PRACTICAL EXAM 3 - ANIMAL BIOLOGY
實作3 動物生物學

Max. total points
滿分 99
Exam duration 90 minutes
考試時間 90分鐘
8 questions
8 題

In this exam you will dissect a cod (*Gadus morhua*). You will be scored on your ability to dissect and identify structures and organs of the fish. In addition, you will be asked about functions of structures. Thus the exam is about functional morphology of an ecologically and economically important fish species.
在此實作中你要解剖鱈魚(Gadus morhua)。你的分數是由你的解剖能力及對這隻魚各構造器官的辨識來決定，此外你會被問及有關構造的功能。此實作是關於一種在生態及經濟上重要的魚種其形態功能學。

The exam consists of four parts.
此實作包含4部份。

Part 1. Identification of external structures (15 points)
Part 2. Identification of internal structures (37 points)
Part 3. An analysis of the heart (22 points)
Part 4. An analysis of the brain (25 points)

第1部份 標示外部構造(15分)
第2部份 標示內部構造(37分)
第3部份 分析心臟 (22分)
第4部份 分析腦(25分)
我們建議你在進行實作之前，先把整個題目看完一遍。這很重要，以避免其後所需操作的魚體部份在之前遭到破壞，記住我們只提供每位學生一條魚。

INTRODUCTION 前言

MATERIALS & EQUIPMENT材料及儀器

In order to do your lab work, you need the materials A-J listed below. Please, ensure yourself that all these items are on your table.
If anything is missing, contact the exam personnel immediately – and no later than 15 minutes after start of exam. If you need any assistance during the exam, please raise your pink card..
要完成你的實作，你需要下列的材料A-J。檢查在你桌上的材料。假設缺任何東西，立刻通知監試人員。考試開始**15**分鐘後不予受理，考試期間如需協助，請舉起你的粉紅色卡片 。
Material A. 1 cod
Material B. 1 pair of scissors
Material C. 1 tweezer
Material D. 4 pairs of gloves
Material E. Needles
Material F. Number strips (cut off individual numbered tags)
Material G. 1 dissection polystyrene board
Material H. 1 bag for waste
Material I. Cleansing tissues
Material J. 1 touch pen for tablet
材料A. 一隻鱈魚
材料B 一付剪刀
材料C 一個鑷子
材料D 4副手套
材料E 多隻大頭針
材料F 數字標籤條(剪下個別數字標籤)
材料G 一個保麗龍解剖板
材料H 一個垃圾袋
材料I 清潔面紙
材料J 1隻平版電腦感應筆
NB: Keep the tablet plugged in during the entire exam.
注意：在整個考試期間讓平版電腦，保持電源連線。

1. IDENTIFICATION OF EXTERNAL STRUCTURES (15 POINTS) 辨識外部構造(15分)

Protocol流程
1. Place the cod on the polystyrene dissection board with

its left side upwards and head towards the left (Fig. 2.1.).
將鱈魚左側朝上放在保麗龍解剖板上，頭朝向左邊(圖2.1)
2. Mark the positions, using needles with a numbered tag (Material F), of all 11 external morphological structures listed below.Use the numbers given below for each of the corresponding structures If a structure is present more than once, you only have to mark one of them. To create the tags, mount each numbered tag onto a needle by placing the tag on the polystyrene board and pressing the needle through the tag
用具有數字標籤(材料F)的大頭針來標示下列所列的11個外部形態構造，標示時，根據下列數字所代表的構造標示在魚體上對應的位置，假設某種構造分佈在兩處以上，你只要標示一處即可。製作數字標籤大頭針時，請將標籤紙置放在保麗龍板上(而非魚體)，而後將大頭針穿過標籤紙即可。

External morphological structures
外部形態構造
1. Caudal fin
2. Anal fin
3. Pelvic fin
4. Pectoral fin
5. Dorsal fin (only one of these)
6. Operculum
7. Nostril
8. Lateral line
9. Barbel/whisker
10. Anus
11. Urogenital aperture
1.尾鰭
2.臀鰭
3.腹鰭
4.胸鰭
5.背鰭(只要其一即可)
6.鰓蓋
7.鼻孔
8.側線
9.鯰鬚
10.肛門
11.泄殖口

