examples in which satisfactory therapeutic effect is obtained. Thus, there is a need for alternative methods of delivering nucleic acid molecules to subjects for gene therapy applications.

SUMMARY

In one aspect, there is provided the use of a composition in the manufacture of a medicament for gene therapy of a disease or condition , wherein:

the composition comprises:

a delivery agent comprising a therapeutic nucleic acid molecule and an agent that facilitates entry of the delivery agent into the parenchymal cells in a compartmentalized tissue or organ or portion of a tissue or organ; and

an agent that facilitates entry of the delivery agent into the parenchymal cells;

the nucleic acid molecule encodes an enzyme, a hormone, a coagulation or clotting factor, a cytokine, a growth factor or active portion thereof, an antibody or antigen binding portion thereof, an angiogenesis modulator, an immunomodulator, a pain modulator, a receptor or active portion thereof, a transport protein or a regulatory protein for treating a disease or condition;

the disease or condition is selected from among arthritis, chronic pain, HIV-related AIDS, atherosclerosis, restenosis, inherited enzyme deficiency, inherited immune deficiency, cancer, a retrovirus infection, hemophilia, a muscular dystrophy, a dystrophy, a cardiovascular disorder, cystic fibrosis, a neurodegenerative disorder, trauma, pain, sickle cell anemia, autoimmune disease, inflammatory disease and hypertension;

the composition is formulated for direct administration into the parenchyma of a compartmentalized tissue, organ, or portion of a tissue or organ sufficient in size to compartmentalize and for administration of the composition;

the parenchyma in the compartmentalized tissue or organ or portion thereof does not include connective tissue, blood vessels, nerves or ducts; and

a compartmentalized tissue or organ or portion of a tissue or organ is a tissue or organ that has been isolated from the systemic circulation, whereby the arteries, veins, ducts and/or vessels servicing or traversing the tissue or organ or portion of the tissue or organ are blocked so that blood supply and flow to the tissue or organ or portion thereof is reduced or eliminated.

In one aspect, there is provided a composition for direct delivery of a therapeutic nucleic acid molecule into parenchyma cells of an organ or tissue for treatment of a disease or condition, comprising:

a delivery agent comprising a nucleic acid molecule that encodes an enzyme, a hormone, a coagulation or clotting factor, a cytokine, a growth factor or active portion thereof, an antibody or antigen binding portion thereof, an angiogenesis modulator, an immunomodulator, a pain modulator, a receptor or active portion thereof, a transport protein or a regulatory protein for treating a disease or condition; and

an agent that facilitates entry of the delivery agent into the parenchymal cells in a compartmentalized tissue or organ or portion of a tissue or organ, wherein:

the composition is formulated for direct administration of the delivery agent comprising the nucleic acid molecule into the parenchyma of a compartmentalized tissue, organ, or portion of a tissue or organ sufficient in size to compartmentalize and for administration of the composition;

a compartmentalized tissue or organ or portion of a tissue or organ is a tissue or organ that has been isolated from the systemic circulation, whereby the arteries, veins, ducts and/or vessels servicing or traversing the tissue or organ or portion of the tissue or organ are blocked so that blood supply and flow to the tissue or organ or portion thereof is reduced or eliminated; and

the disease or condition is selected from among arthritis, chronic pain, HIV-related AIDS, atherosclerosis, restenosis, inherited enzyme deficiency, inherited immune deficiency, cancer, a retrovirus infection, hemophilia, , a muscular dystrophy, a dystrophy, a cardiovascular disorder, cystic fibrosis, a neurodegenerative disorder, trauma, pain, sickle cell anemia, autoimmune disease, inflammatory disease and hypertension.

In one aspect, there is provided a composition, comprising an adenovirus or adeno-associated virus comprising heterologous nucleic acid in its genome, wherein:

the composition is formulated for single dosage administration for gene therapy and contains less than 1×10^7 viral particles or less than 1×10^7 pfu of the virus; and

the composition comprises an agent that facilitates uptake by or entry into parenchymal cells.

Provided herein is a method of delivering a nucleic acid molecule to a subject. The method can be used in gene therapy applications, including in applications to treat diseases and conditions as well as in industrial, agricultural and veterinary applications. As provided herein, the method includes a) compartmentalizing a tissue or organ or portion of the tissue or organ from systemic circulation of the host; and b) administering a delivered agent directly to the parenchyma of the tissue or organ or portion of the tissue or organ, wherein the delivered agent contains the nucleic acid molecule, whereby the delivered agent enters parenchymal cells of the compartmentalized tissue or organ or portion of the tissue or organ. Compartmentalizing the tissue or organ or portion of the tissue or organ can be effected prior to, simultaneous or subsequent to administering the delivered agent. Generally, compartmentalization of the tissue or organ or portion of the tissue or organ is initiated prior to administering the delivered agent, and typically no more than 5 minutes, 4 minutes, 3 minutes, 2 minutes, 1 minute or 30 seconds before delivery of the delivered agent containing a nucleic acid molecule.

The method provided can further include a step of restoring communication between the tissue, organ or portion of the tissue or organ with the systemic circulation. The step of restoring communication is generally a predetermined time after administering the delivered agent. The predetermined time is a time period that is sufficient for the administered delivered agent to enter parenchymal cells (*e.g.* by transduction), whereby upon restoration of communication no more than 20% of the delivered agent has not entered a parenchymal cell. For example, no more than 15%, 14%, 13%, 12%, 11%, 10%, 9%, 8%, 7%, 6%, or 5% of the delivered agent has not entered a parenchymal cell. In some examples, the predetermined times is a time period sufficient for the administered delivered agent to enter parenchymal cells, whereby upon restoration of communication no more than 20% of the delivered agent is exposed to the systemic circulation. For example, no more than 15%, 14%, 13%, 12%, 11%, 10%, 9%, 8%, 7%, 6%, or 5% of the delivered agent is exposed to the

WHAT IS CLAIMED:

1. Use of a composition in the manufacture of a medicament for gene therapy of a disease or condition , wherein:

the composition comprises:

a delivery agent comprising a therapeutic nucleic acid molecule and an agent that facilitates entry of the delivery agent into the parenchymal cells in a compartmentalized tissue or organ or portion of a tissue or organ; and

an agent that facilitates entry of the delivery agent into the parenchymal cells;

the nucleic acid molecule encodes an enzyme, a hormone, a coagulation or clotting factor, a cytokine, a growth factor or active portion thereof, an antibody or antigen binding portion thereof, an angiogenesis modulator, an immunomodulator, a pain modulator, a receptor or active portion thereof, a transport protein or a regulatory protein for treating a disease or condition;

the disease or condition is selected from among arthritis, chronic pain, HIV-related AIDS, atherosclerosis, restenosis, inherited enzyme deficiency, inherited immune deficiency, cancer, a retrovirus infection, hemophilia, a muscular dystrophy, a dystrophy, a cardiovascular disorder, cystic fibrosis, a neurodegenerative disorder, trauma, pain, sickle cell anemia, autoimmune disease, inflammatory disease and hypertension;

the composition is formulated for direct administration into the parenchyma of a compartmentalized tissue, organ, or portion of a tissue or organ sufficient in size to compartmentalize and for administration of the composition;

the parenchyma in the compartmentalized tissue or organ or portion thereof does not include connective tissue, blood vessels, nerves or ducts; and

a compartmentalized tissue or organ or portion of a tissue or organ is a tissue or organ that has been isolated from the systemic circulation, whereby the arteries, veins, ducts and/or vessels servicing or traversing the tissue or organ or portion of the tissue or organ are blocked so that blood supply and flow to the tissue or organ or portion thereof is reduced or eliminated.

2. A composition for direct delivery of a therapeutic nucleic acid molecule into parenchyma cells of an organ or tissue for treatment of a disease or condition, comprising:

a delivery agent comprising a nucleic acid molecule that encodes an enzyme, a hormone, a coagulation or clotting factor, a cytokine, a growth factor or active portion thereof, an antibody or antigen binding portion thereof, an angiogenesis modulator, an immunomodulator, a pain modulator, a receptor or active portion thereof, a transport protein or a regulatory protein for treating a disease or condition; and

an agent that facilitates entry of the delivery agent into the parenchymal cells in a compartmentalized tissue or organ or portion of a tissue or organ, wherein:

the composition is formulated for direct administration of the delivery agent comprising the nucleic acid molecule into the parenchyma of a compartmentalized tissue, organ, or portion of a tissue or organ sufficient in size to compartmentalize and for administration of the composition;

a compartmentalized tissue or organ or portion of a tissue or organ is a tissue or organ that has been isolated from the systemic circulation, whereby the arteries, veins, ducts and/or vessels servicing or traversing the tissue or organ or portion of the tissue or organ are blocked so that blood supply and flow to the tissue or organ or portion thereof is reduced or eliminated; and

the disease or condition is selected from among arthritis, chronic pain, HIV-related AIDS, atherosclerosis, restenosis, inherited enzyme deficiency, inherited immune deficiency, cancer, a retrovirus infection, hemophilia, , a muscular dystrophy, a dystrophy, a cardiovascular disorder, cystic fibrosis, a neurodegenerative disorder, trauma, pain, sickle cell anemia, autoimmune disease, inflammatory disease and hypertension.

