

18th INTERNATIONAL BIOLOGY OLYMPIAD
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第 18 屆國際生物奧林匹亞



PRACTICAL EXAMINATION 1

ANIMAL ANATOMY, SYSTEMATICS AND ECOLOGY
動物解剖、系統分類及生態學

This examination is composed of 3 tasks.

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| TASK A: Dissection of two annelids
解剖 2 隻環節動物 (26 分) | 26 marks |
| TASK B: Identification of annelids using a dichotomous key
以檢索表將環節動物分類 (10 分) | 10 marks |
| TASK C: Defining the structures, body plan, life style and classification of 10 “worm-like animals”.
鑑定十種「蟲形」動物的構造、體制、生活型態及分類 (27 分) | 27 marks |

TOTAL MARKS = 63
總分 = 63

TOTAL TIME AVAILABLE = 90 minutes
總操作時間 = 90 分鐘

GENERAL INSTRUCTIONS

指引

- Read the exam paper carefully before commencing the exam.
在操作開始前，請仔細閱讀試卷內文
- It is recommended that you allocate your time according to the mark value of each task and question.
建議請按照各試題配分的比重來規劃作答時間

IMPORTANT INFORMATION FOR TASK A

Task A 重要訊息

You must commence with Task A. When Task A is completed, raise your hand and a lab assistant will take a photo of your dissections, ~~record the time~~, sign the pan labels and remove the dissections for marking.

一定要從 Task A 開始作答。當 Task A 操作完畢，舉手請監試人員將解剖結果照相存證，並在盤上名牌簽名。

IMPORTANT INFORMATION FOR TASKS B AND C

Task B & C 重要訊息

- All answers for Tasks B and C must be recorded in the answer booklet provided.
Task B 及 Task C 的答案需於答案卷上作答。
- Ensure that your 4-digit student code number is written on ALL pages of your answer booklet.
務必將 4 位數學生代碼寫於所有答案卷的每頁頁首的欄位上。
- Use the pencil provided to fill in the appropriate circle for each question in the answer booklet.
請以鉛筆作答，塗選適當圈位。

Task A. Annelid Dissection (26 marks)

環節動物解剖 (26 分)

Objective: To locate key features in a marine and a terrestrial annelid.

主題：將一隻海洋及一隻陸生的環節動物特徵標出

Materials: 材料：

- dissecting tray containing annelid 1 (tray labeled with blue sticker)

解剖盤內有環節動物 1 (標藍標解剖盤)

- dissecting tray containing annelid 2 (tray labeled with yellow sticker)

解剖盤內有環節動物 2 (標黃標解剖盤)

- 1 pair of dissecting scissors

一把解剖剪

- 1 pair of forceps

一隻鑷子

- 1 scalpel

一把解剖刀

- 20 steel pins on foam board

保麗龍板上有 20 個 T 型大頭針

- 14 colored pins on foam board (2 red-orange, 2 blue, 2 yellow, 2 black, 2 white, 2 pink, 2 green)

保麗龍板上有 14 個彩色大頭針 (二橘紅、二藍、二黃、二黑、二白、二粉紅、二綠)

- 1 pair disposable gloves

一對拋棄式手套

- 1 dissecting microscope and external lamp

一台解剖顯微鏡及外接光源

- 2 specimen cards (1 labeled with blue sticker, the other labeled with yellow sticker)

2 個標本卡 (一個以藍貼紙標示, 一個以黃貼紙標示)

- water bottle for keeping specimens wet

使標本保濕用的水瓶

- 15 cm ruler from student pencil case

學生鉛筆盒中 15 公分長的尺

NOTE: Before beginning your dissection, ensure that you have all of the materials listed above. If you do not, immediately notify a lab assistant by raising your hand.

