# SCIENCE IN ACTION

Stage 4 & 5: Science; Working Scientifically Skills
SC4-4WS, SC4-6WS, SC4-9WS, SC5-4WS, SC5-6WS, SC5-9WS

Observation drives scientific investigation and central to scientific inquiry is the idea that evidence forms the basis of defensible conclusions. Through the processes of scientific inquiry, scientists develop answers to questions and improve explanations for phenomena in the natural world.

**Key Inquiry Question - How does observation instigate scientific investigation?**

# PROJECT OUTLINE

## AT SCHOOL

Students will:

- learn about well known scientists who have made a big impact on the world by 'working scientifically'. What was it that made them successful and how have they contributed to science?
- increase their understanding of what constitutes the scientific method by examining research undertaken atTaronga Zoo.

## AT THE ZOO

Students will:

- choose their favorite animal at the Zoo to carry out an Ethogram. They will use this data to form an inquiry question they would like to explore further.

## ZOO WORKSHOP

The inquiry experience will guide students to use their senses for effective scientific animal observations and data collection. These observations will form the basis for making predictions, formulating hypotheses and drawing valid conclusions, which are evidence-based. Students will work authentically like a scientist, in one of the three habitat classrooms.

## BACK AT SCHOOL

Students will:

- review the science skills they applied at the Zoo by considering the animals that live around their school.
- consolidate their observation, data collecting and hypothesising skills by planning and conducting a scientific investigation based on a local species.
- share their investigation and results with other budding scientists in their school.

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# AT SCHOOL - BEFORE THE ZOO

How does observation instigate scientific investigation?

## AMAZING SCIENTISTS

Learn about well known scientists who have made a big impact on the world by 'working scientifically', such as observing animals in the wild like Jane Goodall or Charles Darwin.

- What was it that made them successful?
- What made them curious scientists?
- What skills do they have that assist them to be successful scientists?
- What did they do in their career that demonstrated working scientifically?

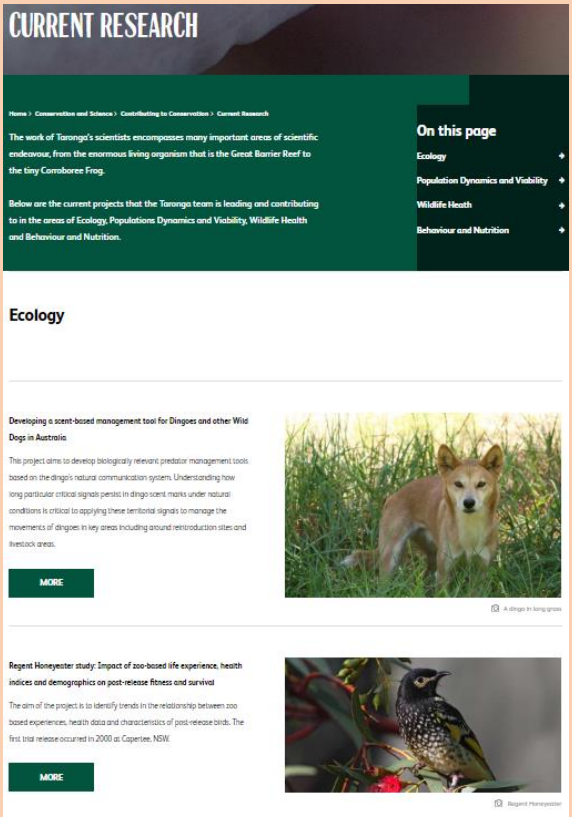
Watch this introduction video on 'How Jane Goodall Changed the Study of Animal Behaviour'.
https://bit.ly/2RPTpIx

## SCIENTIFIC RESEARCH METHOD

Watch this 3 minute introduction video about the Scientific Method (PBS learning media)
https://bit.ly/2CP3Asw

Explore the Taronga Zoo website and choose one animal that Taronga Zoo is researching.
https://taronga.org.au/conservation-and-science/current-research

Apply Consider the scientific method to conduct and complete the Scientific Method worksheet (on page 4), filling in all bubbles with details for your chosen animal.

