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Level 3 Biology, 2016

91603 Demonstrate understanding of the responses of plants and animals to their external environment

2.00 p.m. Thursday 10 November 2016
Credits: Five

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of the responses of plants and animals to their external environment.	Demonstrate in-depth understanding of the responses of plants and animals to their external environment.	Demonstrate comprehensive understanding of the responses of plants and animals to their external environment.

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 2–15 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.

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QUESTION ONE: TUI

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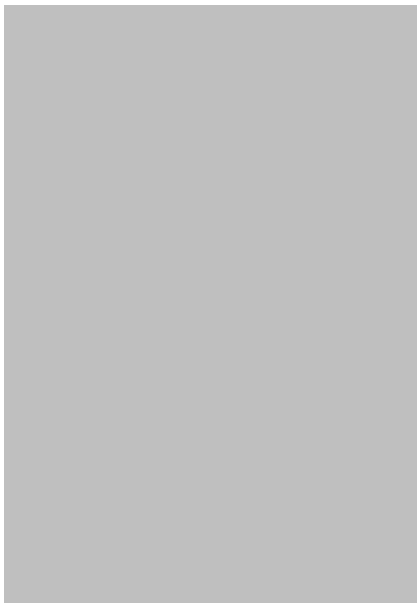
Tui (*Prosthemadera novaeseelandiae*) are notoriously aggressive, and will defend a flowering or fruiting tree, or a small part of a large tree, from all comers, whether another tui or another bird species. They vigorously chase other birds away from their feeding area with loud whirring wings. Tui have a display flight, in which they fly upwards above the canopy, and then make a noisy, near-vertical dive back into the canopy.



http://www.nzbirdsonline.org.nz/species/tui

http://www.biol.canterbury.ac.nz/mistletoes/photo_library.shtml

Tui feed on nectar from the red mistletoe (*Peraxellia tetrapetala)*. The red mistletoe grows on the mountain beech (*Fuscospora cliffortioides)*.

The flowers are pollinated by tui. To open flowers, tui grasp the top of the bud with their beaks and twist. This causes the flower petals to spring open (in less than ¼ of a second), and the birds can then insert their beaks to drink nectar, and thereby pollinate the flower.

Red mistletoe use specialised roots to get water and dissolved mineral ions from a host tree rather than from the soil, causing harm to its host tree mountain beech.

Identify and explain the behaviours and types of competition between the red mistletoe, tui, other birds, and the mountain beech, and evaluate the costs and benefits of maintaining these behaviours and relationships.

In your answer you should:

- describe territoriality
- explain the costs and benefits of the tui's territorial behaviour
- identify and describe the other types of relationships mentioned
- evaluate the costs and benefits to each species in the relationships identified.

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QUESTION TWO: THE SPOTTED HYENA

http://animalsversesanimals.yuku.com/topic/1856#.Vx64pTZ9650

The spotted hyena (*Crocuta crocuta*) is one of the most social of all carnivores. It lives in groups containing up to 90 individuals, and exhibits the most complex social behaviour. These animals live in social groups called clans that defend group territories.

Females are dominant over males, and even the lowest ranking female is dominant to the highest ranking male. Although males typically disperse from the clans they were born into, when they are between two and six years of age, females usually remain in their natal clan, so large clans may contain several different female lines of descent.

Females give birth at any time of year to litters containing one or two cubs. At the communal den, cubs are maintained for a period of 8 to 12 months; during this period the major source of food for cubs is milk provided solely by their mother. Although cubs of both sexes 'inherit' their mothers' social ranks, males voluntarily forsake those to assume much lower ranks in the neighbouring clans to which they disperse.

The following set of data shows the interactions of six female hyenas.

		Hyenas doing the biting					
		A	**B**	**C**	**D**	**E**	**F**
Hyenas being bitten	**A**	-	0	10	11	9	20
	B	7	-	18	8	6	8
	C	0	0	-	0	0	0
	D	0	0	17	-	12	11
	E	0	0	6	4	-	27
	F	0	0	18	0	0	-

Compare and contrast the advantages and disadvantages of belonging to the hierarchy of a clan, or living a solitary lifestyle.

In your answer you should:

- describe what a linear hierarchy is, and give the order of the linear hierarchy in the table above
- explain how a hierarchy is maintained, and identify which hyena is challenging for a higher position in the hierarchy
- explain factors that could influence an individual's position in the hierarchy
- discuss the advantages and disadvantages to individual male and female hyenas belonging to a social hierarchy in the clan, compared to living a solitary lifestyle.

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QUESTION THREE: WETA

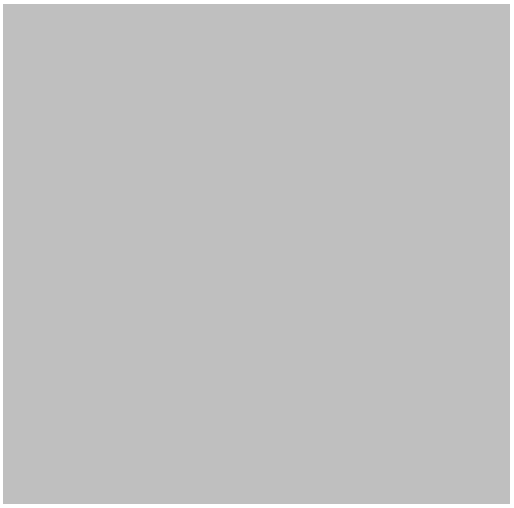
http://auckland-west.co.nz/wordpress/wp-content/uploads/2010/03/PICT6794aw.jpg

The Auckland tree weta (*Hemideina thoracica*) tokoriro remains secluded in the daytime under bark or in holes in trees in dim light. It emerges from cover soon after sunset to forage for mainly plant material, to return before dawn.

In the experiment below, the environmental conditions were maintained at 20°C in constant darkness for an experiment to observe its biological timing. The results are shown in **Graph 1** below left. The dark bars show when the weta is active.

The weta was then placed in 12 hours of light followed by 12 hours of darkness until day 18 (when it was exposed to 8 hours of light during the dark period), after which it was left in constant darkness. The results are shown in **Graph 2** below right.

Graph 1: Constant Darkness



Single plotted actogram of weta activity in a 24-hour period in constant environmental conditions.

Graph 2: 12 hr Light + 12 hr Darkness

A double-plotted actogram of weta with 8 hrs light (arrowed) on day 18 during the hours of darkness.

www.tandfonline.com/doi/pdf/10.1080/03014223.1994.9517476

Analyse the findings from these actograms to explain how the responses shown above help the weta adapt to its ecological niche.

In your analysis you should:

- describe the activity and rhythm shown by the weta
- explain how this rhythm is controlled
- explain the effect of the additional 8 hours of light on day 18 on the weta
- evaluate the adaptive advantage that this rhythm and control mechanism have for the weta.

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