

Chapter 12-Synthesis of commercial products by recombinant microbes

Restriction enzymes
Small molecules
Antibiotic genes
Biopolymers

Restriction enzymes are great products for recombinant microbes (*E. coli*)

- \$200 million in annual RE sales in 2001
- Some microbes are difficult or expensive to grow in culture
- Strategy: clone the gene for the RE from a given microbe and express it in *E. coli* (along with the corresponding modification [methylase] gene for protection of the *E. coli* DNA)
- *E. coli* is simple to grow

Small molecules are also great products for recombinant microbes (often *E. coli*)

- Ascorbic acid (Vitamin C)
- Indigo (Fig. 12.8)
- Amino acids (e.g., Glutamic acid or Glu for production of the flavor enhancer MSG)
- Antibiotics, novel antibiotics and polyketide antibiotics
- Note that in all of these cases, one needs to clone the genes encoding the enzymes making these metabolites in order to create or alter a biochemical pathway

Biopolymers are also great products for recombinant microbes

- Xanthan gum production in *Xanthomonas campestris* (genetically engineered to grow on whey, a byproduct of cheese production)
- Melanins
- Animal adhesive proteins (from the blue mussel)
- Rubber (from the rubber plant *Hevea brasiliensis*)
- Biodegradable plastics (polyhydroxyalkanoates)
- Note that in all of these cases, one needs to clone the genes encoding enzymes in order to create or alter a biochemical pathway

A final note

- I do not expect you to memorize all of the genetic engineering details provided in the numerous examples presented in this chapter; however, I do want you to be familiar with the various strategies that are employed in these examples.