



Life without Oxygen

CHEM-643 Intermediary Metabolism
Case Study Problem No. 2 - Written by Harold B. White

Page 4 - Life without Petroleum - II

Living organisms produce a variety of polymers of controlled structure and specific function that are the envy of synthetic chemists. On the other hand, chemists can invent polymers not limited to biological building blocks like sugars, amino acids, and nucleotides. These plastic polymers seem inextricably connected to carbon from petroleum.

Some companies have begun to think in terms of renewable biological feedstocks such as corn sugar for the direct biological synthesis of monomers. The latter is intriguing because organisms have no need to make something like 1,3-propanediol, a monomer used by duPont in [Sorona®](#) synthesis. DuPont has devoted considerable effort to genetic engineering and protein evolution to enable organisms to biosynthesize 1,3-propanediol on a commercial scale. Other companies are modifying organisms to synthesize new polyketide antibiotics. It is clear that a good understanding of metabolism, enzyme chemistry, and molecular biology are needed to generate products that reduce our dependence on petroleum.

Read one or more of the following on-line articles

- Yang, Y-T, Bennett, G. N., San, K-Y (1998) Genetic and Metabolic Engineering. *J. Biotechnology* **1**, 134-141.
- Koffas, M., Roberge, C., Lee, K., Stephanopoulos, G. (1999) Metabolic Engineering. *Ann. Rev. Biomed. Eng.* **1**, 535-357.
- Shimizu, H. (2002) Metabolic Engineering—Integrating Methodologies of Molecular Breeding and Bioprocess Systems Engineering *J. Biosci. Bioeng.* **6**, 563-573.

Select a topic of interest from that article that relates to the production of a specific specialty chemical, then find and read one of the cited references on that topic.

Write two pages about the significance and/or implications of that article, i.e. this is more than just a report on what the article said.