UNIVERSITY
OF SKÖVDE

School of Bioscience

WRITTEN EXAMINATION

Course Applied Molecular Ecology

Examination Written examination

Course code BV716A

Credits for written examination 3.5 hp

Date 2026-08-26

Examination time 8.15-12.30h

Examination responsible Sonja Leidenberger

Teachers concerned Tomas Jonsson, Niclas Norrström

Aid at the exam/appendices (nothing)

Other

Instructions

- ☐ Take a new sheet of paper for each teacher.
- ☐ Take a new sheet of paper when starting a new question.
- ☒ Write only on one side of the paper.
- ☒ Write your name and personal ID No. on all pages you hand in.
- ☒ Use page numbering.
- ☒ Don´t use a red pen.
- ☒ Mark answered questions with a cross on the cover sheet.

Grade points

The written exam will determine the grade of the course. You have to reach at least 50-59% = E, 60-69% = D, 70-79% = C, 80-89% = B, and more than 90% = A in the exam.

Examination results should be made public within 18 working days

Good luck!

Total number of pages 3

Applied Molecular Ecology, BV716A, VT 2026

Final examination 26th of August 2026 **In total: 40 points**

The written exam will determine the grade of the course. You have to reach at least 50-59% = E, 60-69% = D, 70-79% = C, 80-89% = B, and more than 90% = A in the exam.

Goal 1: *provide an in-depth explanation of theories, applications, and scientific methods in the field of molecular ecology,*

Goal 2: *formulate ecological, evolutionary, population genetic, and other biological questions where molecular analyses are particularly suitable,*

Goal 3: *independently plan and conduct a project in DNA barcoding*

A) Barcoding (10 points)

1. What is meant by "delimitation of DNA barcoding"? (3 points)

a) Explain shortly what it means. (1 point)

b) Name two methods that can be used. (1 point – 0.5 for each method)

c) Name two challenges with delimitation of DNA barcoding. (1 point – 0.5 for each challenge)

2. Name two reference databases used for DNA barcoding (1point total - 0.5 for each).

3. Describe the 6 points step-by-step barcoding workflow that you learnt both in theory (lecture) and practice (laboratory work). (2 points)

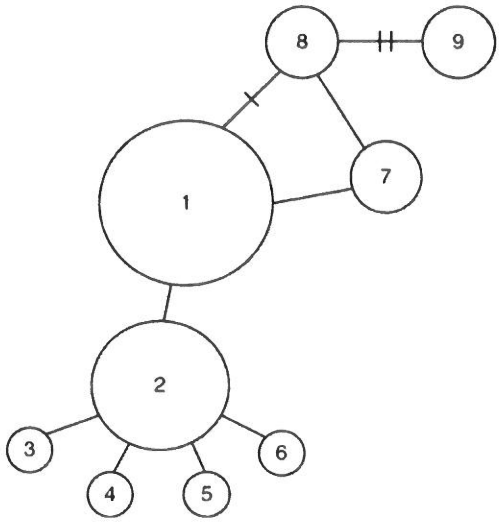
3. What is the "barcode gap"? (2 points)

4. Explain two important applications of DNA barcoding. (2 points)

B) Applied Molecular Ecology (10 points)

1. Haplotype networks have been essential tools in conservation genetics for many years.

What does the haplotype network below show us? Explain (2 points)



2. Name two methods for target species detection (1 point)

3. Explain what alpha, beta and gamma diversity is. (1.5 points)

4. What is the Nagoya – protocol? Name the three key principles. (1.5 points)

5. Explain advantages (at least two) and disadvantages (at least two) of a metabarcoding study through a description of a concrete project (4 points).

C) Ecological risk assessment and evoluationary conservation biology (10 points)

1) Molecular biomarkers are frequently used in ecological risk assessment.

a) What is meant by a molecular biomarker? (1p)

b) Give one example of how biomarkers can be used as early warning indicators of environmental stress. (1p)

2) Ecological systems are often difficult to predict from molecular data alone.

a) Explain why molecular-level responses do not always translate directly into ecosystem-level outcomes. (1p)

b) How do emergent ecological properties contribute to this challenge? (1p)

3) Human activities can drive evolutionary change in natural populations.

a) Explain how size-selective fishing can alter life-history traits in fish populations. (1p)

b) Describe one potential management strategy to reduce fisheries-induced evolution. (1p)

4) Urbanization can influence evolutionary processes in wildlife populations.

a) Give one example of how urban environments may alter phenotypic traits in organisms. (1p)

b) Explain how urbanization can influence genetic structure and local adaptation. (1p)

5) Molecular ecology contributes to conservation planning at multiple biological levels.

a) Explain why genetic diversity is important for long-term population survival. (1p)

b) Describe how molecular tools can help identify conservation units or prioritize conservation efforts. (1p)

D) Evolution (10 points)

1. Mutualistic and antagonistic interactions can produce two main types of coevolutionary processes that can be studied using molecular techniques.

a) Briefly describe what characterizes/distinguishes these two processes and give one example each. (2p)

b) Explain the so called 'Red Queen hypothesis', that is, what does it maintain about the evolution of species in relation to eachother? (1p)

2. Explain what 'genotype-environment interactions' mean and describe, using graphs, what this interaction may look like if there is a) no phenotypic plasticity, b) continous phenotypic plasticity and c) discrete phenotypic plasticity. (4p)

3. Define what 'paleogenomics' is and give two examples of general questions within this field where molecular techniques can be useful. (3p)