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# SCIENTIFIC METHOD EXAMPLE - PORT JACKSON SHARK

**Make observations**

There are many Port Jackson (PJ) sharks living in the waters of Jervis Bay

**Construct hypothesis**

PJ sharks are social animals and aggregate in groups

**Test with experiment**

Put acoustic trackers on PJ sharks to monitor their movements and determine who is 'hanging out' with who

**Draw conclusion**

PJ sharks have ongoing/ stable relationships with other PJ sharks and they stay in the same group for some time

**Accept/ reject hypothesis**

PJ sharks do appear to be social and aggregate in groups

**Report results**

Results are being used by Taronga zoo scientists, university researchers and other organisations to determine how PJ shark populations should be managed and protected. More research and hypotheses continue to be carried out on PJ sharks

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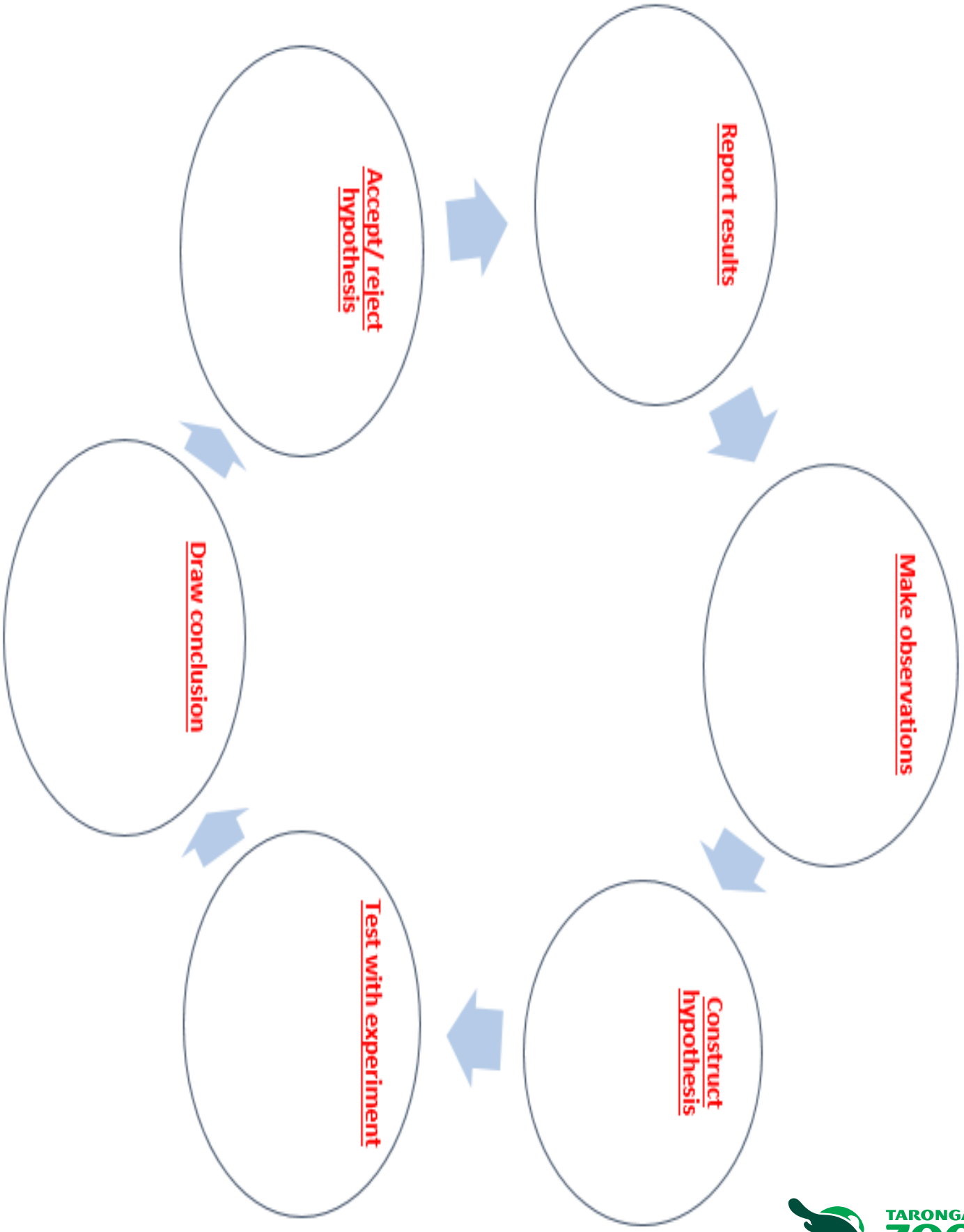
# SCIENTIFIC METHOD FOR YOUR CHOSEN ANIMAL

Choose an animal that has been / is being studied by Taronga Zoo and complete the scientific method to develop and test a hypothesis.

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# AT THE ZOO

How does observation instigate scientific investigation?

