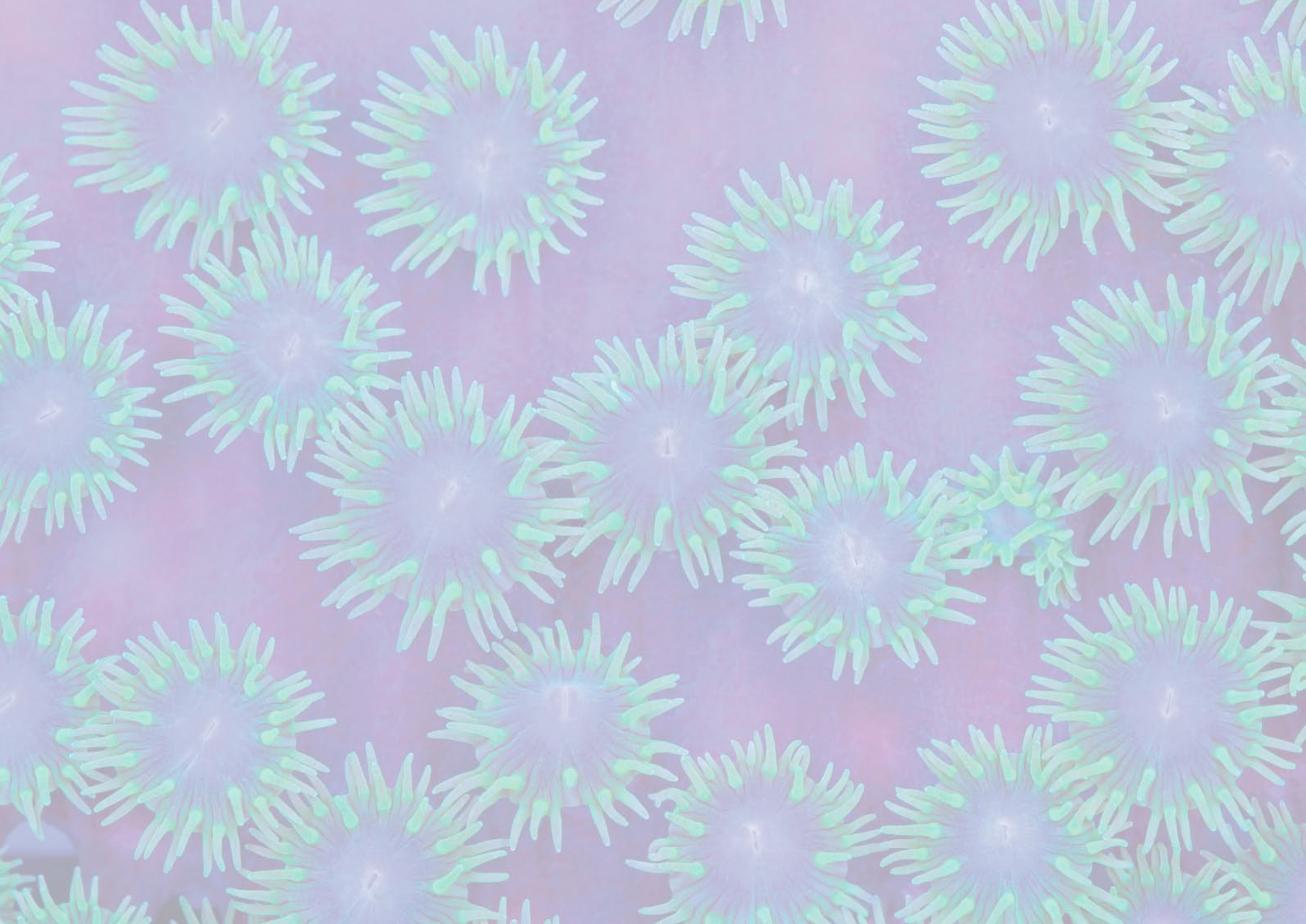


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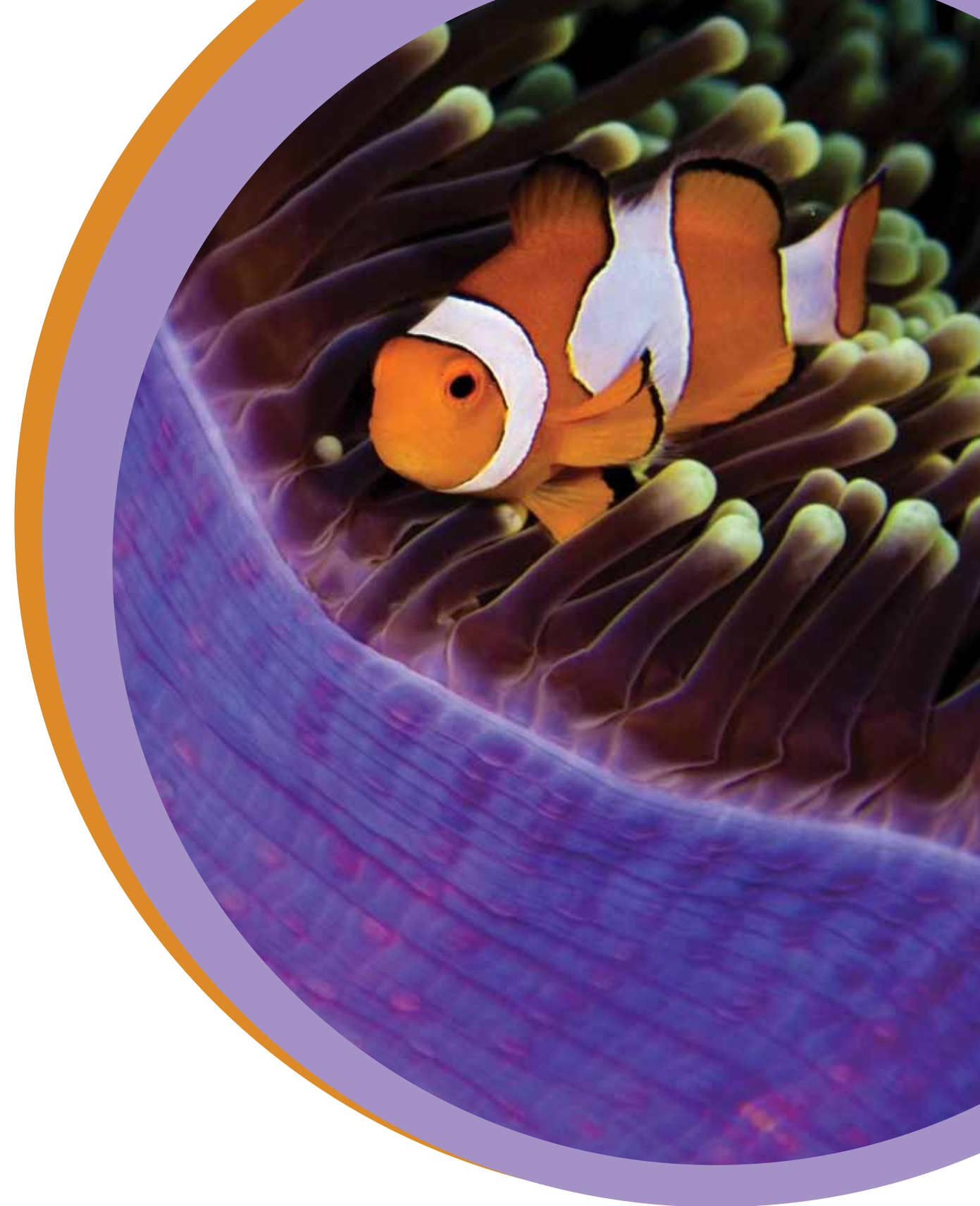
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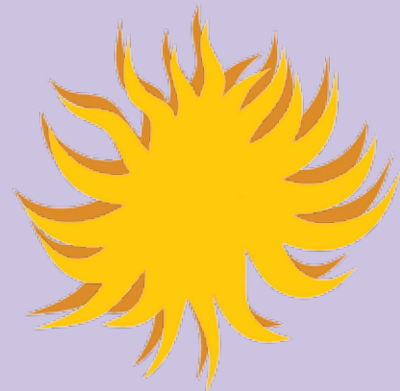
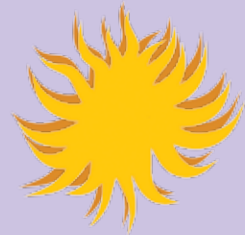
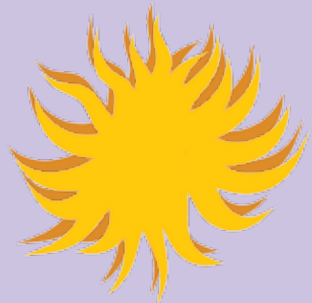
# ADAPTATIONS FINDING A FIT IN THE CHANGING WORLD

Place-based resources for Pacific Island schools



# DEDICATION

*For students, teachers and communities  
living in tropical Pacific island environments.*



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## WHY LEARN ABOUT ADAPTATIONS?

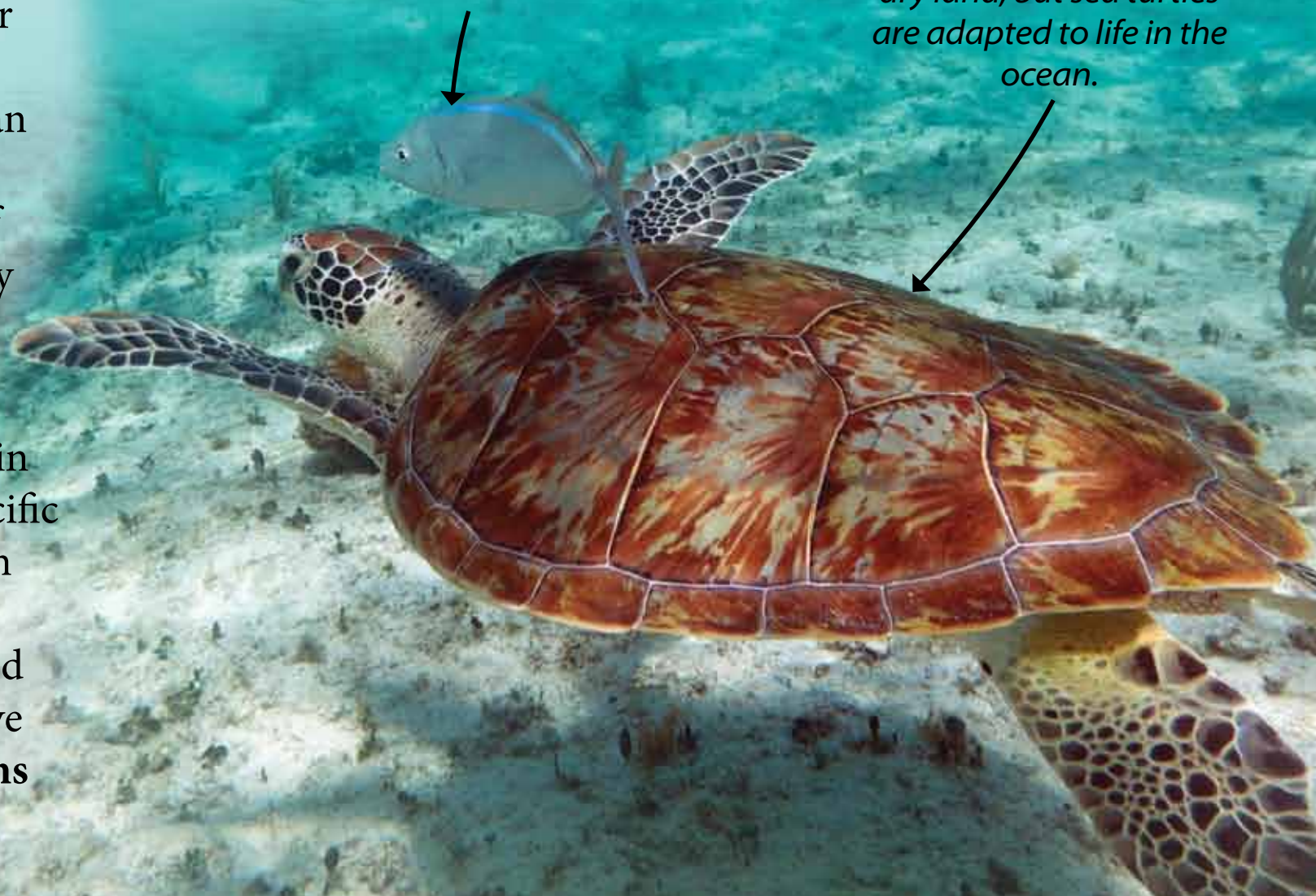
Some places on our planet are very cold and some are very hot year round. Some are cold for a part of the year and hot for a part of the year. Some places have lots of water and some places are very dry. Yet, living things can be found almost anywhere on our planet including the cold deep ocean, hot deserts, dark caves and the tops of trees. How do living things manage to thrive in so many different places?

