Year 9

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

Internal systems work together to respond to changes in an organism's environment.

What concepts do I want my students to understand?

- Form and function within systems, describing how the requirements for life (for example, oxygen, nutrients, water and removal of waste) are provided, through the coordinated function of body systems, such as the respiratory, circulatory, digestive, nervous and excretory systems.
- How the human body as a system responds to its external environment.

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

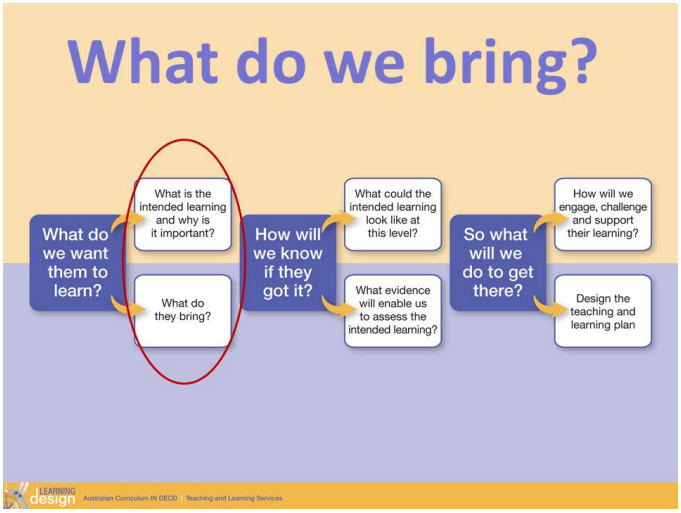
What might my students already know about this concept?

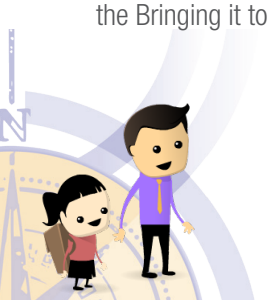
Features of living things are linked to their function. The form and function of living things adapt to the environment where they live.

What content could I use to explore this concept?

We could look at this concept through how different body systems work together to maintain and coordinate functions of the body. Some body systems we may link together, are the respiratory, circulatory, digestive, nervous and excretory systems to see how they respond to changes in the environment. For example, how does our body respond to bacterial infection, or high altitudes, or swimming in freezing cold water?

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 9, we want our students to understand how our internal body systems respond to change in the environment.

Year 9 example

In this example, my students will investigate how body systems work together to respond to changes in the environment, such as the body's response to heat stress. We can do this by slightly stressing the body to heat, by undertaking exercises, or wearing lots of clothing, or sitting in a warm spa.

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 my students to observe the changes that happen when their own body is *slightly* heat stressed.

- *How do you behave when you are hot?*
- *How do you feel?*
- *Do you feel warmer to touch?*
- *Is your skin dry or wet?*
- *When you run and sweat - what does it taste like?*
- *What can you observe about a person's appearance when they are heat stressed?*
- *If you needed to direct a movie, in which a character is heat stressed, what would you tell them to do?*
- *What do you see dogs doing when they get hot?*
- *Do plants react to heat stress? If so, what do you notice?*
- *Were there any difference in body temperature before and after exercise?*
- *What physical changes did you notice during exercise?*

What patterns and relationships can you see?

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

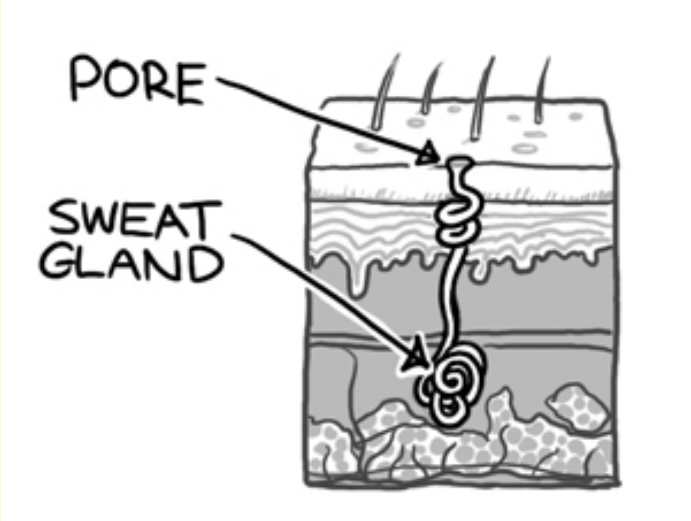
Student's curiosity leads them to ask questions. These questions help students to order their findings into a pattern, to be able to make comparisons or find relationships. These questions support students to be more precise and foster analysis and classification of the observations.

