1. How has cereal crop productivity changed over the past 10,000 years? Illustrate your answer by reference to cereal domestication, the intensification of agriculture and the Green Revolution.

2. Critically assess the evidence that genetically modified crops may pose a greater or lesser risk to the natural or agricultural environment than conventionally grown crops.

3. You have been asked to develop a research strategy for expressing a novel antifreeze protein from Arctic cod in tomato fruit with the aim of improving its tolerance to freezing. (A) Describe how you would design and create this transgenic plant. Your answer should include an outline description of the construct, one appropriate method of transformation and a suitable selectable marker. (B) What regulatory issues would you need to consider when bringing this product to market? You should consider both environmental issues and possible impacts on human health.

4. Critically assess the advantages and disadvantages of using classical and inundative biological control strategies for the control of weeds. What role can these strategies play in the control of weeds in agriculture today? Illustrate your answer with named examples.

5. Discuss the challenges and possible solutions for ensuring global food security in the 21st century.
DEPARTMENT OF ANIMAL AND PLANT SCIENCES

Spring Semester 2011-2012

ANIMAL BEHAVIOUR

1 Hour 30 Minutes

DATA PROVIDED
Computer cards

PLEASE LEAVE THIS EXAM PAPER ON YOUR DESK. DO NOT REMOVE IT FROM THE HALL.

Read the following section carefully

Answer ONE question from SECTION A and ALL of the multiple choice questions from SECTION B. Section A and Section B are worth equal marks.

Write your answer to SECTION A in a blue answer book and write the question number on the front.

SECTION B contains 25 questions. Check now to ensure that all 10 pages are printed.

Your answers to SECTION B should be marked on the computer card. Ensure that you have written your candidate number on the computer card and filled in the box underneath. DO NOT USE A PEN.

In SECTION B each correct answer is worth 2 marks. A guessing correction of -2/3 mark will be applied to incorrect answers. If you do not know the answer to a question, select option E and no guessing correction will be applied. YOU MUST FILL IN A BOX (A, B, C, D OR E) FOR EACH QUESTION.

In each case, only one answer is correct.

Candidate number from U-Card (9 digits) – to be completed by student
SECTION A
Answer ONE question only

Answer ONE question in essay format. Your essay should provide evidence of a thorough understanding of the appropriate special readings and the ability to synthesize and compare and to relate to the wider picture as discussed in lectures and the course book. Your essay must answer the question as written and may include diagrams, equations etc. if appropriate.

A1. Andrade (1996) reported that when the first male to mate with a female redback spider is cannibalized during copulation the chance that the female will reject a second male is 67% (6/9), but when the first male is not cannibalized this falls to 4% (1/23). Compare and contrast these results to those obtained from second males in terms of causing increased paternity and discuss the possible mechanism. In addition, compare and contrast the reproductive strategy of male redback spiders in gaining increased paternity to that used by male *Callosobruchus* beetles (Crudgington and Siva-Jothy 2000). Finally, put these results into a wider context by discussing, with reference to other behavioural research, how the evolutionary approach to animal behaviour enables scientists to understand how natural selection can favour behaviours that at first sight seem paradoxical.


A2. Male sperm competition and female cryptic choice are ways in which males and females engage in sexual selection after copulation. Pizzari and Birkhead (2000) used an experimental study to investigate cryptic female choice in feral fowl, while Hunter et al (2000) conducted an observational study to explore sperm competition in male Adélie penguins. Describe these studies in the context of post-copulation sexual selection and comment on the suitability of the experiments/observations for the particular questions being addressed. Put these studies into a wider context by discussing, with reference to other behavioural research, the relative merits and failings of an experimental versus an observational approach to studies of behaviour.


A3. The coevolutionary arms race between brood parasitic cuckoos and their hosts has resulted in the widespread occurrence of egg mimicry by parasites and egg discrimination and rejection by their hosts. However, if cuckoos can evade this defence, their chicks may impose a high cost on the host by ejecting host eggs and chicks, so it is puzzling that in such instances discrimination and rejection of cuckoo nestlings by hosts is not also widespread. Lotem (1993) suggested that learning to recognise cuckoo nestlings may be maladaptive for hosts because of the costs of recognition errors. However, Langmore et al. (2003) have shown that nestling discrimination by hosts has evolved in at least one cuckoo-host system. Compare and contrast these two studies and the approaches taken by these two studies and their conclusions. Discuss the factors that might explain the evolution of supposedly maladaptive nestling discrimination in Langmore et al.’s (2003) study system.


