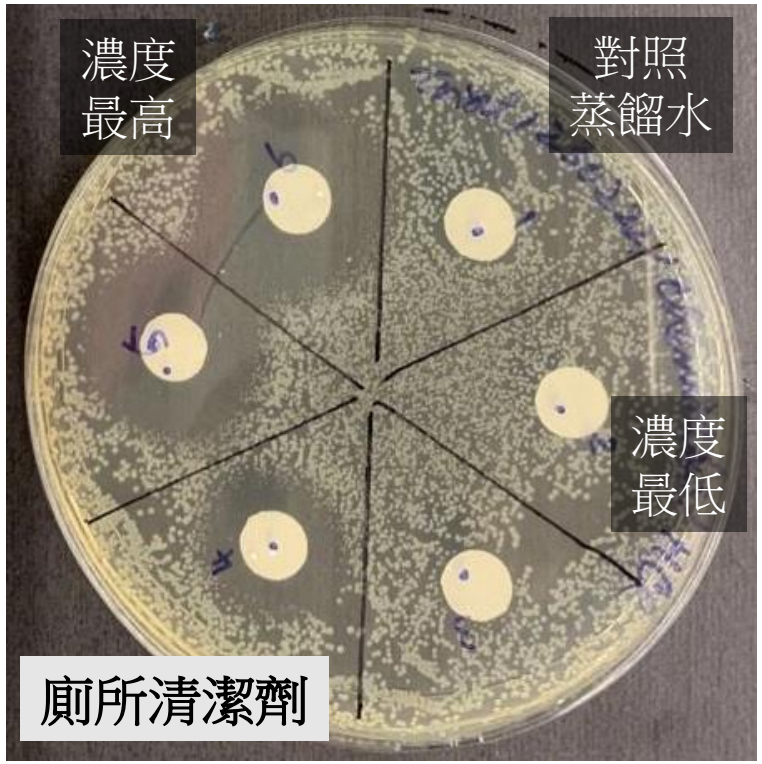
不同濃度的 氫氯酸 (H) / 滴露 (D) 溶液的酸鹼度：

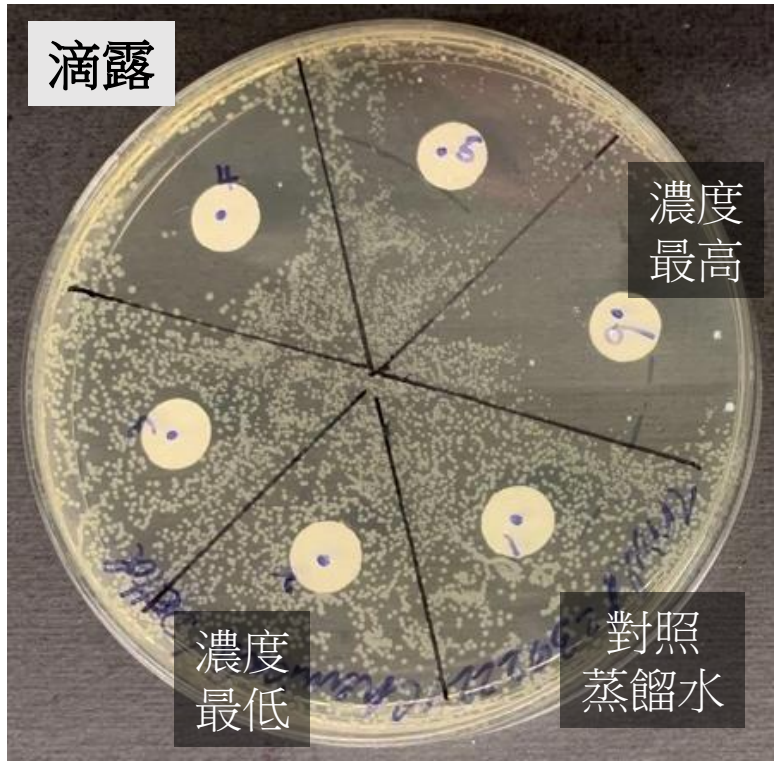
樣本	H1	H2	H3	H4	H5	H6	D1	D2	D3	D4	D5	D6
濃度	蒸餾水	1/16 X	1/8 X	1/4 X	1/2 X	1X	蒸餾水	1/16 X	1/8 X	1/4 X	1/2 X	1X
pH 值	4	2	2	1	1	1	7	9	9	10	10	10

在下圖繪畫實驗結果：

清晰區內（有 / 沒有）細菌生長，因此清晰區的直徑愈大，代表樣本的抗菌能力 愈高 。







反思

- 活動對學生具新鮮感、趣味性
- 實驗具探究元素、成功率高、安全

- 困難：
  - 實驗室技術員配合
  - 需要使用較多一次性儀器

Jockey Club Ti-I College

MR CHAN Chun Kit Ben, MR YIP Yuk Ki

STEAM activities

- Cross subject collaboration
- Subject based curriculum

STEAM in Cross subject collaboration

- **Making of “Model Thermometer”**
  - **(F.1 Integrated Science, Visual Arts, ICT, Mathematics)**
- **Making of recycled warmth bag**
  - **(F.2 Integrated Science, Visual Arts, Technology & Living, ICT)**

STEAM in Cross subject collaboration

- **Making of “Model Thermometer”**
  - **(F.1 Integrated Science, Visual Arts, ICT, Mathematics)**

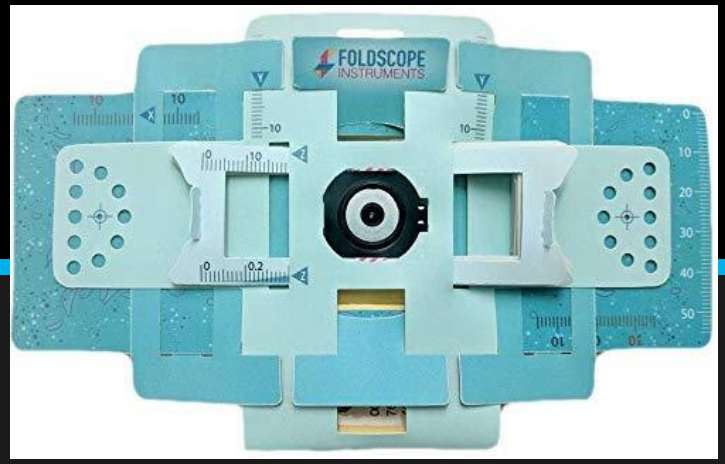
STEAM in Cross subject collaboration

- **Making of recycled warmth bag**
  - **(F.2 Integrated Science, Visual Arts, Technology & Living, ICT)**

STEAM activities

- Subject based curriculum with QTN -S
  - Foldscope (Integrated Science)
  - Gel electrophoresis(Biology)

Foldscope



- Target:
  - All F.1 Students
- Background:
  - Students learnt
    - basic structure of cells
    - basic manipulation of light microscope
  - Pre – lesson task:
    - Students were given the cardboard and worksheet, together with the link of video, to assemble the foldscope by themselves at home

Introduction of Foldscope

This paper microscope “Foldscope” was invented by scientists Manu Prakash and Jim Cybulski. We could study the micro-biology with this amazing FOLDSCOPE.

https://www.youtube.com/watch?v=VGWGJKTqODc

A. Folding Foldscope

Please making a FOLDSCOPE by referring the youtube video

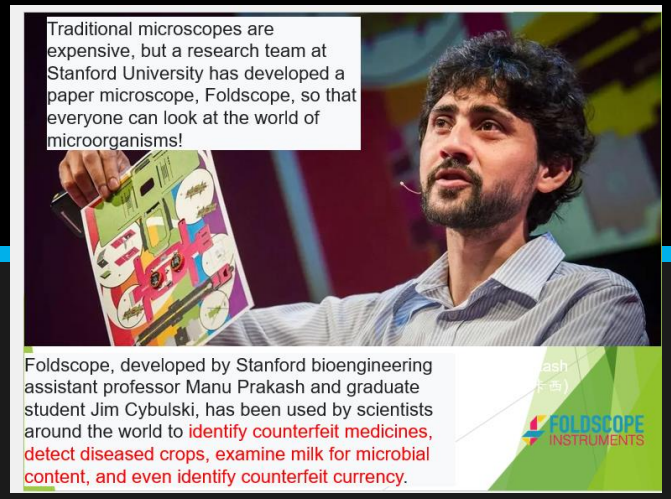
https://www.youtube.com/watch?v=L-tFJRGQBIo&t=245s