It is not the same kinds of plants and animals that live in very different places. For example, trees on **tropical** Pacific islands are very different from those in North American forests. Fish from ocean depths are very different from those around coral reefs. Plants and animals can live and **reproduce** in so many different places because they have become **adapted** to their environments. The **adaptations** of living things make life possible all over our planet.

*Few plants can grow on sandy ground that is sprayed by the ocean. Only specially adapted plants grow near the beach.*

*Fish are some of the most common animals in the ocean. They are adapted to life underwater.*

*Many kinds of turtles live their entire lives on dry land, but sea turtles are adapted to life in the ocean.*



# WHAT DO LIVING THINGS NEED?

*Plants and animals have basic needs that they must satisfy in order to stay alive. This is not easy to do, especially when different places have different challenges.*

Before we can understand adaptations, we should ask, “What do living things need? What exactly are the most basic things that any living thing needs in order to survive?”

*Let's look at this dog and ask ourselves: What does it need? What are the things without which it cannot live?*



*Every living thing needs food and water. It also needs air (or gases from water). To survive, it must also be able to find shelter and protect itself.*



## FOOD

*A dog must eat to stay alive.*



## WATER

*A dog must drink water to stay alive.*



## SHELTER AND PROTECTION

*A dog needs shelter and protects itself from danger.*



## AIR

*A dog needs to breathe air to stay alive.*

*Living things also need to reproduce in order to keep life going.*

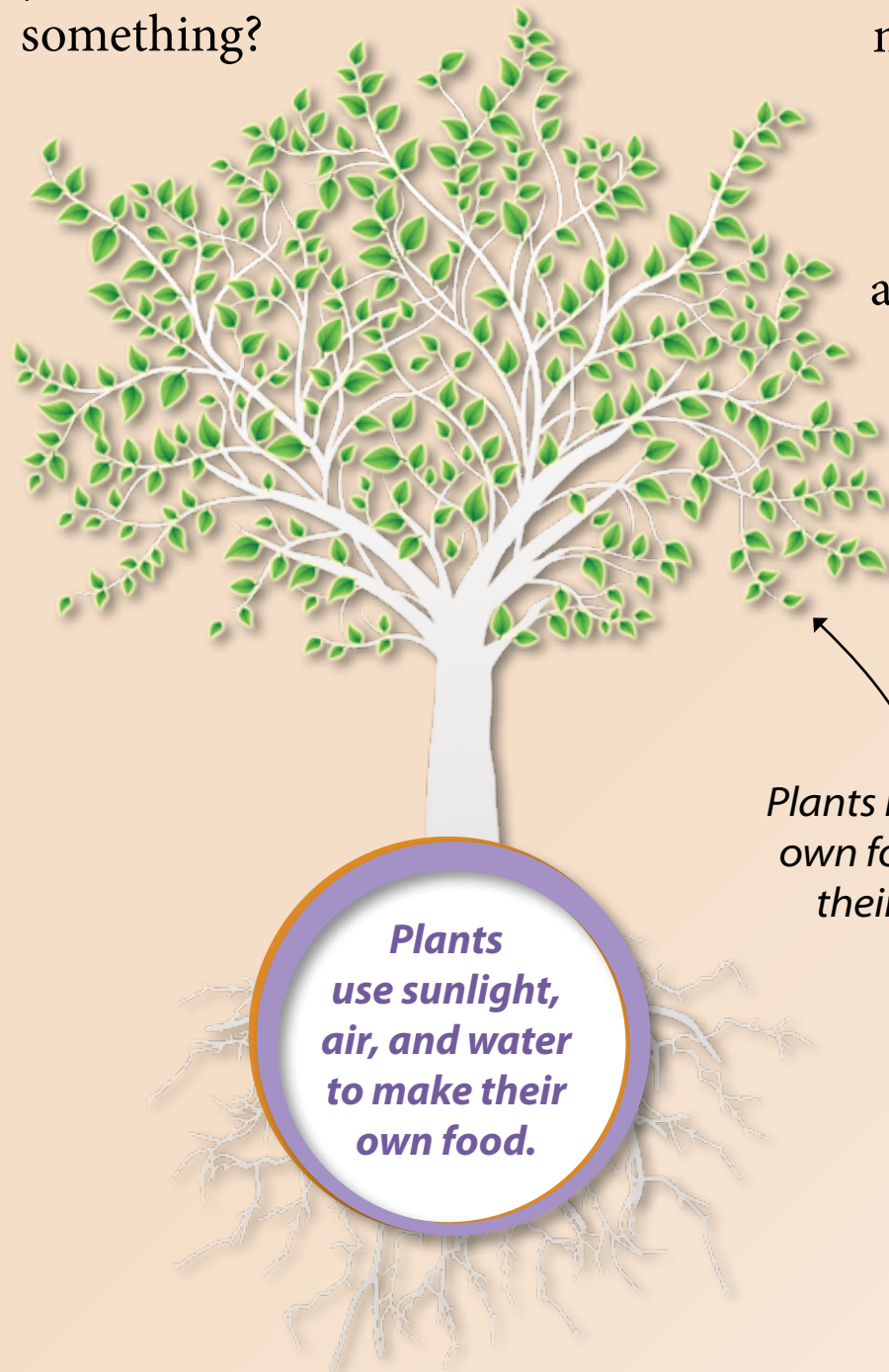


## REPRODUCING

*If dogs do not reproduce, there will be no more dogs.*

# GETTING OR MAKING FOOD

We eat food to get the energy we need to stay alive. Every living thing needs food. But have you ever seen a tree eat something?

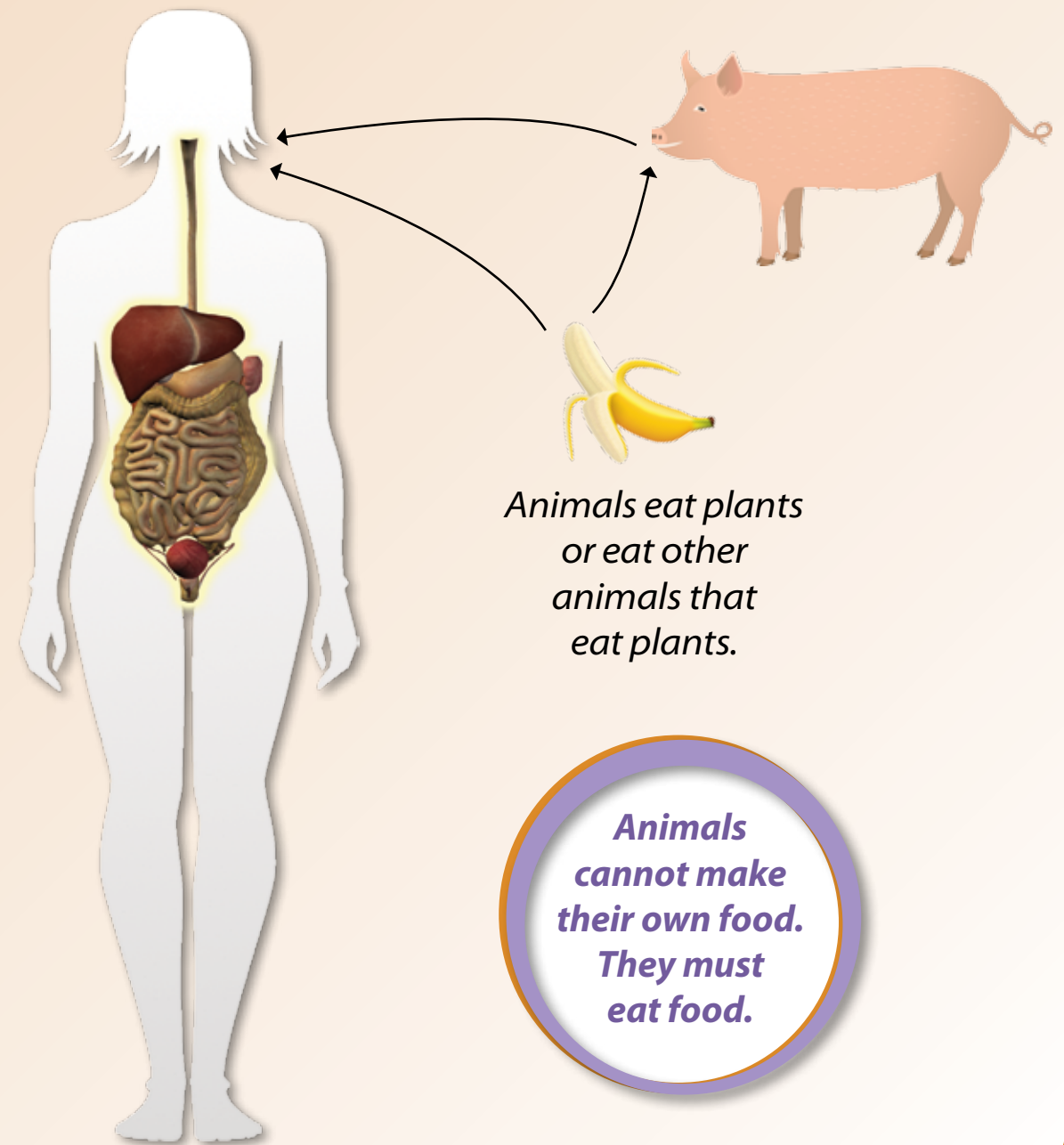


**Plants use sunlight, air, and water to make their own food.**

*Plants make their own food inside their leaves.*

Plants do not need to eat because they can make food! They use sunlight, air, and water to make the food they need. To make food, plants must get enough sunlight, air, and water.

