(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
26 April 2018 (26.04.2018)

WIPO | PCT

(10) International Publication Number
WO 2018/075751 A1

(51) International Patent Classification:
A61K 39/12 (2006.01)

(21) International Application Number:
PCT/US2017/057361

(22) International Filing Date:
19 October 2017 (19.10.2017)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
62/410,165 19 October 2016 (19.10.2016) US

(71) Applicant: **PRESIDENT AND FELLOWS OF HARVARD COLLEGE** [US/US]; 17 Quincy Street, Cambridge, MA 02138 (US).

(72) Inventors: **WHELAN, Sean**; 236 Broadway, Cambridge, MA 02139 (US). **BOSE, Sayantan**; 130 Fuller Street, Brookline, MA 02446 (US). **TIMPONA, Joseph**; 86 Allegheny Street, Roxbury Crossing, MA 02120 (US).

(74) Agent: **SMITH, Deann, F.** et al.; Foley Hoag LLP, 155 Seaport Boulevard, Boston, MA 02210-2600 (US).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:
— *of inventorship (Rule 4.17(iv))*

Published:
— *with international search report (Art. 21(3))*
— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

(54) Title: ZIKA VIRUS VACCINE

(57) Abstract: Compositions and methods useful for treating and/or preventing a Zika virus infection are provided.

WO 2018/075751 A1

ZIKA VIRUS VACCINE

Related Applications

This application claims the benefit of priority to U.S. Provisional Application No. 62/410,165, filed October 19, 2016, the entire contents of which is hereby incorporated in its entirety.

Government Interest

This invention was made with Government support under National Institutes of Health Grant AI109740. The Government has certain rights in the invention.

Background

The ongoing Zika virus outbreak underscores a critical need for the development of candidate vaccines. Vesicular stomatitis virus (VSV), a rhabdovirus, has been successfully used as a vaccine vector, with the recent approval of a recombinant VSV-based Ebola virus vaccine (VSV-EBOV) demonstrating that such VSV based vaccines can be safe and effective. VSV grows robustly in cell culture, is not associated with disease in humans, and can be readily engineered to incorporate foreign antigens. However, to date there are no reports of the successful incorporation of functional flavivirus envelope proteins into VSV particles. Indeed, efforts to incorporate envelope proteins from the flavivirus Dengue into a VSV vector were unsuccessful (Buonocore, et.al. (2002) J. Virol. 76, 6865).

The viral envelope proteins of rhabdoviruses, such as VSV, are structurally very different from the envelope proteins of flaviviruses, such as Zika. Viral envelope proteins mediate attachment to cells and fusion between viral and cellular membranes to initiate the process of infection. Viral fusogens fall into 3 classes. The class I proteins - best exemplified by influenza HA and HIV gp160 - are trimeric, activated by cleavage of a precursor to leave an N-terminal fusion peptide and in response to specific triggers undergo conformational changes in which the fusion peptide inserts into a target membrane with subsequent refolding of the protein into the post-fusion trimer. The class II fusion proteins that are present on flaviviruses exist as dimers, have a hydrophobic fusion loop that inserts into the target membrane during conformational rearrangements of the dimer to a trimer. In the case of the class I and class II fusion proteins such conformational rearrangements are irreversible. The class III fusogens are best exemplified by VSV, here the protein exists as a trimer on the surface of the virus that can reversibly adopt pre and post fusion conformations. Fusion is accomplished by the insertion of two small hydrophobic loops into the target membrane. The

envelope proteins that have been successfully incorporated into VSV particles are predominantly class I and class III fusogens.

The presentation of the envelope proteins on the surface of flavivirus vs rhabdovirus particles is also markedly different. In immature flavivirus particles, the E protein forms a total of 60 heterodimers with prM, the precursor protein of M on the virion surface. This association prevents E from undergoing conformational changes that lead to fusion of viral and cellular membranes. As the virus matures through the trans-golgi network, prM is cleaved by the host endopeptidase, furin. In the mature flavivirus particle, the envelope proteins are arranged flat on the virion surface as a set of 90 homodimers. Under low pH conditions in the endosome upon entry into cells, the dimers of the E protein rearrange to a trimeric form. By contrast, VSV buds from the cell surface and it is at the plasma membrane where the trimers of VSV G are incorporated into viral particles. Thus both the assembly, and arrangement of the envelope proteins on the mature virions are markedly different.

The geometry of intact virus particles are also completely different. VSV has a bullet shaped geometry and is approximately 180 nm in length and 80 nm in diameter the surface of the virus is decorated by approximately 400 spikes – each corresponding to a trimer of the VSV G protein. By contrast, Zika virus particles are completely coated with 90 homodimers of the E protein and are spherical with a diameter of approximately 40 nm. Consequently, it was not known whether Zika E protein could be successfully incorporated into VSV particles, and whether such incorporated E protein would be functional.

Summary

Provided herein are methods and compositions useful in the treatment and/or prevention of a Zika virus infection. In one aspect, provided herein is a recombinant vesicular stomatitis virus (VSV) comprising in its genome a nucleic acid sequence encoding a Zika virus envelope (E) protein. In some embodiments, the recombinant VSV genome comprises the nucleic acid sequence encoding a Zika virus precursor membrane (prM) protein and/or a Zika virus capsid (C) protein. In some embodiments, the nucleic acid sequence encoding a Zika virus E protein substantially replaces the endogenous VSV viral glycoprotein (G) in the VSV genome.

In some aspects, provided herein is a recombinant VSV comprising a Zika virus envelope (E) protein or fragment thereof. In some embodiments, the recombinant VSV

further comprises a Zika virus precursor membrane (prM) protein and/or a Zika virus capsid (C) protein.

In certain aspects, provided herein is a pharmaceutical composition (*e.g.*, a Zika virus vaccine) comprising a recombinant VSV disclosed herein, and a pharmaceutically acceptable carrier. In certain embodiments, the pharmaceutical composition further comprises an adjuvant. In certain embodiments, the recombinant VSV is a live virus.

In certain aspects, provided herein is a method for inducing in a subject an immune response against Zika virus comprising administering to the subject a composition comprising a recombinant VSV disclosed herein. In some aspects, provided herein is a method for protecting a subject from Zika virus, comprising administering to the subject a recombinant VSV disclosed herein. In some aspects, provided herein is a method of treating a Zika virus infection, the method comprising administering a recombinant VSV disclosed herein, a pharmaceutical composition disclosed herein, and/or a vaccine disclosed herein, to a subject (*e.g.*, a subject in need thereof).

In certain aspects, provided herein is a nucleic acid encoding the recombinant VSV disclosed herein. In yet another aspect, provided herein is an expression vector comprising the nucleic acid encoding the recombinant VSV disclosed herein. In certain aspects, provided herein is a method of making virus-like particles (VLP) comprising infecting a cell with an expression vector disclosed herein; culturing the cell under conditions such that the cell produces a Zika virus VLP; and collecting the Zika virus VLP.

Brief Description of the Figures

Fig. 1A and **Fig. 1B** show exemplary schematic representations of VSV-Zika virus construction and rescue. Fig. 1A shows exemplary schematics of the VSV-Zika virus constructs containing prM-E or C-prM-E. Fig. 1B shows a schematic of an exemplary method of recombinant virus recovery following transfection.

Fig. 2A – Fig. 2D show infection of Vero cells with rVSVΔG-Zika-CprME. Fig.2 A and Fig. 2B demonstrate infection independent of VSV G. GFP was monitored as an indicator of infection

Fig. 3A – Fig. 3C show that VSVΔG-Zika recombinants express Zika E in infected cells. Fig. 3A is a gel showing metabolic labeling of viral proteins. Vero cells were infected with VSV-eGFP or rVSVΔG-Zika-prM-E at an MOI of 3. At 6 hours post infection, cells were starved in methionine-free DMEM for 30 minutes, followed by the addition of ^{35}S-

methionine for 30 minutes. Cells were lysed and analyzed by SDS-PAGE. Fig. 3B is an image of a Western blot of infected cell lysates and culture supernatants probed with a pan flavivirus antibody that reacts with ZIKV-E (4G2) or VSV-M. Fig. 3C shows the immunofluorescence of cells infected with VSV-eGFP or rVSVΔG-Zika-prM-E probed with the 4G2 antibody (red channel).

Fig. 4 show that Zika E protein is incorporated into VSV particles. A Coomassie stained SDS-PAGE of purified virus, following sedimentation through sucrose is shown. M: molecular weight markers. Lane 1: rVSVΔG-Zika-C-prM-E. Lane 2: rVSV. The Zika E band is identified.

Fig. 5 shows a plaque assay of rVSV-Zika-CprME on Vero cells. The numbers represent the dilutions of a typical virus stock which demonstrates the high titer of the stocks routinely attained.

Fig. 6 shows that Zika E protein is present together with sedimented VSV. SDS-PAGE analysis of recombinant viruses following concentration on sucrose cushions. Lane 1: rVSVΔG-Zika-CprME, Lane 2: r VSV-Zika-CprME, Lane 3: rVSV-EGFP.

Fig. 7A – Fig. 7D show the production of Zika VLPs and VSV-ZIKA-E coated particles from rVSVΔG-Zika-CprME (Fig. 7A and Fig. 7B) and rVSV-Zika-CprME (Fig. 7C and Fig. 7D). Cells were infected with the indicated recombinant VSV and the cell culture supernatants clarified by centrifugation, virus and VLPs collected by centrifugation through a sucrose cushion, resuspended in NTE and then separated by centrifugation through a linear 15-45% sucrose gradient by ultracentrifugation. Fractions were collected and analyzed by Coomassie stain (Fig. 7A and Fig. 7C) and by blotting to detect the presence of VSV M, G and Zika E proteins (Fig. 7B and Fig. 7D) .

Fig. 8A – Fig. 8D show that the production of Zika VLPs and VSV-ZIKA-E coated particles from rVSVΔG-Zika-prME (Fig. 8A and Fig. 8B) and rVSV-Zika-prME (Fig. 8C and Fig. 8D). Cells were infected with the indicated recombinant VSV and the cell culture supernatants clarified by centrifugation, virus and VLPs collected by centrifugation through a sucrose cushion, resuspended in NTE and then separated by centrifugation through a linear 15-45% sucrose gradient by ultracentrifugation. Fractions were collected and analyzed by Coomassie stain (Fig. 8A and Fig. 8C) and by blotting to detect the presence of VSV M protein, and Zika E protein (Fig. 8B and Fig. 8D).

Fig. 9A and **Fig. 9B** show the electron micrographs of VLPs and VSV-Zika particles. Gradient fractions containing Zika VLPs (Fig. 9A) and VSV particles (Fig. 9B) were analyzed by negative-stain electron microscopy. Size bars are 100 nm and 500 nm respectively.

Fig. 10A – Fig. 10D show the composition and infectivity of VSV-ZIKV recombinants. Fig. 10A is a schematic diagram of recombinant VSV-ZIKV genomes. The VSV genes encoding N – nucleocapsid, P – phospho, M – matrix, G – glyco, L - large polymerase and the eGFP – enhanced green fluorescent protein reporter are shown flanked by the viral Le – leader and Tr – trailer regulatory sequences. The ZIKV precursor membrane envelope (prME) together with the signal peptide portion of the capsid protein (C) are shown together with their position of insertion. Viral titers determined by plaque assay on Vero cells for viruses encoding VSV G are expressed as plaque forming units per milliliter (pfu ml^{-1}) and representative images shown. For viruses lacking VSV, G titers were determined by flow cytometry detection of the eGFP reporter and are expressed as infectious florescence units per milliliter (ifu ml^{-1}) and representative images shown at 40X magnification. Fig. 10B is an image of an SDS-PAGE gel showing protein composition of purified virions. Equivalent protein amounts of VSV-eGFP, the VSV-ZIKV recombinants and wild type ZIKV (strain: MR766) were analyzed by SDS-PAGE and proteins visualized by Coomassie staining. The VSV N, P, M, G and L and the ZIKV E proteins are identified at the side of this representative gel. Fig. 10 is an image of a Western blot showing glycoprotein composition of purified virions. VSV G and ZIKV E were detected by Western blot using antibodies that recognize the cytoplasmic tail of VSV G or flavivirus envelope proteins (4G2) respectively, together with VSV-M as control for virion composition. A 10X exposure of the 4G2 Western blot is also shown to visualize the relatively low levels of E incorporated. Fig. 10D shows exemplary structural properties of purified viral particles. Sucrose gradient purified virions were visualized by negative stain (2% phosphotungstic acid) electron microscopy. Scale bar = 200 nm.

Fig. 11A and **Fig. 11B** show that VSV-ZIKV vectors express ZIKV E protein in infected cells. Fig. 11A is an image of an SDS-PAGE gel showing total protein synthesis in infected cells. Vero cells were infected (MOI=3) with the indicated VSV recombinant and protein synthesis measured by metabolic incorporation of [^{35}S]-methionine from 5-6 h post infection. Protein synthesis in MR766 infected cells (MOI=10) was measured by metabolic

labeling for 1h at 40h post infection. Total cytoplasmic extracts were prepared, equivalent amounts analyzed by SDS-PAGE and proteins detected by phosphoimage analysis. The VSV proteins, together with the eGFP reporter are identified on the left side of the gel, and ZIKV E on the right. Fig. 11B shows the detection of viral proteins by immunofluorescence microscopy. Vero cells were infected as in Fig. 11A, fixed at 6h post infection (VSV recombinants) or 48h post infection (MR766) prior to protein detection using primary antibodies 4G2 for Zika E or IE2 for VSV G. Primary antibodies were detected using Alexa fluor 594 Goat α-mouse secondary antibody and images false colored red for Zika E and green for VSV G. Nuclei (blue) were visualized by NucBlue™.

Fig. 12 shows that the Zika envelope is functional on VSV particles. Immunofluorescence or eGFP epifluorescence of Vero cells infected with the indicated virus. Where indicated, viruses were pre-incubated for 30 minutes at 34°C with 0.1 mg ml^{-1} of the VSV G neutralizing monoclonal antibody (IE2). Cells were fixed, permeabilized and Zika virus envelope detected using the flavivirus antibody (4G2) and a secondary Alexa fluor 594 Goat α-mouse at 6h p.i. for VSV recombinants and at 48h p.i. for ZIKV MR766 strain.

Fig. 13A – Fig. 13E show data regarding the purification of VSV-ZIKV and Zika VLPs. Fig. 13A is a schematic illustrating purification of VSV-Zika and Virus Like Particles (VLPs) from cell culture supernatants. Cell culture supernatants are collected and virions and VLPs recovered by centrifugation followed by sedimentation through a sucrose cushion and subsequent separation on a 15-45% sucrose gradient. Fractions (0.5 ml) were collected from the sucrose gradient and their protein constituents analyzed by SDS-PAGE or Western Blots (Fig. 13B – Fig. 13E). Each of the fractions were resolved on a 10% low bis gel and stained by Coomassie (top panels) or proteins detected using 4G2 antibody (Zika E), VSV-G tail antibody or VSV-M antibody. Fractions are shown on gels going from top (left) to bottom (right). Fig. 13B VSV-ΔG-prME, Fig. 13C VSV-ΔG-CprME, Fig. 13D VSV-prME and Fig. 13E VSV-CprME.

Fig. 14A – Fig. 14E show properties of Zika VLPs produced by VSV-prME and VSV-CprME infections. Fig. 14A shows the image of a Western blot after VLPs were collected from cell culture supernatants by precipitation using polyethylene glycol, resuspended and separated on a 15-45% sucrose gradient and the fractions analyzed by SDS-PAGE and probed by western blot for ZIKV E using the 4G2 antibody. Fig. 14B shows the

detection of the E protein in VSV-ΔG-CprME virions, VLPs from VSV-CprME and purified wt ZIKV MR766 virus using the ZIKV Mab (ZV-54). Fig. 14C and Fig. 14D show negative stain electron micrographs of purified VLPs. stained with 0.5% uranyl formate obtained from the VLP fractions of VSV-prME (Fig. 14C) or VSV-CprME (Fig. 14D) scale bars represent 100 nm. Fig. 14 E is a graph showing diameters (nm) of VLPs produced by VSV-prME (prME) and VSV-CprME (CprME).

Fig. 15A – Fig. 15C show that VSV-Zika are immunogenic in BALB/c mice. Fig. 15A is a schematic showing the immunization schedule for BALB/c mice (n=5 /group). Fig. 15B is a plot showing results of ELISA assay for E-specific antibody present in animals immunized with the indicated immunogen. Fig. 15C is plot showing Sera from the mice inoculated with the indicated immunogens was used to test the ability to neutralize the MR766 strain of Zika (n=3). Dilutions of serum that protect Vero cells from 100 TCID50 of ZIKV MR766 virus infection are shown.

Detailed Description

In certain aspects, provided herein are methods and compositions related to the treatment and/or prevention of a Zika virus infection. In some embodiments, disclosed herein are recombinant vesicular stomatis viruses (VSV), proteins produced by these viruses (*e.g.*, variant polypeptides and fragments thereof), nucleic acids encoding the viruses, expression vectors comprising these nucleic acids, methods of making virus like particles from the recombinant VSV or nucleic acids encoding them, and methods for the use of recombinant VSV in various applications, such as methods for treating and/or vaccinating against a number of conditions including, but not limited to, Zika virus infections. While in no way intended to be limiting, exemplary recombinant VSV and methods for making and using any of the foregoing are described below.

Recombinant Vesicular Stomatis viruses

In certain aspects, provided herein are recombinant vesicular stomatis viruses (VSV). An exemplary nucleic acid sequence for a wild type VSV is as follows (SEQ ID NO: 1):

SEQ ID NO: 1	ACGAAGACAAACAAACCATTATTATCATTAAAAGGCTCAGGAGAAACTTTAACAGTAATCAAA ATGTCTGTTACAGTCAAGAGAATCATTGACAACACAGTCATAGTTCCAAAACTTCCTGCAAAT GAGGATCCAGTGGAATACCCGGCAGATTACTTCAGAAAATCAAAGGAGATTCCTCTTTACATC AATACTACAAAAAGTTTGTCAGATCTAAGAGGATATGTCTACCAAGGCCTCAAATCCGGAAAT GTATCAATCATACATGTCAACAGCTACTTGTATGGAGCATTAAAGGACATCCGGGGTAAGTTG

	GATAAAGATTGGTCAAGTTTCGGAATAAACATCGGGAAAGCAGGGGATACAATCGGAATATTT
	GACCTTGTATCCTTGAAAGCCCTGGACGGCGTACTTCCAGATGGAGTATCGGATGCTTCCAGA
	ACCAGCGCAGATGACAAATGGTTGCCTTTGTATCTACTTGGCTTATACAGAGTGGGCAGAACA
	CAAATGCCTGAATACAGAAAAAAGCTCATGGATGGGCTGACAAATCAATGCAAAATGATCAAT
	GAACAGTTTGAACCTCTTGTGCCAGAAGGTCGTGACATTTTTGATGTGTGGGGAAATGACAGT
	AATTACACAAAAATTGTCGCTGCAGTGGACATGTTCTTCCACATGTTCAAAAAACATGAATGT
	GCCTCGTTCAGATACGGAACTATTGTTTCCAGATTCAAAGATTGTGCTGCATTGGCAACATTT
	GGACACCTCTGCAAAATAACCGGAATGTCTACAGAAGATGTAACGACCTGGATCTTGAACCGA
	GAAGTTGCAGATGAAATGGTCCAAATGATGCTTCCAGGCCAAGAAATTGACAAGGCCGATTCA
	TACATGCCTTATTTGATCGACTTTGGATTGTCTTCTAAGTCTCCATATTCTTCCGTCAAAAAC
	CCTGCCTTCCACTTCTGGGGGCAATTGACAGCTCTTCTGCTCAGATCCACCAGAGCAAGGAAT
	GCCCGACAGCCTGATGACATTGAGTATACATCTCTTACTACAGCAGGTTTGTTGTACGCTTAT
	GCAGTAGGATCCTCTGCCGACTTGGCACAACAGTTTTGTGTTGGAGATAACAAATACACTCCA
	GATGATAGTACCGGAGGATTGACGACTAATGCACCGCCACAAGGCAGAGATGTGGTCGAATGG
	CTCGGATGGTTTGAAGATCAAAACAGAAAACCGACTCCTGATATGATGCAGTATGCGAAAAGA
	GCAGTCATGTCACTGCAAGGCCTAAGAGAGAAGACAATTGGCAAGTATGCTAAGTCAGAATTT
	GACAAATGACCCTATAATTCTCAGATCACCTATTATATATTATGCTACATATGAAAAAAACTA
	ACAGATATCATGGATAATCTCACAAAAGTTCGTGAGTATCTCAAGTCCTATTCTCGTCTGGAT
	CAGGCGGTAGGAGAGATAGATGAGATCGAAGCACAACGAGCTGAAAAGTCCAATTATGAGTTG
	TTCCAAGAGGATGGAGTGGAAGAGCATACTAAGCCCTCTTATTTTCAGGCAGCAGATGATTCT
	GACACAGAATCTGAACCAGAAATTGAAGACAATCAAGGTTTGTATGCACAGGATCCAGAAGCT
	GAGCAAGTTGAAGGCTTTATACAGGGGCCTTTAGATGACTATGCAGATGAGGAAGTGGATGTT
	GTATTTACTTCGGACTGGAAACCACCTGAGCTTGAATCTGACGAGCATGGAAAGACCTTACGG
	TTGACATCGCCAGAGGGTTTAAGTGGAGAGCAGAAATCCCAGTGGCTTTCGACGATTAAAGCA
	GTCGTGCAAAGTGCCAAATACTGGAATCTGGCAGAGTGCACATTTGAAGCATCGGGAGAAGGG
	GTCATTATGAAGGAGCGCCAGATAACTCCGGATGTATATAAGGTCACTCCAGTGATGAACACA
	CATCCGTCCCAATCAGAAGCAGTATCAGATGTTTGGTCTCTCTCAAAGACATCCATGACTTTC
	CAACCCAAGAAAGCAAGTCTTCAGCCTCTCACCATATCCTTGGATGAATTGTTCTCATCTAGA
	GGAGAGTTCATCTCTGTCGGAGGTGACGGACGAATGTCTCATAAAGAGGCCATCCTGCTCGGC
	CTGAGATACAAAAAGTTGTACAATCAGGCGAGAGTCAAATATTCTCTGTAGACTATGAAAAAA
	AGTAACAGATATCACGATCTAAGTGTTATCCCAATCCATTCATCATGAGTTCCTTAAAGAAGA
	TTCTCGGTCTGAAGGGGAAAGGTAAGAAATCTAAGAAATTAGGGATCGCACCACCCCCTTATG
	AAGAGGACACTAGCATGGAGTATGCTCCGAGCGCTCCAATTGACAAATCCTATTTTGGAGTTG
	ACGAGATGGACACCTATGATCCGAATCAATTAAGATATGAGAAATTCTTCTTTACAGTGAAAA
	TGACGGTTAGATCTAATCGTCCGTTCAGAACATACTCAGATGTGGCAGCCGCTGTATCCCATT
	GGGATCACATGTACATCGGAATGGCAGGGAAACGTCCCTTCTACAAAATCTTGGCTTTTTTGG
	GTTCTTCTAATCTAAAGGCCACTCCAGCGGTATTGGCAGATCAAGGTCAACCAGAGTATCACA
	CTCACTGCGAAGGCAGGGCTTATTTGCCACATAGGATGGGGAAGACCCCTCCCATGCTCAATG
	TACCAGAGCACTTCAGAAGACCATTCAATATAGGTCTTTACAAGGGAACGATTGAGCTCACAA