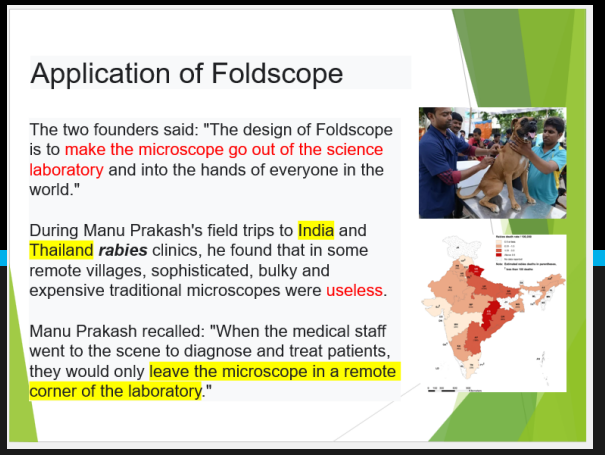
B. Observing the specimen

We can further magnify and record the object by attaching a lens of an iPAD or a mobile phone.

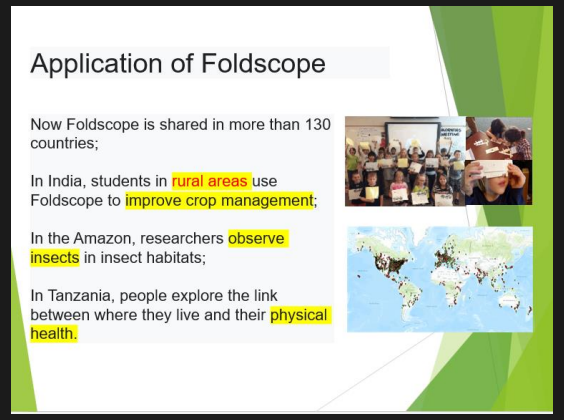
https://www.youtube.com/watch?v=0iRCceGCGus

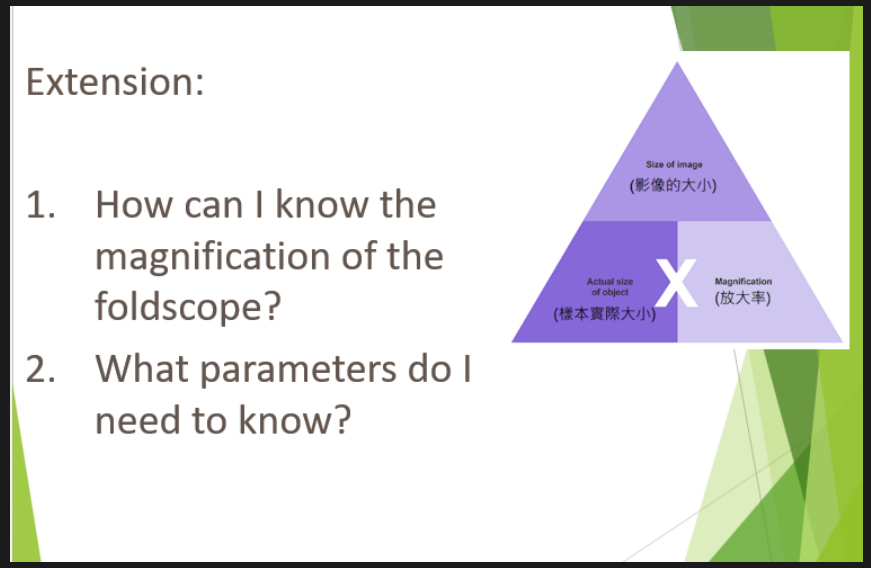
Foldscope

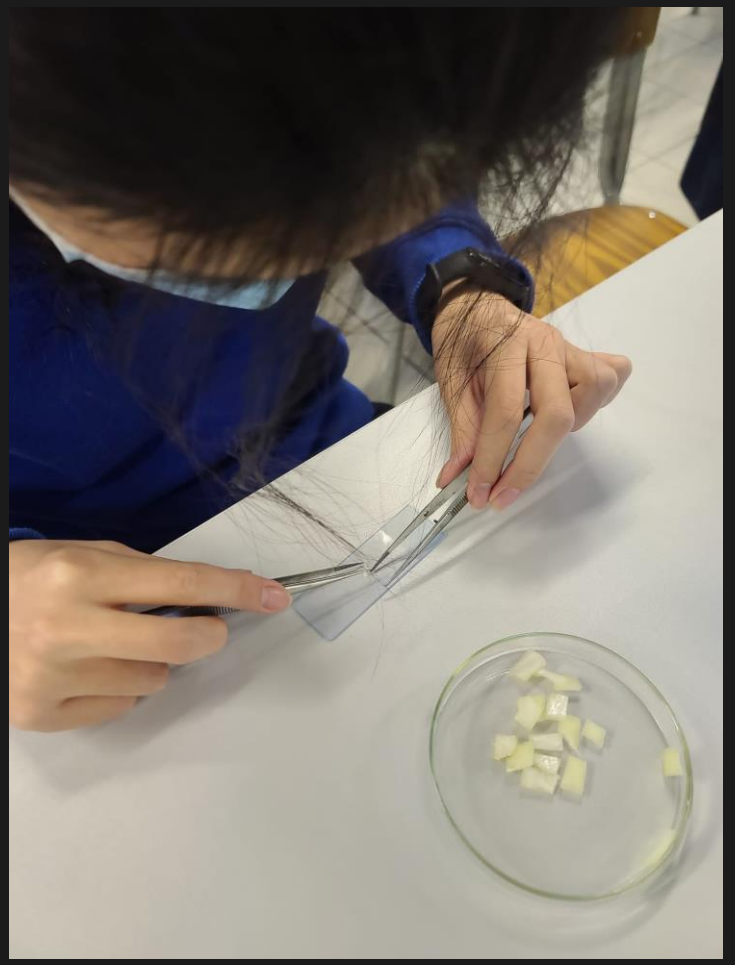




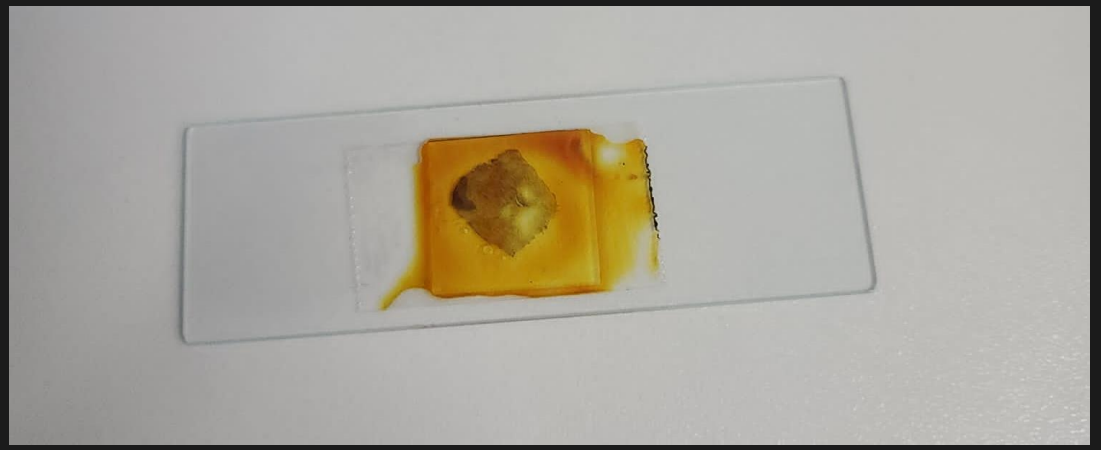
- Lesson:
  - Outline the ideas of foldscope
  - Check the product formed by students with the use of onion epidermal (skin) cells
  - Ask students to
    - figure out the differences between the use of light microscope and foldscope
    - find out the limitations of foldscope
    - advance concept (calculating the actual size of object)