Animals cannot make their own food. They have to eat. Because only plants can make new food, animals depend on eating plants.



*Animals eat plants or eat other animals that eat plants.*

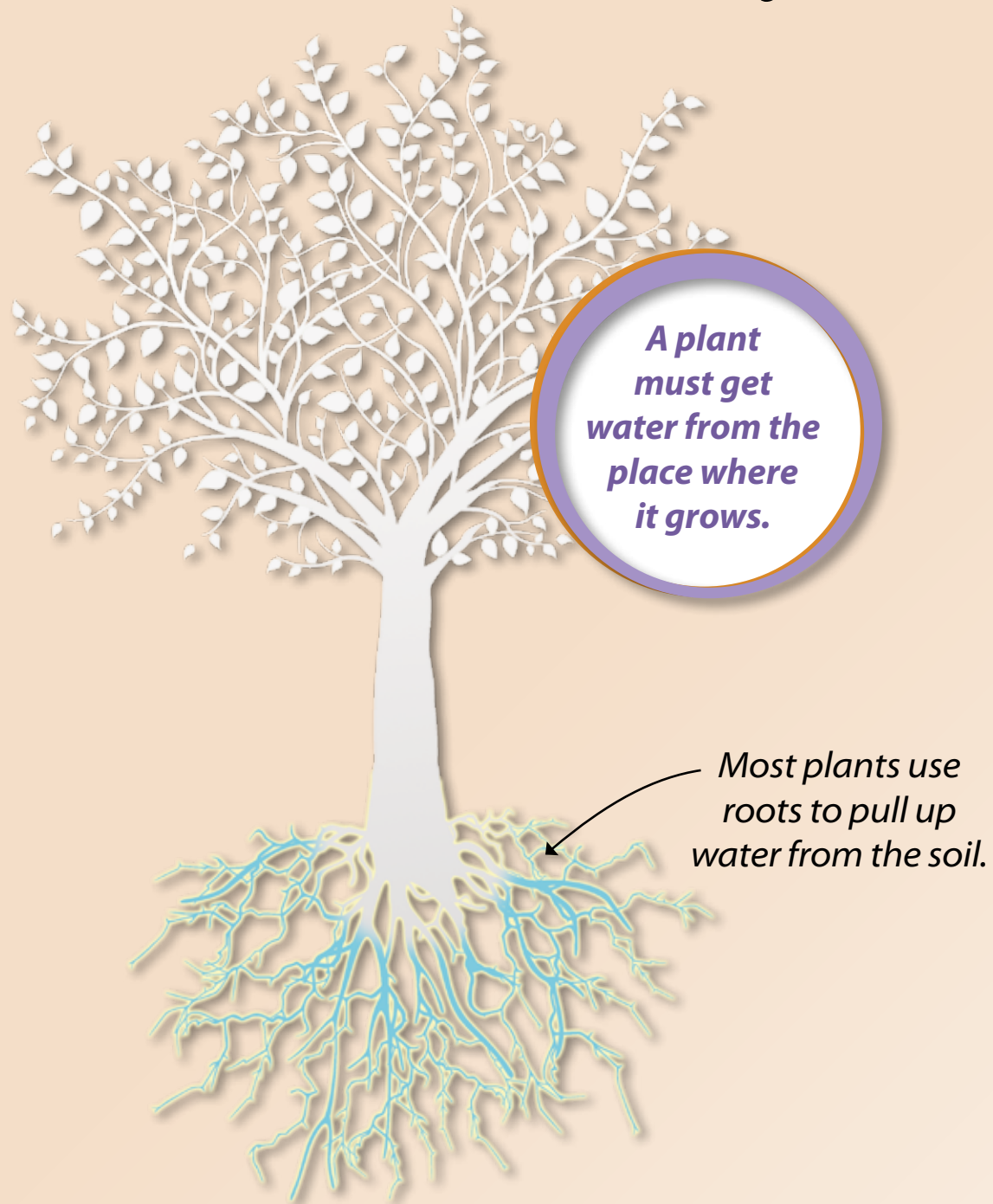
**Animals cannot make their own food. They must eat food.**

Some animals eat other animals, but even their food was originally made by plants. That is because no animal can create new food.

# GETTING WATER

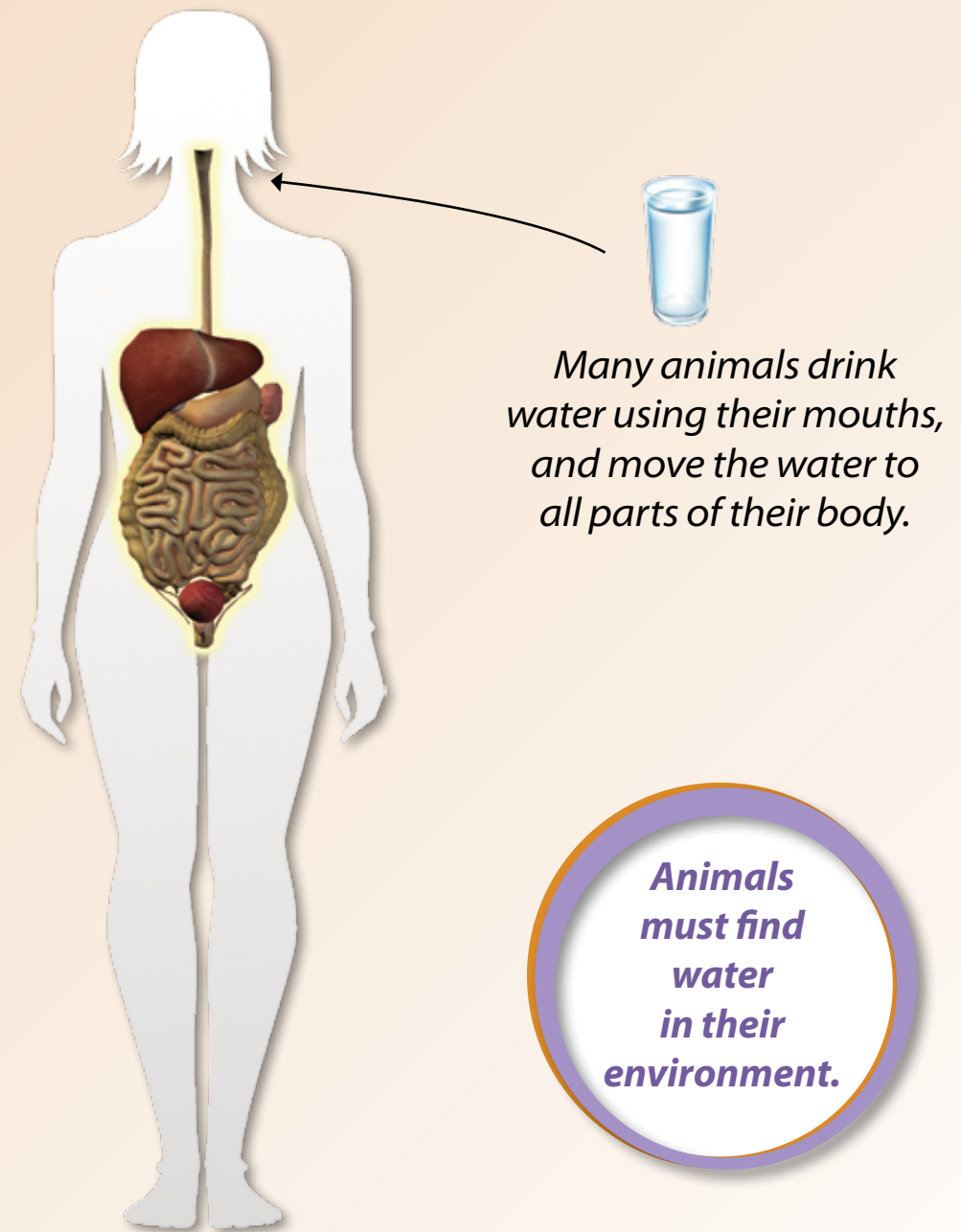
Every living thing needs water. Both plants and animals must get their water from the environment.

Most plants get the water they need from the ground. They pull it up from soil and use it to live and grow.



Most animals, including people, first have to find water in order to drink it.

Some animals, like fish, live in the ocean or rivers where they get the water that they need.



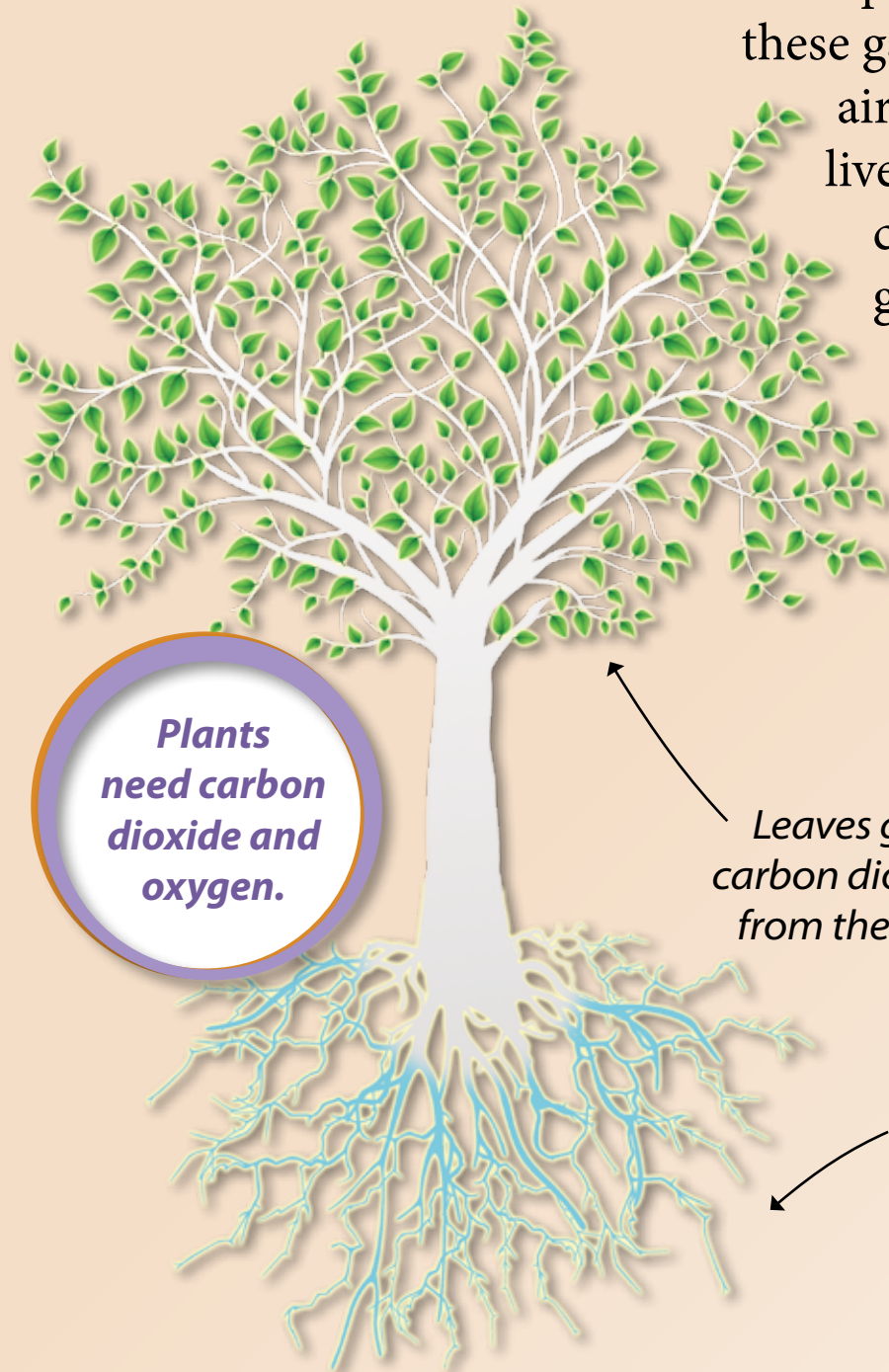


# GETTING GASES FROM AIR OR WATER

In addition to food and water, all living things must be able to get the gases they need to survive.

