Year 10

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 mechanism for passing on adaptations of form and function from one generation to the next.

What concepts do I want my students to understand?

- Genetics and the role of genes and DNA, as a mechanism for passing on these adaptations of form and function from one generation to the next.

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

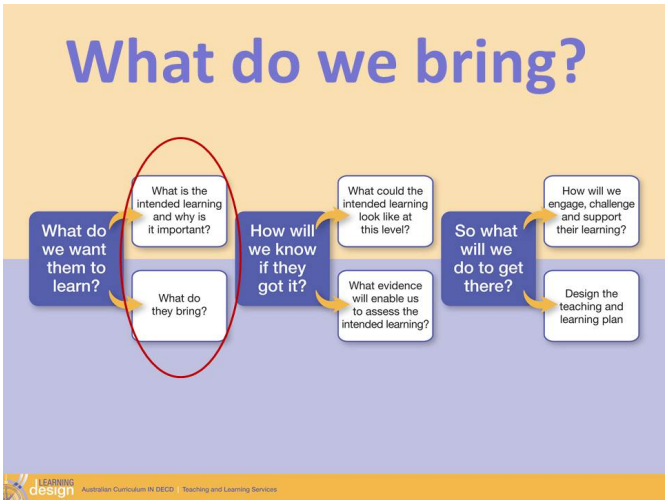
What might my students already know about this concept?

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

What content could I use to explore this concept?

Students can learn about the role of DNA and genes through using models, diagrams and videos. We can investigate the changes caused by natural selection in a particular population as a result of artificial selection in breeding for desired characteristic or interpret fossil records and other evidence for evolution.

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 10, we want our students to understand that the diversity of living things can be explained by the theory of evolution through natural selection. We want them to understand the role of genes and DNA in passing on heritable characteristics from one generation to the next.

Year 10 example

In this example, I want my students to use a pedigree chart for dog breeding and analyse the heritable characteristics. In using this chart, I want my students to explore the role of DNA and genes and their transmission of heritable characteristics such as coat colour from one generation to another.

What do you observe?

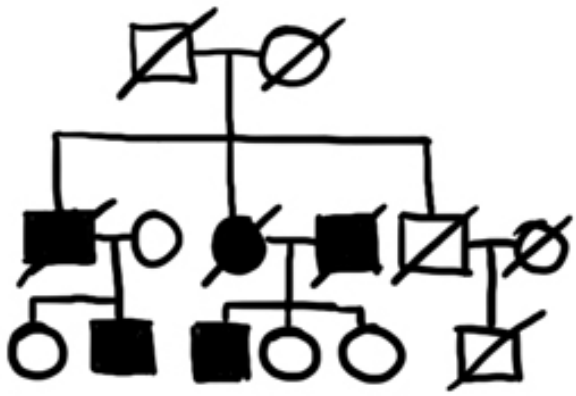
How can I help my students make observations?

Using the BitL questions, I could ask:

- *What do you observe?*

In Year 10, I want my students to make observations that change over time and geographically. I want them to select data that is reliable to make observations from. Questions I could ask my students are:

- *What do you observe about the pedigree charts?*
- *What features or character traits do you observe in each generation?*
- *What symbols help to make the chart easier to read?*



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 investigations can you design?*

In Year 10, I want my students to reveal patterns from their observations, and describe and explain exceptions. I could ask my students:

- *What is the same about each generation? What is different?*
- *What features appear generation after generation?*
- *Are there any anomalies? Are there any features not present in the last generation that were there at the beginning?*
- *When did the change occur?*
- *What are your questions?*

What do you predict might happen?

