ADVANCED BOTANICAL ILLUSTRATION
PART 2

Introducing Dissection Drawing and Scaling

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Why Botanical Illustrators Include Dissections

Dissections of flowers provide information about the internal sexual reproductive system of a plant. This is possibly the most important aspect of any flowering plant given that life is all about reproduction and survival, thus, dissection drawings should never be overlooked or considered as an afterthought. Even if you don't intend to include a dissection, as a botanical illustrator it is your job to understand the plant parts and how they fit together. Flowers are also the focal point, they attract pollinators in many ways with colour, pattern and scent and most reward pollinators with food in a mutualistic relationship. To us they are also usually the most attractive part of a plant and many artists seek to portray them, it's important we understand and are able to interpret flowers inside and out.

There are many different types of floral arrangement within flowers but don't feel that you need to learn everything at once. Instead work on one plant at a time and gather knowledge slowly, otherwise you will become overwhelmed.

Throughout the course you will develop your skills working on the floral anatomy of flowers to improve your knowledge. This module is your introduction, where you will learn the following:

- How to dissect flowers
- Measuring and drawing dissections to size
- Scale drawings of dissections and flower parts

Dissection Tool Kit

The process of dissecting a flower is the starting point. You will need a few tools to carry out a dissection. Small kits are available, with tweezers/ forceps, teasing needles, a scalpel and pins etc. Such a kit isn't essential but can be useful for keeping everything together. If you don't have such a kit, a **sharp blade,** such as a razor or scalpel, **small scissors** and **tweezers** will suffice for most flowers. Here is a typical dissecting kit.

Basic Botany Dissection Kits

US supplier
https://herbariumsupply.com/product/botany-dissecting-kit-739/

UK supplier
https://www.nhbs.com/dissection-kit

You will also need a **small cutting mat** and some **white foam core** for mounting the flower with **a pin.**

Use a **magnifying lens x2 – x2.5 for basic observation** or to see small parts a small **field magnifier** up to x15 which is excellent for observing very small details at close range, you hold the lens next to your eye and bring the subject towards you to view until it comes into focus.

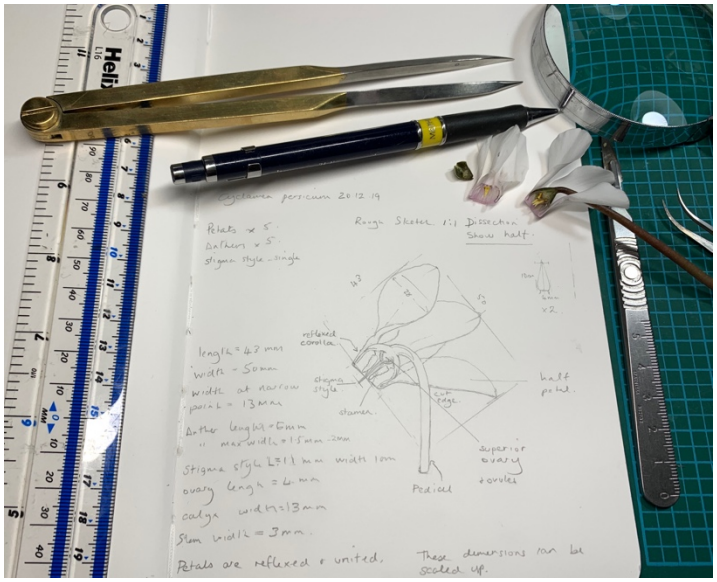
A dissecting microscope is very useful and many connect to a PC for enlarging images, however they are costly and not essential unless you intend to draw lots of tiny flowers and parts. I find that I can manage most dissections with a magnifying lens and camera and often it's easier than getting the microscope out. I will post more information on the website about microscopes and equipment, for those interested.

A **camera** is useful but you can actually get a decent image from **a good mobile phone**, such as an iphone. Only invest in additional equipment if you decide that it's needed for your work.

Equipment for Measuring and Drawing

Dividers and a **perspex ruler in mm** (or half mm if you can find one), are used to measure, you can scale up or down using this basic kit with some simple arithmetic but you can also invest in **proportional dividers**, we will discuss these later as they are not essential.

