EVOLUTION REVOLUTION WORKSHEET

Embark upon an evolution journey …

Discover how some animals have evolved over time from mega three tonne wombats to carnivorous kangaroos!

In small groups, complete the worksheet. We recommend staggered groups to minimise congestion if multiple classes. Read the exhibit signage as well as the worksheet to discover the answers. Worksheet sections/locations can be completed in any order. Come back to a question if you can't answer it right away as you might find it on a sign later.

Please note that Years 9-12 still require teacher/parent supervision to ride the train.

Blinky Bill's Home Tree
(Freshwater animals, nocturnal mammals and reptiles - map reference B14) -

1.

Evidence suggests that the earliest fish had gills. Find a fish that has gills but also uses something else to breath.

_____

2.

Fossil evidence suggests that snakes may have evolved from burrowing lizards. Outline the three physical differences between snakes and lizards.

a)_____

b) _____

c)

_____

Did you know some pythons and boas have tiny hind leg bones buried in the muscles towards the tail. These ***vestigial or remnant*** *legs are another clue that snakes evolved from lizards …*

3.

Find an introduced amphibian that Scientists believe have evolved longer legs to hop further and faster.

_____

Did you know this South to Central American amphibian was introduced to Queensland to control cane beetles in Queensland. It is now invading Northern Territory. These longer legs may have assisted with the journey.

4.

Flying Squirrels are native to North America. They are placental mammals belonging to the order rodentia. ***Natural selection*** *has enabled them to adapt to leaping from treetops and foraging at night hence their gliding membranes and large eyes.*

What is natural selection? A process in nature in which organisms possessing certain genotypic characteristics that make them better adjusted to an environment tend to survive, reproduce, increase in number or frequency, and therefore, are able to transmit and perpetuate their essential genotypic qualities to succeeding generations.

a) Find a marsupial mammal belonging to the order diprotodontia that has the same adaptations. These mammals are only distantly related yet have similar adaptations.

_____

<u>Forest Fringe Aviary</u> (map reference I15) -

5.

Find a female bird that selects only males that are the best builders, decorators and dancers!

_____

*Naturalist Charles Darwin marvelled at the architecture of the bowers, and their place in the **sexual selection** of the species, citing it in his writings on evolution.*

Did you know? The bower is not a 'nest'. It is an attractive 'avenue', used by male bowerbirds to seduce a female. Mating takes place in the bower.

<u>Tasmanian Devil</u> (map reference Q12) -

Australia has a great diversity of marsupials. Marsupials evolved from South America and can also be found in Papua New Guinea. Some scientists say this short gestation or pregnancy period may be a reproductive strategy used to survive Australia's largely desert environment. The Tasmanian Devil is an example of natural selection at its best.

6.

a) How many joeys can Tasmanian Devils have?

_____

b) How many joeys will have the opportunity to attach to a teat?

_____

This reproductive strategy ensures 'survival of the fittest'! Only the fittest genes will survive and reproduce.

*DFTD is a contagious cancer responsible for the decline of Tasmanian Devils. Scientists believe devils may be evolving in response to DFTD as many females are reproducing at a younger age. DFTD itself is a cancer that has evolved as cancer is not normally contagious. Scientists have discovered the rogue cell line that initially evolved in a tumour of unknown origin. Some scientists believe the spread of **mutation** DFTD genes could be due to the lack of **genetic variation** and **isolation** as Tasmanian Devils are only found in Tasmania. They were once found on the mainland of Australia however. Currumbin Wildlife Sanctuary's Insurance Population Program is keeping health animals on the mainland away from sick ones. These specially selected Tasmanian Devils and their offspring are continually monitored for their heath and viability in the program.*

c) What does DFTD stand for?

_____

<u>Kangaroos - paddock</u> (map reference S13) -

7.

Kangaroos are yet another example of an Australian marsupial. Did you know some mammals can put their pregnancy 'on embryonic dipause'.

a) Briefly explain how the kangaroo can have three babies at three different stages at one time

b) What is the benefit of this reproductive strategy?

_____

_____

Present day kangaroos evolved from a tree dwelling animal whose feet were not suited to walking or running on the forest floor. This is why present day kangaroos hop. They also use their strong muscular tail for balance.

c) Can today's kangaroos move backwards? Observe the kangaroos if you cannot find the answer on the signage.

_____

d) Are present day kangaroos omnivores or herbivores?

