titers (Table 2). Thus, AAV-Rh74 and related vectors can be produced in large amounts for more prevalent clinical diseases.

[**0008a**] In one aspect there is provided a method for delivering or transferring a heterologous polynucleotide sequence into a mammal or a cell of a mammal, comprising administering an adeno-associated virus (AAV) vector, said vector comprising a heterologous polynucleotide sequence, to said mammal or a cell of said mammal, thereby delivering or transferring the heterologous polynucleotide sequence into the mammal or cell of the mammal.

[**0008b**] In another aspect there is provided use of an adeno-associated virus (AAV) vector in the manufacture of a medicament for treating a mammal deficient in protein expression or function, said vector comprising a heterologous polynucleotide encoding a polypeptide that can correct for the deficient protein expression or function, wherein the heterologous polynucleotide sequence is operably linked to an expression control element conferring transcription of said heterologous polynucleotide sequence; and wherein said vector is to be administered to a mammal wherein said polypeptide is expressed in the mammal.

[0008] In accordance with the invention, there are provided methods for delivering or transferring a heterologous polynucleotide sequence into a mammal or a cell of a mammal. In one embodiment, a method includes administering an adeno-associated virus (AAV) vector that includes a heterologous polynucleotide sequence to a mammal or a cell of a mammal under suitable conditions to deliver or transfer the heterologous polynucleotide sequence into the mammal or the cell of a mammal, thereby delivering or transferring the heterologous polynucleotide. In one aspect, the method allows transfer/delivery of the heterologous polynucleotide into the mammal and/or cell. In another aspect, the method allows transfer/delivery of the heterologous polynucleotide into the mammal and/or cell, and subsequent transcription of the heterologous polynucleotide thereby forming a transcript. In a further aspect, the method allows transfer/delivery of the heterologous polynucleotide into the cell, subsequent transcription to form a transcript and subsequent translation to form a gene product (protein). In particular, for example, in the latter two aspects a heterologous polynucleotide sequence is operably linked to an expression control element conferring transcription of the heterologous polynucleotide sequence, and optionally subsequent translation of the transcript.

Description of Drawings

[0009] Figure 1 shows human factor IX (FIX) plasma levels in C57BL/6 mice (n=5 per group) injected via the tail vein with AAV vectors expressing the FIX transgene under the

control of a liver-specific promoter. Vector dose 2.5^{10} vector genomes per mouse. FIX transgene product (FIX protein) plasma levels were measured by ELISA at weeks 1, 2, and 4 post gene transfer. AAV-Rh74 conferred the highest levels of FIX transgene expression.

[0010] Figure 2 shows canine FIX plasma levels in hemophilia B dogs after the delivery of 3^{12} vector genomes per kilogram (kg) of weight. AAV vectors were infused intravenously (IV) though the saphenous vein and FIX levels were monitored by ELISA. Expression of the therapeutic FIX transgene was driven by a liver specific promoter. AAV8 and AAV-Rh74 vectors performed roughly equally in hemophilia B dogs and were both superior to AAV6.

[0011] Figure 3 shows AAV-Rh74 VP1, VP2, and VP3 amino acid sequences and, for VP1, polynucleotide (DNA) sequence (SEQ ID NOs:1-4).

[0012] Figure 4 shows administration of AAV8 and AAVrh74 vector expressing human Factor IX (FIX) (under the control of a liver-specific promoter) to rhesus macaques, a non-human primate, and expression of FIX in the animals. Animals receiving the AAVrh74-FIX vectors (last two bars towards the right margin) expressed the FIX transgene at higher levels compared to the other groups of animals injected at the same dose.

titers (Table 2). Thus, AAV-Rh74 and related vectors can be produced in large amounts for more prevalent clinical diseases.

[0007a] In one aspect, there is provided the use of an adeno-associated virus (AAV) vector comprising a heterologous polynucleotide sequence and a VP1 sequence having 100% identity to:

MAADGYLPDWLEDNLSEGIREWWDLKPGAPKPKANQQKQDNGRGLVLPGYKYLG
PFNGLDKGEPVNAADAAALEHDKAYDQQLQAGDNPYLRYNHADAEFQERLQEDTS
FGGNLGRAVFQAKKRVLEPLGLVESPVKTAPGKKRPVEPSPQRSPDSSTGIGKKGQQ
PAKKRLNFGQTGDSESVPDPQPIGEPPAGPSGLGSGTMAAGGGAPMADNNEGADGV
GSSSGNWHCDSTWLGDRVITTSTRTWALPTYNNHLYKQISNGTSGGSTNDNTYFGY
STPWGYFDFNRFHCHFSPRDWQRLINNNWGFRPKRLNFKLFNIQVKEVTQNEGTKTI
ANNLTSTIQVFTDSEYQLPYVLGSAHQGCLPPFPADVFMIPQYGYLTLNNGSQAVGR
SSFYCLEYFPSQMLRTGNNFEFSYNFEDVPFHSSYAHSQSLDRLMNPLIDQYLYYLSR
TQSTGGTAGTQQLLFSQAGPNNMSAQAKNWLPGPCYRQQRVSTTLSQNNNSNFAW
TGATKYHLNGRDSLVNPGVAMATHKDDEERFFPSSGVLMFGKQGAGKDNVDYSSV
MLTSEEEIKTTNPVATEQYGVVADNLQQQNAAPIVGAVNSQGALPGMVWQNRDVY
LQGPIWAKIPHTDGNFHPSPLMGGFGLKHPPPQILIKNTPVPADPPTTFNQAKLASFIT
QYSTGQVSVEIEWELQKENSKRWNPEIQYTSNYYKSTNVDFAVNTEGTYSEPRPIGT
RYLTRNL,

in the manufacture of a medicament for treating cystic fibrosis, Choroideremia, LCA-Lebercilin, Gyrate Atrophy, X-linked Retinoschisis, Usher's Syndrome 1C, retinitis pigmentosa, Connexin 26 deafness, Achromatopsia, Polycystic kidney disease, a lysosomal storage disease, a polynucleotide repeat disease, dentatorubropallidolusyan atropy, spinobulbar muscular atrophy, spinocerebellar ataxia (type 1, 2, 3, 6, 7, 8, 12 17), fragile X syndrome, fragile X-associated tremor/ataxia syndrome, myotonic dystrophy, Friedreich's ataxia, amyotrophic lateral sclerosis (ALS), Parkinson's disease, Alzheimer's disease, hypercoloesterolemia, HIV infection, Rous sarcoma virus (RSV) infection, hepatitis C virus infection, acute kidney injury, delayed graft function kidney transplant, kidney injury acute renal failure, advance recurrent or metastatic solid malignancies, metastatic melanoma, chronic myeloid leukemia, solid tumors, liver tumors, familial adenomatous polyposis, glaucoma, diabetic macular oedma (DME), age-related macular degeneration, choroidal neovascularization, non-arteritic ischaemic optic neuropathy, pachyonychia congenital, influenza infection, severe acute respiratory syndrome (SARS), respiratory syncytial virus

infection, Ebola infection, hepatitis B virus infection, herpes simplex virus infection, coxsackievirus B3 infection, primary dystonia, autosomal dominantly inherited retinitis pigmentosa, lung disease, bleeding disorder, hemophilia A, hemophilia B, thalassemia, blood disorder, anemia, Huntington's disease, epilepsy, lysosomal storage disease, copper or iron accumulation disorders, Wilson's disease, Menkes disease, lysosomal acid lipase deficiency, a neurological or neurodegenerative disorder, cancer, type 1 diabetes, type 2 diabetes, Gaucher's disease, Hurler's disease, adenosine deaminase deficiency, glycogen storage diseases, a retinal degenerative disease, RPE65 deficiency, brain disease, liver disease, kidney disease, heart disease, infectious viral disease, bacterial disease or fungal disease,

wherein said medicament is to be administered to a mammal or a cell of said mammal, thereby delivering or transferring the heterologous polynucleotide sequence into the mammal or cell of the mammal.

[0007b] In one aspect, there is provided the use of an adeno-associated virus (AAV) vector in the manufacture of a medicament for treating a mammal deficient in protein expression or function, said vector comprising a heterologous polynucleotide encoding a polypeptide that can correct for the deficient protein expression or function, wherein the heterologous polynucleotide sequence is operably linked to an expression control element conferring transcription of said heterologous polynucleotide sequence; wherein said vector comprises a VP1 sequence having 100% identity to:

MAADGYLPDWLEDNLSEGIREWWDLKPGAPKPKANQQKQDNGRGLVLPGYKYLG
PFNGLDKGEPVNAADAAALEHDKAYDQQLQAGDNPYLRYNHADAEFQERLQEDTS
FGGNLGRAVFQAKKRVLEPLGLVESPVKTAPGKKRPVEPSPQRSPDSSTGIGKKGQQ
PAKKRLNFGQTGDSESVPDPQPIGEPPAGPSGLGSGTMAAGGGAPMADNNEGADGV
GSSSGNWHCDSTWLGDRVITTSTRTWALPTYNNHLYKQISNGTSGGSTNDNTYFGY
STPWGYFDFNRFHCHFSPRDWQRLINNNWGFRPKRLNFKLFNIQVKEVTQNEGTKTI
ANNLTSTIQVFTDSEYQLPYVLGSAHQGCLPPFPADVFMIPQYGYLTLNNGSQAVGR
SSFYCLEYFPSQMLRTGNNFEFSYNFEDVPFHSSYAHSQSLDRLMNPLIDQYLYYLSR
TQSTGGTAGTQQLLFSQAGPNNMSAQAKNWLPGPCYRQQRVSTTLSQNNNSNFAW
TGATKYHLNGRDSLVNPGVAMATHKDDEERFFPSSGVLMFGKQGAGKDNVDYSSV
MLTSEEEIKTTNPVATEQYGVVADNLQQQNAAPIVGAVNSQGALPGMVWQNRDVY
LQGPIWAKIPHTDGNFHPSPLMGGFGLKHPPPQILIKNTPVPADPPTTFNQAKLASFIT
QYSTGQVSVEIEWELQKENSKRWNPEIQYTSNYYKSTNVDFAVNTEGTYSEPRPIGT

RYLTRNL and wherein said vector is to be administered to a mammal wherein said polypeptide is expressed in the mammal.

