



NTNU – Trondheim
Norwegian University of
Science and Technology

Department of Biology

Exam in Bi3013

EXPERIMENTAL CELL AND MOLECULAR BIOLOGY

Contact person during examination:

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Examination date: 9th December, 2014

Examination time (from-to): 09.00 – 13.00 (4 hours)

Permitted examination support material: None

Other information: Language: English

Number of pages: 3 (including front page)

Number of pages enclosed: 0

Checked by:

Date

Signature

NOTICE THAT QUESTIONS 1, 2, 3, AND 4 ARE WEIGHTED EQUALLY, BUT SINGLE QUESTIONS MIGHT BE WEIGHTED DIFFERENTLY (INDICATED IN %). IF NO WEIGHTING IS GIVEN THE SUB-QUESTIONS ARE WEIGHED EQUALLY. PLEASE START ANSWERING EACH QUESTION (1, 2, 3, and 4) ON A NEW SHEET OF PAPER.

Question 1

You are going to perform an experiment where you want to study global gene expression in roots of a mutant plant that shows growth defects. That is, you want to determine the expression of all genes in the root tissue.

- a. How will you proceed to isolate RNA from the root tissue, and what type of quality checks of the RNA will you run before you perform the transcriptional analysis? (40 %)
- b. There exist various methods to study global gene expression. Choose one of these methods and explain how it can be used to study gene expression in the root tissue. Explain your choice of method and describe the various steps in this process. (40 %)
- c. What advantages and disadvantages have the different methods / technologies which today are used in transcriptional analyses? (20 %)

Question 2.

You have identified a gene in Zebrafish and thinks it encodes a transcription factor. You express the gene in a bacterial expression system and isolate and purify the protein / transcription factor for use in other analyses.

- a. A transcription factor can bind the regulatory regions in many genes. Describe a method that can be used to identify the DNA binding sites in the genome for the transcription factor you have identified. Use as a starting point that you already have a purified protein / transcription factor available.
- b. You suspect that the transcription factor binds to other proteins. Describe a method that can be used to find and isolate these interacting proteins.
- c. How will you proceed to identify these proteins through mass spectroscopy?

Question 3.

Fluorescent proteins are often used to study intracellular protein localization and with new technological advances various methods have been developed to study the dynamic behavior of proteins inside a cell.

- a. Describe how you can use Green fluorescent protein (GFP) or related fluorescent proteins to study intracellular localization of a protein in an algae. You can use methods described and used in the lab course.
- b. Give a short description of confocal microscopy and how a confocal microscope is constructed.
- c. Explain how you can use GFP proteins to study protein-protein interactions.

Question 4.

Explain or describe the following terminologies/techniques, use figures wherever necessary (not more than 200 words for each).

- a. Light harvesting complex.
- b. Genome editing and CRISPR/Cas.
- c. Metabolite profiling.
- d. Chemical derivatization during GC/MS analyses.
- e. Capillary electrophoresis.