**Title:
Cell-cycle dependent control of ribosome synthesis and its role in cell size homeostasis

Abstract:
Mammalian cells need to double their mass before mitosis to maintain size homeostasis. In the growth control during the cell cycle, regulation of the ribosome synthesis rate has been assumed to play critical roles by directly modulating the protein synthesis rate. Ribosomes consist of two components, ribosomal proteins (RPs) and ribosomal RNAs (rRNAs), which are known to be regulated by translational and transcriptional controls respectively. However, due to technical difficulties in measuring dynamic changes in the RP translation rates and rRNA transcription rates, control of the ribosome synthesis rates underlying cell-cycle progression has remained unknown. Here, using the live-cell reporters stably integrated in human epithelial cells, we monitored real-time, cell-cycle dependent changes in the transcription rates of rRNAs and the translation rates of 5’ terminal oligopyrimidine tract (5’TOP) mRNAs which encode RPs. Interestingly, both the RP translation and rRNA transcription peak at early S phase following rapid increase during G1 phase, but moderately drop toward late S phase, revealing the cell-cycle dependent ribosome synthesis. Furthermore, we not only showed that these coordinated behaviors of the RP and rRNA regulation are mediated by the mTORC1 pathway, but also found evidences that large cells show larger drop in the ribosome synthesis rates during S phase, so that the rates converge toward late S phase on the cells with different sizes.**