Topic 10 – data-based questions

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1. coloured, starchy both dominant traits Cc; white, waxy recessive traits Ss; F_1 are all CcSs; so $F_1 \times F_1$; CcSs × CcSs produces typical dihybrid ratio of 9 coloured starchy: 3 coloured waxy: 3 white starchy: 1 white waxy in F_2;

2. the actual frequencies do not follow the 9:3:3:1 ratio and so the genes must be linked as they differ from the theoretical ratio for dihybrid crosses;

3. coloured, shrunken CCnn; white, non-shrinken ccNN; F_1 coloured, non-shrunken is CcNn are test-crossed with homozygous recessive: ccnn; CcNn × ccnn; typical ratio of 1 coloured non-shrunken: 1 coloured shrunken: 1 white non-shrunken: 1 white shrunken

4. actual frequencies frequencies differ from typical ratio of 1:1:1:1, so genes must be linked;

5. if starchy/waxy and non-shrunken/shrunken are both linked to colour, then they must also be linked to each other;

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1 and 2.

	White Crested	Non-white, Non crested	Non-white Crested	White Non-crested	Total
observed	337	337	34	46	754
expected	188.5	188.5	188.5	188.5	754

3. 3 degrees of freedom expected;

4. critical value for 3 df = 7.815;

5. $X^2 >> 7.815$;

6. H_o the traits are not linked and differences between observed and expected are due to sampling error; H_1 the traits are linked and differences between observed and expected are not due to sampling error; $X^2 >> 7.815$, therefore $p << 0.05$; reject H_o and accept H_1;

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a) negative correlation / mean length declining with time;

b) the longer the horns, the more likely the sheep will be shot; advantage to having short horns; long horns removed from reproductive pool; mean length becomes shorter with time; shorter horn alleles become more common in population with time; this is directional selection;

c) long horns more likely to win in courtship battles and become more common in reproductive pool; long horns more likely to be hunted and removed from the pool; the latter seems to be the most relevant factor;

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a) any value from 3.25 to 3.49 kg;

b) any value from 3.50 to 3.74 kg;

c) initially as birth mass increases up to 3.5 kg, survival increases, hencemortality decreases; then, as birth mass further increases beyond 3.5 kg, survival decreases andmortality increases; further from mode the higher the mortality, the highest survival and lowest mortality nearest to mode value;

d) birth mass shows variation; selection against very low / very high birth weights;

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a) **(i)** sneaking approximately 80 cm

(ii) fighting approximately 200 cm

b) **(i)** >60 cm body size for fighting

(ii) 25–29 for sneaking;

c) 45–49 / 40–44;

d) extreme size forms reproduce; intermediate size forms are selected against;

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1. *C. lucasina* has uniform loudness whereas the *C. mediterranea* grows louder and then softer; the *C. lucasina* song lasts longer; individual notes would be more audible in *C. lucasina*;

2. lacewings with certain songs will attract some mates, but not others; over time, gene pools become isolated within the population; this would lead to sympatric reproductive isolation;

3. **a)** allopatric speciation is reproductive isolation due to geographic barriers; founder populations may differ in allele frequencies; the source and founder populations are subjected to different selection pressures; leading to increasing differences between the two;

b) sympatric speciation is reproductive isolation within the same geographic area; it could be caused by behavioural or temporal isolation; variables prevent interbreeding of sub-populations; the same selection pressures present in the habitat may affect the two sub-populations differently.