restraints until a final formulation is selected. It is important that the critical product characteristics be obtainable using raw materials whose properties span the supplier's specification range. This is of particular importance if one or more of the ingredients is a natural product that may tend to have extensive lot-to-lot variability. If the formulation is not tested using at least three different lots of each ingredient, then costly problems may arise during manufacture of the product. Likewise, the ranges for both active and inert ingredient amounts that are tolerable to the formulation should be determined. If more than one drug concentration is anticipated, then the ranges of inert ingredients should be checked at each drug concentration. It becomes quickly apparent that the optimization of even a five-component formulation is a substantial undertaking. Finally, the critical and noncritical process variables must be defined once an optimal formulation is selected. Although this last step is usually associated with scaleup, laboratory scale experiments can help define processing steps such as holding times, holding temperatures, and the effect of heating and cooling cycles.

Obviously, the formulator is faced with a tremendous challenge to actually optimize a topical formulation. To meet this challenge, an efficient, well-planned series of laboratory investigations must be performed. These experiments can be divided into three steps:

1. A preliminary formulation is selected and component ranges are determined by conducting phase behavior studies.
2. A statistically valid experiment is designed utilizing these component ranges and any other process variables considered important.
3. Responses from the experimental trials are empirically modeled and optimized.

The last two steps in this process have been the focus of much attention for solid-dosage forms (1,2) and, more recently, for disperse systems (3). However, these optimization techniques require that the responses be smooth and continuous throughout the variable ranges. For topicals, smoothness and continuity must be established for the composition ranges before optimization. Thorough characterization of the formulation by determining the phase behavior of the system is a way of establishing smoothness and continuity throughout the composition range. Thus, selection of component ranges by phase behavior determination will be the main focus of this chapter.