注意：在開始解剖前，確實清點上述之材料，如有缺，請立刻舉手通知監考人員

Procedure: 步驟：

1. Fill out each of the two specimen cards with your student number and name and set aside. You will sign these cards **upon completion** of your dissections.
1.將你的學生代碼及姓名填入盤上的二張名牌中（二張都要）並放在旁邊。完成解剖後，請簽名。

2. Put on your gloves and remove the wet paper towel that is covering the specimen.
Throughout the dissection, use the water bottle to regularly wet your specimen and any parts removed. This will ensure that the parts do not dry out.
2.戴上手套並將覆蓋標本的濕紙巾移除，解剖過程中，用水瓶的水保持標本及移出的各部分組織潮濕，以防止組織乾燥。

3. Note the differences in the external features of each worm, namely the increased number of sensory structures and the presence of multifunctional appendages on annelid 1.
3.注意每隻蟲外部特徵的差異，觀察環節動物 1 上眾多的感覺構造及其多功能的附肢。

4. **From the mid portion of the body** of annelid 1, detach an entire parapodium. Parapodia function as limbs and gills for the worm. Details of the parapodia allow zoologists to distinguish between different species of this annelid. Each parapodium consists of a ventral division called the **neuropodium** and a bilobed dorsal division called the **notopodium**. Each notopodium is supported by a chitinous and stiff rod called an **aciculum**. A dorsal and a ventral cirrus project from the notopodium and the neuropodium, respectively. **Setae** extend beyond the parapodia.
4.由環節動物 1 的**身體中段**，將整個疣足分離，疣足具有腳及鰓的功能。疣足的細部構造是動物學家作為不同環節動物的分類依據。每個疣足具有背腹二節，腹節稱做「**腹葉 (neuropodium)**」，背節具有二瓣，稱為「**背葉(notopodium)**」。每個背葉藉幾丁質的硬棒狀足針的構造來支撐。背葉與腹葉各具一突出之棘刺，另疣足尚有一些長度超過疣足的**剛毛**。

5. Use the pins provided to pin the detached parapodium in one corner of the annelid 1 dissecting pan. Ensure that it is pinned on wet paper towel. Pin as follows:
5.分離環節動物 1 的疣足，放在濕紙巾上，置於解剖盤上的一角，並用提供的大頭針在標本上插針。插針的方式如下：
 - red-orange pin for the neuropodium (2 marks)
橘紅色針插在**腹葉(neuropodium)**上。(2 分)
 - blue pin for the notopodium (2 marks)
藍色針插在**背葉(notopodium)**上。(2 分)

*** Before continuing, use the water bottle to moisten the parapodium & cover it with a wet piece of paper towel ***
在繼續操作之前，以水瓶濕潤疣足，並將濕紙巾覆蓋其上。

6. Stretch out each worm in its dissecting pan, **dorsal side up**. Place one steel pin through the 1st segment of the body and one pin through the last segment of the body to secure it in place.
- 6.將每隻蟲背部朝上，在解剖盤上延展。將二個T型大頭針分別插在蟲體的頭尾二節（第一體節與最後一節）固定之。
7. Cut open the body wall of annelid 1 from the anterior tip down the body 3-5 cm. Separate the body wall from the internal structures and pin the body wall to the dissecting tray by using the steel pins.
- 7.將環節動物1由前端切開3-5公分，打開蟲體，使體壁與內臟分離，將切開的體壁向左右拉開，以T型大頭針將體壁固定在解剖盤上。
8. Cut open the body wall of annelid 2 from the anterior tip, and continue the cut posteriorly approximately 5 cm. Separate the body wall from the internal structures. To open up the worm, pin the body wall to the dissecting tray by using the steel pins.
- 8.將環節動物2由前端切開約5公分長，打開蟲體，將體壁與內臟分離，將切開的體壁分別拉開，以T型大頭針將體壁固定在解剖盤上。
9. Starting at the anterior end of each worm, locate the muscular **pharynx**. In annelid 1 the pharynx also contains jaws that are useful in its predatory lifestyle. **In both specimens**, pin the following structure:
- 9.從每隻蟲的前端開始，標示其肌肉質的咽。蟲體1的咽同時包含用來捕食的大頷。用大頭針標示二個標本下列構造：
- **yellow pin for the pharynx on annelid 1** (2 marks)
黃色針標示環節動物1的咽。(2分)
 - **yellow pin for the pharynx on annelid 2** (2 marks)
黃色針標示環節動物2的咽。(2分)
10. Moving posteriorly in both specimens, locate the long and tubular intestine used in digestion. **In both specimens**, pin the following:
- 10.由前向後檢示此二個標本，標示出用以消化的長管狀腸道。
- **black pin for the intestine on annelid 1** (2 marks)
黑色針標示環節動物1的腸道。(2分)
 - **black pin for the intestine on annelid 2** (2 marks)
黑色針標示環節動物2的腸道。(2分)

