

LABORATORY FOUR

ANIMAL FORM & FUNCTION: THE ARTHROPOD BODY PLAN

LABORATORY SESSIONS

Date	29 October 2025 (Wednesday)			
Time	1000 – 1200	1200 – 1400	1400 – 1600	1600 – 1800
	B1	B2	B3	B4
Venue	Life Sciences Laboratory 3, Block S1A Level 4			

IMPORTANT INFORMATION

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| 1. You must wear appropriate attire (trousers, jeans, long skirts) and covered footwear ; else you will be denied entry into the laboratory. |
| 2. Please re-use the disposable laboratory coat that was issued to you during the first session. |
| 3. Please be punctual . You will be denied entry into the laboratory if you arrive later than 5 minutes after the scheduled class. |
| 4. It is your responsibility to ensure that your attendance is noted. Absence from laboratory session incurs 50% penalty to the assignment. If you are unable to attend, please contact the teaching team prior to the session and include official documentation for your absence. An alternative assignment will be issued to you under such circumstances. |

ASSIGNMENT

Weightage	8%
Deadline	2359h, 4th November 2025 (Tuesday)
Late Submission	2359h, 5th November 2025 (Wednesday) 50% penalty
Missed Late Submission Deadline	No marks

INSTRUCTIONS

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| 1. Please download the relevant files for this assignment and use the answer sheet provided. |
| 2. Before submission, please rename your file according to the following format, NUSNET UserID-Lab03 . Files that are not renamed to the stated format will be subjected to a 10% penalty . |
| 3. Marks will not be awarded based on keywords alone but will depend on the explanations of the responses that are submitted. |

INTENDED LEARNING OUTCOMES

The main aims of this assignment are to identify basic body plans in different arthropod animal groups, with a focus on decapod crustaceans. At the end of this laboratory session, you must be able to

- (1) Recognise the general and characteristic arthropod anatomy.
- (2) Identify the general internal and external anatomy of a shrimp
- (3) Learn the functions of these identified anatomical structures
- (4) Apply new insights to identify homologous anatomical structures in other decapod groups

All the best and have fun!

INTRODUCTION

This assignment focuses on a group of economically important animals: the decapod crustaceans. During the practical session, you will learn to identify the generalised body plan of one of the most successful animal group: the arthropods. There are significant variations in the anatomy of various arthropod groups as exemplified herein with a shrimp species from the Family Penaeidae and a crab species from the Family Portunidae. The function of the anatomical structures will be discussed, after careful examination of both external and internal structures. This practical session allows you the opportunity to understand the anatomy and biology of some of the most common, and sought-after, food items in Singapore.

PART I: PHYLUM ARTHROPODA

Animals from the phylum Arthropoda, commonly called ‘arthropods’ are bilaterally symmetrical invertebrates with an exoskeleton, segmented body, and paired jointed appendages. About 80% of all known animal species are arthropods. More than one million species have been described, while thousands more are thought to be still unknown to science. The exoskeleton of arthropods is made of chitin, mineralized with calcium carbonate, and thus rigid; joints at the appendages allow for greater flexibility and movement. The rigidity however, limits continuous growth. Arthropods grow by replacing the entire exoskeleton in a process known as ‘ecdysis’ or moulting. Arthropod organisms are important as food sources for humans, and are crucial to the ecosystem processes such as pollination. The general body plan of the arthropod suggests tagmatization i.e. the specialization of body regions, in its evolutionary history. Each tagma, in this instance—the head, thorax, and abdomen—typically bears jointed appendages (see figure 1).

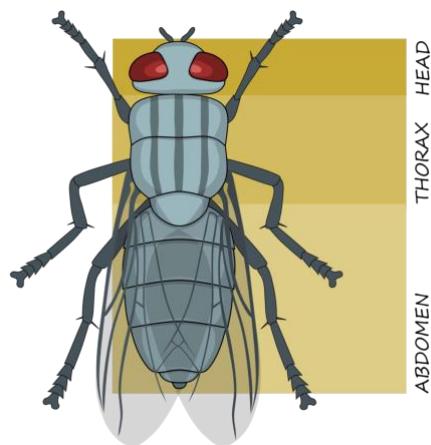


Figure 1: Generalized arthropod body plan, with head, thorax, and abdomen. Image courtesy of WikiCommons.

PART II: CLASS MALACOSTRACA ORDER DECAPODA

The order Decapoda (deca=ten, poda=foot), commonly called ‘decapod’, is a group of crustaceans that includes shrimps, crabs, lobsters, and crayfishes. There are approximately 15000 extant species of decapods, some of them economically important. In decapods, the general body plan differs from that of the typical arthropod in that the head and thorax are fused to form the **cephalothorax** (see figure 2).

