CLAIMS

1. A method of producing a dicarboxylic acid comprising:

contacting a saturated fatty acid substrate having 15-20 carbon atoms and not bound to or by an acyl carrier protein with a CYP102 sub-family enzyme that comprises a ferredoxin reductase and a ferredoxin and that oxidizes the fatty acid substrate and breaks a C-C bond of the fatty acid substrate to produce a dicarboxylic acid product, wherein the dicarboxylic acid product has 3 less carbon atoms than the substrate and the enzyme has at least 95% sequence identity with a sequence selected from the group consisting of: SEQ ID NOs: 2, 4, 6 and 8; and

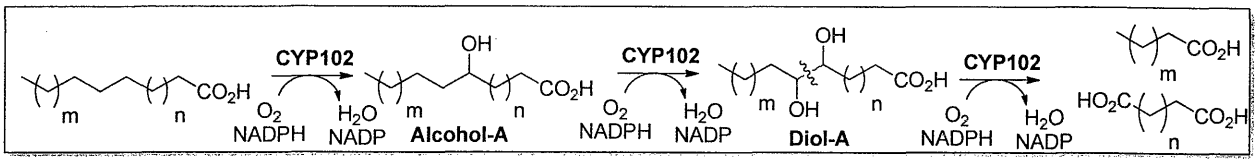
detecting the dicarboxylic acid product.

2. The method of claim 1 further comprising that hydroxylated fatty acid products are produced in addition to the dicarboxylic acid product when the enzyme is incubated with the fatty acid.

3. The method of claim 1 wherein the enzyme overoxidizes the fatty acid substrate.

4. The method of claim 3 wherein the reaction comprises the over-oxidation of adjacent diols.

5. The method of claim 1 wherein oxidizing the fatty acid substrate and breaking the C-C bond comprises the reaction mechanism:



wherein m + n = 9-14.

6. The method of claim 5 further comprising contacting the substrate with an oxidizing agent.

7. The method of claim 1 wherein

the substrate is tridecanedioic acid (C19) and the dicarboxylic acid is palmitic acid (C16).

8. The method of claim 1 wherein the enzyme has at least one amino acid residue different from CYP102A1 wt (BM3) and/or CYP102A2 wt (YetO) and/or CYP102A3 wt (yrhJ) enzymes.

9. The method of claim 1 wherein the enzyme is selected from the group consisting of: BM3 (F87A), YetO (F89A), YetO (F89I), YetO (F89S), YetO (F89V).

10. The method of claim 9 wherein the substrate is palmitic acid or heptadecanoic acid.

11. The method of claim 9 wherein the enzyme is BM3-F87A.

12. The method of claim 1 wherein the enzyme has at least one amino acid residue different from CYP102A1 wt (BM3) or CYP102A2 wt (YetO).

13. The method of claim 1 wherein the substrate is palmitic acid or heptadecanoic acid.

14. The method of claim 13 wherein the substrate is palmitic acid.

15. The method of claim 1 wherein the enzyme has the sequence of SEQ ID NO: 2 or SEQ ID NO: 4.