

P032 Visualization of a viral pseudoknot inducing frameshifting in a mammalian ribosome
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The mechanical basis of -1 frameshifting induced by a viral pseudoknot within a mammalian ribosome has been visualised directly by cryo-electron microscopy. Ribosomes were purified from rabbit reticulocyte lysate stalled on a viral pseudoknot sequence based on that of IBV but without the essential "slippery sequence". Cryo-electron microscopy was used to reconstruct in three-dimensions the structure of this stalled ribosome and also a control ribosome structure (at 15Å and 14 Å respectively). The stalled ribosome can clearly be identified as being in a trapped, mid-translocation state. EF2 is visible and can be seen to interact directly with the P-site tRNA which is in a compressed "spring-like" state. A pseudoknot structure is clearly identified at the entrance to the mRNA tunnel and is associated with dramatic movements of the surrounding ribosomal elements. By modelling based on the prokaryotic atomic structure these elements can be identified as being approximately equivalent to the prokaryotic ribosomal helicase. We therefore suggest that this is the mammalian helicase and present a model for the molecular basis of viral frameshifting.