Enclosing Chemical Space

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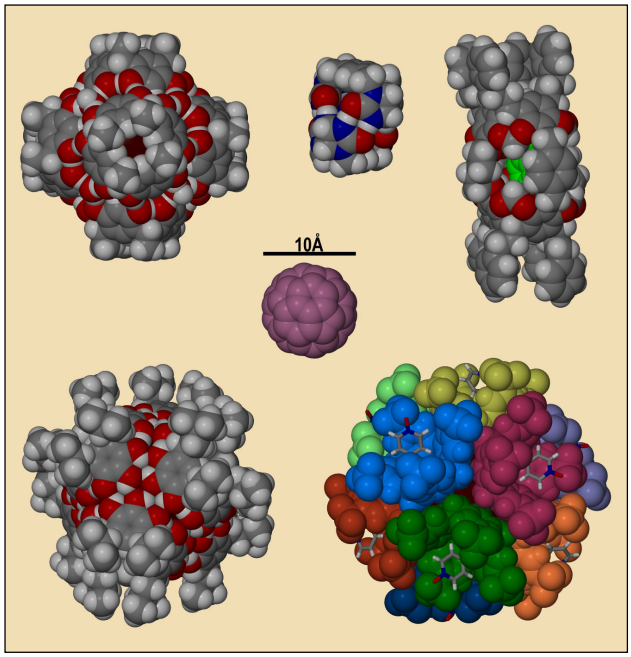
The bottom-up assembly of elaborate structures from a relatively simple set of molecular building blocks is nowhere more beautifully exemplified than in biological systems. By exploiting the principles of supramolecular chemistry, nature has mastered the ability to form remarkably complex molecular capsules on a widely varied scale. Indeed, most of the fascinating chemistry of life-sustaining processes occurs within molecular containers such as viruses (20 to 200 nm), bacteria (1,000 to 2,000 nm) and biological cells (5,000 to 40,000 nm).



We have long been interested in the controlled assembly of large molecular capsules. Although we have derived much of our inspiration from biological systems, the formation of capsules matching the size and complexity encountered in living organisms is currently beyond the synthetic grasp of the chemist. However, we note that viral capsids consist of relatively simple geometrical arrangements of molecules (i.e. polyhedra, helices or a combination of these two morphologies). Since polyhedral arrangements of molecules are often encountered in crystals, we have based our initial approach on the study of supramolecular assemblies in the solid state. We believe that many of the principles governing the formation and stability of self-assembled containers can be unravelled by such studies. This knowledge will ultimately be applicable to the controlled assembly of molecular capsules in solution, and perhaps even in the gas phase.