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Observation

The Bigger Picture

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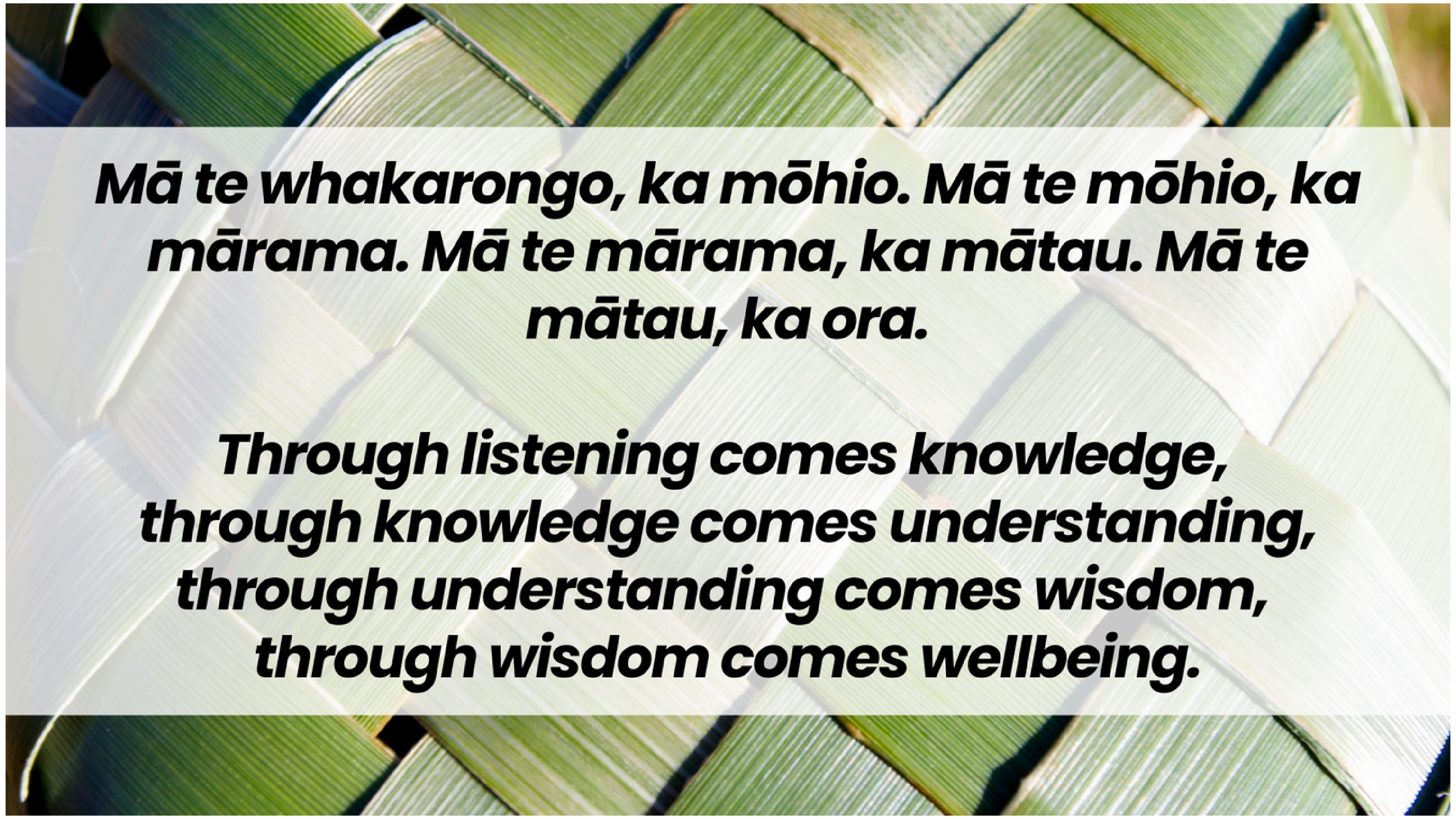
Nau mai ki tēnei akoranga on Observation: The Bigger Picture.

In this lesson we are learning to:

- Explain how observations help scientists make predictions.
- Describe how comparing observations helps scientists find accurate information.



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Science is all about making observations, predicting, comparing, analysing, and forming conclusions to understand how things work - but what is involved in each of these steps?

Observing the world around you is an important part of science, but making sense of what you see is just as important!

