

Transport out of the Nucleus and Beyond: Molecular Mechanisms

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The movement of proteins and RNAs between the nucleus and cytoplasm of eukaryotic cells is mediated by nucleo-cytoplasmic transport receptors. Most receptors belong to the karyopherin β family of protein, which are also known as importins or exportins according to whether they import or export cargo into/from the nucleus. The directionality of import and export processes depends on the small GTPase, Ran. In contrast to most proteins/RNAs, mRNAs are transported out of the nucleus by a transport factor unrelated to the karyopherin family. mRNA export is linked to quality control mechanisms that make sure that only correctly transcribed and processed mRNAs are exported and translated. A ubiquitous quality control mechanism is nonsense-mediated mRNA decay (NMD). NMD is a surveillance pathway that detects mRNAs containing premature translation termination codons (PTCs) and degrades them before they give rise to truncated protein products. In humans, detection and degradation of PTC-containing mRNAs is dependent on splicing. The splicing-dependence is correlated to the exon junction complex (EJC), a multiprotein assembly that is deposited on mRNAs at the end of splicing upstream of exon junctions. EJC components mark aberrant mRNAs for detection by the NMD machinery and deliver the targeted mRNA to degrading enzymes such as the exosome.

X-ray structures of components of the mRNA export/surveillance machinery give insights on the molecular mechanisms with which they function.

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