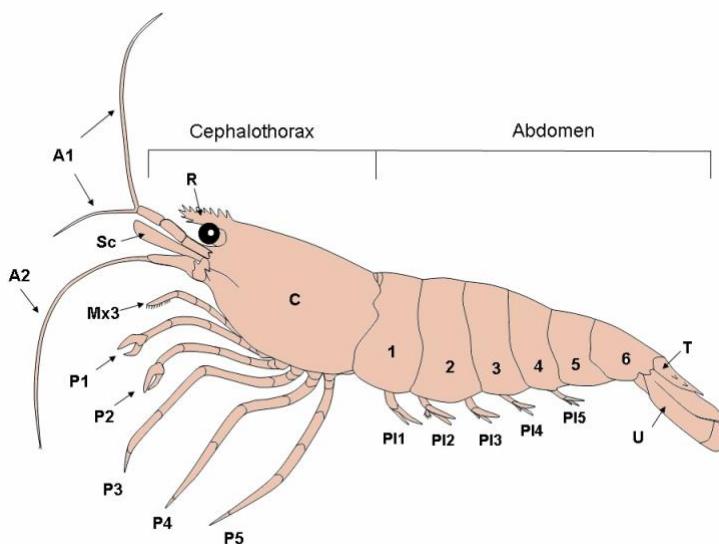


Figure 2: Generalized body plan of a shrimp with cephalothorax, and abdomen. Legend: R = rostrum, C = carapace, 1-6 = abdominal segments, A1–A2 = antennae, Mx3 = maxilliped, P1–P2 = cheliped, P3–P5 = walking legs, PI1–PI5 = 1.-5. swimmerets, U = uropod, T = telson. Image courtesy of WikiCommons.

TASKS

1. Examine the specimen of a shrimp (*Litopenaeus vannamei*) and identify the external anatomical structures with the aid of figure 2. Use the stereomicroscope to examine the stalked eye, feeding structures near the mouth, the ventral region of the body, and identify the anal opening.
2. Take a photograph of the head of the shrimp. Label these structures on the photograph “cephalothorax”, “rostrum”, “stalked eyes” and “antennae”.
3. With the help of your TA, identify if the shrimp you are examining has a petasma (therefore male) or thelycum (therefore female). Take a photograph and label the petasma or thelycum.
4. Carefully remove the carapace from one side of the cephalothorax to expose the respiratory organs. Take a photograph and label the “gills”. Count the number of gills the shrimp possesses.
5. Remove the carapace completely. With the plastic knife provided, make an incision along the ventral and dorsal margins of the shrimp. Identify the dark line that runs along the ventral margin of the shrimp. What is this line? Identify the dark line that runs along the dorsal margin of the shrimp. Where is the line from and where does it lead to?
6. Working with your bench mates, examine a specimen of the crab (*Portunus pelagicus*). **Take photographs of the dorsal and ventral view of the specimen.** Pay close attention to all appendages and mouth parts.
7. Based on what you have learnt on the generalised decapod body plan, identify the external anatomical structures and label these (“cephalothorax”, “rostrum”, “stalked eyes” and “antennae”) on the photograph of the crab.
8. Identify if your crab is male or female. Take a photograph of the reproductive organs.
9. Crabs moult in order to grow. Together with your bench mates, discuss how this is achieved, and identify body areas important in this process.
10. Carefully remove the carapace completely. Take a photograph and label “gills”.
11. With the forceps, remove all mouthparts of the crab and examine them under the microscope.
12. Once you have successfully completed all tasks, please dispose of the shrimp and crab as instructed. Please also wash and dry the plastic knives, forceps, trays, and petri dishes, and return them to the table thereafter.



Please exercise care when handling the crustacean organisms, as they possess sharp spines

QUESTIONS [20 MARKS]

1. Take a photograph of the head of the shrimp. Label these structures on the photograph "cephalothorax", "rostrum", "stalked eyes" and "antennae" [2 marks]
2. Is the shrimp you dissected male or female? Include a photograph and label the associated structure. [2 marks]
3. Take a photograph of the head of the shrimp after the removal of the carapace. Label the "gills" in the photograph. [1 mark]
4. Identify the dark line running along the ventral portion of the body of the shrimp. [1 mark]
5. Identify the dark line running along the dorsal portion of the body of the shrimp, the origin and the terminus of this line. [2 marks]
6. Take a photograph of the crab. Label these structures on the photograph "cephalothorax", "stalked eyes" and "antennae" [2 marks]
7. Is the crab you dissected male or female? Include a photograph and label the associated structure. [2 marks]
8. Take a photograph of the crab after the removal of the carapace. Label the "gills" in the photograph. [1 mark]
9. How is the general body plan of the crab different from the shrimp? Compare the walking appendages (legs) of the crab and the shrimp. Provide one similarity and one difference between these appendages in the two organisms. [3 marks]
10. Using earlier photographs of the crab and shrimp, indicate any spines on their anatomy. In your opinion, what is/are the function(s) of these spines? [4 marks]