[0007c] In one aspect, there is provided the use of an adeno-associated virus (AAV) vector comprising a VP1 sequence having 100% identity to:

MAADGYLPDWLEDNLSEGIREWWDLKPGAPKPKANQQKQDNGRGLVLPGYKYLG
PFNGLDKGEPVNAADAAALEHDKAYDQQLQAGDNPYLRYNHADAEFQERLQEDTS
FGGNLGRAVFQAKKRVLEPLGLVESPVKTAPGKKRPVEPSPQRSPDSSTGIGKKGQQ
PAKKRLNFGQTGDSESVPDPQPIGEPPAGPSGLGSGTMAAGGGAPMADNNEGADGV
GSSSGNWHCDSTWLGDRVITTSTRTWALPTYNNHLYKQISNGTSGGSTNDNTYFGY
STPWGYFDFNRFHCHFSPRDWQRLINNNWGFRPKRLNFKLFNIQVKEVTQNEGTKTI
ANNLTSTIQVFTDSEYQLPYVLGSAHQGCLPPFPADVFMIPQYGYLTLNNGSQAVGR
SSFYCLEYFPSQMLRTGNNFEFSYNFEDVPFHSSYAHSQSLDRLMNPLIDQYLYYLSR
TQSTGGTAGTQQLLFSQAGPNNMSAQAKNWLPGPCYRQQRVSTTLSQNNNSNFAW
TGATKYHLNGRDSLVNPGVAMATHKDDEERFFPSSGVLMFGKQGAGKDNVDYSSV
MLTSEEEIKTTNPVATEQYGVVADNLQQQNAAPIVGAVNSQGALPGMVWQNRDVY
LQGPIWAKIPHTDGNFHPSPLMGGFGLKHPPPQILIKNTPVPADPPTTFNQAKLASFIT
QYSTGQVSVEIEWELQKENSKRWNPEIQYTSNYYKSTNVDFAVNTEGTYSEPRPIGT
RYLTRNL,

in the manufacture of a medicament for treating cystic fibrosis, Choroideremia, LCA-Lebercilin, Gyrate Atrophy, X-linked Retinoschisis, Usher's Syndrome 1C, retinitis pigmentosa, Connexin 26 deafness, Achromatopsia, Polycystic kidney disease, a lysosomal storage disease, a polynucleotide repeat disease, dentatorubropallidolusyan atropy, spinobulbar muscular atrophy, spinocerebellar ataxia (type 1, 2, 3, 6, 7, 8, 12 17), fragile X syndrome, fragile X-associated tremor/ataxia syndrome, myotonic dystrophy, Friedreich's

ataxia, amyotrophic lateral sclerosis (ALS), Parkinson's disease, Alzheimer's disease, hypercoloesterolemia, HIV infection, Rous sarcoma virus (RSV) infection, hepatitis C virus infection, acute kidney injury, delayed graft function kidney transplant, kidney injury acute renal failure, advance recurrent or metastatic solid malignancies, metastatic melanoma, chronic myeloid leukemia, solid tumors, liver tumors, familial adenomatous polyposis, glaucoma, diabetic macular oedma (DME), age-related macular degeneration, choroidal neovascularization, non-arteritic ischaemic optic neuropathy, pachyonychia congenital, influenza infection, severe acute respiratory syndrome (SARS), respiratory syncytial virus infection, Ebola infection, hepatitis B virus infection, herpes simplex virus infection, coxsackievirus B3 infection, primary dystonia, autosomal dominantly inherited retinitis pigmentosa, lung disease, bleeding disorder, hemophilia A, hemophilia B, thalassemia, blood disorder, anemia, Huntington's disease, epilepsy, lysosomal storage disease, copper or iron accumulation disorders, Wilson's disease, Menkes disease, lysosomal acid lipase deficiency, a neurological or neurodegenerative disorder, cancer, type 1 diabetes, type 2 diabetes, Gaucher's disease, Hurler's disease, adenosine deaminase deficiency, glycogen storage diseases, a retinal degenerative disease, RPE65 deficiency, brain disease, liver disease, kidney disease, heart disease, infectious viral disease, bacterial disease or fungal disease,

wherein said medicament is to be administered to a mammal or a cell of said mammal, thereby delivering or transferring a heterologous polynucleotide sequence into the mammal or cell of the mammal, wherein the mammal is sero-negative for AAV-Rh74.

[0007d] In one aspect, there is provided the use of an adeno-associated virus vector (AAV) comprising a VP1 sequence having 100% identity to:

MAADGYLPDWLEDNLSEGIREWWDLKPGAPKPKANQQKQDNGRGLVLPGYKYLG
PFNGLDKGEPVNAADAAALEHDKAYDQQLQAGDNPYLRYNHADAEFQERLQEDTS
FGGNLGRAVFQAKKRVLEPLGLVESPVKTAPGKKRPVEPSPQRSPDSSTGIGKKGQQ
PAKKRLNFGQTGDSESVPDPQPIGEPPAGPSGLGSGTMAAGGGAPMADNNEGADGV
GSSSGNWHCDSTWLGDRVITTSTRTWALPTYNNHLYKQISNGTSGGSTNDNTYFGY
STPWGYFDFNRFHCHFSPRDWQRLINNNWGFRPKRLNFKLFNIQVKEVTQNEGTKTI
ANNLTSTIQVFTDSEYQLPYVLGSAHQGCLPPFPADVFMIPQYGYLTLNNGSQAVGR
SSFYCLEYFPSQMLRTGNNFEFSYNFEDVPFHSSYAHSQSLDRLMNPLIDQYLYYLSR
TQSTGGTAGTQQLLFSQAGPNNMSAQAKNWLPGPCYRQQRVSTTLSQNNNSNFAW
TGATKYHLNGRDSLVNPGVAMATHKDDEERFFPSSGVLMFGKQGAGKDNVDYSSV
MLTSEEEIKTTNPVATEQYGVVADNLQQQNAAPIVGAVNSQGALPGMVWQNRDVY

LQGPIWAKIPHTDGNFHPSPLMGGFGLKHPPPQILIKNTPVPADPPTTFNQAKLASFIT QYSTGQVSVEIEWELQKENSKRWNPEIQYTSNYYKSTNVDFAVNTEGTYSEPRPIGT RYLTRNL, and empty capsid AAV-Rh74,

in the manufacture of a medicament for treating cystic fibrosis, Choroideremia, LCA-Lebercilin, Gyrate Atrophy, X-linked Retinoschisis, Usher's Syndrome 1C, retinitis pigmentosa, Connexin 26 deafness, Achromatopsia, Polycystic kidney disease, a lysosomal storage disease, a polynucleotide repeat disease, dentatorubropallidolusyan atropy, spinobulbar muscular atrophy, spinocerebellar ataxia (type 1, 2, 3, 6, 7, 8, 12 17), fragile X syndrome, fragile X-associated tremor/ataxia syndrome, myotonic dystrophy, Friedreich's ataxia, amyotrophic lateral sclerosis (ALS), Parkinson's disease, Alzheimer's disease, hypercoloesterolemia, HIV infection, Rous sarcoma virus (RSV) infection, hepatitis C virus infection, acute kidney injury, delayed graft function kidney transplant, kidney injury acute renal failure, advance recurrent or metastatic solid malignancies, metastatic melanoma, chronic myeloid leukemia, solid tumors, liver tumors, familial adenomatous polyposis, glaucoma, diabetic macular oedma (DME), age-related macular degeneration, choroidal neovascularization, non-arteritic ischaemic optic neuropathy, pachyonychia congenital, influenza infection, severe acute respiratory syndrome (SARS), respiratory syncytial virus infection, Ebola infection, hepatitis B virus infection, herpes simplex virus infection, coxsackievirus B3 infection, primary dystonia, autosomal dominantly inherited retinitis pigmentosa, lung disease, bleeding disorder, hemophilia A, hemophilia B, thalassemia, blood disorder, anemia, Huntington's disease, epilepsy, lysosomal storage disease, copper or iron accumulation disorders, Wilson's disease, Menkes disease, lysosomal acid lipase deficiency, a neurological or neurodegenerative disorder, cancer, type 1 diabetes, type 2 diabetes, Gaucher's disease, Hurler's disease, adenosine deaminase deficiency, glycogen storage diseases, a retinal degenerative disease, RPE65 deficiency, brain disease, liver disease, kidney disease, heart disease, infectious viral disease, bacterial disease or fungal disease,

wherein said medicament is to be administered to a mammal or a cell of said mammal, thereby delivering or transferring a heterologous polynucleotide sequence into the mammal or cell of the mammal.

[**0007e**] In one aspect, there is provided a method for delivering or transferring a heterologous polynucleotide sequence into a mammal or a cell of a mammal, comprising administering an adeno-associated virus (AAV) vector, said vector comprising a heterologous

polynucleotide sequence, to said mammal or a cell of said mammal, thereby delivering or transferring the heterologous polynucleotide sequence into the mammal or cell of the mammal.

[0007f] In another aspect, there is provided use of an adeno-associated virus (AAV) vector in the manufacture of a medicament for treating a mammal deficient in protein expression or function, said vector comprising a heterologous polynucleotide encoding a polypeptide that can correct for the deficient protein expression or function, wherein the heterologous polynucleotide sequence is operably linked to an expression control element conferring transcription of said heterologous polynucleotide sequence; and wherein said vector is to be administered to a mammal wherein said polypeptide is expressed in the mammal.

[0008] In accordance with the invention, there are provided methods for delivering or transferring a heterologous polynucleotide sequence into a mammal or a cell of a mammal. In one embodiment, a method includes administering an adeno-associated virus (AAV) vector that includes a heterologous polynucleotide sequence to a mammal or a cell of a mammal under suitable conditions to deliver or transfer the heterologous polynucleotide sequence into the mammal or the cell of a mammal, thereby delivering or transferring the heterologous polynucleotide. In one aspect, the method allows transfer/delivery of the heterologous polynucleotide into the mammal and/or cell. In another aspect, the method allows transfer/delivery of the heterologous polynucleotide into the mammal and/or cell, and subsequent transcription of the heterologous polynucleotide thereby forming a transcript. In a further aspect, the method allows transfer/delivery of the heterologous polynucleotide into the cell, subsequent transcription to form a transcript and subsequent translation to form a gene product (protein). In particular, for example, in the latter two aspects a heterologous polynucleotide sequence is operably linked to an expression control element conferring transcription of the heterologous polynucleotide sequence, and optionally subsequent translation of the transcript.

Description of Drawings

[0009] **Figure 1** shows human factor IX (FIX) plasma levels in C57BL/6 mice (n=5 per group) injected via the tail vein with AAV vectors expressing the FIX transgene under the

control of a liver-specific promoter. Vector dose 2.5^{10} vector genomes per mouse. FIX transgene product (FIX protein) plasma levels were measured by ELISA at weeks 1, 2, and 4 post gene transfer. AAV-Rh74 conferred the highest levels of FIX transgene expression.

[0010] **Figure 2** shows canine FIX plasma levels in hemophilia B dogs after the delivery of 3^{12} vector genomes per kilogram (kg) of weight. AAV vectors were infused intravenously (IV) though the saphenous vein and FIX levels were monitored by ELISA. Expression of the therapeutic FIX transgene was driven by a liver specific promoter. AAV8 and AAV-Rh74 vectors performed roughly equally in hemophilia B dogs and were both superior to AAV6.

[0011] **Figure 3** shows AAV-Rh74 VP1, VP2, and VP3 amino acid sequences and, for VP1, polynucleotide (DNA) sequence (SEQ ID NOs:1-4).

[0012] **Figure 4** shows administration of AAV8 and AAVrh74 vector expressing human Factor IX (FIX) (under the control of a liver-specific promoter) to rhesus macaques, a non-human primate, and expression of FIX in the animals. Animals receiving the AAVrh74-FIX vectors (last two bars towards the right margin) expressed the FIX transgene at higher levels compared to the other groups of animals injected at the same dose.

