comprises converting crotonyl-CoA to crotyl alcohol using one or more metabolic pathway enzymes, wherein said metabolic pathway enzymes are selected from the group consisting of: (i) a crotonyl-CoA reductase converting crotonyl-CoA to crotonaldehyde, and a crotonaldehyde reductase converting crotonaldehyde to crotyl alcohol; (ii) a crotonyl-CoA reductase converting crotonyl-CoA to crotyl alcohol; and (iii) a crotonyl-CoA hydrolase, a crotonyl-CoA synthetase, or a crotonyl-CoA transferase converting crotonyl-CoA to crotonate, a crotonate reductase converting crotonate to crotonaldehyde, and a crotonaldehyde reductase converting crotonaldehyde to crotyl alcohol, wherein said biosynthetic pathway further comprises: (i) converting acetyl-CoA to crotonyl-CoA using an acetyl-CoA:acetyl-CoA acyltransferase, an acetoacetyl-CoA reductase and a 3-hydroxybutyryl-CoA dehydratase; (ii) converting glutaconyl-CoA to crotonyl-CoA using a glutaconyl-CoA decarboxylase; (iii) converting glutaryl-CoA to crotonyl-CoA using a glutaryl-CoA dehydrogenase; (iv) converting 3-aminobutyryl-CoA to crotonyl-CoA using an 3-aminobutyryl-CoA deaminase; or (v) converting 4-hydroxybutyryl-CoA to crotonyl-CoA using a 4-hydroxybutyryl-CoA dehydratase, and wherein said microbial organism is a bacteria or a yeast.

In another aspect, there is provided a method for producing crotyl alcohol comprising culturing the non-naturally occurring microbial organism of the present invention under conditions and for a sufficient period of time to produce crotyl alcohol.

The present disclosure provides non-naturally occurring microbial organisms containing butadiene pathways comprising at least one exogenous nucleic acid encoding a butadiene pathway enzyme expressed in a sufficient amount to produce butadiene. The disclosure additionally provides methods of using such microbial organisms to produce butadiene, by culturing a

What is claimed is:

1. A non-naturally occurring microbial organism comprising a biosynthetic pathway for the production of crotyl alcohol wherein said biosynthetic pathway comprises at least one exogenous nucleic acid encoding at least one metabolic pathway enzyme expressed in a sufficient amount to produce crotyl alcohol, wherein said biosynthetic pathway comprises converting crotonyl-CoA to crotyl alcohol using one or more metabolic pathway enzymes, wherein said metabolic pathway enzymes are selected from the group consisting of:

(i) a crotonyl-CoA reductase converting crotonyl-CoA to crotonaldehyde, and a crotonaldehyde reductase converting crotonaldehyde to crotyl alcohol;

(ii) a crotonyl-CoA reductase converting crotonyl-CoA to crotyl alcohol; and

(iii) a crotonyl-CoA hydrolase, a crotonyl-CoA synthetase, or a crotonyl-CoA transferase converting crotonyl-CoA to crotonate, a crotonate reductase converting crotonate to crotonaldehyde, and a crotonaldehyde reductase converting crotonaldehyde to crotyl alcohol,

wherein said biosynthetic pathway further comprises:

(i) converting acetyl-CoA to crotonyl-CoA using an acetyl-CoA:acetyl-CoA acyltransferase, an acetoacetyl-CoA reductase and a 3-hydroxybutyryl-CoA dehydratase;

(ii) converting glutaconyl-CoA to crotonyl-CoA using a glutaconyl-CoA decarboxylase;

(iii) converting glutaryl-CoA to crotonyl-CoA using a glutaryl-CoA dehydrogenase;

(iv) converting 3-aminobutyryl-CoA to crotonyl-CoA using an 3-aminobutyryl-CoA deaminase; or

(v) converting 4-hydroxybutyryl-CoA to crotonyl-CoA using a 4-hydroxybutyryl-CoA dehydratase, and

wherein said microbial organism is a bacteria or a yeast.

18. The non-naturally occurring microbial organism of claim 15, wherein said biosynthetic pathway further comprises converting glutaryl-CoA to crotonyl-CoA using a glutaryl-CoA dehydrogenase.

19. The non-naturally occurring microbial organism of claim 15, wherein said biosynthetic pathway further comprises converting 3-aminobutyryl-CoA to crotonyl-CoA using an 3-aminobutyryl-CoA deaminase.

20. The non-naturally occurring microbial organism of claim 15, wherein said biosynthetic pathway further comprises converting 4-hydroxybutyryl-CoA to crotonyl-CoA using a 4-hydroxybutyryl-CoA dehydratase.

21. The non-naturally occurring microbial organism of claim 1, wherein said microbial organism further comprises a biosynthetic pathway for converting crotyl alcohol to butadiene using metabolic pathway enzymes, wherein said metabolic pathway enzymes are a crotyl alcohol kinase, a 2-butenyl-4-phosphate kinase and a butadiene synthase.

22. The non-naturally occurring microbial organism of claim 1, wherein said microbial organism further comprises a biosynthetic pathway for converting crotyl alcohol to butadiene using metabolic pathway enzymes, wherein said metabolic pathway enzymes are a butadiene synthase and a crotyl alcohol diphosphokinase.

23. The non-naturally occurring microbial organism of claim 1, wherein said at least one exogenous nucleic acid is a heterologous nucleic acid.

24. The non-naturally occurring microbial organism of claim 1, wherein said non-naturally occurring microbial organism is in a substantially anaerobic culture medium.

25. The non-naturally occurring microbial organism of claim 1, wherein said microbial organism is a bacteria.

26. The non-naturally occurring microbial organism of claim 25, wherein said bacteria is *Escherichia coli*.

27. The non-naturally occurring microbial organism of claim 1, wherein said microbial organism is a yeast.

28. The non-naturally occurring microbial organism of claim 27, wherein said yeast is *Saccharomyces cerevisiae*.

29. A method for producing crotyl alcohol comprising culturing the non-naturally occurring microbial organism of claim 1 under conditions and for a sufficient period of time to produce crotyl alcohol.

30. The method of claim 29, wherein said non-naturally occurring microbial organism is in a substantially anaerobic culture medium.