Plants need **carbon dioxide** and **oxygen**.

Most plants get these gases from the air. Some plants live in water and can get these gases from the water.



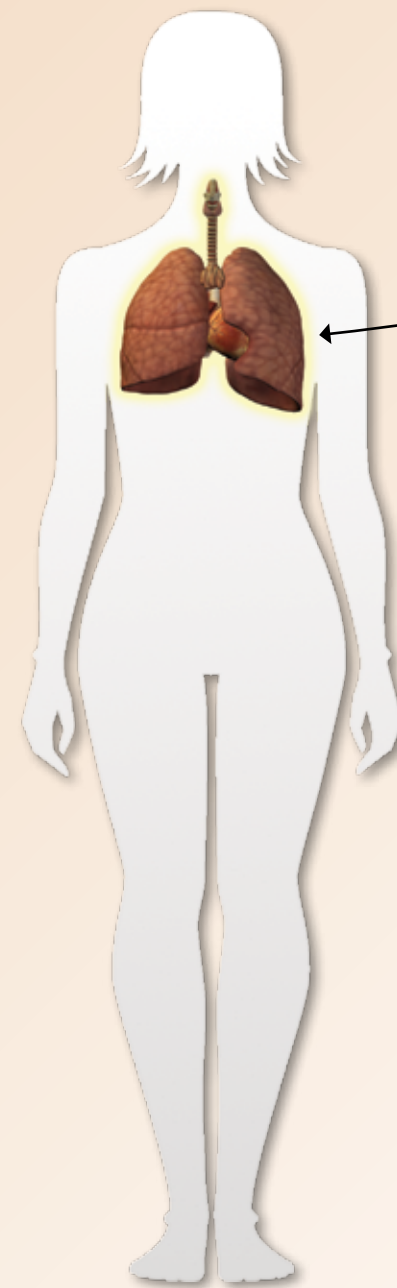
Leaves get carbon dioxide from the air.

Roots get oxygen from air that is in the ground.

The only gas that animals need is oxygen. They get it by **breathing**.

Animals on land get oxygen by breathing air.

Animals that live under water get their oxygen from water.



Animals breathe using special **organs**. Many land animals use lungs to take in air and get oxygen from it.

Animals need oxygen.

# SHELTER AND PROTECTION

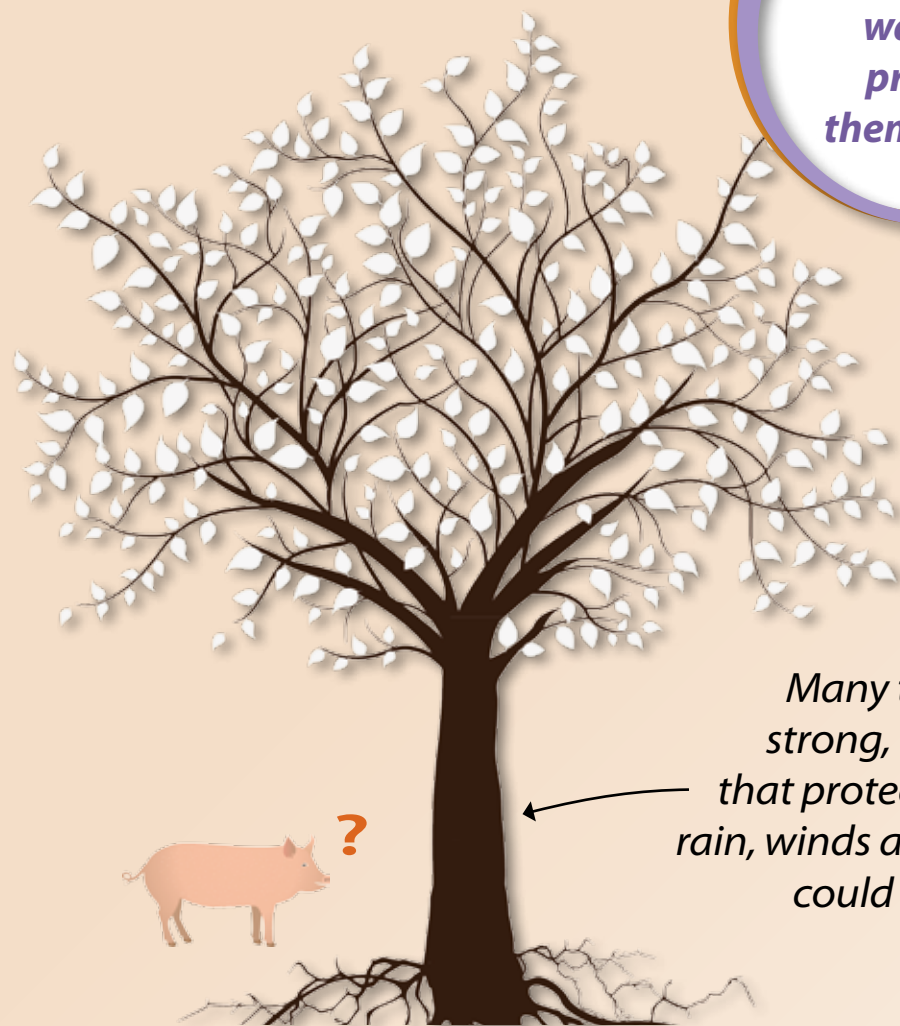
The place where a plant or animal lives may occasionally become too hot, cold, dark, wet, dry, or windy. Living things must find ways to protect themselves from conditions that could harm them.

Plants cannot run or hide. They make strong or sharp body parts, and chemicals that animals do not like to eat.

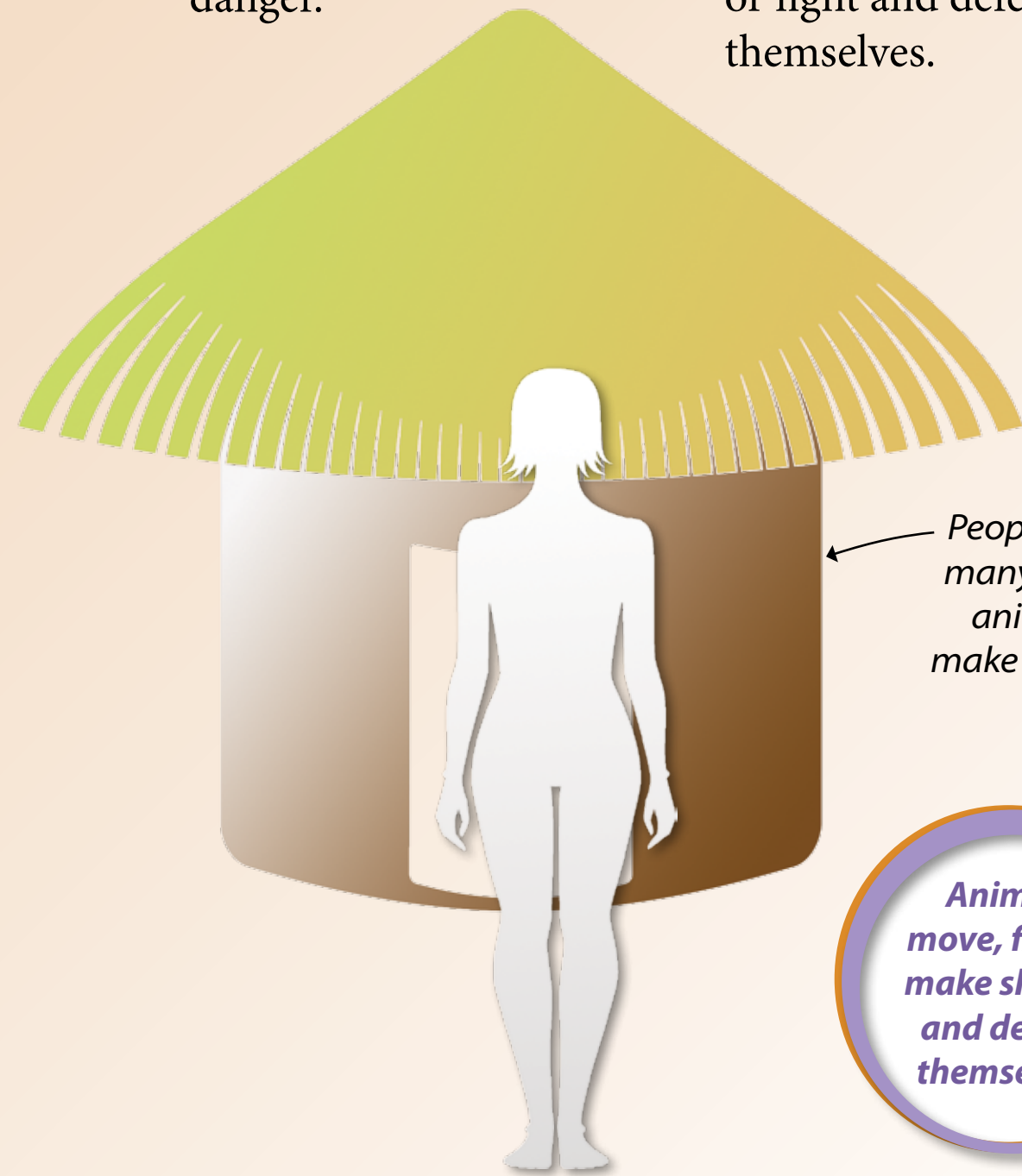
Animals often find or build **shelters**. They make it as safe as possible and go there to escape danger.

Animals may need to hide or run away from attackers. They sometimes scare or confuse attackers, or fight and defend themselves.