Paper for dissection drawing should be smooth. I **make initial sketches in a sketchbook**, such as Stillman & Birn Zeta or Epsilon. The Zeta is heavier in weight and is good for wet media but for drawings in pencil and ink the Epsilon is perfect. Any sketchbook with smooth paper is good, I make notes describing the flower and measurements in the sketchbook, as shown above.



After dissection, initial sketches and measurements are made with dividers and ruler using 0.3mm mechanical pencil in a sketchbook.

Paper and Board for Illustrations with line Strathmore Bristol paper is good but I like a board such as Strathmore 500 Illustration Board or Paper, Plate surface is the smoothest. Also Schoellershammer 4G paper and the board is super smooth for pencil and ink. You can also work on some smoother watercolour papers such as Stonehenge Aqua but it's not as smooth as the board, however if we are making an illustration which is a combined watercolour and line or graphite a compromise is needed at times. Experiment with which paper suits your needs best before investing in a larger amount.

Pencils I use a set of Faber castell 9000 4H to 6B for tonal drawing but also a **0.3 mm mechanical pencil** with H and 2H lead, for fine drawing, I prefer a pencil with a good rubber grip and any leads of the same size can be used, so above you can see a Koh-I-Noor pencil, Rotring also produce a pencil with a rubber grip, what you prefer is personal in terms of grip though. The tip must be sharp at all times, I **use fine glass paper or an emery board to 'tweak' the tip.**

Ink Pens if you want to work in ink there are a few options, you can invest in a set of Rotring pens, I use Isograph ,13 and .10 but they can be temperamental if not used regularly, with blocked nibs being a problem, however, do give the finest lines. Other options are Pigma Micron and Uni Pin as shown, both have excellent ink and flow well for drawing.

Eraser A Tombow eraser is excellent for getting into small areas and a soft putty erases smudges, it can be gently rolled over the paper to lift marks.

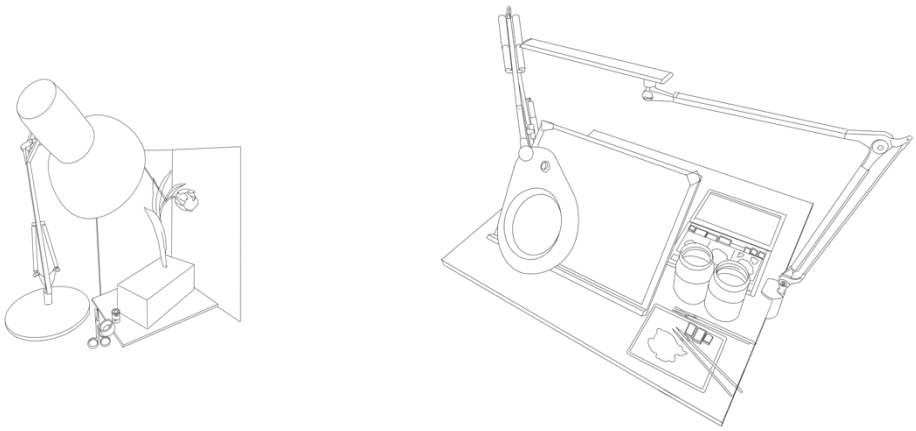
Choice of pens available. Also shown here a field magnifier x15 and a Tombow Mono eraser

Tracing paper – any decent heavyweight paper, such as Goldline, 90 gsm in weight and size A4 is large enough

A small light pad, such as the one made by Huion is very useful, if you want to transfer initial line drawings on to paper https://huion.uk/collections/tracing-boards/products/huion-l4s-led-light-pad There are many others on Amazon. Obviously you can't transfer on to card or board as it's too thick for light to pass through.

Lighting always use good lighting so that you can see your subject properly. Any angle poise lamp with a screw in E27 fitting will do the job and choose one with a swivel head so that you can move it in all directions or an overhead light. The bulb is important, choose a light 5,500K and if possible over 90 CRI (colour render index). These bulbs are generally found in photography supplies rather than art. 40 watt or equivalent is sufficient.

