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When Less is More: Teaching Crystallography to Bioscientists. Bernhard Rupp, Macromolecular Crystallography & Structural Genomics Group, Univ. of California - LLNL, POB 808, Livermore, CA 94551 USA.

Teaching crystallography to bioscientists requires a different approach compared to training material scientists or chemical crystallographers. Crystallography as a science is rooted in physical principles and their description in mathematical formalisms. It is thus of great advantage to capture non-mathematical disciples early by presenting fundamental concepts in a context to which they can relate from their own experience and expectations. Once the apprentice has appreciated the fundamentals qualitatively, much less resistance will develop to necessary refinement of the subject in mathematical terms. In addition, biological crystallography creates unique opportunities for multiple pitfalls during structure determination, the most serious and underappreciated being model - and occasionally mental - phase bias. If biologically relevant conclusions are to be drawn, validation and analysis require careful consideration of protein plasticity, crystal contacts, and local assessment of the structure. No amount of space group theory can compensate for omission of a healthy skepticism and well-informed analysis of biomolecular crystal structures. Such a holistic approach to teaching biomolecular crystallography does require that the teacher himself is at ease with physical and mathematical concepts, as well as informed about biological interpretation and analysis - suggesting that senior investigators themselves devote more time and effort to the training of their disciples.