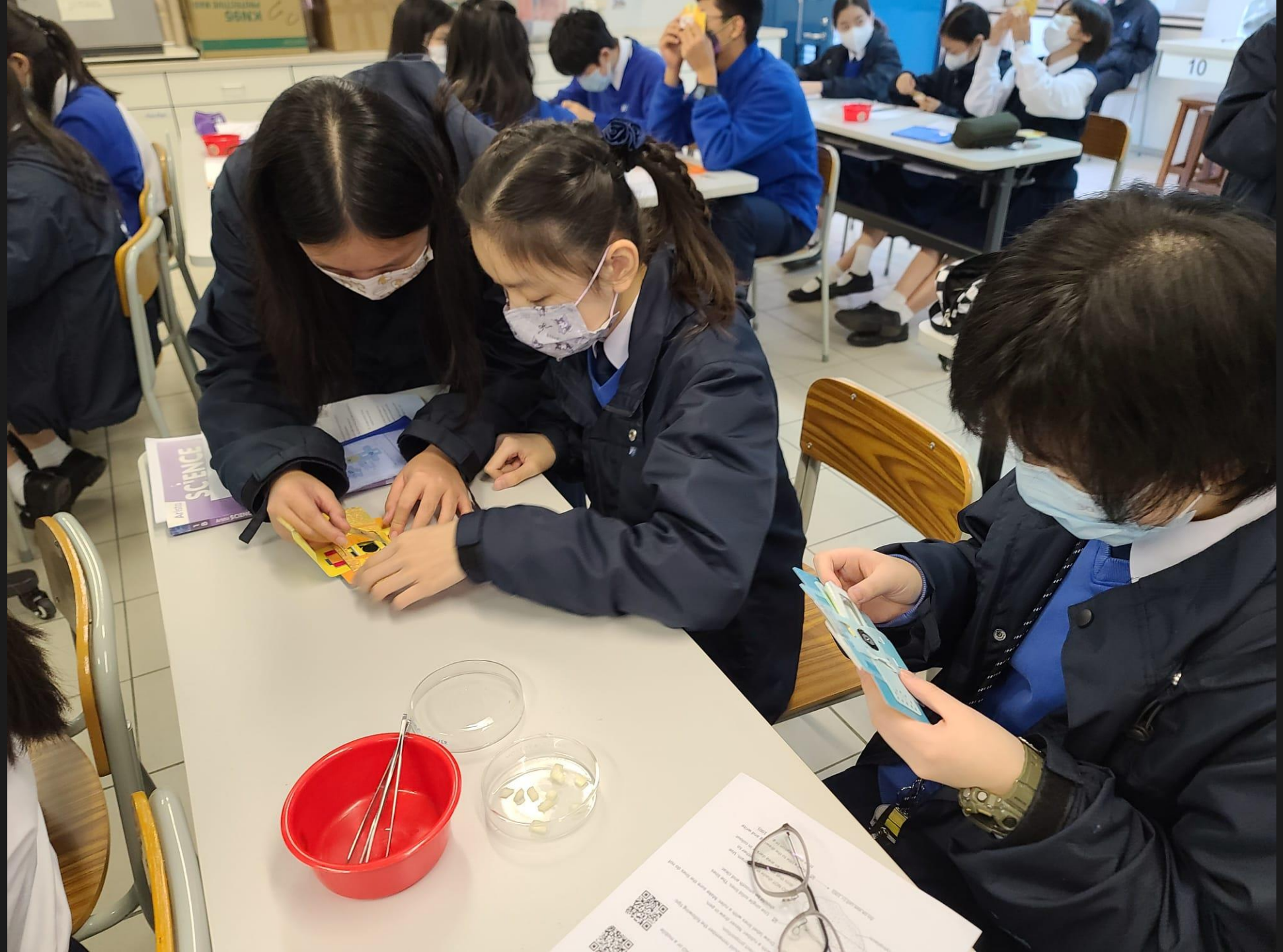




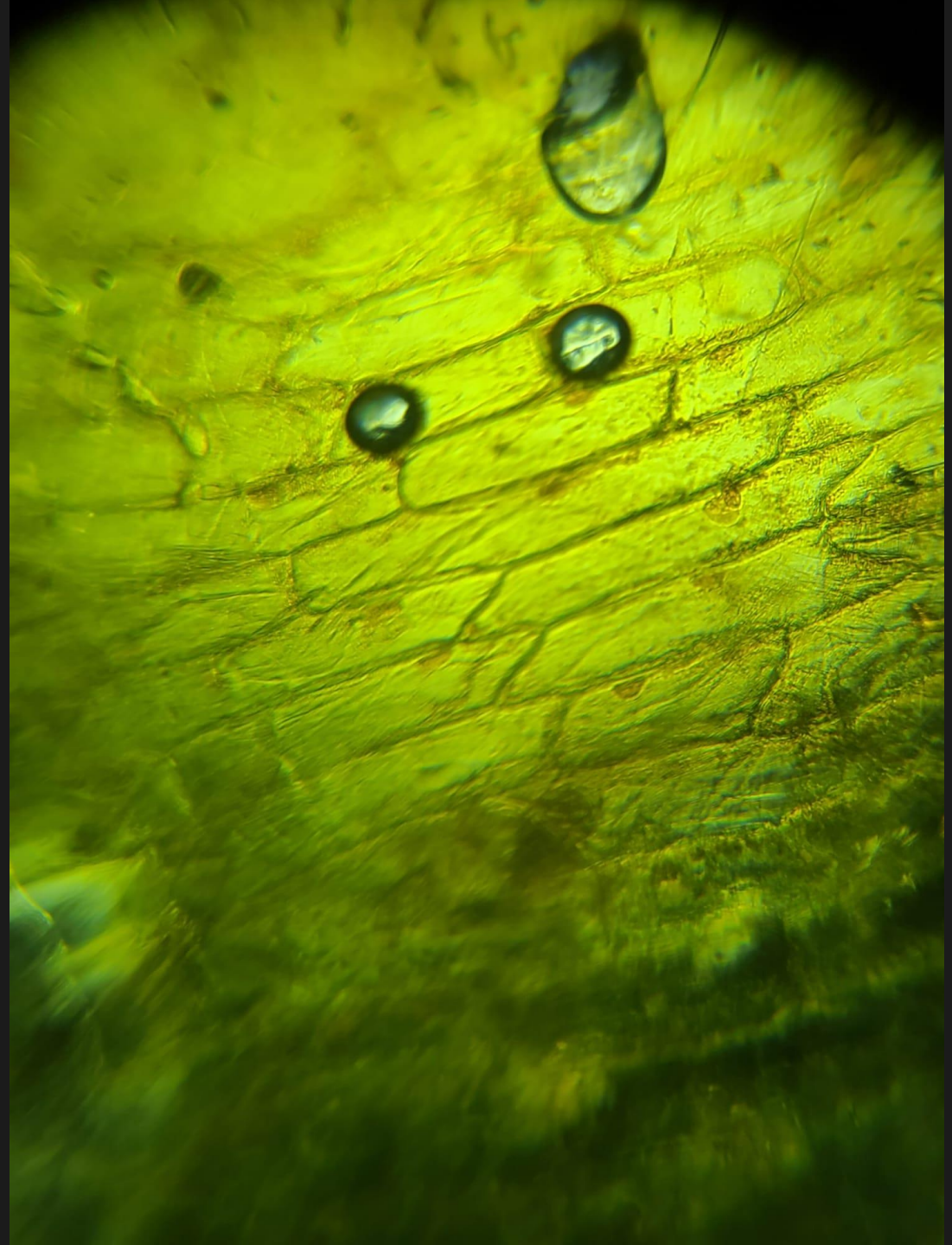

Observation through foldscope
1. Put a slide of onion skin cells into the foldscope for observation after modification.
2. Draw two onion skin cells through the observation from the foldscope.