Drawing Board The dissection is carried out on a flat surface but I generally work with an elevated drawing board. I have a light on the subject and a light over the drawing board with a magnifyer. This makes drawing much more comfortable and reduces strain on the neck.



Lighting a subject and the workspace with lamp, magnifier and drawing board

The Dissection

Dissecting a flower involves cutting it to reveal its inner parts, so first and foremost care should be taken, use a mat and always cut away from you, you will be using a very sharp blade, so please be careful.

Choose a flower

I suggest selecting flowers that are not too small or large, neither should they be overly complicated, such as double flowers with many petals or composite floral discs. Choosing simple flowers will help you to make a clean cut and to identify the parts. Examples include: orchids, some simple roses, cyclamen, crocus, daffodil, fritillaria and primrose are all good options and there are many flowers to choose from. It's also helpful if the flower doesn't wilt too quickly, waxy flowers make excellent subjects.
The idea is to familiarise yourself with the process initially and you will need to experiment with different flowers to understand the arrangement and parts. You will need a few of each type of flowers as the cut can sometimes go wrong, even with experience.

Basic Flower Anatomy

It's worth knowing a little basic knowledge about flower anatomy and you can add to this over time.

The Perfect Flower

For a flower to be 'perfect' it must include all of the following,

Sexual parts

1. **Male parts** in the form of **stamens** i.e. the anthers with the sex cells (pollen) and filaments which support the anthers.
2. **Female parts** are collectively referred to as the **pistil**. The carpel is the basic unit of female reproduction and comprises the stigma (the surface receptive to pollen), the style on which the stigma sits and the ovary, which contains the ovules. The pistil may contain one or more carpels.
   The flower **must therefore be able to receives male gametes**, when pollen is deposited on the stigma it forms a pollen tube which grows down the style to the ovary where it fertilises the ovules and seeds are formed.

The Complete Flower: Also includes the non-sexual parts, collectively referred to as the perianth

1. Petals are usually colourful structures (modified leaves) that surround the reproductive parts
2. Sepals surround the petals and protect the developing flower

The perfect flower facilitates cross-pollination between plants via insects, animals or wind but many perfect flowers can also self-pollinate because they have both male and female parts. Self-pollination is usually a last resort for a flower and only occurs if cross-pollination fails. Examples of perfect flowers are found in the following families, Rosaceae, Solanceae and Leguminaceae etc.

The Imperfect Flower: Pistillate or Staminate

Imperfect flowers have one of these sexual elements missing, so this can be confusing if you open a flower and find it's different. If **a flower has no male parts it is referred to as pistillate** and **a flower without female parts is staminate.**

Monoescious plants have **separate male and female flowers on the same plant.**
Dioecious plants have either **staminate or pistillate flowers on separate plants.**

The Incomplete Flower

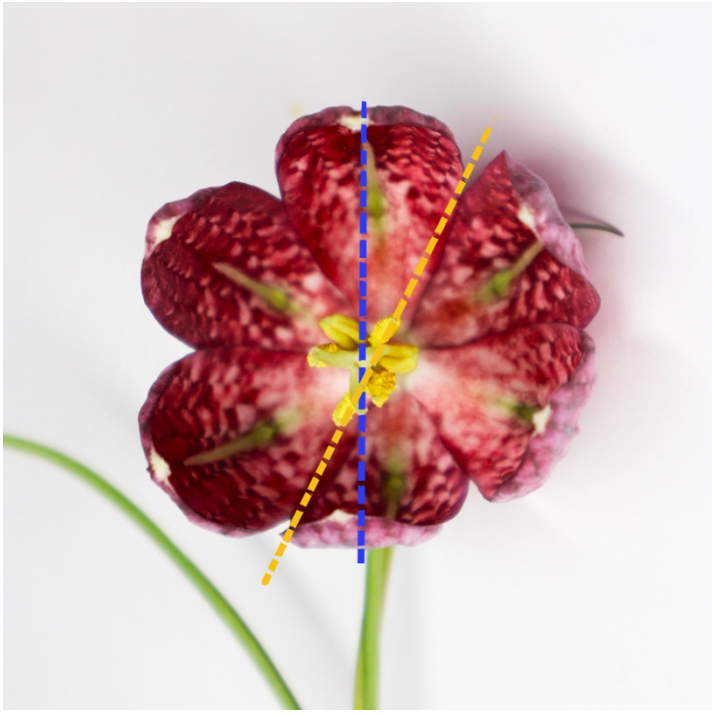
May have any one of the parts missing, thus, imperfect flowers are always incomplete but incomplete flowers are not necessarily imperfect.