_____

Did you know they found carnivorous kangaroo fossils at Riversleigh, a former cattle station in Australia! David Attenborough has called Riversleigh one of the four most important fossil deposits in the world. These kangaroos would have stood up to about a human shoulder with teeth designed for eating flesh and bone …

Species rich rainforest at Riversleigh 19 million years ago. Artist - Dorothy Dunphy

Bonus question

What does biodiversity mean?

_____
_____
_____

Meeting place for WILDLIFE DISCOVERY TOUR – Kangaroo feed machine in paddock

(map reference S13)

Time to be confirmed by your teacher

Meet your Education Officer, here, at the kangaroo feed machine …

As a class, you will go back in time, back to the formation of Gondwana when dinosaurs ruled the earth and many of the major animal groups we know today began their evolution journey …

Wildlife Discovery Tour - Lost Valley (map reference V14) -

8.

Conduct observations of adaptations in action as four animals engage with enrichment (food and/or toy items). Summarise adaptations and how each animal has evolved over time.

a) Southern Cassowary

b) Green Iguana or Goodfellow's Tree Kangaroo

c) Cotton-top Tamarin

d) Ring-tailed Lemur

Suggest sustainability initiatives that we can implement to reduce the impact and conserve biodiversity:

<u>Saltwater Crocodiles</u> (map reference W13)

Of all the present day reptiles, crocodiles and alligators may be the least changed proving they are perfectly adapted. Adaptations include nostrils and ear opening that can close underwater, a third clear eye lid that acts like goggles underwater, strong jaw closing pressure and dermal pressure (vibration) receptors.

9.

Explain an adaptation that assists the crocodile in digesting bones of prey.

_____

_____

<u>Flying Foxes</u> (map reference S11) -

We're related to flying foxes?! …

10.

Observe the facial features and acrobatic nature of these bats. They may remind you of another animal. Scientists believe Flying foxes and humans shared a common ancestor. Which one do you think we shared?

_____

<u>Mega three tonne wombat</u> (between map reference S8 - echidnas and R8 - koalas)

11.

Just kidding! It's just a sign with a picture of one. Can you imagine a time when mega fauna like this massive wombat-like creature walked the earth …

a) How long ago did this creature exist?

Between _____ years ago and _____ years ago.

b) List two features this creature shared with today's wombat species.

_____ and _____

c) List three features that make today's wombats better suited to their environment.

i) _____

ii) _____

iii) _____

<u>Koalas - Near Wombat Den</u> (map reference R8) -

12.

Currumbin Wildlife Sanctuary is working on artificial insemination programs in partnership with University of Queensland. Artificial insemination is collecting semen from male Koalas and inseminating female Koalas.

a) Why is it important that Koalas are genetically diverse (genetic variation)?

_____

_____

Did you know Victorian Koalas vary from their southern cousins. They are darker in colour and almost double the weight to survive the cooler climate.

<u>Dingoes</u> (map reference - U7) -

13.

a) The scientific opinion is that dingoes reached Australia when?

Between _____and _____ years ago.

b) How did dingoes reach Australia?

_____

_____

c) Why are there no dingoes in Tasmania?

_____

_____

d) Which animal is the likely ancestor of dingoes?

_____

e) What does it mean for dingoes as a species if they interbreed with domestic dogs? Is this positive or negative for dingoes?

_____
_____

<u>Bonus question</u>

How are the reproductive strategies of the echidna (and Platypus) different to all other mammals?

_____

Did you know Tasmanian echidnas vary from their southern cousins. They have less quills (spikes) and more fur to survive the cooler climate.

EVOLUTION REVOLUTION WORKSHEET - ANSWERS

Embark upon an evolution journey …

Discover how some animals have evolved over time from mega three tonne wombats to carnivorous kangaroos!

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Please note that Years 9-12 still require teacher/parent supervision to ride the train …

Blinky Bill's Home Tree
(Freshwater animals, nocturnal mammals and reptiles - map reference B14) -

1.

Evidence suggests that the earliest fish had gills. Find a fish that has gills but also uses something else to breath.

Australian Lungfish

2.

Fossil evidence suggests that snakes may have evolved from burrowing lizards. Outline the three physical differences between snakes and lizards.

a) Limbs

b) External ears – Lizards have external ears

c) Eye lids – **Most** lizards have eyelids

*Did you know some pythons and boas have tiny hind leg bones buried in the muscles towards the tail. These **vestigial or remnant** legs are another clue that snakes evolved from lizards …*

3.

Find an introduced amphibian that scientists believe have evolved longer legs to hop further and faster.

Cane Toad

Did you know this South to Central American amphibian was introduced to Queensland to control cane beetles in Queensland. It is now invading Northern Territory. These longer legs may have assisted with the journey.