Have you ever looked really closely at something - maybe a bug crawling on the ground or the way water moves in a puddle?

Scientists do that too!

Observing - The process of carefully noticing and gathering information using the senses or tools to understand the world.

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Scientists don't just stop at looking.

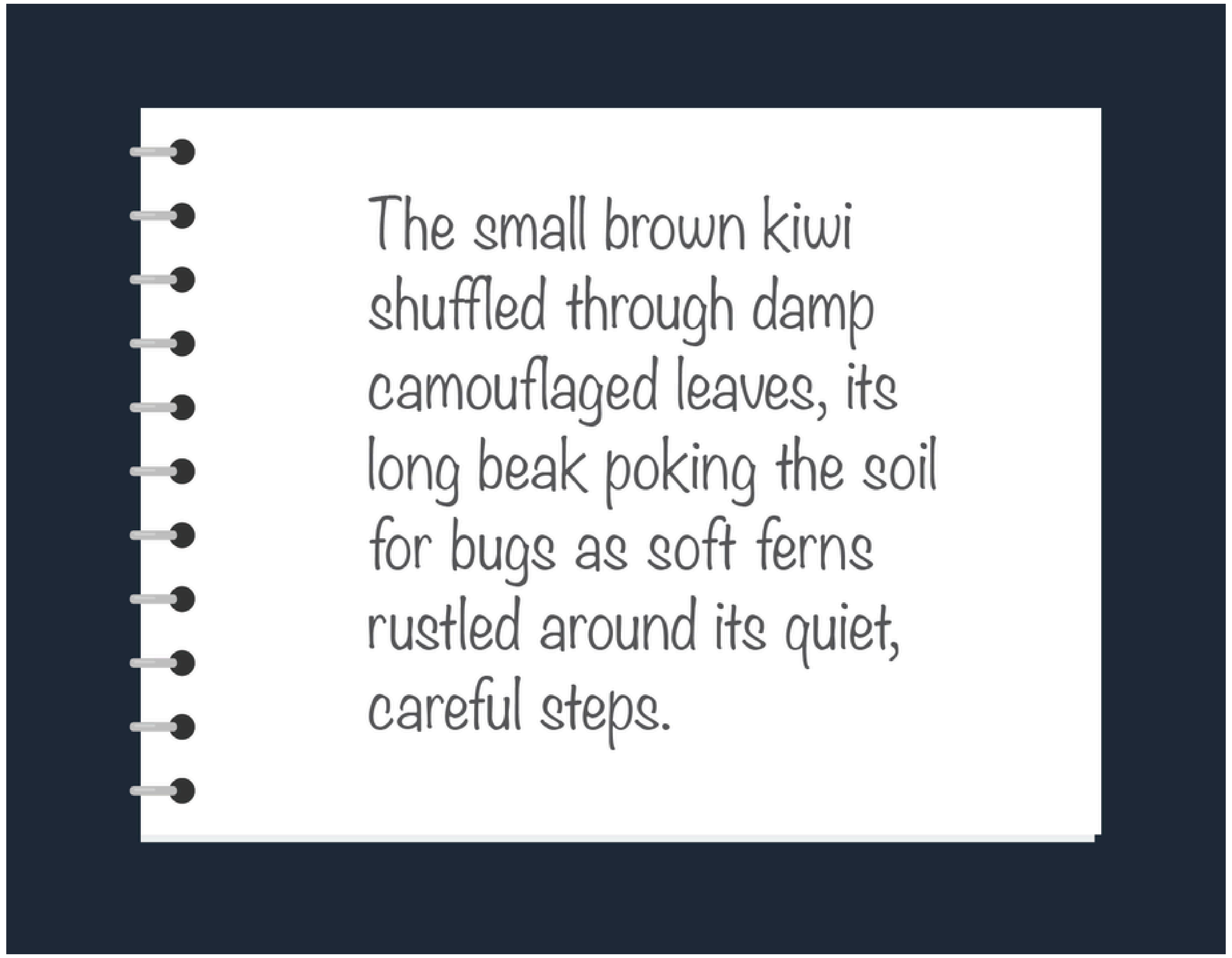
Scientists record their observations, compare their notes, and figure out what it all means. Let's find out the different ways scientists record their observations.

Writing Descriptions

Scientists write descriptions and detailed notes about what they see.