Protocol continued流程繼續
3. Photograph the cod with all structures 1–11 indicated with numbered needles
Be sure that both the number tag and the structure can be seen in the photo; you may have to stand up while taking the photo.
用有數字標籤的大頭針在鱈魚1~11指定的構造上標示，照相存證。
確定在相片上可以看到數字標籤及所標示的構造，在照相時你可以站起來照。

4. Upload the photo (the display tells you that you may either 'retry' or

accept with an 'OK'; only the last photo will be saved). Notice that if a flag is missing or wrongly placed or if a number is not visible, you get 0 point for that particular structure.
上傳相片(訊息會告訴你，你需要"重傳"或以"OK"顯示接受，只有最後一張相片會被存檔)。注意，假如有一個標籤遺失或放錯位置或數字不清，你所標示的該種構造就沒有分數。

Each correctly marked external structure earns you 1 point.
每一個標示正確外部構造可獲1分

Q. 1 Photo of the cod with all 11 EXTERNAL morphological structures and numbered flags visible (max. 11 points)
具所有鱈魚11個外部形態構造及清楚數字標籤的照片(得滿分11分)

Node Id: **52dbc3ff9ecaa76ca90427f8**
Cod photo
鱈魚照

Q. 2 Functions of external organs (1 point for each correct statement, max. 4 points)
外部器官的功能(每一正確的敘述1分，滿分4分)

Node Id: **d8f028dffa966960622974e2**
Indicate if each of the following statements are true or false.
指出下列敘述是正確或錯誤：

	TRUE 正確	FALSE 錯誤
In most fish, the lateral line consists of sensitive cells on the surface of the scales 在大多數的魚，側線由一些敏感細胞組成，它位在鱗片表面上	○	○
In the cod the vertebral column bends and extends upwards into the upper lobe of the tail fin 在鱈魚，其脊柱彎曲並向上延伸至尾鰭的上部	○	○
In most modern fish the lateral line is a system sensitive to motions and vibrations in its surroundings	○	○

在大多數現代魚種中，側線是對環境中移動及震動敏感的系統

During accomodations the lens in a cod's eye changes shape the way it does in a mammalian eye
鱈魚眼的晶體改變形狀的調適過程中其方式與哺乳動物相同

2. IDENTIFICATION OF INTERNAL STRUCTURES (37 POINTS)
辨識內部構造(37分)

Protocol

1. First, remove and discard the operculum as well as lateral musculature on the left side of the cod (as in Fig. 2.1).
首先移除並丟棄鱈魚左邊側面肌肉(如圖2.1)
2. Then separate the organs from the esophagus to the anus, and take them out as a unit; but leave the swim bladder in the fish. You may need to cut through the swim bladder
然後將食道到肛門的器官分離，將他們整個一體拿出只留下魚鰾，在此過程中你可能需要切割過魚鰾
3. Place the organs on the polystyrene board.
將整個器官放在保麗龍板上
4.Identify, in the dissected organs, the 11 internal structures described below, using needles with numbered tags (Material F),
標示解剖過後的器官，用有標籤(材料F)的大頭針來標示下述11個內部構造

Figure 2.1: *Cod with left-side musculature removed; A numbered tag is placed on the eye to show how a correctly placed tag should look like, i.e. both tag and structure are clearly visible.*
圖*2.1*.鱈魚左側的肌肉完全移除後，有一個數字的標籤放在眼睛處，來顯示正確的標示方式，即標籤的數字與魚眼睛皆可以清楚的顯現。

Internal morphological structures

內部形態構造
1. Primary site for gas exchange
2. Urine-producing organ
3. Gas gland
4. The organ in which pepsinogen is secreted
5. The site where substances from the gall bladder and pancreas are

secreted
6. The organ where the main absorption of nutrients takes place
7. Spleen
8. The organ where detoxification of blood takes place
9. Pyloric caeca
10. Swim bladder
11. Gill rakers

1.主要氣體交換所在
2.尿液製造器官
3.氣體腺
4.分泌胃蛋白酶原的器官
5.膽囊與胰臟分泌物的分泌處
6.主要營養吸收處的器官
7.脾臟
8.去除血液毒素的器官
9.幽門盲囊
10.魚鰾
11.鰓耙