3. The use of claim 1, wherein the encoded polypeptide is selected from among adenosine deaminase, cystic fibrosis transmembrane conductance regulator (CTFR), galsulfase, laronidase, N-acetylgalactosamine 6-sulfatase, phenylalanine ammonia lyase, acid alpha glucosidase, imiglucerase, alglucosidase alpha, thyrotropin, growth hormone, , thyroid hormone, erythropoietin (EPO), interleukin-1 (IL-1), IL-2, IL-3, IL-4, IL-5, IL-7, interferons (IFN), tumor necrosis factor (TNF), IL-12, IL-18, fms-related tyrosine kinase 3 (flt3), neuropilin-2 (NP2), bone morphogenic protein (BMPs), epidermal growth factor (EGF), fibroblast growth factor (FGF), granulocyte colony stimulating factor (G-CSF), granulocyte macrophage colony stimulating factor (GM-CSF), hepatocyte growth factor (HGF), -like growth factor (IGF), platelet derived growth factor (PDGF), transforming growth factor α and β, vascular endothelial growth factor (VEGF), epidermal growth factor receptor (EGFR), fibroblast growth factor receptor (FGFR), transforming growth factor receptor (TGFR), vascular endothelial growth factor receptor (VEGFR), plasminogen activator, urokinase, Factor VIII, Factor IX, von Willebrand factor, growth hormone, metalloproteinase thrombospondin motifs 1 (METH-1), METH-2, tryptophanyl-tRNA synthetase (TrpRS) fragments, proliferin-related protein, prolactin fragment, pigment epithelium derived growth factor (PEDF), vasostatin, angiostatin, endostatin, kininostatin, fibrinogen-E fragment, thrombospondin, tumstatin, canstatin, restin, soluble fms-like tyrosine kinase-1 (sFlt-1), soluble vascular endothelial growth factor receptors (sFlk), soluble Neuropilin I (sNRP1), Interferon gamma-induced protein 10 (IP-10), Platelet factor 4 (PF-4), Gro-beta, soluble Ephrin type-B receptor 4 (sEphB4), sephrinB2, TGF, IGF-1, herpes simplex virus

thymidine kinase (HSV-TK), carboxypeptidase G2 (CPG2), carboxylesterase (CA), cytosine deaminase (CD), cytochrome P450 (cyt-450), deoxycytidine kinase (dCK), nitroreductase (NR), purine nucleoside phosphorylase (PNP), thymidine phosphorylase (TP), varicella zoster virus thymidine kinase (VZV-TK), xanthine-guanine phosphoribosyl transferase (XGPRT), Aspartylglucosaminidase, α-Galactosidase A, Palmitoyl Protein Thioesterase, Tripeptidyl Peptidase, Lysosomal transmembrane protein, cysteine transporter, Acid ceramidase, acid α-L-fucosidase, protective protein/cathepsin A, acid-β-glucosidase or glucocerebrosidase, acid β-galactosidase, iduronate-2-sulfatase, α-L-Iduronidase, galactocerebrosidase, acid α-mannosidase, acid β-mannosidase, arylsulfatase B, arylsulfatase A, N-Acetylgalactosamine-6-sulfate sulfatase, N-Acetlylglucosamine-l-phosphotransferase, Acid sphingomyelinase, Niemann-Pick disease type Cl (NPC-l), β-Hexosaminidase B, Heparan N-sulfatase, α-N-Acetylglucosaminidase, Acetyl-Co, α-glucosaminide N-acetyltransferase, N-Acetylglucosamine-6-sulfate sulfatase, β-Glucuronidase, acid lipase, neprilysin, the -degrading enzyme insulysin, thimet oligopeptidase, calbindin D28, parvalbumin, hypoxia induced factor 1-alpha (HIF1-alpha), sirtuin-2 (SIRT-2), survival motor neuron protein-1 (SMN-1), SMN-2, glial cell-derived neurotrophic factor (GDNF), ciliary neurotrophic factor (CNF), low density lipoprotein receptor (LDLR), liproprotein lipase (LPL), Alpha-1-Antitrypsin (AAT), UDP-glucuronyl-transferase (UGT), UGT1A1 , glucose-6 phosphatase, phosphoenolpyruvate-carboxykinase, galactose-1 phosphate uridyl transferase, phenylalanine hydroxylase, branched chain alpha-ketoacid dehydrogenase, fumarylacetoacetate hydrolase, methylmalonyl-CoA mutase, ornithine transcarbamylase, argininosuccinic acid synthetase, adenosine deaminase, hyposanthine guanine phosphoribosyl transferase, biotinidase, beta-glucocerebrosidase, beta-glucuronidase, porphobilinogen deaminase and p53.

4. The use claim 1 or claim 3, wherein the disease or condition treatable by a therapeutic nucleic acid is selected from among hemophilia, and an inborn error of metabolism.

5. The use of any of claims 1, and 3 , wherein the therapeutic nucleic acid molecule encodes a polypeptide selected from among Factor VIII for treating hemophilia A; a Factor IX for treating hemophilia B; an gene for treating type I mellitus; an alpha-1-antitrypsin (AAT) for treating alpha-1-antitrypsin (AAT) deficiency; a hemochromatosis protein (HFE) for treating hemochromatosis; a copper-transporting ATPase 2 for treating Wilson's disease; UDP glucuronosyltransferase 1A1 (UGT1A1) for treating Crigler-Najjar syndrome type I; ornithine transcarbamylase (OTC) for treating ornithine transcarbamylase deficiency, type II; low density lipoprotein receptor (LDLR) for treating familial hypercholesterolemia; fibrinogen alpha (FGA), beta (FGB) or gamma (FGG) for treating afibrinogenemia; glucose-6-phosphate-α for treating glycogen storage disease (GSD) type Ia; G6PT for treating GSD type Ib; acid-α-glucosidase for treating GSD type II (Pompe); α-L-iduronidase for treating mucopolysaccharidosis (MPSI); sulphamidase for

treating MPS IIIA; α-N-acetylglucosaminidase (NaGlu) for treating MPS IIIB; β-glucuronidase for treating MPS VII; α-galactosidase A for treating Fabry disease; glucocerebrosidase for treating Gaucher's disease; acid sphingomyelinase for treating Niemann-Pick syndrome; phenylalanine hydroxylase for treating phenylketonuria; TIMP antagonist or anti-HSC molecules for treating liver fibrosis; anti-ROS molecules for treating liver ischemia reperfusion injury; amyloid-beta degrading enzyme neprilysin, the -degrading enzyme insulysin, or thimet oligopeptidase for treating Alzheimer's disease; growth factor-1 (IGF-1), calbindin D28, parvalbumin, hypoxia induced factor 1-alpha (HIF1-alpha), sirtuin-2 (SIRT-2), survival motor neuron protein-1 (SMN-1), SMN-2, glial cell-derived neurotrophic factor (GDNF) or ciliary neurotrophic factor (CNF) for treating Amyotrophic Lateral Sclerosis (ALS); galactose-1 phosphate uridyl transferase for treating galactosemia; branched chain alpha-ketoacid dehydrogenase for treating maple syrup urine disease; fumarylacetoacetate hydrolase for treating tyrosinemia type 1; methylmalonyl-CoA mutase for treating methylmalonic acidemia; argininosuccinic acid synthetase for treating citrullinemia; hyposanthine guanine phosphoribosyl transferase for treating Gout and Lesch Nyan syndrome; beta-glucuronidase for treating Sly syndrome; peroxisome membrane protein 70 kDa for treating Zellweger syndrome, enfuvirtide for treating Human immunodeficiency virus (HIV) infection; adenosine deaminase (ADA) for treating combined immunodeficiency disease (SCID); CFTR for treating cystic fibrosis; porphobilinogen deaminase (PBDG) for treating acute intermittent porphyria; interferon-beta for treating multiple sclerosis; lipoprotein lipase for treating lipoprotein lipase deficiency (LPLD); p53 for treating cancer; and glutamic acid decarboxylase (GAD) for treating Parkinson's Disease.

6. The use of any of claims 1 and 3-5, wherein the compartmentalized tissue or organ or portion of a tissue or organ to which the composition is to be administered is parenchymally clamped to cut off the blood supply and flow through the tissue or organ or portion thereof.

7. The use or composition of any of claims 1 and 3-6 , wherein the tissue or organ or portion of the tissue or organ is selected from among the liver, brain, spinal cord, pancreas, heart, skin, kidney, lung, blood vessel, bone, muscle, uterus, cervix, prostate, urethra, and intestine.

8. The use of any of claims 1and 3-7, wherein the composition is to be administered by direct administration to the parenchyma of a compartmentalized liver or a portion of the liver.

9. The use of claim 8, wherein the compartmentalized portion of the liver is selected from among a lobe, segment or a portion of a lobe and a segment of the liver.

10. The use of claim 9, wherein the lobe or portion of a lobe is selected from among the right lobe, the left lobe, the quadrate lobe and the caudate lobe and portion thereof.

11. The use of any of claims 1 and 3-10, wherein the delivery agent is selected from among a single stranded DNA, a linear stranded DNA, a viral vector, a circular DNA, a non-viral vector, a virus, a virus-like particle, a minicircle, a nanoparticle that comprises the nucleic acid molecule, and a whole cell that comprises the nucleic acid molecule.

12. The use of claim 11, wherein the delivery agent is a non-viral vector and the non-viral vector is an expression vector.

13. The use of claim 11, wherein the delivery agent is a nanoparticle and the nanoparticle is targeted or radiolabeled.

14. The use of any of claims 1and 3-11, wherein the delivery agent is a virus.

15. The use of claim 14, wherein the virus is selected from among an adenovirus, an adeno-associated virus (AAV), a retrovirus, a vaccinia virus and a herpes simplex virus.

16. The use of any of claims 1 and 3-15, wherein:

the composition is formulated for direct administration of the delivery agent comprising the nucleic acid molecule into the parenchyma of a compartmentalized liver or portion of a liver sufficient in size to compartmentalize and to effect administration of the composition; and

the composition comprises a delivery agent that is an adenovirus or adeno-associated virus vector comprising the therapeutic nucleic acid molecule, wherein the nucleic acid molecule is heterologous to the virus genome.

17. The use of claim 15 or claim 16, wherein the virus is an adenovirus and the serotype of the adenovirus is adenovirus type 2 or adenovirus type 5.

18. The use of any of claims 1 and 3-14, wherein the nucleic acid molecule is selected from among a DNA molecule or a RNA molecule.

19. The use of any of claims 1 and 3-18, wherein the delivery agent is formulated with lipids or polymer reagents that facilitate entry into parenchymal cells.

20. The use of any of claims 1 and 3-19, wherein the delivery agent is formulated with an agent that promotes cellular uptake of the delivery agent.

21. The use of any of claims 1-and 3-18, wherein the delivery agent is a virus and the composition comprises a transcriptional enhancer of a virus-specific cell surface receptor.

