

Turtle Health Research
Animal Husbandry and Behaviour
Student Manual
JCU BIOMEDICINE



Student name: _____

School: _____

Supervisor: _____

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Introduction

Timetable

	Monday	Tuesday	Wednesday	Thursday	Friday
8:00-10:00	Welcome (9:00)	Husbandry	Husbandry	Husbandry	Husbandry (7:00-9:00)
10:00-10:30	Induction Tutorial: Experimental Design	Break	Break	Break	Student Presentations
10:30-12:00		Research	Research	Research	
12:00-12:30	Break	Break	Break	Break	BBQ
12:30-13:30	(1400) Presentations Bethany & Jess: Intro to turtles	Presentations Erin & Eloise: Islands and turtles	Presentation Becky H- Pollution	Presentations Erica- Turtle Conservation	Finish Time
13:30-16:00	Research	Research	(1400) Tutorial: Science Communication	(1400) Research Symposium	
	Finish Time				

Expectations

Have a go!

Read the manual

Be prepared to get wet

Complete the work

Do extra online research into your topic

Create a PowerPoint presentation about your project & experience.

The Project

What is Biomedicine?

BIOMEDICINE = MEDICAL SCIENCE + BIOLOGICAL SCIENCE

The discipline of Biomedicine is a multidisciplinary hub within the College of Public Health, Medical & Veterinary Sciences, in the Division of Tropical Health and Medicine at James Cook University. Biomedicine is a branch of life sciences which closes the gap between natural sciences and industry by applying principles from biology and other science disciplines. Biomedicine graduates contribute to the diagnosis and treatment of disease, by working in academic research, or the medical industry. The aim of JCU Biomedicine is to bring together the North Queensland community, researchers in biology and medicine, clinicians and health workers from across the northern region. The result being collaborate research has implications for the prevention, detection or treatment of diseases relevant to Indigenous health and our tropical communities.

What is JCU Turtle Health Research?

The Turtle Health Research (THR) team is a group of passionate researchers and volunteers interested in bridging the gaps in turtle health. Turtle Health Research works alongside of indigenous communities, rangers, government agencies, non-government and volunteer organisations to study these long-lived, ancient animals. It is very difficult to study marine animals because they are not conveniently accessible to us all the time; the team's research facility, fondly named the Caraplace, has offered a unique opportunity to study these animals up close and personal.

The Caraplace is currently home to 35 green sea turtle hatchlings, *Chelonia mydas*. The team has been able to observe and analyze a life phase of which very little is known. Once hatchlings emerge from their nest and make their way to the sea, they are not seen again until they are several years old and much larger. So far, the research team has investigated their immune system response, colour preference, response to exercise, and reaction to enrichment devices.

The ultimate aim of conducting research within the group is to reveal health information about these animals that allow us to diagnose and treat them when they need it most. In 2011, Cyclone



Yasi decimated sea grass beds, the primary food source for green sea turtles, in the Queensland region causing total turtle patient inundation at rehabilitation centers. Rehab centers needed help and quickly. There was no way to accurately diagnose and treat the diseases that they had and ultimately many turtles were lost. By assessing healthy, wild populations we can obtain healthy baseline parameters and subsequently pin-point disease amongst turtle patients in the future.



Research Immersion Project

Students have the opportunity to aid in a preliminary study focusing on long-term memory potential in green sea turtle hatchlings, *Chelonia mydas*. There have been several studies investigating memory in other species of turtles, but very few on sea turtles. There is a lot of interest in deeply understanding how sea turtles are able to migrate long distances between foraging and nesting sites over their lifetime. Many theories emphasize their use of magnetic, visual, and olfactory cues to find relevant sites as adults, but there are many unknowns about the post-hatchling phase as a whole.

The students' role will be to help with the set-up, execution, and analysis of a pilot study investigating memory. The project involves repetitive training sessions with the use of an enrichment device and a food reward to test memory. The turtles will be introduced to an enrichment puzzle, trained how to use it, and tested after several months of no interaction. This pilot study is necessary in order to confirm the effectiveness of the proposed enrichment device and project design. The students will leave this experience with the understanding and appreciation of the work and thoughtfulness that goes into designing a research project.

The Aim of your project:

- On top of aiding in a real research project, the students will investigate their own topic of interest while learning alongside from sea turtle researchers that have worked in the field.