Protocol continued 流程繼續
5. Photograph the cod with all structures 1–11 indicated with numbered needles. Be sure that both the number tag and the structure can be seen in the photo.
用有數字的大頭針在鱈魚1~11處指定的構造上標示，照相存證。
確定在相片上可以看到標籤上的數字及所標示的構造
6. Upload the photo (the display tells you that you may either 'retry' or accept with an 'OK'; only the last photo will be saved). Notice that if a flag is missing or wrongly placed or if a number is not visible, you get 0 point for that particular structure.

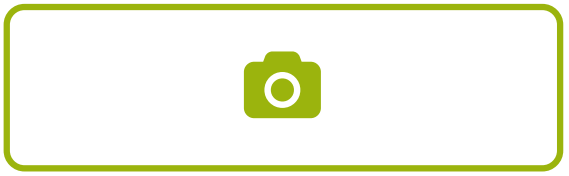
上傳相片(訊息會告訴你，你需要"重傳"或以"OK"顯示接受，只有最後一張相片會被存檔)。注意，假如有一個標籤遺失或放錯位置或數字不清，你所標示的該種構造就沒有分數。

Each correctly marked internal structure earns you 3 points.
每一個內部構造作答正確得3分。

Q. 3 Photo of the dissected cod with all 11 internal morphological structures and numbered flags visible (max. 33 points)
具所有鱈魚11個內部形態構造及清楚數字標示的照片(得滿分33分)

Node Id: **c4648f4d8efb065b76e24861**
Cod photo

鱈魚照



Q. 4 Functions of internal structures (1 POINT FOR EACH CORRECT STATEMENT, MAX. 4 POINTS)
內部構造的功能(每一正確敘述1分，滿分4分)

Node Id: **5229a66edae03ea0b3fd77d6**

Indicate if each of the following statements are true or false.
指出下列敘述是正確或錯誤：

	TRUE 正確	FALSE 錯誤
Gas is secreted into the swim bladder by diffusion through its entire wall 氣體釋放進入魚鰾係藉由擴散作用經過整個魚鰾的表面	○	○
The cod lacks a connection between the gas bladder and the alimentary canal 鱈魚在魚鰾及消化道間缺乏連接	○	○
Catching cod may cause rupture of their swim bladder 捕獲鱈魚時，可能會造成其魚鰾破裂	○	○
The spleen is part of the immune system of the cod 脾臟是鱈魚免疫系統的一部份	○	○

3. STRUCTURE OF THE HEART (22 POINTS)
心臟的構造(22分)

Protocol

1. Remove the heart from the fish and place it on the polystyrene board.
將魚的心臟移除，置放於保麗龍板上
2. Mark the identity, using needles with numbered tags (Material F), of the four structures listed below.

用有標籤的大頭針(材料F)標示下列4種構造
1. Atrium
心房
2. Ventricle
心室
3. Bulbus arteriosus
動脈球
4. Ventral aorta
腹大動脈

Protocol continued
3. Photograph the heart with structures 1–4 indicated with numbered needles. Be sure that both the number tag and the structure can be seen on the photo.
用有標籤的大頭針標示1-4種構造後，照相存證。確定所標示的標籤號碼及構造皆能清楚看見
4. Upload the photo (the display tells you that you may either 'retry' or accept with an 'OK'; only the last photo will be saved). Notice that if a flag is missing or wrongly placed or if a number is not legible/visible, you get 0 point for that particular structure.
上傳相片(訊息會告訴你，你需要"重傳"或以"OK"顯示接受，只有最後一張相片會被存檔) 注意，假如有一個標籤遺失或放錯位置或數字不清，你所標示的該種構造就沒有分數。

Each correctly marked heart structure earns you 5 points.
每一個心臟構造標示正確得5分。

Q. 5 PHOTO OF THE DISSECTED heart WITH ALL four STRUCTURES AND NUMBERED FLAGS VISIBLE (MAX. 20 POINTS)
具所有鱈魚心臟的4種構造及清楚數字標示的照片(得滿分20分)