	TGACCATCTACGATGATGAGTCACTGGAAGCAGCTCCTATGATCTGGGATCATTTCAATTCTT
	CCAAATTTTCTGATTTCAGAGAGAAGGCCTTAATGTTTGGCCTGATTGTCGAGAAAAAGGCAT
	CTGGAGCGTGGGTCCTGGATTCTATCAGCCACTTCAAATGAGCTAGTCTAACTTCTAGCTTCT
	GAACAATCCCCGGTTTACTCAGTCTCTCCTAATTCCAGCCTCTCGAACAACTAATATCCTGTC
	TTTTCTATCCCTATGAAAAAAACTAACAGAGATCGATCTGTTTCCTTGACACTATGAAGTGCC
	TTTTGTACTTAGCCTTTTTATTCATTGGGGTGAATTGCAAGTTCACCATAGTTTTTCCACACA
	ACCAAAAAGGAAACTGGAAAAATGTTCCTTCTAATTACCATTATTGCCCGTCAAGCTCAGATT
	TAAATTGGCATAATGACTTAATAGGCACAGCCATACAAGTCAAAATGCCCAAGAGTCACAAGG
	CTATTCAAGCAGACGGTTGGATGTGTCATGCTTCCAAATGGGTCACTACTTGTGATTTCCGCT
	GGTATGGACCGAAGTATATAACACAGTCCATCCGATCCTTCACTCCATCTGTAGAACAATGCA
	AGGAAAGCATTGAACAAACGAAACAAGGAACTTGGCTGAATCCAGGCTTCCCTCCTCAAAGTT
	GTGGATATGCAACTGTGACGGATGCCGAAGCAGTGATTGTCCAGGTGACTCCTCACCATGTGC
	TGGTTGATGAATACACAGGAGAATGGGTTGATTCACAGTTCATCAACGGAAAATGCAGCAATT
	ACATATGCCCCACTGTCCATAACTCTACAACCTGGCATTCTGACTATAAGGTCAAAGGGCTAT
	GTGATTCTAACCTCATTTCCATGGACATCACCTTCTTCTCAGAGGACGGAGAGCTATCATCCC
	TGGGAAAGGAGGGCACAGGGTTCAGAAGTAACTACTTTGCTTATGAAACTGGAGGCAAGGCCT
	GCAAAATGCAATACTGCAAGCATTGGGGAGTCAGACTCCCATCAGGTGTCTGGTTCGAGATGG
	CTGATAAGGATCTCTTTGCTGCAGCCAGATTCCCTGAATGCCCAGAAGGGTCAAGTATCTCTG
	CTCCATCTCAGACCTCAGTGGATGTAAGTCTAATTCAGGACGTTGAGAGGATCTTGGATTATT
	CCCTCTGCCAAGAAACCTGGAGCAAAATCAGAGCGGGTCTTCCAATCTCTCCAGTGGATCTCA
	GCTATCTTGCTCCTAAAAACCCAGGAACCGGTCCTGCTTTCACCATAATCAATGGTACCCTAA
	AATACTTTGAGACCAGATACATCAGAGTCGATATTGCTGCTCCAATCCTCTCAAGAATGGTCG
	GAATGATCAGTGGAACTACCACAGAAAGGGAACTGTGGGATGACTGGGCACCATATGAAGACG
	TGGAAATTGGACCCAATGGAGTTCTGAGGACCAGTTCAGGATATAAGTTTCCTTTATACATGA
	TTGGACATGGTATGTTGGACTCCGATCTTCATCTTAGCTCAAAGGCTCAGGTGTTCGAACATC
	CTCACATTCAAGACGCTGCTTCGCAACTTCCTGATGATGAGAGTTTATTTTTTGGTGATACTG
	GGCTATCCAAAAATCCAATCGAGCTTGTAGAAGGTTGGTTCAGTAGTTGGAAAAGCTCTATTG
	CCTCTTTTTTCTTTATCATAGGGTTAATCATTGGACTATTCTTGGTTCTCCGAGTTGGTATCC
	ATCTTTGCATTAAATTAAAGCACACCAAGAAAAGACAGATTTATACAGACATAGAGATGAACC
	GACTTGGAAAGTAACTCAAATCCTGCACAACAGATTCTTCATGTTTGGACCAAATCAACTTGT
	GATACCATGCTCAAAGAGGCCTCAATTATATTTGAGTTTTTAATTTTTATGAAAAAAACTAAC
	AGCAATCATGGAAGTCCACGATTTTGAGACCGACGAGTTCAATGATTTCAATGAAGATGACTA
	TGCCACAAGAGAATTCCTGAATCCCGATGAGCGCATGACGTACTTGAATCATGCTGATTACAA
	TTTGAATTCTCCTCTAATTAGTGATGATATTGACAATTTGATCAGGAAATTCAATTCTCTTCC
	GATTCCCTCGATGTGGGATAGTAAGAACTGGGATGGAGTTCTTGAGATGTTAACATCATGTCA
	AGCCAATCCCATCTCAACATCTCAGATGCATAAATGGATGGGAAGTTGGTTAATGTCTGATAA
	TCATGATGCCAGTCAAGGGTATAGTTTTTTACATGAAGTGGACAAAGAGGCAGAAATAACATT
	TGACGTGGTGGAGACCTTCATCCGCGGCTGGGGCAACAAACCAATTGAATACATCAAAAAGGA
	AAGATGGACTGACTCATTCAAAATTCTCGCTTATTTGTGTCAAAAGTTTTTGGACTTACACAA

	GTTGACATTAATCTTAAATGCTGTCTCTGAGGTGGAATTGCTCAACTTGGCGAGGACTTTCAA
	AGGCAAAGTCAGAAGAAGTTCTCATGGAACGAACATATGCAGGATTAGGGTTCCCAGCTTGGG
	TCCTACTTTTATTTCAGAAGGATGGGCTTACTTCAAGAAACTTGATATTCTAATGGACCGAAA
	CTTTCTGTTAATGGTCAAAGATGTGATTATAGGGAGGATGCAAACGGTGCTATCCATGGTATG
	TAGAATAGACAACCTGTTCTCAGAGCAAGACATCTTCTCCCTTCTAAATATCTACAGAATTGG
	AGATAAAATTGTGGAGAGGCAGGGAAATTTTTCTTATGACTTGATTAAAATGGTGGAACCGAT
	ATGCAACTTGAAGCTGATGAAATTAGCAAGAGAATCAAGGCCTTTAGTCCCACAATTCCCTCA
	TTTTGAAAATCATATCAAGACTTCTGTTGATGAAGGGGCAAAAATTGACCGAGGTATAAGATT
	CCTCCATGATCAGATAATGAGTGTGAAAACAGTGGATCTCACACTGGTGATTTATGGATCGTT
	CAGACATTGGGGTCATCCTTTTATAGATTATTACACTGGACTAGAAAAATTACATTCCCAAGT
	AACCATGAAGAAAGATATTGATGTGTCATATGCAAAAGCACTTGCAAGTGATTTAGCTCGGAT
	TGTTCTATTTCAACAGTTCAATGATCATAAAAAGTGGTTCGTGAATGGAGACTTGCTCCCTCA
	TGATCATCCCTTTAAAAGTCATGTTAAAGAAAATACATGGCCCACAGCTGCTCAAGTTCAAGA
	TTTTGGAGATAAATGGCATGAACTTCCGCTGATTAAATGTTTTGAAATACCCGACTTACTAGA
	CCCATCGATAATATACTCTGACAAAAGTCATTCAATGAATAGGTCAGAGGTGTTGAAACATGT
	CCGAATGAATCCGAACACTCCTATCCCTAGTAAAAAGGTGTTGCAGACTATGTTGGACACAAA
	GGCTACCAATTGGAAAGAATTTCTTAAAGAGATTGATGAGAAGGGCTTAGATGATGATGATCT
	AATTATTGGTCTTAAAGGAAAGGAGAGGGAACTGAAGTTGGCAGGTAGATTTTTCTCCCTAAT
	GTCTTGGAAATTGCGAGAATACTTTGTAATTACCGAATATTTGATAAAGACTCATTTCGTCCC
	TATGTTTAAAGGCCTGACAATGGCGGACGATCTAACTGCAGTCATTAAAAAGATGTTAGATTC
	CTCATCCGGCCAAGGATTGAAGTCATATGAGGCAATTTGCATAGCCAATCACATTGATTACGA
	AAAATGGAATAACCACCAAAGGAAGTTATCAAACGGCCCAGTGTTCCGAGTTATGGGCCAGTT
	CTTAGGTTATCCATCCTTAATCGAGAGAACTCATGAATTTTTTGAGAAAAGTCTTATATACTA
	CAATGGAAGACCAGACTTGATGCGTGTTCACAACAACACACTGATCAATTCAACCTCCCAACG
	AGTTTGTTGGCAAGGACAAGAGGGTGGACTGGAAGGTCTACGGCAAAAAGGATGGACTATCCT
	CAATCTACTGGTTATTCAAAGAGAGGCTAAAATCAGAAACACTGCTGTCAAAGTCTTGGCACA
	AGGTGATAATCAAGTTATTTGCACACAGTATAAAACGAAGAAATCGAGAAACGTTGTAGAATT
	ACAGGGTGCTCTCAATCAAATGGTTTCTAATAATGAGAAAATTATGACTGCAATCAAAATAGG
	GACAGGGAAGTTAGGACTTTTGATAAATGACGATGAGACTATGCAATCTGCAGATTACTTGAA
	TTATGGAAAAATACCGATTTTCCGTGGAGTGATTAGAGGGTTAGAGACCAAGAGATGGTCACG
	AGTGACTTGTGTCACCAATGACCAAATACCCACTTGTGCTAATATAATGAGCTCAGTTTCCAC
	AAATGCTCTCACCGTAGCTCATTTTGCTGAGAACCCAATCAATGCCATGATACAGTACAATTA
	TTTTGGGACATTTGCTAGACTCTTGTTGATGATGCATGATCCTGCTCTTCGTCAATCATTGTA
	TGAAGTTCAAGATAAGATACCGGGCTTGCACAGTTCTACTTTCAAATACGCCATGTTGTATTT
	GGACCCTTCCATTGGAGGAGTGTCGGGCATGTCTTTGTCCAGGTTTTTGATTAGAGCCTTCCC
	AGATCCCGTAACAGAAAGTCTCTCATTCTGGAGATTCATCCATGTACATGCTCGAAGTGAGCA
	TCTGAAGGAGATGAGTGCAGTATTTGGAAACCCCGAGATAGCCAAGTTTCGAATAACTCACAT
	AGACAAGCTAGTAGAAGATCCAACCTCTCTGAACATCGCTATGGGAATGAGTCCAGCGAACTT
	GTTAAAGACTGAGGTTAAAAAATGCTTAATCGAATCAAGACAAACCATCAGGAACCAGGTGAT

	TAAGGATGCAACCATATATTTGTATCATGAAGAGGATCGGCTCAGAAGTTTCTTATGGTCAAT
	AAATCCTCTGTTCCCTAGATTTTTAAGTGAATTCAAATCAGGCACTTTTTTGGGAGTCGCAGA
	CGGGCTCATCAGTCTATTTCAAAATTCTCGTACTATTCGGAACTCCTTTAAGAAAAAGTATCA
	TAGGGAATTGGATGATTTGATTGTGAGGAGTGAGGTATCCTCTTTGACACATTTAGGGAAACT
	TCATTTGAGAAGGGGATCATGTAAAATGTGGACATGTTCAGCTACTCATGCTGACACATTAAG
	ATACAAATCCTGGGGCCGTACAGTTATTGGGACAACTGTACCCCATCCATTAGAAATGTTGGG
	TCCACAACATCGAAAAGAGACTCCTTGTGCACCATGTAACACATCAGGGTTCAATTATGTTTC
	TGTGCATTGTCCAGACGGGATCCATGACGTCTTTAGTTCACGGGGACCATTGCCTGCTTATCT
	AGGGTCTAAAACATCTGAATCTACATCTATTTTGCAGCCTTGGGAAAGGGAAAGCAAAGTCCC
	ACTGATTAAAAGAGCTACACGTCTTAGAGATGCTATCTCTTGGTTTGTTGAACCCGACTCTAA
	ACTAGCAATGACTATACTTTCTAACATCCACTCTTTAACAGGCGAAGAATGGACCAAAAGGCA
	GCATGGGTTCAAAAGAACAGGGTCTGCCCTTCATAGGTTTTCGACATCTCGGATGAGCCATGG
	TGGGTTCGCATCTCAGAGCACTGCAGCATTGACCAGGTTGATGGCAACTACAGACACCATGAG
	GGATCTGGGAGATCAGAATTTCGACTTTTTATTCCAAGCAACGTTGCTCTATGCTCAAATTAC
	CACCACTGTTGCAAGAGACGGATGGATCACCAGTTGTACAGATCATTATCATATTGCCTGTAA
	GTCCTGTTTGAGACCCATAGAAGAGATCACCCTGGACTCAAGTATGGACTACACGCCCCCAGA
	TGTATCCCATGTGCTGAAGACATGGAGGAATGGGGAAGGTTCGTGGGGACAAGAGATAAAACA
	GATCTATCCTTTAGAAGGGAATTGGAAGAATTTAGCACCTGCTGAGCAATCCTATCAAGTCGG
	CAGATGTATAGGTTTTCTATATGGAGACTTGGCGTATAGAAAATCTACTCATGCCGAGGACAG
	TTCTCTATTTCCTCTATCTATACAAGGTCGTATTAGAGGTCGAGGTTTCTTAAAAGGGTTGCT
	AGACGGATTAATGAGAGCAAGTTGCTGCCAAGTAATACACCGGAGAAGTCTGGCTCATTTGAA
	GAGGCCGGCCAACGCAGTGTACGGAGGTTTGATTTACTTGATTGATAAATTGAGTGTATCACC
	TCCATTCCTTTCTCTTACTAGATCAGGACCTATTAGAGACGAATTAGAAACGATTCCCCACAA
	GATCCCAACCTCCTATCCGACAAGCAACCGTGATATGGGGGTGATTGTCAGAAATTACTTCAA
	ATACCAATGCCGTCTAATTGAAAAGGGAAAATACAGATCACATTATTCACAATTATGGTTATT
	CTCAGATGTCTTATCCATAGACTTCATTGGACCATTCTCTATTTCCACCACCCTCTTGCAAAT
	CCTATACAAGCCATTTTTATCTGGGAAAGATAAGAATGAGTTGAGAGAGCTGGCAAATCTTTC
	TTCATTGCTAAGATCAGGAGAGGGGTGGGAAGACATACATGTGAAATTCTTCACCAAGGACAT
	ATTATTGTGTCCAGAGGAAATCAGACATGCTTGCAAGTTCGGGATTGCTAAGGATAATAATAA
	AGACATGAGCTATCCCCCTTGGGGAAGGGAATCCAGAGGGACAATTACAACAATCCCTGTTTA
	TTATACGACCACCCCTTACCCAAAGATGCTAGAGATGCCTCCAAGAATCCAAAATCCCCTGCT
	GTCCGGAATCAGGTTGGGCCAATTACCAACTGGCGCTCATTATAAAATTCGGAGTATATTACA
	TGGAATGGGAATCCATTACAGGGACTTCTTGAGTTGTGGAGACGGCTCCGGAGGGATGACTGC
	TGCATTACTACGAGAAAATGTGCATAGCAGAGGAATATTCAATAGTCTGTTAGAATTATCAGG
	GTCAGTCATGCGAGGCGCCTCTCCTGAGCCCCCCAGTGCCCTAGAAACTTTAGGAGGAGATAA
	ATCGAGATGTGTAAATGGTGAAACATGTTGGGAATATCCATCTGACTTATGTGACCCAAGGAC
	TTGGGACTATTTCCTCCGACTCAAAGCAGGCTTGGGGCTTCAAATTGATTTAATTGTAATGGA
	TATGGAAGTTCGGGATTCTTCTACTAGCCTGAAAATTGAGACGAATGTTAGAAATTATGTGCA
	CCGGATTTTGGATGAGCAAGGAGTTTTAATCTACAAGACTTATGGAACATATATTTGTGAGAG

	CGAAAAGAATGCAGTAACAATCCTTGGTCCCATGTTCAAGACGGTCGACTTAGTTCAAACAGA
	ATTTAGTAGTTCTCAAACGTCTGAAGTATATATGGTATGTAAAGGTTTGAAGAAATTAATCGA
	TGAACCCAATCCCGATTGGTCTTCCATCAATGAATCCTGGAAAAACCTGTACGCATTCCAGTC
	ATCAGAACAGGAATTTGCCAGAGCAAAGAAGGTTAGTACATACTTTACCTTGACAGGTATTCC
	CTCCCAATTCATTCCTGATCCTTTTGTAAACATTGAGACTATGCTACAAATATTCGGAGTACC
	CACGGGTGTGTCTCATGCGGCTGCCTTAAAATCATCTGATAGACCTGCAGATTTATTGACCAT
	TAGCCTTTTTTATATGGCGATTATATCGTATTATAACATCAATCATATCAGAGTAGGACCGAT
	ACCTCCGAACCCCCCATCAGATGGAATTGCACAAAATGTGGGGATCGCTATAACTGGTATAAG
	CTTTTGGCTGAGTTTGATGGAGAAAGACATTCCACTATATCAACAGTGTTTAGCAGTTATCCA
	GCAATCATTCCCGATTAGGTGGGAGGCTGTTTCAGTAAAAGGAGGATACAAGCAGAAGTGGAG
	TACTAGAGGTGATGGGCTCCCAAAAGATACCCGAACTTCAGACTCCTTGGCCCCAATCGGGAA
	CTGGATCAGATCTCTGGAATTGGTCCGAAACCAAGTTCGTCTAAATCCATTCAATGAGATCTT
	GTTCAATCAGCTATGTCGTACAGTGGATAATCATTTGAAATGGTCAAATTTGCGAAGAAACAC
	AGGAATGATTGAATGGATCAATAGACGAATTTCAAAAGAAGACCGGTCTATACTGATGTTGAA
	GAGTGACCTACACGAGGAAAACTCTTGGAGAGATTAAAAAATCATGAGGAGACTCCAAACTTT
	AAGTATGAAAAAAACTTTGATCCTTAAGACCCTCTTGTGGTTTTTATTTTTTATCTGGTTTTG
	TGGTCTTCGTGGGTCGGCATGGCATCTCCACCTCCTCGCGGTCCGACCTGGGCATCCGAAGGA
	GGACGTCGTCCACTCGGATGGCTAAGGGAGAGCTCGGATCCGGCTGCTAACAAAGCCCGAAAG
	GAAGCTGAGTTGGCTGCTGCCACCGCTGAGCAATAACTAGCATAACCCCTTGGGGCCTCTAAA
	CGGGTCTTGAGGGGTTTTTTGCTGAAAGGAGGAACTATATCCGGATCGAGATCCTCTAGAGTC
	GACCTGCAGGCATGCAAGCTTGTATTCTATAGTGTCACCTAAATCGTATGTGTATGATACATA
	AGGTTATGTATTAATTGTAGCCGCGTTCTAACGACAATATGTACAAGCCTAATTGTGTAGCAT
	CTGGCTTACTGAAGCAGACCCTATCATCTCTCTCGTAAACTGCCGTCAGAGTCGGTTTGGTTG
	GACGAACCTTCTGAGTTTCTGGTAACGCCGTcCCGCACCCGGAAATGGTCAGCGAACCAATCA
	GCAGGGTCATCGCTAGCCAGATCCTCTACGCCGGACGCATCGTGGCCGGCATCACCGGCGCCA
	CAGGTGCGGTTGCTGGCGCCTATATCGCCGACATCACCGATGGGGAAGATCGGGCTCGCCACT
	TCGGGCTCATGAGCGCTTGTTTCGGCGTGGGTATGGTGGCAGGCCCCGTGGCCGGGGGACTGT
	TGGGCGCCATCTCCTTGCACCATTCCTTGCGGCGGCGGTGCTCAACGGCCTCAACCTACTACT
	GGGCTGCTTCCTAATGCAGGAGTCGCATAAGGGAGAGCGTCGAATGGTGCACTCTCAGTACAA
	TCTGCTCTGATGCCGCATAGTTAAGCCAGCCCCGACACCCGCCAACACCCGCTGACGCGCCCT
	GACGGGCTTGTCTGCTCCCGGCATCCGCTTACAGACAAGCTGTGACCGTCTCCGGGAGCTGCA
	TGTGTCAGAGGTTTTCACCGTCATCACCGAAACGCGCGAGACGAAAGGGCCTCGTGATACGCC
	TATTTTTATAGGTTAATGTCATGATAATAATGGTTTCTTAGACGTCAGGTGGCACTTTTCGGG
	GAAATGTGCGCGGAACCCCTATTTGTTTATTTTTCTAAATACATTCAAATATGTATCCGCTCA
	TGAGACAATAACCCTGATAAATGCTTCAATAATATTGAAAAAGGAAGAGTATGAGTATTCAAC
	ATTTCCGTGTCGCCCTTATTCCCTTTTTTGCGGCATTTTGCCTTCCTGTTTTTGCTCACCCAG
	AAACGCTGGTGAAAGTAAAAGATGCTGAAGATCAGTTGGGTGCACGAGTGGGTTACATCGAAC
	TGGATCTCAACAGCGGTAAGATCCTTGAGAGTTTTCGCCCCGAAGAACGTTTTCCAATGATGA
	GCACTTTTAAAGTTCTGCTATGTGGCGCGGTATTATCCCGTATTGACGCCGGGCAAGAGCAAC

	TCGGTCGCCGCATACACTATTCTCAGAATGACTTGGTTGAGTACTCACCAGTCACAGAAAAGC ATCTTACGGATGGCATGACAGTAAGAGAATTATGCAGTGCTGCCATAACCATGAGTGATAACA CTGCGGCCAACTTACTTCTGACAACGATCGGAGGACCGAAGGAGCTAACCGCTTTTTTGCACA ACATGGGGGATCATGTAACTCGCCTTGATCGTTGGGAACCGGAGCTGAATGAAGCCATACCAA ACGACGAGCGTGACACCACGATGCCTGTAGCAATGGCAACAACGTTGCGCAAACTATTAACTG GCGAACTACTTACTCTAGCTTCCCGGCAACAATTAATAGACTGGATGGAGGCGGATAAAGTTG CAGGACCACTTCTGCGCTCGGCCCTTCCGGCTGGCTGGTTTATTGCTGATAAATCTGGAGCCG GTGAGCGTGGGTCTCGCGGTATCATTGCAGCACTGGGGCCAGATGGTAAGCCCTCCCGTATCG TAGTTATCTACACGACGGGGAGTCAGGCAACTATGGATGAACGAAATAGACAGATCGCTGAGA TAGGTGCCTCACTGATTAAGCATTGGTAACTGTCAGACCAAGTTTACTCATATATACTTTAGA TTGATTTAAAACTTCATTTTTAATTTAAAAGGATCTAGGTGAAGATCCTTTTTGATAATCTCA TGACCAAAATCCCTTAACGTGAGTTTTCGTTCCACTGAGCGTCAGACCCCGTAGAAAAGATCA AAGGATCTTCTTGAGATCCTTTTTTTCTGCGCGTAATCTGCTGCTTGCAAACAAAAAAACCAC CGCTACCAGCGGTGGTTTGTTTGCCGGATCAAGAGCTACCAACTCTTTTTCCGAAGGTAACTG GCTTCAGCAGAGCGCAGATACCAAATACTGTCCTTCTAGTGTAGCCGTAGTTAGGCCACCACT TCAAGAACTCTGTAGCACCGCCTACATACCTCGCTCTGCTAATCCTGTTACCAGTGGCTGCTG CCAGTGGCGATAAGTCGTGTCTTACCGGGTTGGACTCAAGACGATAGTTACCGGATAAGGCGC AGCGGTCGGGCTGAACGGGGGGTTCGTGCACACAGCCCAGCTTGGAGCGAACGACCTACACCG AACTGAGATACCTACAGCGTGAGCTATGAGAAAGCGCCACGCTTCCCGAAGGGAGAAAGGCGG ACAGGTATCCGGTAAGCGGCAGGGTCGGAACAGGAGAGCGCACGAGGGAGCTTCCAGGGGGAA ACGCCTGGTATCTTTATAGTCCTGTCGGGTTTCGCCACCTCTGACTTGAGCGTCGATTTTTGT GATGCTCGTCAGGGGGGCGGAGCCTATGGAAAAACGCCAGCAACGCGGCCTTTTTACGGTTCC TGGCCTTTTGCTGGCCTTTTGCTCACATGTTCTTTCCTGCGTTATCCCCTGATTCTGTGGATA ACCGTATTACCGCCTTTGAGTGAGCTGATACCGCTCGCCGCAGCCGAACGACCGAGCGCAGCG AGTCAGTGAGCGAGGAAGCGGAAGAGCGCCCAATACGCAAACCGCCTCTCCCCGCGCGTTGGC CGATTCATTAATGCAGGGGGATCTCGATCCCGCGAAATTAATACGACTCACTATAGG

In some embodiments, the recombinant viruses further comprise in its genome a nucleic acid sequence encoding an enhanced Green Fluorescent Protein (eGFP) or fragment thereof. An exemplary nucleic acid sequence for wild type VSV with eGFP is as follows (SEQ ID NO: 12):

SEQ ID NO: 12	ACGAAGACAAACAAACCATTATTATCATTAAAAGGCTCAGGAGAAACTTTAACAGTAATCAGA ATTCTCGAGAAAGCCACCATGGTGAGCAAGGGCGAGGAGCTGTTCACCGGGGTGGTGCCCATC CTGGTCGAGCTGGACGGCGACGTAAACGGCCACAAGTTCAGCGTGTCCGGCGAGGGCGAGGGC GATGCCACCTACGGCAAGCTGACCCTGAAGTTCATCTGCACCACCGGCAAGCTGCCCGTGCCC TGGCCCACCCTCGTGACCACCCTGACCTACGGCGTGCAGTGCTTCAGCCGCTACCCCGACCAC

