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QUALIFY FOR THE FUTURE WORLD
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Level 3 Biology, 2015

91605 Demonstrate understanding of evolutionary processes leading to speciation

2.00 p.m. Monday 23 November 2015
Credits: Four

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of evolutionary processes leading to speciation.	Demonstrate in-depth understanding of evolutionary processes leading to speciation.	Demonstrate comprehensive understanding of evolutionary processes leading to speciation.

Check that the National Student Number (NSN) on your admission slip is the same as the number at the top of this page.

You should attempt ALL the questions in this booklet.

If you need more room for any answer, use the extra space provided at the back of this booklet and clearly number the question.

Check that this booklet has pages 2–12 in the correct order and that none of these pages is blank.

YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.

Achievement

TOTAL 10

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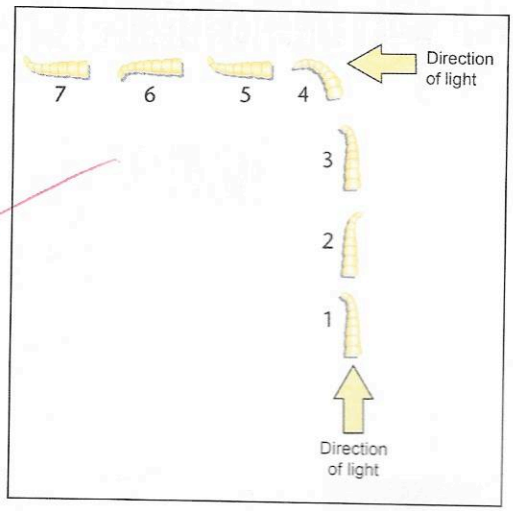
QUESTION ONE

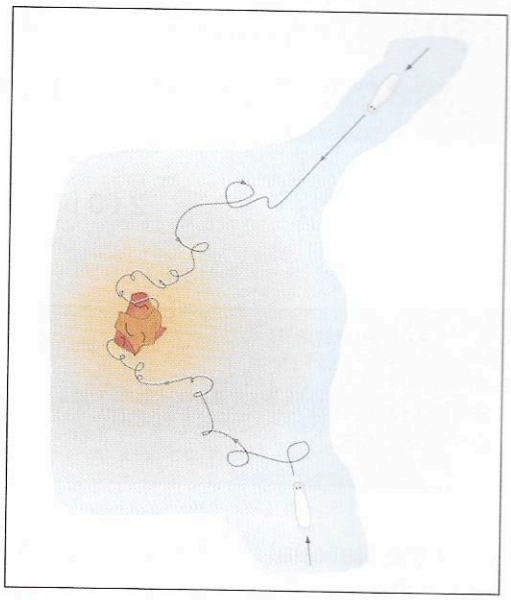
Some animals display innate behaviours.

As green bottle fly maggots (*Phaenicia sericata*) crawl, they turn their heads, comparing the light intensity from each side. They always turn towards the darker side, taking them away from light.



Maggot response to light stimulus.

A piece of meat in water causes a chemical gradient. Flatworms, such as *Planaria torva*, move along a straight path until they detect an increase in chemical concentration. The flatworms increase their rate of turning in the area until they touch the meat and start feeding.



Flatworm response to chemical stimulus.

Compare these responses, the adaptive advantages gained for the animals that display them, and how these animals come to have them.

In your answer:

- identify the full term given for both responses, and define these terms
- using the information above, justify the types of orientation you have described, and explain how they operate in both the maggots and the flatworm
- compare the adaptive advantages these animals gain by displaying these behaviours.

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The response for the Maggot is negative phototaxies. The Maggot move away from the light and toward the opposite direction

The response for the Flatworm is klinokinesis. The Flatworm move non-directional and keep turning, when the detect the chemical in the water. Compare to the ~~first~~ response of Maggot, this response is ~~also the response of the~~ non-directional.

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- The response of Maggot to light is negative phototaxies. No.1.
At the beginning the light is from South and towards north. The Maggot detect the light and the direction by turning the head to find the less light side, and then move away from the light and try to find a darker side that has lower light intensity. At the forth step, the direction of light is from the east and towards west. As the high light intensity are detected by Maggot, from South and east with the light from east Stronger, the movement Starts to turn to the west. These movements give the evidence that Maggot always move away from the light.

The response of Flatworm to the chemical is klinokinesis. When the chemical concentration increases and detected by the Flatworm, the central nerve system direct the responsor in Flatworm to make movement. There are two changes in this movement, the direction and the rate. The direction becomes non-direction and the rate of turning becomes higher because the condition with the chemical is favoured by Flatform. They keep turning quickly until they touch the meat and start feeding.