## ETHOGRAM OF YOUR FAVORITE ZOO ANIMAL

(self guided)

**Your goal today is to learn something about the behaviour of your favourite animal in the Zoo by collecting data, formulating a question and answering that question.**

1. **Walk around** and appreciate the variety of animals in the Zoo.
2. **Working with a partner, choose an animal**, or group of animals, that you will observe for the next 5 minutes. Keep in mind that large charismatic animals are often inactive, birds and small mammals are often more active.
3. **Watch everything they do**, where they move to, who they interact with, whether they like to be in high places or low places.
4. **Formulate a question** with your partner that you would like to answer e.g. What is the most common activity Chimpanzees like to do ?
5. Using the **ethogram** template provided, complete the details about your animal at the top and allocate roles. Who will be the time keeper, who will record, both will need to observe.
6. With your partner **begin collecting and recording data** in your ethogram.
7. **Analyse your data** to assess whether you can answer your scientific question.
8. Did the data collected **answer your scientific question?**
9. As a **scientist** what would be your next step?

## EXPLORE (self guided)

Explore the Zoo to find your favorite animal, Use the instructions and Ethogram template provided on page 6 to guide your investigation. Make it your goal to formulate a scientific question. Use your data to support the answer to your question.

## CONNECT (workshop)

Observation is the starting point for any scientific investigation as it leads to questions, testable hypotheses and eventually theories. Scientist use this process all the time to answer scientific questions about the world we live in. In the Zoo workshop we learn about the scientific skills needed to conduct good scientific investigations by looking at a real-life example. You will then apply those skills to develop some questions and hypotheses of your own.

Develop a hypothesis for a mini investigation with an animal in the zoo habitat classroom. Observe the animal and complete an ethogram. Discuss the results and what investigations could be done in future to ensure it is a more fair and valid research experiment.

Taronga staff will deliver animal encounters in the habitat classrooms to support your investigation.

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# ETHOGRAM SCAFFOLD

Locate your chosen animal and complete each task as indicated below. This task is best done in pairs so that you can capture all the behaviours as well as keep an eye on the time.

| Name of Observers: | Date: |
|---|---|
| Animal/species observed: | |

Inquiry Question: _____

_____

*E.g. How much time do chimpanzees spend resting and sleeping?*

| Ad lib sampling – duration **5 minutes** | Focal sampling – duration **5 minutes** |
|---|---|
| **For <u>all</u> animals in the enclosure, record all observed behaviours.** | **Now choose only <u>one</u> animal in the enclosure.**<br>In this column, tally **how often** your chosen animal exhibits the behaviours recorded in the first column. |
| Start Time: End Time: | Start Time: End Time: |
| *eg social interaction* | 𝍸 \|\| |
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# AT SCHOOL-AFTER THE ZOO

Students are able to further develop their scientific skills through deeper investigations at school.

## APPLY YOUR KNOWLEDGE

### RECORD AND OBSERVE

Using our zoo workshop 'Animal Characteristics Worksheet' (see next page, p8), **observe** and **record** information on animals found around your school grounds.
Record their characteristics, as well as the survival benefit.
As you did in the workshop – determine whether or not the animals have similar characteristics, and why this characteristic may appear in these animals.


### BIODIVERSITY AUDIT

1. Conduct a Biodiversity Audit in the school grounds, and even at home! Use resources such as the Rumbalara EEC resource provided on the 'resource' page.
2. Collate your data, and record your findings on Atlas of Life Australia https://www.ala.org.au/
3. Using Atlas of Life Australia, 'Explore by Location' and discover what other fauna and flora has been sighted and recorded in your local area
4. Analyse the data collected – are the any questions that arise from your investigations? Is there a specific species of animal that is very prominent in your schools grounds?
5. From your analysis and further questioning, create a hypothesis and test it. *Example: Birds that are generalist feeders are more common in urban environments.*

### CONDUCTING A FAIR TEST ACTIVITY

(recommended for Stage 4)

Your students can further develop their understanding of conducting a fair test particularly when testing a hypothesis.
Scootle has a range of examples on different fair tests. Scootle explains what a fair test is and how to set it up.
http://www.scootle.edu.au/ec/viewing/L540/L540/index.html#

### I WONDER...

Think back on an "I wonder…" question you had during your Zoo workshop. With the use of the scientific method, how can you find the answer to your question?
Can you change your "I wonder…" question into a testable hypothesis?

### COMMUNICATE

Communicate your results from any of the Ethogram and other observation activities done at the Zoo or at school to the greater community by creating a Google Site, a video, a podcast, a photo with caption for Instagram, etc. Taronga would also love to be sent your results to see what you have done!

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# ANIMAL ADAPTION WORKSHEET

## Habitat Type: Desert/ Woodland/ Rainforest

List the animals that you would expect to find in this habitat and the characteristics that make it suited to this habitat. The first one is an example of an animal found in the woodland.

| Animal | Adaption (characteristic) | Survival Benefit |
|---|---|---|
| *eg. superb parrot* | *Strong, curved beak* | *Can crack hard nuts found for food* |
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1. Identify the most commonly occurring adaptation. What is it and why do you think that adaptation is common for this habitat?

