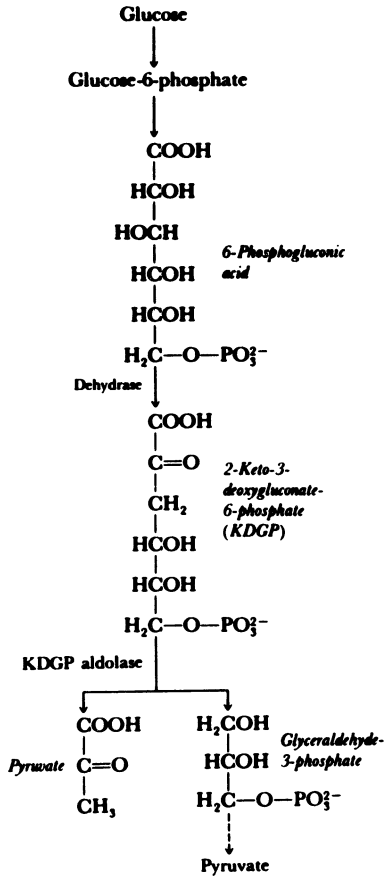

Figure 5.11. Entner–Doudoroff pathway. (With permission, from T. D. Brock. D. W. Smith, and M. T. Madigan, *Biology of Microorganisms*, 4th ed., Pearson Education, Upper Saddle River, NJ, 1984, p. 791.)

riety of organisms to select one that will maximize the yield of a desired product, while minimizing the formation of other by-products.

5.11. OVERVIEW OF AUTOTROPHIC METABOLISM

So far we have been concerned primarily with *heterotrophic growth* (e.g., organic molecules serve as carbon–energy sources). However, *autotrophs* obtain nearly all their carbon from CO_2. Most autotrophs (either photoautotrophs or chemoautotrophs) fix or capture CO_2 by a reaction catalyzed by the enzyme ribulose bisphosphate carboxylase, which converts ribulose-1,5-diphosphate plus CO_2 and H_2O into two molecules of glyceric acid-3-phosphate. This is the key step in the *Calvin cycle* (or Calvin–Benson cycle). This cycle is summarized in Fig. 5.12 and provides the building blocks for autotrophic growth.

Energy for autotrophic growth can be supplied by light (photoautotroph) or chemicals (chemoautotroph). Here we consider the special case of photoautotrophic growth.