Metal ions in the 70S ribosome structure: implications for the structure and structure solution

Rozov A.[1], El Omari K.[2], Khusainov I.[1], Yusupov M.[1], Wagner A.[2], Yusupova G.[1]

[1]Institut de génétique et de biologie moléculaire et cellulaire, Illkirch, France; [2]Diamond Light Source, Chilton, UK.

Structural studies of the 70S ribosome as well as its 30S and 50S subunits were conducted for decades. However, the severe limitations imposed by the size (molecular weight 1-2.3 MDa) and dynamic nature of the complexes cannot be fully overcome until now. Therefore every new development in X-ray technique or research methodology, such as the new Eiger detectors or long-wavelength crystallography, leads to new possibilities in the field of ribosome crystallography.

There is a wealth of biochemical evidence depicting translation sensitivity to the chemical composition (especially ionic) of the reaction medium [1], but these studies were not reciprocated in the structural field equally extensively [2]. In general, metal ions are crucial for correct RNA folding, stability and function. They act as counter-charges for the acidic phosphate backbones, permitting RNA to retain functional three-dimensional structures. In addition to their role as counter ions, metal ions are also implicated in ribozyme catalytic processes [3]. Among these metals, magnesium is thought to be the most important divalent ion for RNA stabilization and as such it is also the most frequently assigned metal in ribosomal structures.

Here we present first experimental data dedicated to the elucidation of ionic composition and environment in the structures of 70S ribosome from *Thermus thermophilus* and its functional complexes. Our data are necessary for the understanding of mechanisms involved in translation on molecular level and also provide an additional dimension to the structural investigation of the ribosomal functional complexes.

1. Gavrilova L.P. et al. J. Mol. Biol., 101 (1976), 537–552
2. Klein DJ, Moore PB, Steitz TA. RNA, 10 (2004), 1366–1379.
3. Steitz TA, Steitz JA. Proc Natl Acad Sci U S A, 90(14), (1993), 6498-502.