	ATGAAGCAGCACGACTTCTTCAAGTCCGCCATGCCCGAAGGCTACGTCCAGGAGCGCACCATC
	TTCTTCAAGGACGACGGCAACTACAAGACCCGCGCCGAGGTGAAGTTCGAGGGCGACACCCTG
	GTGAACCGCATCGAGCTGAAGGGCATCGACTTCAAGGAGGACGGCAACATCCTGGGGCACAAG
	CTGGAGTACAACTACAACAGCCACAACGTCTATATCATGGCCGACAAGCAGAAGAACGGCATC
	AAGGTGAACTTCAAGATCCGCCACAACATCGAGGACGGCAGCGTGCAGCTCGCCGACCACTAC
	CAGCAGAACACCCCCATCGGCGACGGCCCCGTGCTGCTGCCCGACAACCACTACCTGAGCACC
	CAGTCCGCCCTGAGCAAAGACCCCAACGAGAAGCGCGATCACATGGTCCTGCTGGAGTTCGTG
	ACCGCCGCCGGGATCACTCTCGGCATGGACGAGCTGTACAAGTAATGGCCATATGAAAAAAAC
	TAACAGTAATCAAAATGTCTGTTACAGTCAAGAGAATCATTGACAACACAGTCATAGTTCCAA
	AACTTCCTGCAAATGAGGATCCAGTGGAATACCCGGCAGATTACTTCAGAAAATCAAAGGAGA
	TTCCTCTTTACATCAATACTACAAAAAGTTTGTCAGATCTAAGAGGATATGTCTACCAAGGCC
	TCAAATCCGGAAATGTATCAATCATACATGTCAACAGCTACTTGTATGGAGCATTAAAGGACA
	TCCGGGGTAAGTTGGATAAAGATTGGTCAAGTTTCGGAATAAACATCGGGAAAGCAGGGGATA
	CAATCGGAATATTTGACCTTGTATCCTTGAAAGCCCTGGACGGCGTACTTCCAGATGGAGTAT
	CGGATGCTTCCAGAACCAGCGCAGATGACAAATGGTTGCCTTTGTATCTACTTGGCTTATACA
	GAGTGGGCAGAACACAAATGCCTGAATACAGAAAAAAGCTCATGGATGGGCTGACAAATCAAT
	GCAAAATGATCAATGAACAGTTTGAACCTCTTGTGCCAGAAGGTCGTGACATTTTTGATGTGT
	GGGGAAATGACAGTAATTACACAAAAATTGTCGCTGCAGTGGACATGTTCTTCCACATGTTCA
	AAAAACATGAATGTGCCTCGTTCAGATACGGAACTATTGTTTCCAGATTCAAAGATTGTGCTG
	CATTGGCAACATTTGGACACCTCTGCAAAATAACCGGAATGTCTACAGAAGATGTAACGACCT
	GGATCTTGAACCGAGAAGTTGCAGATGAAATGGTCCAAATGATGCTTCCAGGCCAAGAAATTG
	ACAAGGCCGATTCATACATGCCTTATTTGATCGACTTTGGATTGTCTTCTAAGTCTCCATATT
	CTTCCGTCAAAAACCCTGCCTTCCACTTCTGGGGGCAATTGACAGCTCTTCTGCTCAGATCCA
	CCAGAGCAAGGAATGCCCGACAGCCTGATGACATTGAGTATACATCTCTTACTACAGCAGGTT
	TGTTGTACGCTTATGCAGTAGGATCCTCTGCCGACTTGGCACAACAGTTTTGTGTTGGAGATA
	ACAAATACACTCCAGATGATAGTACCGGAGGATTGACGACTAATGCACCGCCACAAGGCAGAG
	ATGTGGTCGAATGGCTCGGATGGTTTGAAGATCAAAACAGAAAACCGACTCCTGATATGATGC
	AGTATGCGAAAAGAGCAGTCATGTCACTGCAAGGCCTAAGAGAGAAGACAATTGGCAAGTATG
	CTAAGTCAGAATTTGACAAATGACCCTATAATTCTCAGATCACCTATTATATATTATGCTACA
	TATGAAAAAAACTAACAGATATCATGGATAATCTCACAAAAGTTCGTGAGTATCTCAAGTCCT
	ATTCTCGTCTGGATCAGGCGGTAGGAGAGATAGATGAGATCGAAGCACAACGAGCTGAAAAGT
	CCAATTATGAGTTGTTCCAAGAGGATGGAGTGGAAGAGCATACTAAGCCCTCTTATTTTCAGG
	CAGCAGATGATTCTGACACAGAATCTGAACCAGAAATTGAAGACAATCAAGGTTTGTATGCAC
	AGGATCCAGAAGCTGAGCAAGTTGAAGGCTTTATACAGGGGCCTTTAGATGACTATGCAGATG
	AGGAAGTGGATGTTGTATTTACTTCGGACTGGAAACCACCTGAGCTTGAATCTGACGAGCATG
	GAAAGACCTTACGGTTGACATCGCCAGAGGGTTTAAGTGGAGAGCAGAAATCCCAGTGGCTTT
	CGACGATTAAAGCAGTCGTGCAAAGTGCCAAATACTGGAATCTGGCAGAGTGCACATTTGAAG
	CATCGGGAGAAGGGGTCATTATGAAGGAGCGCCAGATAACTCCGGATGTATATAAGGTCACTC
	CAGTGATGAACACACATCCGTCCCAATCAGAAGCAGTATCAGATGTTTGGTCTCTCTCAAAGA

	CATCCATGACTTTCCAACCCAAGAAAGCAAGTCTTCAGCCTCTCACCATATCCTTGGATGAAT
	TGTTCTCATCTAGAGGAGAGTTCATCTCTGTCGGAGGTGACGGACGAATGTCTCATAAAGAGG
	CCATCCTGCTCGGCCTGAGATACAAAAAGTTGTACAATCAGGCGAGAGTCAAATATTCTCTGT
	AGACTATGAAAAAAAGTAACAGATATCACGATCTAAGTGTTATCCCAATCCATTCATCATGAG
	TTCCTTAAAGAAGATTCTCGGTCTGAAGGGGAAAGGTAAGAAATCTAAGAAATTAGGGATCGC
	ACCACCCCCTTATGAAGAGGACACTAGCATGGAGTATGCTCCGAGCGCTCCAATTGACAAATC
	CTATTTTGGAGTTGACGAGATGGACACCTATGATCCGAATCAATTAAGATATGAGAAATTCTT
	CTTTACAGTGAAAATGACGGTTAGATCTAATCGTCCGTTCAGAACATACTCAGATGTGGCAGC
	CGCTGTATCCCATTGGGATCACATGTACATCGGAATGGCAGGGAAACGTCCCTTCTACAAAAT
	CTTGGCTTTTTTGGGTTCTTCTAATCTAAAGGCCACTCCAGCGGTATTGGCAGATCAAGGTCA
	ACCAGAGTATCACACTCACTGCGAAGGCAGGGCTTATTTGCCACATAGGATGGGGAAGACCCC
	TCCCATGCTCAATGTACCAGAGCACTTCAGAAGACCATTCAATATAGGTCTTTACAAGGGAAC
	GATTGAGCTCACAATGACCATCTACGATGATGAGTCACTGGAAGCAGCTCCTATGATCTGGGA
	TCATTTCAATTCTTCCAAATTTTCTGATTTCAGAGAGAAGGCCTTAATGTTTGGCCTGATTGT
	CGAGAAAAAGGCATCTGGAGCGTGGGTCCTGGATTCTATCAGCCACTTCAAATGAGCTAGTCT
	AACTTCTAGCTTCTGAACAATCCCCGGTTTACTCAGTCTCTCCTAATTCCAGCCTCTCGAACA
	ACTAATATCCTGTCTTTTCTATCCCTATGAAAAAAACTAACAGAGATCGATCTGTTTCCTTGA
	CACTATGAAGTGCCTTTTGTACTTAGCCTTTTTATTCATTGGGGTGAATTGCAAGTTCACCAT
	AGTTTTTCCACACAACCAAAAAGGAAACTGGAAAAATGTTCCTTCTAATTACCATTATTGCCC
	GTCAAGCTCAGATTTAAATTGGCATAATGACTTAATAGGCACAGCCATACAAGTCAAAATGCC
	CAAGAGTCACAAGGCTATTCAAGCAGACGGTTGGATGTGTCATGCTTCCAAATGGGTCACTAC
	TTGTGATTTCCGCTGGTATGGACCGAAGTATATAACACAGTCCATCCGATCCTTCACTCCATC
	TGTAGAACAATGCAAGGAAAGCATTGAACAAACGAAACAAGGAACTTGGCTGAATCCAGGCTT
	CCCTCCTCAAAGTTGTGGATATGCAACTGTGACGGATGCCGAAGCAGTGATTGTCCAGGTGAC
	TCCTCACCATGTGCTGGTTGATGAATACACAGGAGAATGGGTTGATTCACAGTTCATCAACGG
	AAAATGCAGCAATTACATATGCCCCACTGTCCATAACTCTACAACCTGGCATTCTGACTATAA
	GGTCAAAGGGCTATGTGATTCTAACCTCATTTCCATGGACATCACCTTCTTCTCAGAGGACGG
	AGAGCTATCATCCCTGGGAAAGGAGGGCACAGGGTTCAGAAGTAACTACTTTGCTTATGAAAC
	TGGAGGCAAGGCCTGCAAAATGCAATACTGCAAGCATTGGGGAGTCAGACTCCCATCAGGTGT
	CTGGTTCGAGATGGCTGATAAGGATCTCTTTGCTGCAGCCAGATTCCCTGAATGCCCAGAAGG
	GTCAAGTATCTCTGCTCCATCTCAGACCTCAGTGGATGTAAGTCTAATTCAGGACGTTGAGAG
	GATCTTGGATTATTCCCTCTGCCAAGAAACCTGGAGCAAAATCAGAGCGGGTCTTCCAATCTC
	TCCAGTGGATCTCAGCTATCTTGCTCCTAAAAACCCAGGAACCGGTCCTGCTTTCACCATAAT
	CAATGGTACCCTAAAATACTTTGAGACCAGATACATCAGAGTCGATATTGCTGCTCCAATCCT
	CTCAAGAATGGTCGGAATGATCAGTGGAACTACCACAGAAAGGGAACTGTGGGATGACTGGGC
	ACCATATGAAGACGTGGAAATTGGACCCAATGGAGTTCTGAGGACCAGTTCAGGATATAAGTT
	TCCTTTATACATGATTGGACATGGTATGTTGGACTCCGATCTTCATCTTAGCTCAAAGGCTCA
	GGTGTTCGAACATCCTCACATTCAAGACGCTGCTTCGCAACTTCCTGATGATGAGAGTTTATT
	TTTTGGTGATACTGGGCTATCCAAAAATCCAATCGAGCTTGTAGAAGGTTGGTTCAGTAGTTG

	GAAAAGCTCTATTGCCTCTTTTTTCTTTATCATAGGGTTAATCATTGGACTATTCTTGGTTCT
	CCGAGTTGGTATCCATCTTTGCATTAAATTAAAGCACACCAAGAAAAGACAGATTTATACAGA
	CATAGAGATGAACCGACTTGGAAAGTAACTCAAATCCTGCACAACAGATTCTTCATGTTTGGA
	CCAAATCAACTTGTGATACCATGCTCAAAGAGGCCTCAATTATATTTGAGTTTTTAATTTTTA
	TGAAAAAAACTAACAGCAATCATGGAAGTCCACGATTTTGAGACCGACGAGTTCAATGATTTC
	AATGAAGATGACTATGCCACAAGAGAATTCCTGAATCCCGATGAGCGCATGACGTACTTGAAT
	CATGCTGATTACAATTTGAATTCTCCTCTAATTAGTGATGATATTGACAATTTGATCAGGAAA
	TTCAATTCTCTTCCGATTCCCTCGATGTGGGATAGTAAGAACTGGGATGGAGTTCTTGAGATG
	TTAACATCATGTCAAGCCAATCCCATCTCAACATCTCAGATGCATAAATGGATGGGAAGTTGG
	TTAATGTCTGATAATCATGATGCCAGTCAAGGGTATAGTTTTTTACATGAAGTGGACAAAGAG
	GCAGAAATAACATTTGACGTGGTGGAGACCTTCATCCGCGGCTGGGGCAACAAACCAATTGAA
	TACATCAAAAAGGAAAGATGGACTGACTCATTCAAAATTCTCGCTTATTTGTGTCAAAAGTTT
	TTGGACTTACACAAGTTGACATTAATCTTAAATGCTGTCTCTGAGGTGGAATTGCTCAACTTG
	GCGAGGACTTTCAAAGGCAAAGTCAGAAGAAGTTCTCATGGAACGAACATATGCAGGATTAGG
	GTTCCCAGCTTGGGTCCTACTTTTATTTCAGAAGGATGGGCTTACTTCAAGAAACTTGATATT
	CTAATGGACCGAAACTTTCTGTTAATGGTCAAAGATGTGATTATAGGGAGGATGCAAACGGTG
	CTATCCATGGTATGTAGAATAGACAACCTGTTCTCAGAGCAAGACATCTTCTCCCTTCTAAAT
	ATCTACAGAATTGGAGATAAAATTGTGGAGAGGCAGGGAAATTTTTCTTATGACTTGATTAAA
	ATGGTGGAACCGATATGCAACTTGAAGCTGATGAAATTAGCAAGAGAATCAAGGCCTTTAGTC
	CCACAATTCCCTCATTTTGAAAATCATATCAAGACTTCTGTTGATGAAGGGGCAAAAATTGAC
	CGAGGTATAAGATTCCTCCATGATCAGATAATGAGTGTGAAAACAGTGGATCTCACACTGGTG
	ATTTATGGATCGTTCAGACATTGGGGTCATCCTTTTATAGATTATTACACTGGACTAGAAAAA
	TTACATTCCCAAGTAACCATGAAGAAAGATATTGATGTGTCATATGCAAAAGCACTTGCAAGT
	GATTTAGCTCGGATTGTTCTATTTCAACAGTTCAATGATCATAAAAAGTGGTTCGTGAATGGA
	GACTTGCTCCCTCATGATCATCCCTTTAAAAGTCATGTTAAAGAAAATACATGGCCCACAGCT
	GCTCAAGTTCAAGATTTTGGAGATAAATGGCATGAACTTCCGCTGATTAAATGTTTTGAAATA
	CCCGACTTACTAGACCCATCGATAATATACTCTGACAAAAGTCATTCAATGAATAGGTCAGAG
	GTGTTGAAACATGTCCGAATGAATCCGAACACTCCTATCCCTAGTAAAAAGGTGTTGCAGACT
	ATGTTGGACACAAAGGCTACCAATTGGAAAGAATTTCTTAAAGAGATTGATGAGAAGGGCTTA
	GATGATGATGATCTAATTATTGGTCTTAAAGGAAAGGAGAGGGAACTGAAGTTGGCAGGTAGA
	TTTTTCTCCCTAATGTCTTGGAAATTGCGAGAATACTTTGTAATTACCGAATATTTGATAAAG
	ACTCATTTCGTCCCTATGTTTAAAGGCCTGACAATGGCGGACGATCTAACTGCAGTCATTAAA
	AAGATGTTAGATTCCTCATCCGGCCAAGGATTGAAGTCATATGAGGCAATTTGCATAGCCAAT
	CACATTGATTACGAAAAATGGAATAACCACCAAAGGAAGTTATCAAACGGCCCAGTGTTCCGA
	GTTATGGGCCAGTTCTTAGGTTATCCATCCTTAATCGAGAGAACTCATGAATTTTTTGAGAAA
	AGTCTTATATACTACAATGGAAGACCAGACTTGATGCGTGTTCACAACAACACACTGATCAAT
	TCAACCTCCCAACGAGTTTGTTGGCAAGGACAAGAGGGTGGACTGGAAGGTCTACGGCAAAAA
	GGATGGACTATCCTCAATCTACTGGTTATTCAAAGAGAGGCTAAAATCAGAAACACTGCTGTC
	AAAGTCTTGGCACAAGGTGATAATCAAGTTATTTGCACACAGTATAAAACGAAGAAATCGAGA

	AACGTTGTAGAATTACAGGGTGCTCTCAATCAAATGGTTTCTAATAATGAGAAAATTATGACT
	GCAATCAAAATAGGGACAGGGAAGTTAGGACTTTTGATAAATGACGATGAGACTATGCAATCT
	GCAGATTACTTGAATTATGGAAAAATACCGATTTTCCGTGGAGTGATTAGAGGGTTAGAGACC
	AAGAGATGGTCACGAGTGACTTGTGTCACCAATGACCAAATACCCACTTGTGCTAATATAATG
	AGCTCAGTTTCCACAAATGCTCTCACCGTAGCTCATTTTGCTGAGAACCCAATCAATGCCATG
	ATACAGTACAATTATTTTGGGACATTTGCTAGACTCTTGTTGATGATGCATGATCCTGCTCTT
	CGTCAATCATTGTATGAAGTTCAAGATAAGATACCGGGCTTGCACAGTTCTACTTTCAAATAC
	GCCATGTTGTATTTGGACCCTTCCATTGGAGGAGTGTCGGGCATGTCTTTGTCCAGGTTTTTG
	ATTAGAGCCTTCCCAGATCCCGTAACAGAAAGTCTCTCATTCTGGAGATTCATCCATGTACAT
	GCTCGAAGTGAGCATCTGAAGGAGATGAGTGCAGTATTTGGAAACCCCGAGATAGCCAAGTTT
	CGAATAACTCACATAGACAAGCTAGTAGAAGATCCAACCTCTCTGAACATCGCTATGGGAATG
	AGTCCAGCGAACTTGTTAAAGACTGAGGTTAAAAAATGCTTAATCGAATCAAGACAAACCATC
	AGGAACCAGGTGATTAAGGATGCAACCATATATTTGTATCATGAAGAGGATCGGCTCAGAAGT
	TTCTTATGGTCAATAAATCCTCTGTTCCCTAGATTTTTAAGTGAATTCAAATCAGGCACTTTT
	TTGGGAGTCGCAGACGGGCTCATCAGTCTATTTCAAAATTCTCGTACTATTCGGAACTCCTTT
	AAGAAAAAGTATCATAGGGAATTGGATGATTTGATTGTGAGGAGTGAGGTATCCTCTTTGACA
	CATTTAGGGAAACTTCATTTGAGAAGGGGATCATGTAAAATGTGGACATGTTCAGCTACTCAT
	GCTGACACATTAAGATACAAATCCTGGGGCCGTACAGTTATTGGGACAACTGTACCCCATCCA
	TTAGAAATGTTGGGTCCACAACATCGAAAAGAGACTCCTTGTGCACCATGTAACACATCAGGG
	TTCAATTATGTTTCTGTGCATTGTCCAGACGGGATCCATGACGTCTTTAGTTCACGGGGACCA
	TTGCCTGCTTATCTAGGGTCTAAAACATCTGAATCTACATCTATTTTGCAGCCTTGGGAAAGG
	GAAAGCAAAGTCCCACTGATTAAAAGAGCTACACGTCTTAGAGATGCTATCTCTTGGTTTGTT
	GAACCCGACTCTAAACTAGCAATGACTATACTTTCTAACATCCACTCTTTAACAGGCGAAGAA
	TGGACCAAAAGGCAGCATGGGTTCAAAAGAACAGGGTCTGCCCTTCATAGGTTTTCGACATCT
	CGGATGAGCCATGGTGGGTTCGCATCTCAGAGCACTGCAGCATTGACCAGGTTGATGGCAACT
	ACAGACACCATGAGGGATCTGGGAGATCAGAATTTCGACTTTTTATTCCAAGCAACGTTGCTC
	TATGCTCAAATTACCACCACTGTTGCAAGAGACGGATGGATCACCAGTTGTACAGATCATTAT
	CATATTGCCTGTAAGTCCTGTTTGAGACCCATAGAAGAGATCACCCTGGACTCAAGTATGGAC
	TACACGCCCCCAGATGTATCCCATGTGCTGAAGACATGGAGGAATGGGGAAGGTTCGTGGGGA
	CAAGAGATAAAACAGATCTATCCTTTAGAAGGGAATTGGAAGAATTTAGCACCTGCTGAGCAA
	TCCTATCAAGTCGGCAGATGTATAGGTTTTCTATATGGAGACTTGGCGTATAGAAAATCTACT
	CATGCCGAGGACAGTTCTCTATTTCCTCTATCTATACAAGGTCGTATTAGAGGTCGAGGTTTC
	TTAAAAGGGTTGCTAGACGGATTAATGAGAGCAAGTTGCTGCCAAGTAATACACCGGAGAAGT
	CTGGCTCATTTGAAGAGGCCGGCCAACGCAGTGTACGGAGGTTTGATTTACTTGATTGATAAA
	TTGAGTGTATCACCTCCATTCCTTTCTCTTACTAGATCAGGACCTATTAGAGACGAATTAGAA
	ACGATTCCCCACAAGATCCCAACCTCCTATCCGACAAGCAACCGTGATATGGGGGTGATTGTC
	AGAAATTACTTCAAATACCAATGCCGTCTAATTGAAAAGGGAAAATACAGATCACATTATTCA
	CAATTATGGTTATTCTCAGATGTCTTATCCATAGACTTCATTGGACCATTCTCTATTTCCACC
	ACCCTCTTGCAAATCCTATACAAGCCATTTTTATCTGGGAAAGATAAGAATGAGTTGAGAGAG

	CTGGCAAATCTTTCTTCATTGCTAAGATCAGGAGAGGGGTGGGAAGACATACATGTGAAATTC
	TTCACCAAGGACATATTATTGTGTCCAGAGGAAATCAGACATGCTTGCAAGTTCGGGATTGCT
	AAGGATAATAATAAAGACATGAGCTATCCCCCTTGGGGAAGGGAATCCAGAGGGACAATTACA
	ACAATCCCTGTTTATTATACGACCACCCCTTACCCAAAGATGCTAGAGATGCCTCCAAGAATC
	CAAAATCCCCTGCTGTCCGGAATCAGGTTGGGCCAATTACCAACTGGCGCTCATTATAAAATT
	CGGAGTATATTACATGGAATGGGAATCCATTACAGGGACTTCTTGAGTTGTGGAGACGGCTCC
	GGAGGGATGACTGCTGCATTACTACGAGAAAATGTGCATAGCAGAGGAATATTCAATAGTCTG
	TTAGAATTATCAGGGTCAGTCATGCGAGGCGCCTCTCCTGAGCCCCCCAGTGCCCTAGAAACT
	TTAGGAGGAGATAAATCGAGATGTGTAAATGGTGAAACATGTTGGGAATATCCATCTGACTTA
	TGTGACCCAAGGACTTGGGACTATTTCCTCCGACTCAAAGCAGGCTTGGGGCTTCAAATTGAT
	TTAATTGTAATGGATATGGAAGTTCGGGATTCTTCTACTAGCCTGAAAATTGAGACGAATGTT
	AGAAATTATGTGCACCGGATTTTGGATGAGCAAGGAGTTTTAATCTACAAGACTTATGGAACA
	TATATTTGTGAGAGCGAAAAGAATGCAGTAACAATCCTTGGTCCCATGTTCAAGACGGTCGAC
	TTAGTTCAAACAGAATTTAGTAGTTCTCAAACGTCTGAAGTATATATGGTATGTAAAGGTTTG
	AAGAAATTAATCGATGAACCCAATCCCGATTGGTCTTCCATCAATGAATCCTGGAAAAACCTG
	TACGCATTCCAGTCATCAGAACAGGAATTTGCCAGAGCAAAGAAGGTTAGTACATACTTTACC
	TTGACAGGTATTCCCTCCCAATTCATTCCTGATCCTTTTGTAAACATTGAGACTATGCTACAA
	ATATTCGGAGTACCCACGGGTGTGTCTCATGCGGCTGCCTTAAAATCATCTGATAGACCTGCA
	GATTTATTGACCATTAGCCTTTTTTATATGGCGATTATATCGTATTATAACATCAATCATATC
	AGAGTAGGACCGATACCTCCGAACCCCCCATCAGATGGAATTGCACAAAATGTGGGGATCGCT
	ATAACTGGTATAAGCTTTTGGCTGAGTTTGATGGAGAAAGACATTCCACTATATCAACAGTGT
	TTAGCAGTTATCCAGCAATCATTCCCGATTAGGTGGGAGGCTGTTTCAGTAAAAGGAGGATAC
	AAGCAGAAGTGGAGTACTAGAGGTGATGGGCTCCCAAAAGATACCCGAACTTCAGACTCCTTG
	GCCCCAATCGGGAACTGGATCAGATCTCTGGAATTGGTCCGAAACCAAGTTCGTCTAAATCCA
	TTCAATGAGATCTTGTTCAATCAGCTATGTCGTACAGTGGATAATCATTTGAAATGGTCAAAT
	TTGCGAAGAAACACAGGAATGATTGAATGGATCAATAGACGAATTTCAAAAGAAGACCGGTCT
	ATACTGATGTTGAAGAGTGACCTACACGAGGAAAACTCTTGGAGAGATTAAAAAATCATGAGG
	AGACTCCAAACTTTAAGTATGAAAAAAACTTTGATCCTTAAGACCCTCTTGTGGTTTTTATTT
	TTTATCTGGTTTTGTGGTCTTCGTGGGTCGGCATGGCATCTCCACCTCCTCGCGGTCCGACCT
	GGGCATCCGAAGGAGGACGTCGTCCACTCGGATGGCTAAGGGAGAGCTCGGATCCGGCTGCTA
	ACAAAGCCCGAAAGGAAGCTGAGTTGGCTGCTGCCACCGCTGAGCAATAACTAGCATAACCCC
	TTGGGGCCTCTAAACGGGTCTTGAGGGGTTTTTTGCTGAAAGGAGGAACTATATCCGGATCGA
	GATCCTCTAGAGTCGACCTGCAGGCATGCAAGCTTGTATTCTATAGTGTCACCTAAATCGTAT
	GTGTATGATACATAAGGTTATGTATTAATTGTAGCCGCGTTCTAACGACAATATGTACAAGCC
	TAATTGTGTAGCATCTGGCTTACTGAAGCAGACCCTATCATCTCTCTCGTAAACTGCCGTCAG
	AGTCGGTTTGGTTGGACGAACCTTCTGAGTTTCTGGTAACGCCGTcCCGCACCCGGAAATGGT
	CAGCGAACCAATCAGCAGGGTCATCGCTAGCCAGATCCTCTACGCCGGACGCATCGTGGCCGG
	CATCACCGGCGCCACAGGTGCGGTTGCTGGCGCCTATATCGCCGACATCACCGATGGGGAAGA
	TCGGGCTCGCCACTTCGGGCTCATGAGCGCTTGTTTCGGCGTGGGTATGGTGGCAGGCCCCGT

