



# 高中生物科野外考察課程 Senior Secondary Biology Field Study Course



## 電子顯微鏡生態探索 (可觀及其附近地方) Electron Microscope Eco Exploration (Ho Koon & nearby area)

姓名 Name: \_\_\_\_\_ 組別 Group: \_\_\_\_\_ 日期 Date: \_\_\_\_\_

### 學習目標 Learning goals

完成課程後，學生應能： After the course, students should be able to:

1. 理解光學顯微鏡和電子顯微鏡的運作原理； Understand the operation principle of light microscope and electron microscope;
2. 操作光學顯微鏡和掃描電子顯微鏡作生物觀察； Operate light microscope and scanning electron microscope for biological observation;
3. 仔細觀察和準確記錄； Observe carefully and record precisely;
4. 用不同的方法去驗證已有的知識； Use different methods to verify existing knowledge;
5. 與他人合作進行考察和資料整理工作； Cooperate with others to do field investigation and data processing;
6. 製作簡單科學報告； Make simple scientific report;
7. 欣賞大自然之美和尊重生物。 Appreciate the wonder of nature and respect living things.

### 程序 Schedule

09:00 - 09:45	簡介 Briefing
09:45 - 10:15	野外搜集樣本 Collecting samples in the field
10:15 - 12:00	電子顯微鏡觀察 SEM observation
12:00 - 13:00	午膳 Lunch
13:00 - 13:30	野外搜集樣本 Collecting samples in the field
13:30 - 15:00	電子顯微鏡觀察 SEM observation
15:00 - 15:30	數據分析 Data analysis
15:30 - 16:15	分組匯報 Group presentation
16:15 - 16:30	討論 & 總結 Discussion & summary

### 儀器及工具 Equipment and tools

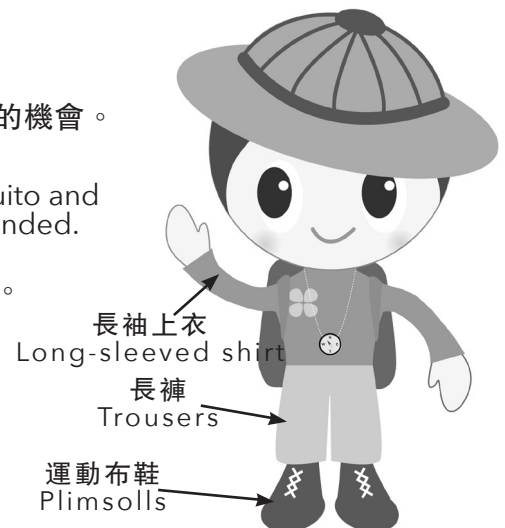
1	鑷子、剪刀、培養皿 Forceps, scissors, petri dishes
2	平板電腦 / 數碼相機 Tablet computer / Digital camera
3	圖鑑 Pictorial Guides
4	數碼解剖顯微鏡 Digital dissecting microscope
5	導電雙面膠貼 Double-side conductive adhesive tape
6	濺射鍍膜機 Sputter coater
7	掃描電子顯微鏡 Scanning electron microscope

### 衣著 Clothing

1. 穿著長袖上衣和長褲能更有效防止蚊蟲叮咬，亦可減低被太陽曬傷的機會。  
不應穿著短褲。  
Long-sleeved shirt and trousers for better protection against mosquito and insect bites, as well as preventing sunburn. Shorts are not recommended.
2. 不應穿著拖鞋或涼鞋，而應穿著運動布鞋，以減低腳部受傷的機會。  
A pair of plimsolls for preventing injuries. Slippers and sandals are not recommended.

### 安全 Safety

1. 避免踏足陡斜和濕滑的岩石和泥土表面。  
Avoid stepping on steep and wet rock surfaces and soil surfaces.
2. 切勿闖入植物生長茂密的地方，以免觸及蜂巢或被植物割傷。  
To prevent being attacked by wasps from disturbed wasp nests or being injured by plant leaves and thorns, do not get into places with dense vegetation.



### A. 花粉 Pollens

收集三種不同植物成熟的花，其中兩個物種為同一科。於解剖顯微鏡下摘下成熟雄蕊，將雄蕊置於金屬載碟上的導電膠貼表面塗擦，經噴金處理後置入掃描電子顯微鏡觀察和攝取圖像。

Collect 3 mature flowers of different plant species. 2 of the plant species should belong to the same family. Pick mature anther from the flowers and smear on the surface of conductive adhesive tape stuck to the metal stage. After sputter coating of gold, observe under scanning electron microscope and capture images.

