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Level 3 Biology 2022

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

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.

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

Do not write in any cross-hatched area (▨). This area may be cut off when the booklet is marked.

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

Achievement

TOTAL 11

QUESTION ONE: INTRASPECIFIC RELATIONSHIPS

The stitchbird or hihi (*Notiomystis cincta*) is an endemic species that is now found only on islands or mainland regions to where it has been moved, due to predation from animals, such as domestic cats. Hihi have an unusual breeding system that includes pair or **group nesting**.

They **defend a territory in the mating season** of spring and summer, and have known dominance hierarchies. Older birds are dominant over the younger ones, especially those of the same sex. Males are dominant over females, except when chicks are present at the nest.

At the start of the breeding season, the males sing loudly until the end of the egg laying season. They also perform flight displays at the nesting area, which enhances their white and yellow colours.

Male hihi
Source: https://nzbirdsonline.org.nz/species/stitchbird

Female hihi
Source: https://nzbirdsonline.org.nz/species/stitchbird

Discuss how behaviours of the hihi work together to support the population size of the species.

In your answer:

- describe the terms hierarchy, predation, and territory ✓
- explain how a courtship strategy, such as singing or flight displays, can be both an advantage and a disadvantage for the male bird → attracts both mates & predators ✓
- evaluate how behaviours in **bold** above (group nesting and defending territory in the mating season) work together to maintain population size in protected areas.

Hierarchy is the order of dominance (pecking order) in a population, from most to least dominant. Predation is where one animal preys on and eats another animal/harms another animal. Territory is the area defended by a population, and often is where the population mate etc. The courtship strategy of the male hihi has both advantages & disadvantages. Whilst their loud singing and flight displays may attract potential mates, they also draw attention to the bird & its location → potentially attracting predators, who will hear their song's / see their flight displays, thus potentially putting the male hihi at risk of predation from animals such as hawks.

This shows that their specific courtship strategies have both advantages & disadvantages, as, for example, when the male hihi performs its flight displays, its white and yellow colours are enhanced, thus making it stand out more → making it more easily visable for both female hihi, and predators such as hawks or domestic cats. By doing both group nesting and defending territories in the mating season, the hihi are able to maintain population size in protected areas. This is because by group nesting, there is at least one bird at all times defending the nest, thus decreasing the chances of attacks, therefore increasing the chances of survival for the young. By defending their territory during the mating season, vulnerable chicks are less likely to be attacked, which allows for the continued survival & growth of the species.

✱ In the case of the hihi, older birds are more dominant over younger birds (especially those of the same sex) and male birds are dominant over female birds, with the exception of when chicks are present at the nest.

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QUESTION TWO: MIGRATION OF INDIGO BUNTING

Source: https://ebird.org/science/status-and-trends/indbun/range-map Source: www.flickr.com/photos/slingher/4522490194/

The indigo bunting (*Passerina cyanea*) is a bird that flies a long distance during its yearly migration, migrating only at night. Indigo buntings fly about 2000 km each way between breeding grounds in eastern North America (shown in red), and wintering areas from southern Florida to southern Central America (shown in blue).

Discuss how the behaviours mentioned above combine to help ensure the success of the species.

In your answer:

- define the term migration
- describe the biological rhythm shown, and give the likely environmental cue for migration
- explain a navigational method for the night migration of the bunting
- discuss how, despite the difficulties of a long journey, this repeated journey has enabled the indigo bunting population to be maintained.

circannual

seasonal change

→ lunar/stellar navigation

→ Benefits outweigh costs

typically annual

Migration is the mass movement of a species from one place (breeding grounds) to another (feeding grounds), and includes a return trip. It can be triggered by seasonal changes → increased temperatures → or by the biological clocks of the species / their mating pattern. The indigo bunting uses a circannual biological rhythm, as their migration follows a yearly pattern. As they only migrate at night, the indigo bunting displays nocturnal behaviour. The likely environmental

There is more space for your answer to this question on the following pages.

Cues which leads to their migration are seasonal changes and mating patterns. When the temperature drops in overwintering areas such as Southern Florida to Central America, food may become scarce, thus leading to the mass migration of the species to potentially warmer and more suitable areas to feed/breed, in areas such as Eastern North America. This is because they will be able to better raise their young there, and there will be more food, hence the likelihood of survival for the young offspring will be increased. The geographical location of the breeding grounds are most likely more suitable at that time of year, which is another factor which contributes to the cause of their migration. As the bunting only travel at night, they must use lunar/stellar navigation methods, which are methods that make use of stars/their placement in order to navigate their path. Although it is a very long trip (2000km each way) for the Indigo bunting to ~~Act~~ migrate & uses a lot of energy, the benefits of it outweigh the costs, thus leading to the survival of the species. This repeated journey has allowed for the population of the indigo bunting to be maintained, hence they will continue their annual migration.