What is claimed:

1. Use of an adeno-associated virus (AAV) vector comprising a heterologous polynucleotide sequence and a VP1 sequence having more than 99% identity to:
MAADGYLPDWLEDNLSEGIREWWDLKPGAPKPKANQQKQDNGRGLVLPGYKYLGPF
NGLDKGEPVNAADAAALEHDKAYDQQLQAGDNPYLRYNHADAEFQERLQEDTSFGGN
LGRAVFQAKKRVLEPLGLVESPVKTAPGKKRPVEPSPQRSPDSSTGIGKKGQQPAKKRL
NFGQTGDSESVPDPQPIGEPPAGPSGLGSGTMAAGGGAPMADNNEGADGVGSSSGNWH
CDSTWLGDRVITTSTRTWALPTYNNHLYKQISNGTSGGSTNDNTYFGYSTPWGYFDFN
RFHCHFSPRDWQRLINNNWGFRPKRLNFKLFNIQVKEVTQNEGTKTIANNLTSTIQVFTD
SEYQLPYVLGSAHQGCLPPFPADVFMIPQYGYLTLNNGSQAVGRSSFYCLEYFPSQMLR
TGNNFEFSYNFEDVPFHSSYAHSQSLDRLMNPLIDQYLYYLSRTQSTGGTAGTQQLLFSQ
AGPNNMSAQAKNWLPGPCYRQQRVSTTLSQNNNSNFAWTGATKYHLNGRDSLVNPG
VAMATHKDDEERFFPSSGVLMFGKQGAGKDNVDYSSVMLTSEEEIKTTNPVATEQYGV
VADNLQQQNAAPIVGAVNSQGALPGMVWQNRDVYLQGPIWAKIPHTDGNFHPSPLMG
GFGLKHPPPQILIKNTPVPADPPTTFNQAKLASFITQYSTGQVSVEIEWELQKENSKRWNP
EIQYTSNYYKSTNVDFAVNTEGTYSEPRPIGTRYLTRNL,

in the manufacture of a medicament for treating cystic fibrosis, Choroideremia, LCA-Lebercilin, Gyrate Atrophy, X-linked Retinoschisis, Usher's Syndrome 1C, retinitis pigmentosa, Connexin 26 deafness, Achromatopsia, Polycystic kidney disease, a lysosomal storage disease, a polynucleotide repeat disease, dentatorubropallidolusyan atropy, spinobulbar muscular atrophy, spinocerebellar ataxia (type 1, 2, 3, 6, 7, 8, 12 17), fragile X syndrome, fragile X-associated tremor/ataxia syndrome, myotonic dystrophy, Friedreich's ataxia, amyotrophic lateral sclerosis (ALS), Parkinson's disease, Alzheimer's disease, hypercoloesterolemia, HIV infection, Rous sarcoma virus (RSV) infection, hepatitis C virus infection, acute kidney injury, delayed graft function kidney transplant, kidney injury acute renal failure, advance recurrent or metastatic solid malignancies, metastatic melanoma, chronic myeloid leukemia, solid tumors, liver tumors, familial adenomatous polyposis, glaucoma, diabetic macular oedma (DME), age-related macular degeneration, choroidal neovascularization, non-arteritic ischaemic optic neuropathy, pachyonychia congenital, influenza infection, severe acute respiratory syndrome (SARS), respiratory syncytial virus infection, Ebola infection, hepatitis B virus infection, herpes simplex

virus infection, coxsackievirus B3 infection, primary dystonia, autosomal dominantly inherited retinitis pigmentosa, lung disease, bleeding disorder, hemophilia A, hemophilia B, thalassemia, blood disorder, anemia, Huntington's disease, epilepsy, lysosomal storage disease, copper or iron accumulation disorders, Wilson's disease, Menkes disease, lysosomal acid lipase deficiency, a neurological or neurodegenerative disorder, cancer, type 1 diabetes, type 2 diabetes, Gaucher's disease, Hurler's disease, adenosine deaminase deficiency, glycogen storage diseases, a retinal degenerative disease, RPE65 deficiency, brain disease, liver disease, kidney disease, heart disease, infectious viral disease, bacterial disease or fungal disease,

wherein said medicament is to be administered to a mammal or a cell of said mammal, thereby delivering or transferring the heterologous polynucleotide sequence into the mammal or cell of the mammal.

2. The use of claim 1, wherein the heterologous polynucleotide sequence is operably linked to an expression control element conferring transcription of said heterologous polynucleotide sequence.

3. Use of an adeno-associated virus (AAV) vector in the manufacture of a medicament for treating a mammal deficient in protein expression or function, said vector comprising a heterologous polynucleotide encoding a polypeptide that can correct for the deficient protein expression or function, wherein the heterologous polynucleotide sequence is operably linked to an expression control element conferring transcription of said heterologous polynucleotide sequence; wherein said vector comprises a VP1 sequence having more than 99% identity to:
MAADGYLPDWLEDNLSEGIREWWDLKPGAPKPKANQQKQDNGRGLVLPGYKYLGPF
NGLDKGEPVNAADAAALEHDKAYDQQLQAGDNPYLRYNHADAEFQERLQEDTSFGGN
LGRAVFQAKKRVLEPLGLVESPVKTAPGKKRPVEPSPQRSPDSSTGIGKKGQQPAKKRL
NFGQTGDSESVPDPQPIGEPPAGPSGLGSGTMAAGGGAPMADNNEGADGVGSSSGNWH
CDSTWLGDRVITTSTRTWALPTYNNHLYKQISNGTSGGSTNDNTYFGYSTPWGYFDFN
RFHCHFSPRDWQRLINNNWGFRPKRLNFKLFNIQVKEVTQNEGTKTIANNLTSTIQVFTD
SEYQLPYVLGSAHQGCLPPFPADVFMIPQYGYLTLNNGSQAVGRSSFYCLEYFPSQMLR
TGNNFEFSYNFEDVPFHSSYAHSQSLDRLMNPLIDQYLYYLSRTQSTGGTAGTQQLLFSQ
AGPNNMSAQAKNWLPGPCYRQQRVSTTLSQNNNSNFAWTGATKYHLNGRDSLVNPG

VAMATHKDDEERFFPSSGVLMFGKQGAGKDNVDYSSVMLTSEEEIKTTNPVATEQYGV
VADNLQQQNAAPIVGAVNSQGALPGMVWQNRDVYLQGPIWAKIPHTDGNFHPSPLMG
GFGLKHPPPQILIKNTPVPADPPTTFNQAKLASFITQYSTGQVSVEIEWELQKENSKRWNP
EIQYTSNYYKSTNVDFAVNTEGTYSEPRPIGTRYLTRNL and wherein said vector is to be administered to a mammal wherein said polypeptide is expressed in the mammal.

4. Use of an adeno-associated virus (AAV) vector comprising a VP1 sequence having more than 99% identity to:
MAADGYLPDWLEDNLSEGIREWWDLKPGAPKPKANQQKQDNGRGLVLPGYKYLGPF
NGLDKGEPVNAADAAALEHDKAYDQQLQAGDNPYLRYNHADAEFQERLQEDTSFGGN
LGRAVFQAKKRVLEPLGLVESPVKTAPGKKRPVEPSPQRSPDSSTGIGKKGQQPAKKRL
NFGQTGDSESVPDPQPIGEPPAGPSGLGSGTMAAGGGAPMADNNEGADGVGSSSGNWH
CDSTWLGDRVITTSTRTWALPTYNNHLYKQISNGTSGGSTNDNTYFGYSTPWGYFDFN
RFHCHFSPRDWQRLINNNWGFRPKRLNFKLFNIQVKEVTQNEGTKTIANNLTSTIQVFTD
SEYQLPYVLGSAHQGCLPPFPADVFMIPQYGYLTLNNGSQAVGRSSFYCLEYFPSQMLR
TGNNFEFSYNFEDVPFHSSYAHSQSLDRLMNPLIDQYLYYLSRTQSTGGTAGTQQLLFSQ
AGPNNMSAQAKNWLPGPCYRQQRVSTTLSQNNNSNFAWTGATKYHLNGRDSLVNPG
VAMATHKDDEERFFPSSGVLMFGKQGAGKDNVDYSSVMLTSEEEIKTTNPVATEQYGV
VADNLQQQNAAPIVGAVNSQGALPGMVWQNRDVYLQGPIWAKIPHTDGNFHPSPLMG
GFGLKHPPPQILIKNTPVPADPPTTFNQAKLASFITQYSTGQVSVEIEWELQKENSKRWNP
EIQYTSNYYKSTNVDFAVNTEGTYSEPRPIGTRYLTRNL,

in the manufacture of a medicament for treating cystic fibrosis, Choroideremia, LCA-Lebercilin, Gyrate Atrophy, X-linked Retinoschisis, Usher's Syndrome 1C, retinitis pigmentosa, Connexin 26 deafness, Achromatopsia, Polycystic kidney disease, a lysosomal storage disease, a polynucleotide repeat disease, dentatorubropallidolusyan atropy, spinobulbar muscular atrophy, spinocerebellar ataxia (type 1, 2, 3, 6, 7, 8, 12 17), fragile X syndrome, fragile X-associated tremor/ataxia syndrome, myotonic dystrophy, Friedreich's ataxia, amyotrophic lateral sclerosis (ALS), Parkinson's disease, Alzheimer's disease, hypercoloesterolemia, HIV infection, Rous sarcoma virus (RSV) infection, hepatitis C virus infection, acute kidney injury, delayed graft function kidney transplant, kidney injury acute renal failure, advance recurrent or metastatic solid malignancies, metastatic melanoma, chronic myeloid leukemia, solid tumors, liver tumors,

familial adenomatous polyposis, glaucoma, diabetic macular oedma (DME), age-related macular degeneration, choroidal neovascularization, non-arteritic ischaemic optic neuropathy, pachyonychia congenital, influenza infection, severe acute respiratory syndrome (SARS), respiratory syncytial virus infection, Ebola infection, hepatitis B virus infection, herpes simplex virus infection, coxsackievirus B3 infection, primary dystonia, autosomal dominantly inherited retinitis pigmentosa, lung disease, bleeding disorder, hemophilia A, hemophilia B, thalassemia, blood disorder, anemia, Huntington's disease, epilepsy, lysosomal storage disease, copper or iron accumulation disorders, Wilson's disease, Menkes disease, lysosomal acid lipase deficiency, a neurological or neurodegenerative disorder, cancer, type 1 diabetes, type 2 diabetes, Gaucher's disease, Hurler's disease, adenosine deaminase deficiency, glycogen storage diseases, a retinal degenerative disease, RPE65 deficiency, brain disease, liver disease, kidney disease, heart disease, infectious viral disease, bacterial disease or fungal disease,

wherein said medicament is to be administered to a mammal or a cell of said mammal, thereby delivering or transferring a heterologous polynucleotide sequence into the mammal or cell of the mammal, wherein the mammal is sero-negative for AAV-Rh74.

