**WHAT IS CLAIMED**:

1. A genetically modified host cell capable of producing an isoprenoid, the cell comprising:

(a) one or more heterologous nucleic acids encoding one or more enzymes of a mevalonate (MEV) pathway for making isopentenyl pyrophosphate; and

(b) a heterologous nucleic acid encoding an acylating acetylaldehyde dehydrogenase (ADA).

2. The genetically modified host cell of claim 1, wherein the one or more enzymes of the MEV pathway comprise an enzyme that condenses acetyl-CoA with malonyl-CoA to form acetoacetyl-CoA.

3. The genetically modified host cell of claim 1 or claim 2, wherein the one or more enzymes of the MEV pathway comprise an acetyl-CoA:malonyl-CoA acyltransferase.

4. The genetically modified host cell of any one of claims 1 to 3, wherein the one or more enzymes of the MEV pathway comprise an NADH-using enzyme that converts 3-hydroxy-3-methylglutaryl-CoA (HMG-CoA) to mevalonate.

5. The genetically modified host cell of any one of claims 1 to 4, wherein the one or more enzymes of the MEV pathway comprise an NADH-using HMG-CoA reductase.

6. The genetically modified host cell of any one of claims 1 to 5, further comprising a heterologous nucleic acid encoding a phosphoketolase (PK).

7. The genetically modified host cell of any one of claims 1 to 6, further comprising a heterologous nucleic acid encoding a phosphotransacetylase (PTA).

8. The genetically modified host cell of any one of claims 1 to 7, further comprising a functional disruption of one or more enzymes of the native pyruvate dehydrogenase (PDH) -bypass.

9. The genetically modified host cell of claim 8, wherein the one or more enzymes of the PDH-bypass are selected from acetyl-CoA synthase 1 (ACS1), acetyl-CoA synthase 2 (ACS2), and aldehyde dehydrogenase 6 (ALD6).

10. The genetically modified host cell of claim 9, wherein ACS1 is functionally disrupted.

11. The genetically modified host cell of claim 9, wherein ACS2 is functionally disrupted.

12. The genetically modified host cell of claim 9, wherein ALD6 is functionally disrupted.

13. The genetically modified host cell of claim 9, wherein ACS1 and ACS2 are functionally disrupted.

14. The genetically modified host cell of claim 9, wherein ACS1, ACS2 and ALD6 are functionally disrupted.

15. The genetically modified host cell of any one of claims 1 to 14, further comprising a functional disruption of one or more enzymes having alcohol dehydrogenase (ADH) activity.

16. The genetically modified host cell of claim 15, wherein the one or more enzymes having ADH activity are selected from alcohol dehydrogenase 1 (ADH1), alcohol dehydrogenase 3 (ADH3), alcohol dehydrogenase 4 (ADH4), and alcohol dehydrogenase 5 (ADH5).

17. The genetically modified host cell of any one of claims 1 to 16, wherein the amino acid sequence of the ADA is at least 80% identical to SEQ ID NO:2.

18. The genetically modified host cell of claim 3, wherein the amino acid sequence of the acetyl-CoA:malonyl-CoA acyltransferase is at least 80% identical to SEQ ID NO:16.

19. The genetically modified host cell of claim 5, wherein the amino acid sequence of the NADH-using HMG-CoA reductase is at least 80% identical to SEQ ID NO:20.

20. The genetically modified host cell of claim 6, wherein the amino acid sequence of the phosphoketolase (PK) is at least 80% identical to SEQ ID NO:12.

21. The genetically modified host cell of claim 7, wherein the amino acid sequence of the phosphotransacetylase (PTA) is at least 80% identical to SEQ ID NO:14.

22. The genetically modified host cell of any one of claims 1, 4 to 17, and 19 to 21, wherein the one or more enzymes of the MEV pathway comprise an enzyme that condenses two molecules of acetyl-CoA to form acetoacetyl-CoA.

23. The genetically modified host cell of any one of claims 1 to 22, wherein the one or more enzymes of the MEV pathway comprise an enzyme that condenses acetoacetyl-CoA with acetyl-CoA to form HMG-CoA.

24. The genetically modified host cell of any one of claims 1 to 3, 6 to 18, and 20 to 22, wherein the one or more enzymes of the MEV pathway comprise an enzyme that converts HMG-CoA to mevalonate.

25. The genetically modified host cell of any one of claims 1 to 24, wherein the one or more enzymes of the MEV pathway comprise an enzyme that phosphorylates mevalonate to mevalonate 5-phosphate.