22. The use of claim 21, wherein the transcriptional enhancer is a histone deacetylase (HDAC) inhibitor.

23. The use of any of claims 1 and 3-22, wherein:

the delivery agent is an adenovirus or adeno-associated virus comprising a heterologous nucleic acid molecule in its genome;

the composition is for single dosage administration; and

the amount of adenovirus in the composition is less than1 x 10^7 particles or less than 1 x 10^7 pfu, 1 x 10^6 pfu, 1 x 10^5 pfu, 1 x 10^4 pfu, 1 x 10^3 pfu.

24. The use of any of claims 1 and 3-13, wherein the composition comprises an agent that facilitates uptake or entry into parenchymal cells selected from among polyamine, calcium phosphate precipitate, histone protein, protamine, polyethylenimine, polylysine, polyarginine, polyornithinine, DEAE dextran, polybrene, polyampholyte complex, spermine, spermidine, putrescine, human serum albumin, DNA binding proteins, non-histone chromosomal proteins, coat proteins from DNA viruses and polymers of N-substituted glycines.

25. A composition, comprising an adenovirus or adeno-associated virus comprising heterologous nucleic acid in its genome, wherein:

the composition is formulated for single dosage administration for gene therapy and contains less than 1 x 10^7 viral particles or less than 1 x 10^7 pfu of the virus; and

the composition comprises an agent that facilitates uptake by or entry into parenchymal cells.

26. The composition of claim 24, wherein the agent that facilitates uptake or entry is selected from among polyamine, calcium phosphate precipitate, histone protein, protamine, polyethylenimine, polylysine, polyarginine, polyornithinine, DEAE dextran, polybrene, polyampholyte complex, spermine, spermidine, putrescine, human serum albumin, DNA binding proteins, non-histone chromosomal proteins, coat proteins from DNA viruses and polymers of N-substituted glycines.

27. The use of claim 26, wherein the agent is a histone deacetylase (HDAC) inhibitor.

28. The composition of claim 2, wherein the encoded polypeptide is selected from among adenosine deaminase, cystic fibrosis transmembrane conductance regulator (CTFR), galsulfase, laronidase, N-acetylgalactosamine 6-sulfatase, phenylalanine ammonia lyase, acid alpha glucosidase, imiglucerase, alglucosidase alpha, thyrotropin, growth hormone, , thyroid hormone, erythropoietin (EPO), interleukin-1 (IL-1), IL-2, IL-3, IL-4, IL-5, IL-7, interferons (IFN), tumor necrosis factor (TNF), IL-12, IL-18, fms-related tyrosine kinase 3 (flt3), neuropilin-2 (NP2), bone morphogenic protein (BMPs), epidermal growth factor (EGF), fibroblast growth factor (FGF), granulocyte colony stimulating factor (G-CSF), granulocyte macrophage colony stimulating factor (GM-CSF), hepatocyte growth factor (HGF), -like growth factor (IGF), platelet derived growth factor (PDGF), transforming growth factor α and β, vascular endothelial growth factor (VEGF), epidermal growth factor receptor (EGFR), fibroblast growth factor receptor (FGFR), transforming growth factor receptor (TGFR), vascular endothelial growth factor receptor (VEGFR), plasminogen activator, urokinase, Factor VIII, Factor IX, von Willebrand factor, growth hormone, metalloproteinase thrombospondin motifs 1 (METH-1), METH-2, tryptophanyl-tRNA synthetase (TrpRS) fragments, proliferin-related protein, prolactin fragment, pigment epithelium derived growth factor (PEDF), vasostatin, angiostatin, endostatin, kininostatin, fibrinogen-E fragment, thrombospondin, tumstatin, canstatin, restin, soluble fms-like tyrosine kinase-1 (sFlt-1), soluble vascular endothelial growth factor receptors (sFlk), soluble Neuropilin I (sNRP1), Interferon gamma-induced protein 10 (IP-10), Platelet factor 4 (PF-4), Gro-beta, soluble Ephrin type-B receptor 4 (sEphB4), sephrinB2, TGF, IGF-1, herpes simplex virus thymidine kinase (HSV-TK), carboxypeptidase G2 (CPG2), carboxylesterase (CA), cytosine deaminase (CD), cytochrome P450 (cyt-450), deoxycytidine kinase (dCK), nitroreductase (NR), purine nucleoside phosphorylase (PNP), thymidine phosphorylase (TP), varicella zoster virus thymidine kinase (VZV-TK), xanthine-guanine phosphoribosyl transferase (XGPRT), Aspartylglucosaminidase, α-Galactosidase A, Palmitoyl Protein Thioesterase, Tripeptidyl Peptidase, Lysosomal transmembrane protein, cysteine transporter, Acid ceramidase, acid α-L-fucosidase, protective protein/cathepsin A, acid-β-glucosidase or glucocerebrosidase, acid β-galactosidase, iduronate-2-sulfatase, α-L-Iduronidase, galactocerebrosidase, acid α-mannosidase, acid β-mannosidase, arylsulfatase B, arylsulfatase A, N-Acetylgalactosamine-6-sulfate sulfatase, N-Acetlylglucosamine-l-phosphotransferase, Acid sphingomyelinase, Niemann-Pick disease type Cl (NPC-l), β-Hexosaminidase B, Heparan N-sulfatase, α-N-Acetylglucosaminidase, Acetyl-CoA, α-glucosaminide N-acetyltransferase, N-Acetylglucosamine-6-sulfate sulfatase, β-Glucuronidase, acid lipase, neprilysin, the -degrading enzyme insulysin, thimet oligopeptidase, calbindin D28, parvalbumin, hypoxia induced factor 1-alpha (HIF1-alpha), sirtuin-2 (SIRT-2), survival motor neuron protein-1 (SMN-1), SMN-2, glial cell-derived neurotrophic factor (GDNF), ciliary neurotrophic factor (CNF), low density lipoprotein receptor (LDLR), liproprotein lipase (LPL), Alpha-1-Antitrypsin (AAT), UDP-glucuronyl-transferase (UGT), UGT1A1 , glucose-6 phosphatase, phosphoenolpyruvate-carboxykinase, galactose-1 phosphate uridyl transferase, phenylalanine hydroxylase, branched chain

alpha-ketoacid dehydrogenase, fumarylacetoacetate hydrolase, methylmalonyl-CoA mutase, ornithine transcarbamylase, argininosuccinic acid synthetase, adenosine deaminase, hyposanthine guanine phosphoribosyl transferase, biotinidase, beta-glucocerebrosidase, beta-glucuronidase, porphobilinogen deaminase and p53.

29. The composition of claim 2 or claim 28 , wherein the disease or condition treatable by a therapeutic nucleic acid is selected from among hemophilia, and an inborn error of metabolism.

30. The composition of any of claims 2, and 29 , wherein the therapeutic nucleic acid molecule encodes a polypeptide selected from among Factor VIII for treating hemophilia A; a Factor IX for treating hemophilia B; an gene for treating type I mellitus; an alpha-1-antitrypsin (AAT) for treating alpha-1-antitrypsin (AAT) deficiency; a hemochromatosis protein (HFE) for treating hemochromatosis; a copper-transporting ATPase 2 for treating Wilson's disease; UDP glucuronosyltransferase 1A1 (UGT1A1) for treating Crigler-Najjar syndrome type I; ornithine transcarbamylase (OTC) for treating ornithine transcarbamylase deficiency, type II; low density lipoprotein receptor (LDLR) for treating familial hypercholesterolemia; fibrinogen alpha (FGA), beta (FGB) or gamma (FGG) for treating afibrinogenemia; glucose-6-phosphate-α for treating glycogen storage disease (GSD) type Ia; G6PT for treating GSD type Ib; acid-α-glucosidase for treating GSD type II (Pompe); α-L-iduronidase for treating mucopolysaccharidosis (MPSI); sulphamidase for treating MPS IIIA; α-N-acetylglucosaminidase (NaGlu) for treating MPS IIIB; β-glucuronidase for treating MPS VII; α-galactosidase A for treating Fabry disease; glucocerebrosidase for treating Gaucher's disease; acid sphingomyelinase for treating Niemann-Pick syndrome; phenylalanine hydroxylase for treating phenylketonuria; TIMP antagonist or anti-HSC molecules for treating liver fibrosis; anti-ROS molecules for treating liver ischemia reperfusion injury; amyloid-beta degrading enzyme neprilysin, the -degrading enzyme insulysin, or thimet oligopeptidase for treating Alzheimer's disease; growth factor-1 (IGF-1), calbindin D28, parvalbumin, hypoxia induced factor 1-alpha (HIF1-alpha), sirtuin-2 (SIRT-2), survival motor neuron protein-1 (SMN-1), SMN-2, glial cell-derived neurotrophic factor (GDNF) or ciliary neurotrophic factor (CNF) for treating Amyotrophic Lateral Sclerosis (ALS); galactose-1 phosphate uridyl transferase for treating galactosemia; branched chain alpha-ketoacid dehydrogenase for treating maple syrup urine disease; fumarylacetoacetate hydrolase for treating tyrosinemia type 1; methylmalonyl-CoA mutase for treating methylmalonic acidemia; argininosuccinic acid synthetase for treating citrullinemia; hyposanthine guanine phosphoribosyl transferase for treating Gout and Lesch Nyan syndrome; beta-glucuronidase for treating Sly syndrome; peroxisome membrane protein 70 kDa for treating Zellweger syndrome, enfuvirtide for treating Human immunodeficiency virus (HIV) infection; adenosine deaminase (ADA) for treating combined immunodeficiency disease (SCID); CFTR for treating cystic fibrosis; porphobilinogen deaminase (PBDG) for treating acute intermittent porphyria; interferon-beta for treating multiple

sclerosis; lipoprotein lipase for treating lipoprotein lipase deficiency (LPLD); p53 for treating cancer; and glutamic acid decarboxylase (GAD) for treating Parkinson's Disease.

31. The composition of any of claims 2 and 28-30, wherein the compartmentalized tissue or organ or portion of a tissue or organ to which the composition is to be administered is parenchymally clamped to cut off the blood supply and flow through the tissue or organ or portion thereof.

