**UNIVERSITY OF OSLO**

**Faculty of Mathematics and Natural Sciences**

**Exam in MBV4240 Biochemical mechanisms in intracellular transport**

**Day of exam: Friday December 9th**

**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) Make a schematic drawing of a glycerophospholipid.

b) Indicate where phospholipase A2, C and D may cleave in this structure.

c) What is the type of bond that is cleaved by these enzymes?

d) After cleavage with PLA2 the shape of the lipid substrate is changed. How may this influence membrane curvature?

e) Indicate what happens to the shape of sphingomyelin after cleavage by sphingomyelinase. What is the headgroup that is removed?

f) Which lipids do you find enriched in caveolae?

g) What happens to caveolae after they pinch off?

h) How can caveolae protect cells against mechanical stress?

i) Mention two membrane lipids that are found preferentially in the inner leaflet of the plasma membrane.

j) What is a plasmalogen?

**2. Endocytic mechanism:**

Describe essential differences between different endocytic mechanisms when it comes to proteins required for the mechanism to function.

**3**. **Protein complexes and their role:**

Where in the cell do you find the following complexes and what are their roles?

a) retromer

b) Wash complex

c) CORVET/HOPS

d) GARP

e) EARP

f) AP2

g) COG

**4**. Clathrin can be found on endosomes and is important for sorting cargo from endosomes to different intracellular destinations. Which ones?

**5. Multivesicular endosomes:**

a) How are multivesicular endosomes formed?

b) What are the fates of their intraluminal vesicles?

**6. Exosomes**:

What happens to exosomes after release from cells and which functions may they have?

**7. Autophagy**

a) What is meant by autophagy and what is the origin of the membranes involved?

**8. ER quality control:**

a) What do the terms ER and ERAD stand for?

b) What happens to a newly synthesized protein which is recognized as misfolded in the ER?

c) How can a cell identify a protein as misfolded?

**9. The ER and the Golgi apparatus:**

a) How can a resident ER protein that has been transported from the ER to the Golgi apparatus be detected and returned to the ER?

**10. Golgi apparatus:**

a) Describe two different models (the vesicle shuttle model and the maturation model) for transport through the Golgi apparatus.

b) Which other models that have been proposed to explain cargo transport in the Golgi apparatus do you know?

c) What type of coated structure may be observed associated with membranes of the Golgi apparatus? What is the role of these coated structures, particularly in light of different models for Golgi transport?