26. The genetically modified host cell of any one of claims 1 to 25, wherein the one or more enzymes of the MEV pathway comprise an enzyme that converts mevalonate 5-phosphate to mevalonate 5-pyrophosphate.

27. The genetically modified host cell of any one of claims 1 to 26, wherein the one or more enzymes of the MEV pathway comprise an enzyme that converts mevalonate 5-pyrophosphate to isopentenyl pyrophosphate.

28. The genetically modified host cell of any one of claims 1 to 27, wherein the one or more enzymes of the MEV pathway are selected from HMG-CoA synthase, mevalonate kinase, phosphomevalonate kinase and mevalonate pyrophosphate decarboxylase.

29. The genetically modified host cell of any one of claims 1 to 28, wherein the host cell comprises a plurality of heterologous nucleic acids encoding all of the enzymes of the MEV pathway.

30. The genetically modified host cell of any one of claims 1 to 29, wherein the one or more heterologous nucleic acids encoding one or more enzymes of the MEV pathway are under control of a single transcriptional regulator.

31. The genetically modified host cell of any one of claims 1 to 29, wherein the one or more heterologous nucleic acids encoding one or more enzymes of the MEV pathway are under control of multiple heterologous transcriptional regulators.

32. The genetically modified host cell of any one of claims 1 to 31, further comprising a heterologous nucleic acid encoding an enzyme that can convert isopentenyl pyrophosphate (IPP) into dimethylallyl pyrophosphate (DMAPP).

33. The genetically modified host cell of any one of claims 1 to 32, further comprising a heterologous nucleic acid encoding an enzyme that can condense IPP and/or DMAPP molecules to form a polyprenyl compound.

34. The genetically modified host cell of any one of claims 1 to 33, further comprising a heterologous nucleic acid encoding an enzyme that can modify IPP or a polyprenyl to form an isoprenoid compound.

35. The genetically modified host cell of claim 34, wherein the enzyme that can modify IPP or a polyprenyl to form an isoprenoid compound is selected from the group consisting of carene synthase, geraniol synthase, linalool synthase, limonene synthase, myrcene synthase, ocimene synthase, α-pinene synthase, β-pinene synthase, γ-terpinene synthase, terpinolene synthase, amorphadiene synthase, α-farnesene synthase, β-farnesene

synthase, farnesol synthase, nerolidol synthase, patchouliol synthase, nootkatone synthase, and abietadiene synthase.

36. The genetically modified host cell of claim 34, wherein the isoprenoid is selected from the group consisting of a hemiterpene, monoterpene, diterpene, triterpene, tetraterpene, sesquiterpene, and polyterpene.

37. The genetically modified host cell of claim 34, wherein the isoprenoid is a sesquiterpene.

38. The genetically modified host cell of claim 34, wherein the isoprenoid is a $C_5$-$C_{20}$ isoprenoid.

39. The genetically modified host cell of claim 34, wherein the isoprenoid is selected from the group consisting of abietadiene, amorphadiene, carene, α-farnesene, β-farnesene, farnesol, geraniol, geranylgeraniol, isoprene, linalool, limonene, myrcene, nerolidol, ocimene, patchoulol, β-pinene, sabinene, γ-terpinene, terpinolene, and valencene.

40. The genetically modified host cell of any one of claims 1 to 39, wherein the cell is a yeast cell.

41. The genetically modified host cell of claim 40, wherein the yeast cell belongs to the genera selected from the group consisting *of Aciculoconidium, Ambrosiozyma, Arthroascus, Arxiozyma, Ashbya, Babjevia, Bensingtonia, Botryoascus, Botryozyma, Brettanomyces, Bullera, Bulleromyces, Candida, Citeromyces, Clavispora, Cryptococcus, Cystofilobasidium, Debaryomyces, Dekkara, Dipodascopsis, Dipodascus, Eeniella, Endomycopsella, Eremascus, Eremothecium, Erythrobasidium, Fellomyces, Filobasidium, Galactomyces, Geotrichum, Guilliermondella, Hanseniaspora, Hansenula, Hasegawaea, Holtermannia, Hormoascus, Hyphopichia, Issatchenkia, Kloeckera, Kloeckeraspora, Kluyveromyces, Kondoa, Kuraishia, Kurtzmanomyces, Leucosporidium, Lipomyces, Lodderomyces, Malassezia, Metschnikowia, Mrakia, Myxozyma, Nadsonia, Nakazawaea, Nematospora, Ogataea, Oosporidium, Pachysolen, Phachytichospora, Phaffia, Pichia, Rhodosporidium, Rhodotorula, Saccharomyces, Saccharomycodes, Saccharomycopsis, Saitoella, Sakaguchia, Saturnospora, Schizoblastosporion, Schizosaccharomyces, Schwanniomyces, Sporidiobolus, Sporobolomyces, Sporopachydermia, Stephanoascus,*

*Sterigmatomyces, Sterigmatosporidium, Symbiotaphrina, Sympodiomyces, Sympodiomycopsis, Torulaspora, Trichosporiella, Trichosporon, Trigonopsis, Tsuchiyaea, Udeniomyces, Waltomyces, Wickerhamia, Wickerhamiella, Williopsis, Yamadazyma, Yarrowia, Zygoascus, Zygosaccharomyces, Zygowilliopsis,* and *Zygozyma*.

