Animal Diversity

Introduction

The animal kingdom is divided into about 35 phyla. You are probably most familiar with vertebrate animals such as mammals, birds and fish. However, you should be aware that vertebrates constitute a single subphylum within a single phylum, the Chordata. All other animals, about 95% of the species known, belong to the other phyla and are collectively known as the invertebrates. You are surrounded by invertebrates of one sort or another every day and one group, the insects, are the most abundant multicellular organisms on the planet.

The objective of this practical class is to introduce you to some representatives of the major phyla of animals. By comparing and contrasting the morphological features of the major animal groups, you will become familiar with the characteristics defining each phylum. You will also learn the use of dichotomous keys in identifying organisms.

Note that in this practical you will be comparing features that can be determined by external examination. Differences in internal anatomy, development and gene/protein sequences are also important in distinguishing between different animal phyla. You will learn about these in the lectures.

You will find it useful to bring your textbook to this practical. The major animal phyla are discussed in chapters 32- 34.

Pre-practical quiz on Moodle

A quiz will be posted on the SLE132 page of Moodle, in the Resources and Assessments section, ONE WEEK before the first practical, and will close the day before the practical class. This quiz will test your knowledge of practical 1 and ensure you have prepared yourself for the class. You will have two opportunities to complete this quiz so please ensure you have thoroughly read the practical notes before you attempt the quiz. Your result from this quiz will contribute 1% of your overall SLE132 mark.

Pre-practical task - A comparison of the major animal phyla
Pre-lab task on page 12 must be completed before class

Complete the Animal Diversity Table on last page of prac 1 worksheet. Fill in the table as best you can by using the information given in lecture/class 1 and your textbook. The table will be used in prac and will be marked as you enter the class. You will find that phyla are distinguished by characteristic combinations of features, rather than any single feature. Assess each phylum for the following features. Remember that the glossary at the end of your textbook is also a good place to check definitions.

Symmetry   Radial, bilateral or asymmetrical.
Cephalisation   Is there a distinct head: always, sometimes, never?
Skeleton   External, internal, hydrostatic, or otherwise (sponge?).
Segmentation   Is the body divided into distinct segments? Segments may be numerous and visible along almost the entire length of the animal, or restricted to a region/s of the body.
Appendages   Present or absent? Jointed or not?
Mouth and anus   Present or absent? You may need the help of the textbook here. Mouths and anuses aren't always where you would expect them to be.

In-class activities: classification and dichotomous keys

We classify things to simplify them and to create order. A classification scheme helps us make sense of the vast diversity of organisms around us. It also enables us to predict the likely features of an unfamiliar species given its taxonomy. Taxonomy is the science of classification. The system is hierarchical and is, ideally, based on phylogeny (the history of the evolution of a group of organisms).

A common approach to identifying organisms involves the use of **dichotomous keys**. These keys contain two contrasting statements or **leads,** which are grouped together to form a **couplet**. All of the characters described in one lead of a couplet should be described in the other lead and in the same order. Verbs are often omitted. The questions are normally descriptive and discriminatory, where the answer is typically yes or no. Some questions may include the number of an individual feature.

For example:

1a   Walking legs present on abdomen   go to 2
1b   Walking legs absent on abdomen   go to 3

2a   Antennae, two pairs; body colour red   Class Crustacea
2b   Antennae, one pair; body colour other than red   go to 4
Some terms commonly used in keys are:

Unicellular	Organism of one cell only.
Multicellular	Organism made up of many cells.
Radial symmetry	Lacking a left and right side. Divisible into mirror images by any plane through the central or long axis.
Bilateral symmetry	Only one central, longitudinal plane can divide the body into mirror image halves.
Dorsiventrally flattened	Flattened by compression along the dorsal (back) and ventral (front) surfaces (e.g. flatworms).
Appendage	An attached part.
Locomotory appendage	Appendages used to move the organism from one place to another (eg. walking, crawling, swimming)
Paired appendage	Appendages arranged in pairs on body segments.
Parapodia	A pair of fleshy, paddle-like appendages on each segment of marine worms.
Tentacles	Fleshy appendages that surround the mouth (e.g. as in sea anemones). Not, for example, the 'arms' of a sea star.
Segmentation	Body divided into repeated segments.
Exoskeleton	External skeleton, outside the rest of the body.

The above terms are frequently used in biology and, if you are not familiar with their meaning, do some extra pre-reading of the textbook as part of your pre-lab preparation; your demonstrator can also discuss them with you.

Work in pairs and complete the following two keys.

Constructing a key

Q1. Construct a dichotomous key to separate specimens of the phylum Echinodermata into their appropriate classes. Use appropriate terminology from the list above.

Examples of four classes of echinoderms – brittle stars (Ophiuroidea), sea stars (Asteroidea), sea urchins (Echinoidea) and sea cucumbers (Holothuroidea) - are available in the Virtual Practical 1 file.