QUESTION THREE: DODDER

Source: https://upload.wikimedia.org/wikipedia/commons/4/42/Cuscuta_campestris_covering_host01.jpg

Source: https://bygl.osu.edu/node/1682

Parasitism

The golden dodder (*Cuscuta campestris*) is a leafless and rootless plant that lives off other plants.

It has a growth response, enabling it to wind up and around a host plant, branching to form a tangled mass, which can spread from the initial host to nearby plants. It uses a special organ, the haustorium, to attach itself to the host and grow into host tissues. Through the haustorium, it gains water and nutrients from the host plant.

The flowering time is critical for the successful reproduction of the dodder. Various environmental cues, especially changes in night length (photoperiod), are perceived by the plant. Very little is known about how flowering of the dodder is triggered to start; however it is known that the dodder has both short-day plant (SDP) hosts and long-day plant (LDP) hosts. Scientists have found that the flowering of the dodder seems to be synchronised with the flowering of their hosts, as they flower when the host does.

Discuss reasons for the success of the dodder.

In your answer

- identify and describe the interspecific relationship between the dodder and the host plant ✓
- explain how auxin enables the dodder to grow up and wind around the host plant, and identify and describe this growth response → thigmotropism → positive ✓
- discuss how, through the ability to live off other plants and flowering at the same time as their hosts (both SDP and LDP), the dodder species is successful. ✓

The dodder displays parasitic behaviour towards the host plant, as it gains water and nutrients from it whilst not providing any benefits to the host plant in return. Because only one organism (the dodder) is benefitting from the relationship, ~~that~~ it can be said that the interspecific relationship between the dodder and the

host plant can be defined as parasitism. Auxin is a growth hormone which is found in plants. Auxin promotes growth in plant cells, which allows for the dodder to grow up and wind around the host plant. This is because when the dodder comes into contact with the stimulus (the host plant) the auxins shift towards the side of the plant that comes into contact with the stimulus, thus causing the dodder to elongate and wrap around the host plant. This displays the growth response of positive thigmotropism, as the plant is growing towards the stimulus (hence positive), and the stimulus is the dodder touching (touch) the host plant. By having the ability to live off other plants, as well as being able to flower at the same time as them, the dodder species are successful in their survival. By being able to absorb the water & nutrients from their host plant, the dodder can grow almost anywhere, as it ~~does~~ only requires a host and does not need to find an independant source of water/nutrients. In addition to this, the dodder has developed the ability to flower at the same time as its host plant, thus increasing its chances of successful reproduction. This is because animals/organisms which pollinate the host plant will most likely also pollinate the dodder, as they are both flowering at the same time, hence it is convenient. If it flowered at a different time than its host, it may struggle to attract organisms to polinate it, thus decreasing its chances of successful reproduction.

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Write the question number(s) if applicable.

QUESTION NUMBER

Extra space if required.
Write the question number(s) if applicable.

QUESTION NUMBER

Standard	91603	Display ID	NSN: 136811204	Total score	11
Q	**Grade score**	**Annotation**			
1	A4	This candidate describes hierarchy, predation, territory, an advantage of courtship/flight display and a disadvantage of courtship/flight display. Each of those points is an Achieved grade so they have more points than needed for the maximum Achieved score of A4. There is insufficient evidence for Merit or Excellence points.			
2	A4	Describes migration, identifies the pattern as circannual, briefly describes stellar navigation and a benefit that applies to the bunting. No additional Achieved points were awarded. There is insufficient evidence for Merit or Excellence points.			
3	A3	Describes parasitism, positive thigmotropism and an adaptive advantage to the dodder. Description/explanation of the role of auxin is incorrect so was not awarded. The explanation of synchronised flowering and getting more pollinators is at the Merit level, but as there are no further Merit points it is below the threshold (of 2 Merit points) to award Merit.			

Overall: A total of 11 points gives this candidate a mid-range Achieved grade. This is a good example of the need for candidates to read through their answers to determine if they have described or explained the processes/concepts that they are being questioned on, as some minor additions to the answers could have resulted in additional Merit points