These descriptions must be clear and specific so others can fully understand what they have observed.

Example:
Instead of writing "The rock was big," a scientist might write: "The rock was 15 cm wide, dark grey, and had a rough surface with tiny white specks."



Some methods are better suited than others, based on what they are observing.

Observation Tables

Scientists often use tables to organise their observations so they can compare objects and spot patterns or changes over time.

Example:
Anecdotal Notes - What was seen or heard during the observation - eg: Students actions, comments, and reactions.

Numerical Data - Measured or counted information - eg: How the temperature changes over time.

Changes Over Time (Numerical Data)

TIME	6:00am	7:00am	8:00am	9:00am	10:00am
TEMPERATURE (°C)	15°C	18°C	24°C	28°C	25°C

Object Comparison Table (Anecdotal Notes)

OBJECT	Leaf
SIZE	5cm
SHAPE	Oval
COLOUR	Green with brown spots
TEXTURE	Smooth
SMELL	No Smell

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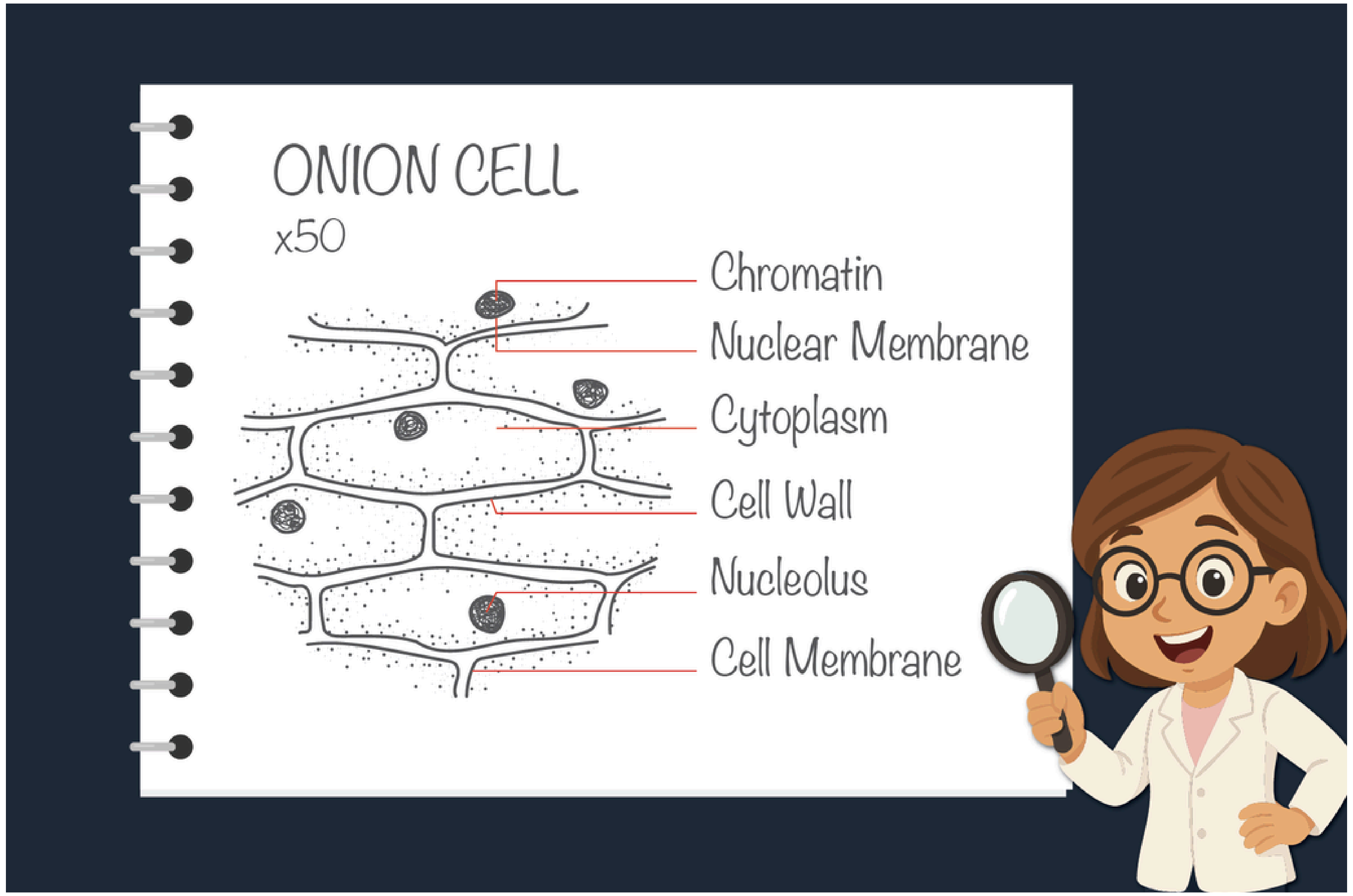
Drawing Observations