32. The use or composition of any of claims 2 and 28-31 , wherein the tissue or organ or portion of the tissue or organ is selected from among the liver, brain, spinal cord, pancreas, heart, skin, kidney, lung, blood vessel, bone, muscle, uterus, cervix, prostate, urethra, and intestine.

33. The composition of any of claims 2 and 28-32, wherein the composition is to be administered by direct administration to the parenchyma of a compartmentalized liver or a portion of the liver.

34. The composition of claim 33, wherein the compartmentalized portion of the liver is selected from among a lobe, segment or a portion of a lobe and a segment of the liver.

35. The composition of claim 34, wherein the lobe or portion of a lobe is selected from among the right lobe, the left lobe, the quadrate lobe and the caudate lobe and portion thereof.

36. The composition of any of claims 2 and 28-35, wherein the delivery agent is selected from among a single stranded DNA, a linear stranded DNA, a viral vector, a circular DNA, a non-viral vector, a virus, a virus-like particle, a minicircle, a nanoparticle that comprises the nucleic acid molecule, and a whole cell that comprises the nucleic acid molecule.

37. The composition of claim 36, wherein the delivery agent is a non-viral vector and the non-viral vector is an expression vector.

38. The composition of claim 36, wherein the delivery agent is a nanoparticle and the nanoparticle is targeted or radiolabeled.

39. The composition of any of claims 3 and 28-36, wherein the delivery agent is a virus.

40. The composition of claim 39, wherein the virus is selected from among an adenovirus, an adeno-associated virus (AAV), a retrovirus, a vaccinia virus and a herpes simplex virus.

41. The composition of any of claims 2 and 28-40, wherein:

the composition is formulated for direct administration of the delivery agent comprising the nucleic acid molecule into the parenchyma of a compartmentalized liver or portion of a liver sufficient in size to compartmentalize and to effect administration of the composition; and

the composition comprises a delivery agent that is an adenovirus or adeno-associated virus vector comprising the therapeutic nucleic acid molecule, wherein the nucleic acid molecule is heterologous to the virus genome.

42. The composition of claim 40 or claim 41, wherein the virus is an adenovirus and the serotype of the adenovirus is adenovirus type 2 or adenovirus type 5.

43. The composition of any of claims 2 and 28-39, wherein the nucleic acid molecule is selected from among a DNA molecule or a RNA molecule.

44. The composition of any of claims 2 and 28-43, wherein the delivery agent is formulated with lipids or polymer reagents that facilitate entry into parenchymal cells.

45. The composition of any of claims 2 and 28-43, wherein the delivery agent is formulated with an agent that promotes cellular uptake of the delivery agent.

46. The composition of any of claims 2-and 28-45, wherein the delivery agent is a virus and the composition comprises a transcriptional enhancer of a virus-specific cell surface receptor.

47. The composition of claim 46, wherein the transcriptional enhancer is a histone deacetylase (HDAC) inhibitor.

48. The composition of any of claims 2 and 28-47, wherein:

the delivery agent is an adenovirus or adeno-associated virus comprising a heterologous nucleic acid molecule in its genome;

the composition is for single dosage administration; and

the amount of adenovirus in the composition is less than1 x 10^7 particles or less than 1 x 10^7 pfu, 1 x 10^6 pfu, 1 x 10^5 pfu, 1 x 10^4 pfu, 1 x 10^3 pfu.

49. The composition of any of claims 2 and 28-48, wherein the composition comprises an agent that facilitates uptake or entry into parenchymal cells selected from among polyamine, calcium phosphate precipitate, histone protein, protamine, polyethylenimine, polylysine, polyarginine, polyornithinine, DEAE dextran, polybrene, polyampholyte complex, spermine, spermidine, putrescine, human serum albumin, DNA binding proteins, non-histone chromosomal proteins, coat proteins from DNA viruses and polymers of N-substituted glycines.

WHAT IS CLAIMED:

1. A composition for use in treating a disease or condition treatable by a therapeutic nucleic acid, wherein:

the composition is to be administered by direct parenchymal administration of the nucleic acid molecule to a compartmentalized tissue, organ or portion of a tissue or organ, wherein the portion is sufficient in size to compartmentalize and to effect administration of the composition;

the composition is formulated for direct parenchymal administration;

the composition comprises a delivered agent; and

the delivered agent comprises the therapeutic nucleic acid molecule.

2. Use of a composition for manufacture of a medicament for treating a disease or condition treatable by a therapeutic nucleic acid, wherein:

the composition is to be administered by direct parenchymal administration of a nucleic acid molecule to a compartmentalized tissue, organ or portion of a tissue or organ, wherein the portion is sufficient in size to compartmentalize and to effect administration of the composition;

the composition is formulated for direct parenchymal administration;

the composition comprises a delivered agent; and

the delivered agent comprises the therapeutic nucleic acid molecule.

3. The use or composition of claim 1 or claim 2, wherein the disease or condition treatable by a therapeutic nucleic acid is selected from among a genetic deficiency, a disease or condition ameliorated by an exogenous gene product, and a disease or condition involving aberrant or altered expression of a gene product in its etiology.

4. The use or composition of any of claims 1-3, wherein the therapeutic nucleic acid effects treatment of a disease or condition, overproduces a heterologous polypeptide in a subject, increases muscle production in an animal, increases growth of an animal, or effects nutrient synthesis or utilization in an animal.

5. The use or composition of any of claims 1-4, wherein the nucleic acid molecule encodes a polypeptide.

6. The use or composition of claim 5, wherein the encoded polypeptide is selected from among an enzyme, a hormone, a coagulation or clotting factor, a

cytokine, a growth factor or active portion thereof, an antibody or antigen portion thereof, an angiogenesis modulator, an immunomodulator, a pain modulator, a receptor or active portion thereof, a transport protein, a regulatory protein, an antigen and an allergen.

7. The use or composition of claim 5 or claim 6, wherein the encoded polypeptide is selected from among adenosine deaminase, cystic fibrosis transmembrane conductance regulator (CTFR), galsulfase, laronidase, N-acetylgalactosamine 6-sulfatase, phenylalanine ammonia lyase, acid alpha glucosidase, imiglucerase, alglucosidase alpha, thyrotropin, growth hormone, insulin, thyroid hormone, erythropoietin (EPO), interleukin-1 (IL-1), IL-2, IL-3, IL-4, IL-5, IL-7, IFN, TNF, IL-12, IL-18, flt3, NP2, bone morphogenic protein (BMPs), epidermal growth factor (EGF), erythropoietin (EPO), fibroblast growth factor (FGF), granulocyte colony stimulating factor (G-CSF), granulocyte macrophage colony stimulating factor (GM-CSF), hepatocyte growth factor (HGF), insulin-like growth factor (IGF), platelet derived growth factor (PDGF), transforming growth factor α and β, vascular endothelial growth factor (VEGF), epidermal growth factor receptor (EGFR), fibroblast growth factor receptor (FGFR), transforming growth factor receptor (TGFR), vascular endothelial growth factor receptor (VEGFR), plasminogen activator, urokinase, Factor VIII, Factor IX, von Willebrand factor, growth hormone, METH-1, METH -2, TrpRS fragments, proliferin-related protein, prolactin fragment, PEDF, vasostatin, angiostatin, endostatin, kininostatin, fibrinogen-E fragment, thrombospondin, tumstatin, canstatin, restin, sFlt-1, sFlk, sNRP1, IP-10, PF-4, Gro-beta, IFN-gamma, IFN, FGF, FGFR, FGFR antagonist (sFGFR), sEphB4 and sephrinB2, PDGF, TGF and IGF-1, HSV-TK, carboxypeptidase G2 (CPG2), carboxylesterase (CA), cytosine deaminase (CD), cytochrome P450 (cyt-450), deoxycytidine kinase (dCK), nitroreductase (NR), purine nucleoside phosphorylase (PNP), thymidine phosphorylase (TP), varicella zoster virus thymidine kinase (VZV-TK), xanthine-guanine phosphoribosyl transferase (XGPRT), Aspartylglucosaminidase, α-Galactosidase A, Palmitoyl Protein Thioesterase, Tripeptidyl Peptidase, Lysosomal transmembrane protein, cysteine transporter, Acid ceramidase, acid α-L-fucosidase, protective protein/cathepsin A, acid β-glucosidase or glucocerebrosidase, acid β-galactosidase, iduronate-2-sulfatase, α-L-Iduronidase,

galactocerebrosidase, acid α-mannosidase, acid β-mannosidase, arylsulfatase B, arylsulfatase A, N-Acetylgalactosamine-6-sulfate sulfatase, N-Acetlylglucosamine-1-phosphotransferase, Acid sphingomyelinase, NPC-1, β-Hexosaminidase B, Heparan N-sulfatase,α-N-Acetylglucosaminidase, Acetyl-CoA:αglucosamininde N-acetyltransferase, N-Acetylglucosamine-6-sulfate sulfatase, β-Glucuronidase, acid lipase, neprilysin, the insulin-degrading enzyme insulysin, thimet oligopeptidase, IGF-1, calbindin D28, parvalbumin, HIF1-alpha, SIRT-2, VEGF, SMN-1, SMN-2, GDNF, ciliary neurotrophic factor (CNF), low density lipoprotein (LDLR), Alpha-1-Antitrypsin (AAT), UDP-glucuronyl-transferase, UGT1A1, glucose-6 phosphatase, phosphoenolpyruvate-carboxykinase, galactose-1 phosphate uridyl transferase, phenylalanine hydroxylase, branched chain alpha-ketoacid dehydrogenase, fumarylacetoacetate hydrolase, methylmalonyl-CoA mutase, ornithine transcarbamylase, argininosuccinic acid synthetase, adenosine deaminase, hyposanthine guanine phosphoribosyl transferase, biotinidase, beta-glucocerebrosidase, beta-gluronidase, porphobilinogen deaminase and p53.