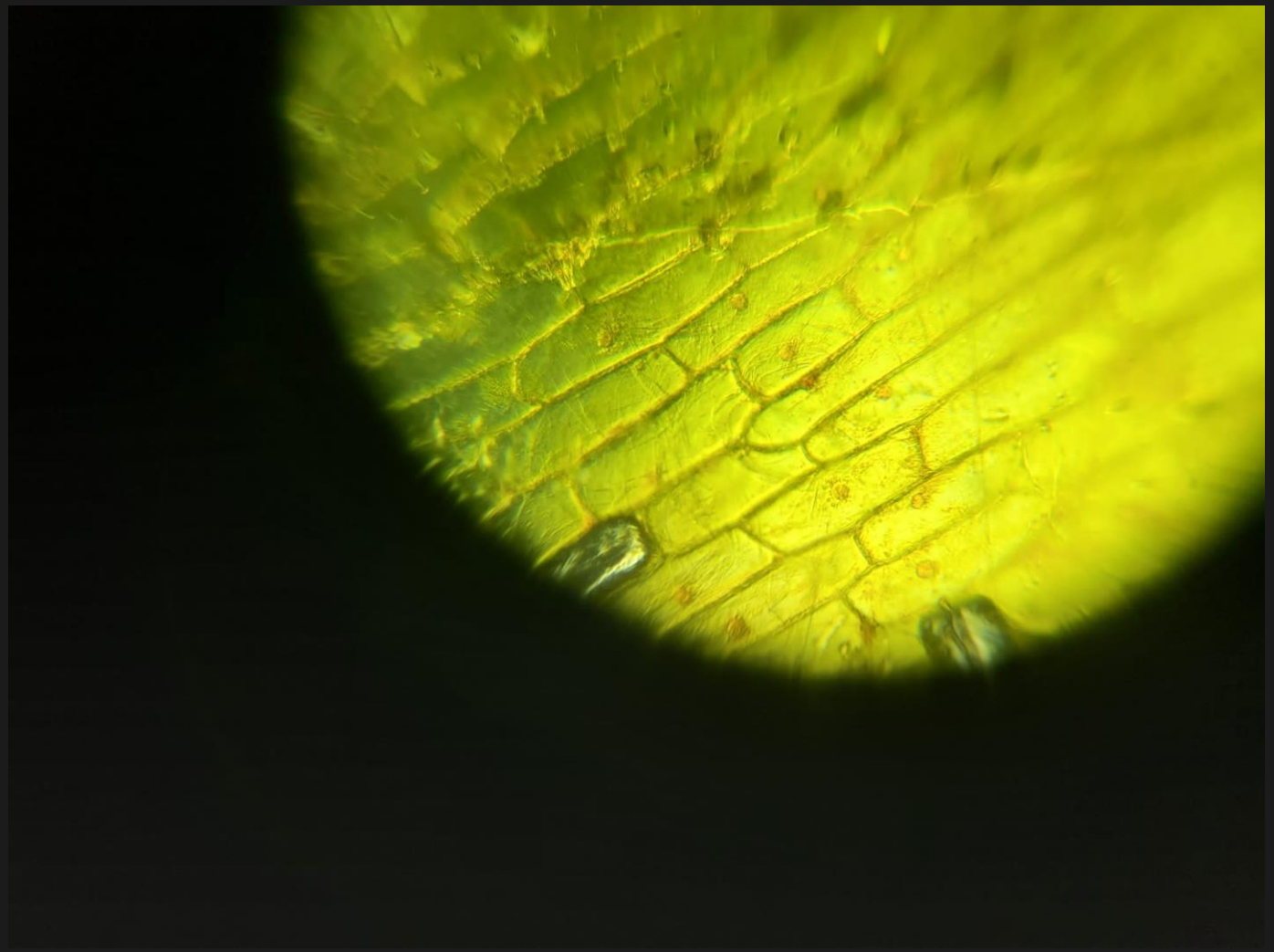



Observation through foldscope


SCIENCE


KN95
PROTECTIVE MASK





Foldscope

- Feedback
  - Most students were able to assemble the foldscope by themselves
  - Some foldscopes were "too thick" that they could not focus the specimen easily
  - Students did not aware of the size of the slide. When they fit the slide into the foldscope, they accidently damaged their own foldscope
  - The experience on using Foldscope really widen their horizon and know more about STEAM
  - Positive feedback from both students and teachers

Reflection :

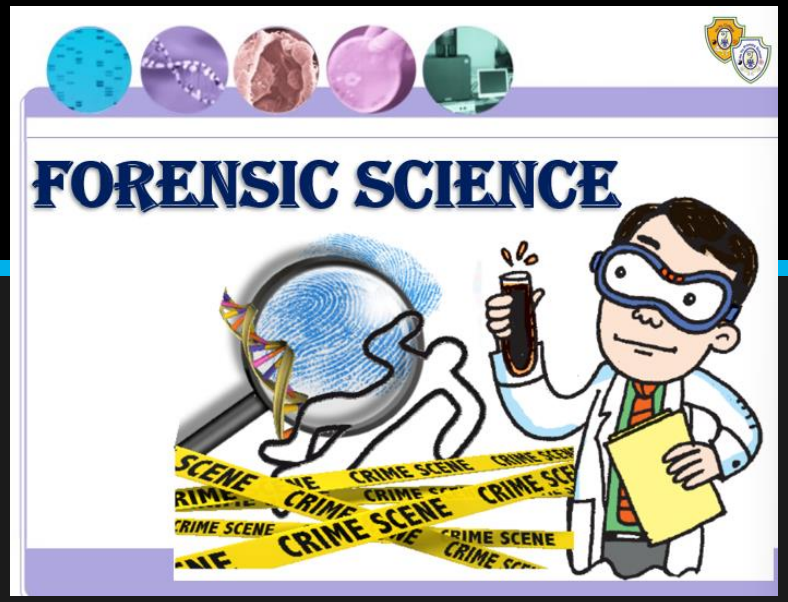
1. Marking Scheme for the drawing a cell diagram of an onion cell

Marking Scheme	Team member rating	Self rating
1. Use a sharp **HB** pencil **/ lead pen.**	0 / 1	0 / 1
2. Use a single solid line for drawing.	0 / 1	0 / 1
3. **DO NOT shade** the diagram.	0 / 1	0 / 1
4. Different parts of the drawing should be in correct proportion.	0 / 1	0 / 1
5. Use a label line '——' to label different parts of the cell. The label line should be a straight line and the label lines cannot overlap each other. (labels : cell wall, cell membrane, cytoplasm and nucleus)	0 / 1 / 2	0 / 1 / 2
6. Draw the specimen, DON'T copy from the picture of a textbook.	0 / 1	0 / 1
7. Cell diagram is large, clearly show different parts of the cell.	0 / 1	0 / 1
8. Give a title and to the drawing and write the magnification (e.g. × 100).	0 / 1 / 2	0 / 1 / 2
Total mark	**/ 10**	**/ 10**