Sea turtle memory potential

What is already known about turtle memory?

Turtle health also encompasses overall well-being, which is why THR is interested in enrichment devices and their ability to learn. This means that we can examine how to keep a turtle entertained and enriched while in our care. We have observed that turtles at the Caraplace can interact with novel puzzles and “toys” that encourage natural behaviours. It’s important to us that our turtles are treated with the highest standards while investigating their health-related characteristics that we otherwise wouldn’t be able to learn without the turtles in captivity.

A lot of literature exploring the theories of turtle memory are focused on how turtles navigate the ocean to get to their nesting beaches. It is believed that turtles use the Earth’s magnetic field, the sun, olfactory cues, and visual recognition. In addition, it has been suggested that reptiles are studied less frequently than other classes of animals in cognitive studies. Most published works on turtle memory and enrichment has been conducted on freshwater turtles and several tortoises; however it has been suggested that juvenile green sea turtles can remember how to solve a simple puzzle up to six weeks after not interacting with the device. It is intriguing to think about how such a small, young turtle learns from its surroundings and survives in the open ocean. Can a sea turtle riding an oceanic current remember novel things that it so infrequently encounters?

Why is understanding memory potential important?

Knowing if a hatchling can recollect how to solve a simple device after a prolonged absence can help us piece together the cognitive development of hatchlings in the open ocean. A sea turtle may encounter a plethora of different predators, marine animals, plants, plankton, and even garbage; can hatchlings learn from these interactions quickly or are they so naïve that they may be gobbled up easily? Can hatchlings learn and remember that something they come across infrequently is a food source after not stumbling upon it for a long time? Unfortunately, these are questions are hard to answer in the wild, but we can evaluate their capabilities experimentally in a lab or aquarium setting.

Rehabilitation centers and aquariums may keep sea turtles for a prolonged period of time. Rehabilitation centers do not typically house turtles for any longer than they have to; their ultimate goal is to release them in a better state than how they came in. Turtles temporarily staying at rehabilitation facilities should never get used to receiving “free” food because that is certainly not the case in the ocean; however in order for them to recover sometimes that may be the case for a time. Once the turtle is healthy enough to participate with enrichment devices, the turtles should be challenged to get food. Vets and rehabilitators may be able to use learning and memory success as a tool for assessing whether or not a turtle is ready to be released.

On the other hand, aquariums may be home for their display animals for their entire lives. It is important to ensure that their quality of life mirrors that of what they experience in the wild. If we begin to unlock and understand the cognitive capability of turtles, caretakers could apply this



knowledge into their enrichment programs. Providing a variety of enrichment devices to turtles offers them the opportunity to learn and act like a wild turtle.

We're lucky enough to be able to study sea turtle hatchlings at the Caraplace, so let's take advantage of learning as much as possible from our mysterious reptiles! Can hatchlings remember how to solve a simple device after a prolonged period of absence?

What are you going to be doing?

Students will attend husbandry, participate in the set-up and execution of a preliminary research project, attend presentations from turtle researchers, and presentations provided by the Research Emergence Program.

1. Husbandry starts Tuesday through Friday from 8-10 AM including tasks such as:
 - a. Enclosure cleaning
 - b. Feeding
 - c. Scrubbing hatchlings
 - d. Data collection
2. Aid in a preliminary research project focusing on training the hatchlings to investigate memory potential
 - a. Set up devices
 - b. Record and analyse data
3. Attend several presentations provided by turtle researchers within the university
4. Research a topic of interest on sea turtles with tips from post graduate students
5. Give a PowerPoint presentation on your findings & experience in the program (refer to [Appendix B](#) for Presentation Outline).



Common Techniques in Husbandry

Hygiene and Biosecurity

Daily hygiene is essential to the health of the volunteers and sea turtles and no we're not exactly talking whether you shower or not! Personal hygiene refers to cleanliness your extremities and your head; hands and arms are always scrubbed prior to touching anything in the Caraplace, changing into lab shoes, and wearing a hair net. We can minimise our affect on the turtles and their environment by scrubbing our hands of our human bacteria. On the other side, we can certainly get germs from turtles too; therefore, it's important to wash our hands frequently throughout our tasks and at the end of husbandry. Biosecurity encompasses these techniques with the intention of keeping humans and turtles healthy. Follow these steps immediately upon starting your shift.