8. The use or composition of any of claims 1-7, wherein the disease or condition treatable by a therapeutic nucleic acid is selected from among arthritis, chronic pain, HIV-related AIDS, atherosclerosis, restenosis, inherited enzyme deficiency, inherited immune deficiency, cancer, a retrovirus infection, hemophilia, diabetes, a muscular dystrophy, a cardiovascular disorder, cystic fibrosis, a neurodegenerative disorder, trauma, pain, sickle cell anemia, autoimmune disease, inflammatory disease, and hypertension.

9. The use or composition of any of claims 1-8, wherein the therapeutic nucleic acid molecule encodes a polypeptide selected from among Factor VIII for treating hemophila A; a Factor IX for treating hemophilia B; an insulin gene for treating type I diabetes mellitus; an alpha-1-antitrypsin (AAT) for treating alpha-1-antitrypsin (AAT) deficiency; a hemochromatosis protein (HFE) for treating hemochromatosis; a copper-transporting ATPase 2 for treating Wilson's disease; UDP glucuronosyltransferase 1A1 (UGT1A1) for treating Crigler-Najjar syndrome type I; ornithine transcarbamylase (OTC) for treating ornithine transcarbamylase deficiency, type II; low density lipoprotein receptor (LDLR) for treating familial hypercholesterolemia; fibrinogen alpha (FGA), beta (FGB) or gamma (FGB) for

treating afibrinogenemia; glucose-6-phosphate-α for treating glycogen storage disease (GSD) type Ia; G6PT for treating GSD type Ib; acid-α-glucosidase for treating GSD type II (Pompe); α-L-iduronidase for treating mucopolysaccharidosis (MPSI); sulphamidase for treating MPS IIIA; α-N-acetylglucosaminidase (NaGlu) for treating MPS IIIB; β-glucuronidase for treating MPS VII; α-galactosidase A for treating Fabry disease,; glucocerebrosidase for treating Gaucher's disease; acid sphingomyelinase for treating Niemann-Pick syndrome; phenylalanine hydroxylase for treating phenylketonuria; TIMP antagonist or anti-HSC molecules for treating liver fibrosis; anti-ROS molecules for treating liver ischemia reperfusion injury; amyloid-beta degrading enzyme neprilysin, the insulin-degrading enzyme insulysin, or thimet oligopeptidase for treating Alzheimer's disease; insulin growth factor-1 (IGF-1), calbindin D28, parvalbumin, HIF1-alpha, SIRT-2, VEGF, SMN-1, SMN-2, GDNF or ciliary neurotrophic factor (CNF) for treating Amyotrophic Lateral Sclerosis (ALS); galactose-1 phosphate uridyl transferase for treating galactosemia; branched chain alpha-ketoacid dehydrogenase for treating maple syrup urine disease; fumarylacetoacetate hydrolase for treating tyrosinemia type 1; methylmalonyl-CoA mutase for treating methylmalonic acidemia; argininosuccinic acid synthetase for treating citrullinemia; hyposanthine guanine phosphoribosyl transferase for treating Gout and Lesch Nyan syndrome; beta-gluronidase for treating Sly syndrome; peroxisome membrane protein 70 kDa for treating Zellweger syndrome, enfuvirtide for treating Human immunodeficiency virus (HIV) infection; adenosine deaminase (ADA) for treating combined immunodeficiency disease (SCID); CFTR for treating cystic fibrosis; porphobilinogen deaminase (PBDG) for treating acute intermittent porphyria; interferon-beta treating multiple sclerosis; lipoprotein lipase for treating lipoprotein lipase deficiency (LPLD), p53 for treating cancer; and glutamic acid decarboxylase (GAD) for treating Parkinson's Disease.

10. A composition for use in increasing muscle production in an animal, increasing hair growth in an animal, increasing wool production in an animal, increasing growth of an animal, or for facilitating nutrient synthesis or utilization in an animal, wherein:

the composition is to be administered by direct parenchymal administration to a compartmentalized tissue, organ or portion of a tissue or organ, wherein the

portion is sufficient in size to compartmentalize and to effect administration of the composition;

the composition is formulated for direct parenchymal administration;

the composition comprises a delivered agent; and

the delivered agent comprises a nucleic acid molecule that encodes a polypeptide that increases muscle production in an animal, increases hair growth in an animal, increases wool production in an animal, increases growth of an animal, or is involved in nutrient synthesis or utilization .

11. Use of a composition for manufacture of a medicament for increasing muscle production in an animal, increasing hair growth in an animal, increasing wool production in an animal, increasing growth of an animal, or for facilitating nutrient synthesis or utilization in an animal, wherein:

the composition is to be administered by direct parenchymal administration to a compartmentalized tissue, organ or portion of a tissue or organ, wherein the portion is sufficient in size to compartmentalize and to effect administration of the composition;

the composition is formulated for direct parenchymal administration;

the composition comprises a delivered agent; and

the delivered agent comprises a nucleic acid molecule that encodes a polypeptide that increases muscle production in an animal, increases hair growth in an animal, increases wool production in an animal, increases growth of an animal, or is involved in nutrient synthesis or utilization.

12. The use or composition of claim 10 or claim 11, wherein the encoded polypeptide is selected from among:

a polypeptide that increases muscle production in an animal that is a myostatin inhibitor;

a polypeptide that increases growth in an animal that is a growth hormone, IGF-1, a growth hormone releasing factor or chicken Ski; and

a polypeptide that is involved in nutrient synthesis or utilization that is a serine transacetylase and o-acetylserine sulphydrylase.

13. The use or composition of claim 12, wherein the myostatin inhibitor is follistatin.

14. The composition or use of any of claims 1-13, wherein the compartmentalized tissue or organ or portion of a tissue or organ is isolated from the systemic circulation, whereby the arteries, veins, ducts and/or vessels servicing or traversing the tissue or organ or portion of the tissue or organ are blocked so that blood supply and flow to the tissue or organ or portion thereof is reduced or eliminated.

15. The composition or use of any of claims 1-14, wherein the compartmentalized tissue or organ or portion of a tissue or organ is parenchymally clamped.

16. The composition or use of any of claims 1-15, wherein the tissue or organ or portion of the tissue or organ is selected from among the liver, brain spinal cord, pancreas, heart, skin, kidney, lung, blood vessel, bone, muscle, uterus, cervix, prostate, urethra, and intestine.

17. The composition or use of any of claims 1-16, wherein the composition is to be administered by direct parenchymal administration of a nucleic acid molecule to a compartmentalized liver or a portion of the liver.

18. The composition or use of claim 17, wherein the compartmentalized portion of the liver is selected from among a lobe, segment or a portion of a lobe or segment of the liver.

19. The composition or use of claim 18, wherein the lobe or portion of a lobe is selected from among the right lobe, the left lobe, the quadrate lobe and the caudate lobe or portion thereof.

20. The composition or use of any of claims 1-19, wherein the delivered agent is selected from among a single stranded DNA, a linear stranded DNA, a circular DNA, a non-viral vector, a virus, a virus-like particle, a minicircle, a nanoparticle and a whole cell that comprise the nucleic acid molecule.

21. The use or composition of claim 20, wherein the delivered agent is a non-viral vector and the non-viral vector is an expression vector.

22. The use or composition of claim 20, wherein the delivered agent is a nanoparticle and the nanoparticle is targeted or radiolabeled.

23. The use or composition of claim 20, wherein the delivered agent is a virus.

24. The use or composition of claim 23, wherein the delivered agent is a virus and the virus is selected from among an adenovirus, an adeno-associated virus (AAV), a retrovirus, vaccinia virus and herpes simplex virus.

25. The use or composition of claim 23 or claim 24, wherein the virus comprises the nucleic acid molecule and the nucleic acid molecule is heterologous to the virus genome.

26. The use or composition of any of claims 23-25, wherein the retrovirus is a lentivirus.

27. The use or composition of any of claims 23-25, wherein the virus is an adenovirus.

28. The use or composition of any of claims 1-27, wherein:

the composition is to be administered by direct parenchymal administration of the nucleic acid molecule to a compartmentalized liver or portion of a liver, wherein the portion is sufficient in size to compartmentalize and to effect administration of the composition;

the composition is formulated for direct parenchymal administration;

the composition comprises an adenovirus or adeno-associated virus comprising the therapeutic nucleic acid molecule, wherein the nucleic acid molecule is heterologous to the virus genome.

29. The use or composition of claim 27 or claim 28, wherein the serotype is adenovirus type 2 or adenovirus type 5.

30. The use or composition of any of claims 27-29, wherein the adenovirus comprises a deletion in an E1, E2a, E2b, E3, or E4 coding region.

31. The use or composition of any of claims 27-30, wherein the adenovirus comprises a deletion in the E1 coding region.

32. The use or composition of any of claims 1-20, wherein the nucleic agent molecule is selected from among a DNA molecule, a RNA molecule, and an aptamer.

33. The use or composition of claim 32, wherein the nucleic acid molecule is selected from the among a microRNA, a small interfering RNA, a ribozyme and an antisense nucleic acid.

34. The use or composition of any of claims 1-33, wherein the delivered agent is formulated with lipids, polymer reagents or other agents to facilitate entry by parenchymal cells.

35. The use or composition of any of claims 1-34, wherein the delivered agent is formulated with an agent that promotes cellular uptake of the delivered agent.

36. The use or composition of claim 35, wherein the delivered agent is a virus and the agent is a transcriptional enhancer of a virus-specific cell surface receptor.

37. The use or composition of claim 36, wherein the agent is a histone deacetylase (HDAC) inhibitor.

38. The use or composition of claim 37, wherein the HDAC inhibitor is selected from among trischostatin A, vorinostat (SAHA), belionostat (PXD101), LAQ824, panobinostat (LBH589), entinostat (MS-275), C199, mocetinostat (MGCD0103), romidepsin (lstodax), valproic acid, PCI-24781, SB939, resminostat, givinostat, CUDC-101, AR-42, CHR-2845, CHR-3996, 4SC-202, CG200745, Kevetrin, and trichostatin A (TSA).

39. The use or composition of any of claims 1-38, wherein the amount of delivered agent in the composition is 100-fold or less than the amount of the same delivered agent in a composition formulated for intravenous administration for the same purpose.

