

Dissection and Scientific Drawing

Teaching and Technical Notes

Introduction

The ability to accurately observe, dissect and record an organism is a key skill for biology students. Many students are intimidated by the idea of making a scientific drawing, and struggle to develop their skills in this area.

This resource is designed to meet the specifications for the A-level practical endorsement in England (CPAC). However, it will make a valuable guide to dissection and scientific drawing of a flower for those following a variety of different specifications.

These teaching notes, the student sheets and the accompanying Powerpoint include full guidance on how to carry out a dissection and a scientific drawing.

We recommend *Alstroemeria*, a flower regularly available in supermarkets, for dissection, and these teaching notes focus on this plant. However, our additional extension resources give information and example drawings of a range of other readily available flowers. These resources can be found on the SAPS website, www.saps.org.uk.

Learning outcomes

The students will:

- Observe the structure of a flower
- Observe, dissect and record the floral parts of that flower
- Prepare a longitudinal section of a flower
- Produce an annotated scientific drawing of the longitudinal section of the flower
- Understand how the structure of the flower is adapted to its function.

Health and Safety

CLEAPSS Student Safety Sheet 74 provides information about assessing the risk posed by plant material

Many plants contain toxins. Good general advice is:

- Check before organising the practical whether any pupil is aware of allergies to a particular plant so that it can be avoided.
- Avoid using plants with latex. Latex can cause skin irritation and can be very dangerous if it gets onto the lips or into the eyes.
- The pollen of some lilies stains clothing and may produce hayfever symptoms in susceptible students.

Pupils will be using sharp and pointed tools for dissection. Make sure they know how to use these safely.

When drawing, it is important to take regular breaks to avoid eye strain and damage to the wrist and back. A short rest from drawing every half hour is a good idea.

Teaching Notes

The students will use two *Alstroemeria* flowers to carry out this activity in 5 steps:

Flower A

1. Observation
2. Examining the floral parts

Flower B

3. Cutting a longitudinal section
4. Scientific drawing
5. Labelling

The investigation could be completed in a single lesson.

You may wish to cover steps 1 and 2 as a demonstration or with students working in groups. Steps 3, 4 and 5 should be carried out by students working individually.

Before students start their own dissection, advise them to take care with sharp and pointed instruments. Also advise them to work slowly and carefully - most flowers are quite fragile.

Students should have drawing tools and materials ready in advance, as the cut flower will not survive for long.

How to use this resource

The accompanying **PowerPoint** presentation 'Dissection and scientific drawing' contains slides that can be used together with the **Student's Support Sheet** and the **Student's Sheet**.

Guidance on how to dissect the *Alstroemeria* flower is given in the **Student's Sheet** and the **PowerPoint**. The **Student Support Sheet** asks the students to find the errors in the drawing containing common mistakes.

An example of a well-drawn flower diagram, an illustration of some common drawing mistakes and an example of a labelled drawing of an *Alstroemeria* flower are given in the **PowerPoint**.

The **Student Support Sheet** also asks the students to consider how the *Alstroemeria* flower is adapted for pollination. This section of the resource can be completed after the flower dissection and drawing and will allow the students to spend time reflecting on the function of the different parts of the flower, and on how they assist pollination.

Students will tend to see pollination from an animal-focused point of view, e.g. a bee searching out sources of nectar. They may benefit from a brief discussion of pollination and the evolution of flower morphology from a plant standpoint, focusing on how a sessile organism is able to manipulate animals to achieve its goals.

Examples of labelled scientific drawings of other flowers are given in the extension file 'Examples of scientific drawings of flowers'.

The Powerpoint 'Understanding the parts of a flower in detail', in the Extension Activities collection on the SAPS website, gives a detailed look at flower parts and their role in pollination. You may wish to use this to refresh your own understanding of the topic, or to address any specific student queries.

The value of scientific drawing

Drawing and modern photographic techniques both have an important role to play in biological illustration and are often used together in recording observations.

Drawing may be slower than taking a photograph. The advantage however is that it requires constant reference back to the specimen, looking carefully at detail and working out of how structures fit together. This has the value of leading to a greater understanding of the overall structure of the specimen and how it works. If students can draw a flower, they will understand it!