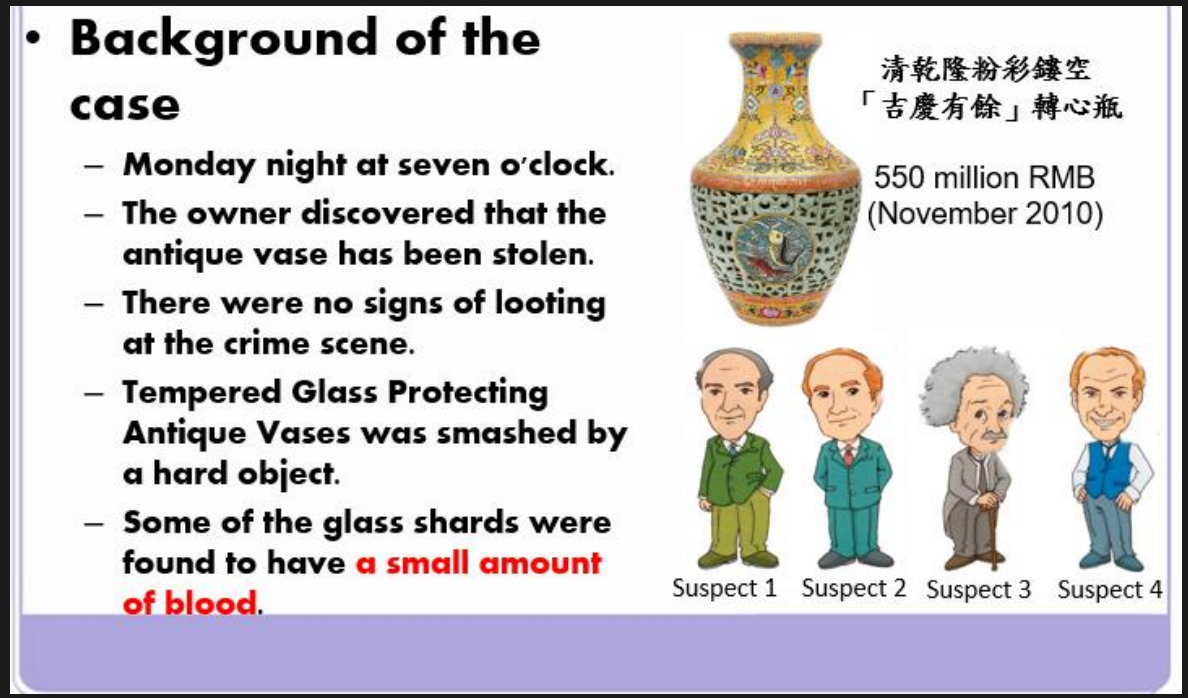
2. Give one advantage and disadvantage of using FLDSCOPE to observe biological specimen?

_____

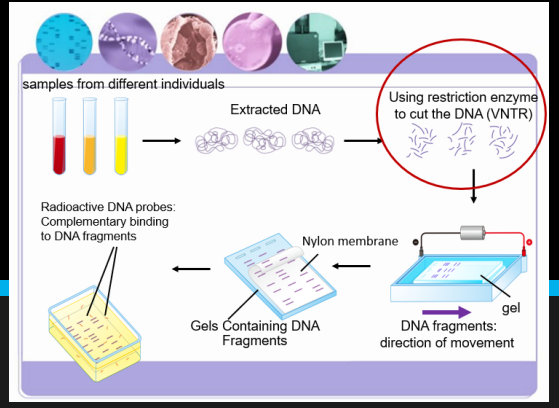
Gel electrophoresis



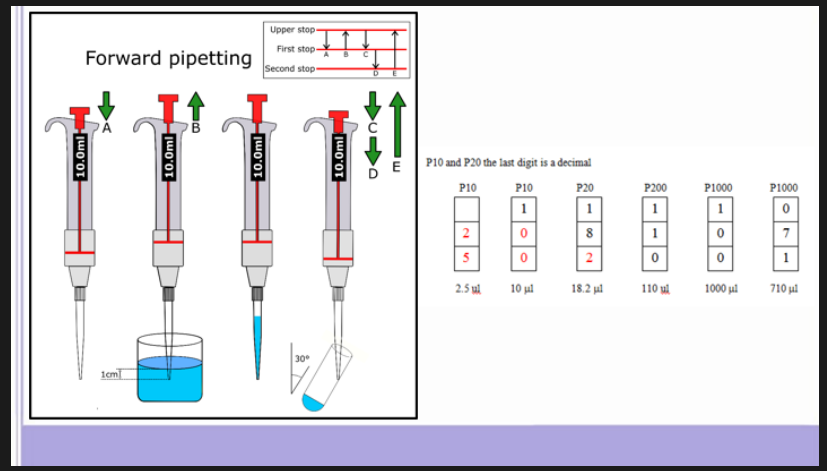
- Target
  - F.5 Biology Students
- Background
  - Students learnt the knowledge of DNA fingerprinting and gel electrophoresis
  - They did not have experience in using micropipette