Step 1: Before touching anything inside the Caraplace, change your shoes for a pair of Crocs that remain within the Caraplace. Take off all jewellery and leave it behind in the lockers provided. Put on a reusable hair net which are located in the office close to the lockers.

Step 2: Wash and scrub your nails and hands all the way up to your elbows with disinfecting soap or detergent (Figure 24).

Step 3: Check the white board for any important announcements, even if your team leader has verbally communicated any changes to you. Also, check the daily task sheet that your team leader will make available to all volunteers. This sheet is used to tick completed tasks and can be found in the "Daily Task Sheet" folder in the meeting room.

Please be advised that the tasks are always referred to by SYSTEM. It doesn't matter what turtles are being kept in that system. Only refer to individual turtles when recording behaviour.

Step 4: set up a series of wash baths for equipment to be rinsed with fresh water (Figure 26). These tubs can be found drying on the walking platform next to the sink. Typically, four rinse bins are placed on top of two other tubs to ease your back. The sink is plugged with the stopper and filled with detergent to clean any equipment. Make sure to use the scrubbing brush if it is appropriate.

Now you are ready to begin the day's duties!



Figure 24. Upon entering the Caraplace, scrub and wash your hands, nails and arms with the soap provided. Scrub up until your elbows because your arms are likely to be submerged in the tanks. Scrub underneath your nails because to reduce the spread of harmful bacteria.



Figure 26. Set up the rinse bins to get ready to wash equipment according to proper protocol (refer to *Rinsing Equipment*).

Introduction to sea turtles

A basic understanding of sea turtle anatomy will help identify a turtle's species. The Carapace is currently hosting green sea turtles, *Chelonia mydas*.

All species of sea turtle share some basic anatomy. They all have 4 flippers, a beak-like mouth, and a shell called a carapace. The front flippers are used for propulsion through the water and the hind flippers provide stability and direction. The hind flippers are also used by females to dig nests on the beach when laying eggs. Their external skeleton is for protection and support of the turtle's internal organs and the internal skeleton is to help maintain a sea turtle's shape. It is divided into two parts: the carapace (top half, dorsal) and the plastron (bottom half, ventral).

However, even these basic similarities differ between species. Every species, except for leatherback sea turtles (*Dermochelys coriacea*), has a carapace covered in a series of horny plate structures called scutes. Unlike the other six species of sea turtles, leatherbacks have parallel ridges running from front to back. Each species has a particular number of scutes on its carapace. Central scutes are located in the middle of the carapace and run from front to back; each species has a different number of central and costal scutes, although species like *C. mydas* and *Eretmochelys imbricata* have the same number of costal scutes. Thus, counting scutes can be used to help identify a sea turtle, but isn't the only method for determination. They also have different numbers of scales on top of their snouts called the prefrontal scutes. Although they all have a carapace, the shape and the colour will be different between species and can help clue in to species identity.