Before starting pupils should get as much information about the flower they are studying as possible. Knowledge of its geographical distribution habitat, how it's pollinated, and what structure might be expected can all be very helpful in understanding what they see in the dissection. This information is given for *Alstoemeria*, our recommended flower for dissection, in the fact file below. Fact files for other flowers are given in the Extension Activities collection.

Students should always draw what they see. Anything unexpected should be described in the labels.

Getting learning value from the practical

Practical skill development	Developing the student's ability to accurately observe, dissect and record biological specimens.
Maths skill development	Calculation of scale of the drawing
Associated subject knowledge development	Understanding of floral structure Appreciation of adaptation of floral structure to floral function
Recording evidence of student's work	Completion of student support sheet, including biological drawing of longitudinal section of flower and dissection and arrangement of floral parts.
Meeting aspects of the use of apparatus and techniques	https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/447147/2015-07-20-gce-subject-level-conditions-and-requirements-for-science-and-certificate-requirements.pdf <ul style="list-style-type: none"> produce scientific drawing from observation with annotations safely use instruments for dissection of an animal organ, or plant organ
Meeting aspects of the CPAC	https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/447147/2015-07-20-gce-subject-level-conditions-and-requirements-for-science-and-certificate-requirements.pdf Use and apply scientific methods and practices <ul style="list-style-type: none"> safely and correctly use a range of practical equipment and materials follow written instructions make and record observations

Technical notes

Equipment

Per student

For observing and dissecting flowers

- At least 2 flowers per student. The flowers should have stems at least 1cm long. We suggest *Alstroemeria*.
- Containers (jam jar) for students to put their specimen in
- Tile or cutting mat
- Single-edged (safety) razor blade
- Dissecting needle or seeker for separating parts
- Fine (pointed) forceps
- Small pointed sharp dissecting scissors
- Hand lens x10

Single-edged blades are available from school suppliers, e.g.

- Griffin Education, Park 100 for £46, code 11904325
- Timstar £8.50 for 100, code DI 140150

For drawing

- A4 white paper
- HB pencil. A soft pencil (e.g. 2B) will smudge too easily
- Access to a pencil sharpener.
- A clean good quality eraser.
- A ruler for measuring and label lines

Per class

- Also very useful if available: a dissecting microscope magnification x10-20

Selecting flowers for dissection

Decide which flowers will be studied well in advance and make sure they are in good condition.

Each pupil will need at least 2 flowers.

We recommend *Alstroemeria* as a flower that provides opportunity for interesting scientific observation, and is readily and cheaply available throughout the year.

A list of suitable flowers showing the season available and the most likely sources; garden, plant nursery, florist or supermarket is given in the list below. Fact files on these and other popular flowers for dissection are included in the Extension Activities collection.

When to collect material

It is often best to buy/collect flowers in bud or half open well before the practical session to ensure that you have fresh flowers when you need them. If it is left until the day of the practical, florists and supermarkets may have run out of stock, or weather conditions e.g.

heavy rain may destroy flowers you were planning to collect from the garden! 24-48 hours at room temperature is usually sufficient for flowers in bud to open.

NB *Alstroemerias* are often sold in tight bud and these may take 4-5 days to open.

Care of plant material

If possible put the stems of your specimens straight into water. Use a sharp knife to cut off about 2 cm of stem below the surface of the water. This removes the lower part of the stem in which airlocks may have formed and makes sure that water can reach the upper parts of the specimen. Cut flowers also last better if the water is slightly acidic and contains a little sugar. The flowers may come with a sachet of powder to add. Alternatively adding a teaspoonful of lemonade to the water will do the trick. If the specimens are being kept for any length of time the water is best changed every two days.