11. Other major features of the annelid digestive system can be seen in annelid 2. Immediately posterior to the reproductive organs in annelid 2 lie the soft **crop** and the tougher-walled **gizzard**. **In annelid 2**, pin the following:

11. 在環節動物2並可見環節動消化系統的其他重要特徵。緊接在蟲體2生殖器官的後方，為柔軟的**嚙囊**及厚壁的**砂囊**。以大頭針標示出**環節動物2**的下列構造：

- **pink pin for the crop on annelid 2** (2 marks)
粉紅色針插在環節動物2的**嚙囊**上。(2分)
- **green pin for the gizzard on annelid 2** (2 marks)
綠色針插在環節動物2的**砂囊**上。(2分)

12. Both annelids possess a closed circulatory system with tubular hearts and a dorsal and ventral blood vessel. **In both specimens**, pin the following:

12. 二種環節動物皆具有閉鎖循環系，包括管狀的心臟及背血管、腹血管。用大頭針標示二標本的下列構造：。

- **white pin for the dorsal blood vessel on annelid 1** (2 marks)
白針標示環節動物1的**背血管**。(2分)
- **white pin for the dorsal blood vessel on annelid 2** (2 marks)
白針標示環節動物2的**背血管**。(2分)

13. Although both specimens are annelids, annelid 1 is sexually dioecious, whereas annelid 2 is hermaphroditic. Hermaphroditism is an advantage for this slow-moving organism. Examine the anterior internal structures in annelid 2, and any external features found on the body wall. **In annelid 2 only**, pin the following:

13. 雖然二隻都是環節動物，但環節動物1是雌雄異體，而環節動物2是雌雄同體。雌雄同體對此緩慢移動的動物是有利的。檢視蟲體2前段的內部構造，及其體壁所具有的外在特徵。請只在**環節動物2**上以大頭針標示下列構造：

- **plain steel pin for clitellum** (2 marks)
T型鋼針插在**生殖環節**上。(2分)
- **red-orange pin for seminal vesicle** (2 marks)
橘紅色針插在**儲精囊**上。(2分)
- **blue pin for seminal receptacle** (2 marks)
藍色針插在**受精囊**上。(2分)

14. **After finishing the task, place a wet paper towel over the dissected specimens. Raise your hand. A lab assistant will take a photo of your dissection. Both the lab assistant and yourself will sign your dissection pan labels. Your dissection will then be taken in and graded as you move onto the next section of the practicum.**

14. 完成上述工作後，將濕紙巾覆蓋在解剖完畢的標本上，**舉手**，監考人員會將你的解剖成果拍照紀錄。你與監考人員都要在解剖盤上的名牌簽名。

Task B. Identification of annelids using a dichotomous key (10 marks)

使用檢索表將各環節動物分類。(10分)

Objective: To use a dichotomous key to identify ten annelids to the genus-level.

主題：使用檢索表將10個環節動物分類至屬的階層。

Materials:

- line drawings of 10 annelids (labeled as 1 to 10). All of the organisms are drawn in the same orientation.

材料：

10種環節動物的線條圖（標示1號至10號）。所有蟲體皆呈一致的頭尾方向。

Procedure:

Use the dichotomous key below to identify the genus to which each annelid belongs. Indicate your selections in the answer booklet by filling in the **most** appropriate circle for each annelid.