What do we want to show?

The primary aim of a dissection drawing is clarity of parts for the viewer.

The way that we cut the flower depends on the arrangement of the flower parts but we aim to **show half of everything,** this can be tricky **depending on the position of the petals and the arrangement of the stamens and pistil because we also need to show the interior of the ovary with ovules**. We have to work out the best angle to cut the flower, which requires some detective work.

For example, in a 5 petalled flower with 5 anthers, we want to show half, which means cutting the flower to show 2.5 petals and the same with anthers, plus the stigma. The situation in a flower with 6 petals or tepals, such as the *Fritillaria meleagris*, shown here, could be cut to show 2 half petals and 2 whole petals (blue line) *or* 3 whole petals (yellow line). While both show half the flower, the dissection cut will depend on the position of chambers in the ovary, bearing in mind that we need to show the ovules too. Note that some negotiation around parts will be needed to avoid cutting through parts that need to remain intact.

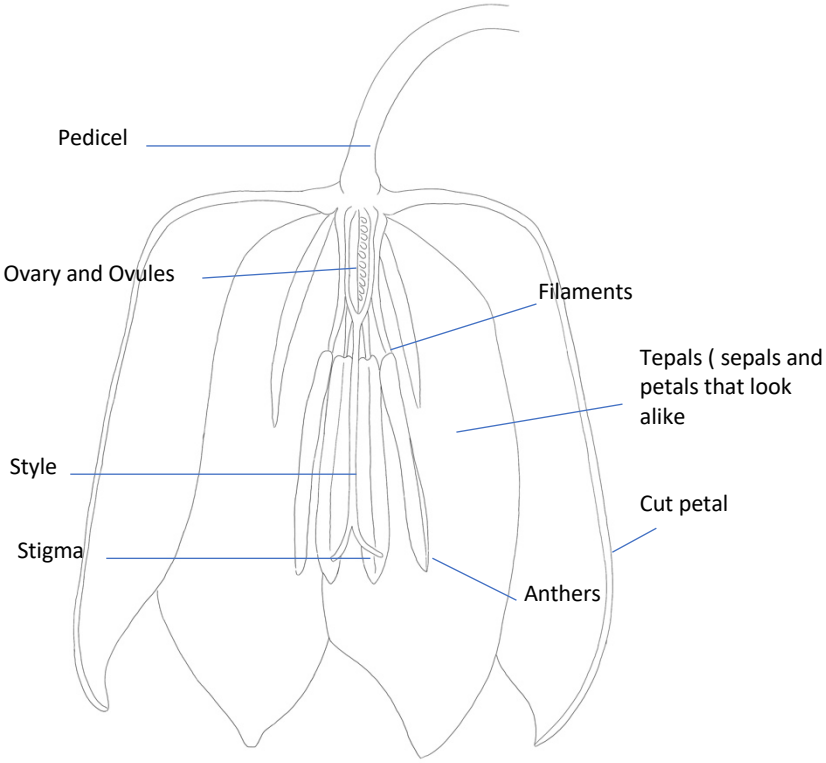


Initial observation and investigation is required to decide on the best place to cut the flower and there is usually some trial and error. In the Fritillaria the blue line was the preferred cut.

There are many different types of flower so the decision is made on a flower by flower basis.

If presented with too many obstacles in a dissection there is the option of breaking the flower down further into separate parts. We can also do this in addition to the main dissection to enlarge smaller parts.

