CLAIMS

1. An engineered polynucleotide encoding an engineered polypeptide having proline hydroxylase activity comprises an amino acid sequence having at least 95% or more sequence identity to reference sequence SEQ ID NO:810 and one or more residue differences as compared to SEQ ID NO: 810 at residue positions selected from: 2, 4, 8, 10, 15, 26, 30, 33, 36, 37, 39, 42, 43, 44, 45, 48, 50, 52, 55, 56, 57, 58, 61, 62, 63, 71, 76, 77, 81, 82, 87, 88, 92, 94, 95, 97, 98, 101, 107, 109, 114, 115, 119, 121, 124, 128, 130, 131, 132, 134, 136, 145, 151, 153, 156, 158, 160, 161, 165, 166, 168, 173, 176, 178, 180, 184, 194, 213, 230, 237, 240, 256, 263, 266, 269, 270, 271, 273, 274, 275, and 280.

2. The engineered polynucleotide encoding an engineered polypeptide having proline hydroxylase activity of Claim 1, wherein said one or more residue differences as compared to SEQ ID NO:810 is at residue positions selected from: 33, 95, 156, and 166.

3. The engineered polynucleotide encoding an engineered polypeptide of Claim 1, wherein said engineered polypeptide is capable of converting (S)-pipecolic acid to (2S,5S)-5-hydroxypipecolic acid.

4. The engineered polynucleotide encoding an engineered polypeptide of Claim 3, wherein said engineered polypeptide is capable of converting (S)-pipecolic acid to (2S,5S)-5-hydroxypipecolic acid with at least 1.2 fold, 1.5 fold, 2 fold, 3 fold, 4 fold, 5 fold, 10 fold, 20 fold, 30 fold, 40 fold, 50 fold, 60 fold, 70 fold, 80 fold, 90 fold, 100 fold or more enzymatic activity of the naturally occurring enzyme.

5. The engineered polynucleotide encoding an engineered polypeptide of Claim 3, wherein said engineered polypeptide is capable of converting (S)-pipecolic acid to (2S,5S)-5-hydroxypipecolic acid with greater than 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99 % or more diastereomeric excess of (2*S*,5*R*)-5-hydroxypipecolic acid.

6. The engineered polynucleotide of Claim 1, wherein said polynucleotide comprises a nucleic acid sequence optimized for expression in *E. coli*.

7. The polynucleotide of Claim 2, wherein said polynucleotide comprises a nucleic acid sequence optimized for expression in *E. coli*.

8. An expression vector comprising the polynucleotide of Claim 1, optionally further comprising at least one control sequence.

9. The expression vector of Claim 8, wherein said vector comprises SEQ ID NO:1007, 1008, or 1009.

10. A host cell comprising the polynucleotide of Claim 1.

11. A host cell comprising the expression vector of Claim 8.

12. The host cell of Claim 11, wherein the host cell is *E. coli*.

13. A method of preparing an engineered polypeptide, comprising culturing the host cell of Claim 12, under conditions suitable for expression of the polypeptide.

14. The method of Claim 13, further comprising a step of isolating the engineered polypeptide.