Node Id: **a28ee37fed343b00cbf50dce**
Heart photo
心臟圖

Q. 6 FUNCTIONS OF heart STRUCTURES (1 POINT FOR

EACH CORRECT STATEMENT, MAX. 2 POINTS)
心臟構造的功能(每一正確的敘述1分，滿分2分)

Node Id: **2faa3c835b94befd7ec81a1e**

Indicate if each of the following statements are true or false.
指出下列敘述是正確或錯誤：

	TRUE 正確	FALSE 錯誤
The heart of the cod has two atria and one ventricle 鱈魚的心具有2心房1心室	○	○
The blood pressure of the cod is mainly created by the ventricle 鱈魚的血壓主要來自於心室的運作	○	○

4. STRUCTURE OF THE BRAIN (25 POINTS)大腦的構造(25分)

Protocol流程

1. Remove very carefully the central nervous system (brain and spinal cord) (as in Fig. 4.1).
非常仔細地移除中樞神經系統(腦和脊髓)
(如圖4.1)
2. Place the central nervous system on the polystyrene board
將中樞神經系統放在保麗龍板上
3. Mark the identity, using needles with numbered tags (Material F), of the seven structures listed below.
利用數字標籤的大頭針 (材料 F)，標定下列七個構造

1. Tectum opticum (optic tectum)
2. Cerebellum (“little brain”)
3. Medulla spinalis (spinal cord)
4. Telencephalon (containing the olfactory center)
5. Sagittal otolith (sagittal otoliths are the largest of the three ear stones)
6. Optic nerve
7. Muscle(s) controlling eye movements

1.視頂蓋
2.小腦
3.脊髓
4.端腦 (含嗅覺中心)
5.矢耳石 (矢耳石是三個耳石中最大的)
6.視神經
7.控制眼球運動的肌肉(群)

Protocol continued 流程繼續

4. Photograph the cod with all structures 1–7 indicated with numbered needles. Be sure that both the number tag and the structure can be seen on the photo.
用有標籤的大頭針標示1-7種構造後，照相存證。確定所標示的標籤號碼及構造皆能清楚看見

5. Upload the photo (the display tells you that you may either 'retry' or accept with an 'OK'; only the last photo will be saved). Notice that if a flag is missing or wrongly placed or if a number is not legible/visible, you get 0 point for that particular structure.

上傳相片(訊息會告訴你，你需要"重傳"或以"OK"顯示接受，只有最後一張相片會被存檔)。注意，假如有一個標籤遺失或放錯位置或數字不清，你所標示的該種構造就沒有分數。

Each correctly marked brain and spinal cord structure earns you 3 points.
每一個正確的標定的腦及脊髓構造可得3分

Figure 4.1: *Removal of brain and spinal cord*
圖*4.1* 移除腦及脊髓

Q. 7 PHOTO OF THE DISSECTED brain and spinal cord WITH ALL seven STRUCTURES AND NUMBERED FLAGS VISIBLE (MAX. 21 POINTS)
具有腦和脊髓上的7種構造及清楚數字標籤的照片(得滿分21分)

Node Id: **5e34175fa38ef286888d85bc**
Brain and spinal cord photo
腦和脊髓的照片

Q. 8 FUNCTIONS OF brain and other STRUCTURES (1 POINT FOR EACH CORRECT STATEMENT, MAX. 4 POINTS)
大腦和其他構造的功能(每個正確的描述得1 分，滿分

4 分)

Node Id: **21833062d859e0c48e045735**

Indicate if each of the following statements are true or false.
指出下列的敘述是正確或錯誤。

	TRUE 正確	FALSE 錯誤
The telencephalon is relatively smaller in fish than in mammals 與哺乳動物相比較，魚的端腦相對較小	○	○
Fish have 12 cranial nerves, the same as in mammals 魚與哺乳動物相同，有 12對腦神經	○	○
Tectum opticum of the cod has two lobes, the left receives information from the left eye and the right from the right ey 鱈魚的視頂蓋有兩葉，左葉接收來自左眼的訊息，右葉接收來自右眼的訊息	○	○
Otoliths are homologous to the inner ear bones of mammals 魚的耳石與哺乳動物內耳的骨頭是同源構造	○	○

END 結束