WHAT IS CLAIMED:

1. A method for producing a recombinant sialylated glycoprotein in a host cell, the host cell selected or engineered to produce glycoproteins comprising a $Gal_{(1-4)}GlcNAc_{(1-4)}Man_3GlcNAc_2$ glycoform, the method comprising the step of introducing into the host cell a nucleic acid encoding an enzyme having sialyltransferase activity, the enzyme comprising a sialyltransferase catalytic domain and a cellular targeting signal peptide to target the sialyltransferase catalytic domain to the secretory pathway of the host cell; wherein, upon passage of the recombinant glycoprotein through the secretory pathway of the host cell, a recombinant glycoprotein comprising a $NANA_{(1-4)}Gal_{(1-4)}GlcNAc_{(1-4)}Man_3GlcNA_2$ glycoform is produced.

2. The method of claim 1, wherein the cellular targeting signal peptide targets the sialyltransferase catalytic domain to a location in the secretory pathway selected from the group consisting of the endoplasmic reticulum, the Golgi apparatus, the trans-Golgi network and secretory vesicles.

3. The method of claim 1, wherein the method further comprises the step of introducing into the host cell a nucleic acid encoding one or more enzymes involved in the biosynthesis or transport of CMP-Sia.

4. A method for producing a recombinant sialylated glycoprotein in a host cell, the host cell selected or engineered to produce glycoproteins comprising a $Gal_{(1-4)}GlcNAc_{(1-4)}Man_3GlcNAc_2$ glycoform, the method comprising the step of introducing into the host cell:

(a) a nucleic acid encoding an enzyme having sialyltransferase activity; and

(b) a nucleic acid encoding one or more enzymes involved in the biosynthesis or transport of CMP-Sia;

wherein upon passage of the recombinant glycoprotein through the secretory pathway of the host cell, a recombinant glycoprotein comprising a $NANA_{(1-4)}Gal_{(1-4)}GlcNAc_{(1-4)}Man_3GlcNA_2$ glycoform is produced.

5. The method of claim 4, wherein the enzyme having sialyltransferase activity comprises a sialyltransferase catalytic domain and a cellular targeting signal peptide to target the sialyltransferase catalytic domain to the secretory pathway of the host cell.

6. A method for producing a recombinant sialylated glycoprotein in a eukaryotic host cell comprising introducing into the host cell a nucleic acid encoding a trans-sialidase enzyme.

7. The method of claim 6, wherein said nucleic acid encodes a fusion protein comprising a trans-sialidase catalytic domain with a cellular targeting signal peptide to target the trans-sialidase catalytic domain to the secretory pathway, the cell wall or the cell membrane of the host cell.

8. The method of claim 6, wherein said method further comprises the step of introducing into the host cell one or more nucleic acids encoding one or more enzymes involved in the biosynthesis or transport of CMP-Sialic acid.

9. The method of claim 6, wherein said host cell produces a glycoprotein comprising a terminal galactose.

10. A method for producing a recombinant sialylated glycoprotein in a host cell, the host cell selected or engineered to produce glycoproteins comprising a $GalGlcNAcMan_5GlcNAc_2$ glycoform, the method comprising the step of introducing into the host cell a nucleic acid encoding an enzyme having sialyltransferase activity, the enzyme comprising a sialyltransferase catalytic domain and a cellular targeting signal peptide to target the sialyltransferase catalytic domain to the secretory pathway of the host cell; wherein, upon passage of the recombinant glycoprotein through the secretory pathway of the host cell, a recombinant glycoprotein comprising a $NANAGalGlcNAcMan_5GlcNA_2$ glycoform is produced.

11. A method for producing a recombinant sialylated glycoprotein in a host cell, the host cell selected or engineered to produce glycoproteins comprising a $GalGlcNAcMan_5GlcNAc_2$ glycoform, the method comprising the step of introducing into the host cell:

(a) a nucleic acid encoding an enzyme having sialyltransferase activity; and

(b) a nucleic acid encoding one or more enzymes involved in the biosynthesis or transport of CMP-Sia;

wherein upon passage of the recombinant glycoprotein through the Golgi apparatus of the host cell, a recombinant glycoprotein comprising a $NANAGalGlcNAcMan_5GlcNA_2$ glycoform is produced.