5. Use of an adeno-associated virus vector (AAV) comprising a VP1 sequence having more than 99% identity to:

MAADGYLPDWLEDNLSEGIREWWDLKPGAPKPKANQQKQDNGRGLVLPGYKYLGPF
NGLDKGEPVNAADAAALEHDKAYDQQLQAGDNPYLRYNHADAEFQERLQEDTSFGGN
LGRAVFQAKKRVLEPLGLVESPVKTAPGKKRPVEPSPQRSPDSSTGIGKKGQQPAKKRL
NFGQTGDSESVPDPQPIGEPPAGPSGLGSGTMAAGGGAPMADNNEGADGVGSSSGNWH
CDSTWLGDRVITTSTRTWALPTYNNHLYKQISNGTSGGSTNDNTYFGYSTPWGYFDFN
RFHCHFSPRDWQRLINNNWGFRPKRLNFKLFNIQVKEVTQNEGTKTIANNLTSTIQVFTD
SEYQLPYVLGSAHQGCLPPFPADVFMIPQYGYLTLNNGSQAVGRSSFYCLEYFPSQMLR
TGNNFEFSYNFEDVPFHSSYAHSQSLDRLMNPLIDQYLYYLSRTQSTGGTAGTQQLLFSQ
AGPNNMSAQAKNWLPGPCYRQQRVSTTLSQNNNSNFAWTGATKYHLNGRDSLVNPG
VAMATHKDDEERFFPSSGVLMFGKQGAGKDNVDYSSVMLTSEEEIKTTNPVATEQYGV
VADNLQQQNAAPIVGAVNSQGALPGMVWQNRDVYLQGPIWAKIPHTDGNFHPSPLMG
GFGLKHPPPQILIKNTPVPADPPTTFNQAKLASFITQYSTGQVSVEIEWELQKENSKRWNP
EIQYTSNYYKSTNVDFAVNTEGTYSEPRPIGTRYLTRNL, and

empty capsid AAV-Rh74,

in the manufacture of a medicament for treating cystic fibrosis, Choroideremia, LCA-Lebercilin, Gyrate Atrophy, X-linked Retinoschisis, Usher's Syndrome 1C, retinitis pigmentosa, Connexin 26 deafness, Achromatopsia, Polycystic kidney disease, a lysosomal storage disease, a polynucleotide repeat disease, dentatorubropallidolusyan atropy, spinobulbar muscular atrophy, spinocerebellar ataxia (type 1, 2, 3, 6, 7, 8, 12 17), fragile X syndrome, fragile X-associated tremor/ataxia syndrome, myotonic dystrophy, Friedreich's ataxia, amyotrophic lateral sclerosis (ALS), Parkinson's disease, Alzheimer's disease, hypercoloesterolemia, HIV infection, Rous sarcoma virus (RSV) infection, hepatitis C virus infection, acute kidney injury, delayed graft function kidney transplant, kidney injury acute renal failure, advance recurrent or metastatic solid malignancies, metastatic melanoma, chronic myeloid leukemia, solid tumors, liver tumors, familial adenomatous polyposis, glaucoma, diabetic macular oedma (DME), age-related macular degeneration, choroidal neovascularization, non-arteritic ischaemic optic neuropathy, pachyonychia congenital, influenza infection, severe acute respiratory syndrome (SARS), respiratory syncytial virus infection, Ebola infection, hepatitis B virus infection, herpes simplex virus infection, coxsackievirus B3 infection, primary dystonia, autosomal dominantly inherited retinitis pigmentosa, lung disease, bleeding disorder, hemophilia A, hemophilia B, thalassemia, blood disorder, anemia, Huntington's disease, epilepsy, lysosomal storage disease, copper or iron accumulation disorders, Wilson's disease, Menkes disease, lysosomal acid lipase deficiency, a neurological or neurodegenerative disorder, cancer, type 1 diabetes, type 2 diabetes, Gaucher's disease, Hurler's disease, adenosine deaminase deficiency, glycogen storage diseases, a retinal degenerative disease, RPE65 deficiency, brain disease, liver disease, kidney disease, heart disease, infectious viral disease, bacterial disease or fungal disease,

wherein said medicament is to be administered to a mammal or a cell of said mammal, thereby delivering or transferring a heterologous polynucleotide sequence into the mammal or cell of the mammal.

6. The use of any of claims 1 to 5, wherein said adeno-associated virus (AAV) vector comprises an AAV with a VP2 sequence having 90% or more sequence identity to:
TAPGKKRPVEPSPQRSPDSSTGIGKKGQQPAKKRLNFGQTGDSESVPDPQPIGEPPAGPS
GLGSGTMAAGGGAPMADNNEGADGVGSSSGNWHCDSTWLGDRVITTSTRTWALPTY

NNHLYKQISNGTSGGSTNDNTYFGYSTPWGYFDFNRFHCHFSPRDWQRLINNNWGFRP
KRLNFKLFNIQVKEVTQNEGTKTIANNLTSTIQVFTDSEYQLPYVLGSAHQGCLPPFPAD
VFMIPQYGYLTLNNGSQAVGRSSFYCLEYFPSQMLRTGNNFEFSYNFEDVPFHSSYAHS
QSLDRLMNPLIDQYLYYLSRTQSTGGTAGTQQLLFSQAGPNNMSAQAKNWLPGPCYRQ
QRVSTTLSQNNNSNFAWTGATKYHLNGRDSLVNPGVAMATHKDDEERFFPSSGVLMF
GKQGAGKDNVDYSSVMLTSEEEIKTTNPVATEQYGVVADNLQQQNAAPIVGAVNSQG
ALPGMVWQNRDVYLQGPIWAKIPHTDGNFHPSPLMGGFGLKHPPPQILIKNTPVPADPP
TTFNQAKLASFITQYSTGQVSVEIEWELQKENSKRWNPEIQYTSNYYKSTNVDFAVNTE
GTYSEPRPIGTRYLTRNL; and/or a VP3 sequence having 90% or more sequence identity to:
MAAGGGAPMADNNEGADGVGSSSGNWHCDSTWLGDRVITTSTRTWALPTYNNHLYK
QISNGTSGGSTNDNTYFGYSTPWGYFDFNRFHCHFSPRDWQRLINNNWGFRPKRLNFKL
FNIQVKEVTQNEGTKTIANNLTSTIQVFTDSEYQLPYVLGSAHQGCLPPFPADVFMIPQY
GYLTLNNGSQAVGRSSFYCLEYFPSQMLRTGNNFEFSYNFEDVPFHSSYAHSQSLDRLM
NPLIDQYLYYLSRTQSTGGTAGTQQLLFSQAGPNNMSAQAKNWLPGPCYRQQRVSTTL
SQNNNSNFAWTGATKYHLNGRDSLVNPGVAMATHKDDEERFFPSSGVLMFGKQGAGK
DNVDYSSVMLTSEEEIKTTNPVATEQYGVVADNLQQQNAAPIVGAVNSQGALPGMVW
QNRDVYLQGPIWAKIPHTDGNFHPSPLMGGFGLKHPPPQILIKNTPVPADPPTTFNQAKL
ASFITQYSTGQVSVEIEWELQKENSKRWNPEIQYTSNYYKSTNVDFAVNTEGTYSEPRPI
GTRYLTRNL.

7. The use of any of claims 1 to 5, wherein said adeno-associated virus (AAV) vector comprises an AAV with a VP1 sequence having 99.1% or more sequence identity to:
MAADGYLPDWLEDNLSEGIREWWDLKPGAPKPKANQQKQDNGRGLVLPGYKYLGPF
NGLDKGEPVNAADAAALEHDKAYDQQLQAGDNPYLRYNHADAEFQERLQEDTSFGGN
LGRAVFQAKKRVLEPLGLVESPVKTAPGKKRPVEPSPQRSPDSSTGIGKKGQQPAKKRL
NFGQTGDSESVPDPQPIGEPPAGPSGLGSGTMAAGGGAPMADNNEGADGVGSSSGNWH
CDSTWLGDRVITTSTRTWALPTYNNHLYKQISNGTSGGSTNDNTYFGYSTPWGYFDFN
RFHCHFSPRDWQRLINNNWGFRPKRLNFKLFNIQVKEVTQNEGTKTIANNLTSTIQVFTD
SEYQLPYVLGSAHQGCLPPFPADVFMIPQYGYLTLNNGSQAVGRSSFYCLEYFPSQMLR
TGNNFEFSYNFEDVPFHSSYAHSQSLDRLMNPLIDQYLYYLSRTQSTGGTAGTQQLLFSQ
AGPNNMSAQAKNWLPGPCYRQQRVSTTLSQNNNSNFAWTGATKYHLNGRDSLVNPG

VAMATHKDDEERFFPSSGVLMFGKQGAGKDNVDYSSVMLTSEEEIKTTNPVATEQYGV
VADNLQQQNAAPIVGAVNSQGALPGMVWQNRDVYLQGPIWAKIPHTDGNFHPSPLMG
GFGLKHPPPQILIKNTPVPADPPTTFNQAKLASFITQYSTGQVSVEIEWELQKENSKRWNP
EIQYTSNYYKSTNVDFAVNTEGTYSEPRPIGTRYLTRNL.

8. The use of any of claims 1 to 5, wherein said adeno-associated virus (AAV) vector comprises an AAV with a VP1 sequence having 99.3% or more sequence identity to:
MAADGYLPDWLEDNLSEGIREWWDLKPGAPKPKANQQKQDNGRGLVLPGYKYLGPF
NGLDKGEPVNAADAAALEHDKAYDQQLQAGDNPYLRYNHADAEFQERLQEDTSFGGN
LGRAVFQAKKRVLEPLGLVESPVKTAPGKKRPVEPSPQRSPDSSTGIGKKGQQPAKKRL
NFGQTGDSESVPDPQPIGEPPAGPSGLGSGTMAAGGGAPMADNNEGADGVGSSSGNWH
CDSTWLGDRVITTSTRTWALPTYNNHLYKQISNGTSGGSTNDNTYFGYSTPWGYFDFN
RFHCHFSPRDWQRLINNNWGFRPKRLNFKLFNIQVKEVTQNEGTKTIANNLTSTIQVFTD
SEYQLPYVLGSAHQGCLPPFPADVFMIPQYGYLTLNNGSQAVGRSSFYCLEYFPSQMLR
TGNNFEFSYNFEDVPFHSSYAHSQSLDRLMNPLIDQYLYYLSRTQSTGGTAGTQQLLFSQ
AGPNNMSAQAKNWLPGPCYRQQRVSTTLSQNNNSNFAWTGATKYHLNGRDSLVNPG
VAMATHKDDEERFFPSSGVLMFGKQGAGKDNVDYSSVMLTSEEEIKTTNPVATEQYGV
VADNLQQQNAAPIVGAVNSQGALPGMVWQNRDVYLQGPIWAKIPHTDGNFHPSPLMG
GFGLKHPPPQILIKNTPVPADPPTTFNQAKLASFITQYSTGQVSVEIEWELQKENSKRWNP
EIQYTSNYYKSTNVDFAVNTEGTYSEPRPIGTRYLTRNL.

9. The use of any of claims 1 to 5, wherein said adeno-associated virus (AAV) vector comprises an AAV with a VP1 sequence having 99.5% or more sequence identity to:
MAADGYLPDWLEDNLSEGIREWWDLKPGAPKPKANQQKQDNGRGLVLPGYKYLGPF
NGLDKGEPVNAADAAALEHDKAYDQQLQAGDNPYLRYNHADAEFQERLQEDTSFGGN
LGRAVFQAKKRVLEPLGLVESPVKTAPGKKRPVEPSPQRSPDSSTGIGKKGQQPAKKRL
NFGQTGDSESVPDPQPIGEPPAGPSGLGSGTMAAGGGAPMADNNEGADGVGSSSGNWH
CDSTWLGDRVITTSTRTWALPTYNNHLYKQISNGTSGGSTNDNTYFGYSTPWGYFDFN
RFHCHFSPRDWQRLINNNWGFRPKRLNFKLFNIQVKEVTQNEGTKTIANNLTSTIQVFTD
SEYQLPYVLGSAHQGCLPPFPADVFMIPQYGYLTLNNGSQAVGRSSFYCLEYFPSQMLR
TGNNFEFSYNFEDVPFHSSYAHSQSLDRLMNPLIDQYLYYLSRTQSTGGTAGTQQLLFSQ

AGPNNMSAQAKNWLPGPCYRQQRVSTTLSQNNNSNFAWTGATKYHLNGRDSLVNPG
VAMATHKDDEERFFPSSGVLMFGKQGAGKDNVDYSSVMLTSEEEIKTTNPVATEQYGV
VADNLQQQNAAPIVGAVNSQGALPGMVWQNRDVYLQGPIWAKIPHTDGNFHPSPLMG
GFGLKHPPPQILIKNTPVPADPPTTFNQAKLASFITQYSTGQVSVEIEWELQKENSKRWNP
EIQYTSNYYKSTNVDFAVNTEGTYSEPRPIGTRYLTRNL.