4.

*Flying Squirrels are native to North America. They are placental mammals belonging to the order rodentia. **Natural selection** has enabled them to adapt to leaping from treetops and foraging at night hence their gliding membranes and large eyes.*

What is natural selection? A process in nature in which organisms possessing certain genotypic characteristics that make them better adjusted to an environment tend to survive, reproduce, increase in number or frequency, and therefore, are able to transmit and perpetuate their essential genotypic qualities to succeeding generations.

a) Find a marsupial mammal belonging to the order diprotodontia that has the same adaptations. These mammals are only distantly related yet have similar adaptations.

Squirrel Glider

Forest Fringe Aviary (map reference I15) -

5.

Find a female bird that selects only males that are the best builders, decorators and dancers!

Satin Bowerbird

*Naturalist Charles Darwin marvelled at the architecture of the bowers, and their place in the **sexual selection** of the species, citing it in his writings on evolution.*

Did you know? The bower is not a 'nest'. It is an attractive 'avenue', used by male bowerbirds to seduce a female. Mating takes place in the bower.

Tasmanian Devil (map reference Q12) -

Australia has a great diversity of marsupials. Marsupials evolved from South America and can also be found in Papua New Guinea. Some scientists say this short gestation or pregnancy period may be a reproductive strategy used to survive Australia's largely desert environment. The Tasmanian devil is an example of natural selection at its best …

6.

a) How many joeys can Tasmanian Devils have?

As many as 40

b) How many joeys will have the opportunity to attach to a teat?

Four

This reproductive strategy ensures 'survival of the fittest'! Only the fittest genes will survive and reproduce.

*DFTD is a contagious cancer responsible for the decline of Tasmanian Devils. Scientists believe devils may be evolving in response to DFTD as many females are reproducing at a younger age. DFTD itself is a cancer that has evolved as cancer is not normally contagious. Scientists have discovered the rogue cell line that initially evolved in a tumour of unknown origin. Some scientists believe the spread of **mutation** DFTD genes could be due to the lack of **genetic variation** and **isolation** as Tasmanian Devils are only found in Tasmania. They were once found on the mainland of Australia however. Currumbin Wildlife Sanctuary's Insurance Population Program is keeping health animals on the mainland away from sick ones. These specially selected Tasmanian Devils and their offspring are continually monitored for their heath and viability in the program.*

c) What does DFTD stand for?

Devil Facial Tumour Disease

<u>Kangaroos - paddock</u> (map reference S13) -

7.

Kangaroos are yet another example of an Australian marsupial … Did you know some mammals can put their pregnancy 'on pause' …

a) Briefly explain how the kangaroo can have three babies at three different stages at one time.

One joey out of the pouch, one in the pouch and one suspended in development. Kangaroos have a reproductive adaptation called delayed implantation. This is when the fertilised egg can cease development and wait.

b) What is the benefit of this reproductive strategy?

So they can wait until the mother is ready and conditions are right.

Today's kangaroos evolved from a tree dwelling animal whose feet were not suited to walking or running on the forest floor. This is why today's kangaroos hop. They also use their strong muscular tail for balance.

c) Can present day kangaroos move backwards? Observe the kangaroos if you cannot find the answer on the signage.

No (because of their tail)

d) Are present day kangaroos omnivores or herbivores?

Herbivores

Did you know they found carnivorous kangaroo fossils at Riversleigh, a former cattle station in Australia! David Attenborough has called Riversleigh one of the four most important fossil deposits in the world. These kangaroos would have stood up to about a human shoulder with teeth designed for eating flesh and bone.

Species rich rainforest at Riversleigh 19 million years ago. Artist - Dorothy Dunphy

<u>Bonus question</u>

What does biodiversity mean?

The existence of a wide range of different types of organisms in a given place at a given time.
The diversity of plant and animal life in a particular habitat (or in the world as a whole); *a high level of biodiversity is desirable*. Pertaining to the diversity and frequency of organisms in a given area.

Meeting place for WILDLIFE DISCOVERY TOUR – Kangaroo feed machine in paddock

(map reference S13)

Time to be confirmed by your teacher

Meet your Education Officer, here, at the kangaroo feed machine …

As a class, you will go back in time, back to the formation of Gondwana when dinosaurs ruled the earth and many of the major animal groups we know today began their evolution journey …

Wildlife Discovery Tour - Lost Valley (map reference V14) -

8.