- The adaptive advantage for Maggot's response by moving their head first only to compare the light intensity, more energy are saved.

② By responsing to the light intensity, they are able to find the favourable

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Condition to ~~to~~ stay

The adaptive advantage for flatworm's response are:

① By only turning quickly when they dectect the chemical, the energy are saved. They can save their energy when the chemical are not detected.

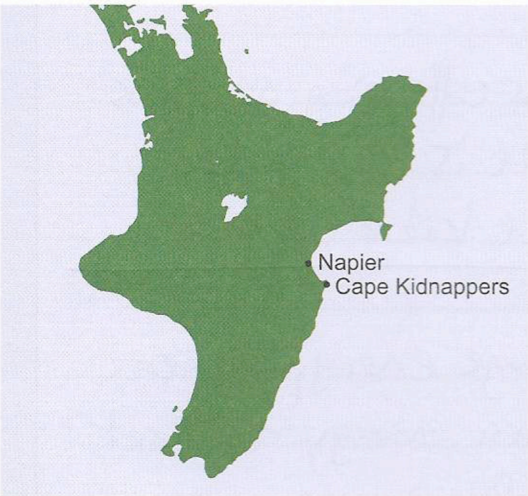
② This response help them to find the food resourses and gain more nutrients.

QUESTION TWO

Cape Kidnappers on the coast of Hawke's Bay is an exposed headland, which hosts the largest mainland gannet *(Morus serrator)* colony in New Zealand, with around 6500 breeding pairs arriving in early August each year. The birds remain until the young fledglings are mature enough to leave, and then return to Australia in March the following year.

Gannets usually have the same mate over many breeding seasons and re-establish their relationship at the beginning of each breeding season. During the breeding season, the area is densely occupied by the gannets which actively defend their nesting sites.

Females lay a single pale blue egg, the size of a large hen's egg, any time from mid-September till mid-December. It is laid in a nest prepared from dried seaweed, cemented with guano (bird droppings), and incubated by each parent in turn. After 43 days, a blind, naked chick hatches, and is fed and cared for by both parents.



https://upload.wikimedia.org/wikipedia/commons/e/e9/Gannet_colony_cape_kidnappers.jpg

Evaluate the behaviours the gannet displays, using the given information above.

In your answer:

- identify and describe THREE behaviours displayed by the gannets
- explain the costs and benefits of the behaviours you have identified
- discuss how the combination of behaviours provides adaptive value to the gannets.

· Migration, gannets migrates to New Zealand ~~to where~~ in early August and mate. They reproduce the ~~ox~~ offspring ~~or~~ any time between ~~Setmp~~ September to December.

· mono..., gannets have ~~the~~ the same mate over many breeding season. One male and one female ~~for~~.

· Rising offspring (K strategy). ~~that~~ with small amount of offspring

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and long period of looking after.

The cost of migration is the death on the way. The long distance travelling may exusted individual or they may attacked by the predator. The benefit is that their offspring gets the optimum condition to grow and matual. The reproductive success is achieved.

The cost of only one mate is less offspring and less combination of genes. The benefit is the stable relationship between parants protect kid well.

The cost of K-strategy is huge energy devote to looking after the offspring and less energy to seek the food. The benefit is that offspring are more likely to reach the breeding age and reproduce

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QUESTION THREE

Mutualistic relationships exist between New Zealand's native birds and trees, but introduced mammalian predators can affect this.

Maungatautari in the Waikato is a large area of forest where mammalian predators have been eradicated and a perimeter fence has been built to keep it predator free. The area has been used to study the effect of predator removal on the ability of birds to successfully pollinate species of native plants.

The New Zealand fuchsia, (kōtukutuku) – *Fuchsia excorticata*, was used as an indicator species, and comparisons were made with nearby Pirongia Forest Park, where mammalian predators are present.

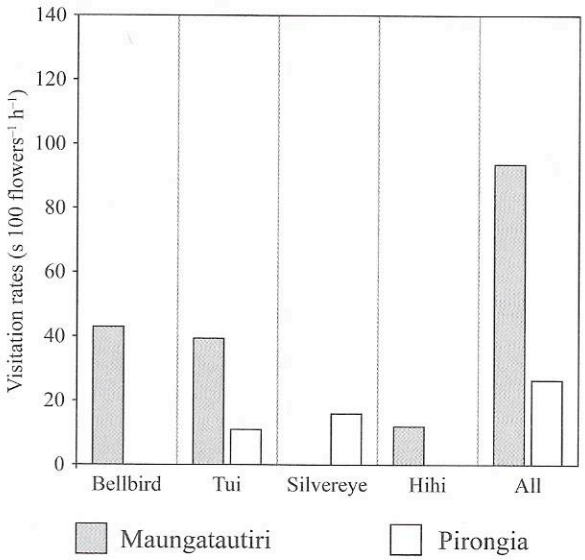
Fuchsia excorticata trees have one of two flower types:

- female flowers which need pollination
- hermaphrodites (male and female) which can self-pollinate.