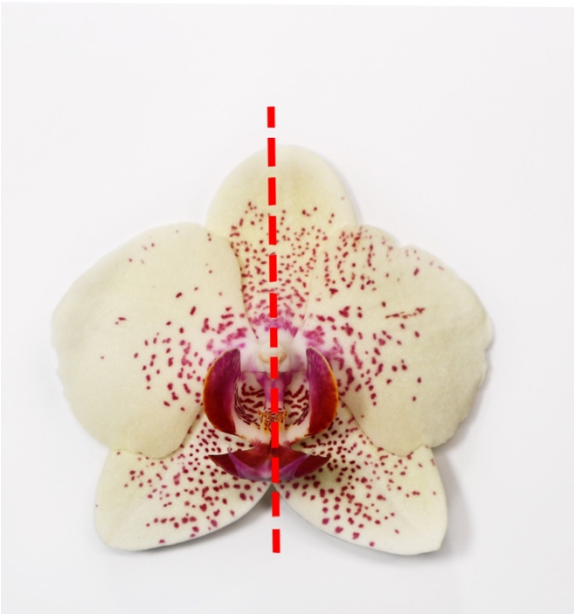
We need to pay special attention to the anthers which change with the flowers phases, usually there is a male or female phase, as anthers open to release their pollen, which means that either the male (anthers and pollen within) or female stigma is receptive first. The anthers open in

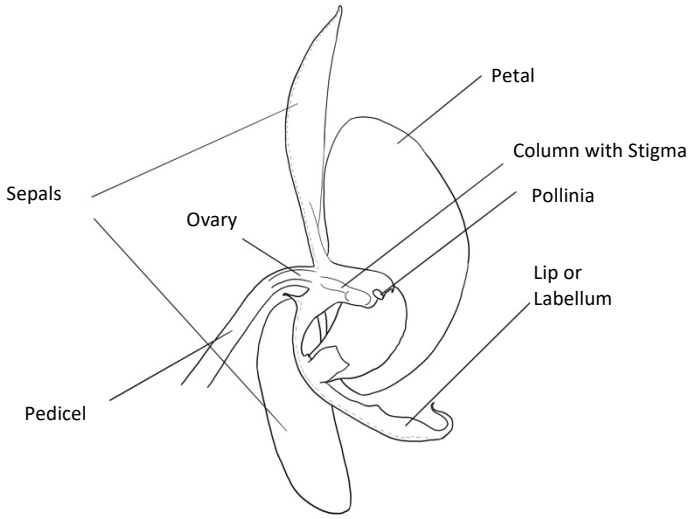


The cut was made on the blue line, this shows the interior of the ovary with ovules, 2 whole tepals and 2 half tepals – the double line indicates the cut edge of petal – the inner line can be dotted if necessary to show that it's been cut. There are also 2 full anthers and 2 half anthers and half of the trifid stigma.

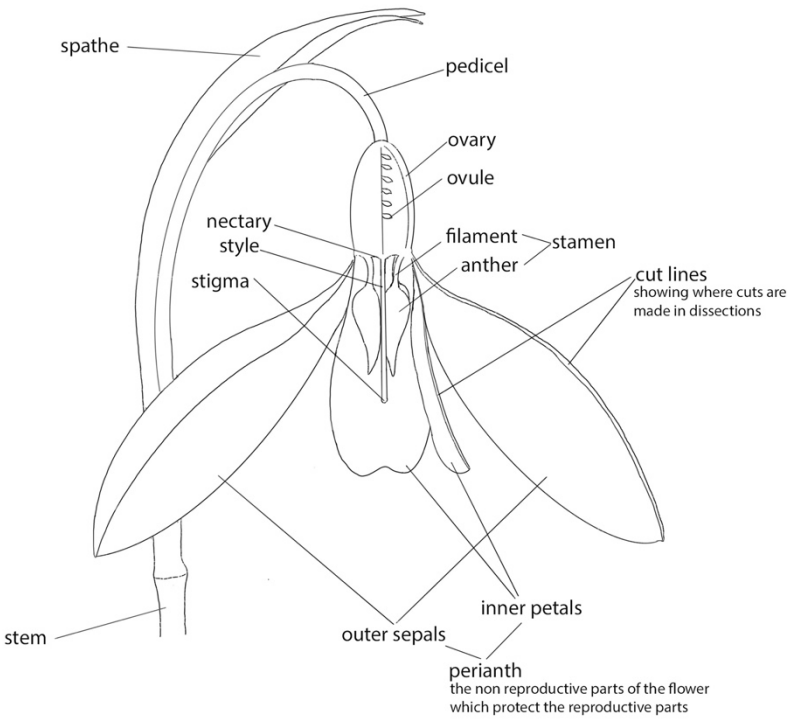
different ways to release the pollen are positioned on the filament in different ways too. Sometimes the stigma grows after the male phase, all of these points are important in reproduction and we need to take time observing such features.