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

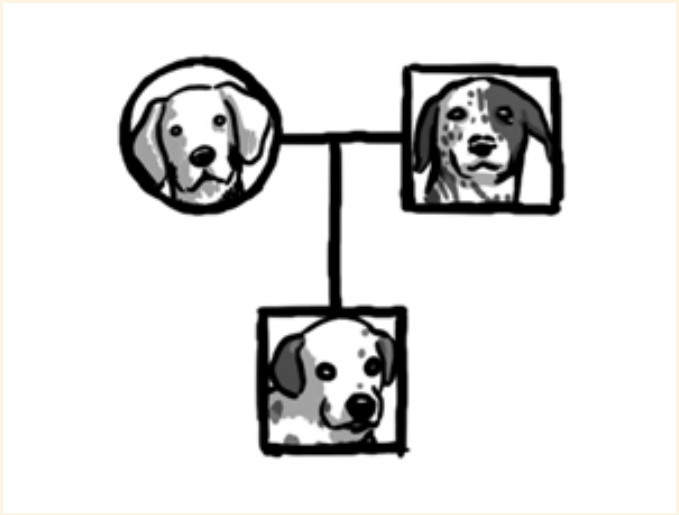
Students ask testable questions that help them to narrow the focus of the inquiry. These questions provide opportunities for students to make predictions.

Using the BitL questions, I could ask:

- *What do you predict might happen?*

In Year 10, I want my students to predict what will happen over time. I could ask the students:

- *What do you think will happen in the next generation?*
- *What other predictions might be plausible?*
- *What determines what the next generation will look like?*
- *What determines what genes a particular puppy gets?*
- *What changes can we predict with accuracy?*
- *How might you use the pedigree chart to investigate if a white coat is autosomal, sex linked, recessive or dominant?*



What do you predict the phenotypic ratio for coat colour will be in the F5 generation?

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 patterns and relationships can you see?*

In Year 10, I want my students to design their own investigations. Questions I may ask:

- *How might you test your hypothesis?*
- *What could you try?*
- *Would computer modelling be useful?*
- *How will you measure and record data?*
- *How will you ensure the data is reliable and representative?*

How can you review and communicate?

How can I help students share their observations and questions?

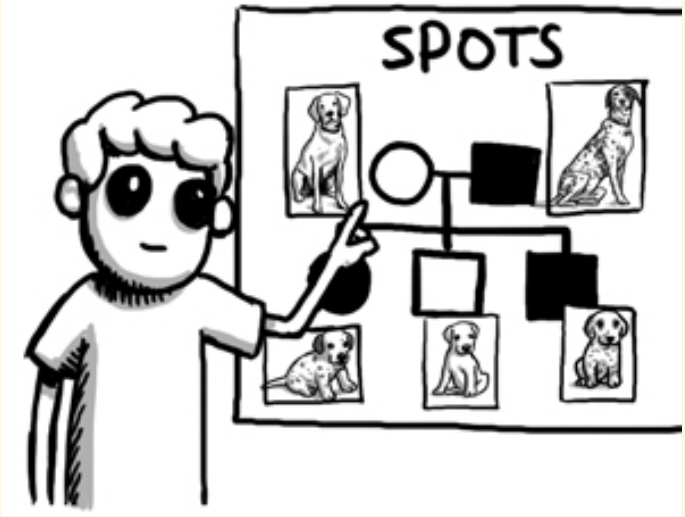
These questions stimulate student's reasoning and help them analyse, draw conclusions and make generalisations about the concepts.

Using the BitL questions, I could ask:

- *How can you review and communicate?*

In Year 10, I want my students to analyse patterns in the data to generalise and justify their conclusion based on evidence and scientific theories. I might ask my students:

- *How can you best represent your data and evidence?*
- *How could you improve your test/ investigation?*
- *How could you explain what you have found?*
- *Has your hypothesis changed? How?*
- *What can you infer from the data?*
- *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 would understanding the genotype of the parents influence your decision to breed or purchase a dog?*
- *What other information would be useful in making your decision?*
- *How does this type of research translate to reproductive science in humans?*
- *Who might benefit?*
- *What is the 'cost'?*
- *What would our lives be like if we didn't know this?*

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 heritable characteristics are transmitted from one generation to the next via genes and DNA.

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.