40. The use or composition of claim 39, wherein the amount of delivered agent in the composition is 200-fold, 500-fold, 1000-fold, 5000-fold, 10000-fold or less than the amount of the same delivered agent in a composition formulated for intravenous administration.

41. The use or composition of any of claims 1-40, wherein:

the delivered agent is an adenovirus or adeno-associated virus comprising a heterologous nucleic acid molecule in its genome; and

the amount of adenovirus in the composition is or is about 2×10^3 pfu/ mL to 1×10^{14} pfu/mL, 2×10^3 pfu/ mL to 1×10^{12} pfu/mL, 2×10^3 pfu/mL to 2×10^{11} pfu/mL, 1×10^4 pfu/mL to 5×10^{11} pfu/mL, 1×10^5 pfu/mL to 1×10^{11} pfu/mL, 2×10^6 pfu/mL to 2×10^{10} pfu/mL, or1×10^8 to 1×10^{10} pfu/mL; or is or is about between 2×10^3 particles/ mL to 1×10^{14} particles/mL, 2×10^3 particles/ mL to 1×10^{12}

particles/mL, 2 x 10^3 particles/mL to 2 x 10^{11} particles/mL, 1 x 10^4 particles/mL to 5 x 10^{11} particles/mL, 1 x 10^5 particles/mL to 1 x 10^{11} particles/mL, 2 x 10^6 particles/mL to 2 x 10^{10} particles/mL, or 1 x 10^8 to 1 x 10^{10} particles/mL.

42. The use or composition of any of claims 1-41, wherein the volume of the composition is or is about between 0.02 mL to 100 mL, 0.05 mL to 50 mL, 1 mL to 10 mL, 0.05 mL to 5 mL or 0.02 mL to 1 mL.

43. The use or composition of any of claims 1-42 that is formulated for single dosage administration.

44. The use or composition of any of claims 1-42 that is formulated for multiple dosage administration.

45. The use or composition of any of claims 1-44, wherein:

the delivered agent is an adenovirus or adeno-associated virus comprising a heterologous nucleic acid molecule in its genome;

the composition is for single dosage administration; and

the amount of adenovirus in the composition is between or between about 10 to 1 x 10^{12} particles, 10 to 1 x 10^6 particles, 1 x 10^3 to 1 x 10^{12} particles, 1 x 10^6 to 1 x 10^{10} particles, or 1 x 10^7 to 1 x 10^9 particles; or is or is about 10 to 1 x 10^{12} pfu, 10 to 1 x 10^6 pfu, 1 x 10^3 to 1 x 10^{12} pfu, 1x 10^6 to 1x 10^{10} pfu, or 1x 10^7 to 1x 10^9 pfu; orless than 1 x 10^{12} particles, 1 x 10^{11} particles, 1 x 10^{10} particles, 1 x 10^9 particles, 1 x 10^8 particles, 1 x 10^7 particles, 1 x 10^6 particles, 1 x 10^5 particles, 1 x 10^4 particles, 1 x 10^3 particles or less; or is less than 1 x 10^{12} pfu, 1 x 10^{11} pf, 1 x 10^{10} pfu, 1 x 10^9 pfu, 1 x 10^8 pfu, 1 x 10^7 pfu, 1 x 10^6 pfu, 1 x 10^5 pfu, 1 x 10^4 pfu, 1 x 10^3 pfu or less.

46. The use or composition of any of claims 1-45 that is formulated for administration to a human patient.

47. The use or composition of any of claims 1-46 that is formulated for administration to a human child under the age of 18.

48. The use or composition of any of claims 1-47 that is formulated for administration to a fetus.

49. A method of delivering a nucleic acid molecule to a subject, comprising:

a) compartmentalizing a tissue or organ or portion of the tissue or organ from systemic circulation of the host, wherein the portion is sufficient in size to compartmentalize and to effect delivery of the agent; and

b) administering a delivered agent directly to the parenchyma of the tissue or organ or portion of the tissue or organ, wherein the delivered agent comprises the nucleic acid molecule, whereby the delivered agent enters parenchymal cells of the compartmentalized tissue or organ or portion of the tissue or organ.

50. The method of claim 49, wherein compartmentalizing the tissue or organ or portion of the tissue or organ is effected prior to, simultaneous or subsequent to administering the delivered agent.

51. The method of claim 49 or claim 50, wherein compartmentalizing the tissue or organ or portion of the tissue or organ is effected prior to administering the delivered agent; and

the delivered agent is administered after compartmentalizing the tissue or organ or portion of the tissue or organ.

52. The method of any of claims 49-51, wherein administering the delivered agent is no more than 5 minutes, 4 minutes, 3 minutes, 2 minutes, 1 minute or 30 seconds after compartmentalizing the tissue or organ or portion of the tissue or organ.

53. The method of any of claims 49-52, wherein compartmentalizing is achieved by blocking any one or more arteries, veins, ducts and/or vessels in the tissue or organ or portion of the tissue or organ, whereby blood supply and flow to the tissue or organ or portion thereof is reduced or eliminated.

54. The method of claim 53, wherein all arteries, veins, ducts and/or vessels servicing or traversing the tissue or organ or portion of the tissue or organ are blocked.

55. The method of claim 53 or claim 54, wherein blocking an artery, vein, duct and/or vessel is with a device or technique selected from among manual compression, a parenchymal clamp, an arterial or venous clamp, an occlusion catheter, a stapling device, a band, a tourniquet and a cable.

56. The method of any of claims 49-55, wherein a tissue or organ or portion of a tissue or organ is compartmentalized by clamping with a parenchymal clamp.

57. The method of claim 56, wherein the clamp is a laparoscopic clamp.

58. The method of any of claims 49-57, wherein after compartmentalizing the tissue or organ or portion thereof, further comprising applying suction to reduce or eliminate blood in the tissue or organ or portion thereof.

59. The method of any of claims 49-58, further comprising:

c) after administering the delivered agent, restoring communication between the tissue, organ or portion of the tissue or organ with the systemic circulation.

60. The method of claim 59, wherein restoring communication with the systemic circulation comprises removing the device or technique used to block an artery, vein, duct and/or vessel.

61. The method of claim 59 or claim 60, wherein the step of restoring communication is effected a predetermined time after administering the delivered agent.

62. The method of claim 61, wherein the predetermined time is sufficient for the administered delivered agent to enter parenchymal cells, whereby upon restoration of communication no more than 20% of the delivered agent has not entered a parenchymal cell or no more than 20% of the delivered agent is exposed to the systemic circulation.

63. The method of claim 62, wherein no more than 15%, 14%, 13%, 12%, 11%, 10%, 9%, 8%, 7%, 6%, or 5% of the delivered agent is exposed to the systemic circulation.

64. The method of any of claims 61-63, wherein the predetermined time is 1 minute to 120 minutes after administering the delivered agent.

65. The method of any of claims 61-64, wherein the predetermined time is at least or at least about or is or is about 30 minutes after administering the delivered agent.

66. The method of any of claims 49-65, wherein the tissue or organ or portion of the tissue or organ is selected from among the liver, brain spinal cord,

pancreas, heart, skin, kidney, lung, blood vessel, bone, muscle, uterus, cervix, prostate, urethra, and intestine.

67. The method of any of claims 49-66, wherein the tissue or organ or portion of the tissue or organ is the liver.

68. The method of any of claims 49-67, wherein:

the tissue or organ or portion of the tissue or organ is the liver; and

the predetermined time before restoring communication with the systemic circulation is at least or at least about or is or is about 30 minutes.

69. The method of any of claims 49-68, wherein a portion of the tissue or organ is compartmentalized.

70. The method of claim 69, wherein a portion of the liver is compartmentalized and the portion is a lobe, segment or a portion of a lobe or segment of the liver.

71. The method of claim 70, wherein the lobe or portion of a lobe is selected from among the right lobe, the left lobe, the quadrate lobe and the caudate lobe or is a portion thereof.

72. The method of any of claims 49-71, wherein the delivered agent is selected from among a non-viral vector, a virus, a virus-like particle, a minicircle, a nanoparticle and a whole cell that comprise the nucleic acid molecule.

73. The method of claim 72, wherein the delivered agent is a nanoparticle and the nanoparticle is targeted or radiolabeled.

74. The method of claim 72, wherein the delivered agent is a virus and the virus is selected from among an adenovirus, an adeno-associated virus (AAV), a retrovirus, vaccinia virus and herpes simplex virus.

75. The method of claim 74, wherein the retrovirus is a lentivirus.

76. The method of claim 74, wherein the virus is an adenovirus.

77. The method of claim 74, wherein the serotype is adenovirus type 2 or adenovirus type 5.

78. The method of claim 76 or claim 77, wherein the adenovirus comprises a deletion in an E1, E2a, E2b, E3, or E4 coding region.

79. The method of any of claims 74-78, wherein the virus comprises the nucleic acid molecule and the nucleic acid molecule is heterologous to the virus genome.

80. The method of any of claims 49-79, wherein the nucleic acid molecule encodes a polypeptide, whereby the polypeptide is expressed.

81. The method of claim 80, wherein the encoded polypeptide is selected from the among an enzyme, a hormone, a coagulation or clotting factor, a cytokine, a growth factor or active portion thereof, an antibody or antigen binding portions of antibodies, an angiogenesis modulator, an immunomodulator, a pain modulator, a receptor or active portion thereof, a transport protein, a regulatory protein, an antigen and an allergen.