	GGCCGGGGGACTGTTGGGCGCCATCTCCTTGCACCATTCCTTGCGGCGGCGGTGCTCAACGGC CTCAACCTACTACTGGGCTGCTTCCTAATGCAGGAGTCGCATAAGGGAGAGCGTCGAATGGTG CACTCTCAGTACAATCTGCTCTGATGCCGCATAGTTAAGCCAGCCCCGACACCCGCCAACACC CGCTGACGCGCCCTGACGGGCTTGTCTGCTCCCGGCATCCGCTTACAGACAAGCTGTGACCGT CTCCGGGAGCTGCATGTGTCAGAGGTTTTCACCGTCATCACCGAAACGCGCGAGACGAAAGGG CCTCGTGATACGCCTATTTTTATAGGTTAATGTCATGATAATAATGGTTTCTTAGACGTCAGG TGGCACTTTTCGGGGAAATGTGCGCGGAACCCCTATTTGTTTATTTTTCTAAATACATTCAAA TATGTATCCGCTCATGAGACAATAACCCTGATAAATGCTTCAATAATATTGAAAAAGGAAGAG TATGAGTATTCAACATTTCCGTGTCGCCCTTATTCCCTTTTTTGCGGCATTTTGCCTTCCTGT TTTTGCTCACCCAGAAACGCTGGTGAAAGTAAAAGATGCTGAAGATCAGTTGGGTGCACGAGT GGGTTACATCGAACTGGATCTCAACAGCGGTAAGATCCTTGAGAGTTTTCGCCCCGAAGAACG TTTTCCAATGATGAGCACTTTTAAAGTTCTGCTATGTGGCGCGGTATTATCCCGTATTGACGC CGGGCAAGAGCAACTCGGTCGCCGCATACACTATTCTCAGAATGACTTGGTTGAGTACTCACC AGTCACAGAAAAGCATCTTACGGATGGCATGACAGTAAGAGAATTATGCAGTGCTGCCATAAC CATGAGTGATAACACTGCGGCCAACTTACTTCTGACAACGATCGGAGGACCGAAGGAGCTAAC CGCTTTTTTGCACAACATGGGGGATCATGTAACTCGCCTTGATCGTTGGGAACCGGAGCTGAA TGAAGCCATACCAAACGACGAGCGTGACACCACGATGCCTGTAGCAATGGCAACAACGTTGCG CAAACTATTAACTGGCGAACTACTTACTCTAGCTTCCCGGCAACAATTAATAGACTGGATGGA GGCGGATAAAGTTGCAGGACCACTTCTGCGCTCGGCCCTTCCGGCTGGCTGGTTTATTGCTGA TAAATCTGGAGCCGGTGAGCGTGGGTCTCGCGGTATCATTGCAGCACTGGGGCCAGATGGTAA GCCCTCCCGTATCGTAGTTATCTACACGACGGGGAGTCAGGCAACTATGGATGAACGAAATAG ACAGATCGCTGAGATAGGTGCCTCACTGATTAAGCATTGGTAACTGTCAGACCAAGTTTACTC ATATATACTTTAGATTGATTTAAAACTTCATTTTTAATTTAAAAGGATCTAGGTGAAGATCCT TTTTGATAATCTCATGACCAAAATCCCTTAACGTGAGTTTTCGTTCCACTGAGCGTCAGACCC CGTAGAAAAGATCAAAGGATCTTCTTGAGATCCTTTTTTTCTGCGCGTAATCTGCTGCTTGCA AACAAAAAAACCACCGCTACCAGCGGTGGTTTGTTTGCCGGATCAAGAGCTACCAACTCTTTT TCCGAAGGTAACTGGCTTCAGCAGAGCGCAGATACCAAATACTGTCCTTCTAGTGTAGCCGTA GTTAGGCCACCACTTCAAGAACTCTGTAGCACCGCCTACATACCTCGCTCTGCTAATCCTGTT ACCAGTGGCTGCTGCCAGTGGCGATAAGTCGTGTCTTACCGGGTTGGACTCAAGACGATAGTT ACCGGATAAGGCGCAGCGGTCGGGCTGAACGGGGGGTTCGTGCACACAGCCCAGCTTGGAGCG AACGACCTACACCGAACTGAGATACCTACAGCGTGAGCTATGAGAAAGCGCCACGCTTCCCGA AGGGAGAAAGGCGGACAGGTATCCGGTAAGCGGCAGGGTCGGAACAGGAGAGCGCACGAGGGA GCTTCCAGGGGGAAACGCCTGGTATCTTTATAGTCCTGTCGGGTTTCGCCACCTCTGACTTGA GCGTCGATTTTTGTGATGCTCGTCAGGGGGGCGGAGCCTATGGAAAAACGCCAGCAACGCGGC CTTTTTACGGTTCCTGGCCTTTTGCTGGCCTTTTGCTCACATGTTCTTTCCTGCGTTATCCCC TGATTCTGTGGATAACCGTATTACCGCCTTTGAGTGAGCTGATACCGCTCGCCGCAGCCGAAC GACCGAGCGCAGCGAGTCAGTGAGCGAGGAAGCGGAAGAGCGCCCAATACGCAAACCGCCTCT CCCCGCGCGTTGGCCGATTCATTAATGCAGGGGGATCTCGATCCCGCGAAATTAATACGACTC ACTATAGG

In some embodiments, the recombinant viruses comprise in its genome a nucleic acid sequence encoding a Zika virus envelope protein or fragment thereof. An exemplary nucleic acid sequence for a wild type Zika virus envelope protein is as follows (SEQ ID NO: 2):

SEQ ID NO: 2	ATCCGGTGTATCGGCGTGTCCAACCGGGACTTCGTGGAAGGCATGAGCGGCGGCACATGGGTG GACGTGGTGCTGGAACATGGCGGCTGCGTGACAGTGATGGCTCAGGACAAGCCCACCGTGGAC ATCGAGCTCGTGACCACCACCGTGTCCAATATGGCCGAAGTGCGGAGCTACTGCTACGAGGCC AGCATCAGCGACATGGCAAGCGACAGCAGATGCCCTACACAGGGCGAGGCCTACCTGGACAAG CAGTCCGACACCCAGTACGTGTGCAAGCGGACCCTGGTGGATAGAGGCTGGGGCAATGGCTGC GGCCTGTTTGGCAAGGGCAGCCTCGTGACCTGCGCCAAGTTCGCCTGCAGCAAGAAGATGACC GGCAAGAGCATCCAGCCCGAGAACCTGGAATACCGGATCATGCTGAGCGTGCACGGCAGCCAG CACTCCGGCATGATCGTGAACGACACCGGCCACGAGACAGACGAGAACCGGGCCAAGGTGGAA ATCACCCCCAACAGCCCTAGAGCCGAGGCCACACTGGGCGGCTTTGGATCTCTGGGCCTGGAC TGCGAGCCTAGAACCGGCCTGGATTTCAGCGACCTGTACTACCTGACCATGAACAACAAGCAC TGGCTGGTGCACAAAGAGTGGTTCCACGACATCCCCCTGCCCTGGCATGCCGGCGCTGATACA GGCACACCCCACTGGAACAACAAAGAGGCTCTGGTGGAATTCAAGGACGCCCACGCCAAGCGG CAGACCGTGGTGGTGCTGGGATCTCAGGAAGGCGCCGTGCATACAGCTCTGGCTGGCGCCCTG GAAGCCGAAATGGATGGCGCCAAAGGCAGACTGTCCAGCGGCCACCTGAAGTGCCGGCTGAAG ATGGACAAGCTGCGGCTGAAGGGCGTGTCCTACAGCCTGTGTACCGCCGCCTTCACCTTCACC AAGATCCCCGCCGAGACACTGCACGGCACCGTGACTGTGGAAGTGCAGTACGCCGGCACCGAC GGCCCTTGTAAAGTGCCTGCTCAGATGGCCGTGGATATGCAGACCCTGACCCCCGTGGGCAGA CTGATCACCGCCAACCCTGTGATCACCGAGAGCACCGAGAACAGCAAGATGATGCTGGAACTG GACCCCCCCTTCGGCGACTCCTACATCGTGATCGGCGTGGGAGAGAAGAAGATCACCCACCAC TGGCACAGAAGCGGCAGCACCATCGGCAAGGCCTTTGAGGCTACAGTGCGGGGAGCCAAGAGA ATGGCCGTGCTGGGAGATACCGCCTGGGACTTTGGCTCTGTGGGCGGAGCCCTGAACTCTCTG GGCAAGGGAATCCACCAGATCTTCGGAGCCGCCTTTAAGAGCCTGTTCGGCGGCATGAGCTGG TTCAGCCAGATCCTGATCGGCACCCTGCTGATGTGGCTGGGCCTGAACGCCAAGAACGGCAGC ATCTCCCTGATGTGCCTGGCTCTGGGAGGCGTGCTGATCTTCCTGAGCACAGCCGTGTCTGCC

In some embodiments, the recombinant viruses further comprise in its genome a nucleic acid sequence encoding a Zika virus precursor membrane (prM) protein or fragment thereof. An exemplary nucleic acid sequence for a prM protein is as follows (SEQ ID NO: 3):

SEQ ID NO: 3	AGAAGAGGCAGCGCCTACTACATGTACCTGGACCGGAACGATGCCGGCGAGGCCATCAGCTTT CCAACCACCCTGGGCATGAACAAGTGCTACATCCAGATCATGGACCTGGGCCACACCTGTGAC GCCACCATGAGCTACGAGTGCCCCATGCTGGACGAGGGCGTGGAACCCGACGATGTGGACTGC TGGTGCAACACCACCAGCACCTGGGTGGTGTACGGCACCTGTCACCACAAGAAGGGCGAAGCC AGACGGTCCAGACGGGCCGTGACACTGCCTAGCCACAGCACCAGAAAGCTGCAGACCCGGTCC CAGACCTGGCTGGAAAGCAGAGAGTACACCAAGCACCTGATCCGGGTGGAAAACTGGATCTTC CGGAACCCCGGCTTTGCCCTGGCCGCTGCTGCTATTGCTTGGCTGCTGGGCAGCAGCACCTCC CAGAAAGTGATCTACCTCGTGATGATCCTGCTGATCGCCCCTGCCTACAGC

In some embodiments, the recombinant viruses further comprise in its genome a nucleic acid sequence encoding Zika virus capsid (C) protein or fragment thereof. An exemplary nucleic acid sequence for a portion of the C protein (codon optimized) is as follows (SEQ ID NO: 4):

SEQ ID NO: 4	ACCAGCGTGGGCATCGTGGGCCTGCTGCTGACCACCGCCATGGCCGCCGAGGTGACC

In some embodiments, the recombinant VSV comprises a nucleic acid sequence that is at least 80 (*e.g.*, at least 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, or 99) % identical to: (i) the nucleic acid of SEQ ID NO:2; (ii) the nucleic acid of SEQ ID NO:3; or (iii) the nucleic acid of SEQ ID NO:4. In some embodiments, the recombinant VSV comprises a nucleic acid sequence that is identical to: (i) the nucleic acid of SEQ ID NO:2; (ii) the nucleic acid of SEQ ID NO:3; or (iii) the nucleic acid of SEQ ID NO:4.

In some embodiments, the nucleic acid sequence encoding a Zika virus E protein substantially replaces the endogenous VSV viral glycoprotein (G) in the VSV genome. Exemplary sequences where the Zika coding sequences were cloned into the VSV genome, replacing the endogenous VSV viral glycoprotein (G), include the sequences of rVSVΔGZika-prME (SEQ ID NO:5) and rVSVΔGZika-CprME (SEQ ID NO:6).

SEQ ID NO:5	ACGAAGACAAACAAACCATTATTATCATTAAAAGGCTCAGGAGAAACTTTAACAGTAATCAGA ATTCTCGAGAAAGCCACCATGGTGAGCAAGGGCGAGGAGCTGTTCACCGGGGTGGTGCCCATC CTGGTCGAGCTGGACGGCGACGTAAACGGCCACAAGTTCAGCGTGTCCGGCGAGGGCGAGGGC GATGCCACCTACGGCAAGCTGACCCTGAAGTTCATCTGCACCACCGGCAAGCTGCCCGTGCCC TGGCCCACCCTCGTGACCACCCTGACCTACGGCGTGCAGTGCTTCAGCCGCTACCCCGACCAC

	ATGAAGCAGCACGACTTCTTCAAGTCCGCCATGCCCGAAGGCTACGTCCAGGAGCGCACCATC
	TTCTTCAAGGACGACGGCAACTACAAGACCCGCGCCGAGGTGAAGTTCGAGGGCGACACCCTG
	GTGAACCGCATCGAGCTGAAGGGCATCGACTTCAAGGAGGACGGCAACATCCTGGGGCACAAG
	CTGGAGTACAACTACAACAGCCACAACGTCTATATCATGGCCGACAAGCAGAAGAACGGCATC
	AAGGTGAACTTCAAGATCCGCCACAACATCGAGGACGGCAGCGTGCAGCTCGCCGACCACTAC
	CAGCAGAACACCCCCATCGGCGACGGCCCCGTGCTGCTGCCCGACAACCACTACCTGAGCACC
	CAGTCCGCCCTGAGCAAAGACCCCAACGAGAAGCGCGATCACATGGTCCTGCTGGAGTTCGTG
	ACCGCCGCCGGGATCACTCTCGGCATGGACGAGCTGTACAAGTAATGGCCATATGAAAAAAAC
	TAACAGTAATCAAAATGTCTGTTACAGTCAAGAGAATCATTGACAACACAGTCATAGTTCCAA
	AACTTCCTGCAAATGAGGATCCAGTGGAATACCCGGCAGATTACTTCAGAAAATCAAAGGAGA
	TTCCTCTTTACATCAATACTACAAAAAGTTTGTCAGATCTAAGAGGATATGTCTACCAAGGCC
	TCAAATCCGGAAATGTATCAATCATACATGTCAACAGCTACTTGTATGGAGCATTAAAGGACA
	TCCGGGGTAAGTTGGATAAAGATTGGTCAAGTTTCGGAATAAACATCGGGAAAGCAGGGGATA
	CAATCGGAATATTTGACCTTGTATCCTTGAAAGCCCTGGACGGCGTACTTCCAGATGGAGTAT
	CGGATGCTTCCAGAACCAGCGCAGATGACAAATGGTTGCCTTTGTATCTACTTGGCTTATACA
	GAGTGGGCAGAACACAAATGCCTGAATACAGAAAAAAGCTCATGGATGGGCTGACAAATCAAT
	GCAAAATGATCAATGAACAGTTTGAACCTCTTGTGCCAGAAGGTCGTGACATTTTTGATGTGT
	GGGGAAATGACAGTAATTACACAAAAATTGTCGCTGCAGTGGACATGTTCTTCCACATGTTCA
	AAAAACATGAATGTGCCTCGTTCAGATACGGAACTATTGTTTCCAGATTCAAAGATTGTGCTG
	CATTGGCAACATTTGGACACCTCTGCAAAATAACCGGAATGTCTACAGAAGATGTAACGACCT
	GGATCTTGAACCGAGAAGTTGCAGATGAAATGGTCCAAATGATGCTTCCAGGCCAAGAAATTG
	ACAAGGCCGATTCATACATGCCTTATTTGATCGACTTTGGATTGTCTTCTAAGTCTCCATATT
	CTTCCGTCAAAAACCCTGCCTTCCACTTCTGGGGGCAATTGACAGCTCTTCTGCTCAGATCCA
	CCAGAGCAAGGAATGCCCGACAGCCTGATGACATTGAGTATACATCTCTTACTACAGCAGGTT
	TGTTGTACGCTTATGCAGTAGGATCCTCTGCCGACTTGGCACAACAGTTTTGTGTTGGAGATA
	ACAAATACACTCCAGATGATAGTACCGGAGGATTGACGACTAATGCACCGCCACAAGGCAGAG
	ATGTGGTCGAATGGCTCGGATGGTTTGAAGATCAAAACAGAAAACCGACTCCTGATATGATGC
	AGTATGCGAAAAGAGCAGTCATGTCACTGCAAGGCCTAAGAGAGAAGACAATTGGCAAGTATG
	CTAAGTCAGAATTTGACAAATGACCCTATAATTCTCAGATCACCTATTATATATTATGCTACA
	TATGAAAAAAACTAACAGATATCATGGATAATCTCACAAAAGTTCGTGAGTATCTCAAGTCCT
	ATTCTCGTCTGGATCAGGCGGTAGGAGAGATAGATGAGATCGAAGCACAACGAGCTGAAAAGT
	CCAATTATGAGTTGTTCCAAGAGGATGGAGTGGAAGAGCATACTAAGCCCTCTTATTTTCAGG
	CAGCAGATGATTCTGACACAGAATCTGAACCAGAAATTGAAGACAATCAAGGTTTGTATGCAC
	AGGATCCAGAAGCTGAGCAAGTTGAAGGCTTTATACAGGGGCCTTTAGATGACTATGCAGATG
	AGGAAGTGGATGTTGTATTTACTTCGGACTGGAAACCACCTGAGCTTGAATCTGACGAGCATG
	GAAAGACCTTACGGTTGACATCGCCAGAGGGTTTAAGTGGAGAGCAGAAATCCCAGTGGCTTT
	CGACGATTAAAGCAGTCGTGCAAAGTGCCAAATACTGGAATCTGGCAGAGTGCACATTTGAAG
	CATCGGGAGAAGGGGTCATTATGAAGGAGCGCCAGATAACTCCGGATGTATATAAGGTCACTC
	CAGTGATGAACACACATCCGTCCCAATCAGAAGCAGTATCAGATGTTTGGTCTCTCTCAAAGA

	CATCCATGACTTTCCAACCCAAGAAAGCAAGTCTTCAGCCTCTCACCATATCCTTGGATGAAT
	TGTTCTCATCTAGAGGAGAGTTCATCTCTGTCGGAGGTGACGGACGAATGTCTCATAAAGAGG
	CCATCCTGCTCGGCCTGAGATACAAAAAGTTGTACAATCAGGCGAGAGTCAAATATTCTCTGT
	AGACTATGAAAAAAAGTAACAGATATCACGATCTAAGTGTTATCCCAATCCATTCATCATGAG
	TTCCTTAAAGAAGATTCTCGGTCTGAAGGGGAAAGGTAAGAAATCTAAGAAATTAGGGATCGC
	ACCACCCCCTTATGAAGAGGACACTAGCATGGAGTATGCTCCGAGCGCTCCAATTGACAAATC
	CTATTTTGGAGTTGACGAGATGGACACCTATGATCCGAATCAATTAAGATATGAGAAATTCTT
	CTTTACAGTGAAAATGACGGTTAGATCTAATCGTCCGTTCAGAACATACTCAGATGTGGCAGC
	CGCTGTATCCCATTGGGATCACATGTACATCGGAATGGCAGGGAAACGTCCCTTCTACAAAAT
	CTTGGCTTTTTTGGGTTCTTCTAATCTAAAGGCCACTCCAGCGGTATTGGCAGATCAAGGTCA
	ACCAGAGTATCACACTCACTGCGAAGGCAGGGCTTATTTGCCACATAGGATGGGGAAGACCCC
	TCCCATGCTCAATGTACCAGAGCACTTCAGAAGACCATTCAATATAGGTCTTTACAAGGGAAC
	GATTGAGCTCACAATGACCATCTACGATGATGAGTCACTGGAAGCAGCTCCTATGATCTGGGA
	TCATTTCAATTCTTCCAAATTTTCTGATTTCAGAGAGAAGGCCTTAATGTTTGGCCTGATTGT
	CGAGAAAAAGGCATCTGGAGCGTGGGTCCTGGATTCTATCAGCCACTTCAAATGAGCTAGTCT
	AACTTCTAGCTTCTGAACAATCCCCGGTTTACTCAGTCTCTCCTAATTCCAGCCTCTCGAACA
	ACTAATATCCTGTCTTTTCTATCCCTATGAAAAAAACTAACAGAGATCGATCTGTTTCCTTGA
	CACGCGTACCATGAGAAGAGGCAGCGCCTACTACATGTACCTGGACCGGAACGATGCCGGCGA
	GGCCATCAGCTTTCCAACCACCCTGGGCATGAACAAGTGCTACATCCAGATCATGGACCTGGG
	CCACACCTGTGACGCCACCATGAGCTACGAGTGCCCCATGCTGGACGAGGGCGTGGAACCCGA
	CGATGTGGACTGCTGGTGCAACACCACCAGCACCTGGGTGGTGTACGGCACCTGTCACCACAA
	GAAGGGCGAAGCCAGACGGTCCAGACGGGCCGTGACACTGCCTAGCCACAGCACCAGAAAGCT
	GCAGACCCGGTCCCAGACCTGGCTGGAAAGCAGAGAGTACACCAAGCACCTGATCCGGGTGGA
	AAACTGGATCTTCCGGAACCCCGGCTTTGCCCTGGCCGCTGCTGCTATTGCTTGGCTGCTGGG
	CAGCAGCACCTCCCAGAAAGTGATCTACCTCGTGATGATCCTGCTGATCGCCCCTGCCTACAG
	CATCCGGTGTATCGGCGTGTCCAACCGGGACTTCGTGGAAGGCATGAGCGGCGGCACATGGGT
	GGACGTGGTGCTGGAACATGGCGGCTGCGTGACAGTGATGGCTCAGGACAAGCCCACCGTGGA
	CATCGAGCTCGTGACCACCACCGTGTCCAATATGGCCGAAGTGCGGAGCTACTGCTACGAGGC
	CAGCATCAGCGACATGGCCAGCGACAGCAGATGCCCTACACAGGGCGAGGCCTACCTGGACAA
	GCAGTCCGACACCCAGTACGTGTGCAAGCGGACCCTGGTGGATAGAGGCTGGGGCAATGGCTG
	CGGCCTGTTTGGCAAGGGCAGCCTCGTGACCTGCGCCAAGTTCGCCTGCAGCAAGAAGATGAC
	CGGCAAGAGCATCCAGCCCGAGAACCTGGAATACCGGATCATGCTGAGCGTGCACGGCAGCCA
	GCACTCCGGCATGATCGTGAACGACACCGGCCACGAGACAGACGAGAACCGGGCCAAGGTGGA
	AATCACCCCCAACAGCCCTAGAGCCGAGGCCACACTGGGCGGCTTTGGATCTCTGGGCCTGGA
	CTGCGAGCCTAGAACCGGCCTGGATTTCAGCGACCTGTACTACCTGACCATGAACAACAAGCA
	CTGGCTGGTGCACAAAGAGTGGTTCCACGACATCCCCCTGCCCTGGCATGCCGGCGCTGATAC
	AGGCACACCCCACTGGAACAACAAAGAGGCTCTGGTGGAATTCAAGGACGCCCACGCCAAGCG
	GCAGACCGTGGTGGTGCTGGGATCTCAGGAAGGCGCCGTGCATACAGCTCTGGCTGGCGCCCT
	GGAAGCCGAAATGGATGGCGCCAAAGGCAGACTGTCCAGCGGCCACCTGAAGTGCCGGCTGAA