10. The use of any of claims 1 to 5, wherein said adeno-associated virus (AAV) vector comprises an AAV with a VP2, or VP3 sequence having 95% or more identity to VP2, or VP3 sequences set forth in Figure 3.

11. The use of any of claims 1 to 5, wherein said adeno-associated virus (AAV) vector comprises a VP2, or VP3 sequence having 96% or more identity to VP2, or VP3 sequences set forth in Figure 3.

12. The use of any of claims 1 to 5, wherein said adeno-associated virus (AAV) vector comprises a VP2, or VP3 sequence having 97% or more identity to VP2, or VP3 sequences set forth in Figure 3.

13. The use of any of claims 1 to 5, wherein said adeno-associated virus (AAV) vector comprises a VP2, or VP3 sequence having 98% or more identity to VP2, or VP3 sequences set forth in Figure 3.

14. The use of any of claims 1 to 5, wherein said adeno-associated virus (AAV) vector comprises a VP2, or VP3 sequence having 99% or more identity to VP2, or VP3 sequences set forth in Figure 3.

15. The use of any of claims 1 to 5, wherein said adeno-associated virus (AAV) vector comprises a VP2, or VP3 sequence having 99.5% or more identity to VP2, or VP3 sequences set forth in Figure 3.

16. The use of any of claims 1 to 5, wherein said adeno-associated virus (AAV) vector comprises a VP1, VP2, or VP3 sequence of AAV-Rh74 set forth in Figure 3.

17. The use of any of claims 1 to 5, wherein said heterologous polynucleotide sequence, or said protein, is expressed at levels having a therapeutic effect on the mammal.

18. The use of any of claims 1 to 5, wherein said adeno-associated virus (AAV) vector has increased tropism for hepatocytes compared to AAV2 or AAV8.

19. The use of any of claims 1 to 5, wherein said heterologous polynucleotide sequence or said protein is expressed in a cell, tissue or organ of said mammal.

20. The use of claim 19, wherein the cell comprises a secretory cell.

21. The use of claim 19, wherein the cell comprises an endocrine cell.

22. The use of claim 19, wherein the cell comprises hepatocyte, a neural cell, a glial cell, a retinal cell, an epithelial cell, a lung cell or a totipotent, pluripotent or multipotent stem cell.

23. The use of claim 19, wherein the tissue or organ of said mammal comprises liver, brain, central nervous system, spinal cord, eye, retina or lung.

24. The use of any of claims 1 to 5, wherein the mammal produces an insufficient amount of a protein, or a defective or aberrant protein.

25. The use of claim 24, wherein the protein comprises CFTR (cystic fibrosis transmembrane regulator protein), a blood coagulation (clotting) factor (Factor XIII, Factor IX, Factor X, Factor VIII, Factor VIIa, protein C, etc.) a gain of function blood coagulation factor, an antibody, retinal pigment epithelium-specific 65 kDa protein (RPE65), erythropoietin, LDL receptor, lipoprotein lipase, ornithine transcarbamylase, β-globin, α-globin, spectrin, α-antitrypsin, adenosine deaminase (ADA), a metal transporter (ATP7A or ATP7), sulfamidase, an enzyme involved in

lysosomal storage disease (ARSA), hypoxanthine guanine phosphoribosyl transferase, β-25 glucocerebrosidase, sphingomyelinase, lysosomal hexosaminidase, branched-chain keto acid dehydrogenase, a hormone, a growth factor, insulin-like growth factor 1 or 2, platelet derived growth factor, epidermal growth factor, nerve growth factor, neurotrophic factor -3 and -4, brain-derived neurotrophic factor, glial derived growth factor, transforming growth factor α and β, a cytokine, α-interferon, β-interferon, interferon-γ, interleukin-2, interleukin-4, interleukin 12, granulocyte-macrophage colony stimulating factor, lymphotoxin, a suicide gene product, herpes simplex virus thymidine kinase, cytosine deaminase, diphtheria toxin, cytochrome P450, deoxycytidine kinase, tumor necrosis factor, a drug resistance protein, a tumor suppressor protein (*e.g.*, p53, Rb, Wt-1, NF1, Von Hippel–Lindau (VHL), adenomatous polyposis coli (APC)), a peptide with immunomodulatory properties, a tolerogenic or immunogenic peptide or protein Tregitope or hCDR1, insulin, glucokinase, guanylate cyclase 2D (LCA-GUCY2D), Rab escort protein 1 (Choroideremia), LCA 5 (LCA-Lebercilin), ornithine ketoacid aminotransferase (Gyrate Atrophy), Retinoschisin 1 (X-linked Retinoschisis), USH1C (Usher's Syndrome 1C), X-linked retinitis pigmentosa GTPase (XLRP), MERTK (AR forms of RP: retinitis pigmentosa), DFNB1 (Connexin 26 deafness), ACHM 2, 3 and 4 (Achromatopsia), PKD-1 or PKD-2 (Polycystic kidney disease), TPP1, CLN2, a gene product implicated in lysosomal storage diseases (e.g., sulfatases, N-acetylglucosamine-1-phosphate transferase, cathepsin A, GM2-AP, NPC1, VPC2, a sphingolipid activator protein, or one or more zinc finger nucleases for genome editing, or donor sequences used as repair templates for genome editing.

26. The use of any of claims 1 to 5, wherein the heterologous polynucleotide sequence comprises a gene encoding a polypeptide, peptide or a protein.

27. The use of claim 26, wherein the gene encodes a therapeutic peptide or protein.

28. The use of claim 26, wherein the gene comprises or encodes CFTR (cystic fibrosis transmembrane regulator protein), a blood coagulation (clotting) factor (Factor XIII, Factor IX, Factor X, Factor VII, Factor VIIa, protein C, etc.) a gain of function blood coagulation factor, an antibody, retinal pigment epithelium-specific 65 kDa protein (RPE65), erythropoietin, LDL receptor, lipoprotein lipase, ornithine transcarbamylase, β-globin, α-globin, spectrin, α-

antitrypsin, adenosine deaminase (ADA), a metal transporter (ATP7A or ATP7), sulfamidase, an enzyme involved in lysosomal storage disease (ARSA), hypoxanthine guanine phosphoribosyl transferase, β-25 glucocerebrosidase, sphingomyelinase, lysosomal hexosaminidase, branched-chain keto acid dehydrogenase, a hormone, a growth factor, insulin-like growth factor 1 or 2, platelet derived growth factor, epidermal growth factor, nerve growth factor, neurotrophic factor -3 and -4, brain-derived neurotrophic factor, glial derived growth factor, transforming growth factor α and β, a cytokine, α-interferon, β-interferon, interferon-γ, interleukin-2, interleukin-4, interleukin 12, granulocyte-macrophage colony stimulating factor, lymphotoxin, a suicide gene product, herpes simplex virus thymidine kinase, cytosine deaminase, diphtheria toxin, cytochrome P450, deoxycytidine kinase, tumor necrosis factor, a drug resistance protein, a tumor suppressor protein (*e.g.*, p53, Rb, Wt-1, NF1, Von Hippel–Lindau (VHL), adenomatous polyposis coli (APC)), a peptide with immunomodulatory properties, a tolerogenic or immunogenic peptide or protein Tregitope or hCDR1, insulin, glucokinase, guanylate cyclase 2D (LCA-GUCY2D), Rab escort protein 1 (Choroideremia), LCA 5 (LCA-Lebercilin), ornithine ketoacid aminotransferase (Gyrate Atrophy), Retinoschisin 1 (X-linked Retinoschisis), USH1C (Usher's Syndrome 1C), X-linked retinitis pigmentosa GTPase (XLRP), MERTK (AR forms of RP: retinitis pigmentosa), DFNB1 (Connexin 26 deafness), ACHM 2, 3 and 4 (Achromatopsia), PKD-1 or PKD-2 (Polycystic kidney disease), TPP1, CLN2, a gene product implicated in lysosomal storage diseases (e.g., sulfatases, N-acetylglucosamine-1-phosphate transferase, cathepsin A, GM2-AP, NPC1, VPC2, a sphingolipid activator protein or one or more zinc finger nucleases for genome editing, or donor sequences used as repair templates for genome editing.

29. The use of claim 1, wherein the heterologous polynucleotide sequence comprises an inhibitory nucleic acid.

30. The use of claim 29, wherein the inhibitory nucleic acid comprises micro-RNA (miRNA), siRNA, shRNA, trans-splicing RNA, antisense RNA or triplex forming RNA.

31. The use of claim 29, wherein the inhibitory nucleic acid binds to a pathogenic gene, a transcript of a pathogenic gene, or a gene transcript associated with a polynucleotide repeat disease, a huntingtin (HTT) gene, a gene associated with dentatorubropallidolusyan atropy