*Plants have many ways to protect themselves.*



*Many trees have strong, tough bark that protects them from rain, winds and animals that could eat them.*



*People and many other animals make homes.*

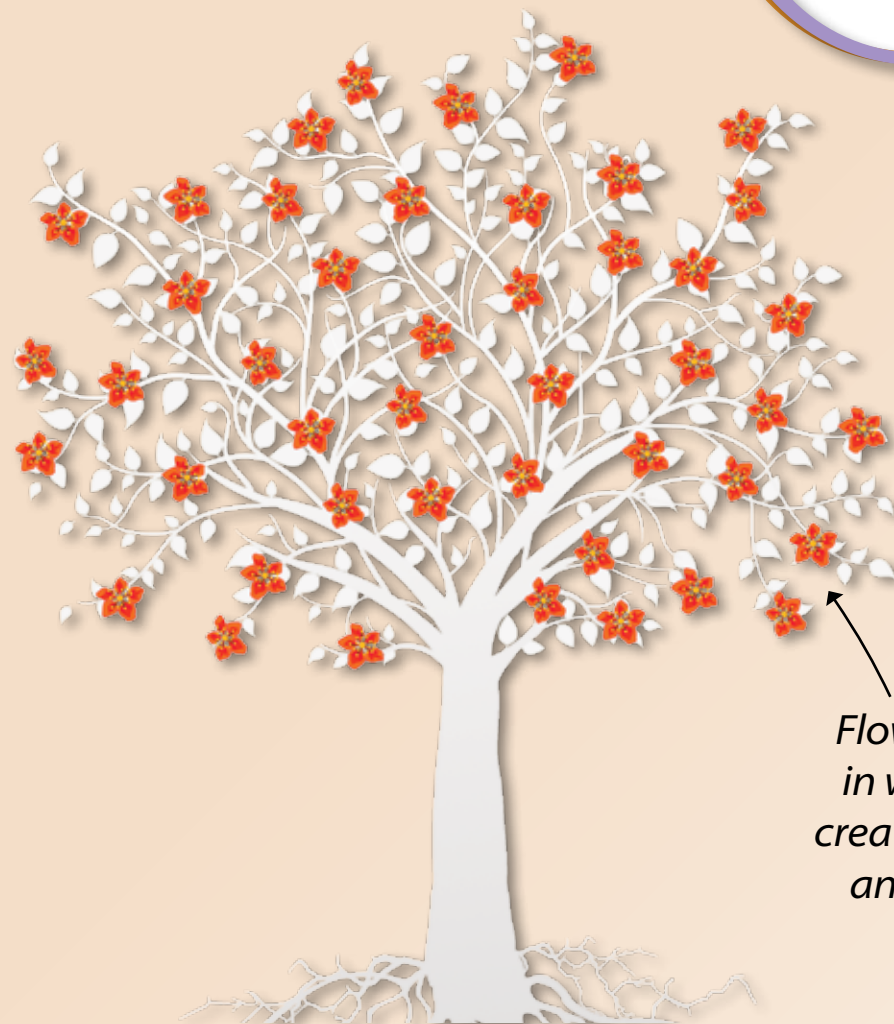
*Animals move, find or make shelter, and defend themselves.*

# REPRODUCING

Any individual plant or animal can survive if it finds food, water, and gases it needs, and can protect itself. However, for the **species** to survive, living things must also reproduce.

Species continue to exist because older organisms create new organisms of the same species.

*Plants make spores or seeds that give rise to new plants.*

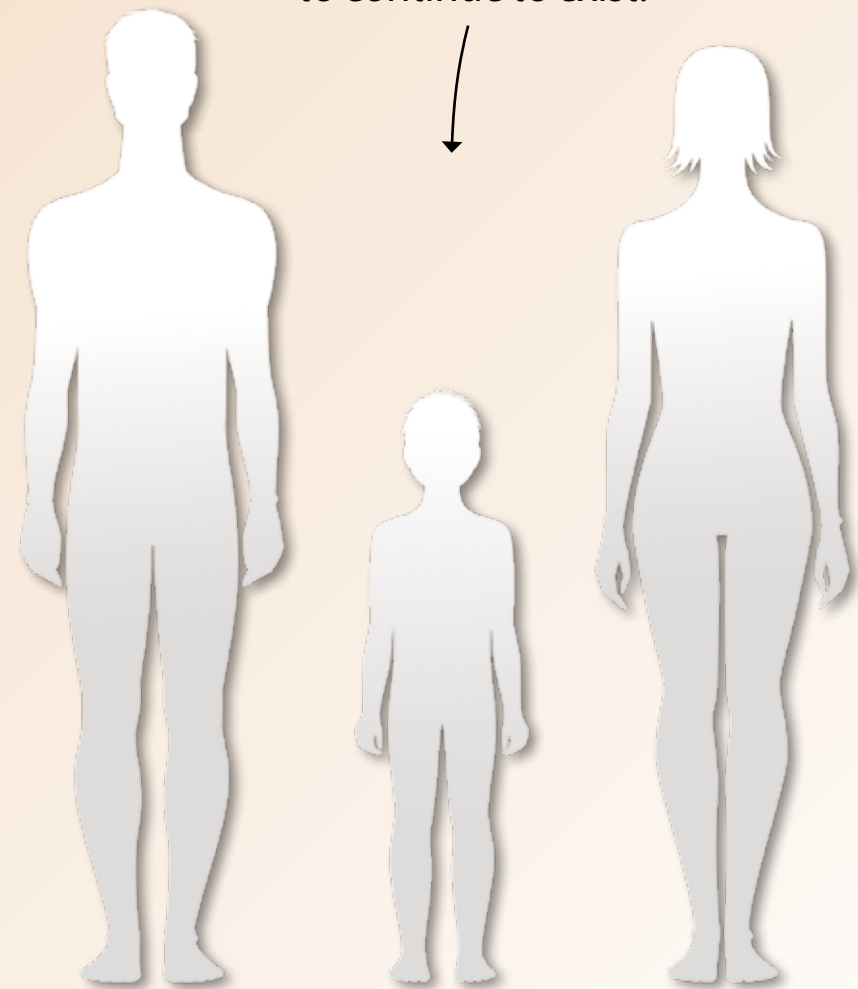


*Flowers are organs in which seeds are created. Seeds sprout and become new plants.*

In general, animals and many plant species have female individuals and male individuals. A female and a male together are able to create new living things.

*Animals mate and produce young animals.*

*Reproducing to create young individuals allows a species to continue to exist.*



# WHY DO LIVING THINGS NEED TO ADAPT?

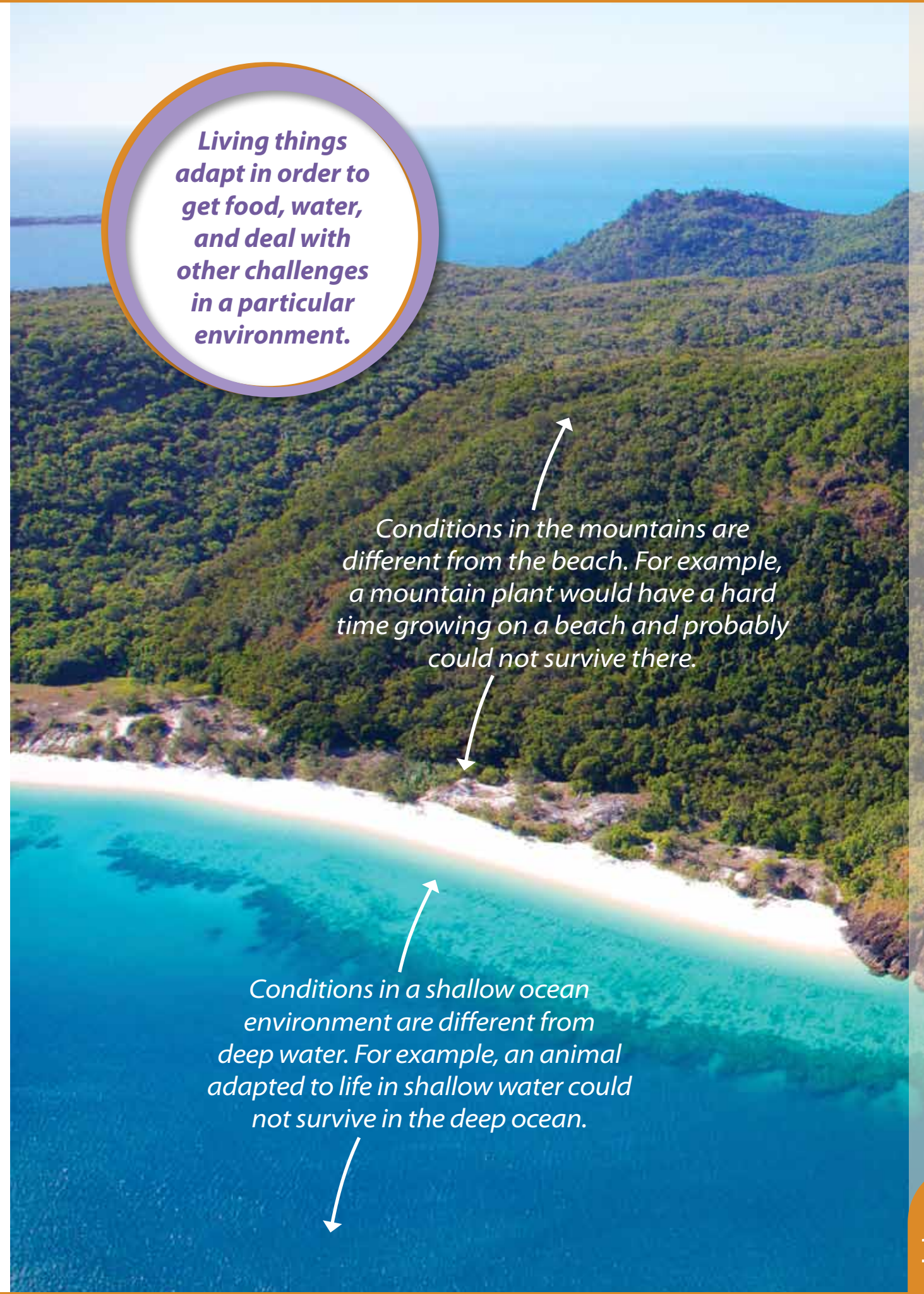
*Different places are different environments. Each environment has unique challenges to living things. Living things cannot meet their basic needs in an environment unless they are adapted to its conditions.*

Plants and animals depend on themselves – their own features and abilities – to find food and water, get the gas they need, keep safe, and survive the **challenges** of their specific environment. These features and abilities are called adaptations. They make it possible for a plant or animal to live in a particular place and in a particular way.

For example, finding fresh water is easy next to a river, but quite difficult on a sandy beach. A plant needs

special adaptations to grow on a beach. Similarly, finding tasty food is easy in a garden, but much harder in a dark cave. An animal would need to be adapted to the dark in order to survive in a cave. All living things that live in all the different places on our planet have special ways to get food, get water, and deal with the other challenges of the environments where they live.

Without adaptations to meet basic needs, plants or animals cannot survive.