	GATGGACAAGCTGCGGCTGAAGGGCGTGTCCTACAGCCTGTGTACCGCCGCCTTCACCTTCAC
	CAAGATCCCCGCCGAGACACTGCACGGCACCGTGACTGTGGAAGTGCAGTACGCCGGCACCGA
	CGGCCCTTGTAAAGTGCCTGCTCAGATGGCCGTGGATATGCAGACCCTGACCCCCGTGGGCAG
	ACTGATCACCGCCAACCCTGTGATCACCGAGAGCACCGAGAACAGCAAGATGATGCTGGAACT
	GGACCCCCCCTTCGGCGACTCCTACATCGTGATCGGCGTGGGAGAGAAGAAGATCACCCACCA
	CTGGCACAGAAGCGGCAGCACCATCGGCAAGGCCTTTGAGGCTACAGTGCGGGGAGCCAAGAG
	AATGGCCGTGCTGGGAGATACCGCCTGGGACTTTGGCTCTGTGGGCGGAGCCCTGAACTCTCT
	GGGCAAGGGAATCCACCAGATCTTCGGAGCCGCCTTTAAGAGCCTGTTCGGCGGCATGAGCTG
	GTTCAGCCAGATCCTGATCGGCACCCTGCTGATGTGGCTGGGCCTGAACGCCAAGAACGGCAG
	CATCTCCCTGATGTGCCTGGCTCTGGGAGGCGTGCTGATCTTCCTGAGCACAGCCGTGTCTGC
	CTAAGCGGCCGCCCTGCACAACAGATTCTTCATGTTTGGACCAAATCAACTTGTGATACCATG
	CTCAAAGAGGCCTCAATTATATTTGAGTTTTTAATTTTTATGAAAAAAACTAACAGCAATCAT
	GGAAGTCCACGATTTTGAGACCGACGAGTTCAATGATTTCAATGAAGATGACTATGCCACAAG
	AGAATTCCTGAATCCCGATGAGCGCATGACGTACTTGAATCATGCTGATTACAATTTGAATTC
	TCCTCTAATTAGTGATGATATTGACAATTTGATCAGGAAATTCAATTCTCTTCCGATTCCCTC
	GATGTGGGATAGTAAGAACTGGGATGGAGTTCTTGAGATGTTAACATCATGTCAAGCCAATCC
	CATCTCAACATCTCAGATGCATAAATGGATGGGAAGTTGGTTAATGTCTGATAATCATGATGC
	CAGTCAAGGGTATAGTTTTTTACATGAAGTGGACAAAGAGGCAGAAATAACATTTGACGTGGT
	GGAGACCTTCATCCGCGGCTGGGGCAACAAACCAATTGAATACATCAAAAAGGAAAGATGGAC
	TGACTCATTCAAAATTCTCGCTTATTTGTGTCAAAAGTTTTTGGACTTACACAAGTTGACATT
	AATCTTAAATGCTGTCTCTGAGGTGGAATTGCTCAACTTGGCGAGGACTTTCAAAGGCAAAGT
	CAGAAGAAGTTCTCATGGAACGAACATATGCAGGATTAGGGTTCCCAGCTTGGGTCCTACTTT
	TATTTCAGAAGGATGGGCTTACTTCAAGAAACTTGATATTCTAATGGACCGAAACTTTCTGTT
	AATGGTCAAAGATGTGATTATAGGGAGGATGCAAACGGTGCTATCCATGGTATGTAGAATAGA
	CAACCTGTTCTCAGAGCAAGACATCTTCTCCCTTCTAAATATCTACAGAATTGGAGATAAAAT
	TGTGGAGAGGCAGGGAAATTTTTCTTATGACTTGATTAAAATGGTGGAACCGATATGCAACTT
	GAAGCTGATGAAATTAGCAAGAGAATCAAGGCCTTTAGTCCCACAATTCCCTCATTTTGAAAA
	TCATATCAAGACTTCTGTTGATGAAGGGGCAAAAATTGACCGAGGTATAAGATTCCTCCATGA
	TCAGATAATGAGTGTGAAAACAGTGGATCTCACACTGGTGATTTATGGATCGTTCAGACATTG
	GGGTCATCCTTTTATAGATTATTACACTGGACTAGAAAAATTACATTCCCAAGTAACCATGAA
	GAAAGATATTGATGTGTCATATGCAAAAGCACTTGCAAGTGATTTAGCTCGGATTGTTCTATT
	TCAACAGTTCAATGATCATAAAAAGTGGTTCGTGAATGGAGACTTGCTCCCTCATGATCATCC
	CTTTAAAAGTCATGTTAAAGAAAATACATGGCCCACAGCTGCTCAAGTTCAAGATTTTGGAGA
	TAAATGGCATGAACTTCCGCTGATTAAATGTTTTGAAATACCCGACTTACTAGACCCATCGAT
	AATATACTCTGACAAAAGTCATTCAATGAATAGGTCAGAGGTGTTGAAACATGTCCGAATGAA
	TCCGAACACTCCTATCCCTAGTAAAAAGGTGTTGCAGACTATGTTGGACACAAAGGCTACCAA
	TTGGAAAGAATTTCTTAAAGAGATTGATGAGAAGGGCTTAGATGATGATGATCTAATTATTGG
	TCTTAAAGGAAAGGAGAGGGAACTGAAGTTGGCAGGTAGATTTTTCTCCCTAATGTCTTGGAA
	ATTGCGAGAATACTTTGTAATTACCGAATATTTGATAAAGACTCATTTCGTCCCTATGTTTAA

	AGGCCTGACAATGGCGGACGATCTAACTGCAGTCATTAAAAAGATGTTAGATTCCTCATCCGG
	CCAAGGATTGAAGTCATATGAGGCAATTTGCATAGCCAATCACATTGATTACGAAAAATGGAA
	TAACCACCAAAGGAAGTTATCAAACGGCCCAGTGTTCCGAGTTATGGGCCAGTTCTTAGGTTA
	TCCATCCTTAATCGAGAGAACTCATGAATTTTTTGAGAAAAGTCTTATATACTACAATGGAAG
	ACCAGACTTGATGCGTGTTCACAACAACACACTGATCAATTCAACCTCCCAACGAGTTTGTTG
	GCAAGGACAAGAGGGTGGACTGGAAGGTCTACGGCAAAAAGGATGGACTATCCTCAATCTACT
	GGTTATTCAAAGAGAGGCTAAAATCAGAAACACTGCTGTCAAAGTCTTGGCACAAGGTGATAA
	TCAAGTTATTTGCACACAGTATAAAACGAAGAAATCGAGAAACGTTGTAGAATTACAGGGTGC
	TCTCAATCAAATGGTTTCTAATAATGAGAAAATTATGACTGCAATCAAAATAGGGACAGGGAA
	GTTAGGACTTTTGATAAATGACGATGAGACTATGCAATCTGCAGATTACTTGAATTATGGAAA
	AATACCGATTTTCCGTGGAGTGATTAGAGGGTTAGAGACCAAGAGATGGTCACGAGTGACTTG
	TGTCACCAATGACCAAATACCCACTTGTGCTAATATAATGAGCTCAGTTTCCACAAATGCTCT
	CACCGTAGCTCATTTTGCTGAGAACCCAATCAATGCCATGATACAGTACAATTATTTTGGGAC
	ATTTGCTAGACTCTTGTTGATGATGCATGATCCTGCTCTTCGTCAATCATTGTATGAAGTTCA
	AGATAAGATACCGGGCTTGCACAGTTCTACTTTCAAATACGCCATGTTGTATTTGGACCCTTC
	CATTGGAGGAGTGTCGGGCATGTCTTTGTCCAGGTTTTTGATTAGAGCCTTCCCAGATCCCGT
	AACAGAAAGTCTCTCATTCTGGAGATTCATCCATGTACATGCTCGAAGTGAGCATCTGAAGGA
	GATGAGTGCAGTATTTGGAAACCCCGAGATAGCCAAGTTTCGAATAACTCACATAGACAAGCT
	AGTAGAAGATCCAACCTCTCTGAACATCGCTATGGGAATGAGTCCAGCGAACTTGTTAAAGAC
	TGAGGTTAAAAAATGCTTAATCGAATCAAGACAAACCATCAGGAACCAGGTGATTAAGGATGC
	AACCATATATTTGTATCATGAAGAGGATCGGCTCAGAAGTTTCTTATGGTCAATAAATCCTCT
	GTTCCCTAGATTTTTAAGTGAATTCAAATCAGGCACTTTTTTGGGAGTCGCAGACGGGCTCAT
	CAGTCTATTTCAAAATTCTCGTACTATTCGGAACTCCTTTAAGAAAAAGTATCATAGGGAATT
	GGATGATTTGATTGTGAGGAGTGAGGTATCCTCTTTGACACATTTAGGGAAACTTCATTTGAG
	AAGGGGATCATGTAAAATGTGGACATGTTCAGCTACTCATGCTGACACATTAAGATACAAATC
	CTGGGGCCGTACAGTTATTGGGACAACTGTACCCCATCCATTAGAAATGTTGGGTCCACAACA
	TCGAAAAGAGACTCCTTGTGCACCATGTAACACATCAGGGTTCAATTATGTTTCTGTGCATTG
	TCCAGACGGGATCCATGACGTCTTTAGTTCACGGGGACCATTGCCTGCTTATCTAGGGTCTAA
	AACATCTGAATCTACATCTATTTTGCAGCCTTGGGAAAGGGAAAGCAAAGTCCCACTGATTAA
	AAGAGCTACACGTCTTAGAGATGCTATCTCTTGGTTTGTTGAACCCGACTCTAAACTAGCAAT
	GACTATACTTTCTAACATCCACTCTTTAACAGGCGAAGAATGGACCAAAAGGCAGCATGGGTT
	CAAAAGAACAGGGTCTGCCCTTCATAGGTTTTCGACATCTCGGATGAGCCATGGTGGGTTCGC
	ATCTCAGAGCACTGCAGCATTGACCAGGTTGATGGCAACTACAGACACCATGAGGGATCTGGG
	AGATCAGAATTTCGACTTTTTATTCCAAGCAACGTTGCTCTATGCTCAAATTACCACCACTGT
	TGCAAGAGACGGATGGATCACCAGTTGTACAGATCATTATCATATTGCCTGTAAGTCCTGTTT
	GAGACCCATAGAAGAGATCACCCTGGACTCAAGTATGGACTACACGCCCCCAGATGTATCCCA
	TGTGCTGAAGACATGGAGGAATGGGGAAGGTTCGTGGGGACAAGAGATAAAACAGATCTATCC
	TTTAGAAGGGAATTGGAAGAATTTAGCACCTGCTGAGCAATCCTATCAAGTCGGCAGATGTAT
	AGGTTTTCTATATGGAGACTTGGCGTATAGAAAATCTACTCATGCCGAGGACAGTTCTCTATT

	TCCTCTATCTATACAAGGTCGTATTAGAGGTCGAGGTTTCTTAAAAGGGTTGCTAGACGGATT
	AATGAGAGCAAGTTGCTGCCAAGTAATACACCGGAGAAGTCTGGCTCATTTGAAGAGGCCGGC
	CAACGCAGTGTACGGAGGTTTGATTTACTTGATTGATAAATTGAGTGTATCACCTCCATTCCT
	TTCTCTTACTAGATCAGGACCTATTAGAGACGAATTAGAAACGATTCCCCACAAGATCCCAAC
	CTCCTATCCGACAAGCAACCGTGATATGGGGGTGATTGTCAGAAATTACTTCAAATACCAATG
	CCGTCTAATTGAAAAGGGAAAATACAGATCACATTATTCACAATTATGGTTATTCTCAGATGT
	CTTATCCATAGACTTCATTGGACCATTCTCTATTTCCACCACCCTCTTGCAAATCCTATACAA
	GCCATTTTTATCTGGGAAAGATAAGAATGAGTTGAGAGAGCTGGCAAATCTTTCTTCATTGCT
	AAGATCAGGAGAGGGGTGGGAAGACATACATGTGAAATTCTTCACCAAGGACATATTATTGTG
	TCCAGAGGAAATCAGACATGCTTGCAAGTTCGGGATTGCTAAGGATAATAATAAAGACATGAG
	CTATCCCCCTTGGGGAAGGGAATCCAGAGGGACAATTACAACAATCCCTGTTTATTATACGAC
	CACCCCTTACCCAAAGATGCTAGAGATGCCTCCAAGAATCCAAAATCCCCTGCTGTCCGGAAT
	CAGGTTGGGCCAATTACCAACTGGCGCTCATTATAAAATTCGGAGTATATTACATGGAATGGG
	AATCCATTACAGGGACTTCTTGAGTTGTGGAGACGGCTCCGGAGGGATGACTGCTGCATTACT
	ACGAGAAAATGTGCATAGCAGAGGAATATTCAATAGTCTGTTAGAATTATCAGGGTCAGTCAT
	GCGAGGCGCCTCTCCTGAGCCCCCCAGTGCCCTAGAAACTTTAGGAGGAGATAAATCGAGATG
	TGTAAATGGTGAAACATGTTGGGAATATCCATCTGACTTATGTGACCCAAGGACTTGGGACTA
	TTTCCTCCGACTCAAAGCAGGCTTGGGGCTTCAAATTGATTTAATTGTAATGGATATGGAAGT
	TCGGGATTCTTCTACTAGCCTGAAAATTGAGACGAATGTTAGAAATTATGTGCACCGGATTTT
	GGATGAGCAAGGAGTTTTAATCTACAAGACTTATGGAACATATATTTGTGAGAGCGAAAAGAA
	TGCAGTAACAATCCTTGGTCCCATGTTCAAGACGGTCGACTTAGTTCAAACAGAATTTAGTAG
	TTCTCAAACGTCTGAAGTATATATGGTATGTAAAGGTTTGAAGAAATTAATCGATGAACCCAA
	TCCCGATTGGTCTTCCATCAATGAATCCTGGAAAAACCTGTACGCATTCCAGTCATCAGAACA
	GGAATTTGCCAGAGCAAAGAAGGTTAGTACATACTTTACCTTGACAGGTATTCCCTCCCAATT
	CATTCCTGATCCTTTTGTAAACATTGAGACTATGCTACAAATATTCGGAGTACCCACGGGTGT
	GTCTCATGCGGCTGCCTTAAAATCATCTGATAGACCTGCAGATTTATTGACCATTAGCCTTTT
	TTATATGGCGATTATATCGTATTATAACATCAATCATATCAGAGTAGGACCGATACCTCCGAA
	CCCCCCATCAGATGGAATTGCACAAAATGTGGGGATCGCTATAACTGGTATAAGCTTTTGGCT
	GAGTTTGATGGAGAAAGACATTCCACTATATCAACAGTGTTTAGCAGTTATCCAGCAATCATT
	CCCGATTAGGTGGGAGGCTGTTTCAGTAAAAGGAGGATACAAGCAGAAGTGGAGTACTAGAGG
	TGATGGGCTCCCAAAAGATACCCGAACTTCAGACTCCTTGGCCCCAATCGGGAACTGGATCAG
	ATCTCTGGAATTGGTCCGAAACCAAGTTCGTCTAAATCCATTCAATGAGATCTTGTTCAATCA
	GCTATGTCGTACAGTGGATAATCATTTGAAATGGTCAAATTTGCGAAGAAACACAGGAATGAT
	TGAATGGATCAATAGACGAATTTCAAAAGAAGACCGGTCTATACTGATGTTGAAGAGTGACCT
	ACACGAGGAAAACTCTTGGAGAGATTAAAAAATCATGAGGAGACTCCAAACTTTAAGTATGAA
	AAAAACTTTGATCCTTAAGACCCTCTTGTGGTTTTTATTTTTTATCTGGTTTTGTGGTCTTCG
	TGGGTCGGCATGGCATCTCCACCTCCTCGCGGTCCGACCTGGGCATCCGAAGGAGGACGTCGT
	CCACTCGGATGGCTAAGGGAGAGCTCGGATCCGGCTGCTAACAAAGCCCGAAAGGAAGCTGAG
	TTGGCTGCTGCCACCGCTGAGCAATAACTAGCATAACCCCTTGGGGCCTCTAAACGGGTCTTG

	AGGGGTTTTTTGCTGAAAGGAGGAACTATATCCGGATCGAGATCCTCTAGAGTCGACCTGCAG
	GCATGCAAGCTTGTATTCTATAGTGTCACCTAAATCGTATGTGTATGATACATAAGGTTATGT
	ATTAATTGTAGCCGCGTTCTAACGACAATATGTACAAGCCTAATTGTGTAGCATCTGGCTTAC
	TGAAGCAGACCCTATCATCTCTCTCGTAAACTGCCGTCAGAGTCGGTTTGGTTGGACGAACCT
	TCTGAGTTTCTGGTAACGCCGTcCCGCACCCGGAAATGGTCAGCGAACCAATCAGCAGGGTCA
	TCGCTAGCCAGATCCTCTACGCCGGACGCATCGTGGCCGGCATCACCGGCGCCACAGGTGCGG
	TTGCTGGCGCCTATATCGCCGACATCACCGATGGGGAAGATCGGGCTCGCCACTTCGGGCTCA
	TGAGCGCTTGTTTCGGCGTGGGTATGGTGGCAGGCCCCGTGGCCGGGGGACTGTTGGGCGCCA
	TCTCCTTGCACCATTCCTTGCGGCGGCGGTGCTCAACGGCCTCAACCTACTACTGGGCTGCTT
	CCTAATGCAGGAGTCGCATAAGGGAGAGCGTCGAATGGTGCACTCTCAGTACAATCTGCTCTG
	ATGCCGCATAGTTAAGCCAGCCCCGACACCCGCCAACACCCGCTGACGCGCCCTGACGGGCTT
	GTCTGCTCCCGGCATCCGCTTACAGACAAGCTGTGACCGTCTCCGGGAGCTGCATGTGTCAGA
	GGTTTTCACCGTCATCACCGAAACGCGCGAGACGAAAGGGCCTCGTGATACGCCTATTTTTAT
	AGGTTAATGTCATGATAATAATGGTTTCTTAGACGTCAGGTGGCACTTTTCGGGGAAATGTGC
	GCGGAACCCCTATTTGTTTATTTTTCTAAATACATTCAAATATGTATCCGCTCATGAGACAAT
	AACCCTGATAAATGCTTCAATAATATTGAAAAAGGAAGAGTATGAGTATTCAACATTTCCGTG
	TCGCCCTTATTCCCTTTTTTGCGGCATTTTGCCTTCCTGTTTTTGCTCACCCAGAAACGCTGG
	TGAAAGTAAAAGATGCTGAAGATCAGTTGGGTGCACGAGTGGGTTACATCGAACTGGATCTCA
	ACAGCGGTAAGATCCTTGAGAGTTTTCGCCCCGAAGAACGTTTTCCAATGATGAGCACTTTTA
	AAGTTCTGCTATGTGGCGCGGTATTATCCCGTATTGACGCCGGGCAAGAGCAACTCGGTCGCC
	GCATACACTATTCTCAGAATGACTTGGTTGAGTACTCACCAGTCACAGAAAAGCATCTTACGG
	ATGGCATGACAGTAAGAGAATTATGCAGTGCTGCCATAACCATGAGTGATAACACTGCGGCCA
	ACTTACTTCTGACAACGATCGGAGGACCGAAGGAGCTAACCGCTTTTTTGCACAACATGGGGG
	ATCATGTAACTCGCCTTGATCGTTGGGAACCGGAGCTGAATGAAGCCATACCAAACGACGAGC
	GTGACACCACGATGCCTGTAGCAATGGCAACAACGTTGCGCAAACTATTAACTGGCGAACTAC
	TTACTCTAGCTTCCCGGCAACAATTAATAGACTGGATGGAGGCGGATAAAGTTGCAGGACCAC
	TTCTGCGCTCGGCCCTTCCGGCTGGCTGGTTTATTGCTGATAAATCTGGAGCCGGTGAGCGTG
	GGTCTCGCGGTATCATTGCAGCACTGGGGCCAGATGGTAAGCCCTCCCGTATCGTAGTTATCT
	ACACGACGGGGAGTCAGGCAACTATGGATGAACGAAATAGACAGATCGCTGAGATAGGTGCCT
	CACTGATTAAGCATTGGTAACTGTCAGACCAAGTTTACTCATATATACTTTAGATTGATTTAA
	AACTTCATTTTTAATTTAAAAGGATCTAGGTGAAGATCCTTTTTGATAATCTCATGACCAAAA
	TCCCTTAACGTGAGTTTTCGTTCCACTGAGCGTCAGACCCCGTAGAAAAGATCAAAGGATCTT
	CTTGAGATCCTTTTTTTCTGCGCGTAATCTGCTGCTTGCAAACAAAAAAACCACCGCTACCAG
	CGGTGGTTTGTTTGCCGGATCAAGAGCTACCAACTCTTTTTCCGAAGGTAACTGGCTTCAGCA
	GAGCGCAGATACCAAATACTGTCCTTCTAGTGTAGCCGTAGTTAGGCCACCACTTCAAGAACT
	CTGTAGCACCGCCTACATACCTCGCTCTGCTAATCCTGTTACCAGTGGCTGCTGCCAGTGGCG
	ATAAGTCGTGTCTTACCGGGTTGGACTCAAGACGATAGTTACCGGATAAGGCGCAGCGGTCGG
	GCTGAACGGGGGGTTCGTGCACACAGCCCAGCTTGGAGCGAACGACCTACACCGAACTGAGAT
	ACCTACAGCGTGAGCTATGAGAAAGCGCCACGCTTCCCGAAGGGAGAAAGGCGGACAGGTATC

	CGGTAAGCGGCAGGGTCGGAACAGGAGAGCGCACGAGGGAGCTTCCAGGGGGAAACGCCTGGT ATCTTTATAGTCCTGTCGGGTTTCGCCACCTCTGACTTGAGCGTCGATTTTTGTGATGCTCGT CAGGGGGGCGGAGCCTATGGAAAAACGCCAGCAACGCGGCCTTTTTACGGTTCCTGGCCTTTT GCTGGCCTTTTGCTCACATGTTCTTTCCTGCGTTATCCCCTGATTCTGTGGATAACCGTATTA CCGCCTTTGAGTGAGCTGATACCGCTCGCCGCAGCCGAACGACCGAGCGCAGCGAGTCAGTGA GCGAGGAAGCGGAAGAGCGCCCAATACGCAAACCGCCTCTCCCCGCGCGTTGGCCGATTCATT AATGCAGGGGGATCTCGATCCCGCGAAATTAATACGACTCACTATAGG
SEQ ID NO:6	ACGAAGACAAACAAACCATTATTATCATTAAAAGGCTCAGGAGAAACTTTAACAGTAATCAGA ATTCTCGAGAAAGCCACCATGGTGAGCAAGGGCGAGGAGCTGTTCACCGGGGTGGTGCCCATC CTGGTCGAGCTGGACGGCGACGTAAACGGCCACAAGTTCAGCGTGTCCGGCGAGGGCGAGGGC GATGCCACCTACGGCAAGCTGACCCTGAAGTTCATCTGCACCACCGGCAAGCTGCCCGTGCCC TGGCCCACCCTCGTGACCACCCTGACCTACGGCGTGCAGTGCTTCAGCCGCTACCCCGACCAC ATGAAGCAGCACGACTTCTTCAAGTCCGCCATGCCCGAAGGCTACGTCCAGGAGCGCACCATC TTCTTCAAGGACGACGGCAACTACAAGACCCGCGCCGAGGTGAAGTTCGAGGGCGACACCCTG GTGAACCGCATCGAGCTGAAGGGCATCGACTTCAAGGAGGACGGCAACATCCTGGGGCACAAG CTGGAGTACAACTACAACAGCCACAACGTCTATATCATGGCCGACAAGCAGAAGAACGGCATC AAGGTGAACTTCAAGATCCGCCACAACATCGAGGACGGCAGCGTGCAGCTCGCCGACCACTAC CAGCAGAACACCCCCATCGGCGACGGCCCCGTGCTGCTGCCCGACAACCACTACCTGAGCACC CAGTCCGCCCTGAGCAAAGACCCCAACGAGAAGCGCGATCACATGGTCCTGCTGGAGTTCGTG ACCGCCGCCGGGATCACTCTCGGCATGGACGAGCTGTACAAGTAATGGCCATATGAAAAAAAC TAACAGTAATCAAAATGTCTGTTACAGTCAAGAGAATCATTGACAACACAGTCATAGTTCCAA AACTTCCTGCAAATGAGGATCCAGTGGAATACCCGGCAGATTACTTCAGAAAATCAAAGGAGA TTCCTCTTTACATCAATACTACAAAAAGTTTGTCAGATCTAAGAGGATATGTCTACCAAGGCC TCAAATCCGGAAATGTATCAATCATACATGTCAACAGCTACTTGTATGGAGCATTAAAGGACA TCCGGGGTAAGTTGGATAAAGATTGGTCAAGTTTCGGAATAAACATCGGGAAAGCAGGGGATA CAATCGGAATATTTGACCTTGTATCCTTGAAAGCCCTGGACGGCGTACTTCCAGATGGAGTAT CGGATGCTTCCAGAACCAGCGCAGATGACAAATGGTTGCCTTTGTATCTACTTGGCTTATACA GAGTGGGCAGAACACAAATGCCTGAATACAGAAAAAAGCTCATGGATGGGCTGACAAATCAAT GCAAAATGATCAATGAACAGTTTGAACCTCTTGTGCCAGAAGGTCGTGACATTTTTGATGTGT GGGGAAATGACAGTAATTACACAAAAATTGTCGCTGCAGTGGACATGTTCTTCCACATGTTCA AAAAACATGAATGTGCCTCGTTCAGATACGGAACTATTGTTTCCAGATTCAAAGATTGTGCTG CATTGGCAACATTTGGACACCTCTGCAAAATAACCGGAATGTCTACAGAAGATGTAACGACCT GGATCTTGAACCGAGAAGTTGCAGATGAAATGGTCCAAATGATGCTTCCAGGCCAAGAAATTG ACAAGGCCGATTCATACATGCCTTATTTGATCGACTTTGGATTGTCTTCTAAGTCTCCATATT CTTCCGTCAAAAACCCTGCCTTCCACTTCTGGGGGCAATTGACAGCTCTTCTGCTCAGATCCA CCAGAGCAAGGAATGCCCGACAGCCTGATGACATTGAGTATACATCTCTTACTACAGCAGGTT TGTTGTACGCTTATGCAGTAGGATCCTCTGCCGACTTGGCACAACAGTTTTGTGTTGGAGATA ACAAATACACTCCAGATGATAGTACCGGAGGATTGACGACTAATGCACCGCCACAAGGCAGAG