Conduct observations of adaptations in action as four animals engage with enrichment/food items. Summarise adaptations and how each animal has evolved over time.

a) Southern Cassowary

Adaptations -

- Large greyish helmet or casque. The purpose is unknown however recent research suggests that it may help cassowaries feel vibrating sound from other male cassowaries over long distances. This sense is called infrasound and was used by dinosaurs. It is also used by present-day elephants.
- 9cm dagger claw to protect from intruders
- Feathers are course and the quill splits into two. Emu feathers are the same.
- Females are generally larger although the male incubates the eggs and rears the chicks. The female is dominant. She may breed with many males
- Solitary
- Chicks are striped yellow and black for camouflage

Evolution –

- Cassowaries and emus belong to a group of large flightless birds called ratites. They have vestigial or remnant wings.
- Ratites descended from dinosaurs. They were the earliest types of birds to develop. Many are still present however moas and elephant birds are now extinct. There are a couple of dinosaurs that look very similar, with their head casques, to the present-day cassowary. Some of these dinosaurs also had some feathers.
- Cassowaries evolved in a region of the supercontinent, Gondwana. Three species are now found in PNG but only the Southern Cassowary is found in Australia.

Observations –

Make a note of any adaptations in action as the Keeper offers enrichment (food and/or toy items).

b) Green Iguana OR Goodfellow's Tree Kangaroo

Green Iguana

Adaptations –

- Hard, long tail is used as a weapon and for balance when climbing
- Greenish grey colour can change colour slightly but not as well as some lizards such as chameleons
- Parietal eye or third eye on the head is photoreceptive and detects changing light patterns or shadows from predators overhead
- Large (subtympanic) shield serves no purpose however may fool predators into thinking it is an eye or may assist with camouflage
- Females and juvenile males are brighter green than adult males acquire the faeces from adults in order to essential gut bacteria to hep digest vegetation
- Juvenile iguanas often eat
- Diurnal

Evolution –

- Scientists believe land and marine iguanas from the Galapagos Islands rafted and descended from green iguanas from Central and South America

Observations –

Make a note of any adaptations in action as the Keeper offers enrichment (food and/or toy) item.

Goodfellow's Tree Kangaroo

Adaptations –

- Shorter, broader feet than ground kangaroos with padded soles and sharp, curved claws to help them climb
- Long tails for balancing when jumping from tree to tree
- Can walk moving their hind limbs independently. Ground kangaroos can only move their hind limbs at the same time
- Fur grows in whorls, thought to be an adaptation for rain-shedding
- Solitary however male territory will overlap with a few females
- Mostly nocturnal in the wild however more crepuscular in captivity
- Males are dominant. Tree roos will have many mates

Evolution –

- Some tree roo species have only been discovered very recently
- It is unclear whether tree roos came before or after ground kangaroos. Some research suggests that they did not come first at all. Some research also suggests they are closely related to rock wallabies

Observations –

Make a note of any adaptations in action as the Keeper offers enrichment (food and/or toy items).

c) Cotton-top Tamarin

Adaptations –

- Tamarins belong to a group of monkeys called 'New World Monkeys' from South America. Chimpanzees and humans belong to a group of monkeys called 'Old World Monkeys, Apes and Humans'
- Unlike some monkeys, they do not have opposable thumbs and their tales are not prehensile

- They have more pointed claws than most primates. They are shaped more like a squirrel's claw than a human finger nail. This helps them cling to trees
- Diurnal
- They constantly scan the forest for potential predators. When the group rests, one group member stays alert and makes warning noises if it senses danger
- Live in family groups of around 40 animals
- Only dominant males and females reproduce to ensure strong genes are passed on
- Newborns cling to their parents. Both parents care for the young. The father carries the young but transfers them to the mother at feeding time
- Behavioural - They will display their rear to intruding primates to tell them it is their territory!
- Communication – Living in dense vegetation, cotton-top tamarins do not rely heavily on visual communication. They use scent and vocal signals. When interacting closely they utilise tongue flicking, teeth baring, head flicking, head lowering and frowning. When alarmed or excited, they raise the hair on top of their heads and stand tall to make themselves look bigger. Vocal communication including chirping and chucking calls primarily serves as a warning to the group when predators are nearby. Females scent more than males to signal they are in season.

