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EMBO workshop on Meiotic Divisions and Checkpoints

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Sea urchin acellular model to study cell cycle-translation relationships.

Control of cell cycle progression and translational regulation of protein synthesis are highly related processes. The synthesis of cyclin is required to activate CDK, the universal cell cycle regulator. On the other hand, CDK regulates protein synthesis through direct or indirect phosphorylation of initiation or elongation factors. The exact pathway leading from translation to CDK activation and vice-versa remains to be elucidated. The use of acellular extracts has been a conclusive step to analyse the molecular mechanism of CDK complexes activation during the different phases of the cell cycle. We therefore decided to develop a cell free system able to carry out the cell cycle in vitro using fertilized eggs of sea urchin. To characterize the progression through the phases of the cell cycle, the extracts were supplemented with a number of interphasic nuclei under the form of sea urchin demembrated sperm.

We obtained cytosolic extracts from post-fertilized eggs which, support chromatin decondensation and nuclear membrane formation of the added demembrated sea urchin sperm as judged by Hoesht staining and lipids dye labelling. Such extracts were demonstrated to perform protein synthesis as well as DNA synthesis, indicative of the probable occurrence of a S-phase.

The next step will be the elaboration of the conditions to obtain chromatin re-condensation and nuclear membrane breakdown the hallmarks of G2 to M-phase progression. The ability to deplete and purify certain components from these complex cell-free extracts by the use of antibodies and recombinant proteins will allow to elucidate the relationships between cell cycle and translation.