42. The genetically modified host cell of claim 40, wherein the yeast is selected from the group consisting of *Saccharomyces cerevisiae, Pichia pastoris, Schizosaccharomyces pombe, Dekkera bruxellensis, Kluyveromyces lactis* (previously called *Saccharomyces lactis*), *Kluveromyces marxianus, Arxula adeninivorans,* and *Hansenula polymorpha* (now known as *Pichia angusta)*.

43. The genetically modified host cell of claim 40, wherein the yeast is selected from the group consisting of *Candida lipolytica, Candida guilliermondii, Candida krusei, Candida pseudotropicalis*, and *Candida utilis*.

44. The genetically modified host cell of claim 40, wherein the yeast is *Saccharomyces cerevisiae*.

45. The genetically modified host cell of claim 44, wherein the yeast is a strain of *Saccharomyces cerevisiae* selected from the group consisting of Baker's yeast, CBS 7959, CBS 7960, CBS 7961, CBS 7962, CBS 7963, CBS 7964, IZ-1904, TA, BG-1, CR-1, SA-1, M-26, Y-904, PE-2, PE-5, VR-1, BR-1, BR-2, ME-2, VR-2, MA-3, MA-4, CAT-1, CB-1, NR-1, BT-1, and AL-1.

46. A genetically modified host cell capable of producing an isoprenoid, the cell comprising:

(a) one or more heterologous nucleic acids encoding one or more enzymes of a mevalonate (MEV) pathway for making isopentenyl pyrophosphate;

(b) a heterologous nucleic acid encoding an acetylaldehyde dehydrogenase, acetylating (ADA);

(c) a functional disruption of at least one enzyme of the native PDH-bypass selected from the group consisting of acetyl-CoA synthase 1 (ACS1), acetyl-CoA synthase 2 (ACS2), and aldehyde dehydrogenase 6 (ALD6)

(d) a heterologous nucleic acid encoding a phosphoketolase (PK); and

(e) a heterologous nucleic acid encoding a phosphoketolase (PTA).

47. A genetically modified host cell capable of producing an isoprenoid, the cell comprising:

(a) one or more heterologous nucleic acids encoding one or more enzymes of a mevalonate (MEV) pathway for making isopentenyl pyrophosphate, wherein the one or more enzymes comprise a NADH-using HMG-CoA reductase;

(b) a heterologous nucleic acid encoding an acetylaldehyde dehydrogenase, acetylating (ADA); and

(c) a functional disruption of at least one enzyme of the native PDH-bypass selected from the group consisting of acetyl-CoA synthase 1 (ACS1), acetyl-CoA synthase 2 (ACS2), and aldehyde dehydrogenase 6 (ALD6).

48. A genetically modified host cell capable of producing an isoprenoid, the cell comprising:

(a) one or more heterologous nucleic acids encoding one or more enzymes of a mevalonate (MEV) pathway for making isopentenyl pyrophosphate, wherein the one or more enzymes comprise a NADH-using HMG-CoA reductase;

(b) a heterologous nucleic acid encoding an acetylaldehyde dehydrogenase, acetylating (ADA);

(c) a functional disruption of at least one enzyme of the native PDH-bypass selected from the group consisting of acetyl-CoA synthase 1 (ACS1), acetyl-CoA synthase 2 (ACS2), and aldehyde dehydrogenase 6 (ALD6);

(d) a heterologous nucleic acid encoding a phosphoketolase (PK); and

(e) a heterologous nucleic acid encoding a phosphoketolase (PTA).

49. A genetically modified host cell capable of producing an isoprenoid, the cell comprising:

(a) one or more heterologous nucleic acids encoding one or more enzymes of a mevalonate (MEV) pathway for making isopentenyl pyrophosphate, wherein the one or more enzymes comprise an acetyl-CoA:malonyl-CoA acyltransferase;

(b) a heterologous nucleic acid encoding acetylaldehyde dehydrogenase, acetylating (ADA); and

(c) a functional disruption of at least one enzyme of the native PDH-bypass selected from the group consisting of acetyl-CoA synthase 1 (ACS1), acetyl-CoA synthase 2 (ACS2), and aldehyde dehydrogenase 6 (ALD6).