A very simple flower to dissect is a Phalaenopsis flower(below). This is a bilateral flower rather than one that exhibits radial symmetry, you can see that it has two halves that are mirrored, so we can simply cut straight down the centre. It's arrangement and parts differ somewhat though, it has 3 outer sepals and 3 inner petals, the bottom one being the lip or labellum. The ovary is hidden behind the flower inside the petiole and the stigma is merely a sticky area on the column. The pollen or male gametes in the form of a pollinia sits under the anther cap at the tip of the column.





The final example is a *Galanthus nivalis,* the Snowdrop. This flower has three large outer sepals and 3 smaller inner petals, the cut has been made to show 1.5 of each.
The ovary is in a different position in this flower, it is inferior, which means it sits below the flower at the top of the pedicel, this is the opposite of the Fritillaria on the previous page, which has a superior ovary, i.e. positioned inside the flower and above the petals.

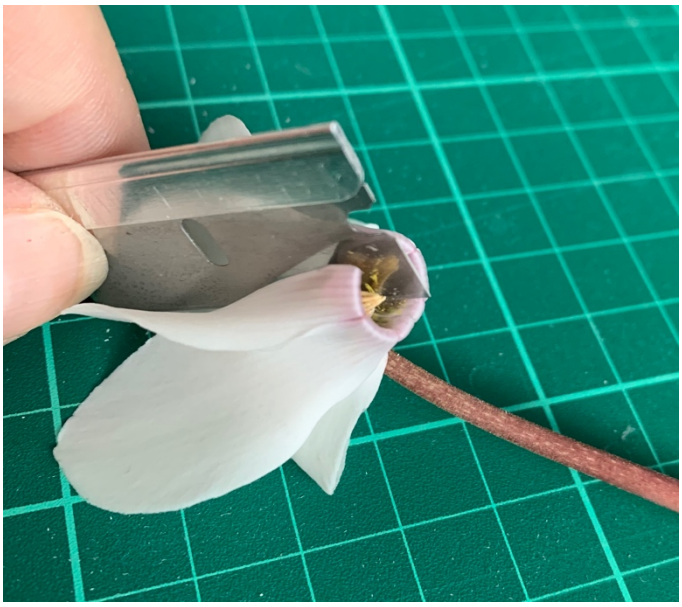


You can see from the examples that there is considerable diversity but there are also common features. Try to examine many flowers and see if you can identify the parts, it will get easier!

Dissection Example: *Cyclamen persicum* cultivar

A cyclamen is a good choice. It is both perfect and complete, as it has both male and female parts as well as petals and sepals.
First I arrange my tool kit so that everything is at hand. Make the dissection using the most appropriate cut to show half of the flower with the cut through the ovary (see below).
I use a larger blade if a flower has thicker parts and a scalpel on thin petals.

Below: cutting through a cyclamen flower with a razor blade but I could also do the same with a scalpel. There is a whole petal at the top and a cut through a half petal at the bottom.



Having completed the dissection I should end up with something like this, showing half of the flower.

