Year 8

Conceptual narrative Science: Form and function

In the biological sciences sub-strand, there are three main conceptual threads being developed from Foundation through to year 10. They are the concepts of diversity and evolution, form and function and interdependence and ecosystems.

Big ideas

The scale in Year 8, zooms in to the microscopic, where students learn about the form and function of cells as the basic unit of living things. They then zoom out, to examine how the structure of organs relates to the specialised function of the system it is part of.

What concepts do I want my students to understand?

- Cells are microscopic structures.
- The relationship between structure and function, at cell, organ and body system levels, in multicellular organisms.
- Multi-cellular is the term we use for organisms made up of many cells.
- Organisation of body systems, in terms of flows of matter between interdependent organs.
- Why and how cells reproduce through both asexual reproduction processes.

Appendix 1 shows how the three interwoven strands, Science Understanding, Science as a Human Endeavour and Science Inquiry Skills, work together to build the sophistication and complexity of the science concepts from Foundation to Year 10.

This conceptual narrative illustrates one of the nine science concepts from the Australian Curriculum: Science Content structure. It tells the story of the concept in isolation of the eight others. However, there are situations when it is advisable to teach both concepts, (properties of matter and changes of matter) together, because they complement each other.

Note: Not all concepts are specifically addressed in each year level.

Introduction

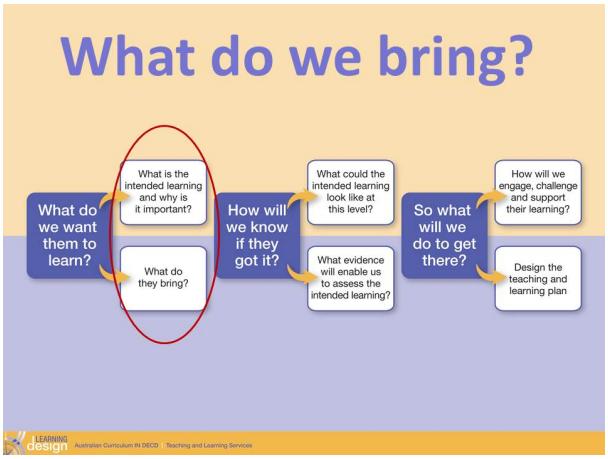
What might my students already know about this concept?

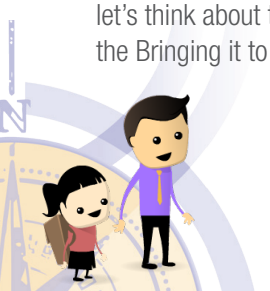
The features of living things are linked to their function. The form and function of living things adapt to the environment where they live.

What content could I use to explore this concept?

We could explore a variety of cells using a light microscope, digital technology or by viewing a simulation. Then distinguish between plant cells and animal cells, identify structures within cells and describe their function. We could also compare,the digestive system of different organisms or compare the respiratory system of fish, frogs and mice.

Now to bring the essence of scientific understanding to life, let's think about this concept through the six questions from the Bringing it to Life tool (BitL).





In Year 8, we want students to understand that the organisms are made up of cells and the products of cells. We also want students to know that some organisms are made up of only one cell, whereas other organisms are made up of many cells.

Year 8 example

In this example, I want my students to investigate the structure of spirogyra and cheek cells, using a light microscope, and how the structural features of the cells, determine the functions of the cells within an organism.

What do you observe?

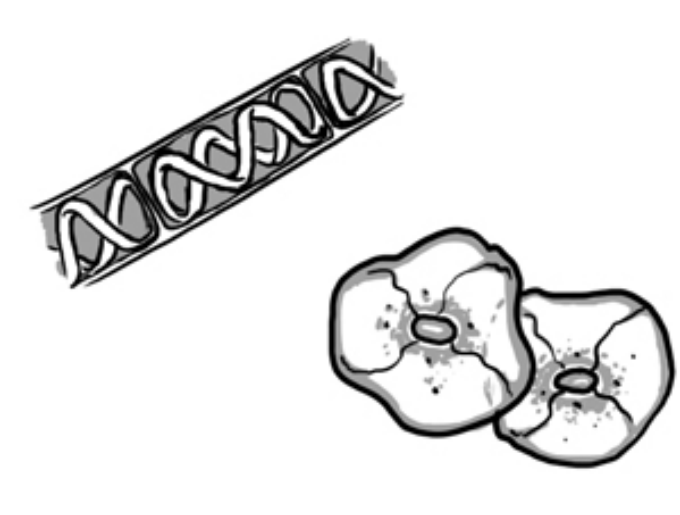
How can I help my students make observations?