	ATGTGGTCGAATGGCTCGGATGGTTTGAAGATCAAAACAGAAAACCGACTCCTGATATGATGC
	AGTATGCGAAAAGAGCAGTCATGTCACTGCAAGGCCTAAGAGAGAAGACAATTGGCAAGTATG
	CTAAGTCAGAATTTGACAAATGACCCTATAATTCTCAGATCACCTATTATATATTATGCTACA
	TATGAAAAAAACTAACAGATATCATGGATAATCTCACAAAAGTTCGTGAGTATCTCAAGTCCT
	ATTCTCGTCTGGATCAGGCGGTAGGAGAGATAGATGAGATCGAAGCACAACGAGCTGAAAAGT
	CCAATTATGAGTTGTTCCAAGAGGATGGAGTGGAAGAGCATACTAAGCCCTCTTATTTTCAGG
	CAGCAGATGATTCTGACACAGAATCTGAACCAGAAATTGAAGACAATCAAGGTTTGTATGCAC
	AGGATCCAGAAGCTGAGCAAGTTGAAGGCTTTATACAGGGGCCTTTAGATGACTATGCAGATG
	AGGAAGTGGATGTTGTATTTACTTCGGACTGGAAACCACCTGAGCTTGAATCTGACGAGCATG
	GAAAGACCTTACGGTTGACATCGCCAGAGGGTTTAAGTGGAGAGCAGAAATCCCAGTGGCTTT
	CGACGATTAAAGCAGTCGTGCAAAGTGCCAAATACTGGAATCTGGCAGAGTGCACATTTGAAG
	CATCGGGAGAAGGGGTCATTATGAAGGAGCGCCAGATAACTCCGGATGTATATAAGGTCACTC
	CAGTGATGAACACACATCCGTCCCAATCAGAAGCAGTATCAGATGTTTGGTCTCTCTCAAAGA
	CATCCATGACTTTCCAACCCAAGAAAGCAAGTCTTCAGCCTCTCACCATATCCTTGGATGAAT
	TGTTCTCATCTAGAGGAGAGTTCATCTCTGTCGGAGGTGACGGACGAATGTCTCATAAAGAGG
	CCATCCTGCTCGGCCTGAGATACAAAAAGTTGTACAATCAGGCGAGAGTCAAATATTCTCTGT
	AGACTATGAAAAAAAGTAACAGATATCACGATCTAAGTGTTATCCCAATCCATTCATCATGAG
	TTCCTTAAAGAAGATTCTCGGTCTGAAGGGGAAAGGTAAGAAATCTAAGAAATTAGGGATCGC
	ACCACCCCCTTATGAAGAGGACACTAGCATGGAGTATGCTCCGAGCGCTCCAATTGACAAATC
	CTATTTTGGAGTTGACGAGATGGACACCTATGATCCGAATCAATTAAGATATGAGAAATTCTT
	CTTTACAGTGAAAATGACGGTTAGATCTAATCGTCCGTTCAGAACATACTCAGATGTGGCAGC
	CGCTGTATCCCATTGGGATCACATGTACATCGGAATGGCAGGGAAACGTCCCTTCTACAAAAT
	CTTGGCTTTTTTGGGTTCTTCTAATCTAAAGGCCACTCCAGCGGTATTGGCAGATCAAGGTCA
	ACCAGAGTATCACACTCACTGCGAAGGCAGGGCTTATTTGCCACATAGGATGGGGAAGACCCC
	TCCCATGCTCAATGTACCAGAGCACTTCAGAAGACCATTCAATATAGGTCTTTACAAGGGAAC
	GATTGAGCTCACAATGACCATCTACGATGATGAGTCACTGGAAGCAGCTCCTATGATCTGGGA
	TCATTTCAATTCTTCCAAATTTTCTGATTTCAGAGAGAAGGCCTTAATGTTTGGCCTGATTGT
	CGAGAAAAAGGCATCTGGAGCGTGGGTCCTGGATTCTATCAGCCACTTCAAATGAGCTAGTCT
	AACTTCTAGCTTCTGAACAATCCCCGGTTTACTCAGTCTCTCCTAATTCCAGCCTCTCGAACA
	ACTAATATCCTGTCTTTTCTATCCCTATGAAAAAAACTAACAGAGATCGATCTGTTTCCTTGA
	CACGCGTGCCACCATGACCAGCGTGGGCATCGTGGGCCTGCTGCTGACCACCGCCATGGCCGC
	CGAGGTGACCAGAAGAGGCAGCGCCTACTACATGTACCTGGACCGGAACGATGCCGGCGAGGC
	CATCAGCTTTCCAACCACCCTGGGCATGAACAAGTGCTACATCCAGATCATGGACCTGGGCCA
	CACCTGTGACGCCACCATGAGCTACGAGTGCCCCATGCTGGACGAGGGCGTGGAACCCGACGA
	TGTGGACTGCTGGTGCAACACCACCAGCACCTGGGTGGTGTACGGCACCTGTCACCACAAGAA
	GGGCGAAGCCAGACGGTCCAGACGGGCCGTGACACTGCCTAGCCACAGCACCAGAAAGCTGCA
	GACCCGGTCCCAGACCTGGCTGGAAAGCAGAGAGTACACCAAGCACCTGATCCGGGTGGAAAA
	CTGGATCTTCCGGAACCCCGGCTTTGCCCTGGCCGCTGCTGCTATTGCTTGGCTGCTGGGCAG
	CAGCACCTCCCAGAAAGTGATCTACCTCGTGATGATCCTGCTGATCGCCCCTGCCTACAGCAT

	CCGGTGTATCGGCGTGTCCAACCGGGACTTCGTGGAAGGCATGAGCGGCGGCACATGGGTGGA
	CGTGGTGCTGGAACATGGCGGCTGCGTGACAGTGATGGCTCAGGACAAGCCCACCGTGGACAT
	CGAGCTCGTGACCACCACCGTGTCCAATATGGCCGAAGTGCGGAGCTACTGCTACGAGGCCAG
	CATCAGCGACATGGCCAGCGACAGCAGATGCCCTACACAGGGCGAGGCCTACCTGGACAAGCA
	GTCCGACACCCAGTACGTGTGCAAGCGGACCCTGGTGGATAGAGGCTGGGGCAATGGCTGCGG
	CCTGTTTGGCAAGGGCAGCCTCGTGACCTGCGCCAAGTTCGCCTGCAGCAAGAAGATGACCGG
	CAAGAGCATCCAGCCCGAGAACCTGGAATACCGGATCATGCTGAGCGTGCACGGCAGCCAGCA
	CTCCGGCATGATCGTGAACGACACCGGCCACGAGACAGACGAGAACCGGGCCAAGGTGGAAAT
	CACCCCCAACAGCCCTAGAGCCGAGGCCACACTGGGCGGCTTTGGATCTCTGGGCCTGGACTG
	CGAGCCTAGAACCGGCCTGGATTTCAGCGACCTGTACTACCTGACCATGAACAACAAGCACTG
	GCTGGTGCACAAAGAGTGGTTCCACGACATCCCCCTGCCCTGGCATGCCGGCGCTGATACAGG
	CACACCCCACTGGAACAACAAAGAGGCTCTGGTGGAATTCAAGGACGCCCACGCCAAGCGGCA
	GACCGTGGTGGTGCTGGGATCTCAGGAAGGCGCCGTGCATACAGCTCTGGCTGGCGCCCTGGA
	AGCCGAAATGGATGGCGCCAAAGGCAGACTGTCCAGCGGCCACCTGAAGTGCCGGCTGAAGAT
	GGACAAGCTGCGGCTGAAGGGCGTGTCCTACAGCCTGTGTACCGCCGCCTTCACCTTCACCAA
	GATCCCCGCCGAGACACTGCACGGCACCGTGACTGTGGAAGTGCAGTACGCCGGCACCGACGG
	CCCTTGTAAAGTGCCTGCTCAGATGGCCGTGGATATGCAGACCCTGACCCCCGTGGGCAGACT
	GATCACCGCCAACCCTGTGATCACCGAGAGCACCGAGAACAGCAAGATGATGCTGGAACTGGA
	CCCCCCCTTCGGCGACTCCTACATCGTGATCGGCGTGGGAGAGAAGAAGATCACCCACCACTG
	GCACAGAAGCGGCAGCACCATCGGCAAGGCCTTTGAGGCTACAGTGCGGGGAGCCAAGAGAAT
	GGCCGTGCTGGGAGATACCGCCTGGGACTTTGGCTCTGTGGGCGGAGCCCTGAACTCTCTGGG
	CAAGGGAATCCACCAGATCTTCGGAGCCGCCTTTAAGAGCCTGTTCGGCGGCATGAGCTGGTT
	CAGCCAGATCCTGATCGGCACCCTGCTGATGTGGCTGGGCCTGAACGCCAAGAACGGCAGCAT
	CTCCCTGATGTGCCTGGCTCTGGGAGGCGTGCTGATCTTCCTGAGCACAGCCGTGTCTGCCtg
	agcggccgcCCTGCACAACAGATTCTTCATGTTTGGACCAAATCAACTTGTGATACCATGCTC
	AAAGAGGCCTCAATTATATTTGAGTTTTTAATTTTTATGAAAAAAACTAACAGCAATCATGGA
	AGTCCACGATTTTGAGACCGACGAGTTCAATGATTTCAATGAAGATGACTATGCCACAAGAGA
	ATTCCTGAATCCCGATGAGCGCATGACGTACTTGAATCATGCTGATTACAATTTGAATTCTCC
	TCTAATTAGTGATGATATTGACAATTTGATCAGGAAATTCAATTCTCTTCCGATTCCCTCGAT
	GTGGGATAGTAAGAACTGGGATGGAGTTCTTGAGATGTTAACATCATGTCAAGCCAATCCCAT
	CTCAACATCTCAGATGCATAAATGGATGGGAAGTTGGTTAATGTCTGATAATCATGATGCCAG
	TCAAGGGTATAGTTTTTTACATGAAGTGGACAAAGAGGCAGAAATAACATTTGACGTGGTGGA
	GACCTTCATCCGCGGCTGGGGCAACAAACCAATTGAATACATCAAAAAGGAAAGATGGACTGA
	CTCATTCAAAATTCTCGCTTATTTGTGTCAAAAGTTTTTGGACTTACACAAGTTGACATTAAT
	CTTAAATGCTGTCTCTGAGGTGGAATTGCTCAACTTGGCGAGGACTTTCAAAGGCAAAGTCAG
	AAGAAGTTCTCATGGAACGAACATATGCAGGATTAGGGTTCCCAGCTTGGGTCCTACTTTTAT
	TTCAGAAGGATGGGCTTACTTCAAGAAACTTGATATTCTAATGGACCGAAACTTTCTGTTAAT
	GGTCAAAGATGTGATTATAGGGAGGATGCAAACGGTGCTATCCATGGTATGTAGAATAGACAA
	CCTGTTCTCAGAGCAAGACATCTTCTCCCTTCTAAATATCTACAGAATTGGAGATAAAATTGT

	GGAGAGGCAGGGAAATTTTTCTTATGACTTGATTAAAATGGTGGAACCGATATGCAACTTGAA
	GCTGATGAAATTAGCAAGAGAATCAAGGCCTTTAGTCCCACAATTCCCTCATTTTGAAAATCA
	TATCAAGACTTCTGTTGATGAAGGGGCAAAAATTGACCGAGGTATAAGATTCCTCCATGATCA
	GATAATGAGTGTGAAAACAGTGGATCTCACACTGGTGATTTATGGATCGTTCAGACATTGGGG
	TCATCCTTTTATAGATTATTACACTGGACTAGAAAAATTACATTCCCAAGTAACCATGAAGAA
	AGATATTGATGTGTCATATGCAAAAGCACTTGCAAGTGATTTAGCTCGGATTGTTCTATTTCA
	ACAGTTCAATGATCATAAAAAGTGGTTCGTGAATGGAGACTTGCTCCCTCATGATCATCCCTT
	TAAAAGTCATGTTAAAGAAAATACATGGCCCACAGCTGCTCAAGTTCAAGATTTTGGAGATAA
	ATGGCATGAACTTCCGCTGATTAAATGTTTTGAAATACCCGACTTACTAGACCCATCGATAAT
	ATACTCTGACAAAAGTCATTCAATGAATAGGTCAGAGGTGTTGAAACATGTCCGAATGAATCC
	GAACACTCCTATCCCTAGTAAAAAGGTGTTGCAGACTATGTTGGACACAAAGGCTACCAATTG
	GAAAGAATTTCTTAAAGAGATTGATGAGAAGGGCTTAGATGATGATGATCTAATTATTGGTCT
	TAAAGGAAAGGAGAGGGAACTGAAGTTGGCAGGTAGATTTTTCTCCCTAATGTCTTGGAAATT
	GCGAGAATACTTTGTAATTACCGAATATTTGATAAAGACTCATTTCGTCCCTATGTTTAAAGG
	CCTGACAATGGCGGACGATCTAACTGCAGTCATTAAAAAGATGTTAGATTCCTCATCCGGCCA
	AGGATTGAAGTCATATGAGGCAATTTGCATAGCCAATCACATTGATTACGAAAAATGGAATAA
	CCACCAAAGGAAGTTATCAAACGGCCCAGTGTTCCGAGTTATGGGCCAGTTCTTAGGTTATCC
	ATCCTTAATCGAGAGAACTCATGAATTTTTTGAGAAAAGTCTTATATACTACAATGGAAGACC
	AGACTTGATGCGTGTTCACAACAACACACTGATCAATTCAACCTCCCAACGAGTTTGTTGGCA
	AGGACAAGAGGGTGGACTGGAAGGTCTACGGCAAAAAGGATGGACTATCCTCAATCTACTGGT
	TATTCAAAGAGAGGCTAAAATCAGAAACACTGCTGTCAAAGTCTTGGCACAAGGTGATAATCA
	AGTTATTTGCACACAGTATAAAACGAAGAAATCGAGAAACGTTGTAGAATTACAGGGTGCTCT
	CAATCAAATGGTTTCTAATAATGAGAAAATTATGACTGCAATCAAAATAGGGACAGGGAAGTT
	AGGACTTTTGATAAATGACGATGAGACTATGCAATCTGCAGATTACTTGAATTATGGAAAAAT
	ACCGATTTTCCGTGGAGTGATTAGAGGGTTAGAGACCAAGAGATGGTCACGAGTGACTTGTGT
	CACCAATGACCAAATACCCACTTGTGCTAATATAATGAGCTCAGTTTCCACAAATGCTCTCAC
	CGTAGCTCATTTTGCTGAGAACCCAATCAATGCCATGATACAGTACAATTATTTTGGGACATT
	TGCTAGACTCTTGTTGATGATGCATGATCCTGCTCTTCGTCAATCATTGTATGAAGTTCAAGA
	TAAGATACCGGGCTTGCACAGTTCTACTTTCAAATACGCCATGTTGTATTTGGACCCTTCCAT
	TGGAGGAGTGTCGGGCATGTCTTTGTCCAGGTTTTTGATTAGAGCCTTCCCAGATCCCGTAAC
	AGAAAGTCTCTCATTCTGGAGATTCATCCATGTACATGCTCGAAGTGAGCATCTGAAGGAGAT
	GAGTGCAGTATTTGGAAACCCCGAGATAGCCAAGTTTCGAATAACTCACATAGACAAGCTAGT
	AGAAGATCCAACCTCTCTGAACATCGCTATGGGAATGAGTCCAGCGAACTTGTTAAAGACTGA
	GGTTAAAAAATGCTTAATCGAATCAAGACAAACCATCAGGAACCAGGTGATTAAGGATGCAAC
	CATATATTTGTATCATGAAGAGGATCGGCTCAGAAGTTTCTTATGGTCAATAAATCCTCTGTT
	CCCTAGATTTTTAAGTGAATTCAAATCAGGCACTTTTTTGGGAGTCGCAGACGGGCTCATCAG
	TCTATTTCAAAATTCTCGTACTATTCGGAACTCCTTTAAGAAAAAGTATCATAGGGAATTGGA
	TGATTTGATTGTGAGGAGTGAGGTATCCTCTTTGACACATTTAGGGAAACTTCATTTGAGAAG
	GGGATCATGTAAAATGTGGACATGTTCAGCTACTCATGCTGACACATTAAGATACAAATCCTG

	GGGCCGTACAGTTATTGGGACAACTGTACCCCATCCATTAGAAATGTTGGGTCCACAACATCG
	AAAAGAGACTCCTTGTGCACCATGTAACACATCAGGGTTCAATTATGTTTCTGTGCATTGTCC
	AGACGGGATCCATGACGTCTTTAGTTCACGGGGACCATTGCCTGCTTATCTAGGGTCTAAAAC
	ATCTGAATCTACATCTATTTTGCAGCCTTGGGAAAGGGAAAGCAAAGTCCCACTGATTAAAAG
	AGCTACACGTCTTAGAGATGCTATCTCTTGGTTTGTTGAACCCGACTCTAAACTAGCAATGAC
	TATACTTTCTAACATCCACTCTTTAACAGGCGAAGAATGGACCAAAAGGCAGCATGGGTTCAA
	AAGAACAGGGTCTGCCCTTCATAGGTTTTCGACATCTCGGATGAGCCATGGTGGGTTCGCATC
	TCAGAGCACTGCAGCATTGACCAGGTTGATGGCAACTACAGACACCATGAGGGATCTGGGAGA
	TCAGAATTTCGACTTTTTATTCCAAGCAACGTTGCTCTATGCTCAAATTACCACCACTGTTGC
	AAGAGACGGATGGATCACCAGTTGTACAGATCATTATCATATTGCCTGTAAGTCCTGTTTGAG
	ACCCATAGAAGAGATCACCCTGGACTCAAGTATGGACTACACGCCCCCAGATGTATCCCATGT
	GCTGAAGACATGGAGGAATGGGGAAGGTTCGTGGGGACAAGAGATAAAACAGATCTATCCTTT
	AGAAGGGAATTGGAAGAATTTAGCACCTGCTGAGCAATCCTATCAAGTCGGCAGATGTATAGG
	TTTTCTATATGGAGACTTGGCGTATAGAAAATCTACTCATGCCGAGGACAGTTCTCTATTTCC
	TCTATCTATACAAGGTCGTATTAGAGGTCGAGGTTTCTTAAAAGGGTTGCTAGACGGATTAAT
	GAGAGCAAGTTGCTGCCAAGTAATACACCGGAGAAGTCTGGCTCATTTGAAGAGGCCGGCCAA
	CGCAGTGTACGGAGGTTTGATTTACTTGATTGATAAATTGAGTGTATCACCTCCATTCCTTTC
	TCTTACTAGATCAGGACCTATTAGAGACGAATTAGAAACGATTCCCCACAAGATCCCAACCTC
	CTATCCGACAAGCAACCGTGATATGGGGGTGATTGTCAGAAATTACTTCAAATACCAATGCCG
	TCTAATTGAAAAGGGAAAATACAGATCACATTATTCACAATTATGGTTATTCTCAGATGTCTT
	ATCCATAGACTTCATTGGACCATTCTCTATTTCCACCACCCTCTTGCAAATCCTATACAAGCC
	ATTTTTATCTGGGAAAGATAAGAATGAGTTGAGAGAGCTGGCAAATCTTTCTTCATTGCTAAG
	ATCAGGAGAGGGGTGGGAAGACATACATGTGAAATTCTTCACCAAGGACATATTATTGTGTCC
	AGAGGAAATCAGACATGCTTGCAAGTTCGGGATTGCTAAGGATAATAATAAAGACATGAGCTA
	TCCCCCTTGGGGAAGGGAATCCAGAGGGACAATTACAACAATCCCTGTTTATTATACGACCAC
	CCCTTACCCAAAGATGCTAGAGATGCCTCCAAGAATCCAAAATCCCCTGCTGTCCGGAATCAG
	GTTGGGCCAATTACCAACTGGCGCTCATTATAAAATTCGGAGTATATTACATGGAATGGGAAT
	CCATTACAGGGACTTCTTGAGTTGTGGAGACGGCTCCGGAGGGATGACTGCTGCATTACTACG
	AGAAAATGTGCATAGCAGAGGAATATTCAATAGTCTGTTAGAATTATCAGGGTCAGTCATGCG
	AGGCGCCTCTCCTGAGCCCCCCAGTGCCCTAGAAACTTTAGGAGGAGATAAATCGAGATGTGT
	AAATGGTGAAACATGTTGGGAATATCCATCTGACTTATGTGACCCAAGGACTTGGGACTATTT
	CCTCCGACTCAAAGCAGGCTTGGGGCTTCAAATTGATTTAATTGTAATGGATATGGAAGTTCG
	GGATTCTTCTACTAGCCTGAAAATTGAGACGAATGTTAGAAATTATGTGCACCGGATTTTGGA
	TGAGCAAGGAGTTTTAATCTACAAGACTTATGGAACATATATTTGTGAGAGCGAAAAGAATGC
	AGTAACAATCCTTGGTCCCATGTTCAAGACGGTCGACTTAGTTCAAACAGAATTTAGTAGTTC
	TCAAACGTCTGAAGTATATATGGTATGTAAAGGTTTGAAGAAATTAATCGATGAACCCAATCC
	CGATTGGTCTTCCATCAATGAATCCTGGAAAAACCTGTACGCATTCCAGTCATCAGAACAGGA
	ATTTGCCAGAGCAAAGAAGGTTAGTACATACTTTACCTTGACAGGTATTCCCTCCCAATTCAT
	TCCTGATCCTTTTGTAAACATTGAGACTATGCTACAAATATTCGGAGTACCCACGGGTGTGTC

	TCATGCGGCTGCCTTAAAATCATCTGATAGACCTGCAGATTTATTGACCATTAGCCTTTTTTA
	TATGGCGATTATATCGTATTATAACATCAATCATATCAGAGTAGGACCGATACCTCCGAACCC
	CCCATCAGATGGAATTGCACAAAATGTGGGGATCGCTATAACTGGTATAAGCTTTTGGCTGAG
	TTTGATGGAGAAAGACATTCCACTATATCAACAGTGTTTAGCAGTTATCCAGCAATCATTCCC
	GATTAGGTGGGAGGCTGTTTCAGTAAAAGGAGGATACAAGCAGAAGTGGAGTACTAGAGGTGA
	TGGGCTCCCAAAAGATACCCGAACTTCAGACTCCTTGGCCCCAATCGGGAACTGGATCAGATC
	TCTGGAATTGGTCCGAAACCAAGTTCGTCTAAATCCATTCAATGAGATCTTGTTCAATCAGCT
	ATGTCGTACAGTGGATAATCATTTGAAATGGTCAAATTTGCGAAGAAACACAGGAATGATTGA
	ATGGATCAATAGACGAATTTCAAAAGAAGACCGGTCTATACTGATGTTGAAGAGTGACCTACA
	CGAGGAAAACTCTTGGAGAGATTAAAAAATCATGAGGAGACTCCAAACTTTAAGTATGAAAAA
	AACTTTGATCCTTAAGACCCTCTTGTGGTTTTTATTTTTTATCTGGTTTTGTGGTCTTCGTGG
	GTCGGCATGGCATCTCCACCTCCTCGCGGTCCGACCTGGGCATCCGAAGGAGGACGTCGTCCA
	CTCGGATGGCTAAGGGAGAGCTCGGATCCGGCTGCTAACAAAGCCCGAAAGGAAGCTGAGTTG
	GCTGCTGCCACCGCTGAGCAATAACTAGCATAACCCCTTGGGGCCTCTAAACGGGTCTTGAGG
	GGTTTTTTGCTGAAAGGAGGAACTATATCCGGATCGAGATCCTCTAGAGTCGACCTGCAGGCA
	TGCAAGCTTGTATTCTATAGTGTCACCTAAATCGTATGTGTATGATACATAAGGTTATGTATT
	AATTGTAGCCGCGTTCTAACGACAATATGTACAAGCCTAATTGTGTAGCATCTGGCTTACTGA
	AGCAGACCCTATCATCTCTCTCGTAAACTGCCGTCAGAGTCGGTTTGGTTGGACGAACCTTCT
	GAGTTTCTGGTAACGCCGTcCCGCACCCGGAAATGGTCAGCGAACCAATCAGCAGGGTCATCG
	CTAGCCAGATCCTCTACGCCGGACGCATCGTGGCCGGCATCACCGGCGCCACAGGTGCGGTTG
	CTGGCGCCTATATCGCCGACATCACCGATGGGGAAGATCGGGCTCGCCACTTCGGGCTCATGA
	GCGCTTGTTTCGGCGTGGGTATGGTGGCAGGCCCCGTGGCCGGGGGACTGTTGGGCGCCATCT
	CCTTGCACCATTCCTTGCGGCGGCGGTGCTCAACGGCCTCAACCTACTACTGGGCTGCTTCCT
	AATGCAGGAGTCGCATAAGGGAGAGCGTCGAATGGTGCACTCTCAGTACAATCTGCTCTGATG
	CCGCATAGTTAAGCCAGCCCCGACACCCGCCAACACCCGCTGACGCGCCCTGACGGGCTTGTC
	TGCTCCCGGCATCCGCTTACAGACAAGCTGTGACCGTCTCCGGGAGCTGCATGTGTCAGAGGT
	TTTCACCGTCATCACCGAAACGCGCGAGACGAAAGGGCCTCGTGATACGCCTATTTTTATAGG
	TTAATGTCATGATAATAATGGTTTCTTAGACGTCAGGTGGCACTTTTCGGGGAAATGTGCGCG
	GAACCCCTATTTGTTTATTTTTCTAAATACATTCAAATATGTATCCGCTCATGAGACAATAAC
	CCTGATAAATGCTTCAATAATATTGAAAAAGGAAGAGTATGAGTATTCAACATTTCCGTGTCG
	CCCTTATTCCCTTTTTTGCGGCATTTTGCCTTCCTGTTTTTGCTCACCCAGAAACGCTGGTGA
	AAGTAAAAGATGCTGAAGATCAGTTGGGTGCACGAGTGGGTTACATCGAACTGGATCTCAACA
	GCGGTAAGATCCTTGAGAGTTTTCGCCCCGAAGAACGTTTTCCAATGATGAGCACTTTTAAAG
	TTCTGCTATGTGGCGCGGTATTATCCCGTATTGACGCCGGGCAAGAGCAACTCGGTCGCCGCA
	TACACTATTCTCAGAATGACTTGGTTGAGTACTCACCAGTCACAGAAAAGCATCTTACGGATG
	GCATGACAGTAAGAGAATTATGCAGTGCTGCCATAACCATGAGTGATAACACTGCGGCCAACT
	TACTTCTGACAACGATCGGAGGACCGAAGGAGCTAACCGCTTTTTTGCACAACATGGGGGATC
	ATGTAACTCGCCTTGATCGTTGGGAACCGGAGCTGAATGAAGCCATACCAAACGACGAGCGTG
	ACACCACGATGCCTGTAGCAATGGCAACAACGTTGCGCAAACTATTAACTGGCGAACTACTTA