(atrophin 1, ATN1), androgen receptor on the X chromosome in spinobulbar muscular atrophy, human Ataxin-1, -2, -3, and -7, $Ca_v2.1$ P/Q voltage-dependent calcium channel is encoded by the (CACNA1A), TATA-binding protein, Ataxin 8 opposite strand, also known as ATXN8OS, Serine/threonine-protein phosphatase 2A 55 kDa regulatory subunit B beta isoform in spinocerebellar ataxia (type 1, 2, 3, 6, 7, 8, 12 17), *FMR1* (fragile X mental retardation 1) in fragile X syndrome, *FMR1* (fragile X mental retardation 1) in fragile X-associated tremor/ataxia syndrome, *FMR1* (fragile X mental retardation 2) or AF4/FMR2 family member 2 in fragile XE mental retardation; Myotonin-protein kinase (MT-PK) in myotonic dystrophy; Frataxin in Friedreich's ataxia; a mutant of superoxide dismutase 1 (SOD1) gene in amyotrophic lateral sclerosis; a gene involved in pathogenesis of Parkinson's disease and/or Alzheimer's disease; apolipoprotein B (APOB) and proprotein convertase subtilisin/kexin type 9 (PCSK9), hypercoloesterolemia; HIV Tat, human immunodeficiency virus transactivator of transcription gene, in HIV infection; HIV TAR, HIV TAR, human immunodeficiency virus transactivator response element gene, in HIV infection; C-C chemokine receptor (CCR5) in HIV infection; Rous sarcoma virus (RSV) nucleocapsid protein in RSV infection, liver-specific microRNA (miR-122) in hepatitis C virus infection; p53, acute kidney injury or delayed graft function kidney transplant or kidney injury acute renal failure; protein kinase N3 (PKN3) in advance recurrent or metastatic solid malignancies; LMP2, LMP2 also known as proteasome subunit beta-type 9 (PSMB 9), metastatic melanoma; LMP7,also known as proteasome subunit beta-type 8 (PSMB 8), metastatic melanoma; MECL1 also known as proteasome subunit beta-type 10 (PSMB 10), metastatic melanoma; vascular endothelial growth factor (VEGF) in solid tumors; kinesin spindle protein in solid tumors, apoptosis suppressor B-cell CLL/lymphoma (BCL-2) in chronic myeloid leukemia; ribonucleotide reductase M2 (RRM2) in solid tumors; Furin in solid tumors; polo-like kinase 1 (PLK1) in liver tumors, diacylglycerol acyltransferase 1 (DGAT1) in hepatitis C infection, beta-catenin in familial adenomatous polyposis; beta2 adrenergic receptor, glaucoma; RTP801/Redd1 also known as DAN damage-inducible transcript 4 protein, in diabetic macular oedma (DME) or age-related macular degeneration; vascular endothelial growth factor receptor I (VEGFR1) in age-related macular degeneration or choroidal neivascularization, caspase 2 in non-arteritic ischaemic optic neuropathy; Keratin 6A N17K mutant protein in pachyonychia congenital; influenza A virus genome/gene sequences in influenza infection; severe acute respiratory syndrome (SARS) coronavirus genome/gene sequences in SARS

infection; respiratory syncytial virus genome/gene sequences in respiratory syncytial virus infection; Ebola filovirus genome/gene sequence in Ebola infection; hepatitis B and C virus genome/gene sequences in hepatitis B and C infection; herpes simplex virus (HSV) genome/gene sequences in HSV infection, coxsackievirus B3 genome/gene sequences in coxsackievirus B3 infection; silencing of a pathogenic allele of a gene (allele-specific silencing) like torsin A (TOR1A) in primary dystonia, pan-class I and HLA-allele specific in transplant; or mutant rhodopsin gene (RHO) in autosomal dominantly inherited retinitis pigmentosa (adRP).

32. The use of any of claims 1 to 5, wherein the mammal has a lung disease (*e.g.*, cystic fibrosis), a bleeding disorder (*e.g.*, hemophilia A or hemophilia B with or without inhibitors), thalassemia, a blood disorder (*e.g.*, anemia), Alzheimer's disease, Parkinson's disease, Huntington's disease, amyotrophic lateral sclerosis (ALS), epilepsy, lysosomal storage diseases, a copper or iron accumulation disorders (*e.g.*, Wilson's or Menkes disease) lysosomal acid lipase deficiency, a neurological or neurodegenerative disorder, cancer, type 1 or type 2 diabetes, Gaucher's disease, Hurler's disease, adenosine deaminase deficiency, a metabolic defect (*e.g.*, glycogen storage diseases), a retinal degenerative disease (such as RPE65 deficiency, choroideremia, and other diseases of the eye), a disease of solid organs (*e.g.*, brain, liver, kidney, heart), or an infectious viral (*e.g.*, hepatitis B and C, HIV, etc.), bacterial or fungal disease.

33. The use of any of claims 1 to 5, wherein the expression control element comprises a constitutive or regulatable control element.

34. The use of any of claims 1 to 5, wherein the expression control element comprises a tissue-specific expression control element or promoter.

35. The use of any of claims 1 to 5, wherein the AAV vector is prepared to be delivered intravenously, intraarterially, intramuscularly, subcutaneously, orally, by intubation, via catheter, dermally, intra-cranially, via inhalation, intra-cavity, or mucosally.

36. The use of any of claims 1 to 5, wherein the mammal is human.

37. The use of any of claims 1 to 5, wherein the mammal is sero-positive for an AAV serotype other than AAV-Rh74.

38. The use of any of claims 1 to 5, wherein the mammal is sero-positive for an AAV serotype AAV1, AAV2, AAV3, AAV4, AAV5, AAV6, AAV7, AAV8, AAV9, AAV10 or AAV11.

39. The use of any of claims 1 to 3 or 5, wherein the mammal is sero-negative for AAV-Rh74.

40. The use of any of claims 1 to 4, further comprising use of empty capsid AAV in the preparation of a pharmaceutical.

41. The use of any of claims 1 to 4, further comprising use of empty capsid AAV-Rh74.

42. The use of any of claims 1 to 5, wherein the VP1 sequence has 1, 2, 3, 4, 5, 6, or 7 conservative, non-conservative, or conservative and non-conservative amino acid substitutions.

43. The use of any of claims 1 to 5, wherein the VP2 or VP3 sequence has 1, 2, 3, 4, 5, 6, 7, 8, 9 or 10 conservative, non-conservative, or conservative and non-conservative amino acid substitutions.

44. The use of any of claims 1 to 5, wherein the AAV comprises a pharmaceutical composition.

45. The use of any of claims 1 to 4, wherein the pharmaceutical composition comprises empty capsid AAV.

46. The use of any of claims 1 to 4, wherein the pharmaceutical composition comprises empty capsid AAV-Rh74.

What is claimed:

1. Use of an adeno-associated virus (AAV) vector comprising a heterologous polynucleotide sequence and a VP1 sequence having 100% identity to:
MAADGYLPDWLEDNLSEGIREWWDLKPGAPKPKANQQKQDNGRGLVLPGYKYLGPF
NGLDKGEPVNAADAAALEHDKAYDQQLQAGDNPYLRYNHADAEFQERLQEDTSFGGN
LGRAVFQAKKRVLEPLGLVESPVKTAPGKKRPVEPSPQRSPDSSTGIGKKGQQPAKKRL
NFGQTGDSESVPDPQPIGEPPAGPSGLGSGTMAAGGGAPMADNNEGADGVGSSSGNWH
CDSTWLGDRVITTSTRTWALPTYNNHLYKQISNGTSGGSTNDNTYFGYSTPWGYFDFN
RFHCHFSPRDWQRLINNNWGFRPKRLNFKLFNIQVKEVTQNEGTKTIANNLTSTIQVFTD
SEYQLPYVLGSAHQGCLPPFPADVFMIPQYGYLTLNNGSQAVGRSSFYCLEYFPSQMLR
TGNNFEFSYNFEDVPFHSSYAHSQSLDRLMNPLIDQYLYYLSRTQSTGGTAGTQQLLFSQ
AGPNNMSAQAKNWLPGPCYRQQRVSTTLSQNNNSNFAWTGATKYHLNGRDSLVNPG
VAMATHKDDEERFFPSSGVLMFGKQGAGKDNVDYSSVMLTSEEEIKTTNPVATEQYGV
VADNLQQQNAAPIVGAVNSQGALPGMVWQNRDVYLQGPIWAKIPHTDGNFHPSPLMG
GFGLKHPPPQILIKNTPVPADPPTTFNQAKLASFITQYSTGQVSVEIEWELQKENSKRWNP
EIQYTSNYYKSTNVDFAVNTEGTYSEPRPIGTRYLTRNL,

in the manufacture of a medicament for treating cystic fibrosis, Choroideremia, LCA-Lebercilin, Gyrate Atrophy, X-linked Retinoschisis, Usher's Syndrome 1C, retinitis pigmentosa, Connexin 26 deafness, Achromatopsia, Polycystic kidney disease, a lysosomal storage disease, a polynucleotide repeat disease, dentatorubropallidolusyan atropy, spinobulbar muscular atrophy, spinocerebellar ataxia (type 1, 2, 3, 6, 7, 8, 12 17), fragile X syndrome, fragile X-associated tremor/ataxia syndrome, myotonic dystrophy, Friedreich's ataxia, amyotrophic lateral sclerosis (ALS), Parkinson's disease, Alzheimer's disease, hypercoloesterolemia, HIV infection, Rous sarcoma virus (RSV) infection, hepatitis C virus infection, acute kidney injury, delayed graft function kidney transplant, kidney injury acute renal failure, advance recurrent or metastatic solid malignancies, metastatic melanoma, chronic myeloid leukemia, solid tumors, liver tumors, familial adenomatous polyposis, glaucoma, diabetic macular oedma (DME), age-related macular degeneration, choroidal neovascularization, non-arteritic ischaemic optic neuropathy, pachyonychia congenital, influenza infection, severe acute respiratory syndrome (SARS), respiratory syncytial virus infection, Ebola infection, hepatitis B virus infection, herpes simplex

virus infection, coxsackievirus B3 infection, primary dystonia, autosomal dominantly inherited retinitis pigmentosa, lung disease, bleeding disorder, hemophilia A, hemophilia B, thalassemia, blood disorder, anemia, Huntington's disease, epilepsy, lysosomal storage disease, copper or iron accumulation disorders, Wilson's disease, Menkes disease, lysosomal acid lipase deficiency, a neurological or neurodegenerative disorder, cancer, type 1 diabetes, type 2 diabetes, Gaucher's disease, Hurler's disease, adenosine deaminase deficiency, glycogen storage diseases, a retinal degenerative disease, RPE65 deficiency, brain disease, liver disease, kidney disease, heart disease, infectious viral disease, bacterial disease or fungal disease,

wherein said medicament is to be administered to a mammal or a cell of said mammal, thereby delivering or transferring the heterologous polynucleotide sequence into the mammal or cell of the mammal.

2. The use of claim 1, wherein the heterologous polynucleotide sequence is operably linked to an expression control element conferring transcription of said heterologous polynucleotide sequence.

3. Use of an adeno-associated virus (AAV) vector in the manufacture of a medicament for treating a mammal deficient in protein expression or function, said vector comprising a heterologous polynucleotide encoding a polypeptide that can correct for the deficient protein expression or function, wherein the heterologous polynucleotide sequence is operably linked to an expression control element conferring transcription of said heterologous polynucleotide sequence; wherein said vector comprises a VP1 sequence having 100% identity to:
MAADGYLPDWLEDNLSEGIREWWDLKPGAPKPKANQQKQDNGRGLVLPGYKYLGPF
NGLDKGEPVNAADAAALEHDKAYDQQLQAGDNPYLRYNHADAEFQERLQEDTSFGGN
LGRAVFQAKKRVLEPLGLVESPVKTAPGKKRPVEPSPQRSPDSSTGIGKKGQQPAKKRL
NFGQTGDSESVPDPQPIGEPPAGPSGLGSGTMAAGGGAPMADNNEGADGVGSSSGNWH
CDSTWLGDRVITTSTRTWALPTYNNHLYKQISNGTSGGSTNDNTYFGYSTPWGYFDFN
RFHCHFSPRDWQRLINNNWGFRPKRLNFKLFNIQVKEVTQNEGTKTIANNLTSTIQVFTD
SEYQLPYVLGSAHQGCLPPFPADVFMIPQYGYLTLNNGSQAVGRSSFYCLEYFPSQMLR
TGNNFEFSYNFEDVPFHSSYAHSQSLDRLMNPLIDQYLYYLSRTQSTGGTAGTQQLLFSQ
AGPNNMSAQAKNWLPGPCYRQQRVSTTLSQNNNSNFAWTGATKYHLNGRDSLVNPG

VAMATHKDDEERFFPSSGVLMFGKQGAGKDNVDYSSVMLTSEEEIKTTNPVATEQYGV
VADNLQQQNAAPIVGAVNSQGALPGMVWQNRDVYLQGPIWAKIPHTDGNFHPSPLMG
GFGLKHPPPQILIKNTPVPADPPTTFNQAKLASFITQYSTGQVSVEIEWELQKENSKRWNP
EIQYTSNYYKSTNVDFAVNTEGTYSEPRPIGTRYLTRNL and wherein said vector is to be administered to a mammal wherein said polypeptide is expressed in the mammal.