*Living things adapt in order to get food, water, and deal with other challenges in a particular environment.*

*Conditions in the mountains are different from the beach. For example, a mountain plant would have a hard time growing on a beach and probably could not survive there.*

*Conditions in a shallow ocean environment are different from deep water. For example, an animal adapted to life in shallow water could not survive in the deep ocean.*

# HOW DO LIVING THINGS ADAPT?

*Species of plants and animals change over time. Any change that helps a living thing adapt is beneficial. It helps the organism to survive and reproduce.*

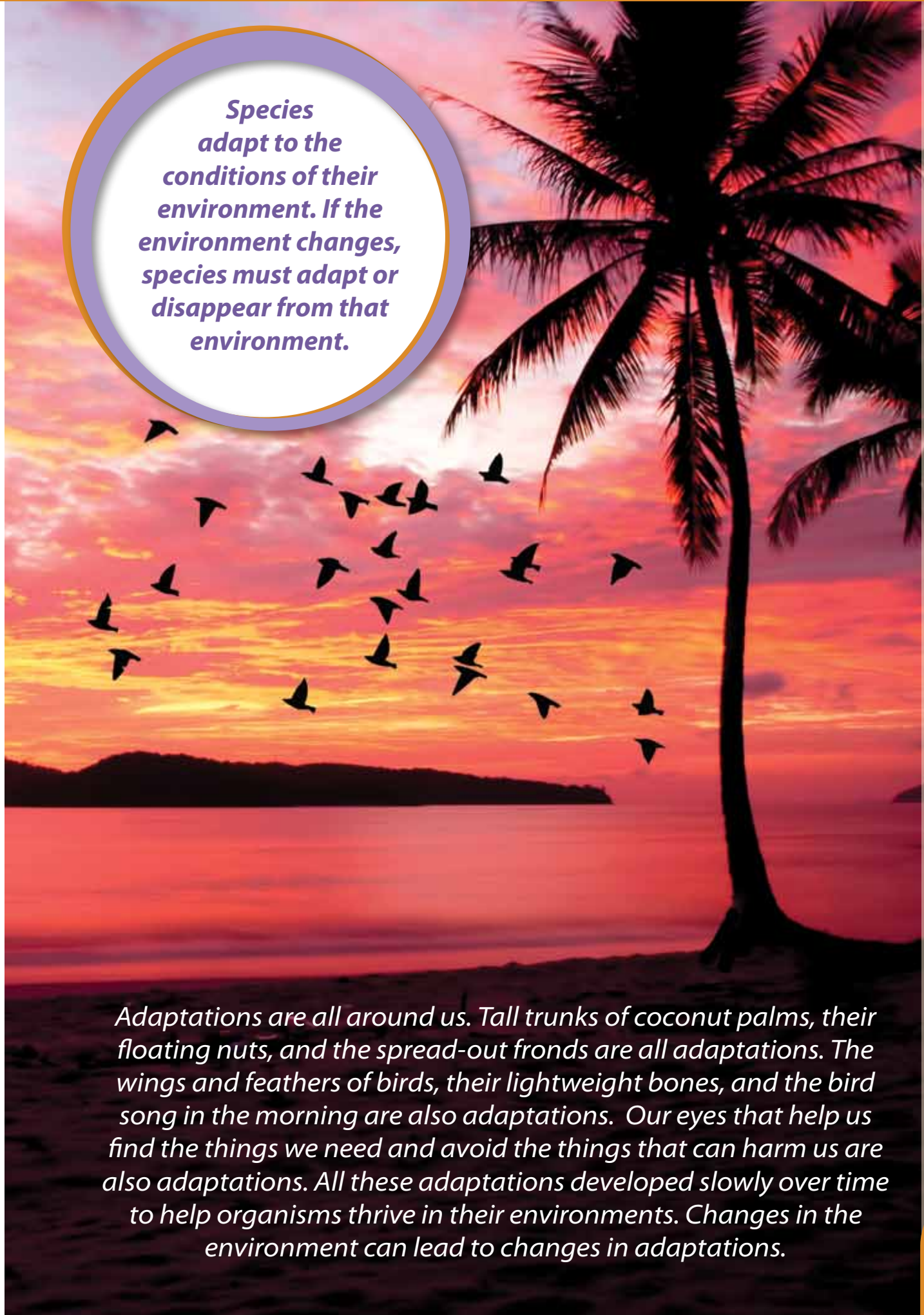
**A**daptations happen gradually. Living things change and get better and better at living in a particular place. Everything a living thing has – its organs, shape, size, color – is an adaptation to some feature of its environment.

**T**he ways organisms behave are also adaptations. These **behavior** adaptations include when it sleeps, how it finds food, and how it reproduces.

**A**ll of these characteristics – both features and behaviors – are adaptations that help different living things live where they are. Adaptations make it easier for organisms to survive in their own environment. It can also make it harder to live in a different environment. That explains why certain plants and animals are found in one area, but not in another.



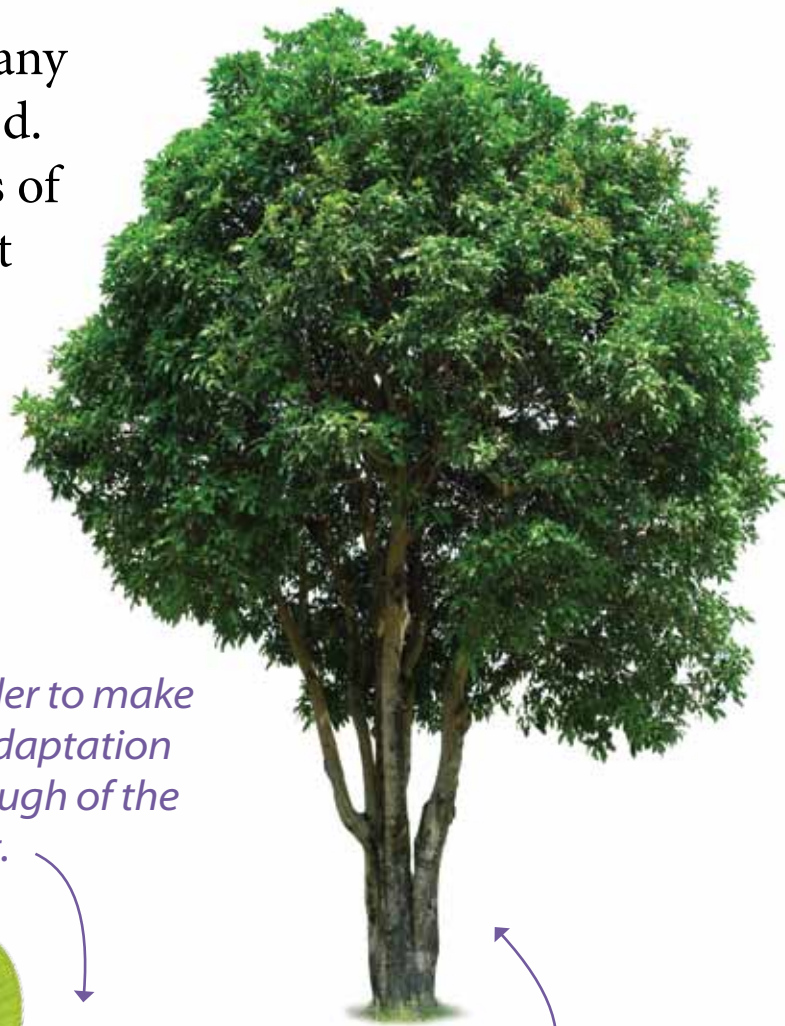
*Species adapt to the conditions of their environment. If the environment changes, species must adapt or disappear from that environment.*



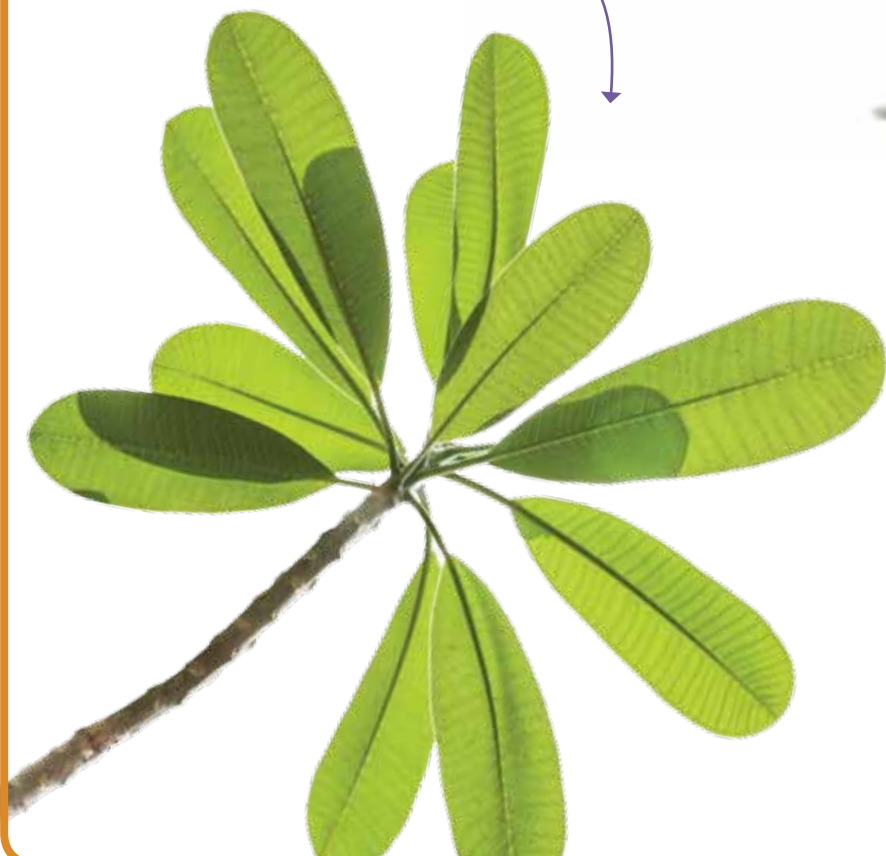
*Adaptations are all around us. Tall trunks of coconut palms, their floating nuts, and the spread-out fronds are all adaptations. The wings and feathers of birds, their lightweight bones, and the bird song in the morning are also adaptations. Our eyes that help us find the things we need and avoid the things that can harm us are also adaptations. All these adaptations developed slowly over time to help organisms thrive in their environments. Changes in the environment can lead to changes in adaptations.*

# GETTING OR MAKING FOOD

Living things have many ways of obtaining food. Let's look at examples of some adaptations that different plants and animals developed to meet their needs for food.

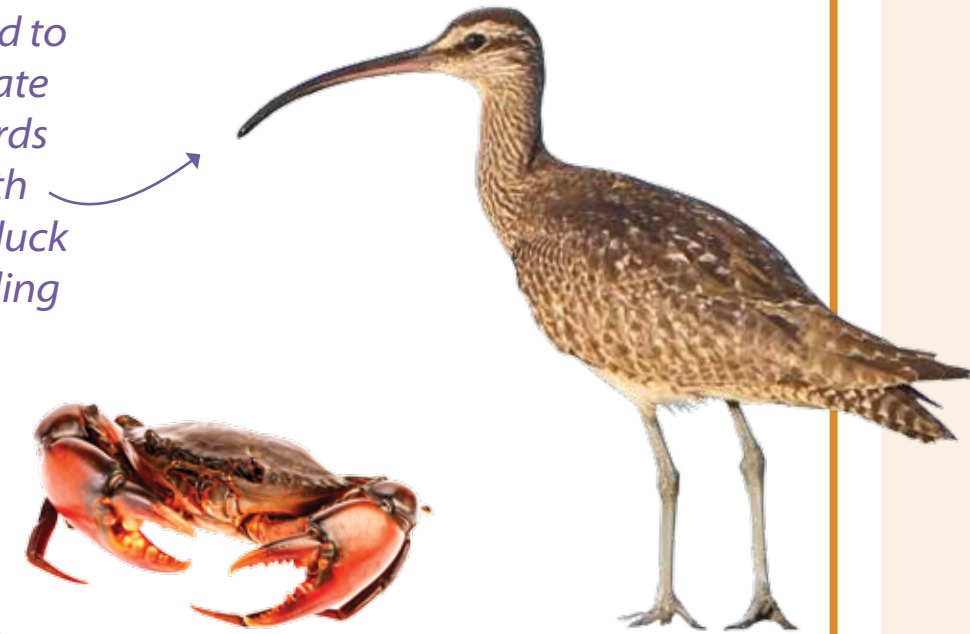


Plants need light in order to make food. Leaves are an adaptation to help plants get enough of the needed light.