Gel electrophoresis

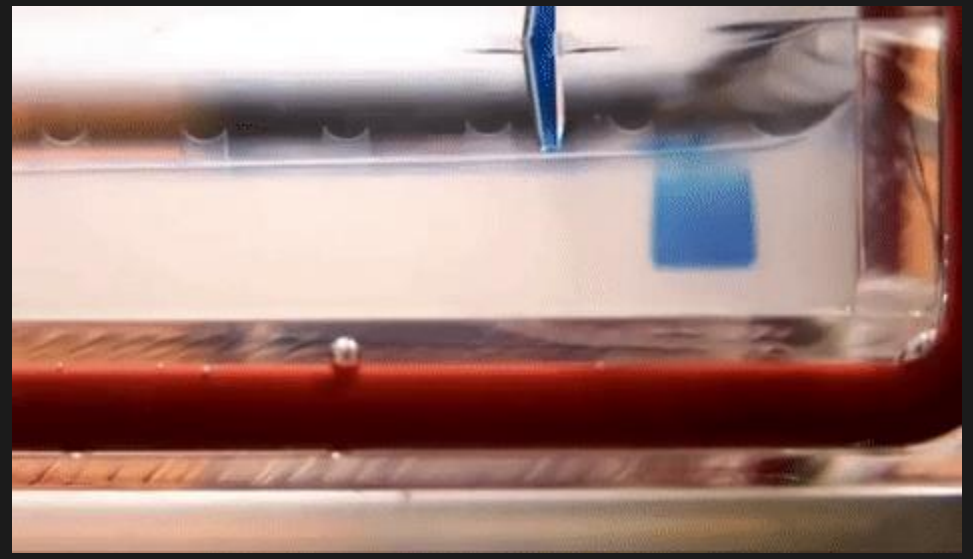


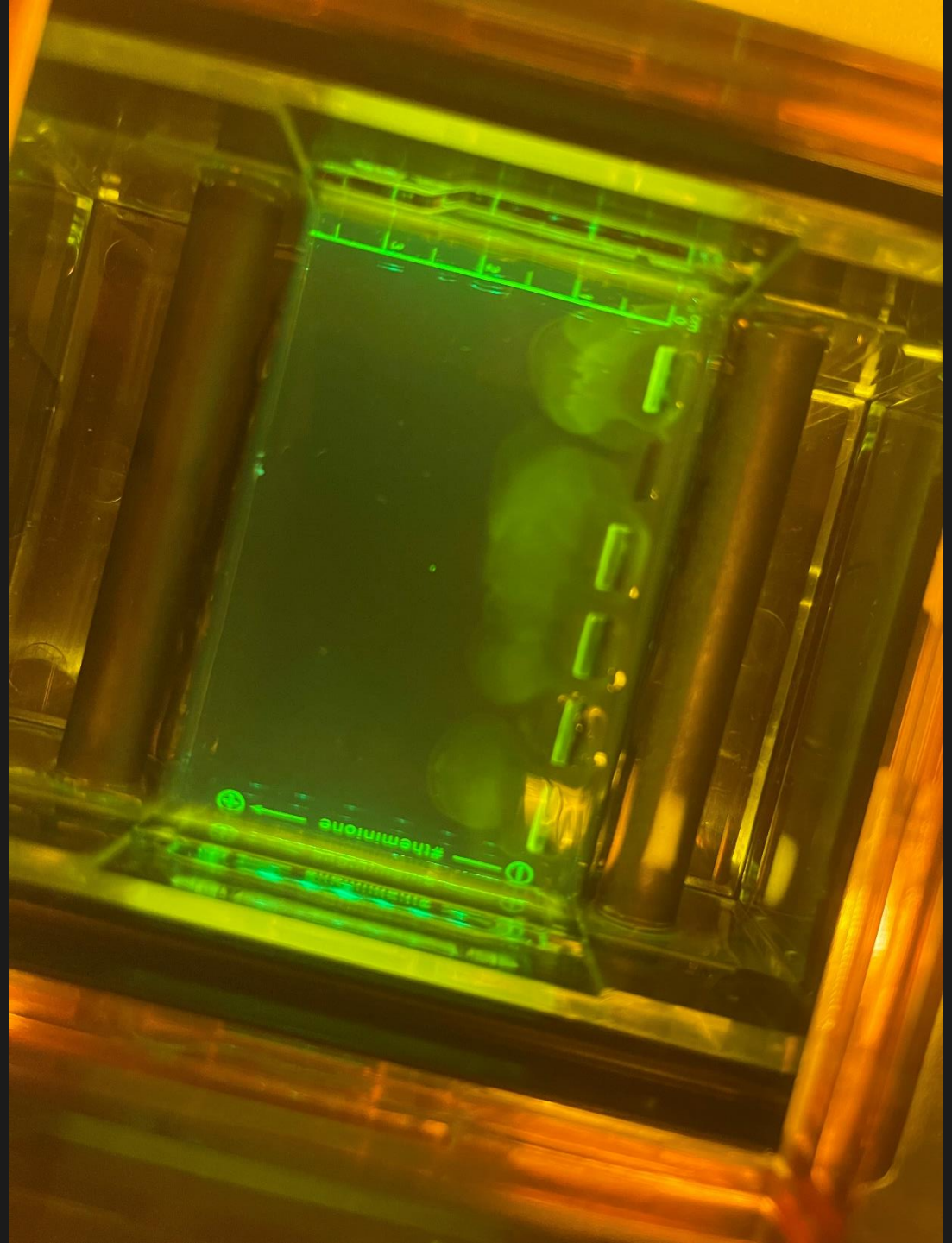
- Lesson outline
  - Introduce / Recall concepts of DNA fingerprinting
  - Introduce the technique applied in the experiment
  - Hands on experience on
    - setting of gel
    - using micropipette
    - loading the sample into the well
    - analyzing the DNA fingerprinting
  - Prospects on Biotechnology



Gel electrophoresis

- Feedback
  - Students understood the basic manipulation of micropipette
  - Students conducted the experiment successfully
  - Students were able to acquire the basic technique in this experiment