Evolution –

- Scientists estimate that monkeys arrived in South America 37 to 40 million years ago evolving from apes and Old World Monkeys however the first fossil evidence of them is dated 11 million years later. This is most likely due to the Amazon's excessively humid and wet climate
- Some research suggests they may have rafted from South America to Africa

Observations –

- Make a note of any adaptations in action as the Keeper offers enrichment (food and/or toy items)
- Take note of any similarities between tamarins and humans

d) Ring-tailed Lemur

Adaptations –

- Lemurs are prosimians. One of the primitive forms of primate
- Opposable thumbs and big toes for gripping branches and holding objects
- Most lemurs send most of their time in trees with the exception of the ring-tailed lemur. They have one claw on each of their back feet. Most digits have nails for climbing and feeding
- They have strong back legs for jumping and long tails for balance
- Long bushy tail for balance when climbing
- Ring-tailed lemurs have scent glands on their wrists and chests that they use to mark their foraging routes. Males have a horny spur on each wrist to pierce tree ranches before scent marking them. Secretions can also be rubbed on the tail and flicked at an opponent
- When they travel in troops they keep their tails in the air, like flags
- They live in groups ranging from three to 25
- Females are dominant which is unusual in the primate world. Females must fight for this position. Females spend their whole life in their birth group

- Communication - They use various facial expressions utilising their mouth and teeth. They are one of the most vocal primates.

Evolution –

- Prosimians were once found in many continents but were eventually replaced by monkeys who were stronger in the trees. Researchers believe they rafted to islands off the coast of Africa and Asia where the absence of monkeys allowed them to flourish into many species.
- Lemurs are only found on the island of Madagascar. Research suggests this occurred 40-50 million years ago. Many researchers believe this isolation from other primates is what led to their differences and numerous species of lemurs have already become extinct in the millions of years that past. Some fossil remains indicate they may have weighed the size of an adult gorilla. Researchers believe this reduction in size allowed them to live and forage for food in trees

Observations –

- Make a note of any adaptations in action as the Keeper offers enrichment (food and/or toy items)
- Take note of any similarities between tamarins and humans

Saltwater Crocodiles (map reference W13)

9.

Of all the present day reptiles, crocodiles and alligators may be the least changed proving they are perfectly adapted. Adaptations include nostrils and ear opening that can close underwater, a third clear eye lid that acts like goggles underwater, strong jaw closing pressure and dermal pressure (vibration) receptors.

Explain an adaptation that assists the crocodile in digesting bones of prey

The stomach is the most acidic known to man and is capable of digesting even the large bones of prey which have been broken by the crocodile's jaw pressure that exceeds 3500 psi.

Flying Foxes (map reference S11) -

We're related to flying foxes?! …

10.

Observe the facial features and acrobatic nature of these bats. They may remind you of another animal. Scientists believe flying foxes and humans shared a common ancestor. Which one do you think we shared?

Primitive primates

Mega three tonne wombat (between map reference S8 - echidnas and R8 - koalas)

11.

Just kidding! It's just a sign with a picture of one. Can you imagine a time when mega fauna like this massive wombat-like creature walked the earth.

a) How long ago did this creature exist?

Between 20,000 years ago and 1.6 million years ago

b) List two features this creature shared with today's wombat species.

Pouch and predominant incisors at the front

c) List three features that make today's wombats better suited to their environment.

i) Size

ii) Feet shape

iii) Backwards facing pouch

<u>Koalas - Near Wombat Den</u> (map reference R8) -

Currumbin Wildlife Sanctuary is working on artificial insemination programs in partnership with University of Queensland. Artificial insemination is collecting semen from male Koalas and inseminating female Koalas.

12.

Why is it important that Koalas are genetically diverse (genetic variation)?

To reduce the side effects of inbreeding. Inbreeding can cause Koalas to carry undesired genetic traits and they may also become susceptible to diseases.

Did you know Victorian Koalas vary from their southern cousins. They are darker in colour and almost double the weight to survive the cooler climate.

<u>Dingoes</u> (map reference - U7) -

13.

a) The scientific opinion is that dingoes reached Australia when?

Between 3000 and 8000 years ago

b) How did dingoes reach Australia?

Former land bridges that linked Australia with New Guinea. They may have been brought over by Aboriginal people.

c) Why are there no dingoes in Tasmania?

Because Bass Strait became inundated with sea about 14 000 years ago (before the arrival of the dingo)

d) Which animal is the likely ancestor of dingoes?

The Indian Plains Wolf

e) What does it mean for dingoes as a species if they interbreed with domestic dogs? Is this positive or negative for dingoes?

This will result in fewer pure breed Dingoes. It could mean the extinction of pure breed dingoes.

Bonus question

How are the reproductive strategies of the Echidna (and Platypus) different to all other mammals?

Echidnas and Platypus are egg-laying mammals called monotremes.

Did you know Tasmanian echidnas vary from their southern cousins. They have less quills (spikes) and more fur to survive the cooler climate.