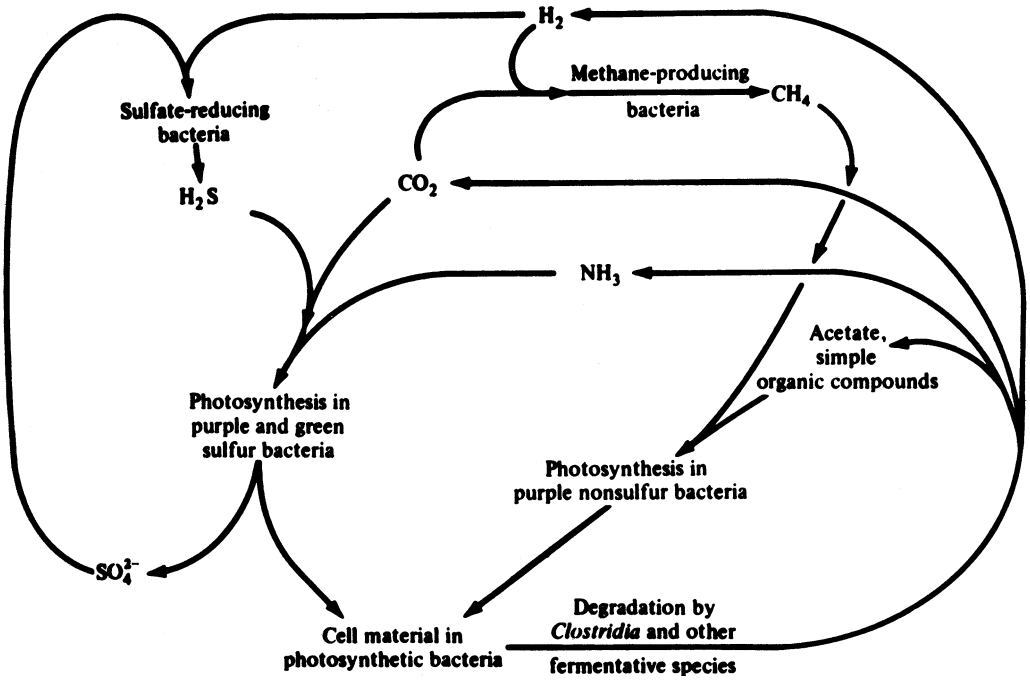

Figure 16.6. Simplified schematic of the cycles of matter in an anaerobic environment. (With permission, from J. E. Bailey and D. F. Ollis, *Biochemical Engineering Fundamentals,* 2d ed., McGraw-Hill Book Co., New York, 1986, p. 918.)

Fig. 16.6 for an anaerobic environment. Understanding such complex cycles is important to understanding the capacity of natural ecosystems to degrade organic pollutants.

16.5. INDUSTRIAL UTILIZATION OF MIXED CULTURES

Defined mixed microbial populations are commonly used in cheese making, a good example of using mixed cultures in food production. Cheeses of various types are produced by inoculating pasteurized fresh milk with appropriate lactic acid organisms. The bacteria used for lactic acid production are various species of *Streptococcus* and *Lactobacillus* in a mixed culture. Other organisms are used to develop flavor and aroma. Among these are *Brevibacterium linens, Propionibacterium shermanii, Leuconostoc* sp., and *Streptococcus diacetilactis.* After inoculation of pasteurized milk, a protein-rich curd is precipitated by the acidity of the medium, and the liquid is drained off. The precipitated curd is allowed to age by action of bacteria or mold. Some molds used in cheese making are *Penicillum camemberti* and *Penicillum roqueforti.*

Lactic acid bacteria are also used in whiskey manufacture. *Lactobacillus* added to the yeast reduces pH and, therefore, the chance of contamination. *Lactobacillus* also contributes to the flavor and aroma of whiskey. A favorable interaction between yeast and lactic acid bacteria exists in ginger-beer fermentation.