# M07.0A Problematics in Macromolecular Structures: I Phasing

## Chair: R. Read
## Co-Chair: Z. Otwinoski

## Attendance: 430


While macromolecular crystallographers all have a common interest in the structure and function of the molecules we study, what really unites us is the common problems that plague the techniques we share. This was reflected in the turnout for the session on phasing, which filled the hall to overflowing.

Two talks dealt with phasing through molecular replacement. Current techniques make easy work of most of the molecular replacement problems that would have been attempted just a decade ago. But in those days we avoided crystals with large unit cells (multiple copies of the molecules, displaying high crystallographic or non-crystallographic symmetry), and we couldn't make much use of phases from a model with low homology. Jorge Navaza discussed approaches to dealing with the problems raised by high non-crystallographic symmetry, by exploiting the prior information available from self-rotation and Patterson functions. He showed, in a number of examples, how this could simplify the problem tremendously. In complementary work, Randy Read showed that likelihood functions give a much clearer indication of the correct answer than the conventional scores that are used, particularly for poor or incomplete models.

The next two talks explored the phase information that could be gained by averaging multiple images of a structure, either through non-crystallographic symmetry or multiple crystals. Kevin Cowtan described the theoretical background and then went on to discuss the usefulness of combining the images obtained from a crystal at room temperature and the same crystal at cryogenic temperatures, which generally shrink the unit cell significantly. He showed that typical changes in cell dimensions indeed can give useful phase information, particularly if the data are measured carefully. Jimin Wang presented the specific example of ClpP, where 14-fold non-crystallographic symmetry was used to generate an excellent map from nearly random phases.

Finally, Qun Shen gave a lucid explanation of 3-beam X-ray diffraction and the use of a reference beam geometry to collect 3-beam data. In favourable cases, the resulting profiles give clear indications of the triplet phases, which can be used in conjunction with direct methods programs to give clear electron density maps. There are serious technical obstacles remaining — the crystals must have exceptionally low mosaic spread — but the evolution of the theory and technology is fascinating nonetheless.

*Randy J. Read*