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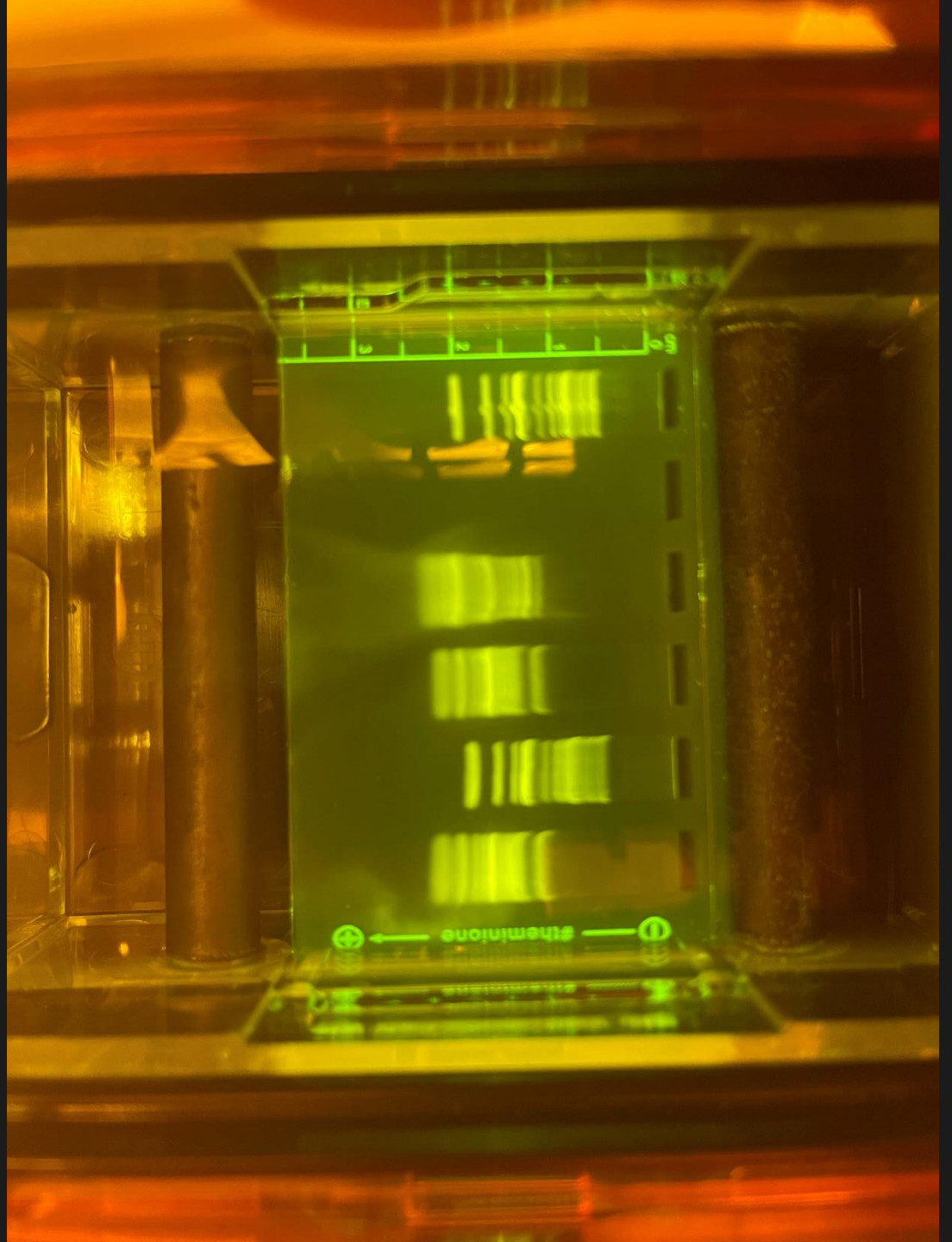
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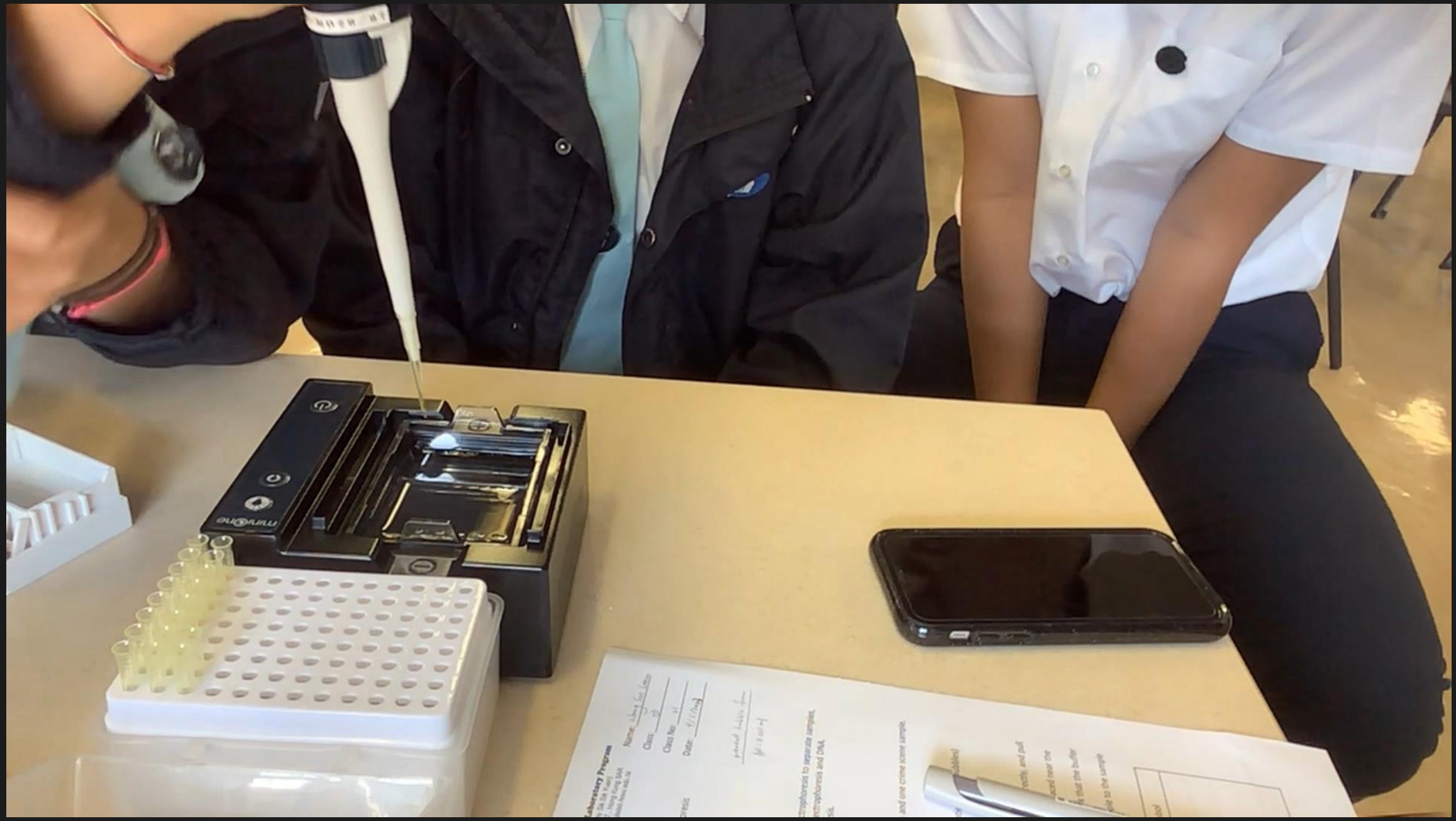
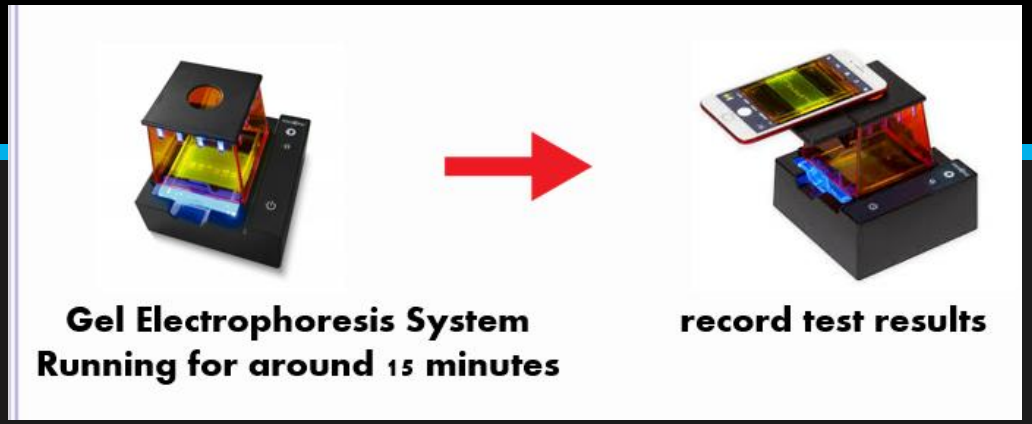
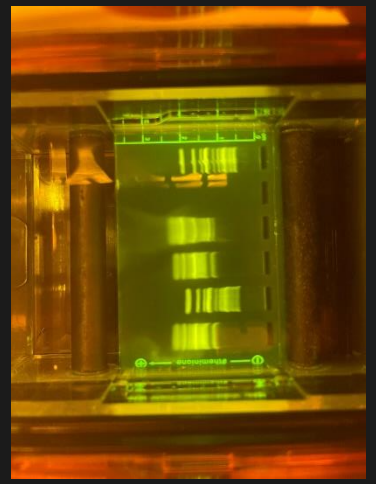
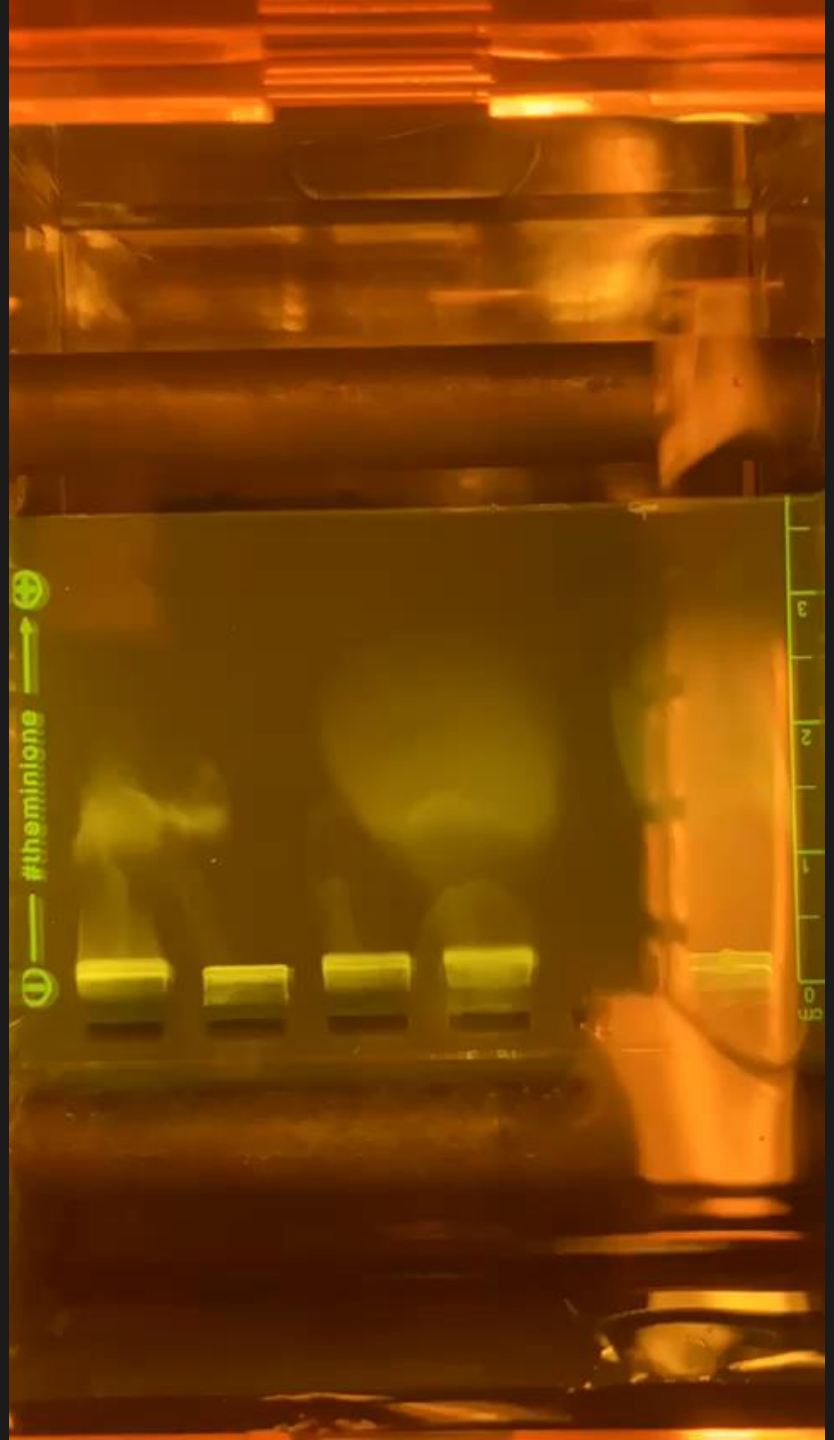


