THE ROLE OF MITOTIC VESICLES IN THE NUCLEAR ASSEMBLY

RYSZARD RZEPECKI1, CARL SMYTHE2,3 and CHRISTOPHER J. HUTCHISON2

1Department of Biochemical Genetics, Institute of Biochemistry, University of Wrocław, Przybyszewskiego 63/77, 51-148 Wrocław, Poland, 2Department of Biological Sciences, University of Durham, South Road, Durham DH1 3LE, U.K., 3MRC Phosphorylation Unit, Department of Biological Sciences, University of Dundee, Dundee DD1 4HN, U.K.

The nucleus is physically separated from the rest of the cell by the nuclear envelope, which is composed of two lipid bilayer membranes, nuclear pore complexes and a nuclear lamina. The nuclear envelope is completely disassembled during mitosis in higher eukariotic cells. It has been thought that nuclear disassembly is triggered by the phosphorylation of nuclear and nuclear envelope proteins by active maturation-promoting factor (MPF), which is believed to be a complex of cyclin B and cdc2/cdc1 kinase. MPF directly phosphorylates (or causes the phosphorylation of) nuclear pore complex proteins and components of the nuclear lamina. Two theories were formulated to describe the possible fate of the nuclear envelope membranes during nuclear disassembly. According to the first theory, nuclear envelope membranes disperse into mitotic vesicles and cisternae, the lipid and protein composition of which reflects the composition of the original membrane. The second theory suggests that the nuclear envelope membranes simply disperse within the ER membranes. It now appears that both theories may be valid. It seems to be that the first theory is valid at least for oocytes and early embryonic cells, while the second is useful to describe the processes in vertebrate tissue culture cells. Several reports have been published so far on the successful fractionation of mitotic vesicles into several fractions distinct from each other in properties. The latest data from the Xenopus system described beyond any doubt a preparation procedure leading to the separation of two types of mitotic vesicle: MP1 and MP2, differing in size, density structure, protein composition and biochemical properties. In our experiments we also used the Xenopus system and “in vitro nuclear assembly” method to study the properties of these vesicles in more details. Our approach was focused primarily on the association of the essential integral membrane proteins with each type of vesicle. Our experiments suggest the essential role of some integral membrane proteins from each type of vesicle in the nuclear envelope assembly.