UNIVERSITY OF OSLO

Faculty of Mathematics and Natural Sciences

Exam in MBV4240 / 9240 Biochemical mechanisms in intracellular transport
Day of exam: Thursday Dec. 9 th
Exam hours: 14.30 – 16.30
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. Endocytosis

a) What is the definition of the term endocytosis?

b) Describe the following characteristics for a clathrin-coated pit:
How large is it (diameter)?
Which molecule is essential for the pinching off of a clathrin-coated vesicle?
How long-lived is a clathrin-coated pit at the plasma membrane (until it pinches off)?
In clathrin-coated pits at the cell-surface there are adaptor proteins that bind cytoplasmic tails of trans-membrane receptors: What is the most common adaptor at the cell-surface called? What is the composition of this adaptor complex? What type of sequences does it bind to (two main types)?

2. GTP-binding proteins

a) Different GTP-binding proteins are involved in clathrin-independent endocytosis. Mention some of these.

b) Caveolae are characteristic structures at the cell surface: What do they look like?
Which are the main lipids present in caveolae? When caveolae are induced to pinch off: Which GTP-ase is involved? Where in the cell does material internalized via caveolae end up?

3. Rafts

The plasma membrane is not homogenous; it may contain what is called “lipid rafts.” What kinds of molecules are typically found there? How does one attempt to isolate rafts in experiments?

4. Ubiquitinylation

a) Ubiquitinylation of proteins can function as an endocytosis signal. By which pathway does this modification facilitate uptake?

b) Ubiquitinylation can also mediate sorting of proteins later in the endocytic pathway. Where and how?

5. Early endosomes

Upon endocytosis ligands and fluid will be transported to early endosomes: In which directions can ligands be sorted from this organelle system, and what are the requirements for sorting?

6. Late endosomes

How are multivesicular (late) endosomes formed? Are there different types of multivesicular endosomes? Where is the content of these endosomes transported?
What is meant by the term “maturation” in the context of endosomes?

7. Rab-proteins

a) Rab-proteins may exist in an active and an inactive state. What is the difference between these two states, and how is the conversion between the states mediated?

b) Rab-proteins can bind effector-molecules: Mention at least two different types of effector molecules.

8. Exosomes

What are exosomes, and what might their function be?

9. Golgi-transport

Describe briefly the main models for transport of proteins through the Golgi apparatus.

10. Transport from the Golgi apparatus to the cell surface in epithelial cells

Sorting of newly synthesized proteins to the apical and basolateral membrane domains in epithelial cells can take place in different regions of the cell. Describe such sorting sites and what types of signals that may form the basis for the sorting.