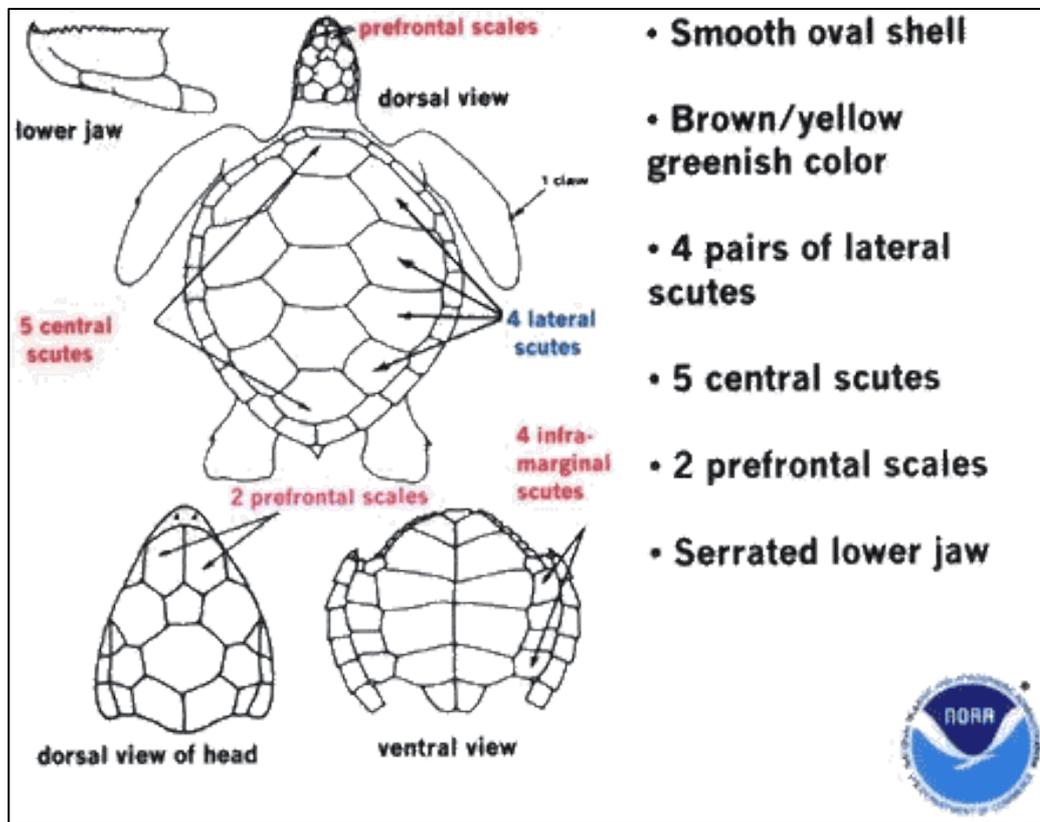


Figure 15. Green Turtle Identification Guide (NOAA Fisheries, Galveston Laboratory).

As previously mentioned, the most basic way to identify a sea turtle is to count the number of central (vertebral) or lateral (costal) scutes. A green sea turtle's carapace will have five central scutes and four lateral scutes (Figure 15). You can also count the number of prefrontal scutes on top of their head. A green sea turtle's has two prefrontal scutes (one pair). Hatchlings will have an oval shaped shell that is black, with a white edge. Juveniles are brown/yellow, while adults are olive or gray-green. Once they're adults, their carapace will have speckles of brown and yellow creating a starburst or firework pattern. The plastron also changes colours as the turtle gets older; as a hatchling, it is bright white and will turn creamy yellow as it grows.

Their mouths will differ and are a good indicator of their diet in the wild. Smooth, broad beaks indicate the species is mostly herbivorous, while carnivorous species have serrated and pointed beaks. However, sea turtles in general are opportunistic foragers and can get them into trouble. At the Caraplace, we take special care to ensure that nothing unnatural or harmful can be ingested. A sea turtle's esophagus is lined with papillae. These structures aid in the movement of food towards the stomach and towards the stomach only. This means that turtles aren't able to regurgitate anything ingests.

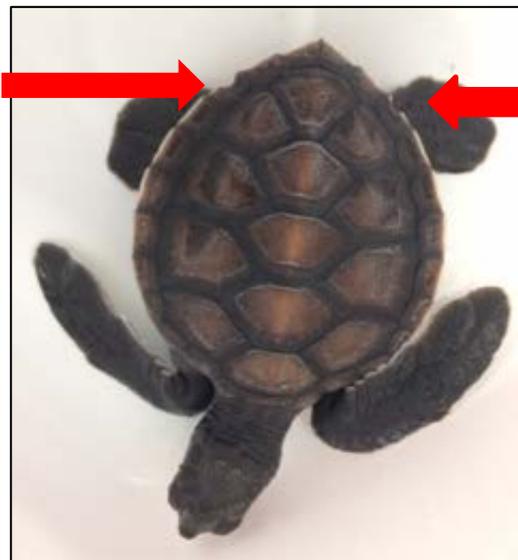


Identification of Carapace Turtles

In order to help ensure the safety and protection of our turtles, the Carapace has a unique identification system for each turtle you handle. A notch system has been utilized to correctly identify each turtle with the correct system. Using this technique guarantees that turtles stay in their appointed tanks and system to avoid cross contamination. It is simple to decipher the notches and appointed system once you get the hang of it. When a turtle is taken out of its designated tank for any reason, it is important to know where the turtle belongs.