12. The method of claim 1, 4, 10 or 11, wherein said host cell comprises a cellular pool of CMP-sialic acid.

13. The method of claim 3, 4 or 11, wherein the one or more enzymes involved in the biosynthesis of CMP-Sia are mammalian enzymes selected from the group consisting of: UDP-N-acetylglucosamine-2-epimerase/N-acetylmannosamine kinase, N-acetylneuraminate-9-phosphate synthase, N-acetylneuraminate-9-phosphatase, and CMP-sialic acid synthase.

14. The method of claim 3, 4 or 11, wherein the one or more enzymes involved in the biosynthesis of CMP-Sia are bacterial enzymes selected from the group consisting of: UDP-GlcNAc epimerase, sialate synthase and CMP-Sia synthase.

15. The method of claim 3, 4 or 11, wherein the one or more enzymes involved in the biosynthesis of CMP-Sia are selected from the group consisting of: bacterial *NeuC,* bacterial *NeuB* and mammalian CMP-Sia synthase.

16. The method of claim 1, 4, 10 or 11, wherein the method further comprises culturing said host cell in the presence of a sialic acid donor or a precursor of a sialic acid donor.

17. The method of claim 1, 4, 10 or 11, wherein said method further comprises the step of introducing into the host cell one or more additional nucleic acids encoding one or more enzymes selected from the group consisting of glycosyltransferases, glycosidases and sugar transporters.

18. The method of claim 1, 4, 10 or 11, wherein said method further comprises the step of introducing into the host cell one or more additional nucleic acids encoding a CMP-sialic acid transporter.

19. The method of claim 1, 4, 10 or 11, wherein said host cell lacks endogenous sialyltransferase activity.

20. The method of claim 19, wherein said host cell is selected from the group consisting of: a lower eukaryotic host cell, an insect cell or a plant cell.

21. The method of claim 1, 4, 10 or 11, wherein said host cell is selected from the group consisting of any *Pichia sp.,* any *Saccharomyces sp., Hansenula polymorpha,* any *Kluyveromyces sp., Candida albicans,* any *Aspergillus sp., Trichoderma reesei, Chrysosporium lucknowense,* any *Fusarium sp.* and *Neurospora crassa.*

22. A glycoprotein composition comprising recombinant glycoprotein produced by the method of any one of claims 1, 4, 10 or 11.

23. The glycoprotein composition of claim 22, wherein said recombinant glycoprotein comprises a $NANA_{(1-4)}Gal_{(1-4)}GlcNAc_{(1-4)}Man_3GlcNAc_2$ glycoform.

24. The glycoprotein composition of claim 22, wherein said recombinant glycoprotein comprises a $NANAGalGlcNAcMan_5GlcNAc_2$ glycoform.

25. A nucleic acid encoding an enzyme comprising a sialyltransferase catalytic domain operatively linked to a cellular targeting signal peptide to target the sialyltransferase catalytic domain to the Golgi apparatus of the host cell.

26. A nucleic acid encoding a fusion protein comprising a trans-sialidase catalytic domain and a cellular targeting signal peptide to target the trans-sialidase catalytic domain to the secretory pathway, cell wall or cell membrane of the host cell.

27. A host cell comprising the nucleic acid of claim 25 or 26.

28. The host cell of claim 27, wherein said host cell further produces CMP-sialic acid.

29. The host cell of claim 27, wherein said host cell is capable of producing a recombinant glycoprotein comprising a $NANA_{(1-4)}Gal_{(1-4)}GlcNAc_{(1-4)}Man_3GlcNAc_2$ glycoform.

30. The host cell of claim 27, wherein said host cell is capable of producing a recombinant glycoprotein comprising a $NANAGalGlcNAcMan_5GlcNAc_2$ glycoform.

31. A method for producing a sialylated glycoprotein in a recombinant non-human eukaryotic host cell comprising introducing into medium used for growing the host a trans-sialidase enzyme and a sialic acid donor.

32. A method of enhancing the production of CMP-sialic acid in a host cell comprising the step of introducing into the host cell a nucleic acid encoding an enzyme having GlcNAc epimerase activity.

33. A method of enhancing the production of CMP-sialic acid in a host cell comprising the step of introducing into the host cell a nucleic acid encoding an enzyme having sialate aldolase activity.

34. The method of claim 10, wherein the method further comprises the step of introducing into the host cell a nucleic acid encoding one or more enzymes involved in the biosynthesis or transport of CMP-Sia.