A drawing can capture details that might be hard to explain with kupu (words) alone. Labels help to show important features, such as size, pattern, or colour.

If measuring size, scientists might use a ruler or callipers to be more accurate.

Science is like being a detective - you gather clues (observations) and try to solve a mystery about how the world works!



Callipers - A tool used to measure the distance between two sides of an object, such as its width, thickness, or diameter, often with very precise results.

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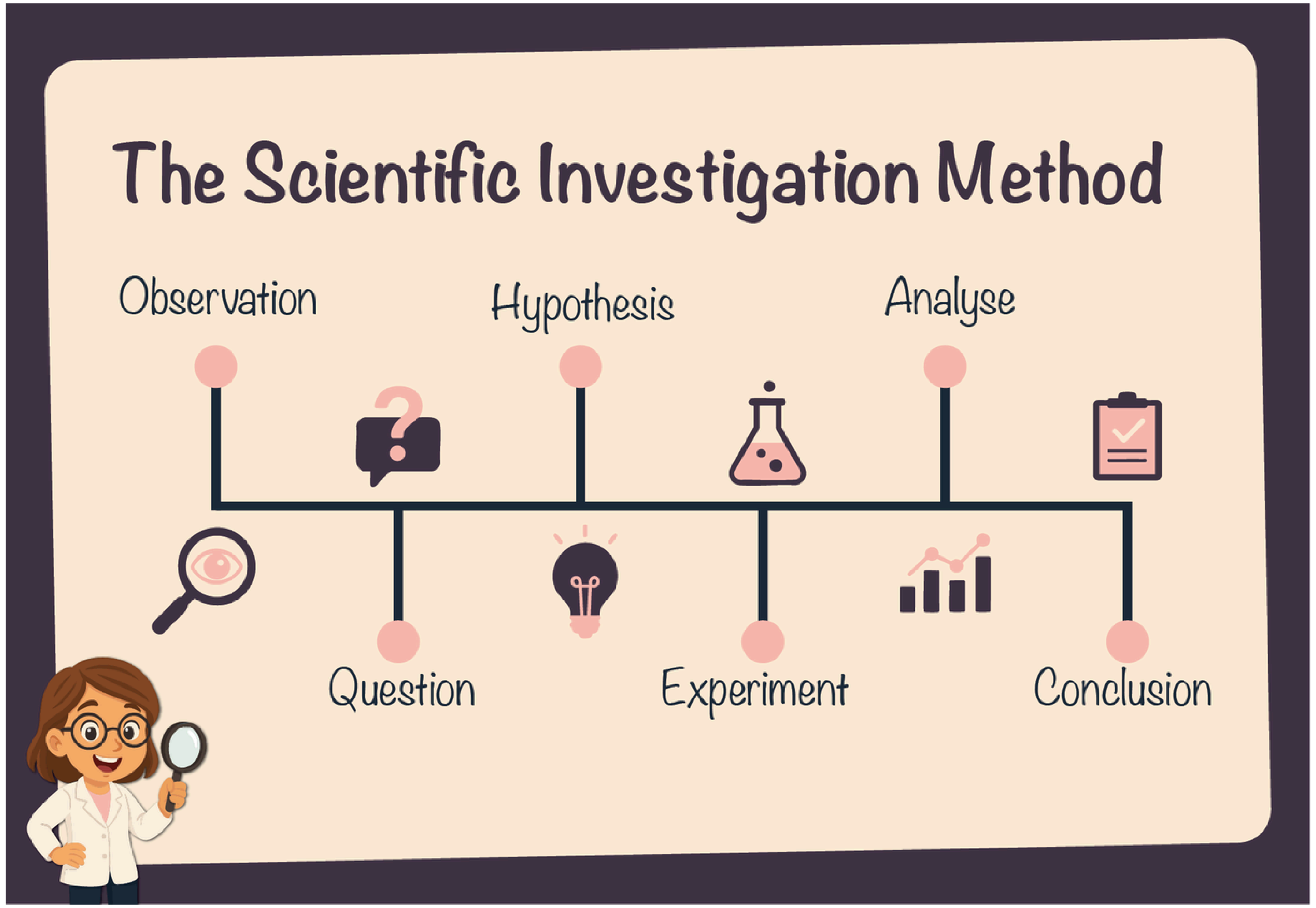
Observing is a core part of the scientific investigation method.