- First, hold the turtle so that its head is facing you, carapace is facing up, and the tail is facing away from you. From here you will notice notches on both sides of their carapace. These notches indicate the letter of the system (A,B,C,D,E,F,G,H) and the number (1,2,3,4,5,6) within that system that they belong in.
- Second, identify the marginal scute that is missing which indicates the letter of the system. Start at the caudal end (tail end), move cranially (towards the head) down the dexter (right) side of body of their carapace to where the notch is located. This notch indicates the letter of the system they belong to. Please pay special attention to G and H system turtles; both systems have double notches on their alphabetical side.
- Third, count numerically from the caudal (tail end) towards the head on the sinister (left) side of the body to the notch to determine the number in that system. The notch in which you stop on signifies the number turtle. This will tell you which tank in the system the turtle belongs in. If you are unsure of which turtle you are handling, ask someone to clarify. Refer to Figure 16 for an example of turtle identification.

Letter: C



Number: 3

Figure 16. Every turtle is identified by the notches on their carapace. When the turtle is facing you, read the letter of the system first (dexter) and then the number (sinister).



Handling turtles

Proper handling techniques are very important at the Caraplace because the safety of volunteers and turtles are a priority. Turtles may be handled every day, but we only handle them when it is necessary. The days that involve basking, scrubbing, weighing, and inspecting require more handling than usual, but it's important to reiterate that handling is to be kept to a minimum. Additionally, handling the turtles safely and correctly alleviates unnecessary stress. It is important to recognize signs of stress, which will be covered in later.

Like other reptiles, sea turtles appear to be calm when they have a bit of pressure applied to their carapace and head. It is thought that this makes them feel secure. Ensure that when you're handling them, the majority of your palm is underneath their bodies and use your fingers to secure their flippers (Figure 17). You can place your fingers underneath their chin and between their flippers. If you do this, they tend to move less. We offer them another level of security by holding their head or having a finger under their chin (Figure 18). Securing their flippers also protects you from any potential harm. **It is important to emphasize that securing them does not mean to restrain them forcefully. At this size, it is easy to overpower and hurt them.** These techniques may start to become difficult as they get bigger. It is suggested to hold the turtles over their tank (if you are scrubbing them) or over a towel (when you are weighing them) as an additional safety precaution. If you do not feel confident in your holding techniques, ask for advice from your team leader. Please remember to prioritize your and the turtles safety first.

There are some tasks that involve handling the turtles on their "backs," such as inspecting their bodies and scrubbing their plastron. Although you have to be careful when handling the hatchlings during any job, it's vital to be especially aware when you are holding them in a position that isn't natural for them. We have found that gently placing a finger (likely the thumb in this case) on their chin stops them from moving when they are having their plastron scrubbed (Figure 19). The less they move the more quickly and efficiently we can complete the task. It is also suggested that larger sea turtles do not like being on their backs because they cannot breathe properly; although the hatchlings are small, for these activities angle their bodies more upright rather than completely horizontal.

Use the photos on the next page as a guide for when you are handling the hatchlings!

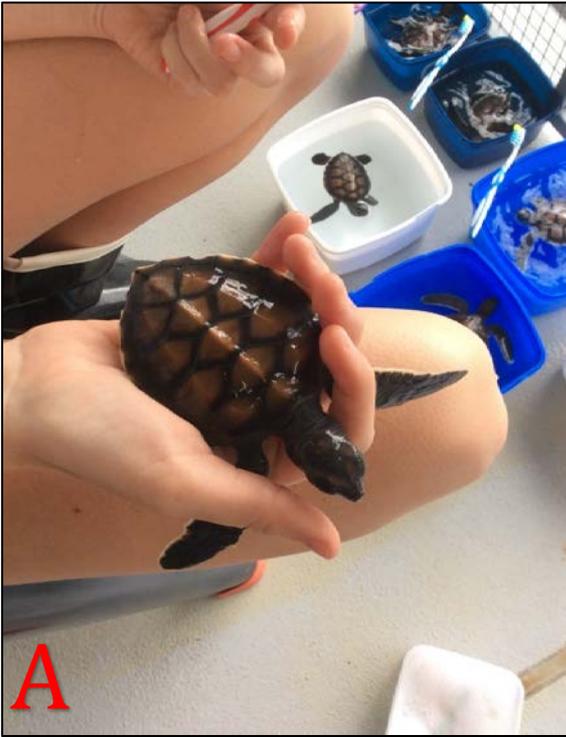


Figure 17. Always hold the turtle securely when handling them. A) Smaller turtles may still fit in your palm quite easily, but B) some turtles are too large for your hand. If this is the case ensure that as much of your palm is under them as possible. Use your fingers to secure their flippers. **DO NOT FORCEFULLY OVERPOWER THEM.**



Figure 18. Place your finger underneath their chin to support their head.

