s3.m1.o1 ***Ab Initio*** **Crystal Structures Solution of Macromolecules**. M.C. Burla*, M. Camalli◆, B. Carrozzini☆, G. Cascarano☆, C. Giacovazzo☆, G. Polidori* and R. Spagna◆, **Dipartimento di Scienze della Terra, Università di Perugia, 06100 Perugia, Italy, ☆IRMEC, CNR, c/o Dip. Geomineralogico, Università di Bari, 70125 Bari, Italy, ◆Istituto di Strutturistica Chimica "G. Giacomello", CNR, C.P. 10 - Monterotondo Stazione - 00016 Roma, Italy.*
Keywords: proteins, direct methods, software.

The practical solution of the phase problem for small molecules addressed the efforts of several scientists working to direct methods towards macromolecular crystallography.

A milestone of the new trend has been Shake-and-Bake[1]: it differs from previous computer programs because each trial solution is repeatedly cycled in both real and reciprocal space, and structure (or phase) refinement is performed in each space. The algorithm is computer intensive and it has been made feasible only in recent years because to the increased computing power. A strategy related to Shake-and-Bake approach is that at the basis of Half-Bake[2,3]: it also alternates refinement in direct and in reciprocal space but stresses refinement in direct space.

A new approach has been recently suggested[4], implemented into the program SIR99, which preserves the more traditional point of view of SIR97[5], i.e., tangent formula followed by direct space refinement without alternating the two approaches. Its evolution is SIR2000[6], a very powerful program for *ab initio* phasing of proteins.

The various approaches will be analysed to discover the factors which allow to immoderately enlarge the size of crystal structures solvable by direct methods (today crystal structures with 2000 non-hydrogen atoms in the asymmetric unit can be solved *ab initio*). The problem of data resolution is the most critical at the present state of the art: the efficiency of the new methods decreases as soon as data resolution departs from atomic resolution. Data completeness and low resolution data are other factors which can affect the effectiveness of the techniques. Future perspectives will also be discussed.

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s3.m1.o2 **Refinement of Twinned Structures with SHELXL-97.** R. Herbst-Irmer, *Institute of Inorganic Chemistry, University of Göttingen, Tammannstr. 4, D-37077 Göttingen, Germany.*
Keywords: twin, refinement, SHELXL.

Some example of twinned structures will be presented. It will be discussed how we detected and handled the twinning and how the structures were refined with SHELXL[1]. Also several warning signs of twinning will be presented[2].

A twin consist of two or more single crystals of the same species but in different orientations. So for the description of a twin two things are necessary: a description of the orientation of the different species relative to each other (twin law) and the fractional contribution of each component. The twin law can be expressed as a matrix that transforms the *hkl* indices of one species into the other.

In SHELXL the twin refinement method of Pratt, Coyle and Ibers[3] and Jameson[4] has been implemented. The sum of the F_c^2 values of the individual twin domains, each multiplied by its fractional contribution, is fitted to the observed F_o^2.

SHELXL distinguishes two kinds of twins. In the first case every reflection is affected by the twinning (merohedral or pseudo-merohedral twinning). Here the twin law can be given in a single command. In the second case (twinning by reticular merohedry or non-merohedral twins) only part of the reflections have contribution of the second twin domain. For this type of twinning a special reflection file must be prepared. In both cases the fractional contribution is refined by a single command.

For non-merohedral twins three types of reflections are possible. There are first the reflections with no overlap of the other domain. Then there are the reflections with an exact overlap of a reflection of the second domain. The intensity should be the sum of both intensities of both reflections. Finally there are the difficult reflections with a partial overlap of a reflection of the second domain. Compared to merohedral twins there are the additional problems of dividing the reflections into the three categories and the treatment of the partially overlapped reflection.

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