步驟：

使用下列提供的檢索表，將各環節動物歸至表中各個屬名。將答案卷中各環節動物其屬名所在位置的圓圈塗黑。

Dichotomous Key 檢索表

1a. Has a prominent posterior sucker 後端有一個非常明顯的吸盤.....	go to 2
1b. Lacks a posterior sucker 缺乏後吸盤.....	go to 3
2a. Posterior half of body much wider than the anterior end 蟲體的後半部較前半部寬很多	<i>Glossiphonia</i>
2b. Body more ribbon like, anterior part tapered 蟲體比較像帶狀，前端尖細，往後漸寬.....	<i>Eropobdella</i>
3a. Has a prominent clitellum 有明顯的生殖環帶.....	<i>Lumbricus</i>
3b. Clitellum absent 缺乏生殖環帶.....	go to 4
4a. Each segment has a pair of lateral appendages (parapodia) 每一體節有一對側肢（疣足）	go to 5
4b. Parapodia are reduced, modified and/or not present on each segment 疣足退化、變形或並非每一體節都有.....	go to 8
5a. Worm bears dorsal scales (elytra) 蟲體具有背鱗（鞘鱗）	<i>Lepidontus</i>
5b. Worm lacks dorsal scales 蟲體缺乏背鱗	to 6
6a. More than 15 body segments 超過15個體節.....	go to 7
6b. Less than 15 body segments; prostomium with a pair of club-shaped palps 少於15個體節，口前葉有一對棍棒狀的觸鬚....	<i>Nerillidopsis</i>
7a. Segment 2 bears a pair of long parapodial cirri 第二體節有一對長疣足狀的剛毛.....	<i>Tomopteris</i>
7b. Lacks long parapodial cirri on segment 2 第二體節缺乏長疣足狀的剛毛	<i>Nereis</i>
8a. Possesses numerous tentacles ... 有很多觸鬚（觸手）	<i>Neoamphitrite</i>
8b. Lacks tentacles 缺乏觸鬚（觸手）.....	go to 9
9a. Parapodia of the mid-body region modified as tufted branchia (gills) 身體中段的疣足特化成叢生的鰓.....	<i>Arenicola</i>
9b. Body divided into distinct regions; anterior end modified for filter-feeding. 身體分成幾個不同的區域，前端特化成濾食構造...	<i>Chaetopterus</i>

Task C. Form and function of “worm-like” animals (27 marks)

「蟲形」動物的形態與功能（27分）

Introduction

The following 10 animals all resemble “worms” in habit or appearance based on their general tubular or “worm-like” body plans. Most people without scientific training would initially use the term “worms” to describe these ten animals but with our zoological knowledge we know that these animals actually belong to several very different phyla and are only related superficially by their “worm-like” body plan. These 10 animals have structural characteristics that are adapted to their particular environments and life styles.

前言：

下列十種動物根據其管狀或蟲狀的體型，在外表或習性看來都像「蟲」。故大多數缺乏科學訓練的人常用「蟲」來形容這十種動物，但根據我們對動物學的知識，這些動物事實上屬於不同的動物門，只是外表似蟲的假相。這十種動物都有其構造上的特徵以適應其所生活的環境及型態。

Objective: Using the pictures provided, determine which adaptations (form) these animals have that helps them in their environment and life styles (function)

主題：用所提供的圖片，來確定這些動物的形態及其對環境適應的方式（功能）。

Materials:

➤ laminated, colour photographs of 10 animals (labeled A to J)

材料：十種動物的彩色照片（從 A 標至 J）

Procedure:

There are two parts to this task. Fill in the tables in your answer booklet.

步驟：

此題有二部分，將答案填於答案卷上的表中。

1. In Part I, select the best response for each of 6 characteristics (body shape; structures used in locomotion or for attachment to a host; structures used in feeding; type of digestive tract; body segmentation; type of sensory structures) from the choices provided.

1. 第一部分，由上述十種動物選出其在各特徵中所屬的特徵選項。一共有六組主要的特徵：體型、用於移動或附著於寄主的構造、攝食的構造、消化道的形態、身體分節、感覺構造的類型。

2. In Part 2, use your observations from Part 1 to select the best response from the choices provided for the life style of each animal, the phylum to which it belongs and its body plan. For each part, indicate your choices by filling in the circles in the appropriate section of the answer booklet.

2. 第二部分，由第一部分所提供的資料，選擇每種動物的生活型態、所屬的門及其體制，將答案卷中正確位置的圓圈塗黑。

- THE END -