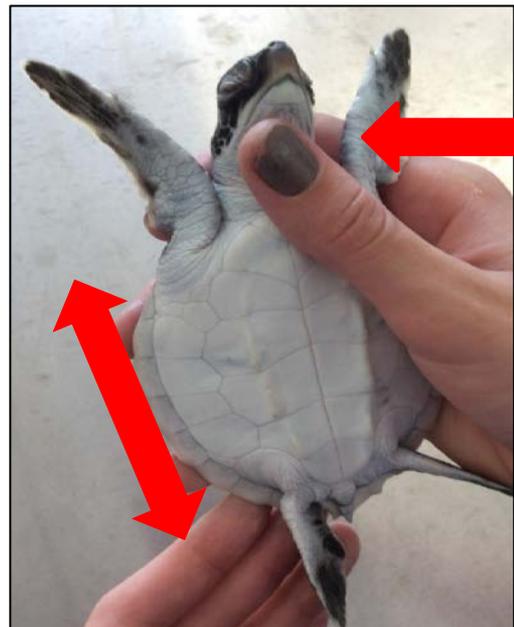


Figure 19. When a turtle is on its back, hold them on an angle and placing a finger (likely the thumb) on their chin tends to calm them down. Do this GENTLY.



Appendix

A – Recommended Readings and References

Bryant, Z., & Kother, G. R. A. N. T. (2014). Environmental enrichment with simple puzzle feeders increases feeding time in fly river turtles (*Carettochelys insculpta*). *Herp. Bull.*, 130, 3-5.

Burghardt, G. M. (2013). Environmental enrichment and cognitive complexity in reptiles and amphibians: concepts, review, and implications for captive populations. *Applied Animal Behaviour Science*, 147(3), 286-298.

Davis, K. M., & Burghardt, G. M. (2007). Training and long-term memory of a novel food acquisition task in a turtle (*Pseudemys nelsoni*). *Behavioural processes*, 75(2), 225-230.

Fleming, G. J., & Skurski, M. L. (2014). Chapter 11 - Conditioning and behavioral training in reptiles. *Current Therapy in Reptile Medicine and Surgery*, 128-132.



Melissa Marshall: Talk Nerdy to Me



Julian Treasure: How to speak so that people want to listen



Amy Cuddy: Your body language shapes who you are



Turtle Health Research trip to Bowen 2017



B – Presentation Outline

Time: 15min

Group Presentation

Minimum 10 Slides

1. Title slide: your project, your name
2. Introduction
3. Aim of your research
4. Why is it important?
5. Results of research
6. Conclusions
7. The Good: tell us what went well
8. The Bad: tell us what didn't go well
9. Questions
10. Reference List & Acknowledgements (supervisors)

Awards will be presented at the conclusion of all the presentations.



C – Forms

Informed Consent Forms



James Cook University

TOWNSVILLE Queensland Australia Telephone: (07) 4781 4111

INFORMED CONSENT FROM

PRINCIPAL INVESTIGATOR Associate Professor Jeff Warner
PROJECT TITLE *Research Immersion Program: Antimicrobial Resistance*
SCHOOL Biomedical Sciences
CONTACT DETAILS Biomedical Sciences Building 87 Room 107 ext. 14748

Student as asked to work with microorganism in a PC2 facility (please see research immersion student manual for full details). Time commitments for this program is 5 days. Information collected in this program is solely for the student to create a PowerPoint presentation and gain research experience.

I agree that if I have a medical condition which might be affected, exacerbated or preclude me I will inform the supervisor in charge and I shall abstain from participation. I am aware that any information I give is confidential.

