mTOR regulates ribosome biogenesis in mammalian cells
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The biogenesis of ribosomes is a highly coordinated multistep process that largely takes place in the nucleolus, where ribosomal RNA (rRNA) is synthesized, processed, modified and assembled into ribosomal subunits. In dividing cells, ribosome biogenesis consumes a high proportion of cellular energy, and this process is linked to cell growth and proliferation. mTOR, is a sensor for nutrient availability and controls diverse functions, many of which are related to cell growth/division.

We treated HeLa cells with different mTOR inhibitors (rapamycin and PP242) to study their effects on transcription and/or processing of rRNA. We analyzed each step of rRNA processing by Northern blot and the synthesis of new rRNAs by Pol I and Pol III using a novel labelling method and real-time RT-PCR. We found that treatment with rapamycin strongly inhibited pre-rRNA synthesis and affected the processing of the 18S and 28S rRNA. In order to analyze the effect of these mTOR inhibitors on protein synthesis, we developed a stable-isotope labelling method to tag newly-synthesized proteins (pSILAC). Using this approach, we observed a substantial inhibition of the synthesis of ribosomal proteins. The results will help us to understand the important role of mTOR in controlling ribosome biogenesis in mammalian cells.