The Scientific Investigation method is when scientists ask questions, make observations, conduct experiments, and analyse data to draw conclusions about how the world works.

There are six stages in this process.

Let's learn about each of the stages of the science investigation process.



Conduct -To carry out or lead an activity or task.

Data - Information collected through observations, measurements, or experiments that scientists use to help answer questions or solve problems.

The Scientific Investigation Method

Observation - Use your senses or tools to notice and describe what is happening. This helps you spot something unusual or interesting to investigate.

Ask a Question - Identify something you want to find out or understand.

Form a Hypothesis - Make a prediction about what you think might happen, based on what you already know or have observed.

Test your Hypothesis with an Experiment - Carry out an experiment or make observations to see what actually happens. Observation plays a key role here, as you gather data through what you see, hear, or measure.

Analyse the Results - Look closely at the data to find patterns, relationships, or trends that help explain what is going on.

Draw a Conclusion - Decide what the results mean and whether they support your hypothesis.

Let’s take a closer look at how observation helps at each of these stages.

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Scientists like to make hypotheses, or predictions, before they do experiments.

This is a statement about what scientists think will happen, based on their prior knowledge or something they have observed.

It helps them to figure out what to expect and why things happen the way they do.
Scientists:

- Look for patterns in their observations.
- Use what they know to predict what might happen.
- Design an investigation to see if their prediction is correct.

Predictions help scientists focus their investigations and give them a purpose. They give a clear idea on what to test and what results to look for.

Without predictions, scientists wouldn't know what to test, or what results to look for in their experiments.

Hypotheses - A testable idea or explanation that scientists make based on what they already know or have observed.

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Let's take a look at some examples of predictions in science.

Plants

Prior Knowledge:
- I know that plants need light to make food and grow through photosynthesis.

Observation:
- Plants in the sun grow taller than plants in the shade.

Prediction:
- I predict that if I put a plant in a dark room, it will grow more slowly than one in sunlight.

Puddle

Prior Knowledge:
- I know that heat speeds up evaporation.

Observation:
- A puddle dries up faster in the sun than the shade.

Prediction:
- I predict that if I leave a cup of water outside in the sun it will evaporate faster than the cup of water left inside.

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Scientists don't just rely on one observation, because it could be a mistake or an outlier.

Scientists think about how they will use the data and decide how much is needed to make accurate conclusions.

They compare multiple observations to make sure the information is accurate and to find patterns.

Why is Comparing Important?

SEEING CHANGES OVER TIME

Observing something just once often doesn't give us reliable results. Scientists observe things over time to see how things change.

DIFFERENT PERSPECTIVES

Different scientists might observe the same thing, but describe it differently. By comparing their observations, they can check for accuracy, notice more details, and make better conclusions.

Outlier - Something in a set of results that really stands out — it's much bigger, smaller, or just very different from the others.

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When scientists observe something they need to make sure they test fairly.

Imagine you're growing two harakeke (flax) plants — one in the sun and one in the shade.

- You notice the one in the sun grows taller. Why do you think that is?
- Could it be because of the sunlight? Or could there be other factors involved, like the type of soil or the amount of water?

Scientists ask questions like this all the time.

To find out what is really causing the difference, they change and test one variable at a time while keeping everything else the same.

This is one way to help them understand which factor is making the difference and gives the confidence in their conclusions.

Test fairly - A fair test is where scientists only change one variable at a time, and all other conditions are kept the same to make the results reliable.

Factors - Anything that might change the outcome of an investigation — like sunlight, water, or temperature when growing a plant.

Variable - The one factor the scientist decides to change or measure on purpose to see what happens in an experiment.

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Let's look at an example to see why comparing multiple observations really does matter. Imagine you and a friend are told to describe the same bird that you are observing.