Many trees adapt to getting enough light by growing very tall.

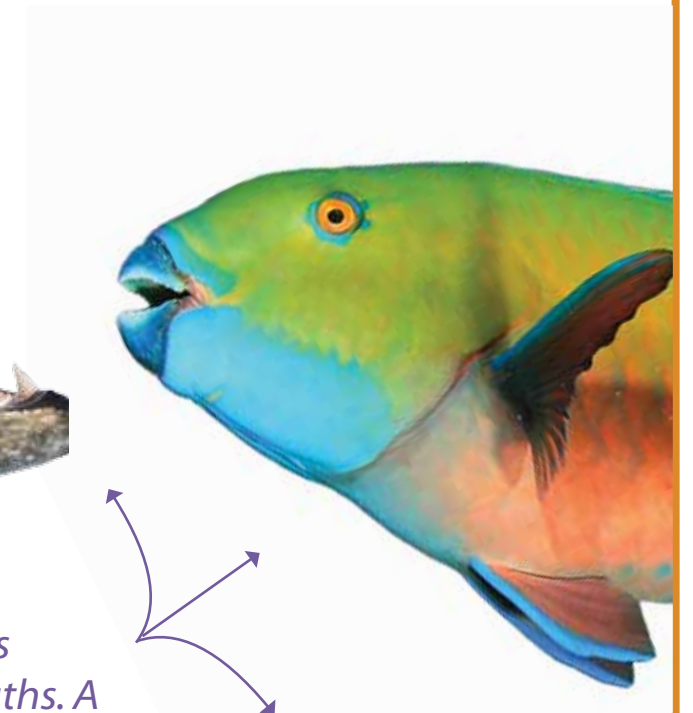
Bird beaks are adapted to getting the appropriate food. Many beach birds have long beaks with which they find and pluck out small animals hiding in the sand.



Crabs have pincers and use them to chop up food and pass it to their mouth.



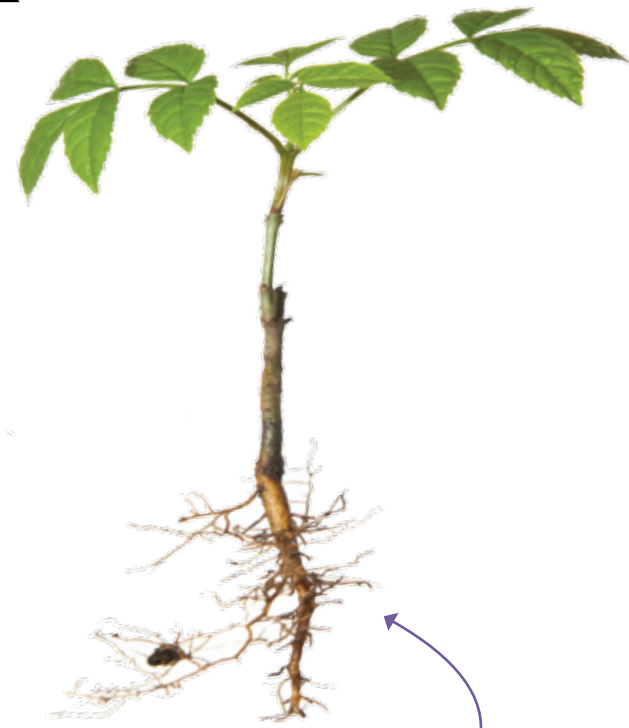
Fish that feed in different ways have differently adapted mouths. A barracuda's mouth full of sharp teeth is adapted to eating fish. The parrotfish mouth is like a beak adapted to grinding coral. Some fish have long snouts adapted to picking out tiny worms and crustaceans.



# GETTING WATER

The ocean surrounding our islands is so huge that it seems like there is plenty of water for every living thing. In fact, it is not always easy for plants and animals to get enough water. Some places in the world or seasons of the year are quite dry.

Even the ocean is not an easy place to get water. That is because living things need fresh water, not salty water. To meet the challenges of finding enough of suitable water, living things have developed many adaptations.



*Land plants have roots, which they use to get water out of the soil.*

*Algae live underwater and do not need roots. Their entire bodies take in water directly from the surroundings.*



*Cats use their tongues to lap up water. They can fold the tongue into a spoon-shape to catch water.*



*Albatross birds spend months at a time above the open ocean. They have developed adaptations that allow them to drink seawater. Seawater is too salty for most birds and land animals, but albatrosses have special organs that get rid of extra salt.*



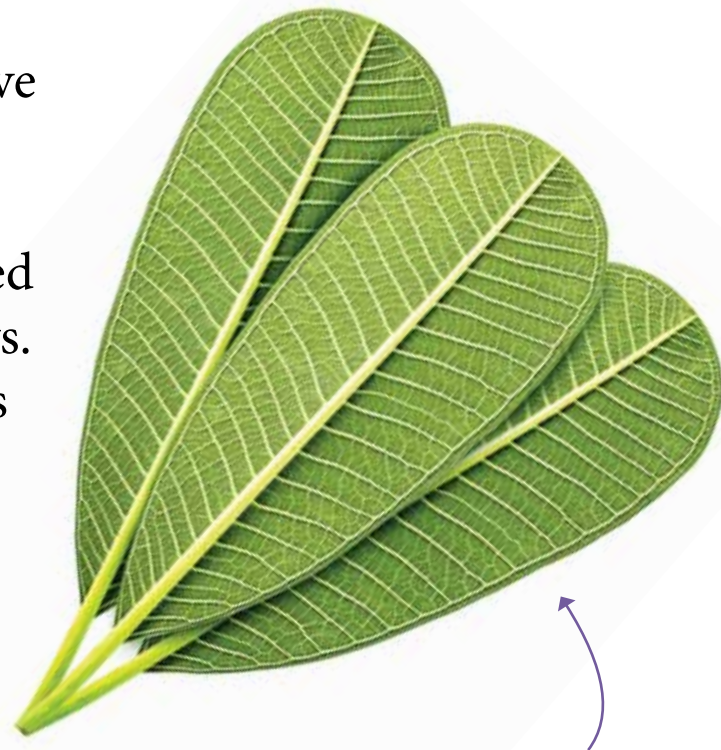
*Freshwater fish do not need to drink. The water enters their bodies through their skin.*



*Saltwater fish quickly lose water from their bodies, so they must drink a lot. They take in water through their mouth as they swim, and throw out salt through specially adapted organs.*

## GETTING GASES FROM AIR OR WATER

Plants and animals live in so many different places that they must get the gases they need in quite different ways. Let's look at examples of some adaptations that different plants and animals use to get gases from air and water.



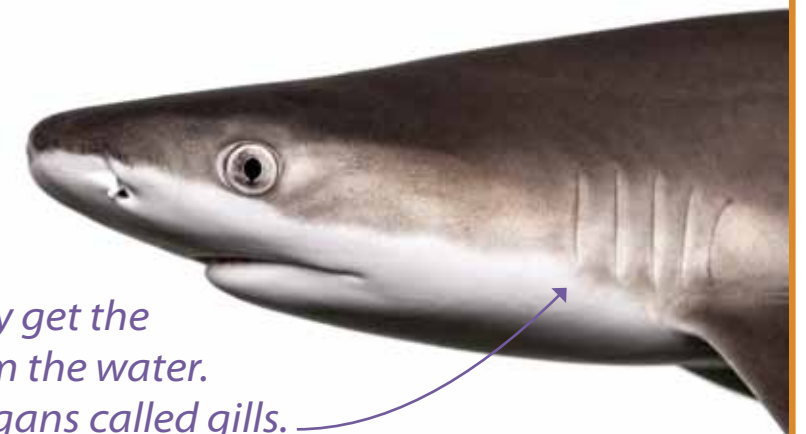
Plants need carbon dioxide gas from air in order to make their food. To get it, they must have some holes for air to enter. However, having open holes is risky because the precious water taken up by the roots quickly evaporates through open holes. The solution is tiny holes called stomata. Stomata are located on the underside of leaves which are cooler and have less evaporation. Plants can open and close their stomata depending on the need to get more carbon dioxide or prevent evaporation. This adaptation helps plants to live nearly everywhere on land, even in very dry places.



Mosses get air through tiny holes in their leaves. These holes are always open, so mosses cannot stop water inside them from evaporating. That is why mosses need to live in very wet environments.



Mammals breathe by taking in air through their noses to the lungs. Depending on the animal's way of life, noses can have different shapes. Pigs noses are large and very well developed. Pigs have a keen sense of smell and use their noses not only to breathe, but also to find food.



Fish have no noses. They get the oxygen they need from the water.

They use special organs called gills. Gills are an adaptation that allows fish and some other animals to get the oxygen gas that is dissolved in water.



Sea animals have developed many different ways to get oxygen from the water. Clams have a special organ called a siphon. They use it to suck in water to drink, and also to feed. Clams get dissolved oxygen from water and also small particles of food to eat.



# SHELTER AND PROTECTION

Living things adapt to shelter themselves from the various challenges of their environment. They protect themselves from difficult environmental conditions and from other living things. Let's look at examples of adaptations that help plants and animals overcome difficulties in their environment and also avoid becoming someone's meal.



Some plants have thorns to protect themselves from being eaten by animals. The best known among them is cactus. This type of plant is not native to the Pacific Islands but can be seen in people's gardens.



Sea urchins' spines protect them from hungry fish.



Hermit crabs find snail shells and use them as shelter that they carry around.



Lionfish have dangerous spines on their back. Their bright colors warn and discourage predators.

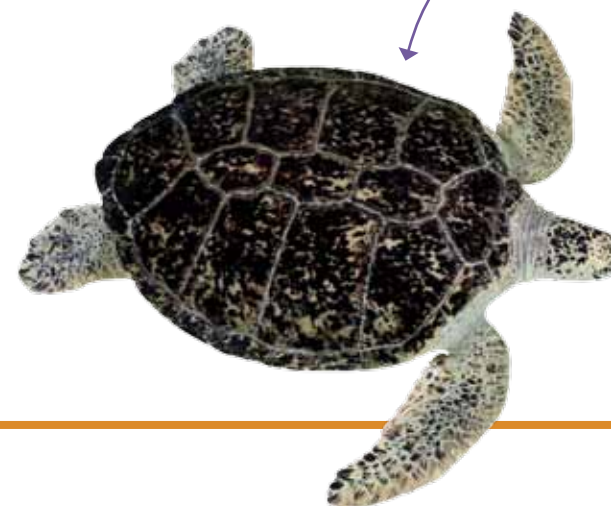


Unusual colors and patterns are often adaptations to confuse predators.