The anthers can be removed for further inspection and from additional flowers.

a. Here you can see where anthers are fixed or fused to the petal

b. The stigma and calyx (sepals that surround the petals)

c. The ovary, with ovules and calyx, part of the stem is also cut

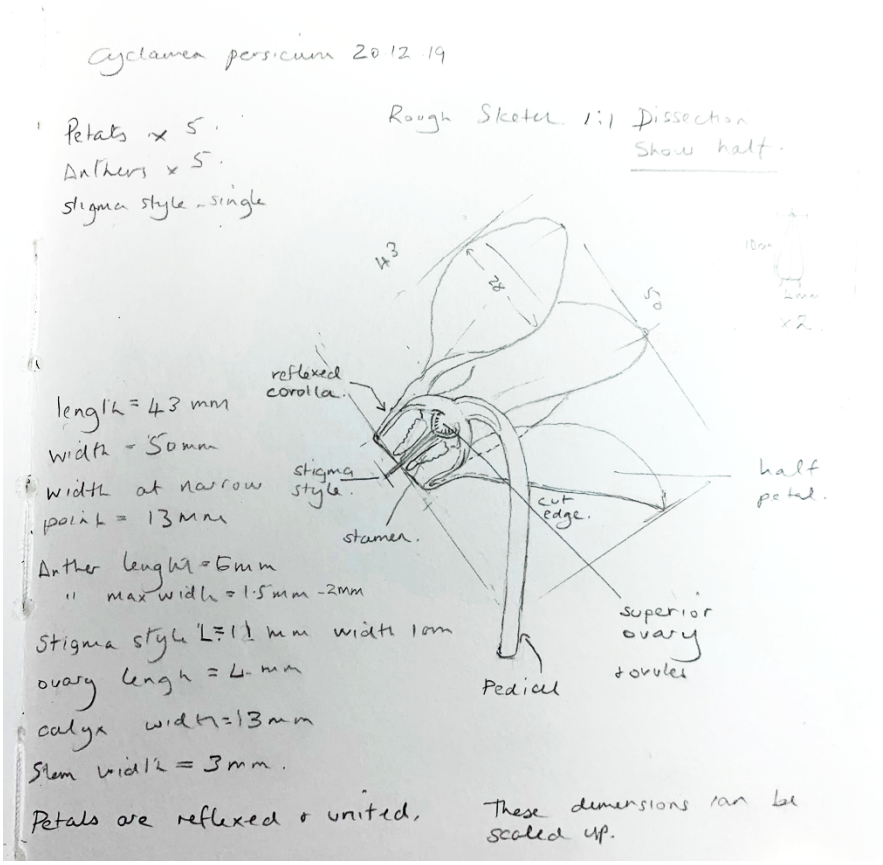
d. The anther ventral view (anther is basifixed)

e. Anther dorsal view

Recording Measurements and Sketching

Pin the flower to foam core if necessary to stop it moving. The flower will die quickly once cut, so take photographs and record measurements as soon as possible. For this task I used dividers and a ruler and construct a drawing of the flower at life size, 1:1. The reproductive parts can be scaled up by x2 or whatever is deemed appropriate for easy viewing. Simply multiply the height and width measurements of the anther by 2.

Using dividers to measure all parts



Dissection notes and sketch of *Cyclamen persicum*

Drawings are made using a 0.3mm mechanical pencil. Record as much information as possible and remember to examine each small part with a hand lens. Make notes on what you see as shown above, work quickly as this is preparatory work and the drawing can be refined later on, do not use any shading in the drawing.

Exercise

Use a selection of flowers to make dissections, take notes identifying all of the parts and record measurements in your sketchbook, make line drawings showing the dissection, you may also add other details such as separate anther drawings. I suggest trying at least 4 flowers.

Send images of your dissection drawings and photographs of the flowers to me for assessment. Send to coursework@botanicalart-online.com

This completes the introduction to dissection. In the second part of this module you will learn to make clean line drawing using pencil and ink, as well as scale drawings.
Shading and colour will also be introduced.

Recommended resources:
Books
Michael Hickey and Clive King (2010) The Cambridge Illustrated Glassary of Botanical Terms

Web sites
A good description of flowers
https://www.cs.rochester.edu/~nelson/wildflowers/glossaries/flowers/index.html?fbclid=IwAR3DikLYrJDj0Wh-cb2eDqnXvExYrd57tUl2if67tLQhgi45-Yn9TD3yOBg