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*Designing Cyclodextrin Derivatives for Analytical Applications*  
(Chemistry and Biochemistry / Arts and Sciences)

Cyclodextrin (CD) is a bucket-shaped molecule obtained by bacterial breakdown of starch. Smaller molecules can be trapped inside the bucket-shaped cavity, and this gives rise to many applications in chemistry. In particular, CD can sometimes be used to separate pairs of molecules that differ only in that they are mirror images of each other. This is the molecular equivalent of having a machine that can separate right-handed gloves from left-handed ones. The ability to do this is very important in organic chemistry, mainly because drugs are often mirror-image molecules. In these cases, only one of the mirror images is an active drug, with the other typically causing undesirable side effects and thus being prohibited by the FDA. The severe birth defects associated with thalidomide in the late 1950s is an extreme example of problems caused by the "wrong" mirror image of a drug. Thus, it is important to be able to separate mirror images for both preparative and analytical reasons. To use CD to separate mirror images, it must be chemically modified. To date, these modifications have been relatively simple, providing only a small part of the range of possibly useful CD derivatives. I believe this is because it has been primarily analytical chemists who have worked with cyclodextrins, rather than synthetic organic chemists who would perhaps have both new ideas and more skill with preparative techniques. Herein are proposed cyclodextrin derivatives that are dramatically different than any that have been reported to date. These new derivatives would have deeper cavities, with walls that are both more organized and chemically different than existing ones. Model studies suggest that it should be possible to prepare these molecules. While such derivatives might be useful in many aspects of analytical chemistry, we propose to study them first in the context of capillary gas chromatography, the analytical technique with both the greatest separating power and the highest sensitivity.