SECTION B – NOT AVAILABLE
DEPARTMENT OF ANIMAL AND PLANT SCIENCES          Autumn Semester 2011-2012

INSECTS                                      1 Hour 30 Minutes

Answer TWO questions. The question in SECTION A (Student Centred Learning Exercise) and ONE of the questions from SECTION B. Write your answer to each question in a separate blue answer book with the appropriate question number on the front.

Your answers should include named examples, and diagrams where appropriate.

SECTION A (Student Centred Learning Exercise)

1. Write an essay on an aspect of the biology of a named insect taxon.

SECTION B

1. If holometabolism is such a good thing, why are so many insects hemimetabolous?

2. “The uniraman condition is key to understanding insect origins”. Discuss this statement and explore the underlying controversy.

3. “Being small is the key to insect success”. Discuss.

END OF EXAMINATION PAPER
DEPARTMENT OF ANIMAL AND PLANT SCIENCES

Spring Semester 2011-2012

PLANT, CELL AND ENVIRONMENT

1 Hour 30 Minutes

Answer TWO questions. Write your answer to each question in a separate blue answer book. Write the appropriate question number on the front of the blue answer book.

Your answers should include named examples and diagrams where appropriate.

1. How do plants survive in environments that have either periodic or unpredictable supplies of water?

2. Discuss the role of the vacuole in allowing plants to survive different environmental stresses.

3. How do plants cope with high temperatures and excess light?

4. Discuss the role of phytochromes in controlling growth and development from seeds to flowering in adult plants.

5. How are plants able to cope with chilling and freezing conditions?

END OF EXAMINATION PAPER
Answer ONE question from Section A and ONE question from Section B. Write your answer to each question in a separate blue answer book. Write the appropriate question number on the front of the blue answer book.

Your answers should include named examples and diagrams where appropriate.

Section A

1. Discuss the signatures of natural selection that might be found in DNA sequence data.

2. What are the forces driving the origin of reproductive isolation during speciation?

3. Why is there so much genetic diversity within natural populations?

Section B

1. What is the fundamental cause of sexual dimorphism and how does intra- and inter-sexual selection result as a consequence of this?

2. Discuss two different types of evolutionary conflict and their potential evolutionary outcome.

3. A study has shown that hatchery salmon have been steadily evolving smaller egg size due to changes in extrinsic mortality. Given what you have learned about the evolution of life histories, predict – with justification - how female age at reproductive maturity, female fecundity and offspring survival may evolve as a consequence.
DEPARTMENT OF ANIMAL AND PLANT SCIENCES       Autumn Semester 2011-2012

WORLD ECOSYSTEMS       1 Hour 30 Minutes

Answer TWO questions. Answer ONE question from SECTION A and ONE question from SECTION B. Write your answer to each question in a separate blue answer book. Write the appropriate question number on the front of the blue answer book.

Your answers should include named examples, and diagrams where appropriate.

SECTION A (Answer ONE question)

1. Describe the long-term and event-driven responses of arctic ecosystems to climate change and discuss any responses that are counter-intuitive.

2. Discuss the responses of wetland structure and composition to current and future environmental change.

3. Does deforestation change regional and global climate? Discuss by comparing the historical effects of deforestation in Mediterranean ecosystems with ongoing deforestation in tropical rainforest ecosystems.

SECTION B (Answer ONE question)

4. Explain the importance of niche differentiation for species diversity in tropical rainforests, and outline two other mechanisms that maintain diversity in these ecosystems.

5. Discuss how boreal forests have responded to climate change over the past 10,000 years, including the past century, giving evidence and underlying mechanisms.

END OF EXAMINATION PAPER
Instructions:

1. Write your candidate number in the space below.

2. Answer all six short answer questions in Section A. Write your answers in the spaces provided after the questions. There is adequate space for a full answer in each case. You will not need additional paper. Each question carries equal marks.

3. Answer ONE of the three essay questions in Section B using the blue booklet provided.

4. Marks are divided equally between Section A and Section B and within Section A all questions carry equal weight.

Registration number from U-Card (9 digits) – to be completed by student
SECTION A – Not available

SECTION B: Essay questions. Answer ONE question.

1. What approaches can be used to provide information on gene function? What are the limitations of these approaches and how can they be overcome?