Using the BitL questions, I could ask:

- *What patterns and relationships can you see?*

In Year 9, I want my students to classify their observations according to scientific models based on similarities and differences. Questions I may ask my students:

- *Why do we sweat more when we are hot?*
- *How is sweat produced?*
- *How do your sweat glands know when to make sweat? When to stop?*
- *Which body system or systems causes us to respond like this?*
- *Why did some people's skin turn pink when they got hot?*
- *What are your questions?*
- *What causes these observable reactions to heat stress?*



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 9, I would prompt my students to think of a scientifically testable question with:

- *What might happen to your body if you decreased the temperature of the environment?*
- *What is your hypothesis?*
- *What reasons do you have for making that prediction?*
- *What might happen to your heart rate? Your skin temperature?*
- *What colour might your skin go when you are cold?*

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 9, I want my students to plan and design their own method to investigate their hypothesis. Questions I could ask my students are:

- *How might you test your predictions?*
- *What type of tests can you design to help you answer your questions?*
- *What should you consider in planning?*
- *Which safety and ethical issues should you consider in your investigation?*
- *What technology, may you consider using, to help you collect accurate data?*

How can you review and communicate?

How can I help students share their observations and questions?

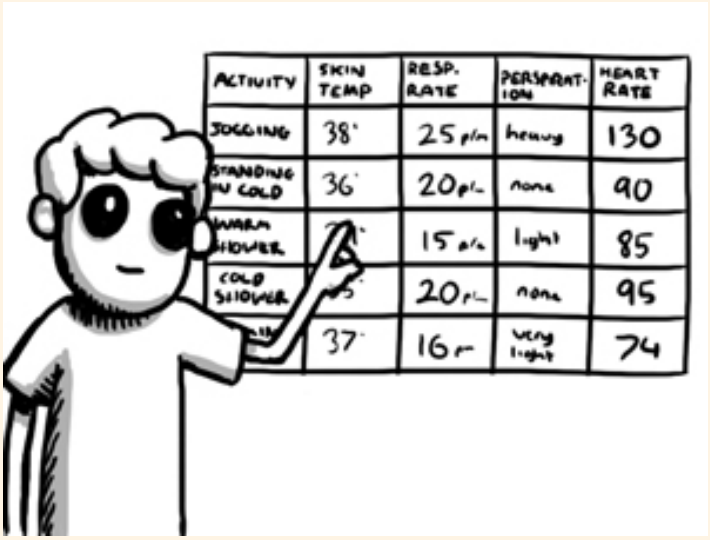
These questions stimulate student's reasoning and help them analyse, draw conclusions and make generalisations about the concepts.

Using the BitL questions, I could ask:

- *How can you review and communicate?*

At Year 9, I want my students to analyse and communicate any patterns they discover and evaluate their results. Questions I could ask my students are:

- *How can you best represent the data?*
- *How does the evidence you have gathered, compare with the current science understanding of how our body changes with the environment?*
- *Were your results consistent with your hypothesis?*
- *What can you infer from the data?*
- *What generalisation might you make?*
- *How might others view your data and evidence differently?*
- *How can you justify your conclusion?*



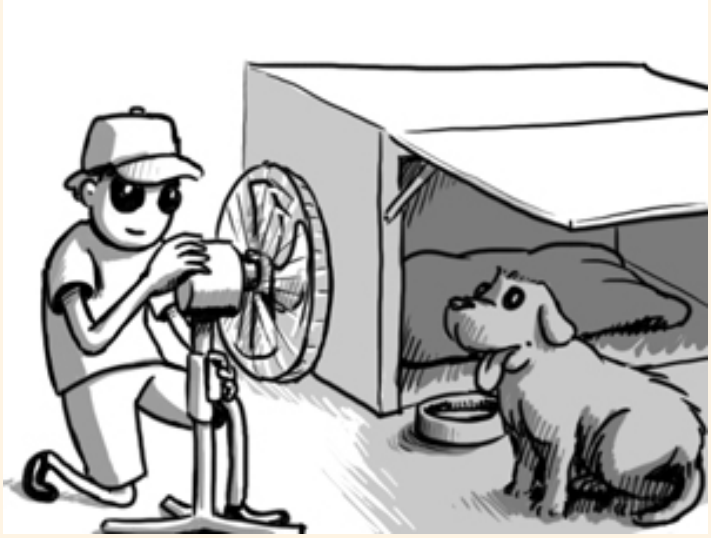
So what? What next?

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:

- *So what? What next?*
- *How does understanding the changes in the way your body systems function, respond. to respond to an environmental change, the way you might act or think now?*
- *Who might this knowledge or learning influence?*
- *What else do you need to investigate about this?*
- *Do animal carers make any special allowances for pets on particularly hot days?*
- *What safety recommendations are given in heat waves? How might these help us?*
- *Why is there such a high death toll in heat waves?*



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 animals and plants react to changes in their environment through coordinated responses of their body systems.

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.