50. A genetically modified host cell capable of producing an isoprenoid, the cell comprising:

(a) one or more heterologous nucleic acids encoding a plurality of enzymes of a mevalonate (MEV) pathway for making isopentenyl pyrophosphate, wherein the plurality of enzymes comprise an acetyl-CoA:malonyl-CoA acyltransferase and an NADH-using HMG-CoA reductase;

(b) a heterologous nucleic acid encoding an acetylaldehyde dehydrogenase, acetylating (ADA);

(c) a functional disruption of at least one enzyme of the native PDH-bypass selected from the group consisting of acetyl-CoA synthase 1 (ACS1), acetyl-CoA synthase 2 (ACS2), and aldehyde dehydrogenase 6 (ALD6);

(d) a heterologous nucleic acid encoding a phosphoketolase (PK); and

(e) a heterologous nucleic acid encoding a phosphoketolase (PTA).

51. A method for producing an isoprenoid comprising:

(a) culturing a population of the genetically modified yeast cells of any one of claims 1 to 50 in a medium with a carbon source under conditions suitable for making said isoprenoid compound; and

(b) recovering said isoprenoid compound from the medium.

52. The method of claim 51, wherein the isoprenoid compound is produced in an amount greater than about 10 grams per liter of medium.

53. The method of claim 51, wherein the isoprenoid compound is produced in an amount greater than about 50 mg per gram of dry cell weight.

54. The method of any one of claims 51 to 53, wherein the host cell produces an increased amount of an isoprenoid compound compared to the same host cell not comprising a heterologous nucleotide sequence encoding said ADA.

55. The method of claim 54, wherein said increased amount is at least 10%.

**WHAT IS CLAIMED:**

1. A genetically modified host cell capable of producing an isoprenoid, the cell comprising:

(a) one or more heterologous nucleic acids encoding one or more enzymes of a mevalonate (MEV) pathway for making isopentenyl pyrophosphate; and

(b) a heterologous nucleic acid encoding an acylating acetylaldehyde dehydrogenase (ADA).

2. The genetically modified host cell of claim 1, wherein the one or more enzymes of the MEV pathway comprise an enzyme that condenses acetyl-CoA with malonyl-CoA to form acetoacetyl-CoA.

3. The genetically modified host cell of claim 1 or claim 2, wherein the one or more enzymes of the MEV pathway comprise an acetyl-CoA:malonyl-CoA acyltransferase.

4. The genetically modified host cell of any one of claims 1 to 3, wherein the one or more enzymes of the MEV pathway comprise an NADH-using enzyme that converts 3-hydroxy-3-methylglutaryl-CoA (HMG-CoA) to mevalonate.

5. The genetically modified host cell of any one of claims 1 to 4, wherein the one or more enzymes of the MEV pathway comprise an NADH-using HMG-CoA reductase.

6. The genetically modified host cell of any one of claims 1 to 5, further comprising a heterologous nucleic acid encoding a phosphoketolase (PK).

7. The genetically modified host cell of any one of claims 1 to 6, further comprising a heterologous nucleic acid encoding a phosphotransacetylase (PTA).

8. The genetically modified host cell of any one of claims 1 to 7, further comprising a functional disruption of one or more enzymes of the native pyruvate dehydrogenase (PDH) -bypass.

9. The genetically modified host cell of claim 8, wherein the one or more enzymes of the PDH-bypass are selected from acetyl-CoA synthase 1 (ACS1), acetyl-CoA synthase 2 (ACS2), and aldehyde dehydrogenase 6 (ALD6).

10. The genetically modified host cell of claim 9, wherein ACS1 is functionally disrupted.

11. The genetically modified host cell of claim 9, wherein ACS2 is functionally disrupted.

12. The genetically modified host cell of claim 9, wherein ALD6 is functionally disrupted.

13. The genetically modified host cell of claim 9, wherein ACS1 and ACS2 are functionally disrupted.

14. The genetically modified host cell of claim 9, wherein ACS1, ACS2 and ALD6 are functionally disrupted.

15. The genetically modified host cell of any one of claims 1 to 14, further comprising a functional disruption of one or more enzymes having alcohol dehydrogenase (ADH) activity.