4. Use of an adeno-associated virus (AAV) vector comprising a VP1 sequence having 100% identity to:
MAADGYLPDWLEDNLSEGIREWWDLKPGAPKPKANQQKQDNGRGLVLPGYKYLGPF
NGLDKGEPVNAADAAALEHDKAYDQQLQAGDNPYLRYNHADAEFQERLQEDTSFGGN
LGRAVFQAKKRVLEPLGLVESPVKTAPGKKRPVEPSPQRSPDSSTGIGKKGQQPAKKRL
NFGQTGDSESVPDPQPIGEPPAGPSGLGSGTMAAGGGAPMADNNEGADGVGSSSGNWH
CDSTWLGDRVITTSTRTWALPTYNNHLYKQISNGTSGGSTNDNTYFGYSTPWGYFDFN
RFHCHFSPRDWQRLINNNWGFRPKRLNFKLFNIQVKEVTQNEGTKTIANNLTSTIQVFTD
SEYQLPYVLGSAHQGCLPPFPADVFMIPQYGYLTLNNGSQAVGRSSFYCLEYFPSQMLR
TGNNFEFSYNFEDVPFHSSYAHSQSLDRLMNPLIDQYLYYLSRTQSTGGTAGTQQLLFSQ
AGPNNMSAQAKNWLPGPCYRQQRVSTTLSQNNNSNFAWTGATKYHLNGRDSLVNPG
VAMATHKDDEERFFPSSGVLMFGKQGAGKDNVDYSSVMLTSEEEIKTTNPVATEQYGV
VADNLQQQNAAPIVGAVNSQGALPGMVWQNRDVYLQGPIWAKIPHTDGNFHPSPLMG
GFGLKHPPPQILIKNTPVPADPPTTFNQAKLASFITQYSTGQVSVEIEWELQKENSKRWNP
EIQYTSNYYKSTNVDFAVNTEGTYSEPRPIGTRYLTRNL,

in the manufacture of a medicament for treating cystic fibrosis, Choroideremia, LCA-Lebercilin, Gyrate Atrophy, X-linked Retinoschisis, Usher's Syndrome 1C, retinitis pigmentosa, Connexin 26 deafness, Achromatopsia, Polycystic kidney disease, a lysosomal storage disease, a polynucleotide repeat disease, dentatorubropallidolusyan atropy, spinobulbar muscular atrophy, spinocerebellar ataxia (type 1, 2, 3, 6, 7, 8, 12 17), fragile X syndrome, fragile X-associated tremor/ataxia syndrome, myotonic dystrophy, Friedreich's ataxia, amyotrophic lateral sclerosis (ALS), Parkinson's disease, Alzheimer's disease, hypercoloesterolemia, HIV infection, Rous sarcoma virus (RSV) infection, hepatitis C virus infection, acute kidney injury, delayed graft function kidney transplant, kidney injury acute renal failure, advance recurrent or metastatic solid malignancies, metastatic melanoma, chronic myeloid leukemia, solid tumors, liver tumors,

familial adenomatous polyposis, glaucoma, diabetic macular oedma (DME), age-related macular degeneration, choroidal neovascularization, non-arteritic ischaemic optic neuropathy, pachyonychia congenital, influenza infection, severe acute respiratory syndrome (SARS), respiratory syncytial virus infection, Ebola infection, hepatitis B virus infection, herpes simplex virus infection, coxsackievirus B3 infection, primary dystonia, autosomal dominantly inherited retinitis pigmentosa, lung disease, bleeding disorder, hemophilia A, hemophilia B, thalassemia, blood disorder, anemia, Huntington's disease, epilepsy, lysosomal storage disease, copper or iron accumulation disorders, Wilson's disease, Menkes disease, lysosomal acid lipase deficiency, a neurological or neurodegenerative disorder, cancer, type 1 diabetes, type 2 diabetes, Gaucher's disease, Hurler's disease, adenosine deaminase deficiency, glycogen storage diseases, a retinal degenerative disease, RPE65 deficiency, brain disease, liver disease, kidney disease, heart disease, infectious viral disease, bacterial disease or fungal disease,

wherein said medicament is to be administered to a mammal or a cell of said mammal, thereby delivering or transferring a heterologous polynucleotide sequence into the mammal or cell of the mammal, wherein the mammal is sero-negative for AAV-Rh74.

5. Use of an adeno-associated virus vector (AAV) comprising a VP1 sequence having 100% identity to:

MAADGYLPDWLEDNLSEGIREWWDLKPGAPKPKANQQKQDNGRGLVLPGYKYLGPF
NGLDKGEPVNAADAAALEHDKAYDQQLQAGDNPYLRYNHADAEFQERLQEDTSFGGN
LGRAVFQAKKRVLEPLGLVESPVKTAPGKKRPVEPSPQRSPDSSTGIGKKGQQPAKKRL
NFGQTGDSESVPDPQPIGEPPAGPSGLGSGTMAAGGGAPMADNNEGADGVGSSSGNWH
CDSTWLGDRVITTSTRTWALPTYNNHLYKQISNGTSGGSTNDNTYFGYSTPWGYFDFN
RFHCHFSPRDWQRLINNNWGFRPKRLNFKLFNIQVKEVTQNEGTKTIANNLTSTIQVFTD
SEYQLPYVLGSAHQGCLPPFPADVFMIPQYGYLTLNNGSQAVGRSSFYCLEYFPSQMLR
TGNNFEFSYNFEDVPFHSSYAHSQSLDRLMNPLIDQYLYYLSRTQSTGGTAGTQQLLFSQ
AGPNNMSAQAKNWLPGPCYRQQRVSTTLSQNNNSNFAWTGATKYHLNGRDSLVNPG
VAMATHKDDEERFFPSSGVLMFGKQGAGKDNVDYSSVMLTSEEEIKTTNPVATEQYGV
VADNLQQQNAAPIVGAVNSQGALPGMVWQNRDVYLQGPIWAKIPHTDGNFHPSPLMG
GFGLKHPPPQILIKNTPVPADPPTTFNQAKLASFITQYSTGQVSVEIEWELQKENSKRWNP
EIQYTSNYYKSTNVDFAVNTEGTYSEPRPIGTRYLTRNL, and

empty capsid AAV-Rh74,

in the manufacture of a medicament for treating cystic fibrosis, Choroideremia, LCA-Lebercilin, Gyrate Atrophy, X-linked Retinoschisis, Usher's Syndrome 1C, retinitis pigmentosa, Connexin 26 deafness, Achromatopsia, Polycystic kidney disease, a lysosomal storage disease, a polynucleotide repeat disease, dentatorubropallidolusyan atropy, spinobulbar muscular atrophy, spinocerebellar ataxia (type 1, 2, 3, 6, 7, 8, 12 17), fragile X syndrome, fragile X-associated tremor/ataxia syndrome, myotonic dystrophy, Friedreich's ataxia, amyotrophic lateral sclerosis (ALS), Parkinson's disease, Alzheimer's disease, hypercoloesterolemia, HIV infection, Rous sarcoma virus (RSV) infection, hepatitis C virus infection, acute kidney injury, delayed graft function kidney transplant, kidney injury acute renal failure, advance recurrent or metastatic solid malignancies, metastatic melanoma, chronic myeloid leukemia, solid tumors, liver tumors, familial adenomatous polyposis, glaucoma, diabetic macular oedma (DME), age-related macular degeneration, choroidal neovascularization, non-arteritic ischaemic optic neuropathy, pachyonychia congenital, influenza infection, severe acute respiratory syndrome (SARS), respiratory syncytial virus infection, Ebola infection, hepatitis B virus infection, herpes simplex virus infection, coxsackievirus B3 infection, primary dystonia, autosomal dominantly inherited retinitis pigmentosa, lung disease, bleeding disorder, hemophilia A, hemophilia B, thalassemia, blood disorder, anemia, Huntington's disease, epilepsy, lysosomal storage disease, copper or iron accumulation disorders, Wilson's disease, Menkes disease, lysosomal acid lipase deficiency, a neurological or neurodegenerative disorder, cancer, type 1 diabetes, type 2 diabetes, Gaucher's disease, Hurler's disease, adenosine deaminase deficiency, glycogen storage diseases, a retinal degenerative disease, RPE65 deficiency, brain disease, liver disease, kidney disease, heart disease, infectious viral disease, bacterial disease or fungal disease,

wherein said medicament is to be administered to a mammal or a cell of said mammal, thereby delivering or transferring a heterologous polynucleotide sequence into the mammal or cell of the mammal.

6. The use of any of claims 1 to 5, wherein said adeno-associated virus (AAV) vector comprises a VP1, VP2, or VP3 sequence of AAV-Rh74 set forth in Figure 3.

7. The use of any of claims 1 to 5, wherein said heterologous polynucleotide sequence, or said protein, is expressed at levels having a therapeutic effect on the mammal.

8. The use of any of claims 1 to 5, wherein said adeno-associated virus (AAV) vector has increased tropism for hepatocytes compared to AAV2 or AAV8.

9. The use of any of claims 1 to 5, wherein said heterologous polynucleotide sequence or said protein is expressed in a cell, tissue or organ of said mammal.

10. The use of claim 9, wherein the cell comprises a secretory cell.

11. The use of claim 9, wherein the cell comprises an endocrine cell.

12. The use of claim 9, wherein the cell comprises hepatocyte, a neural cell, a glial cell, a retinal cell, an epithelial cell, a lung cell or a totipotent, pluripotent or multipotent stem cell.

13. The use of claim 9, wherein the tissue or organ of said mammal comprises liver, brain, central nervous system, spinal cord, eye, retina or lung.

14. The use of any of claims 1 to 5, wherein the mammal produces an insufficient amount of a protein, or a defective or aberrant protein.