Gel electrophoresis



- Feedback
  - The kit – set
    - is easy to handle
    - can obtain results in a short period of time (around 15 minutes)
    - can show a clear (obvious) result
    - allow easy capture of photos and video

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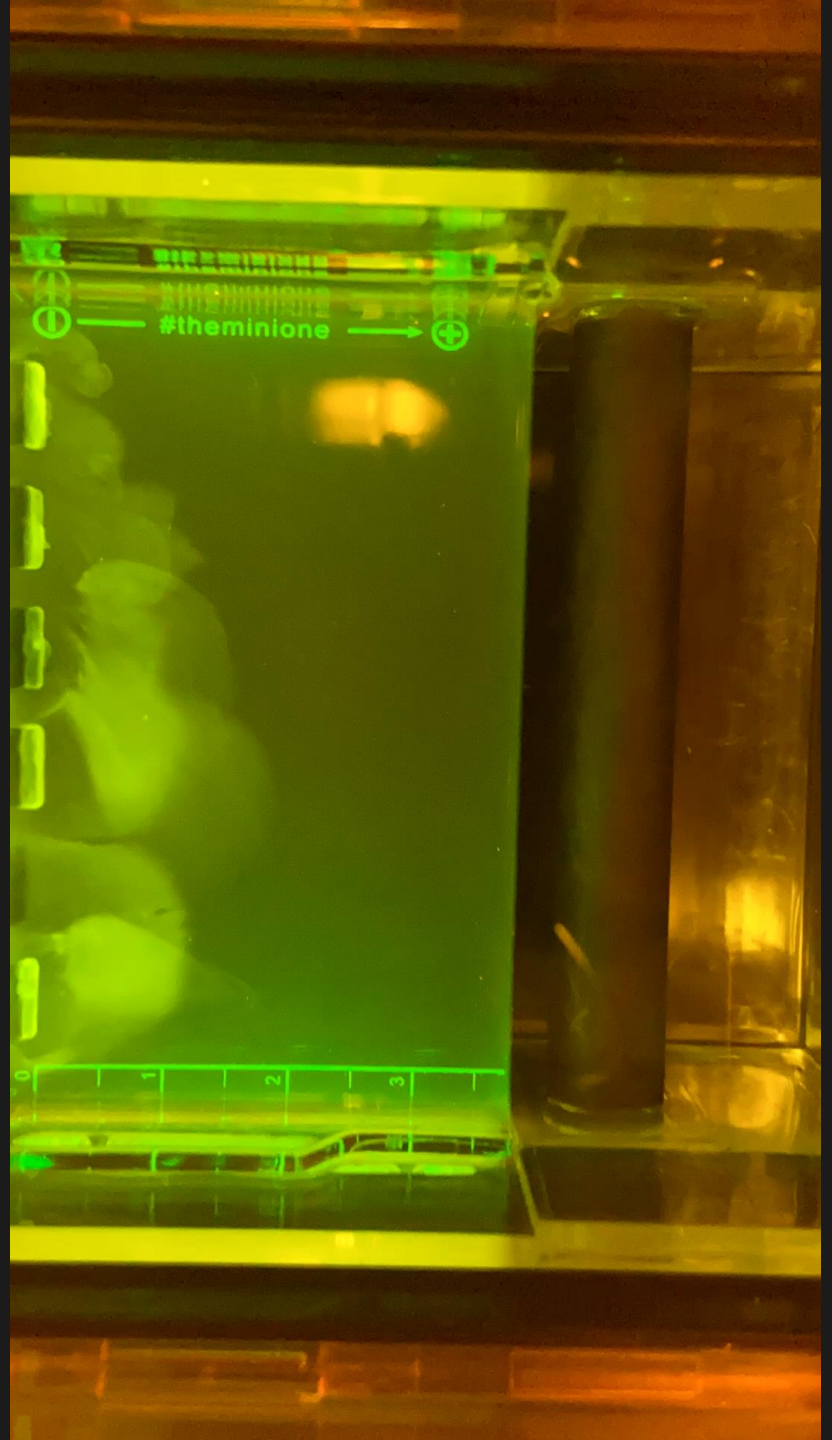
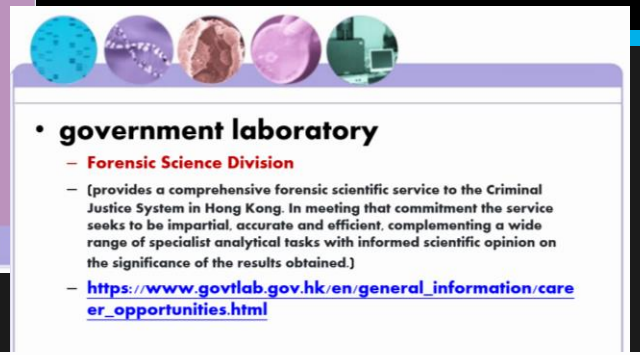
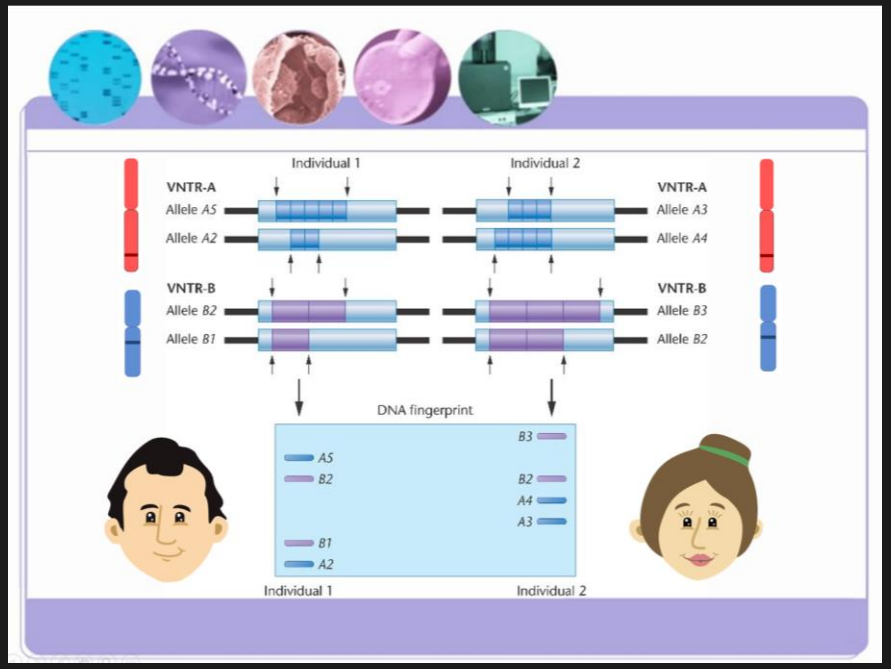

#theminione

Gel electrophoresis

- Feedback
  - Extension: related to E4 (Elective in DSE)
  - Students are interested to know the career path related to biotechnology






THANK YOU
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