	CTCTAGCTTCCCGGCAACAATTAATAGACTGGATGGAGGCGGATAAAGTTGCAGGACCACTTC TGCGCTCGGCCCTTCCGGCTGGCTGGTTTATTGCTGATAAATCTGGAGCCGGTGAGCGTGGGT CTCGCGGTATCATTGCAGCACTGGGGCCAGATGGTAAGCCCTCCCGTATCGTAGTTATCTACA CGACGGGGAGTCAGGCAACTATGGATGAACGAAATAGACAGATCGCTGAGATAGGTGCCTCAC TGATTAAGCATTGGTAACTGTCAGACCAAGTTTACTCATATATACTTTAGATTGATTTAAAAC TTCATTTTTAATTTAAAAGGATCTAGGTGAAGATCCTTTTTGATAATCTCATGACCAAAATCC CTTAACGTGAGTTTTCGTTCCACTGAGCGTCAGACCCCGTAGAAAAGATCAAAGGATCTTCTT GAGATCCTTTTTTTCTGCGCGTAATCTGCTGCTTGCAAACAAAAAAACCACCGCTACCAGCGG TGGTTTGTTTGCCGGATCAAGAGCTACCAACTCTTTTTCCGAAGGTAACTGGCTTCAGCAGAG CGCAGATACCAAATACTGTCCTTCTAGTGTAGCCGTAGTTAGGCCACCACTTCAAGAACTCTG TAGCACCGCCTACATACCTCGCTCTGCTAATCCTGTTACCAGTGGCTGCTGCCAGTGGCGATA AGTCGTGTCTTACCGGGTTGGACTCAAGACGATAGTTACCGGATAAGGCGCAGCGGTCGGGCT GAACGGGGGGTTCGTGCACACAGCCCAGCTTGGAGCGAACGACCTACACCGAACTGAGATACC TACAGCGTGAGCTATGAGAAAGCGCCACGCTTCCCGAAGGGAGAAAGGCGGACAGGTATCCGG TAAGCGGCAGGGTCGGAACAGGAGAGCGCACGAGGGAGCTTCCAGGGGGAAACGCCTGGTATC TTTATAGTCCTGTCGGGTTTCGCCACCTCTGACTTGAGCGTCGATTTTTGTGATGCTCGTCAG GGGGGCGGAGCCTATGGAAAAACGCCAGCAACGCGGCCTTTTTACGGTTCCTGGCCTTTTGCT GGCCTTTTGCTCACATGTTCTTTCCTGCGTTATCCCCTGATTCTGTGGATAACCGTATTACCG CCTTTGAGTGAGCTGATACCGCTCGCCGCAGCCGAACGACCGAGCGCAGCGAGTCAGTGAGCG AGGAAGCGGAAGAGCGCCCAATACGCAAACCGCCTCTCCCCGCGCGTTGGCCGATTCATTAAT GCAGGGGGATCTCGATCCCGCGAAATTAATACGACTCACTATAGG

In some embodiments, the nucleic acid sequence encoding a Zika virus prM protein is adjacent in the VSV genome to the nucleic acid sequence encoding a Zika virus E protein. In some embodiments, the nucleic acid sequence encoding a Zika virus prM protein is adjacent in the VSV genome to the nucleic acid sequence encoding a Zika virus C protein. Exemplary sequences include rVSV-Zika-prME (SEQ ID NO:7) and rVSV-Zika-CprME (SEQ ID NO:8)

SEQ ID NO:7	ACGAAGACAAACAAACCATTATTATCATTAAAAGGCTCAGGAGAAACTTTAACAGTAATCAGA ATTCTCGAGAAAGCCACCATGAGAAGAGGCAGCGCCTACTACATGTACCTGGACCGGAACGAT GCCGGCGAGGCCATCAGCTTTCCAACCACCCTGGGCATGAACAAGTGCTACATCCAGATCATG GACCTGGGCCACACCTGTGACGCCACCATGAGCTACGAGTGCCCCATGCTGGACGAGGGCGTG GAACCCGACGATGTGGACTGCTGGTGCAACACCACCAGCACCTGGGTGGTGTACGGCACCTGT CACCACAAGAAGGGCGAAGCCAGACGGTCCAGACGGGCCGTGACACTGCCTAGCCACAGCACC AGAAAGCTGCAGACCCGGTCCCAGACCTGGCTGGAAAGCAGAGAGTACACCAAGCACCTGATC

	CGGGTGGAAAACTGGATCTTCCGGAACCCCGGCTTTGCCCTGGCCGCTGCTGCTATTGCTTGG
	CTGCTGGGCAGCAGCACCTCCCAGAAAGTGATCTACCTCGTGATGATCCTGCTGATCGCCCCT
	GCCTACAGCATCCGGTGTATCGGCGTGTCCAACCGGGACTTCGTGGAAGGCATGAGCGGCGGC
	ACATGGGTGGACGTGGTGCTGGAACATGGCGGCTGCGTGACAGTGATGGCTCAGGACAAGCCC
	ACCGTGGACATCGAGCTCGTGACCACCACCGTGTCCAATATGGCCGAAGTGCGGAGCTACTGC
	TACGAGGCCAGCATCAGCGACATGGCCAGCGACAGCAGATGCCCTACACAGGGCGAGGCCTAC
	CTGGACAAGCAGTCCGACACCCAGTACGTGTGCAAGCGGACCCTGGTGGATAGAGGCTGGGGC
	AATGGCTGCGGCCTGTTTGGCAAGGGCAGCCTCGTGACCTGCGCCAAGTTCGCCTGCAGCAAG
	AAGATGACCGGCAAGAGCATCCAGCCCGAGAACCTGGAATACCGGATCATGCTGAGCGTGCAC
	GGCAGCCAGCACTCCGGCATGATCGTGAACGACACCGGCCACGAGACAGACGAGAACCGGGCC
	AAGGTGGAAATCACCCCCAACAGCCCTAGAGCCGAGGCCACACTGGGCGGCTTTGGATCTCTG
	GGCCTGGACTGCGAGCCTAGAACCGGCCTGGATTTCAGCGACCTGTACTACCTGACCATGAAC
	AACAAGCACTGGCTGGTGCACAAAGAGTGGTTCCACGACATCCCCCTGCCCTGGCATGCCGGC
	GCTGATACAGGCACACCCCACTGGAACAACAAAGAGGCTCTGGTGGAATTCAAGGACGCCCAC
	GCCAAGCGGCAGACCGTGGTGGTGCTGGGATCTCAGGAAGGCGCCGTGCATACAGCTCTGGCT
	GGCGCCCTGGAAGCCGAAATGGATGGCGCCAAAGGCAGACTGTCCAGCGGCCACCTGAAGTGC
	CGGCTGAAGATGGACAAGCTGCGGCTGAAGGGCGTGTCCTACAGCCTGTGTACCGCCGCCTTC
	ACCTTCACCAAGATCCCCGCCGAGACACTGCACGGCACCGTGACTGTGGAAGTGCAGTACGCC
	GGCACCGACGGCCCTTGTAAAGTGCCTGCTCAGATGGCCGTGGATATGCAGACCCTGACCCCC
	GTGGGCAGACTGATCACCGCCAACCCTGTGATCACCGAGAGCACCGAGAACAGCAAGATGATG
	CTGGAACTGGACCCCCCCTTCGGCGACTCCTACATCGTGATCGGCGTGGGAGAGAAGAAGATC
	ACCCACCACTGGCACAGAAGCGGCAGCACCATCGGCAAGGCCTTTGAGGCTACAGTGCGGGGA
	GCCAAGAGAATGGCCGTGCTGGGAGATACCGCCTGGGACTTTGGCTCTGTGGGCGGAGCCCTG
	AACTCTCTGGGCAAGGGAATCCACCAGATCTTCGGAGCCGCCTTTAAGAGCCTGTTCGGCGGC
	ATGAGCTGGTTCAGCCAGATCCTGATCGGCACCCTGCTGATGTGGCTGGGCCTGAACGCCAAG
	AACGGCAGCATCTCCCTGATGTGCCTGGCTCTGGGAGGCGTGCTGATCTTCCTGAGCACAGCC
	GTGTCTGCCTAAATGGCCATATGAAAAAAACTAACAGTAATCAAAATGTCTGTTACAGTCAAG
	AGAATCATTGACAACACAGTCATAGTTCCAAAACTTCCTGCAAATGAGGATCCAGTGGAATAC
	CCGGCAGATTACTTCAGAAAATCAAAGGAGATTCCTCTTTACATCAATACTACAAAAAGTTTG
	TCAGATCTAAGAGGATATGTCTACCAAGGCCTCAAATCCGGAAATGTATCAATCATACATGTC
	AACAGCTACTTGTATGGAGCATTAAAGGACATCCGGGGTAAGTTGGATAAAGATTGGTCAAGT
	TTCGGAATAAACATCGGGAAAGCAGGGGATACAATCGGAATATTTGACCTTGTATCCTTGAAA
	GCCCTGGACGGCGTACTTCCAGATGGAGTATCGGATGCTTCCAGAACCAGCGCAGATGACAAA
	TGGTTGCCTTTGTATCTACTTGGCTTATACAGAGTGGGCAGAACACAAATGCCTGAATACAGA
	AAAAAGCTCATGGATGGGCTGACAAATCAATGCAAAATGATCAATGAACAGTTTGAACCTCTT
	GTGCCAGAAGGTCGTGACATTTTTGATGTGTGGGGAAATGACAGTAATTACACAAAAATTGTC
	GCTGCAGTGGACATGTTCTTCCACATGTTCAAAAAACATGAATGTGCCTCGTTCAGATACGGA
	ACTATTGTTTCCAGATTCAAAGATTGTGCTGCATTGGCAACATTTGGACACCTCTGCAAAATA
	ACCGGAATGTCTACAGAAGATGTAACGACCTGGATCTTGAACCGAGAAGTTGCAGATGAAATG

	GTCCAAATGATGCTTCCAGGCCAAGAAATTGACAAGGCCGATTCATACATGCCTTATTTGATC
	GACTTTGGATTGTCTTCTAAGTCTCCATATTCTTCCGTCAAAAACCCTGCCTTCCACTTCTGG
	GGGCAATTGACAGCTCTTCTGCTCAGATCCACCAGAGCAAGGAATGCCCGACAGCCTGATGAC
	ATTGAGTATACATCTCTTACTACAGCAGGTTTGTTGTACGCTTATGCAGTAGGATCCTCTGCC
	GACTTGGCACAACAGTTTTGTGTTGGAGATAACAAATACACTCCAGATGATAGTACCGGAGGA
	TTGACGACTAATGCACCGCCACAAGGCAGAGATGTGGTCGAATGGCTCGGATGGTTTGAAGAT
	CAAAACAGAAAACCGACTCCTGATATGATGCAGTATGCGAAAAGAGCAGTCATGTCACTGCAA
	GGCCTAAGAGAGAAGACAATTGGCAAGTATGCTAAGTCAGAATTTGACAAATGACCCTATAAT
	TCTCAGATCACCTATTATATATTATGCTACATATGAAAAAAACTAACAGATATCATGGATAAT
	CTCACAAAAGTTCGTGAGTATCTCAAGTCCTATTCTCGTCTGGATCAGGCGGTAGGAGAGATA
	GATGAGATCGAAGCACAACGAGCTGAAAAGTCCAATTATGAGTTGTTCCAAGAGGATGGAGTG
	GAAGAGCATACTAAGCCCTCTTATTTTCAGGCAGCAGATGATTCTGACACAGAATCTGAACCA
	GAAATTGAAGACAATCAAGGTTTGTATGCACAGGATCCAGAAGCTGAGCAAGTTGAAGGCTTT
	ATACAGGGGCCTTTAGATGACTATGCAGATGAGGAAGTGGATGTTGTATTTACTTCGGACTGG
	AAACCACCTGAGCTTGAATCTGACGAGCATGGAAAGACCTTACGGTTGACATCGCCAGAGGGT
	TTAAGTGGAGAGCAGAAATCCCAGTGGCTTTCGACGATTAAAGCAGTCGTGCAAAGTGCCAAA
	TACTGGAATCTGGCAGAGTGCACATTTGAAGCATCGGGAGAAGGGGTCATTATGAAGGAGCGC
	CAGATAACTCCGGATGTATATAAGGTCACTCCAGTGATGAACACACATCCGTCCCAATCAGAA
	GCAGTATCAGATGTTTGGTCTCTCTCAAAGACATCCATGACTTTCCAACCCAAGAAAGCAAGT
	CTTCAGCCTCTCACCATATCCTTGGATGAATTGTTCTCATCTAGAGGAGAGTTCATCTCTGTC
	GGAGGTGACGGACGAATGTCTCATAAAGAGGCCATCCTGCTCGGCCTGAGATACAAAAAGTTG
	TACAATCAGGCGAGAGTCAAATATTCTCTGTAGACTATGAAAAAAAGTAACAGATATCACGAT
	CTAAGTGTTATCCCAATCCATTCATCATGAGTTCCTTAAAGAAGATTCTCGGTCTGAAGGGGA
	AAGGTAAGAAATCTAAGAAATTAGGGATCGCACCACCCCCTTATGAAGAGGACACTAGCATGG
	AGTATGCTCCGAGCGCTCCAATTGACAAATCCTATTTTGGAGTTGACGAGATGGACACCTATG
	ATCCGAATCAATTAAGATATGAGAAATTCTTCTTTACAGTGAAAATGACGGTTAGATCTAATC
	GTCCGTTCAGAACATACTCAGATGTGGCAGCCGCTGTATCCCATTGGGATCACATGTACATCG
	GAATGGCAGGGAAACGTCCCTTCTACAAAATCTTGGCTTTTTTGGGTTCTTCTAATCTAAAGG
	CCACTCCAGCGGTATTGGCAGATCAAGGTCAACCAGAGTATCACACTCACTGCGAAGGCAGGG
	CTTATTTGCCACATAGGATGGGGAAGACCCCTCCCATGCTCAATGTACCAGAGCACTTCAGAA
	GACCATTCAATATAGGTCTTTACAAGGGAACGATTGAGCTCACAATGACCATCTACGATGATG
	AGTCACTGGAAGCAGCTCCTATGATCTGGGATCATTTCAATTCTTCCAAATTTTCTGATTTCA
	GAGAGAAGGCCTTAATGTTTGGCCTGATTGTCGAGAAAAAGGCATCTGGAGCGTGGGTCCTGG
	ATTCTATCAGCCACTTCAAATGAGCTAGTCTAACTTCTAGCTTCTGAACAATCCCCGGTTTAC
	TCAGTCTCTCCTAATTCCAGCCTCTCGAACAACTAATATCCTGTCTTTTCTATCCCTATGAAA
	AAAACTAACAGAGATCGATCTGTTTCCTTGACACGCGTACCATGAAGTGCCTTTTGTACTTAG
	CTTTTTTATTCATCGGGGTGAATTGCAAGTTCACCATAGTTTTTCCACACAACCGAAAAGGAA
	ACTGGAAAAATGTTCCTTCCAATTACCATTATTGCCCGTCAAGCTCAGATTTAAATTGGCATA
	ATGACTTAATAGGCACAGCCTTACAAGTCAAAATGCCCAAGAGTCACAAGGCTATTCAAGCAG

	ACGGTTGGATGTGTCATGCTTCCAAATGGGTCACTACTTGTGATTTCCGCTGGTACGGACCGG
	AGTATATAACACATTCCATCCGATCCTTCACTCCATCTGTAGAACAATGCAAGGAAAGCATTG
	AACAAACGAAACAAGGAACTTGGCTGAATCCAGGCTTCCCTCCTCAAAGTTGTGGATATGCAA
	CTGTGACGGATGCTGAAGCAGCGATTGTCCAGGTGACTCCTCACCATGTGCTTGTTGATGAAT
	ACACAGGAGAATGGGTTGATTCACAGTTCATCAACGGAAAATGCAGCAATGACATATGCCCCA
	CTGTCCATAACTCCACAACCTGGCATTCCGACTATAAGGTCAAAGGGCTATGTGATTCTAACC
	TCATTTCCATGGACATCACCTTCTTCTCAGAGGACGGAGAGCTATCATCCCTAGGAAAGGAGG
	GCACAGGGTTCAGAAGTAACTACTTTGCTTATGAAACTGGAGACAAGGCCTGCAAAATGCAGT
	ACTGCAAGCATTGGGGAGTCAGACTCCCATCAGGTGTCTGGTTCGAGATGGCTGATAAGGATC
	TCTTTGCTGCAGCCAGATTCCCTGAATGCCCAGAAGGGTCAAGTATCTCTGCTCCATCTCAGA
	CCTCAGTGGATGTAAGTCTCATTCAGGACGTTGAGAGGATCTTGGATTATTCCCTCTGCCAAG
	AAACCTGGAGCAAAATCAGAGCGGGTCTTCCCATCTCTCCAGTGGATCTCAGCTATCTTGCTC
	CTAAAAACCCAGGAACCGGTCCTGTCTTTACCATAATCAATGGTACCCTAAAATACTTTGAGA
	CCAGATACATCAGAGTCGATATTGCTGCTCCAATCCTCTCAAGAATGGTCGGAATGATCAGTG
	GAACTACCACAGAAAGGGAACTGTGGGATGACTGGGCTCCATATGAAGACGTGGAAATTGGAC
	CCAATGGAGTTCTGAGGACCAGTTCAGGATATAAGTTTCCTTTATATATGATTGGACATGGTA
	TGTTGGACTCCGATCTTCATCTTAGCTCAAAGGCTCAGGTGTTTGAACATCCTCACATTCAAG
	ACGCTGCTTCGCAGCTTCCTGATGATGAGACTTTATTTTTTGGTGATACTGGGCTATCCAAAA
	ATCCAATCGAGTTTGTAGAAGGTTGGTTCAGTAGTTGGAAGAGCTCTATTGCCTCTTTTTGCT
	TTATCATAGGGTTAATCATTGGACTATTCTTGGTTCTCCGAGTTGGTATTTATCTTTGCATTA
	AATTAAAGCACACCAAGAAAAGACAGATTTATACAGACATAGAGATGAACCGACTTGGAAAGA
	AGCGGCCGCCCTGCACAACAGATTCTTCATGTTTGGACCAAATCAACTTGTGATACCATGCTC
	AAAGAGGCCTCAATTATATTTGAGTTTTTAATTTTTATGAAAAAAACTAACAGCAATCATGGA
	AGTCCACGATTTTGAGACCGACGAGTTCAATGATTTCAATGAAGATGACTATGCCACAAGAGA
	ATTCCTGAATCCCGATGAGCGCATGACGTACTTGAATCATGCTGATTACAATTTGAATTCTCC
	TCTAATTAGTGATGATATTGACAATTTGATCAGGAAATTCAATTCTCTTCCGATTCCCTCGAT
	GTGGGATAGTAAGAACTGGGATGGAGTTCTTGAGATGTTAACATCATGTCAAGCCAATCCCAT
	CTCAACATCTCAGATGCATAAATGGATGGGAAGTTGGTTAATGTCTGATAATCATGATGCCAG
	TCAAGGGTATAGTTTTTTACATGAAGTGGACAAAGAGGCAGAAATAACATTTGACGTGGTGGA
	GACCTTCATCCGCGGCTGGGGCAACAAACCAATTGAATACATCAAAAAGGAAAGATGGACTGA
	CTCATTCAAAATTCTCGCTTATTTGTGTCAAAAGTTTTTGGACTTACACAAGTTGACATTAAT
	CTTAAATGCTGTCTCTGAGGTGGAATTGCTCAACTTGGCGAGGACTTTCAAAGGCAAAGTCAG
	AAGAAGTTCTCATGGAACGAACATATGCAGGATTAGGGTTCCCAGCTTGGGTCCTACTTTTAT
	TTCAGAAGGATGGGCTTACTTCAAGAAACTTGATATTCTAATGGACCGAAACTTTCTGTTAAT
	GGTCAAAGATGTGATTATAGGGAGGATGCAAACGGTGCTATCCATGGTATGTAGAATAGACAA
	CCTGTTCTCAGAGCAAGACATCTTCTCCCTTCTAAATATCTACAGAATTGGAGATAAAATTGT
	GGAGAGGCAGGGAAATTTTTCTTATGACTTGATTAAAATGGTGGAACCGATATGCAACTTGAA
	GCTGATGAAATTAGCAAGAGAATCAAGGCCTTTAGTCCCACAATTCCCTCATTTTGAAAATCA
	TATCAAGACTTCTGTTGATGAAGGGGCAAAAATTGACCGAGGTATAAGATTCCTCCATGATCA

	GATAATGAGTGTGAAAACAGTGGATCTCACACTGGTGATTTATGGATCGTTCAGACATTGGGG
	TCATCCTTTTATAGATTATTACACTGGACTAGAAAAATTACATTCCCAAGTAACCATGAAGAA
	AGATATTGATGTGTCATATGCAAAAGCACTTGCAAGTGATTTAGCTCGGATTGTTCTATTTCA
	ACAGTTCAATGATCATAAAAAGTGGTTCGTGAATGGAGACTTGCTCCCTCATGATCATCCCTT
	TAAAAGTCATGTTAAAGAAAATACATGGCCCACAGCTGCTCAAGTTCAAGATTTTGGAGATAA
	ATGGCATGAACTTCCGCTGATTAAATGTTTTGAAATACCCGACTTACTAGACCCATCGATAAT
	ATACTCTGACAAAAGTCATTCAATGAATAGGTCAGAGGTGTTGAAACATGTCCGAATGAATCC
	GAACACTCCTATCCCTAGTAAAAAGGTGTTGCAGACTATGTTGGACACAAAGGCTACCAATTG
	GAAAGAATTTCTTAAAGAGATTGATGAGAAGGGCTTAGATGATGATGATCTAATTATTGGTCT
	TAAAGGAAAGGAGAGGGAACTGAAGTTGGCAGGTAGATTTTTCTCCCTAATGTCTTGGAAATT
	GCGAGAATACTTTGTAATTACCGAATATTTGATAAAGACTCATTTCGTCCCTATGTTTAAAGG
	CCTGACAATGGCGGACGATCTAACTGCAGTCATTAAAAAGATGTTAGATTCCTCATCCGGCCA
	AGGATTGAAGTCATATGAGGCAATTTGCATAGCCAATCACATTGATTACGAAAAATGGAATAA
	CCACCAAAGGAAGTTATCAAACGGCCCAGTGTTCCGAGTTATGGGCCAGTTCTTAGGTTATCC
	ATCCTTAATCGAGAGAACTCATGAATTTTTTGAGAAAAGTCTTATATACTACAATGGAAGACC
	AGACTTGATGCGTGTTCACAACAACACACTGATCAATTCAACCTCCCAACGAGTTTGTTGGCA
	AGGACAAGAGGGTGGACTGGAAGGTCTACGGCAAAAAGGATGGACTATCCTCAATCTACTGGT
	TATTCAAAGAGAGGCTAAAATCAGAAACACTGCTGTCAAAGTCTTGGCACAAGGTGATAATCA
	AGTTATTTGCACACAGTATAAAACGAAGAAATCGAGAAACGTTGTAGAATTACAGGGTGCTCT
	CAATCAAATGGTTTCTAATAATGAGAAAATTATGACTGCAATCAAAATAGGGACAGGGAAGTT
	AGGACTTTTGATAAATGACGATGAGACTATGCAATCTGCAGATTACTTGAATTATGGAAAAAT
	ACCGATTTTCCGTGGAGTGATTAGAGGGTTAGAGACCAAGAGATGGTCACGAGTGACTTGTGT
	CACCAATGACCAAATACCCACTTGTGCTAATATAATGAGCTCAGTTTCCACAAATGCTCTCAC
	CGTAGCTCATTTTGCTGAGAACCCAATCAATGCCATGATACAGTACAATTATTTTGGGACATT
	TGCTAGACTCTTGTTGATGATGCATGATCCTGCTCTTCGTCAATCATTGTATGAAGTTCAAGA
	TAAGATACCGGGCTTGCACAGTTCTACTTTCAAATACGCCATGTTGTATTTGGACCCTTCCAT
	TGGAGGAGTGTCGGGCATGTCTTTGTCCAGGTTTTTGATTAGAGCCTTCCCAGATCCCGTAAC
	AGAAAGTCTCTCATTCTGGAGATTCATCCATGTACATGCTCGAAGTGAGCATCTGAAGGAGAT
	GAGTGCAGTATTTGGAAACCCCGAGATAGCCAAGTTTCGAATAACTCACATAGACAAGCTAGT
	AGAAGATCCAACCTCTCTGAACATCGCTATGGGAATGAGTCCAGCGAACTTGTTAAAGACTGA
	GGTTAAAAAATGCTTAATCGAATCAAGACAAACCATCAGGAACCAGGTGATTAAGGATGCAAC
	CATATATTTGTATCATGAAGAGGATCGGCTCAGAAGTTTCTTATGGTCAATAAATCCTCTGTT
	CCCTAGATTTTTAAGTGAATTCAAATCAGGCACTTTTTTGGGAGTCGCAGACGGGCTCATCAG
	TCTATTTCAAAATTCTCGTACTATTCGGAACTCCTTTAAGAAAAAGTATCATAGGGAATTGGA
	TGATTTGATTGTGAGGAGTGAGGTATCCTCTTTGACACATTTAGGGAAACTTCATTTGAGAAG
	GGGATCATGTAAAATGTGGACATGTTCAGCTACTCATGCTGACACATTAAGATACAAATCCTG
	GGGCCGTACAGTTATTGGGACAACTGTACCCCATCCATTAGAAATGTTGGGTCCACAACATCG
	AAAAGAGACTCCTTGTGCACCATGTAACACATCAGGGTTCAATTATGTTTCTGTGCATTGTCC
	AGACGGGATCCATGACGTCTTTAGTTCACGGGGACCATTGCCTGCTTATCTAGGGTCTAAAAC