Successful pollination results in formation of fruit.

Some results from the study are summarised below.

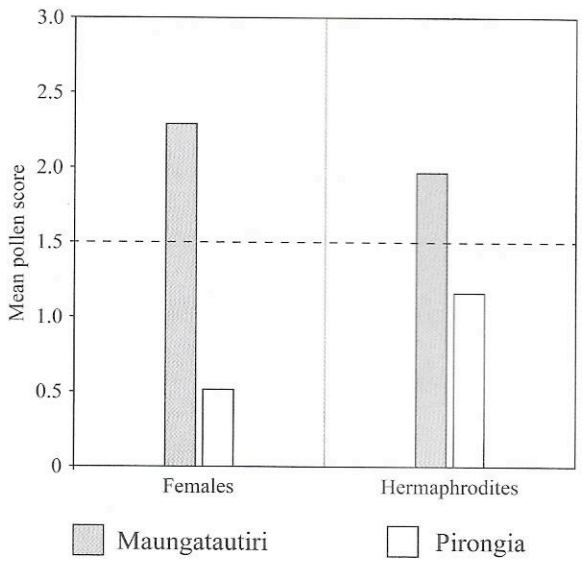
Visitation rates of pollinating birds to *Fuchsia excorticata* flowers



(Mean seconds of bird activity per 100 flowers per hour)

Adapted from Iles J.M. & Kelly D. School of Biological Sciences, Canterbury. Published online 9 April 2014.

Pollen scores of female and hermaphrodite *Fuchsia excorticata*



A pollen score index of at least 1.5 (dashed line) indicates a good pollination score, based on the relationship between pollen load and formation of fruit.

Adapted from Iles J.M. & Kelly D. School of Biological Sciences, Canterbury. Published online 9 April 2014.

Discuss the ecological relationships between the fuchsia trees, the bird species, and the presence or lack of mammals within the two forests, using the information given above to support your discussion.

In your answer:

- define the terms mutualism, predation, and interspecific competition
- explain the importance of pollination for both the fuchsia and the native birds
- use the data to compare, with reasons, the outcomes for *Fuchsia excorticata* and the key native bird species involved at the two sites.

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• Mutualism is a coorperation between two different species, by coorperating with each other they gain benefits.

predation is an interspecific competition, often result in one is get fed and another get killed and eaten. Interspecific competition is a competition between two species.

• The pollination for fuchia is important because it can reproduce and pass their gene to the next generation. The female flowers need pollination by birds who carry the pollen from the male flower and therefore reproduce. The hermaphrodites can self-pollinate so they do not need birds to help, but the pollination by birds still helpful.

• The first graph shows that at Maungatautiri where lack of the predator of the birds, the visitation rates increases whereas the visitation decreases at Pirongia where has predators of birds. The bellbird is the key bird species that involved in pollination because the visitation rate is the highest at Maungatautiri. The second graph shows that it is benefit for the female flower at Maungatautiri because more birds pollinated. Compare to less poor pollination at Pirongia where has less birds. However the different between two places for the pollination rate

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for hermaphrodites is not too large because even without birds, they can self-~~breed~~ pollinate, ~~to maintain the~~ keep but more birds visiting is still helpful for the pollination of hermaphrodites

A3

Achievement exemplar for 91603 2015		Total score	10
Q	**Grade score**	**Annotation**	
1	A4	This response provides consistent evidence towards Achievement. The candidate demonstrates the ability to identify and define both forms of movement, and describes an adaptive advantage of each behaviour. If the candidate had added quality explanations of each behaviour, or fully explained the adaptive advantage of either, they may have gained an M5 or better.	
2	A3	The candidate provides enough evidence in this response for A3, because they are able to describe one of the behaviours, although in a limited way. They also provide evidence of a cost and benefit of the behaviours. Had the candidate also mentioned that the benefits must outweigh the costs, they would most likely have gained M5.	
3	A3	The candidate provides enough evidence for A3 in this response as they have a difference between the forests and two relationships. They do not reach A4 as the definitions are insufficient. Fore xample note that although the candidate recognises interspecific competition is between two species, they don’t indicate an understanding of competition being for limited/the same resources.	