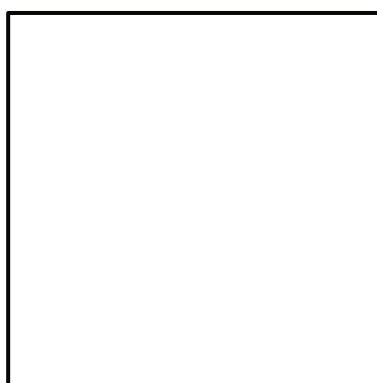
	花粉所屬植物的學名 Scientific name of the pollen bearing plant	俗名 Common name	科名 Family name
1			
2			
3			

### B. 昆蟲 Insects

收集兩種不同的小昆蟲，急凍處理後置於金屬載碟上的導電膠貼表面，經噴金處理後置入掃描電子顯微鏡觀察和攝取圖像。特別留意觸角、複眼和足部跗節的微結構。

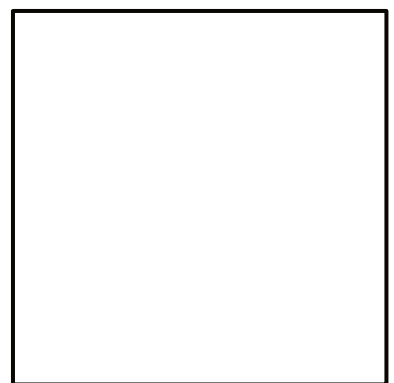
Collect 2 different tiny insects. After frozen, adhere to the surface of conductive adhesive tape stuck to the metal stage. After sputter coating of gold, observe under scanning electron microscope and capture images. Pay special attention to the micro-structure of antennae, compound eyes and tarsi.

	昆蟲名稱 Insect name	觀察結構 Structure observed
1		
2		



花粉  
Pollen

昆蟲  
Insect



以圖畫 / 文字 / 相片記錄金屬載物台上的樣本  
Label the sample on the metal stage by  
drawing / text / photo

### C. 分析和討論 Analysis and discussion

- 選擇其中一幅的昆蟲的電子顯微鏡攝取圖像，簡單描述圖中的各項微結構，並指出各微結構的功能。  
Select one of the insect images capture by the scanning electron microscope, briefly describe the micro-structure shown and point out the function of each micro-structure.
- 比對不同植物的花粉之間的分別，並說明花粉特徵與該植物繁殖方式之間的關係。  
Compare and contrast the pollen owned by different plant species and explain how the pollen's characteristics are related to its mode of reproduction.



# 顯微圖像分析

## Microscopic images analysis

項目 Task 1: 計算葉片氣孔密度 Calculate the density of stomata on the leaf (no. of stomata/cm<sup>2</sup>)

氣孔密度 Density of stomata : \_\_\_\_\_ (no. of stomata / cm<sup>2</sup>)

項目 Task 2: 利用動物眼睛圖像配對生物 Match the animals with the eye images.

圖 Picture A 動物名稱 Name of animal: _____	圖 Picture B 動物名稱 Name of animal: _____	圖 Picture C 動物名稱 Name of animal: _____	圖 Picture D 動物名稱 Name of animal: _____
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項目 Task 3: 利用動物口器圖像配對生物 Match the animals with the mouth part images.

圖 Picture A 動物名稱 Name of animal: _____	圖 Picture B 動物名稱 Name of animal: _____	圖 Picture C 動物名稱 Name of animal: _____	圖 Picture D 動物名稱 Name of animal: _____
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項目 Task 4: 計算花粉體積 (勝紅薊 vs 大紅花)

Calculate the volume pollen (Goatweed vs Chinese Hibiscus)

勝紅薊 Goatweed 花粉體積 Volume of pollen : _____ cm <sup>3</sup>	大紅花 Chinese Hibiscus 花粉體積 Volume of pollen : _____ cm <sup>3</sup>
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項目 Task 5: 在以下位置繪畫顯微照片的低倍標註圖

Draw a labelled low-power diagram of photomicrograph on the space provided.