Using the BitL questions, I could ask:

- *What do you observe?*

I want students to make observations, to find structural features that are common to plant and animal cells, and to decide which features are specific for just plants. I would ask the students:

- *What do you observe about the cells?*
- *Are they the same shape?*
- *Are they the same colour?*
- *Do you see features present in one cell but not the other?*



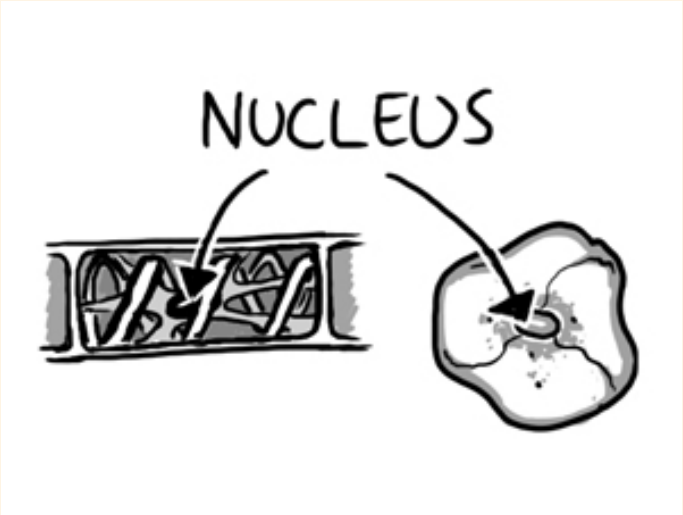
What patterns and relationships can you see?

How can I help students to see patterns and relationships? What questions might my students ask?

Student's curiosity leads them to ask questions. These questions help students to order their findings into a pattern, to be able to make comparisons or find relationships. These questions support students to be more precise and foster analysis and classification of the observations.

Using the BitL questions, I could ask:

- *What patterns and relationships can you see?*
- *What structural features can you see in all types of cells?*
- *Are there any exceptions?*
- *What questions do you have about the structures found in the cells?*
- *How are the cells the same?*
- *How are the cells different?*
- *What are the green bodies inside the spirogyra cells? What shape are these green bodies?*
- *Where were these green bodies mostly located?*
- *Were they stationary, or moving around the cell?*
- *Did anyone notice a large space inside the cell?*



What do you predict might happen?

How can I help students to identify and formulate investigable questions?

Students ask testable questions that help them to narrow the focus of the inquiry. These questions provide opportunities for students to make predictions.

Using the BitL questions, I could ask:

- *What do you predict might happen?*

In Year 8, I want my students to make predictions based on scientific knowledge. I might prompt my students with:

- *How might adding a salt solution to cells, affect the structures of the cells?*
- *What do you think will happen to the plant cell, when it is placed in salt water? What will be the effect on the cell membrane? The cell wall? Why?*
- *How might increasing the concentration of salt solution have a different effect on the cell?*

What investigations could you design?

These questions support students to develop science inquiry skills and problem solve.

Using the BitL questions, I could ask:

- *What investigations can you design?*

In Year 8, I want my students to plan and carry out a safe and fair testing, using accurate measurements and controlling the variables. Questions I might ask my students are:

- *What equipment will you need to this investigation?*
- *What safety aspects will you need to consider?*
- *What technology might help you in gathering data for your investigation?*
- *How might you find out the functions of the structures of the cells?*

How can you review and communicate?

How can I help students share their observations and questions?

