Molecular mechanisms of RNA degradation: the exosome complex

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RNA degradation serves a multitude of functions in all domains of life. The main cellular machinery responsible for degrading RNAs in the 3'-to-5' direction is the RNA exosome complex. The exosome is conserved in all eukaryotes studied to date. Related complexes are also present in bacteria and archaea, highlighting the importance of this ancient machinery. In eukaryotes, exosome-mediated RNA degradation leads to the elimination of nuclear and cytoplasmic transcripts in turnover and quality control pathways, and also to the partial trimming of RNA precursors in processing pathways. How the exosome combines specificity and versatility in RNA degradation is not well understood, but an important aspect appears to be the association with cofactors that target the complex to different transcripts in different cellular compartments and modulate its activity.

Over the years, we have used biochemical and structural studies to understand how the core complex of the yeast exosome recognizes and degrades RNA substrates. We have now proceeded to study how the exosome core complex associates and functions with its nuclear and cytoplasmic cofactors. Increasing evidence indicates that the regulatory complexes of the exosome interact with pre-ribosomes in the nucleus (for processing) and mature ribosomes in the cytoplasm (for turnover and quality control). The results pave the way to understand the crosstalk between exosome and ribosomes and more generally to understand the integration of different gene expression machines that have been so far studied individually.