16. The genetically modified host cell of claim 15, wherein the one or more enzymes having ADH activity are selected from alcohol dehydrogenase 1 (ADH1), alcohol dehydrogenase 3 (ADH3), alcohol dehydrogenase 4 (ADH4), and alcohol dehydrogenase 5 (ADH5).

17. The genetically modified host cell of any one of claims 1 and 4 to 16, wherein the one or more enzymes of the MEV pathway comprise an enzyme that condenses two molecules of acetyl-CoA to form acetoacetyl-CoA.

18. The genetically modified host cell of any one of claims 1 to 17, wherein the one or more enzymes of the MEV pathway comprise an enzyme that condenses acetoacetyl-CoA with acetyl-CoA to form HMG-CoA.

19. The genetically modified host cell of any one of claims 1 to 3 and 6 to 17, wherein the one or more enzymes of the MEV pathway comprise an enzyme that converts HMG-CoA to mevalonate.

20. The genetically modified host cell of any one of claims 1 to 19, wherein the one or more enzymes of the MEV pathway comprise an enzyme that phosphorylates mevalonate to mevalonate 5-phosphate.

21. The genetically modified host cell of any one of claims 1 to 20, wherein the one or more enzymes of the MEV pathway comprise an enzyme that converts mevalonate 5-phosphate to mevalonate 5-pyrophosphate.

22. The genetically modified host cell of any one of claims 1 to 21, wherein the one or more enzymes of the MEV pathway comprise an enzyme that converts mevalonate 5-pyrophosphate to isopentenyl pyrophosphate.

23. The genetically modified host cell of any one of claims 1 to 22, wherein the one or more enzymes of the MEV pathway are selected from HMG-CoA synthase, mevalonate kinase, phosphomevalonate kinase and mevalonate pyrophosphate decarboxylase.

24. The genetically modified host cell of any one of claims 1 to 23, wherein the host cell comprises a plurality of heterologous nucleic acids encoding all of the enzymes of the MEV pathway.

25. The genetically modified host cell of any one of claims 1 to 24, wherein the one or more heterologous nucleic acids encoding one or more enzymes of the MEV pathway are under control of a single transcriptional regulator.

26. The genetically modified host cell of any one of claims 1 to 24, wherein the one or more heterologous nucleic acids encoding one or more enzymes of the MEV pathway are under control of multiple heterologous transcriptional regulators.

27. The genetically modified host cell of any one of claims 1 to 26, further comprising a heterologous nucleic acid encoding an enzyme that can convert isopentenyl pyrophosphate (IPP) into dimethylallyl pyrophosphate (DMAPP).

28. The genetically modified host cell of any one of claims 1 to 27, further comprising a heterologous nucleic acid encoding an enzyme that can condense IPP and/or DMAPP molecules to form a polyprenyl compound.

29. The genetically modified host cell of any one of claims 1 to 28, further comprising a heterologous nucleic acid encoding an enzyme that can modify IPP or a polyprenyl to form an isoprenoid compound.

The genetically modified host cell of claim 29, wherein the enzyme that can modify IPP or a polyprenyl to form an isoprenoid compound is selected from the group consisting of carene synthase, geraniol synthase, linalool synthase, limonene synthase, myrcene synthase, ocimene synthase, α-pinene synthase, β-pinene synthase, γ-terpinene synthase, terpinolene synthase, amorphadiene synthase, α-farnesene synthase, β-farnesene synthase, farnesol synthase, nerolidol synthase, patchouliol synthase, nootkatone synthase, and abietadiene synthase.

30. The genetically modified host cell of claim 29, wherein the isoprenoid is selected from the group consisting of a hemiterpene, monoterpene, diterpene, triterpene, tetraterpene, sesquiterpene, and polyterpene.

31. The genetically modified host cell of claim 29, wherein the isoprenoid is a sesquiterpene.

32. The genetically modified host cell of claim 29, wherein the isoprenoid is a $C_5$-$C_{20}$ isoprenoid.

33. The genetically modified host cell of claim 29, wherein the isoprenoid is selected from the group consisting of abietadiene, amorphadiene, carene, α-farnesene, β-farnesene, farnesol, geraniol, geranylgeraniol, isoprene, linalool, limonene, myrcene, nerolidol, ocimene, patchoulol, β-pinene, sabinene, γ-terpinene, terpinolene, and valencene.

34. The genetically modified host cell of any one of claims 1 to 34, wherein the cell is a yeast cell.

35. A method for producing an isoprenoid comprising:

(a) culturing a population of the genetically modified host cell of any one of claims 1 to 35 in a medium with a carbon source under conditions suitable for making said isoprenoid compound; and

(b) recovering said isoprenoid compound from the medium.