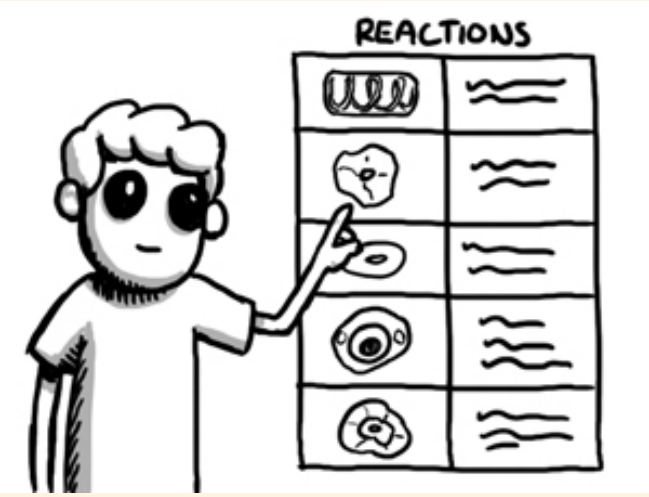
These questions stimulate student's reasoning and help them analyse, draw conclusions and make generalisations about the concepts.

Using the BitL questions, I could ask:

- *How can you review and communicate?*

In Year 8, I want my students to use structural features of cells and their functions to develop their explanations of what they have found through their investigation. Questions I could ask my students are:

- *How can you represent the data and your explanations about the structure and function of cells, in a way that you can communicate the patterns and changes, with others?*
- *What tools, lists, tables, graphs or drawings, might help you to share this information, and help you identify the trends?*
- *How fair was your test? How could it be improved?*
- *Who might be interested in this new data?*
- *How is the structure of the cell membrane related to its function?*
- *What structure did the shrinking of the cell allow you to observe?*



So what? What next?

How can I help students apply the concepts in a range of authentic contexts?

These questions support student's reasoning, to expand or change their ideas from their experience and evidence and generalise to new contexts.

Using the BitL questions, I could ask:

- *So what? What next?*

In Year 8, I want my students to start thinking about where this knowledge may be used in society. Questions I could ask my students are:

- *Why is it important to know about structures of cells and the function of these structures?*
- *How does understanding this, help us to understand the whole organism?*
- *who might interested in this information?*

Concluding comments

What concepts might students develop through working with the BitL questions in this way?

By exploring this science understanding through these questions, we can help our students to think, work and process scientifically. Students can connect science to their world, and consider why they need to learn that animal and plant cells have specialised structures with specific functions to help them perform particular roles in the organism.

Appendix 1

Appendix 1 shows how the Science as a Human Endeavour strand develops in sophistication and complexity across Foundation to Year 10.

This conceptual narrative illustrates one of the nine science concepts from the Australian Curriculum: Science Content structure. These concepts develop in depth and breadth of understanding from Foundation to Year 10. This conceptual narrative tells the story of the concept in isolation of the eight others. However, there are situations when it is advisable to teach both concepts, (properties of matter and changes of matter) together, because they complement each other.

Note: Not all concepts are specifically addressed in each year level.

Biological sciences

In the biological sciences sub-strand, there are three main conceptual threads being developed from Foundation to Year 10. They are the concepts of diversity and evolution, form and function and interdependence and ecosystems.

Let's look at the form and function concept

Year 1

This starts in Year 1, when students explore the features of living things and link them with their function. They might look at familiar insects and identify that eyes are for seeing, wings are for flying and legs are for crawling.

Year 5

In Year 5, students look at how different body parts are adapted to particular environments, such as birds, which have different beaks depending on what they eat. Some, like parrots, are for cracking seeds while honeyeaters beaks are long and narrow to eat nectar from flowers. Another example is the covering of some animals which enables them to be camouflaged in their surroundings.

Year 8

The scale in Year 8, zooms in to the microscopic, where students learn about the form and function of cells as the basic unit of living things. They then zoom out, to examine how the structure of organs relates to the specialised function of the system it is part of. The students might start by looking at blood cells, and then zoom out to the heart, which is an organ that is part of the circulatory system.

Year 9

At Year 9, students start to think about form and function within systems, the focus is on how the internal systems work together to respond to changes in an organism's environment, such as the body's response to heat stress or infection.

Year 10

In Year 10, students learn about genetics, the role of genes and DNA, as a mechanism for passing on these adaptations of form and function, from one generation to the next.

So from Year 1 to Year 10, students develop their understanding from what they can see on familiar living things, to internal systems of living things, at both the macroscopic and microscopic scale. Along the way, they relate this to how they are related to functioning in their environment.