another example, the polynucleotide sequence encodes an amino acid sequence of SEQ ID NO:4 or an equivalent thereof.

[0005a] In one aspect, provided here in a recombinant AAV vector comprising a polynucleotide encoding a polypeptide having an amino acid sequence with at least 85% identity to SEQ ID NO:4 and having GALT activity, or a complement thereof, wherein said polynucleotide has a nucleotide sequence at least 85% identical to the nucleotide sequence of SEQ ID NO: 1 or wild-type hGALT sequence of FIG. 4, and wherein the polynucleotide is operably linked to a promoter and is flanked by inverted terminal repeat ("ITR") sequences.

[0006] In one example, the vector is a self-complementary vector or a single stranded DNA (ssDNA) vector.

[0007] In one example, the recombinant adeno-associated viral ("AAV") comprises, or consists essentially of, or yet furher consists of, a AAV, such as a scAAV or a ssAAV flanked by two Inverted Terminal Repeats (ITRs). These ITRs form hairpins at the end of the sequence to serve as primers to initiate synthesis of the second strand before subsequent steps of infection can begin. The second strand synthesis is considered to be one of several blocks to efficient infection. Additional advantages of scAAV include increased and prolonged transgene expression in vitro and in vivo. Thus, in one example, the AAV further comprises two ITRs.

[0008] Non-limiting examples of recombinant AAV backbones to create the vector include AAV vector serotypes from the group of AAV1, AAV2, AAV4, AAV5, AAV6, AAV7, AAV8, AAV9, AAV10, AAV11, AAV12, AAV13, AAV PHP.B, or AAV rh74. In a further example, the vector backbone is an AAV9 serotype, an rh74 serotype, or a modified AAVrh74 serotype. Also provided is a polynucleotide encoding a modified AAVrh74 VP1 capsid protein comprising one or more modifications selected from the group of a substitution of isoleucine for asparagine at amino acid position 502, and an optional substitution of tryptophan to arginine at amino acid 505 of the VP1 of AAVrh74, and an insertion of the peptide YIG or YIGSR at amino acid position 591 of the VP1 of AAVrh74, or an equivalent thereof, or a polynucleotide that is at least 85% identical with the proviso that one or more, or two or more, or three or more, or four or more modifications are identical to the amino acids in the modifice AAVrh74 VP1 capsid protein and the complements of these polynucleotides. Also provided is modified AAVrh74 VP1 capsid protein comprising one or more modifications selected from the group of a substitution of isoleucine for

What Is Claimed Is:

1. A recombinant AAV vector comprising a polynucleotide encoding a polypeptide having an amino acid sequence with at least 85% identity to SEQ ID NO:4 and having GALT activity, or a complement thereof, wherein said polynucleotide has a nucleotide sequence at least 85% identical to the nucleotide sequence of SEQ ID NO: 1 or wild-type hGALT sequence of FIG. 4, and wherein the polynucleotide is operably linked to a promoter and is flanked by inverted terminal repeat ("ITR") sequences.

2. The recombinant AAV vector of claim 1, wherein the polynucleotide comprises the nucleotide sequence set forth in SEQ ID NO: 1.

3. The recombinant AAV vector of claim 1, wherein the polynucleotide comprises the nucleotide sequence of the wild-type hGALT sequence of FIG. 4.

4. The recombinant AAV vector of any one of claims 1 to 3, wherein the ITR sequences comprise an AAV2 ITR.

5. The recombinant AAV vector of any one of claims 1 to 4, wherein one ITR sequence is a self-complementary AAV ("scAAV") ITR sequence.

6. The recombinant AAV vector of any one of claims 1 to 5, wherein the promoter comprises a Rous sarcoma virus ("RSV") LTR promoter (optionally with the RSV enhancer), a cytomegalovirus ("CMV") promoter, a simian vacuolating virus 40 ("SV40") promoter, a dihydrofolate reductase promoter, a β-actin promoter, a phosphoglycerol kinase ("PGK") promoter, a U6 promoter, a chicken β-actin ("CBA"), promoter, a CMV early enhancer/chicken β-actin/rabbit β-globin splice acceptor ("CAG") promoter or an elongation factor 1 ("EF1") promoter.

7. The recombinant AAV vector of any of claims 1 to 6, wherein the polynucleotide encodes a polypeptide having an amino acid sequence of SEQ ID NO: 4.

8. The recombinant AAV vector of claim 1, which comprises the nucleotide sequence set forth in SEQ ID NO: 2 or SEQ ID NO:3.

9. A recombinant AAV viral particle comprising the recombinant AAV vector of any one of claims 1 to 8 and an AAV capsid protein.

10. The recombinant AAV viral particle of claim 9, wherein the capsid protein is an AAV1 capsid protein, an AAV2 capsid protein, an AAV3 capsid protein, an AAV4 capsid protein, an AAV5 capsid protein, an AAV6 capsid protein, an AAV7 capsid protein, an AAV8 capsid protein, an AAV9 capsid protein, an AAV10 capsid protein, an AAV11 capsid protein, an AAV12 capsid protein, an AAV13 capsid protein, or an rh74 capsid protein.

11. A composition comprising the recombinant AAV viral particle of any one of claims 9 or 10, and a pharmaceutically acceptable carrier.

12. A method for introducing a functional GALT enzyme into a cell, the method comprising contacting the cell with the recombinant AAV vector of any one of claims 1 to 8, or the recombinant AAV viral particle of claims 9 or 10.

13. Use of a therapeutically effective amount of the recombinant AAV viral particle of claims 9 or 10 in the manufacture of a medical for treating galactosemia in a mammalian subject in need thereof, wherein the medicament is to be administered to the subject.

14. Use of an amount of the recombinant AAV viral particle of claims 9 or 10 effective to increase galactose metabolism in the manufacture of a medicament for increasing galactose metabolism in a mammalian subject suffering from galactosemia, wherein the medicament is to be administered to the subject.

15. Use of a therapeutically effective amount of the recombinant AAV viral particle of claims 9 or 10 in the manufacture of a medicament for reducing a disease condition in a mammalian subject suffering from galactosemia, wherein the disease condition is one or more of jaundice, hepatosplenomegaly, hepatocellular insufficiency, hypoglycemia, renal tubular dysfunction, muscle hypotonia, sepsis, cataract, ataxia, tremor, decreased bone density, and primary ovarian insufficiency, wherein the medicament is to be administered to the subject.

16. The use of any one of claims 13 to 15, wherein the galactosemia is a type 1 galactosemia.

17. The use of any of claims 13 to 16, wherein the subject is a human.

18. The use of claim 17, wherein the human is a newborn.

19. The use of claim 18, wherein the newborn lacks expression of a functional GALT gene.

20. The use of any one of claims 13 to 19, wherein the medicament is to be administered by intramuscular injection, localized delivery to the liver, intrathecal injection, or intravenous injection.

21. A cell comprising an AAV helper plasmid, an AAV Ad accessory plasmid and an AAV construct plasmid, the AAV helper plasmid comprising *rep* and *cap*, and the AAV construct plasmid comprising the recombinant AAV vector of any of claims 1 to 8.

22. A method of producing a recombinant AAV viral particle, said method comprising culturing the cell of claim 21 under conditions appropriate for production of the recombinant AAV viral particle.

23. The recombinant AAV viral particle of claims 9 or 10 for use in therapy.