UNIVERSITY OF OSLO

Faculty of Mathematics and Natural Sciences

Exam in MBV 3010 Advanced Cell Biology
Day of exam: August 14th, 2014
Exam hours: 09:00-12:00
This examination paper consists of 3 pages.
Appendices: None
Permitted materials: None

Questions I – IX are multiple choice questions. Only one answer is correct for each question. Write down your answers on a blank answering paper. For example: Question VII, correct answer = A. Write each answer on a new line. Questions X to XII are traditional questions that require longer answers.

Make sure that your copy of this examination paper is complete before answering.

Question I (1 point)

Which phenomenon would you observe in a GABA synapse if the intracellular Cl^- concentration would increase considerably from the normal values?

A) The GABA induced Cl^- current would be outward instead of inward, resulting in an excitatory response.
B) The GABA induced Cl^- current would be inward instead of outward, resulting in an inhibitory response.
C) The GABA induced Na^+ current would be larger, due to enlarged attraction to the Cl^- ions inside the cell.
D) The GABA induced Na^+ current would be smaller, due to the reduced Na^+ concentration gradient, as the intracellular Na^+ concentration would increase simultaneously with Cl^-.
E) No change will be observed, as Cl^- ions always will move into the cell through the GABA receptors, due to the negative membrane potential.

Question II (1 point)

Which of these signaling molecules is a protein kinase?

A) Akt.
B) Bad.
C) Calmodulin.
D) Sos.
E) Wnt.

Question III (1 point)

Amino acid variation among MHC class II allotypes that present antigens to CD4+ T cells is concentrated

A) where MHC class II contacts CD4.
B) in the beta chain.
C) in the alpha chain.
D) where the MHC II molecule interacts with peptide and the T cell receptor.
E) throughout both the alpha and beta chains.

Question IV (1 point)

Which of these GTP-binding proteins contributes to protein export from the endoplasmic reticulum (ER)?

A) Ran.
B) Rho.
C) Arf 6.
D) Sar1.
E) Rac.

Question V (1 point)

What structure (signal) is recognized by the receptor responsible for sorting of newly synthesized lysosomal enzymes from the Golgi-apparatus to the endocytic pathway?

A) Mannose-6-phosphate.
B) Sialic acid.
C) Di-leucine (LL).
D) KDEL (lys-asp-glu-leu).
E) Terminal glucose residues.

Question VI (1 point)

Which of the following is a protein complex involved in control of protein folding in the endoplasmic reticulum (ER)?

A) OXA.
B) COPI.
C) SAM.
D) ESCRT.
E) PERK.

Question VII (1 point)

What is dynamin?

A) A hormone regulating fat storage.
B) A cell surface receptor for lipoproteins.
C) A protein that can bind to microtubules and mediate minus end directed transport along these.
D) A protein in the Golgi apparatus modifying cargo proteins by proteolysis.
E) A GTPase required for endocytic vesicle formation from clathrin coated pits.

Question VIII (1 point)

Which amino acid sequence is a signal for import of proteins from the cytoplasm into peroxisomes?

A) KDEL (-lys-asp-glu-leu).
B) FGFGFG (-phe-gly-phe-gly-phe-gly-).
C) SKL (-ser-lys-leu).
D) GKKKGKK (-gly-lys-lys-lys-gly-lys-lys-).
E) LALKLAGLDI (-leu-ala-leu-lys-leu-ala-gly-leu-asp-ile-).

Question IX (1 point)

A lipid anchor in the plasma membrane can link proteins covalently to the outer membrane leaflet, facing the extracellular space. What is this lipid anchor called?

A) Dolichol.
B) Cholesterol.
C) Phosphatidyl-inositol-phosphate (PIP).
D) Glycosylceramide.
E) Glycosylphosphatidylinositol (GPI).

Question X (3 points)
Describe the Hedgehog signaling pathway (use text only, not figures).

Question XI (3 points)
Some facultative intracellular bacterial pathogens, such as *Listeria monocytogenes* and *Shigella flexneri* induce actin nucleation inside the host cell. How do the bacteria gain access to actin following induced endocytosis? What role does actin nucleation play in the infectious process?

Question XII (3 points)
Describe how a cargo protein is transported out of the endoplasmic reticulum (ER), and to and through the Golgi apparatus. If alternative models exist, please describe these.