15. The use of claim 14, wherein the protein comprises CFTR (cystic fibrosis transmembrane regulator protein), a blood coagulation (clotting) factor (Factor XIII, Factor IX, Factor X, Factor VIII, Factor VIIa, protein C, etc.) a gain of function blood coagulation factor, an antibody, retinal pigment epithelium-specific 65 kDa protein (RPE65), erythropoietin, LDL receptor, lipoprotein lipase, ornithine transcarbamylase, β-globin, α-globin, spectrin, α-antitrypsin, adenosine deaminase (ADA), a metal transporter (ATP7A or ATP7), sulfamidase, an enzyme involved in lysosomal storage disease (ARSA), hypoxanthine guanine phosphoribosyl transferase, β-25 glucocerebrosidase, sphingomyelinase, lysosomal hexosaminidase, branched-chain keto acid dehydrogenase, a hormone, a growth factor, insulin-like growth factor 1 or 2, platelet derived

growth factor, epidermal growth factor, nerve growth factor, neurotrophic factor -3 and -4, brain-derived neurotrophic factor, glial derived growth factor, transforming growth factor α and β, a cytokine, α-interferon, β-interferon, interferon-γ, interleukin-2, interleukin-4, interleukin 12, granulocyte-macrophage colony stimulating factor, lymphotoxin, a suicide gene product, herpes simplex virus thymidine kinase, cytosine deaminase, diphtheria toxin, cytochrome P450, deoxycytidine kinase, tumor necrosis factor, a drug resistance protein, a tumor suppressor protein (*e.g.*, p53, Rb, Wt-1, NF1, Von Hippel–Lindau (VHL), adenomatous polyposis coli (APC)), a peptide with immunomodulatory properties, a tolerogenic or immunogenic peptide or protein Tregitope or hCDR1, insulin, glucokinase, guanylate cyclase 2D (LCA-GUCY2D), Rab escort protein 1 (Choroideremia), LCA 5 (LCA-Lebercilin), ornithine ketoacid aminotransferase (Gyrate Atrophy), Retinoschisin 1 (X-linked Retinoschisis), USH1C (Usher's Syndrome 1C), X-linked retinitis pigmentosa GTPase (XLRP), MERTK (AR forms of RP: retinitis pigmentosa), DFNB1 (Connexin 26 deafness), ACHM 2, 3 and 4 (Achromatopsia), PKD-1 or PKD-2 (Polycystic kidney disease), TPP1, CLN2, a gene product implicated in lysosomal storage diseases (e.g., sulfatases, N-acetylglucosamine-1-phosphate transferase, cathepsin A, GM2-AP, NPC1, VPC2, a sphingolipid activator protein, or one or more zinc finger nucleases for genome editing, or donor sequences used as repair templates for genome editing.

16. The use of any of claims 1 to 5, wherein the heterologous polynucleotide sequence comprises a gene encoding a polypeptide, peptide or a protein.

17. The use of claim 16, wherein the gene encodes a therapeutic peptide or protein.

18. The use of claim 16, wherein the gene comprises or encodes CFTR (cystic fibrosis transmembrane regulator protein), a blood coagulation (clotting) factor (Factor XIII, Factor IX, Factor X, Factor VII, Factor VIIa, protein C, etc.) a gain of function blood coagulation factor, an antibody, retinal pigment epithelium-specific 65 kDa protein (RPE65), erythropoietin, LDL receptor, lipoprotein lipase, ornithine transcarbamylase, β-globin, α-globin, spectrin, α-antitrypsin, adenosine deaminase (ADA), a metal transporter (ATP7A or ATP7), sulfamidase, an enzyme involved in lysosomal storage disease (ARSA), hypoxanthine guanine phosphoribosyl transferase, β-25 glucocerebrosidase, sphingomyelinase, lysosomal hexosaminidase, branched-

chain keto acid dehydrogenase, a hormone, a growth factor, insulin-like growth factor 1 or 2, platelet derived growth factor, epidermal growth factor, nerve growth factor, neurotrophic factor -3 and -4, brain-derived neurotrophic factor, glial derived growth factor, transforming growth factor α and β, a cytokine, α-interferon, β-interferon, interferon-γ, interleukin-2, interleukin-4, interleukin 12, granulocyte-macrophage colony stimulating factor, lymphotoxin, a suicide gene product, herpes simplex virus thymidine kinase, cytosine deaminase, diphtheria toxin, cytochrome P450, deoxycytidine kinase, tumor necrosis factor, a drug resistance protein, a tumor suppressor protein (*e.g.*, p53, Rb, Wt-1, NF1, Von Hippel–Lindau (VHL), adenomatous polyposis coli (APC)), a peptide with immunomodulatory properties, a tolerogenic or immunogenic peptide or protein Tregitope or hCDR1, insulin, glucokinase, guanylate cyclase 2D (LCA-GUCY2D), Rab escort protein 1 (Choroideremia), LCA 5 (LCA-Lebercilin), ornithine ketoacid aminotransferase (Gyrate Atrophy), Retinoschisin 1 (X-linked Retinoschisis), USH1C (Usher's Syndrome 1C), X-linked retinitis pigmentosa GTPase (XLRP), MERTK (AR forms of RP: retinitis pigmentosa), DFNB1 (Connexin 26 deafness), ACHM 2, 3 and 4 (Achromatopsia), PKD-1 or PKD-2 (Polycystic kidney disease), TPP1, CLN2, a gene product implicated in lysosomal storage diseases (e.g., sulfatases, N-acetylglucosamine-1-phosphate transferase, cathepsin A, GM2-AP, NPC1, VPC2, a sphingolipid activator protein or one or more zinc finger nucleases for genome editing, or donor sequences used as repair templates for genome editing.

19. The use of claim 1, wherein the heterologous polynucleotide sequence comprises an inhibitory nucleic acid.

20. The use of claim 19, wherein the inhibitory nucleic acid comprises micro-RNA (miRNA), siRNA, shRNA, trans-splicing RNA, antisense RNA or triplex forming RNA.

21. The use of claim 19, wherein the inhibitory nucleic acid binds to a pathogenic gene, a transcript of a pathogenic gene, or a gene transcript associated with a polynucleotide repeat disease, a huntingtin (HTT) gene, a gene associated with dentatorubropallidolusyan atropy (atrophin 1, ATN1), androgen receptor on the X chromosome in spinobulbar muscular atrophy, human Ataxin-1, -2, -3, and -7, $Ca_v2.1$ P/Q voltage-dependent calcium channel is encoded by the (CACNA1A), TATA-binding protein, Ataxin 8 opposite strand, also known as ATXN8OS,

Serine/threonine-protein phosphatase 2A 55 kDa regulatory subunit B beta isoform in spinocerebellar ataxia (type 1, 2, 3, 6, 7, 8, 12 17), *FMR1* (fragile X mental retardation 1) in fragile X syndrome, *FMR1* (fragile X mental retardation 1) in fragile X-associated tremor/ataxia syndrome, *FMR1* (fragile X mental retardation 2) or AF4/FMR2 family member 2 in fragile XE mental retardation; Myotonin-protein kinase (MT-PK) in myotonic dystrophy; Frataxin in Friedreich's ataxia; a mutant of superoxide dismutase 1 (SOD1) gene in amyotrophic lateral sclerosis; a gene involved in pathogenesis of Parkinson's disease and/or Alzheimer's disease; apolipoprotein B (APOB) and proprotein convertase subtilisin/kexin type 9 (PCSK9), hypercoloesterolemia; HIV Tat, human immunodeficiency virus transactivator of transcription gene, in HIV infection; HIV TAR, HIV TAR, human immunodeficiency virus transactivator response element gene, in HIV infection; C-C chemokine receptor (CCR5) in HIV infection; Rous sarcoma virus (RSV) nucleocapsid protein in RSV infection, liver-specific microRNA (miR-122) in hepatitis C virus infection; p53, acute kidney injury or delayed graft function kidney transplant or kidney injury acute renal failure; protein kinase N3 (PKN3) in advance recurrent or metastatic solid malignancies; LMP2, LMP2 also known as proteasome subunit beta-type 9 (PSMB 9), metastatic melanoma; LMP7,also known as proteasome subunit beta-type 8 (PSMB 8), metastatic melanoma; MECL1 also known as proteasome subunit beta-type 10 (PSMB 10), metastatic melanoma; vascular endothelial growth factor (VEGF) in solid tumors; kinesin spindle protein in solid tumors, apoptosis suppressor B-cell CLL/lymphoma (BCL-2) in chronic myeloid leukemia; ribonucleotide reductase M2 (RRM2) in solid tumors; Furin in solid tumors; polo-like kinase 1 (PLK1) in liver tumors, diacylglycerol acyltransferase 1 (DGAT1) in hepatitis C infection, beta-catenin in familial adenomatous polyposis; beta2 adrenergic receptor, glaucoma; RTP801/Redd1 also known as DAN damage-inducible transcript 4 protein, in diabetic macular oedma (DME) or age-related macular degeneration; vascular endothelial growth factor receptor I (VEGFR1) in age-related macular degeneration or choroidal neivascularization, caspase 2 in non-arteritic ischaemic optic neuropathy; Keratin 6A N17K mutant protein in pachyonychia congenital; influenza A virus genome/gene sequences in influenza infection; severe acute respiratory syndrome (SARS) coronavirus genome/gene sequences in SARS infection; respiratory syncytial virus genome/gene sequences in respiratory syncytial virus infection; Ebola filovirus genome/gene sequence in Ebola infection; hepatitis B and C virus genome/gene sequences in hepatitis B and C infection; herpes simplex virus (HSV) genome/gene

sequences in HSV infection, coxsackievirus B3 genome/gene sequences in coxsackievirus B3 infection; silencing of a pathogenic allele of a gene (allele-specific silencing) like torsin A (TOR1A) in primary dystonia, pan-class I and HLA-allele specific in transplant; or mutant rhodopsin gene (RHO) in autosomal dominantly inherited retinitis pigmentosa (adRP).

22. The use of any of claims 1 to 5, wherein the mammal has a lung disease (*e.g.*, cystic fibrosis), a bleeding disorder (*e.g.*, hemophilia A or hemophilia B with or without inhibitors), thalassemia, a blood disorder (*e.g.*, anemia), Alzheimer's disease, Parkinson's disease, Huntington's disease, amyotrophic lateral sclerosis (ALS), epilepsy, lysosomal storage diseases, a copper or iron accumulation disorders (*e.g.*, Wilson's or Menkes disease) lysosomal acid lipase deficiency, a neurological or neurodegenerative disorder, cancer, type 1 or type 2 diabetes, Gaucher's disease, Hurler's disease, adenosine deaminase deficiency, a metabolic defect (*e.g.*, glycogen storage diseases), a retinal degenerative disease (such as RPE65 deficiency, choroideremia, and other diseases of the eye), a disease of solid organs (*e.g.*, brain, liver, kidney, heart), or an infectious viral (*e.g.*, hepatitis B and C, HIV, etc.), bacterial or fungal disease.

23. The use of any of claims 1 to 5, wherein the expression control element comprises a constitutive or regulatable control element.

24. The use of any of claims 1 to 5, wherein the expression control element comprises a tissue-specific expression control element or promoter.

25. The use of any of claims 1 to 5, wherein the AAV vector is prepared to be delivered intravenously, intraarterially, intramuscularly, subcutaneously, orally, by intubation, via catheter, dermally, intra-cranially, via inhalation, intra-cavity, or mucosally.

26. The use of any of claims 1 to 5, wherein the mammal is human.

27. The use of any of claims 1 to 5, wherein the mammal is sero-positive for an AAV serotype other than AAV-Rh74.

28. The use of any of claims 1 to 5, wherein the mammal is sero-positive for an AAV serotype AAV1, AAV2, AAV3, AAV4, AAV5, AAV6, AAV7, AAV8, AAV9, AAV10 or AAV11.

29. The use of any of claims 1 to 3 or 5, wherein the mammal is sero-negative for AAV-Rh74.

30. The use of any of claims 1 to 4, further comprising use of empty capsid AAV in the preparation of a pharmaceutical.

31. The use of any of claims 1 to 4, further comprising use of empty capsid AAV-Rh74.

32. The use of any of claims 1 to 5, wherein the AAV comprises a pharmaceutical composition.

33. The use of any of claims 1 to 4, wherein the pharmaceutical composition comprises empty capsid AAV.

34. The use of any of claims 1 to 4, wherein the pharmaceutical composition comprises empty capsid AAV-Rh74.