Your Observation Notes	Your Friend's Observation Notes
• The bird is small.	• The bird is tiny.
• It has blue feathers.	• It is light blue.
• A short beak.	• Has a small pointed beak.
• It has skinny legs.	• It has thin legs.
• Has big circle eyes.	• Eyes are round.

Are your descriptions the same? Not quite.

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No two people will describe something in the exact same way.

This is why scientists collate and refine their observations.

They double check their work, share their findings, and sometimes use tools like magnifying glasses or microscopes to look at finer details.

Scientists also repeat their observations to gather more sets of data, which helps them to make more accurate conclusions.

Collate - Collect and organise information in a way that makes it easier to understand or compare.

Refine - To improve something by making small changes, so it becomes clearer, better, or more accurate.

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Scientists don't just look at things once—they look for patterns and ask questions like what, where, when, how, and why something happens. This is called analysing.

When scientists analyse their data, they try to make sense of what they have observed.

They look for patterns and trends to help explain what is going on. This helps them go beyond just noticing something, it helps them to understand it.

Analysing - To carefully examine information or observations to identify patterns, relationships, or meanings.

Trends - When something in your data keeps going in the same direction — like getting bigger, smaller, faster, or slower.

Lets take a look at an example of how scientists analyse their data.

In a study conducted by Massey University, a group of scientists were studying the kākāpō.

The kākāpō is a rare native parrot that lives in Aotearoa.
The scientists noticed the kākāpō birds didn't lay eggs every year.

At first, they thought the birds were just choosing not to breed. But after analysing the data they saw a pattern.

Scientists found that kākāpō only laid eggs in years when rimu trees had lots of fruit. Rimu trees produce their fruit all at once, usually every 2-4 years. This is called a mast year.

Image sourced from the Department of Conservation New Zealand, by photographer Theo Thompson.

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This helped the scientists understand that the rimu fruit are an important food source for kākāpō birds, and their chicks.

They concluded that the timing of rimu mast years directly affects when kākāpō can successfully breed. By noticing this pattern in the data, scientists were able to better understand and could take action to help the kākāpō.

Now in the years that rimu don't produce much fruit, scientists provided extra food to support the kākāpō and help them with egg laying.

Image sourced from the Department of Conservation New Zealand, by photographer Theo Thompson.

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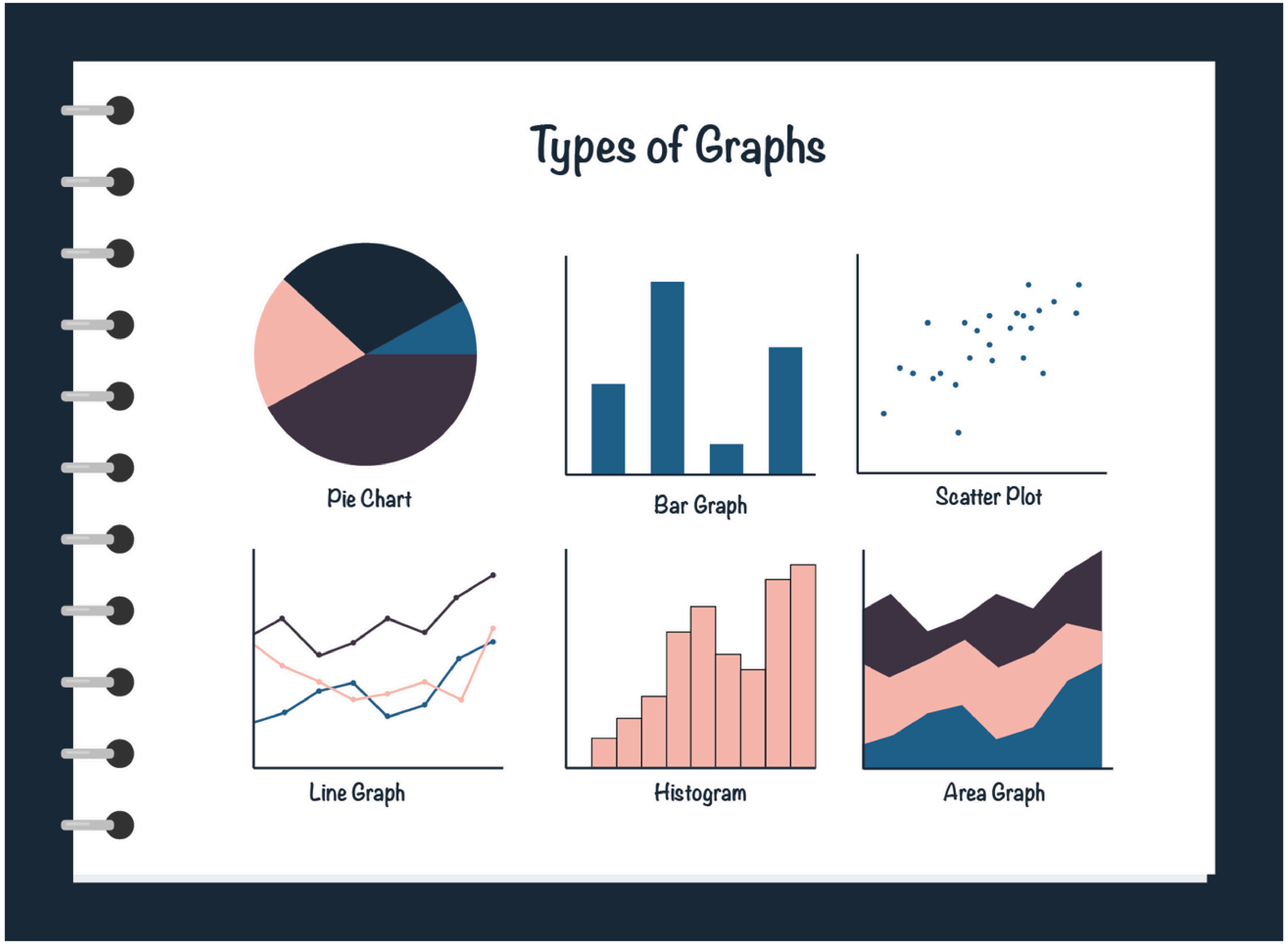
Scientists often use graphs to help them analyse data, especially when they have lots of measurements over time

