**What is it made of?**

You are going to use a light microscope to investigate what samples from different organisms are made of. Can you find out whether they’re made of cells?

**Safety**

* Be very careful when handling glass slides.
* If your microscope has a mirror, **never** use it to reflect direct sunlight.
* If your microscope has a light, **never** look down the eyepiece without a slide on the stage.
* Always start with the slide near the objective lens and then move it **away** from the lens, so that the lens does not smash the slide.

**Apparatus and materials**

* light microscope
* samples from different organisms, mounted on slides with coverslips

**Procedure**

|  |  |
| --- | --- |
| 1. Turn the turret until the lowest power objective lens clicks into position. 2. Place the slide on the stage and fasten it with the stage clips. 3. Look **from the side** and turn the focus knob to move the objective lens closer to the stage. **Stop** before the objective lens touches the slide. 4. Look through the eyepiece. 5. Turn the focus knob until the image is sharp and clear. 6. Move the mirror to reflect more light through the sample, if needed. 7. Turn the turret until the medium power objective lens clicks into position, then re-focus the image. 8. When finished, use the focus knob to move the objective lens away from the stage, and then remove the slide from the stage. | eyepiece  focus knob  turret  objective lens  stage clip  stage  mirror |

**Checklist**

Tick the checklist for each step that is successfully completed.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | **Completed by person** | | |
|  | **1** | **2** | **3** |
| 1. Checks that the lowest power objective lens is in place to look through. | |  |  |  |
| 1. Places the slide on the stage and fastens it using the stage clips. | |  |  |  |
| 1. Looks **from the side** and turns the focus knob so that the objective lens closer to the stage **without letting the objective touch the slide**. | |  |  |  |
| 1. Looks through the eyepiece and turns the focus knob until the image is sharp and clear. Moves the mirror to reflect more light, if needed. | |  |  |  |
| 1. Turns the turret until the medium power objective lens clicks into position, then re-focuses the image. | |  |  |  |
| 1. Records observations of the sample on the slide. | |  |  |  |
| 1. Uses the focus knob to move the objective lens away from the stage, and removes the slide from the stage. | |  |  |  |

**To answer**

1. Were all of the samples made of cells?
2. How were the cells of the samples **different**?
3. How were the cells of the samples **similar**?

*Biology > Big idea BCL: The cellular basis of life > Topic BCL1: Cells > Key concept BCL1.2: Cells and cell structures*

|  |
| --- |
| **Response activity** |
| **What is it made of?** |

**Overview**

|  |  |
| --- | --- |
| Learning focus: | Organisms are made up of one or more cells, which have common structures that carry out life processes. |
| Observable learning outcome: | Use a light microscope to make and record observations of cells from a range of tissues and organisms. |
| Activity type: | Practical investigation |
| Key words: | cell, microscope |

This activity can help develop students’ understanding of what cells look like, and that organisms are made up of cells, following these diagnostic questions:

* Diagnostic question: Alien invasion!
* Diagnostic question: Using a light microscope
* Diagnostic question: Made of cells?

**What does the research say?**

Researchers have acknowledged that the cell is, when first introduced, an abstract concept (Dreyfus and Jungwirth, 1988; 1989). When introducing ideas about cells, several sources advocate starting with hands-on light microscopy of cells from a range of tissues and organisms, to enable students to discover for themselves that cells are the common building blocks of living things and what they look like (AAAS Project 2061, 2009; Skinner, 2011).

Limiting students’ experience of cells (e.g. through microscopy and cellular imagery) to just animal and plant cells (typically epidermal cells from onion and human cheek) can introduce or reinforce the misunderstanding that there are only these two kinds of cells (Clément, 2007).

Haşiloğlu and Eminoğlu (2017) found that light microscopy coupled with drawing cells was effective in helping students to overcome misunderstandings about what cells look like.

**Ways to use this activity**

Students should complete the microscopy and the checklist in pairs or groups of three, apparatus permitting. The students in each group should take turns to complete the different tasks on the checklist each time a different slide is examined. Students could be asked to make scientific drawings of what they see using the light microscope. The quality of learning may be improved with a careful selection of groups, or by allocating specific roles to students in each group.

Typically, this practical is completed using epidermal cells from onion (as examples of plant cells) or from a human cheek swab (as examples of animal cells). However, limiting students’ microscopy experience to just these two tissues can introduce or reinforce the misunderstanding that there are only these two kinds of cells, or that all plant and animal cells have these shapes. Therefore, if possible, provide students with samples of cells from a range of different plant and animal tissues.

**Equipment**

For each pair/group:

* light microscope
* tissue samples from different organisms, stained as appropriate and mounted on slides with coverslips
* (optional) pencils and paper to make drawings of what they see using the microscope

**Technician notes**

Samples of cells from a range of plant and animal tissues should be provided to students. The samples should be already mounted onto slides with coverslips, and stained as appropriate to make cell structural features visible under the light microscope.

Single layers of epidermal cells can be easily obtained from white or red onion, leek, spring onion, or white or red cabbage (Martin, 2002). If possible, slides of human cells from skin, nerve, bone, muscle should also be provided for students to observe (AAAS Project 2061, 2009).

**Health and safety**

Direct sunlight must never be used as the light source for microscopes with a mirror.

Practical work should be carried out in accordance with local health and safety requirements, guidance from manufacturers and suppliers, and guidance available from CLEAPSS.

**Acknowledgments**

Adapted by Alistair Moore (UYSEG) from an activity developed for the York Science project.

Images: UYSEG

**References**

AAAS Project 2061. (2009). *Benchmarks for Science Literacy* [Online]. Available at: <http://www.project2061.org/publications/bsl/online/index.php>.

Clément, P. (2007). Introducing the cell concept with both animal and plant cells: a historical and didactic approach. *Science & Education,* 16(3-5)**,** 423-440.

Dreyfus, A. and Jungwirth, E. (1988). The cell concept of 10th graders: curricular expectations and reality. *International Journal of Science Education,* 10(2)**,** 221-229.

Dreyfus, A. and Jungwirth, E. (1989). The pupil and the living cell: a taxonomy of dysfunctional ideas about an abstract idea. *Journal of Biological Education,* 23(1)**,** 49-55.

Haşiloğlu, M. A. and Eminoğlu, S. (2017). Identifying cell-related misconceptions among fifth graders and removing misconceptions using a microscope. *Universal Journal of Educational Research,* 5**,** 42-50.

Martin, M. (2002). Looking at cells: alternatives to onion cells. *School Science Review,* 83(301)**,** 103.

Skinner, N. (2011). Cells and life processes. In Reiss, M. (ed.) *ASE Science Practice: Teaching Secondary Biology.* London, UK: Hodder Education.