Diabetes mellitus is a chronic disease caused by the loss of pancreatic beta cells due to autoimmune destruction or increased apoptosis. Beta-cell deficiency results in reduced insulin production, which plays an important role in glucose metabolism. The number of beta-cells in the body is one of the main factors that influence the development of this chronic disease. Therefore, it is necessary to find a way by which the number of beta-cells of the organism can be increased and thus the insulin production can be restored in a natural way without any need for the use of insulin infusions. However, the ability of beta-cells to divide decreases with age and is virtually nil in adulthood. The study of the cell cycle, especially the early and late cyclins and cyclin-dependent kinases, which act as cell cycle regulators, thus appears to be a promising way to restore natural insulin-producing tissues.

In order to increase the number of beta cells entering the cell cycle, we focused on studying the effect of *in vitro* transcribed (IVT) mRNAs, encoding cyclins type D and cyclin dependent kinases 4 and 6 on stimulating cell division of isolated beta-cells. We found that transfection IVT mRNAs for type D cyclins in combination with cyclin-dependent kinases 4 and 6 significantly increased the proliferation of beta-cells entrapped in the resting phase of the cell cycle.

Subsequently, we investigated the effect of transfection of various combinations of cyclin D and cyclin dependent kinases 4 and 6 on beta-cell gene expression. From these experiments, we found that the newly formed beta-cells showed a slight decrease in insulin production and an increase in the expression of proteins important for the maturation of beta-cells, due to their dedifferentiation. As part of beta-cell dedifferentiation, we also observed increased expression of lactate dehydrogenase (LdhA) and enolase (Eno1), which tend to be attenuated in differentiated beta-cells due to proper sensing of the extracellular glucose concentration.