

Beyond the visible: Explorations with a

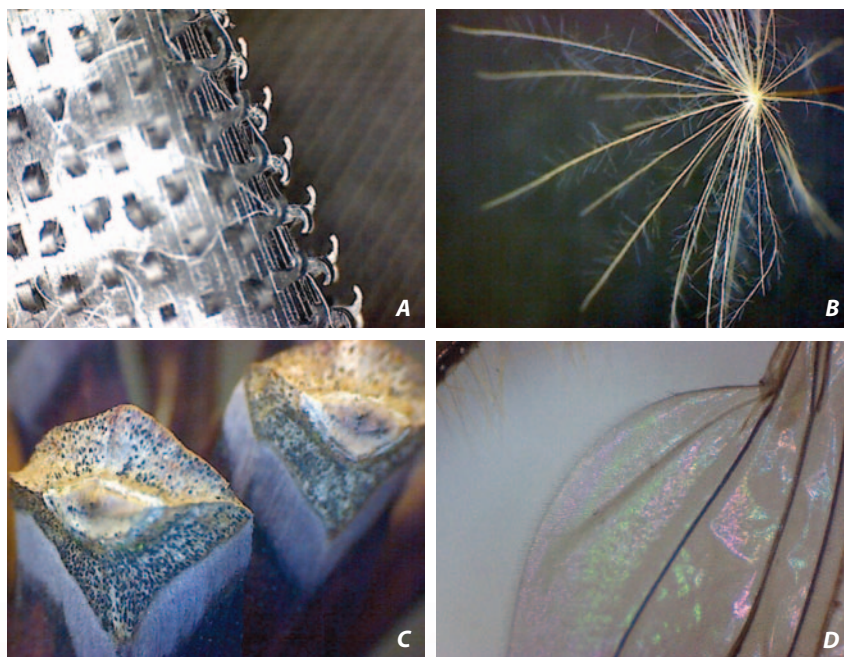


Figure 1 - Four images.

Can you identify the images shown in Figure 1? (Answers are given at the end of the article). As you have possibly guessed from the title of this article, each of the pictures represents an aspect of an object viewed using a microscope.

Each of the images has been captured using a Veho VMS-001 - 200x USB digital microscope (Figure 2). This microscope costs in the region of £35 and is available from a wide range of outlets including Misco [1] and Amazon [2]. The microscope comes with software that allows images to be viewed, saved and manipulated on-screen.

This simple-to-use digital microscope offers easy access to a world that is usually invisible and its use can reveal all sorts of its fascinating secrets. Who can fail to be moved by the beauty of the microscopic algae (Figure 3a) that appear when a drop of 'green

sludge' (Figure 3b) is magnified around 200x, and the fascinating shape of ammonium sulfate crystals as they appear from a warm saturated solution as it cools (Figure 4). It is little wonder that 'wow' is the most common utterance in our microscope workshops! In SSERC, we believe that through discovering a previously hidden microscopic world, learners will be motivated and that this Veho VMS-001 microscope can also be used as a vehicle to develop a range of the science inquiry skills such as those described in the Sciences Principles and Practice paper. [3]

Close observation of the images in Figure 1 offers clues to the identity of each object but additional information might help. For example, it is useful to know by how many times the object has been magnified. Take a look at Figure 5 - we might think at first glance that it looks like a picture of a cucumber, but would we come to the same conclusion when told that the object has been magnified 25 times? (It is, in fact, an image of a bamboo leaf, taken with the Veho VMS-001, magnification x25). The significance and importance of full and accurate recording becomes apparent. The Veho VMS-001 software is uncomplicated to use, allowing full labelling of the images, making recording the name of the sample and the magnification on to the image itself very straightforward. The time that the image was taken can also be automatically recorded. The Veho VMS-001 software comes with a short, electronic manual which provides comprehensive, easy-to-use instructions for using each of its facilities.



Figure 2 - Veho VMS-001 - 200x USB Digital Microscope and protective cap.

simple, inexpensive digital microscope

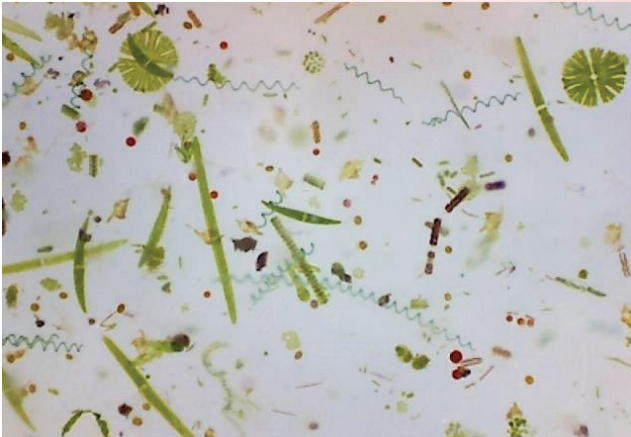


Figure 3a - Microscopic algae x220.

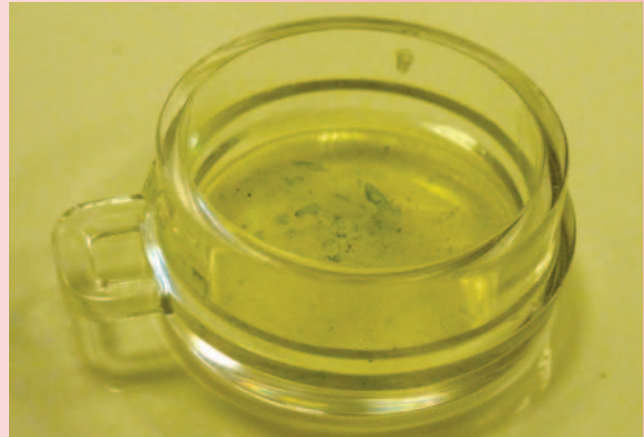


Figure 3b - Microscopic algae in microscope cap, not magnified.

