Assessment Schedule – 2005

Scholarship Biology (93101)

Marking codes for all questions

E	Correct evidence
Des	Correct descriptions (for Q2 & 3) of relevant biology
C/C	Comparison/contrast
Wk	Weak description or evidence
I	Biological ideas relevant to the question
N/A	Irrelevant material
N/C	Not correct
Rep	Repetition

A nine point marking scale (0-8) was used to assess all questions except 1(a) which used a seven point marking scale (0-6).

Evidence Statement

Question	Evidence	Judgement
1(a)	Explains how selective breeding and molecular biology methods could be used to produce a population of cats with the short legs. (i) **Selective breeding** • E_1: bases explanation on the assumption that the mutated allele is dominant. • E_2: breed short-legged offspring together or with mother. • E_3: any short-legged offspring will be either heterozygous or homozygous dominant. • E_4: to find out what they are, carry out a test cross ie breed with another normal cat (homozygous recessive). • E_5: if no normal size legs offspring occur (after multiple breedings), then it can be taken that the tested individual is homozygous for short legs. This cat can be used for future breeding. / Any cat that produces offspring with normal legs is heterozygous and shouldn't be used for future breeding. (ii) **Molecular Biology** • Transgenesis: pro-nuclear injection of isolated gene into **fertilised** egg cell, cell divides to form embryo, then embryo implanted into surrogate. **OR** • Cloning: Somatic (ie 2N) cell from original female cat removed (nucleus has mutated allele), fertilised **egg** extracted from another cat, nucleus removed, and egg fused with donor cell/nucleus (electrical pulse used to stimulate this), egg divides to form embryo, then embryo implanted into surrogate.	**6.** Covers both selective breeding and one molecular biology technique. Explains correctly and fully how the methods can be used to produce a population of Munchkins. Minimal unnecessary information. **5.** Correct and full explanation for one method, the other is substantially correct but lacks some details. **4**. Both methods, substantially correct but lacking in coverage. Selective breeding must have E_1. **3.** Addressed both methods but issues with accuracy and/or coverage. Selective breeding must have E_1. / One method well covered and correct, other hopeless (but has 1 or 2 correct ideas). **2.** Some correct evidence for both methods. / Only one method answered but answered correctly and in detail. **1.** Some correct biological ideas relevant to the question.

Question	Evidence	Judgement
1(b)	**Similarities** • cloning (not transgenesis) and selective breeding both transfer whole genome • both selective breeding and cloning have the potential to reduce genetic variation in population. **Selective breeding** • harder to control which genes are passed on until sure both parents are homozygous • takes several generations • lots of unwanted cats • problems of inbreeding. **Molecular Biology – cloning** • if successful the resultant cat is guaranteed to have the mutation • low success rate / takes time to get a successful clone. • old cells – aged animal. **Molecular Biology – transgenesis** • difficult to successfully insert the gene then successfully re-implant embryo • possible pleiotropic effects • low success rate / takes time. **Both transgenesis and cloning** • more precise than selective breeding • cost / wasteful / low success rate • requires specialists and equipment. **Evaluation / justification examples** • cloning may produce heterozygous individuals (as mother was heterozygous) and suggests a way to get pure breeding cats • molecular biology techniques have a low success rate, but only need a few successes to be able to then breed by conventional means • transgenesis more effective compared with selective breeding, as only transfer the gene of interest • both selective breeding and cloning may produce individuals with undesirable gene combinations as a result of inbreeding but with transgenesis this is less likely • both transgenesis and cloning still need further actions to produce a population – either more transgenesis / cloning or more likely selective breeding using the transgenic cats • if transgenesis is followed by cloning, then the potential for a reduction in genetic diversity still exists • transgenesis may disrupt genome due to the hit and miss nature of insertion. This may affect gene expression if regulatory genes are affected • recognises that cloning and transgenesis have different issues.	**8.** Comparison provides an evaluation of the two methods / justification of the effectiveness / recognises that effectiveness is dependent on interacting factors (see last section in evidence). **6.** Uses evidence to compare and contrast both methods. Thorough coverage. **4.** Superficial comparison of both methods, but tends to be the obvious evidence eg inbreeding/lack of genetic variation, time involved, costs. **2.** 2–3 pieces of isolated evidence, not comparing the two methods. **1.** Some correct biological ideas relevant to the question.