2. Discuss the advantages for a plant breeder in using modern ‘omics technologies to develop new varieties.

3. What is ‘Metagenomics’? Discuss the ways in which metagenomics has revolutionised our understanding of the structure and function of microbial communities present in complex ecosystems.

END OF QUESTION PAPER
READ THESE INSTRUCTIONS CAREFULLY

1. Answer ONE of the three essay questions in Section A (write your answer in a blue answer book) and all of the multiple choice questions in Section B (mark your answers on the computer card supplied).

2. Make sure that you write your U-Card number on the computer answer sheet.

3. Marks are allocated equally between Section A and Section B.

4. Section B contains 25 questions. Check now to ensure that all 8 pages of the paper are printed.

5. When completing the computer card use an HB pencil. DO NOT USE A PEN. Mark only one answer and make sure that any mistakes are erased completely. Do not write additional comments on the card. If you have spoiled the card, ask the invigilator for a new card.

6. In SECTION B each correct answer is worth 2 marks. Of the possible options in the multiple choice section - A,B,C or D - only one is correct. A guessing correction of -2/3 mark will be applied to incorrect answers. If you do not know the answer to a question, select option E and no guessing correction will be applied. YOU MUST FILL IN A BOX (A, B, C, D OR E) FOR EACH QUESTION.

7. Fill in your candidate number in the box below.

Candidate number from U-Card (9 digits) – to be completed by student
Section A – Essay question

Answer **ONE** question

1. Explain why rigid cladistic analysis is essential for successful palaeontological research.

2. How has palaeontological research influenced our perception of global environmental change?

3. Explain how developments in molecular biology have influenced palaeontological research.

Section B – NOT AVAILABLE
DATA PROVIDED
Computer cards

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DEPARTMENT OF ANIMAL AND PLANT SCIENCES
Autumn Semester 2011-2012

CONSERVATION PRINCIPLES

1 Hour 30 Minutes

READ THESE INSTRUCTIONS CAREFULLY

1. Answer ONE of the three essay questions in part 1 (write your answer in a blue answer book) and all of the multiple choice questions in part 2A (questions 1-20) and multiple completion questions in part 2B (questions 21-25). Mark your answers on the computer card supplied.

2. Marks are allocated equally between Part 1 and Part 2.

3. Make sure that you write your U-Card number on the computer answer sheet.

4. When completing the computer card use an HB pencil. DO NOT USE A PEN. Mark only one answer and make sure that any mistakes are erased completely. Do not write additional comments on the card. If you have spoiled the card, ask the invigilator for a new card.

5. Each question in the multiple choice/multiple completion section is worth one mark. Of the possible options in the multiple choice/multiple completion section - A,B,C or D - only one is correct.

6. A guessing correction will be applied of minus one third mark for each incorrect answer. If you have no idea of the answer fill in box E to abstain; the guessing correction will not then be applied. YOU MUST FILL IN A BOX (A, B, C, D or E) FOR EACH QUESTION.

7. Fill in your candidate number in the box below.

Candidate number from U-Card (9 digits) – to be completed by student
Part 1 – Essay question

Answer ONE question

1. You are in charge of conservation on a Caribbean island which comprises a small amount of undisturbed rainforest, and a mix of rainforest fragments, farmland and human settlements. The island supports a distinctive form of a herb that used to be considered a sub-species of a more widely distributed species. It has recently been confirmed by genetic analyses that this taxon is actually an endemic species but no formal survey work or ecological research has been conducted on the species. It is widely used in herbal medicine. Describe and justify the action you would take to assess the conservation status of this species and the threats it faces.

2. You are in charge of protected areas in a tropical country. These have been established in a largely unplanned manner taking advantage of opportunities as they arose over the last 50 years. The World Bank promises to give the country major investment in developing its infrastructure if it devises a strategy for major improvements to this network of protected areas with the aim of maximising their contribution to conservation now and in the future. Describe the plan of action that you would propose to the World Bank including how you would collect the data required to implement the plan?

3. You conduct a survey of a migrant songbird that only breeds in woodland in Northern Europe at sites that were first surveyed 20 years ago. No other population size data are available for this species. The species winters throughout the rainforest of sub-Saharan Africa. Between the two survey periods the species has declined by 80%. In this time period local spring temperatures have increased by two degrees Celsius. You are in charge of assessing if this species is declining due to climate change, and if so which mechanism(s) are driving this decline. Describe how you would instigate a research programme over a five year period to assess this.

Part 2A – Multiple choice questions

NOT AVAILABLE