Another adaptation that plants have for protection is poison. Many plants contain chemicals that protect them from animals that may want to eat them.

Most of a turtle's body is protected by a hard shell.



Geckos can change color. This adaptation allows them to hide by blending in with their surroundings.



# REPRODUCING

Plants and animals have many different adaptations to make their reproduction as successful as possible. Let's look at examples of how some living things attract mates, reproduce, and raise young.



Some plants' fruits contain as many seeds as possible. This adaptation helps the plant spread quickly.



Ferns do not have seeds. They reproduce from spores found on the underside of leaves. Spores are so tiny that they are easily carried by wind. This adaptation allows ferns to spread far and wide.



Many Pacific Island plants, most famously the coconut palm, produce seeds that float in water. This adaptation allows them to spread across the ocean.



Birds' eggs have hard shells. This adaptation allows birds to reproduce on dry land. Eggs of many other animals, such as fish and frogs, do not have hard shells and can only develop underwater.

Mammals, such as pigs and humans, give birth to live young. The young are nourished by milk produced by the mother. This adaptation greatly increases survival chances for the young ones.



Males and females often look different. Males may develop features to attract females. For example, a male frigatebird has a large red pouch in the neck that attracts females. This adaptation increases success in reproduction.

# BIG IDEAS

*Living things have basic needs. Different environments provide different ways to satisfy those needs. Living things can live in different environments only if they adapt to them. A species cannot live in a particular environment unless it is adapted to get its basic needs there.*



## EVERY LIVING THING NEEDS:

- ★ to make or get food,
- ★ to get water,
- ★ to get gas from air or water,
- ★ to find shelter and protection, and
- ★ to reproduce.

## LIVING THINGS ADAPT IN RESPONSE TO THE ENVIRONMENT

There are many different living things on our planet because there are so many different environments. Living things adapt to live under different conditions, and in the process develop adaptations that make each living thing different.

## THE BOTTOM LINE

Living things must adapt to their environment in order to survive. An adaptation is anything about a living thing that helps it live or survive in its environment.

## EVERY LIVING THING ADAPTS TO GET WHAT IT NEEDS!

Adaptations include

- ★ structures – such as the size, shape, organs, color
- ★ behaviors – the ways living things act

Only species that adapt to their environmental conditions survive.

# GLOSSARY



**A** **Adapted** – has features or behaviors that make it possible to live and reproduce in its environment.

**Adaptation** – a feature or behavior of a species that makes it possible for organisms of that species to survive in its natural environment.

**B** **Behavior** – what an animal does as part of how it meets its needs.

**Breathing** – how an animal takes in air.

**C** **Carbon dioxide** – a gas in the air that plants need in order to make food.

**Challenges** – something that makes it harder for an organism to survive.

**O** **Organ** – part of an animal or plant that does a specific function such as the mouth for eating or the roots for taking in water.

**Oxygen** – a gas in the air that most organisms need in order to live.



**R** **Reproduce** – how organisms can make young copies of themselves such as animal babies and plant seedlings.

**S** **Shelter** – a safe place for an animal to live or hide.

**Species** – a group of organisms that are very similar to each other and can produce young together. Generally, different species cannot reproduce with each other.

**Survive** – keep being alive.

**T** **Tropical** – locations near the Equator that are usually warm throughout the whole year.





# TEACHING TIPS

## QUICK TIPS

Students create a mural of an island environment and show how several living things are adapted to that environment.

With a partner, students describe how plants or animals on land and those that live under water get food, water and air.

Students select one plant and one animal that live in the same environment and describe how they are adapted to that environment. They use descriptive adjectives to provide explicit details of the adaptation.

Students compare adaptations of similar organisms found in different environments (e.g., compare trees on mountain tops of high islands in the tropical Pacific to trees that grow in low islands in the tropical Pacific).

## A DAY IN THE LIFE OF A LIVING THING THAT LIVES IN A PACIFIC ISLAND ENVIRONMENT

In groups, students identify a plant or animal in a Pacific island environment they want to learn more about. They write a narrative about a day in the life of the plant or animal from the plant or animal's perspective.

They use the storyboard below to brainstorm ideas for the narrative, remembering that it is the plant or animal that is telling the story.

### Storyboard

Students brainstorm all they know about the plant or animal and the island environment, documenting the key ideas and descriptions. They gather more information if needed. Then they draft the story elements using as much information about the plant or animal as they can. The group decides:

1. Who the main characters are and list their qualities (e.g., friendly, generous, hard working)
2. Where the story takes place (the island environment)
3. The sequence or series of events that take place within 24 hours (a day in the life of...)
4. A complication (something that happens in the environment or to the plant or animal)
5. The resolution (how the complication gets solved)
6. How to end the story

Students write the story in their home language or in English. They revise and edit several times. While it is a narrative and therefore a fictional story, students provide as many real facts about the plant or animal and environment as possible. They illustrate their story and share with others.

## HIDE AND SEEK IN NATURE

Use images or real outdoor experiences of different high island environments:

Observe carefully to identify if there are animals 'hidden' or living in these areas, and how different plant structures, colors and animal characteristics help them to hide and protect them from predators.

Introduce/Review the concepts of "protection" and "adaptation".

Draw from students' experiences to identify what other environments in the lagoon or on the island that help protect different types of animals. List the place and protection for each animal.

ANIMAL (name and/or illustration)	WHERE IT LIVES	TYPE OF PROTECTION
Seaweed seahorse	Reef among seaweeds	Camouflage – body looks like seaweed

Assign groups to each build a poster of an environment with many colors and textures: provide crayons and rub with paper on different surfaces; glue on leaves, grasses, and/or soil /sand materials from that environment).

Guide students to make "pretend animal figures", using the same materials from above, to "hide" animals in the environment.

Do a "gallery walk" with the posters. Have students discover the camouflaged animals in the environments, and have each group explain what adaptations they made on the animals to survive (e.g., mangrove – root-like shape) and what protection the environments offer. Use the key words protection and adaptation.

Study and discuss the protective adaptations different animals have (e.g., color, size, natural structures (e.g., seaweed seahorse vs. borrowed from nature – hermit crabs).

Discuss why certain high island areas are more protected, and the protection these areas give to animals (e.g., mangroves as nurseries). Ask: what would happen if these areas were not protected? (Make connection to conservation and stewardship.)

## FIND OUT!



This book, Adaptations: Finding a fit in the changing world, teaches about how living things thrive in many different places because they change and adapt to their conditions. The book gives many examples of how plants and animals have adapted to different Pacific island environments (see pages 20 – 31).

How do you think plants and animals have adapted to environments that are very different from those found on land and water environments in the Pacific?

Let's find out. Use the resources around you (e.g., people, textbooks, Internet) to learn about plants and animals that live in a very cold climate, and plants and animals that live in a hot, dry desert.

- Find out what structural adaptations they have to help them survive or reproduce (e.g., in the desert, many plants have a waxy "skin" to better conserve water and keep it from evaporating; a camel has hump on the back and stores inside it fat that is used as both a source of food and water)
- Find out what behavioral adaptations they have to help them survive or reproduce (e.g., in the very cold climate of the Arctic, plants grow very close together and close to the ground to protect themselves from cold temperatures and strong winds; there is so little food available on land that the bears learned to be excellent swimmers and catch seals to eat).

Make a chart like the one below, and describe the structural or behavioral adaptations of one plant and one animal in each of the two environments. You can also use more paper to draw the environment and the organisms.

CLIMATE	Plant and Its Adaptations	Animal and Its Adaptations
Very cold 		
Very hot and dry 		

## ISLAND ORGANISMS ADAPTED TO THEIR ENVIRONMENT

In small groups, students choose an island environment. They then select two plants or two animals that live in that environment. They research the adaptations these two organisms have developed to meet basic needs (i.e., food, water and air). Students present findings to peers and others.

A small group of students:

1. Clarify purpose of report (e.g., to describe the similarities and differences of adaptations of two plants or animals living in the same island environment)
2. Identify an island environment (e.g., forest, wetland, beach, reef, open ocean)
3. Identify two plants or two animals that live in that environment
4. Construct 'how' questions to answer how the plants or animals are adapted to meet basic needs in that environment (e.g., food, water, air, shelter)
5. Use the questions to focus the research and collect information that answers the questions
6. Research information using primary (e.g., interview an elder or community expert) and secondary resources (e.g., read the organism adaptation book, find other books or go online to gather information)
7. Document the sources of information
8. Record information collected in table (see an example of a table below)
9. Use the table as an outline to organize ideas by subheadings

10. Write a short report using predetermined subheadings
  - Introduction states the purpose of the report and the topic
  - Detail 1 e.g., adaptations to meet need for food
  - Detail 2 e.g., adaptations to meet need for water
  - Detail 3 e.g., adaptations to meet need for air
  - Conclusion or summary e.g., highlight similarities and differences of adaptations of plants or animals to meet needs in the same environment)
11. Add illustrations
12. Have students, with guidance from adults, peer edit reports
13. Group revises report—text and illustrations—based on peer edits
14. Present orally to peers and parents

Island Environment	Organism (Plant / animal)	Adaptations		
		Food	Water	Air
	1.			
	2.			
	3.			

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## OTHER BOOKS IN THIS SERIES

This book is a part of the series, Pacific Islands Climate Education Partnership (PCEP), Place-based resources for Pacific Island schools. The series also includes the following titles published thus far.



*Our High Island Home* is a book about natural island environments that Pacific children and their families will enjoy reading together. Highly visual images make familiar high island land- and seascapes come to life. Children living on high islands will recognize their everyday world and yet be amazed at the hidden treasures found within.



*Our Low Island Home* is a book about natural island environments that Pacific children and their families will enjoy reading together. Highly visual images make familiar low island land- and seascapes come to life. Children living on low islands will recognize their everyday world and yet be amazed at the hidden treasures found within.



*Pacific High Island Environments* is a book for those wanting to learn more about the places, plants, and animals on tropical high islands in the Pacific. The reader learns how high islands are formed and the various environments that create habitats for many species of plants and animals. From agroforests to mangrove swamps and lagoons, the reader is connected to island life and how important these environments are for the communities that live there.



*Pacific Low Island Environments* is a book for those wanting to learn more about the places, plants, and animals on tropical low islands in the Pacific. The reader learns how low islands are formed and the various environments that create habitats for many species of plants and animals. From atoll forests to patch reefs and the open ocean, the reader is connected to island life and how important these environments are for the communities that live there.



*Mangroves—Living on the Edge in a Changing Climate* offers readers of all ages a fascinating journey through the inner worlds of the mangroves. Intricate adaptations and unexpected habitats emerge from the pages of the swamp, unsettling the reader into realizing the incredible value of this island ecosystem. Mangroves provide many resources for local communities, and help reduce global warming by storing more carbon in the soil and its trees than other comparable ecosystems. This book also explains climate change, and how communities can help protect mangroves from climate change impacts such as rising sea levels.



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