Question	Evidence	Judgement
2	Compares and contrasts examples of behaviours seen in **social animal groups.** Different behaviours are linked to the survival of the species. Areas covered may include: **Competitive behaviour** • dominance behaviours • removal of individuals to other groups which minimises inbreeding eg lions, apes. **Cooperative behaviours** • group living, specialist roles, eg bees, ants • altruism, eg social insects, meerkats • group defence, eg social insects, baboon troops • group hunting, eg big cats • cooperative breeding, eg pūkeko • group territories, eg pūkeko, chimps, baboon. Could approach answer by looking at the different types of social organisation and comparing the behaviours between the types of organisation. • hierarchies (dominant / submissive behaviours, mate selection, group protection, food collection and distribution) • insect castes (behaviours for collecting/distributing food, defence. NOT a hierarchy) • family groups (behaviours for group protection, food collection and distribution, looking after young, individuals leaving to join other groups). NOTE Social animals comprise groups of individuals of the same species living together in an **organised** fashion. They divide resources and activities between them and are mutually dependent ie unlikely to survive outside of the group.	**8.** Compares and contrasts the different ways different social animals exhibit the same type of behaviour and explains the survival benefit of that behaviour to the **species**. Chooses appropriate behaviours and appropriate social animals to compare and contrast. *Eg compares different forms of hierarchies in different social animals eg pūkeko, big cats, baboon, meerkats.* **7.** Evidence for 8 but weak in either the compare and contrast or the explanation. **6.** Compares and contrasts the different ways different social animals exhibit the same behaviour and explains the survival benefit to the **group.** **5.** Evidence for 4 plus some comparison of the behaviour between social animal groups. **4.** Correctly describes behaviours of different **social** animal groups and explains the survival benefit to the **group** / compares only one behaviour in several groups OR vice versa. **3.** Evidence for 4 but with descriptions of behaviours of animals that are found in informal groups (rather than social animals) / describes one behaviour in one social animal group well and links it to survival. **2.** Descriptions of the behaviours with minimal or no links to survival (common example is a long description of the behaviour finishing with a statement like "thus increasing the survival of the species") / describes only one species. **1.** Some correct biological ideas relevant to the question. **Additional codes** $E_{group/species}$ — Explanations linked to survival benefit of group/species

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<tr><th>Question</th><th>Evidence</th><th>Judgement</th></tr>
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Uses appropriate examples from the Hebe data to illustrate the role of each area/concept in the evolution of the Hebe. In doing so, explains the biology involved. Note: a definitive example is not expected; rather the candidate needs to choose likely and appropriate examples to illustrate each area.

• Selection pressures
Explains the process of natural selection resulting in the adaptations of the whipcord species to the alpine environment or the larger leaved species to the lower light but higher water level environments of other environments. (OR any other appropriate selection pressure.)

• Mutations: Aneuploidy OR Polyploidy
Aneuploidy
Links the process of aneuploidy to an example such as the ancestral form which likely had n = 21 therefore any Hebe with n = 20 could be an aneuploid due to the loss of one chromosome;

Polyploidy
Links the process of polyploidy to an example. There are several examples where there is a doubling or tripling of the chromosomal number eg H. gracillima (n = 40) and H. venustula (n = 60).

• Genetic Drift OR Founder Effect
Founder effect
The Founder effect is where a small population has become isolated and does not represent the main population in its genetic constitution. The NZ Hebe are a small and genetically unrepresentative population compared with the original Australian population because of the likely single introduction.

OR The Founder effect could also occur where a small group of Hebe became isolated from the main population and did not represent the main population in its genetic constitution. This could have happened during both the mountain uplift and glaciation periods when populations became isolated, eg H. hectorii, which is found on the wet side of the South Island, while most of the other whipcords are found on the dry side.

Genetic drift
Change in allele frequency (loss of allele from population / fixation of an allele) due to chance events in a small isolated population.
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8. The required evidence from Selection pressures plus the required evidence from THREE other areas.

6. The required evidence from Selection pressures plus TWO other areas.

5. Required evidence from any THREE areas

4. Required evidence from any TWO areas, plus correct descriptions of the process in a THIRD area with an attempt to support this with data from the Hebe but the examples chosen are not good evidence for this process

3. Describes the processes correctly for any THREE areas and attempts to support each with data from the Hebe. / Required evidence from ONE area, plus correct descriptions of the process in TWO areas with attempts to support each with data from the Hebe / Uses appropriate Hebe examples to illustrate the areas but the biology involved is implied rather than described.

2. Describes evolutionary processes correctly for any TWO areas and attempts to support EACH with data from the Hebe. / Describes biological theory for any FOUR concepts but makes no attempt to support this with data

1. Some correct biological ideas relevant to the question.

Additional codes
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<tr><td>E_x</td><td>supplied extra evidence</td></tr>
<tr><td>Des^{+}</td><td>Correct description of process with attempt to support with Hebe data.</td></tr>
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Question	Evidence	Judgement
3 (continued)	• **Adaptive radiation OR convergence** **Adaptive radiation** Explanation of the adaptive radiation process linked to the introduction of a single species and the wide range of ecological niches. Supported by several examples showing the variety in *Hebe sp*. **Convergence** Where species of very different evolutionary backgrounds have developed similar features due to selective pressures of their environment. • **Sympatric OR allopatric speciation** **Sympatry** The development of new species within a population. Two *Hebe sp* living in the same location but with different chromosomal numbers could suggest the reproductive isolation of the two species by polyploidy or anueploidy. **Allopatry** Genetic isolation of populations due to factors such as mountain building, glaciation. Eg the initial mountain building separated some species and the new environmental conditions changed the selective pressures acting on the gene pools, resulting in different species after reproductive isolation, *eg H.speciosa and H. cupressoides*.	

Judgement Statement

An aggregate mark of 30 from four questions was used in Biology.
In 2005, candidates who achieved 22 marks or better were awarded outstanding scholarship and candidates who achieved 15-21 marks were awarded scholarship.