Do you have or aware of any medical conditions that might be affected, exacerbated or preclude you from participating in the research immersion program (please indicate in the space provided);

Medical conditions: _____

If you have indicated a potential medical condition and you wish to participate you must inform and discuss with your academic supervisor in charge of your project before the undertaking of any task.

The aim of this project have been clearly explained to me.

I understand what is wanted of me.

I know that taking part is this is voluntary and I am aware that I need not participate and can stop at any time without affect my completion of the program.

I have read the research immersion student manual and agree to participate in all activities described in the manual.

I understand that every effort is made to keep my information confidential but this cannot be assured in every case and no names will be used to identify me with this without my approval.

Student name (<i>printed</i>):	
Student signature:	Date:
Guardian name (<i>printed</i>):	
Guardian signature:	Date:
Relationship to student:	



Media Release Form



Talent Release Form 2017

Full Name:	
Telephone contact:	
Email:	

I (name) _____, hereby consent for James Cook University to use any photograph and/or video footage taken of me or provided by me, whole or in part; recordings of my voice and/or written extraction, whole or in part of such recordings; and to use the information contained therein for any purpose in connection to learning and teaching including but not limited to: study guides, websites, social media and other forms of media.

By signing this form I agree that electronic and/or hard copy of photographic images and/or recordings of me and/or my profile are collected and stored for the purposes above.

I understand that the images and/or recordings of me and/or my profile will only be accessed by James Cook University employees, including persons acting under its permission or authority, such as commissioned agency.

I acknowledge that the information I have provided may be used to contact me; however, my details will not pass on to any third party without your approval.

I waive any right to inspect or approve of the finished product, including written copy that may appear in connection with my images and/or recordings of me and/or profile.

I understand that the use of the images and/or recordings of me and/or my profile does not give me any right to request payment and that no payment will be made to me in return for reproduction of any such image, recording or profile.

I have read and understood the terms of this release.

Student name (*printed*): _____

Student signature: _____ Date: _____

Please complete this section if the model is a minor:

I am the parent or guardian of the minor named in the release above and have legal authority to execute the above release. I hereby approve the foregoing on behalf of the above named minor.

Guardian name (*printed*): _____

Guardian signature: _____ Date: _____



Volunteer Register Form

If you wish to continue volunteering with JCU Turtle Health research group in the future please fill in the below form. Your details will be used when the facilities are looking for an extra set of hands during busy project times an school holidays. Please return to Bethany Adomanis before the end of the program.

Personal Details Volunteers Only

Name:
Address:.....
Phone: (bh)..... (ah)..... (Mobile)
Field Trip Organiser

Emergency Contact in Australia

Name:
Address:.....
Phone: (bh)..... (ah)..... (Mobile)

Please inform this person that their information has been provided to the Safety Officer for the purpose of being an emergency contact.

Medical information

I am aware that it may be essential for people other than myself to know about conditions which pertain to me, and that any information I provide to the staff member-in-charge of the field trip will be treated with the strictest confidence and not disclosed to anyone without my consent, except in the case of a medical emergency.

I am aware that the field trip first aid facilities do not include provision of medications such as analgesics, antihistamines, Ventolin, insulin etc..

I am qualified (current) in First Aid Yes / No

If yes what qualification Expiry date:.....



D – MSDS and SOPs (TO BE COLLATED FROM RISK WARE)

Risk Assessments

- Risk of falling from slippery floor
- Risk of water getting into dry equipment
- Risk of water or moisture getting into electrical sockets

SOP's

- Caraplace Manual will be presented to students upon induction



E – Glossary of Terms

Biosecurity

Carapace - a turtle's shell made out of keratin

Cognition - the process of obtaining and understanding information that is delivered

Cross contamination - the act of sharing bacteria or other microorganisms between one system to another.

Memory - the ability to remember and the capability of learning and adapting to surroundings.

Enrichment - anything that stimulates or encourages natural behaviour, play, cognitive activity, or social interactions. Enrichment can be provided through devices, toys, surroundings, or other individuals. It essentially is a tool or method that can enhance an animal's quality of life while in captivity

Hygiene - At the Carapace, we refer to hygiene as the cleanliness of our extremities that come into contact with the turtles and their equipment. This means we are incredibly mindful of what we touch at all times and we know when to wash our hands and arms when necessary.

Plastron - a turtle's underside

Scutes - plate-like structures that make up a turtle's carapace.