Graphs turn numbers into something visual, making it easier to spot patterns and compare results.

Graphs can show things like:

- Changes over time (increases and decreases).
- Comparing differences between groups.
- Links between causes and effects.

Once scientists have analysed their data, they form conclusions.



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A conclusion is an explanation based on the data that scientists have observed and tested.

They then share it with other scientists to critique, test and see if they get the same conclusion.

In the kākāpō example, the scientist formed the conclusion that rimu fruit is essential for breeding. This conclusion was based on what the data showed.

After forming a conclusion, scientists share their findings with others.

Other scientists can test the idea again to see if they get the same result. If they do, the conclusion becomes more reliable.

Image sourced from the Department of Conservation, by photographer Jake Osborne - Kākāpō Sinbad feeding at a smart hopper.

Critique - To carefully check and give feedback on something to see how good it is and how it could be improved.

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Observations might focus on one small thing – but they can help you understand much bigger ideas.

Scientists always ask themselves, "How does this fit into a bigger picture?"

They don't just observe — they think about how their observation fits into a larger scientific concept or idea.

For example:

- If you see birds eating seeds, it might tell you something about the food chain.
- If you watch water move in a puddle, it might help you understand how rivers flow or how the water cycle works.
- If you notice a tree losing its leaves in autumn, it can help you understand how plants survive different seasons.

Scientists zoom in to observe, then zoom out to see the big picture.

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Ka pai ākonga!

Here are a few things to take away from this akoranga:

- Observation is a key skill in science that uses the five senses (sight, smell, taste, touch, and hearing) to gather information about the world around us and helps scientists make accurate observations that lead to new discoveries.
- Recording observations is important as it helps scientists remember details, compare results over time, share their findings with others, and to build their knowledge.
- Scientists use different methods for recording observations, which can include writing descriptions, tables, and detailed drawings, photographs of diagrams.
- Scientists make direct observations using their senses with or without tools, and indirect observations using secondary data like video recordings or articles.

Glossary

Observation	The process of carefully noticing and gathering information using senses or tools, to understand the world.
Prediction	A statement about what scientists think will happen, based on their prior knowledge or something they have observed.
Variable	Something you can change or measure in an experiment.
Analyse	To carefully examine information or observations to identify patterns, relationships, or meanings.
Conclusion	An explanation or understanding based on the data and observations scientists have collected.

He mihi (Acknowledgements)

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