Suitable plants

Key to Source column:

S supermarkets

F florists - NOTE: Florists may remove some floral plants e.g. stamens or leaves. Check that specimens are complete before buying

N plant nurseries/garden centres

G common garden plants

Season	Common name	Scientific Name	Source
All year-round	Peruvian Lily	<i>Alstroemeria</i> species or cultivars	SF
Spring January-April	Daffodil	<i>Narcissus</i> species and cultivars	SFNG
	Tulip	<i>Tulipa</i> species and cultivars	SFNG
	Primrose	<i>Primula</i> species	NG
Summer May-July	Daffodil	<i>Narcissus</i> species and cultivars	SFNG
	Tulip	<i>Tulipa</i> species and cultivars	SFNG
	Primrose	<i>Primula</i> species	NG
	Geranium	<i>Pelargonium</i> species	N
	Hardy Geraniums	<i>Geranium</i> species	G
	Wallflower	<i>Erysimum cheiri</i>	NG
	Fuchsia	<i>Fuchsia</i> species	NG
Late summer August-Oct	Geranium	<i>Pelargonium</i> species	N
	Hardy Geraniums	<i>Geranium</i> species	NG
	Fuchsia	<i>Fuchsia</i> species	NG
	Snapdragon	<i>Antirrhinum majus</i>	NG

Flowers to avoid

- Plants with copious latex (see Health and safety notes).
- Lilies: The pollen of these flowers may stain clothing and may produce hayfever symptoms in susceptible students(see Health and Safety notes).
- Exotic species such as orchids which are difficult to interpret.
- Double flowers: These are difficult both to interpret and draw.
- Fragile flowers: Flowers like the poppy which fall apart too readily.
- Flowerheads made up of large numbers of tiny flowers, the whole head resembling a single flower. This includes members of the daisy family such as dahlias, sunflowers and chrysanthemums commonly found in supermarkets and florists.

Further reading

Bebbington and Bebbington (1997) **Describing Flowers**. Field Studies Council Occasional Publication 42

Bebbington, ALD (2014) **Understanding the Flowering Plants**. The Crowood Press. ISBN 9781847977588 (paperback). Also available as an e-book, ISBN 9781847977595.

Royal Horticultural Society Eds. Ingram, Vince-Prue and Gregory (2016) **Science and the Garden, 3rd edition**. Wiley Blackwell. ISBN 9781118778432 (paperback)

A really useful source of information about pollination adaptations (although using American examples) is at <http://dept.ca.uky.edu/PLS220/Flowerpollinationadaptations>

Acknowledgements

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Fact file - *Alstroemeria* (*Alstroemeria* cultivars)

We recommend *Alstroemeria* for dissection: fact files on other popular flowers for dissection are included in the Extension Activities collection.



Alstroemerias in a vase

Name

Named after Baron Alstroemer, a good friend of Carl Linnaeus. Its official English common name is the Peruvian Lily but it is often referred to as just Alstroemeria

Classification

Family Alstroemeriaceae - the Peruvian Lily Family - closely allied to the family Liliaceae to which it was once thought to belong.

Wild species

Large number with two main centres of geographical distribution

- Chile.- winter-growing
- Brazil – summer-growing

Cultivars

Very popular in the floral trade.

The genetics of the cultivars is complex and it is difficult to determine the original parents but crossing species from the two geographical areas has helped to produce plants which grow and produce flowers all year round.

Flower morphology and pollination

In its native habitat *Alstroemeria* is predominantly pollinated by bumblebees although it is also visited by hummingbirds. Research on *Alstroemeria* species indicates that they are mainly pollinated by a native bumblebee (*Bombus dahlbomii*). An introduced European bumblebee, (*Bombus ruderatus*), appears to be displacing this species, but

although the native bee is larger and carries more pollen on its body the European bee visits the flowers more frequently and seems to be a better pollinator.

Flower structure and function Pollinators are attracted to the flowers by both the sepals and petals which are large and brightly coloured. A landing platform is provided by the lower petal. Strong nectar guides on the two upper petals guide insects over the stamens and stigma to the nectar produced and stored at their base

Promotion of cross-pollination The stamens develop before the stigma and normally development is synchronous so all the flowers in a head will be at the same stage which helps to limit self-pollination. Research has also shown that more nectar is produced at the male stage so flowers at this stage will be preferentially visited. This will help to ensure that flowers at the female stage will be visited by bees already covered in pollen from flowers on other heads visited at the male stage. Interestingly small drops of liquid appear on the stigmatic lobes late in the female stage of flowering. The purpose of this is not known.



Stigmatic lobe with small drop of liquid late in the female stage of flowering.