

UNIVERSITY OF OSLO

Faculty of Mathematics and Natural Sciences

Exam in MBV4240 Biochemical mechanisms in intracellular transport

Day of exam: December 7th

Exam hours: 09.00 – 12.00

This examination paper consists of 2 pages.

Appendices: None

Permitted materials: None

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

1. Plasma membrane composition and structures:

- a) What are the main types of lipids found in the plasma membrane?
- b) What is meant by lipid rafts?
- c) In the plasma membrane you find caveolae: Which main proteins and lipids do you find in caveolae?
- d) What are the functions of caveolae?
- e) Changes in lipid structure and shape affect membrane curvature. Describe what happens after exposure of sphingomyelin to sphingomyelinase and how this affects lipid structure and membrane curvature.
- f) Describe what happens to structure and shape of a glycerophospholipid upon action of phospholipase A2?
- g) How can cholesterol be transported to different destinations in the cell?
- h) Ceramide is transported from the endoplasmic reticulum (ER) to the Golgi apparatus by two different mechanisms: What are these mechanisms?

2. Endocytic mechanism:

- a) Describe briefly three different types of endocytic mechanisms.
- b) Recently, the endoplasmic reticulum (ER) has been shown to contribute to endocytosis of epidermal growth factor (EGF). Which ion is essential for this process?
- c) Small GTP-binding proteins go through cycles of activation and inactivation. Describe one such cycle and the proteins involved in the process.

3. Endosomes:

- a) Flat clathrin domains are found on endosomes: What is their role?
- b) Name one endosomal lipid that is important for recruitment of cytosolic proteins to these organelles.
- c) Which protein(s) are used as markers for endosomes for instance in microscopy studies?

4. Motors facilitating transport:

Vesicles are transported along actin microfilaments and microtubules: Which are the protein complexes that mediate transport along actin microfilaments and microtubules? Indicate whether they facilitate transport in the plus or minus direction.

5. Sorting nexins:

Which protein domain is typical for sorting nexins, and what does it bind to in the membrane? Name one of the sorting nexins, its location and function.

6. The retromer complex:

- a) Where is the retromer complex found intracellularly, and which lipid is important for its correct localization?
- b) What are the transport processes facilitated by the retromer complex?

7. Multivesicular endosomes:

- a) Describe what is meant by maturation of endosomes?
- b) What is the role of ESCRT complexes?
- c) What are the possible fates of multivesicular endosomes?

8. Exosomes:

- a) What are exosomes, how are they formed?
- b) What has been suggested to be the physiological roles of exosomes?

9. Transport through the Golgi apparatus:

- a) What post-translational glycosylation events take place in the endoplasmic reticulum (ER), and which occur in the Golgi apparatus?
- b) Describe at least two models for transport of cargo proteins through the Golgi apparatus.
- c) What is the role of FAPP2 in glycolipid synthesis?