If there are examples of the fifth and perhaps most ancient class, the feather stars and sea lilies (Crinoidea) available, make observations but do not include them in your key.

Q2. Construct a dichotomous key to separate specimens of the phylum Mollusca into their appropriate classes. Use appropriate terminology from the list above.

Examples of four classes of molluscs - chitons (Polyplacophora), bivalves (Bivalvia), gastropods (Gastropoda) and cephalopods (Cephalopoda) - are available in the Virtual Practical 1 file. In this key, it is possible that you may end up at one of the classes more than once (e.g. once for shelled gastropods and later for unshelled gastropods).

Your keys should enable your demonstrator to key out any given echinoderm or mollusc in the laboratory into its correct class. When identifying the physical features of the samples, try to be specific to the class to which they belong and not the individual samples you are observing. It is recommended not to mention colour or size of samples, as this may have changed from life in the dead, preserved specimens.

There will be a group discussion about these keys before starting the rest of the practical. You will need to use these keys in the next section of the practical.

Using a key

Q3.   Use keys 1, 2 (below), together with the keys you constructed for Q's 1, 2, to determine the phylum and class (if appropriate) of the four unknown specimens in the virtual practical information. For each specimen, list the path you followed through the keys to arrive at your final classification.

And: Draw any three specimens of the four specimens. Label distinguishing features (make sure you can identify five distinguishing features before you start drawing). See Appendix 2 for instructions on drawing.

Key no. 1: A key to some of the major animal phyla

1a	Entire body wall perforated with small holes. Not enclosed in a thick leathery coat.	Phylum **Porifera**
1b	Body otherwise	Go to 2
2a	Body trunk-like and enclosed in a thick leathery coat. Often two openings at anterior end. Animals single or in colonies.	Phylum **Chordata**
2b	Body otherwise	Go to 3
3a	Body symmetry radial	Go to 4
3b	Body symmetry bilateral	Go to 5
4a	Tentacles present; body soft	Phylum **Cnidaria**
4b	Tentacles absent; body hard and rough	Phylum **Echinodermata** (now use your key)
5a	Paired locomotory appendages (flippers, fins, legs, wings) present	Go to 6
5b	Paired locomotory appendages absent	Go to 8
6a	Locomotory appendages in 2 pairs	Phylum **Chordata**
6b	Locomotory appendages in 3 or more pairs	Go to 7
7a	Body with jointed locomotory appendages	Phylum **Arthropoda** (now go to 12)
7b	Body without jointed locomotory appendages	Phylum **Annelida**
8a	Body soft and dorsoventrally flattened	Phylum **Platyhelminthes**
8b	Body otherwise	Go to 9
9a	Body externally segmented	Phylum **Annelida**
9b	Body not externally segmented	Go to 10
10a	Body with external shell and/or muscular foot and/or tentacles	Phylum **Mollusca** (now use your key)
10b	Body otherwise	Go to 11
11a	Body cylindrical and slender (worm-like, but lacking a well-developed head); if free-living, usually less than 1 mm long.	Phylum **Nematoda**
11b	Body 'eel' or 'snake' like (i.e. with well-developed head), larger than 1 mm long.	Phylum **Chordata**

If you end up with a representative of the phyla **Annelida**, **Cnidaria**, **Porifera**, **Platyhelminthes**, **Nematoda** or **Chordata,** there is no need to go any further.

Key no. 2: A key to the classes of arthropods

12a	3 or 4 pairs of locomotory appendages	Go to 13
12b	More than 4 pairs of locomotory appendages	Go to 14
13a	3 pairs of walking legs	Class **Insecta**
13b	4 pairs of walking legs	Class **Arachnida**
14a	Walking legs on more than one body segment	Go to 15
14b	Walking legs on one body segment	Class **Crustacea**
15a	1 pair of walking legs per body segment	Class **Chilopoda**
15b	2 pairs of walking legs per body segment	Class **Diplopoda**

Q4:   List three features of all insects that distinguish them from arachnids and myriapods. (2 marks)

Biological Drawings

See **Appendix 2** for details on how to correctly present biological drawings.

Assessment (8%)

Pre-prac quiz on Moodle: Resources and Assessments section: 1% of final assessment.

Submission of the following for 7% of the assessment (35 marks) is due 1 week after the practical session to the Practical 1 submission dropbox on moodle in the *Assessment, test and quizzes* section.
1. Pre-lab: A completed table of distinguishing features for each phylum (5 marks).
2. Completed dichotomous keys to the echinoderms (3 marks) and molluscs (3 marks).
3. A list of the path followed through the keys to arrive at your final classifications for the four specimens provided (3 marks).
4. Answers to the written-answer question 4 (3 marks).
5. Clearly labelled drawings of three specimens with full legends (6 marks each).