

Structure of the 30S Ribosomal Subunit and Recognition of Cognate tRNA

J. M. Ogle, D. E. Brodersen, W. M. Clemons, Jr., A. P. Carter, M. J. Tarry, V. Ramakrishnan
MRC Laboratory of Molecular Biology, Hills Road, Cambridge, United Kingdom

The ribosome is the large molecular machine present in all cells that is the site of translation of the genetic code into proteins. It consists of two subunits, called 30S and 50S. Research in our laboratory has focused on the high-resolution crystal structure of the ribosome, in particular the 30S ribosomal subunit.

We were able to solve the crystal structure of the ribosome as well as its complexes with several antibiotics. In particular, we have recently shed light on how the ribosome recognizes cognate tRNA (i.e., the one that matches the codon on messenger RNA) and ensures accuracy in translation of the genetic code, and how the antibiotic paromomycin interferes with this process.

For our work, data collection at the SBC 19-ID beamline was extremely important for several reasons:

1. The beamline can produce an intense, highly tunable beam that is precisely aligned, so that it can be made small enough to match our crystal dimensions of about 60-100 microns. This means that we can get low background and correspondingly good signal to noise.

2. The CCD detector had the appropriate size and resolution (and speed) to allow data collection on the large unit cell involved.

3. We were able to tune precisely at the LIII edges of various anomalous scatterers and thereby obtain a strong enough phasing signal.

4. We also were able to orient our crystals precisely about a mirror plane using the kappa goniostat and therefore optimize the measurement of anomalous differences.

This combination of capabilities was crucial in allowing us to get good experimental phases to solve the 30S structure to 3 Å resolution and produce a complete and refined atomic model for it.

Publications from this work:

J.M. Ogle, D.E. Brodersen, W.M. Clemons, Jr., M.J. Tarry, A.P. Carter, and V. Ramakrishnan, "Recognition of cognate tRNA by the 30S ribosomal subunit", *Science* **292**, 897-902 (2001).

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A.P. Carter, W.M. Clemons, Jr., D.E. Brodersen, R.J. Morgan-Warren, B.T. Wimberly, and V. Ramakrishnan, "Functional insights from the structure of the 30S ribosomal subunit and its interactions with antibiotics," *Nature* **407**, 340-348 (2000).