_____

_____

2. Turn your answer in Q1 into a testable hypothesis and write in the space below.

_____

_____

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# RESOURCES

Online science program for years 7 to 10

https://www.sciencebydoing.edu.au/

Jane Goodall profile

http://www.janegoodall.org/

How Jane Goodall changed the study of animal behaviour

https://mass.pbslearningmedia.org/resource/nat16.sci.lisci.goodall/how-jane-goodall-changed-the-study-of-animal-behavior/#.Ww-NkUpuLIV

The Scientific Method

https://mass.pbslearningmedia.org/resource/ketae.sci.method/the-scientific-method/#.Ww-Q4kpuLIU

Taronga Zoo animal research

https://taronga.org.au/taronga-science

Port Jackson Shark research on Catalyst

http://www.abc.net.au/catalyst/stories/3852523.htm

Australian Museum Woodland Habitat:

https://australianmuseum.net.au/image/woodland-habitats

Australian Museum Arid Habitat:

https://australianmuseum.net.au/image/arid-habitats

Atlas of Living Australia:

http://www.ala.org.au/
https://www.ala.org.au/education-resources/

Catalyst program

http://www.abc.net.au/catalyst/stories/4136241.htm

Smithsonian – leaf margin analysis:

http://www.smithsonianeducation.org/idealabs/prehistoric_climate_change/index.htm

Smithsonian In Your Classroom lesson plan:

https://learninglab.si.edu/collections/prehistoric-climate-change-and-why-it-matters-today/djh0bq5kFaghmqTd#r

Scootle: Conducting a fair test

http://www.scootle.edu.au/ec/viewing/L540/L540/index.html#

# SYLLABUS LINKS - SCIENCE

**STAGE 4**

**QUESTIONING AND PREDICTING**
**OUTCOME**
**A student:**
identifies questions and problems that can be tested or researched and makes predictions based on scientific knowledge SC4-4WS
**CONTENT**
WS4 - Students question and predict by:
- **a.** identifying questions and problems that can be investigated scientifically (ACSIS124, ACSIS139)
- **b.** making predictions based on scientific knowledge and their own observations (ACSIS124, ACSIS139)

**CONDUCTING INVESTIGATIONS**
**OUTCOME**
**A student:**
follows a sequence of instructions to safely undertake a range of investigation types, collaboratively and individually SC4-6WS
**CONTENT**
WS6 - Students conduct investigations by:
- **a.** collaboratively and individually conducting a range of investigation types, including fieldwork and experiments, ensuring safety and ethical guidelines are followed (ACSIS125, ACSIS140)
- **e.** recording observations and measurements accurately, using appropriate units for physical quantities

**COMMUNICATING**
**OUTCOME**
**A student:**
presents science ideas, findings and information to a given audience using appropriate scientific language, text types and representations SC4-9WS
**CONTENT**
WS9 - Students communicate by:
- **a.** presenting ideas, findings and solutions to problems using scientific language and representations using digital technologies as appropriate (ACSIS133, ACSIS148)
- **d.** constructing and using a range of representations to honestly, clearly and/or succinctly present data and information including diagrams, keys, models, tables, drawings, images, flowcharts, spreadsheets and databases

**STAGE 5**

**QUESTIONING AND PREDICTING**
**OUTCOME**
**A student:**
develops questions or hypotheses to be investigated scientifically SC5-4WS
**CONTENT**
WS4 - Students question and predict by:
- **a.** formulating questions or hypotheses that can be investigated scientifically (ACSIS164, ACSIS198)
- **b.** predicting outcomes based on observations and scientific knowledge

**CONDUCTING INVESTIGATIONS**
**OUTCOME**
**A student:**
undertakes first-hand investigations to collect valid and reliable data and information, individually and collaboratively SC5-6WS
**CONTENT**
WS6 - Students conduct investigations by:
- **a.** individually and collaboratively using appropriate investigation methods, including fieldwork and laboratory experimentation, to collect reliable data (ACSIS165, ACSIS199)
- **e.** reporting data and information, evidence and findings, with accuracy and honesty

**COMMUNICATING**
**OUTCOME**
**A student:**
presents science ideas and evidence for a particular purpose and to a specific audience, using appropriate scientific language, conventions and representations SC5-9WS
**CONTENT:**
WS9 - Students communicate by:
- **a.** selecting and using in presentations, for different purposes and contexts, appropriate text types including discussions, explanations, expositions, procedures, recounts or reports
- **b.** selecting and constructing an appropriate table, type of diagram, table or graph (histogram or sector, column or line graph) to present information and show relationships clearly and succinctly using digital technologies as appropriate
- **e.** presenting scientific ideas and information for a particular purpose, including constructing evidence based arguments and using appropriate scientific language, conventions and representations for specific audiences (ACSIS174, ACSIS208)