

Department of Biology

**Examination paper for Bi3016
Molecular Cell Biology**

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Permitted examination support material: None

Other information:

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Informasjon om trykking av eksamensoppgave

Originalen er:

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Checked by:

Date

Signature

NOTICE THAT QUESTIONS 1- 5 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 ON A NEW SHEET OF PAPER.

Question 1

Eukaryotic cells must be able to switch the activity of genes on or off in response to their cellular environment and the level and sophistication of gene regulation is particular high in multicellular organisms.

- a. Describe the various ways a cell uses to control the activity of transcriptional regulators so they can be turned on or off in as a response to various cellular stimuli. (40%)
- b. Explain how proliferating cells in a multicellular organism can maintain their cell identities. (40 %)
- c. List and briefly discuss features that make micro RNA (miRNA) especially useful regulators of gene expression. (20 %)

Question 2

- a. Why have phosphorylation/dephosphorylation, as opposed to allosteric binding of small molecules, for example, evolved to play such a prominent role in switching proteins on and off in signaling pathways? (30 %)
- b. Smell and vision depend on specific G-protein coupled receptors, GPCRs. Explain how a single photon of light can activate the rhodopsin receptor and produce a response which results in neurotransmitter release. (40 %)
- c. How is the activity of the rhodopsin receptor returned to its resting state? (30 %)

Question 3

- a. Describe how actin subunits can assemble into dynamic filaments and explain the process known as filament treadmilling.
- b. Describe the structure of a sarcomere and the molecular processes that regulate muscle contraction.
- c. Cell movement is a highly complex and integrated process that is dependent on the actin cytoskeleton. Explain the various steps that are necessary for cell movement and describe the function of the small GTPases Rac and Rho.

Question 4

During development and maintenance of multicellular organisms cell death is often not a random process but occur in several programmed molecular events called apoptosis.

- a. Describe briefly the functions of caspases during apoptosis and explain how the intrinsic pathway of apoptosis operates.
- b. Explain how DNA damage can block cell division and in severe cases (ex. due to irreparable DNA damage) lead to apoptosis.

Question 5

Define / explain 4 of the 5 the following words and terminologies and give a short description of their function, max 200 words.

- a. Cohesin.
- b. Ras oncogene
- c. Tumor suppressor gene.
- d. Morphogen
- e. Lateral inhibition (Notch mediated)

Use figures where appropriate to explain your answers, (questions 1-5).