82. The method of claim 80 or claim 81, wherein the encoded polypeptide is selected from among adenosine deaminase, cystic fibrosis transmembrane conductance regulator (CTFR), galsulfase, laronidase, N-acetylgalactosamine 6-sulfatase, phenylalanine ammonia lyase, acid alpha glucosidase, imiglucerase, alglucosidase alpha, thyrotropin, growth hormone, insulin, thyroid hormone, erythropoietin (EPO), interleukin-1 (IL-1), IL-2, IL-3, IL-4, IL-5, IL-7, interferon-α (IFN-α), IFN-β, IFN-γ), TNF, IL-12, IL-18, flt3, NP2, bone morphogenic protein (BMPs), epidermal growth factor (EGF), erythropoietin (EPO), fibroblast growth factor (FGF), granulocyte colony stimulating factor (G-CSF), granulocyte macrophage colony stimulating factor (GM-CSF), hepatocyte growth factor (HGF), insulin-like growth factor (IGF), platelet derived growth factor (PDGF), transforming growth factor α or β, vascular endothelial growth factor (VEGF), epidermal growth factor receptor (EGFR), fibroblast growth factor receptor (FGFR), FGFR antagonist (sFGFR) transforming growth factor receptor (TGFR), vascular endothelial growth factor receptor (VEGFR), plasminogen activator, urokinase, Factor VIII, Factor IX, von Willebrand factor, growth hormone, METH-1, METH -2, TrpRS fragments, proliferin-related protein, prolactin fragment, PEDF, vasostatin, angiostatin, endostatin, kininostatin, fibrinogen-E fragment, thrombospondin, tumstatin, canstatin, restin, sFlt-1, sFlk, sNRP1, IP-10, PF-4, Gro-beta, sEphB4 and sephrinB2, IGF-1, HSV-TK, carboxypeptidase G2 (CPG2), carboxylesterase (CA), cytosine deaminase (CD), cytochrome P450 (cyt-450), deoxycytidine kinase (dCK), nitroreductase (NR),

purine nucleoside phosphorylase (PNP), thymidine phosphorylase (TP), varicella zoster virus thymidine kinase (VZV-TK), xanthine-guanine phosphoribosyl transferase (XGPRT), Aspartylglucosaminidase, α-Galactosidase A, Palmitoyl Protein Thioesterase, Tripeptidyl Peptidase, Lysosomal transmembrane protein, cysteine transporter, Acid ceramidase, acid α-L-fucosidase, protective protein/cathepsin A, acid β-glucosidase or glucocerebrosidase, acid β-galactosidase, iduronate-2-sulfatase, α-L-Iduronidase, galactocerebrosidase, acid α-mannosidase, acid β-mannosidase, arylsulfatase B, arylsulfatase A, N-Acetylgalactosamine-6-sulfate sulfatase, N-Acetlylglucosamine-1-phosphotransferase, Acid sphingomyelinase, NPC-1, β-Hexosaminidase B, Heparan N-sulfatase, α-N-Acetylglucosaminidase (NaGlu), Acetyl-CoA:αglucosamininde N-acetyltransferase, N-Acetylglucosamine-6-sulfate sulfatase, β-Glucuronidase, acid lipase, neprilysin, the insulin-degrading enzyme insulysin, thimet oligopeptidase, IGF-1, calbindin D28, parvalbumin, HIF1-alpha, SIRT-2, SMN-1, SMN-2, GDNF, ciliary neurotrophic factor (CNF), low density lipoprotein (LDLR), lipoprotein lipase (LDL), Alpha-1-Antitrypsin (AAT), UDP-glucuronyl-transferase, UGT1A1, glucose-6 phosphatase, phosphoenolpyruvate-carboxykinase, galactose-1 phosphate uridyl transferase, phenylalanine hydroxylase, branched chain alpha-ketoacid dehydrogenase, fumarylacetoacetate hydrolase, methylmalonyl-CoA mutase, ornithine transcarbamylase, argininosuccinic acid synthetase, adenosine deaminase, hyposanthine guanine phosphoribosyl transferase, biotinidase, beta-glucocerebrosidase, beta-gluronidase, porphobilinogen deaminase (PBDG) and p53.

83. The method of any of claims 80-82, wherein the nucleic acid molecule is a therapeutic nucleic acid molecule that encodes a therapeutic product, whereby delivery of the nucleic acid molecule effects treatment of a disease or condition.

84. The method of claim 83, wherein the disease or condition is selected from among an arthritis, chronic pain, HIV-related AIDS, atherosclerosis, restenosis, inherited enzyme deficiency, inherited immune deficiency, cancer, a retrovirus infection, hemophilia, diabetes, a muscular dystrophy, a cardiovascular disorder, cystic fibrosis, a neurodegenerative disorder, trauma, pain, sickle cell anemia, autoimmune disease, inflammatory disease, and hypertension

85. The method of claim 83 or claim 84, wherein the nucleic acid molecule encodes a protein selected from among a Factor VIII for the treatment of hemophilia A; a Factor IX for the treatment of hemophilia B; an insulin gene for treatment of type I diabetes mellitus; an alpha-1-antitrypsin (AAT) for the treatment of alpha-1-antitrypsin (AAT) deficiency; a hemochromatosis protein (HFE) for treatment of hemochromatosis; a copper-transporting ATPase 2 for treatment of Wilson's disease; UDP glucuronosyltransferase 1A1 (UGT1A1) for the treatment of Crigler-Najjar syndrome type I; ornithine transcarbamylase (OTC) for the treatment of ornithine transcarbamylase deficiency, type II; low density lipoprotein receptor (LDLR) for the treatment of familial hypercholesterolemia; fibrinogen alpha (FGA), beta (FGB) or gamma (FGB) for the treatment of afibrinogenemia; glucose-6-phosphate-α for the treatment of glycogen storage disease (GSD) type Ia; G6PT for the treatment of GSD type Ib; acid-α-glucosidase for the treatment of GSD type II (Pompe); α-L-iduronidase for the treatment of mucopolysaccharidosis (MPSI); sulphamidase for the treatment of MPS IIIA; α-N-acetylglucosaminidase (NaGlu) for the treatment of MPS IIIB; β-glucuronidase for the treatment of MPS VII; α-galactosidase A for the treatment of Fabry disease,; glucocerebrosidase for the treatment ofGaucher's disease; acid sphingomyelinase for the treatment of Niemann-Pick syndrome; , phenylalanine hydroxylase for the treatment of phenylketonuria; TIMP antagonist or anti-HSC molecules for the treatment of liver fibrosis;anti-ROS molecules for the treatment of liver ischemia reperfusion injury; amyloid-beta degrading enzyme neprilysin, the insulin-degrading enzyme insulysin, or thimet oligopeptidase for the treatment of Alzheimer's disease; insulin growth factor-1 (IGF-1), calbindin D28, parvalbumin, HIF1-alpha, SIRT-2, VEGF, SMN-1, SMN-2, GDNF or ciliary neurotrophic factor (CNF) for the treatment ofAmyotrophic Lateral Sclerosis (ALS); galactose-1 phosphate uridyl transferase for the treatment of galactosemia; branched chain alpha-ketoacid dehydrogenase for the treatment of maple syrup urine disease; fumarylacetoacetate hydrolase for the treatment of tyrosinemia type 1; methylmalonyl-CoA mutase for the treatment of methylmalonic acidenia; argininosuccinic acid synthetase for the treatment of citrullinemia; hyposanthine guanine phosphoribosyl transferase for the treatment of Gout and Lesch Nyan syndrome; beta-gluronidase for the treatment of Sly syndrome; peroxisome

membrane protein 70 kDa for the treatment of Zellweger syndrome, enfuvirtide for the treatment of Human immunodeficiency virus (HIV) infection; adenosine deaminase (ADA) for the treatment of combined immunodeficiency disease (SCID); CFTR for the treatment of cystic fibrosis; porphobilinogen deaminase (PBDG) for the treatment of acute intermittent porphyria; interferon-beta for the treatment of multiple sclerosis; lipoprotein lipase for the treatment of lipoprotein lipase deficiency (LPLD), p53 for the treatment of cancer; and glutamic acid decarboxylase (GAD) for the treatment of Parkinson's Disease.

86. The method of claim 80, wherein the nucleic acid molecule encodes a polypeptide that increases muscle production in an animal, increases hair production in an animal, increases wool production in an animal, increases growth of an animal, or is involved in nutrient synthesis or utilization.

87. The method of claim 86, wherein the encoded polypeptide is selected from among:

a polypeptide that increases muscle production in an animal that is a myostatin inhibitor;

a polypeptide that increases growth in an animal that is a growth hormone, IGF-1, a growth hormone releasing factor or chicken Ski; and

a polypeptide that is involved in nutrient synthesis or utilization that is a serine transacetylase and o-acetylserine sulphydrylase.

88. The method of claim 87, wherein the myostatin inhibitor is follistatin.

89. The method of any of claims 49-88, wherein the nucleic agent molecule is selected from among a DNA molecule, a RNA molecule, and an aptamer.

90. The method of claim 89, wherein the nucleic acid molecule is selected from among a microRNA, a small interfering RNA, a ribozyme and an antisense nucleic acid.

91. The method of any of claims 49-90, comprising imaging the tissue or organ to identify the parenchymal tissue prior to administration of the delivered agent.

92. The method of claim 91, wherein the imaging is magnetic resonance imaging (MRI), sonography (ultrasound), or computed tomography (ct).

93. The method of any of claims 49-92, wherein the delivered agent is formulated with lipids, polymer reagents or other agents to facilitate entry into the parenchymal cells.

94. The method of any of claims 49-93, wherein the delivered agent is delivered in the presence of a physical method to facilitate entry into parenchymal cells.

95. The method of claim 94, wherein the physical method is selected from among electroporation, sonoporation, hydrodynamic pressure, ultrasound and a gene gun.

96. The method of any of claims 49-95, further comprising administering an agent that promotes cellular uptake of the delivered agent, wherein the agent is administered prior to, simultaneously or subsequent to administration of the delivered agent.

97. The method of claim 96, wherein the agent is a transcriptional enhancer of a virus-specific cell surface receptor or of the therapeutic transgene.

98. The method of claim 97, wherein the agent is a histone deacetylase (HDAC) inhibitor.

99. The method of any of claims 49-98, wherein the amount of delivered agent that is administered is 100-fold or less than the amount of the same delivered agent administered intravenously for the same purpose.