Another useful feature of the Veho VMS-001 is its facility to yield a measurement. By entering the magnification (read from the ruler on the microscope) into the box on the preview screen as shown in Figure 6, then drawing a line between two points, the software will provide a measurement of the distance between the two points. A variety of units is provided. Figure 6 shows cells from red onion epidermis, magnified x200 times in which the length and breadth of three cells have been measured. Clearly, this feature could be used

to highlight the importance of accuracy of manipulation skills when taking the measurements. There is also the opportunity to explore the meanings of, and highlight the differences between, accuracy and precision. Measurements made using the Veho VMS-001 are unlikely to be as accurate as those using a scale micrometer. A given Veho VMS-001 microscope will measure a fixed distance to be the same each time and so it measures precisely, although not necessarily completely accurately.

By taking images at short, regular time intervals and then inserting the images into a PowerPoint and running them together, a time lapse movie can be made. This technique was used to record the crystallisation of ammonium sulfate from a warm saturated solution as it cooled (www.sserc.org.uk). In addition to providing still images, the Veho VMS-001 software can also take short videos. We at SSERC have used the Veho VMS-001 to record plasmolysis in red onion cells in real time (www.sserc.org.uk). ▶

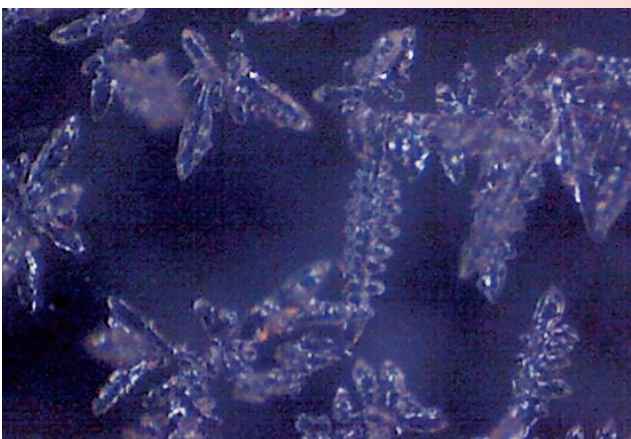


Figure 4 - Ammonium sulfate crystallising from a cooling saturated solution x200.



Figure 5 - Bamboo leaf x25.

The software allows for only short videos of up to 30 seconds to be recorded. If a longer video is required, then a number of shorter ones can be linked together using Windows Moviemaker. The set-up and method used for that will appear in a future article. To record good quality, sharp images, either as a series of stills or video calls for careful planning and setting up of the microscope and the subject to be photographed, skills included in the Principles and Practice document [1]. Clearly, opportunities exist for learners to bring together their skills from different subject areas - for example, the science disciplines, technology, art.

The Veho VMS-001 microscope does have limitations. Its maximum effective magnification is x220. While this magnification is great enough to view onion cells, a magnification of x400 is required to view most animal cells. (Veho do produce a microscope that magnifies to x400, the VMS-004D - 400x USB Microscope. The additional x200 over the Veho VMS-001 is digital rather

than optical magnification and, in our experience, images produced from the x400 microscope are significantly less clear and are of poorer quality than those produced by the Veho VMS-001). Lighting is only from above and so it is not easy to view organisms that are largely colourless such as protozoa. That said, we believe that the positive aspects of the Veho VMS-001 far outweigh those disadvantages. The microscope simply has to be connected via a USB to a computer, focussing is straightforward and the image appears on the screen so you can be sure that your learner is observing the desired image. The Veho VMS-001 works extremely well within its limitations and we consider that it provides an engaging and exciting introduction to microscopy that can be used across a range of subject areas. ◀

Answers to quiz:

- A: Velcro x25
- B: Dandelion seed x20
- C: Cone from Scots Pine Tree x17
- D: Mosquito wing x195

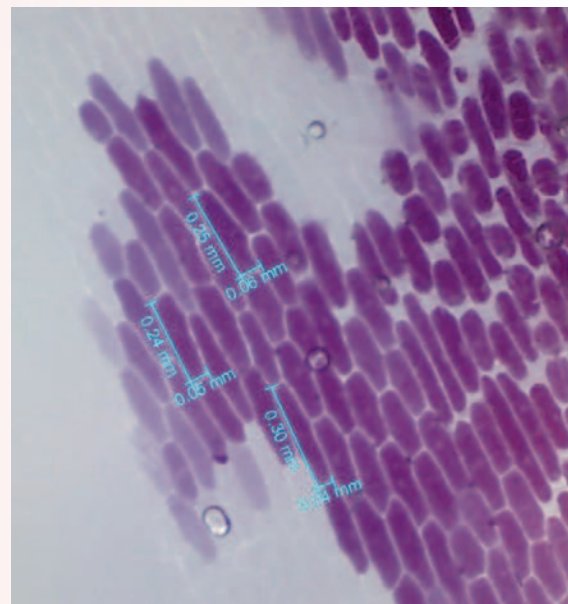


Figure 6 - Red onion epidermis, x220.

References

- [1] www.misco.co.uk/ (accessed 26th October 2012).
- [2] www.amazon.co.uk (accessed 26th October 2012).
- [3] Education Scotland, Curriculum for Excellence: Sciences Principles and Practice, www.educationscotland.gov.uk/Images/sciences_principles_practice_tcm4-540396.pdf (accessed 26th October 2012).