100. The method of any of claims 49-99, wherein:

the delivered agent is an adenovirus or adeno-associated virus comprising a heterologous nucleic acid molecule in its genome; and

the amount of delivered agent administered is:

between or about between 10 to 1 x 10^{12} particles, 10 to 1 x 10^{6} particles, 1 x 10^{3} to 1 x 10^{12} particles, 1 x 10^{6} to 1 x 10^{10} particles, or 1 x 10^{7} to 1x 10^{9} particles; or is or is about between 10 to 1 x 10^{12} pfu, 10 to 1 x 10^{6} pfu, 1 x 10^{3} to 1 x 10^{12} pfu, 1 x 10^{6} to 1 x 10^{10} pfu, or 1 x 10^{7} to 1x 10^{9} pfu; or

less than 1 x 10^{12} particles, 1 x 10^{11} particles, 1 x 10^{10} particles, 1 x 10^{9} particles, 1 x 10^{8} particles, 1 x 10^{7} particles, 1 x 10^{6} particles, 1 x 10^{5} particles, 1 x 10^{4} particles, 1 x 10^{3} particles or less; or is less than 1 x 10^{12} pfu, 1 x 10^{11} pfu, 1 x 10^{10}

pfu, 1 x 10^9 pfu, 1 x 10^8 pfu, 1 x 10^7 pfu, 1 x 10^6 pfu, 1 x 10^5 pfu, 1 x 10^4 pfu, 1 x 10^3 pfu or less.

101. The method of any of claims 49-100, wherein the delivered agent is administered to more than one locus in the compartmentalized tissue, organ or portion of the tissue or organ.

102. The method of any of claims 49-101, wherein prior to restoring communication to the tissue, organ or portion of the tissue or organ with the systemic circulation, further comprising removing from the parenchyma of the tissue or organ or portion of the tissue or organ delivered agent that is extracellular.

103. The method of any of claims 49-102, that is repeated a plurality of times.

104. The method of claim 103, wherein in a subsequent iteration of the method, the delivered agent is administered to the same compartmentalized locus or a different compartmentalized locus.

105. The method of any of claims 49-104, wherein the subject is selected from among a mouse, rat, [illegible], pig, sheep, goat, horse and human.

106. The method of any of claims 49-105, wherein the subject is a human child under the age of 18 or is a human fetus.

107. The method of any of claims 49-106, wherein the subject has been diagnosed with a genetic deficiency.

108. The method of any of claims 49-107 that is performed via laparoscopy.

109. A container, comprising an adenovirus or adeno-associated virus composition, wherein:

the composition is formulated for direct parenchymal administration;

the adenovirus or adeno-associated virus comprises a heterologous nucleic acid molecule in its genome;

the amount of adenovirus or adeno-associated virus in the composition is an amount for single dosage administration that is 100-fold or less than the amount of the same adenovirus or adeno-associated virus administered intravenously for the same purpose; and

the container is sterile and sealed.

110. The container of claim 109, wherein the amount of adenovirus or adeno-associated virus in the composition is:

less than 1 x 10^9 pfu, and is at least or about at least 10 pfu, 1 x 10^2 pfu, 1 x 10^3 pfu, 1 x 10^4 pfu, 1 x 10^5 pfu, 1 x 10^6 pfu, 1 x 10^7 pfu, or 1 x 10^8 pfu or more; or

less than 1 x 10^9 particles, and is at least or about at least 10 particles, 1 x 10^3 particles, 1 x 10^3 particles, 1 x 10^4 particles, 1 x 10^5 particles, 1 x 10^6 particles, 1 x 10^7 particles, 1 x 10^8 particles or more.

111. The container of claim 109 or claim 110 that contains 1 x 10^2 pfu to 1 x 10^6 pfu; or 1 x 10^2 particles to 1 x 10^6 particles.

112. The container of any of claims 109-111 that has a volume of 0.02 mL to 100 mL, 0.05 mL to 50 mL, 1 mL to 10 mL, 0.05 mL to 5 mL or 0.02 mL to 1 mL.

113. The container of any of claims 109-112 that is a syringe or vial.

114. The container of claim 113 that is a syringe that comprises a needle for injection of the composition.

115. The container of any of claims 109-113, that is a capillary device for administration of the composition by capillary action.

116. The container of any of claims 109-115, wherein the delivered agent is an adenovirus.

117. The container of claim 116, wherein the serotype is adenovirus type 2 or adenovirus type 5.

118. The container of claim 116 or claim 117, wherein the adenovirus comprises a deletion in an E1, E2a, E2b, E3, or E4 coding regions.

119. The container of any of claims 109-118, wherein the nucleic acid molecule encodes a polypeptide.

120. The container of claim 119, wherein the nucleic acid molecule is a therapeutic nucleic acid that encodes a therapeutic product.

121. The container of claim 119 or claim 120, wherein the encoded polypeptide is selected from the among an enzyme, a hormone, a coagulation or clotting factor, a cytokine, a growth factor or active portion thereof, an antibody or antigen binding portion thereof, an angiogenesis modulator, an immunomodulator, a pain modulator, a receptor or active portion thereof, a transport protein, a regulatory protein, an antigen and an allergen.

122. The container of any of claims 119-121, wherein the encoded polypeptide is selected from among adenosine deaminase, cystic fibrosis transmembrane conductance regulator (CTFR), galsulfase, laronidase, N-acetylgalactosamine 6-sulfatase, phenylalanine ammonia lyase, acid alpha glucosidase, imiglucerase, alglucosidase alpha, thyrotropin, growth hormone, insulin, thyroid hormone, erythropoietin (EPO), interleukin-1 (IL-1), IL-2, IL-3, IL-4, IL-5, IL-7, interferon-α (IFN-α), IFN-β, IFN-γ, tumor necrosis factor (TNF), IL-12, IL-18, fms-related tyrosine kinase 3 (flt3), neuropilin-2 (NP2), bone morphogenic proteins (BMPs), epidermal growth factor (EGF), erythropoietin (EPO), fibroblast growth factor (FGF), granulocyte colony stimulating factor (G-CSF), granulocyte macrophage colony stimulating factor (GM-CSF), hepatocyte growth factor (HGF), insulin-like growth factor (IGF), platelet derived growth factor (PDGF), transforming growth factor α or β, vascular endothelial growth factor (VEGF), epidermal growth factor receptor (EGFR), fibroblast growth factor receptor (FGFR), FGFR antagonist (sFGFR), transforming growth factor receptor (TGFR), vascular endothelial growth factor receptor (VEGFR), plasminogen activator, urokinase, Factor VIII, Factor IX, von Willebrand factor, growth hormone, metalloproteinase thrombospondin motifs 1 (METH-1), METH -2, tryptophanyl-tRNA synthetase (TrpRS) fragments, proliferin-related protein, prolactin fragment, PEDF, vasostatin, angiostatin, endostatin, kininostatin, fibrinogen-E fragment, thrombospondin, tumstatin, canstatin, restin, soluble fms-like tyrosine kinase-1 (sFlt-1), soluble vascular endothelial growth factor receptors (sFlk), soluble Neuropilin 1 (sNRP1), Interferon gamma-induced protein 10 (IP-10), Platelet factor 4 (PF-4), Gro-beta, soluble Ephrin type-B receptor 4 (sEphB4) and sephrinB2, IGF-1, HSV-TK, carboxypeptidase G2 (CPG2), carboxylesterase (CA), cytosine deaminase (CD), cytochrome P450 (cyt-450), deoxycytidine kinase (dCK), nitroreductase (NR), purine nucleoside phosphorylase (PNP), thymidine phosphorylase (TP), varicella zoster virus thymidine kinase (VZV-TK), xanthine-guanine phosphoribosyl transferase (XGPRT), Aspartylglucosaminidase, α-Galactosidase A, Palmitoyl Protein Thioesterase, Tripeptidyl Peptidase, Lysosomal transmembrane protein, cysteine transporter, Acid ceramidase, acid α-L-fucosidase, protective protein/cathepsin A, acid β-glucosidase or glucocerebrosidase, acid β-galactosidase, iduronate-2-sulfatase, α-L-Iduronidase, galactocerebrosidase, acid α-

mannosidase, acid β-mannosidase, arylsulfatase B, arylsulfatase A, N-Acetylgalactosamine-6-sulfate sulfatase, N-Acetlylglucosamine-1-phosphotransferase, Acid sphingomyelinase, NPC-1, β-Hexosaminidase B, Heparan N-sulfatase, α-N-Acetylglucosaminidase (NaGlu), Acetyl-CoA:αglucosaminide N-acetyltransferase, N-Acetylglucosamine-6-sulfate sulfatase, β-Glucuronidase, acid lipase, neprilysin, the insulin-degrading enzyme insulysin, thimet oligopeptidase, IGF-1, calbindin D28, parvalbumin, hypoxia induced factor 1-alpha (HIF1-alpha), sirtuin-2 (SIRT-2), survival motor neuron protein-1 (SMN-1), SMN-2, glial cell-derived neurotrophic factor (GDNF), ciliary neurotrophic factor (CNF), low density lipoprotein (LDLR), lipoprotein lipase (LDL), Alpha-1-Antitrypsin (AAT), UDP-glucuronyl-transferases (UGT), UGT1A1, glucose-6 phosphatase, phosphoenolpyruvate-carboxykinase, galactose-1 phosphate uridyl transferase, phenylalanine hydroxylase, branched chain alpha-ketoacid dehydrogenase, fumarylacetoacetate hydrolase, methylmalonyl-CoA mutase, ornithine transcarbamylase, argininosuccinic acid synthetase, adenosine deaminase, hyposanthine guanine phosphoribosyl transferase, biotinidase, beta-glucocerebrosidase, beta-gluronidase, porphobilinogen deaminase (PBDG) and p53.

123. The container of claim 119, wherein the nucleic acid molecule encodes a polypeptide that increases muscle production in an animal, increases hair growth in an animal, increases wool production in an animal, increases growth of an animal, or is involved in nutrient synthesis or utilization.

124. The container of claim 123, wherein the encoded polypeptide is selected from among:

a polypeptide that increases muscle production in an animal that is a myostatin inhibitor;

a polypeptide that increases growth in an animal that is a growth hormone, IGF-1, a growth hormone releasing factor or chicken Ski; and

a polypeptide that is involved in nutrient synthesis or utilization that is a serine transacetylase and o-acetylserine sulphydrylase.

125. The container of claim 124, wherein the myostatin inhibitor is follistatin.