	ATCTGAATCTACATCTATTTTGCAGCCTTGGGAAAGGGAAAGCAAAGTCCCACTGATTAAAAG
	AGCTACACGTCTTAGAGATGCTATCTCTTGGTTTGTTGAACCCGACTCTAAACTAGCAATGAC
	TATACTTTCTAACATCCACTCTTTAACAGGCGAAGAATGGACCAAAAGGCAGCATGGGTTCAA
	AAGAACAGGGTCTGCCCTTCATAGGTTTTCGACATCTCGGATGAGCCATGGTGGGTTCGCATC
	TCAGAGCACTGCAGCATTGACCAGGTTGATGGCAACTACAGACACCATGAGGGATCTGGGAGA
	TCAGAATTTCGACTTTTTATTCCAAGCAACGTTGCTCTATGCTCAAATTACCACCACTGTTGC
	AAGAGACGGATGGATCACCAGTTGTACAGATCATTATCATATTGCCTGTAAGTCCTGTTTGAG
	ACCCATAGAAGAGATCACCCTGGACTCAAGTATGGACTACACGCCCCCAGATGTATCCCATGT
	GCTGAAGACATGGAGGAATGGGGAAGGTTCGTGGGGACAAGAGATAAAACAGATCTATCCTTT
	AGAAGGGAATTGGAAGAATTTAGCACCTGCTGAGCAATCCTATCAAGTCGGCAGATGTATAGG
	TTTTCTATATGGAGACTTGGCGTATAGAAAATCTACTCATGCCGAGGACAGTTCTCTATTTCC
	TCTATCTATACAAGGTCGTATTAGAGGTCGAGGTTTCTTAAAAGGGTTGCTAGACGGATTAAT
	GAGAGCAAGTTGCTGCCAAGTAATACACCGGAGAAGTCTGGCTCATTTGAAGAGGCCGGCCAA
	CGCAGTGTACGGAGGTTTGATTTACTTGATTGATAAATTGAGTGTATCACCTCCATTCCTTTC
	TCTTACTAGATCAGGACCTATTAGAGACGAATTAGAAACGATTCCCCACAAGATCCCAACCTC
	CTATCCGACAAGCAACCGTGATATGGGGGTGATTGTCAGAAATTACTTCAAATACCAATGCCG
	TCTAATTGAAAAGGGAAAATACAGATCACATTATTCACAATTATGGTTATTCTCAGATGTCTT
	ATCCATAGACTTCATTGGACCATTCTCTATTTCCACCACCCTCTTGCAAATCCTATACAAGCC
	ATTTTTATCTGGGAAAGATAAGAATGAGTTGAGAGAGCTGGCAAATCTTTCTTCATTGCTAAG
	ATCAGGAGAGGGGTGGGAAGACATACATGTGAAATTCTTCACCAAGGACATATTATTGTGTCC
	AGAGGAAATCAGACATGCTTGCAAGTTCGGGATTGCTAAGGATAATAATAAAGACATGAGCTA
	TCCCCCTTGGGGAAGGGAATCCAGAGGGACAATTACAACAATCCCTGTTTATTATACGACCAC
	CCCTTACCCAAAGATGCTAGAGATGCCTCCAAGAATCCAAAATCCCCTGCTGTCCGGAATCAG
	GTTGGGCCAATTACCAACTGGCGCTCATTATAAAATTCGGAGTATATTACATGGAATGGGAAT
	CCATTACAGGGACTTCTTGAGTTGTGGAGACGGCTCCGGAGGGATGACTGCTGCATTACTACG
	AGAAAATGTGCATAGCAGAGGAATATTCAATAGTCTGTTAGAATTATCAGGGTCAGTCATGCG
	AGGCGCCTCTCCTGAGCCCCCCAGTGCCCTAGAAACTTTAGGAGGAGATAAATCGAGATGTGT
	AAATGGTGAAACATGTTGGGAATATCCATCTGACTTATGTGACCCAAGGACTTGGGACTATTT
	CCTCCGACTCAAAGCAGGCTTGGGGCTTCAAATTGATTTAATTGTAATGGATATGGAAGTTCG
	GGATTCTTCTACTAGCCTGAAAATTGAGACGAATGTTAGAAATTATGTGCACCGGATTTTGGA
	TGAGCAAGGAGTTTTAATCTACAAGACTTATGGAACATATATTTGTGAGAGCGAAAAGAATGC
	AGTAACAATCCTTGGTCCCATGTTCAAGACGGTCGACTTAGTTCAAACAGAATTTAGTAGTTC
	TCAAACGTCTGAAGTATATATGGTATGTAAAGGTTTGAAGAAATTAATCGATGAACCCAATCC
	CGATTGGTCTTCCATCAATGAATCCTGGAAAAACCTGTACGCATTCCAGTCATCAGAACAGGA
	ATTTGCCAGAGCAAAGAAGGTTAGTACATACTTTACCTTGACAGGTATTCCCTCCCAATTCAT
	TCCTGATCCTTTTGTAAACATTGAGACTATGCTACAAATATTCGGAGTACCCACGGGTGTGTC
	TCATGCGGCTGCCTTAAAATCATCTGATAGACCTGCAGATTTATTGACCATTAGCCTTTTTTA
	TATGGCGATTATATCGTATTATAACATCAATCATATCAGAGTAGGACCGATACCTCCGAACCC
	CCCATCAGATGGAATTGCACAAAATGTGGGGATCGCTATAACTGGTATAAGCTTTTGGCTGAG

	TTTGATGGAGAAAGACATTCCACTATATCAACAGTGTTTAGCAGTTATCCAGCAATCATTCCC
	GATTAGGTGGGAGGCTGTTTCAGTAAAAGGAGGATACAAGCAGAAGTGGAGTACTAGAGGTGA
	TGGGCTCCCAAAAGATACCCGAACTTCAGACTCCTTGGCCCCAATCGGGAACTGGATCAGATC
	TCTGGAATTGGTCCGAAACCAAGTTCGTCTAAATCCATTCAATGAGATCTTGTTCAATCAGCT
	ATGTCGTACAGTGGATAATCATTTGAAATGGTCAAATTTGCGAAGAAACACAGGAATGATTGA
	ATGGATCAATAGACGAATTTCAAAAGAAGACCGGTCTATACTGATGTTGAAGAGTGACCTACA
	CGAGGAAAACTCTTGGAGAGATTAAAAAATCATGAGGAGACTCCAAACTTTAAGTATGAAAAA
	AACTTTGATCCTTAAGACCCTCTTGTGGTTTTTATTTTTTATCTGGTTTTGTGGTCTTCGTGG
	GTCGGCATGGCATCTCCACCTCCTCGCGGTCCGACCTGGGCATCCGAAGGAGGACGTCGTCCA
	CTCGGATGGCTAAGGGAGAGCTCGGATCCGGCTGCTAACAAAGCCCGAAAGGAAGCTGAGTTG
	GCTGCTGCCACCGCTGAGCAATAACTAGCATAACCCCTTGGGGCCTCTAAACGGGTCTTGAGG
	GGTTTTTTGCTGAAAGGAGGAACTATATCCGGATCGAGATCCTCTAGAGTCGACCTGCAGGCA
	TGCAAGCTTGTATTCTATAGTGTCACCTAAATCGTATGTGTATGATACATAAGGTTATGTATT
	AATTGTAGCCGCGTTCTAACGACAATATGTACAAGCCTAATTGTGTAGCATCTGGCTTACTGA
	AGCAGACCCTATCATCTCTCTCGTAAACTGCCGTCAGAGTCGGTTTGGTTGGACGAACCTTCT
	GAGTTTCTGGTAACGCCGTcCCGCACCCGGAAATGGTCAGCGAACCAATCAGCAGGGTCATCG
	CTAGCCAGATCCTCTACGCCGGACGCATCGTGGCCGGCATCACCGGCGCCACAGGTGCGGTTG
	CTGGCGCCTATATCGCCGACATCACCGATGGGGAAGATCGGGCTCGCCACTTCGGGCTCATGA
	GCGCTTGTTTCGGCGTGGGTATGGTGGCAGGCCCCGTGGCCGGGGGACTGTTGGGCGCCATCT
	CCTTGCACCATTCCTTGCGGCGGCGGTGCTCAACGGCCTCAACCTACTACTGGGCTGCTTCCT
	AATGCAGGAGTCGCATAAGGGAGAGCGTCGAATGGTGCACTCTCAGTACAATCTGCTCTGATG
	CCGCATAGTTAAGCCAGCCCCGACACCCGCCAACACCCGCTGACGCGCCCTGACGGGCTTGTC
	TGCTCCCGGCATCCGCTTACAGACAAGCTGTGACCGTCTCCGGGAGCTGCATGTGTCAGAGGT
	TTTCACCGTCATCACCGAAACGCGCGAGACGAAAGGGCCTCGTGATACGCCTATTTTTATAGG
	TTAATGTCATGATAATAATGGTTTCTTAGACGTCAGGTGGCACTTTTCGGGGAAATGTGCGCG
	GAACCCCTATTTGTTTATTTTTCTAAATACATTCAAATATGTATCCGCTCATGAGACAATAAC
	CCTGATAAATGCTTCAATAATATTGAAAAAGGAAGAGTATGAGTATTCAACATTTCCGTGTCG
	CCCTTATTCCCTTTTTTGCGGCATTTTGCCTTCCTGTTTTTGCTCACCCAGAAACGCTGGTGA
	AAGTAAAAGATGCTGAAGATCAGTTGGGTGCACGAGTGGGTTACATCGAACTGGATCTCAACA
	GCGGTAAGATCCTTGAGAGTTTTCGCCCCGAAGAACGTTTTCCAATGATGAGCACTTTTAAAG
	TTCTGCTATGTGGCGCGGTATTATCCCGTATTGACGCCGGGCAAGAGCAACTCGGTCGCCGCA
	TACACTATTCTCAGAATGACTTGGTTGAGTACTCACCAGTCACAGAAAAGCATCTTACGGATG
	GCATGACAGTAAGAGAATTATGCAGTGCTGCCATAACCATGAGTGATAACACTGCGGCCAACT
	TACTTCTGACAACGATCGGAGGACCGAAGGAGCTAACCGCTTTTTTGCACAACATGGGGGATC
	ATGTAACTCGCCTTGATCGTTGGGAACCGGAGCTGAATGAAGCCATACCAAACGACGAGCGTG
	ACACCACGATGCCTGTAGCAATGGCAACAACGTTGCGCAAACTATTAACTGGCGAACTACTTA
	CTCTAGCTTCCCGGCAACAATTAATAGACTGGATGGAGGCGGATAAAGTTGCAGGACCACTTC
	TGCGCTCGGCCCTTCCGGCTGGCTGGTTTATTGCTGATAAATCTGGAGCCGGTGAGCGTGGGT
	CTCGCGGTATCATTGCAGCACTGGGGCCAGATGGTAAGCCCTCCCGTATCGTAGTTATCTACA

	CGACGGGGAGTCAGGCAACTATGGATGAACGAAATAGACAGATCGCTGAGATAGGTGCCTCAC TGATTAAGCATTGGTAACTGTCAGACCAAGTTTACTCATATATACTTTAGATTGATTTAAAAC TTCATTTTTAATTTAAAAGGATCTAGGTGAAGATCCTTTTTGATAATCTCATGACCAAAATCC CTTAACGTGAGTTTTCGTTCCACTGAGCGTCAGACCCCGTAGAAAAGATCAAAGGATCTTCTT GAGATCCTTTTTTTCTGCGCGTAATCTGCTGCTTGCAAACAAAAAAACCACCGCTACCAGCGG TGGTTTGTTTGCCGGATCAAGAGCTACCAACTCTTTTTCCGAAGGTAACTGGCTTCAGCAGAG CGCAGATACCAAATACTGTCCTTCTAGTGTAGCCGTAGTTAGGCCACCACTTCAAGAACTCTG TAGCACCGCCTACATACCTCGCTCTGCTAATCCTGTTACCAGTGGCTGCTGCCAGTGGCGATA AGTCGTGTCTTACCGGGTTGGACTCAAGACGATAGTTACCGGATAAGGCGCAGCGGTCGGGCT GAACGGGGGGTTCGTGCACACAGCCCAGCTTGGAGCGAACGACCTACACCGAACTGAGATACC TACAGCGTGAGCTATGAGAAAGCGCCACGCTTCCCGAAGGGAGAAAGGCGGACAGGTATCCGG TAAGCGGCAGGGTCGGAACAGGAGAGCGCACGAGGGAGCTTCCAGGGGGAAACGCCTGGTATC TTTATAGTCCTGTCGGGTTTCGCCACCTCTGACTTGAGCGTCGATTTTTGTGATGCTCGTCAG GGGGGCGGAGCCTATGGAAAAACGCCAGCAACGCGGCCTTTTTACGGTTCCTGGCCTTTTGCT GGCCTTTTGCTCACATGTTCTTTCCTGCGTTATCCCCTGATTCTGTGGATAACCGTATTACCG CCTTTGAGTGAGCTGATACCGCTCGCCGCAGCCGAACGACCGAGCGCAGCGAGTCAGTGAGCG AGGAAGCGGAAGAGCGCCCAATACGCAAACCGCCTCTCCCCGCGCGTTGGCCGATTCATTAAT GCAGGGGGATCTCGATCCCGCGAAATTAATACGACTCACTATAGG
SEQ ID NO:8	ACGAAGACAAACAAACCATTATTATCATTAAAAGGCTCAGGAGAAACTTTAACAGTAATCAGA ATTCGCCACCATGACCAGCGTGGGCATCGTGGGCCTGCTGCTGACCACCGCCATGGCCGCCGA GGTGACCAGAAGAGGCAGCGCCTACTACATGTACCTGGACCGGAACGATGCCGGCGAGGCCAT CAGCTTTCCAACCACCCTGGGCATGAACAAGTGCTACATCCAGATCATGGACCTGGGCCACAC CTGTGACGCCACCATGAGCTACGAGTGCCCCATGCTGGACGAGGGCGTGGAACCCGACGATGT GGACTGCTGGTGCAACACCACCAGCACCTGGGTGGTGTACGGCACCTGTCACCACAAGAAGGG CGAAGCCAGACGGTCCAGACGGGCCGTGACACTGCCTAGCCACAGCACCAGAAAGCTGCAGAC CCGGTCCCAGACCTGGCTGGAAAGCAGAGAGTACACCAAGCACCTGATCCGGGTGGAAAACTG GATCTTCCGGAACCCCGGCTTTGCCCTGGCCGCTGCTGCTATTGCTTGGCTGCTGGGCAGCAG CACCTCCCAGAAAGTGATCTACCTCGTGATGATCCTGCTGATCGCCCCTGCCTACAGCATCCG GTGTATCGGCGTGTCCAACCGGGACTTCGTGGAAGGCATGAGCGGCGGCACATGGGTGGACGT GGTGCTGGAACATGGCGGCTGCGTGACAGTGATGGCTCAGGACAAGCCCACCGTGGACATCGA GCTCGTGACCACCACCGTGTCCAATATGGCCGAAGTGCGGAGCTACTGCTACGAGGCCAGCAT CAGCGACATGGCAAGCGACAGCAGATGCCCTACACAGGGCGAGGCCTACCTGGACAAGCAGTC CGACACCCAGTACGTGTGCAAGCGGACCCTGGTGGATAGAGGCTGGGGCAATGGCTGCGGCCT GTTTGGCAAGGGCAGCCTCGTGACCTGCGCCAAGTTCGCCTGCAGCAAGAAGATGACCGGCAA GAGCATCCAGCCCGAGAACCTGGAATACCGGATCATGCTGAGCGTGCACGGCAGCCAGCACTC CGGCATGATCGTGAACGACACCGGCCACGAGACAGACGAGAACCGGGCCAAGGTGGAAATCAC CCCCAACAGCCCTAGAGCCGAGGCCACACTGGGCGGCTTTGGATCTCTGGGCCTGGACTGCGA GCCTAGAACCGGCCTGGATTTCAGCGACCTGTACTACCTGACCATGAACAACAAGCACTGGCT

	GGTGCACAAAGAGTGGTTCCACGACATCCCCCTGCCCTGGCATGCCGGCGCTGATACAGGCAC
	ACCCCACTGGAACAACAAAGAGGCTCTGGTGGAATTCAAGGACGCCCACGCCAAGCGGCAGAC
	CGTGGTGGTGCTGGGATCTCAGGAAGGCGCCGTGCATACAGCTCTGGCTGGCGCCCTGGAAGC
	CGAAATGGATGGCGCCAAAGGCAGACTGTCCAGCGGCCACCTGAAGTGCCGGCTGAAGATGGA
	CAAGCTGCGGCTGAAGGGCGTGTCCTACAGCCTGTGTACCGCCGCCTTCACCTTCACCAAGAT
	CCCCGCCGAGACACTGCACGGCACCGTGACTGTGGAAGTGCAGTACGCCGGCACCGACGGCCC
	TTGTAAAGTGCCTGCTCAGATGGCCGTGGATATGCAGACCCTGACCCCCGTGGGCAGACTGAT
	CACCGCCAACCCTGTGATCACCGAGAGCACCGAGAACAGCAAGATGATGCTGGAACTGGACCC
	CCCCTTCGGCGACTCCTACATCGTGATCGGCGTGGGAGAGAAGAAGATCACCCACCACTGGCA
	CAGAAGCGGCAGCACCATCGGCAAGGCCTTTGAGGCTACAGTGCGGGGAGCCAAGAGAATGGC
	CGTGCTGGGAGATACCGCCTGGGACTTTGGCTCTGTGGGCGGAGCCCTGAACTCTCTGGGCAA
	GGGAATCCACCAGATCTTCGGAGCCGCCTTTAAGAGCCTGTTCGGCGGCATGAGCTGGTTCAG
	CCAGATCCTGATCGGCACCCTGCTGATGTGGCTGGGCCTGAACGCCAAGAACGGCAGCATCTC
	CCTGATGTGCCTGGCTCTGGGAGGCGTGCTGATCTTCCTGAGCACAGCCGTGTCTGCCTGATG
	GCCATATGAAAAAAACTAACAGTAATCAAAATGTCTGTTACAGTCAAGAGAATCATTGACAAC
	ACAGTCATAGTTCCAAAACTTCCTGCAAATGAGGATCCAGTGGAATACCCGGCAGATTACTTC
	AGAAAATCAAAGGAGATTCCTCTTTACATCAATACTACAAAAAGTTTGTCAGATCTAAGAGGA
	TATGTCTACCAAGGCCTCAAATCCGGAAATGTATCAATCATACATGTCAACAGCTACTTGTAT
	GGAGCATTAAAGGACATCCGGGGTAAGTTGGATAAAGATTGGTCAAGTTTCGGAATAAACATC
	GGGAAAGCAGGGGATACAATCGGAATATTTGACCTTGTATCCTTGAAAGCCCTGGACGGCGTA
	CTTCCAGATGGAGTATCGGATGCTTCCAGAACCAGCGCAGATGACAAATGGTTGCCTTTGTAT
	CTACTTGGCTTATACAGAGTGGGCAGAACACAAATGCCTGAATACAGAAAAAAGCTCATGGAT
	GGGCTGACAAATCAATGCAAAATGATCAATGAACAGTTTGAACCTCTTGTGCCAGAAGGTCGT
	GACATTTTTGATGTGTGGGGAAATGACAGTAATTACACAAAAATTGTCGCTGCAGTGGACATG
	TTCTTCCACATGTTCAAAAAACATGAATGTGCCTCGTTCAGATACGGAACTATTGTTTCCAGA
	TTCAAAGATTGTGCTGCATTGGCAACATTTGGACACCTCTGCAAAATAACCGGAATGTCTACA
	GAAGATGTAACGACCTGGATCTTGAACCGAGAAGTTGCAGATGAAATGGTCCAAATGATGCTT
	CCAGGCCAAGAAATTGACAAGGCCGATTCATACATGCCTTATTTGATCGACTTTGGATTGTCT
	TCTAAGTCTCCATATTCTTCCGTCAAAAACCCTGCCTTCCACTTCTGGGGGCAATTGACAGCT
	CTTCTGCTCAGATCCACCAGAGCAAGGAATGCCCGACAGCCTGATGACATTGAGTATACATCT
	CTTACTACAGCAGGTTTGTTGTACGCTTATGCAGTAGGATCCTCTGCCGACTTGGCACAACAG
	TTTTGTGTTGGAGATAACAAATACACTCCAGATGATAGTACCGGAGGATTGACGACTAATGCA
	CCGCCACAAGGCAGAGATGTGGTCGAATGGCTCGGATGGTTTGAAGATCAAAACAGAAAACCG
	ACTCCTGATATGATGCAGTATGCGAAAAGAGCAGTCATGTCACTGCAAGGCCTAAGAGAGAAG
	ACAATTGGCAAGTATGCTAAGTCAGAATTTGACAAATGACCCTATAATTCTCAGATCACCTAT
	TATATATTATGCTACATATGAAAAAAACTAACAGATATCATGGATAATCTCACAAAAGTTCGT
	GAGTATCTCAAGTCCTATTCTCGTCTGGATCAGGCGGTAGGAGAGATAGATGAGATCGAAGCA
	CAACGAGCTGAAAAGTCCAATTATGAGTTGTTCCAAGAGGATGGAGTGGAAGAGCATACTAAG
	CCCTCTTATTTTCAGGCAGCAGATGATTCTGACACAGAATCTGAACCAGAAATTGAAGACAAT

	CAAGGTTTGTATGCACAGGATCCAGAAGCTGAGCAAGTTGAAGGCTTTATACAGGGGCCTTTA
	GATGACTATGCAGATGAGGAAGTGGATGTTGTATTTACTTCGGACTGGAAACCACCTGAGCTT
	GAATCTGACGAGCATGGAAAGACCTTACGGTTGACATCGCCAGAGGGTTTAAGTGGAGAGCAG
	AAATCCCAGTGGCTTTCGACGATTAAAGCAGTCGTGCAAAGTGCCAAATACTGGAATCTGGCA
	GAGTGCACATTTGAAGCATCGGGAGAAGGGGTCATTATGAAGGAGCGCCAGATAACTCCGGAT
	GTATATAAGGTCACTCCAGTGATGAACACACATCCGTCCCAATCAGAAGCAGTATCAGATGTT
	TGGTCTCTCTCAAAGACATCCATGACTTTCCAACCCAAGAAAGCAAGTCTTCAGCCTCTCACC
	ATATCCTTGGATGAATTGTTCTCATCTAGAGGAGAGTTCATCTCTGTCGGAGGTGACGGACGA
	ATGTCTCATAAAGAGGCCATCCTGCTCGGCCTGAGATACAAAAAGTTGTACAATCAGGCGAGA
	GTCAAATATTCTCTGTAGACTATGAAAAAAAGTAACAGATATCACGATCTAAGTGTTATCCCA
	ATCCATTCATCATGAGTTCCTTAAAGAAGATTCTCGGTCTGAAGGGGAAAGGTAAGAAATCTA
	AGAAATTAGGGATCGCACCACCCCCTTATGAAGAGGACACTAGCATGGAGTATGCTCCGAGCG
	CTCCAATTGACAAATCCTATTTTGGAGTTGACGAGATGGACACCTATGATCCGAATCAATTAA
	GATATGAGAAATTCTTCTTTACAGTGAAAATGACGGTTAGATCTAATCGTCCGTTCAGAACAT
	ACTCAGATGTGGCAGCCGCTGTATCCCATTGGGATCACATGTACATCGGAATGGCAGGGAAAC
	GTCCCTTCTACAAAATCTTGGCTTTTTTGGGTTCTTCTAATCTAAAGGCCACTCCAGCGGTAT
	TGGCAGATCAAGGTCAACCAGAGTATCACACTCACTGCGAAGGCAGGGCTTATTTGCCACATA
	GGATGGGGAAGACCCCTCCCATGCTCAATGTACCAGAGCACTTCAGAAGACCATTCAATATAG
	GTCTTTACAAGGGAACGATTGAGCTCACAATGACCATCTACGATGATGAGTCACTGGAAGCAG
	CTCCTATGATCTGGGATCATTTCAATTCTTCCAAATTTTCTGATTTCAGAGAGAAGGCCTTAA
	TGTTTGGCCTGATTGTCGAGAAAAAGGCATCTGGAGCGTGGGTCCTGGATTCTATCAGCCACT
	TCAAATGAGCTAGTCTAACTTCTAGCTTCTGAACAATCCCCGGTTTACTCAGTCTCTCCTAAT
	TCCAGCCTCTCGAACAACTAATATCCTGTCTTTTCTATCCCTATGAAAAAAACTAACAGAGAT
	CGATCTGTTTCCTTGACACTATGAAGTGCCTTTTGTACTTAGCCTTTTTATTCATTGGGGTGA
	ATTGCAAGTTCACCATAGTTTTTCCACACAACCAAAAAGGAAACTGGAAAAATGTTCCTTCTA
	ATTACCATTATTGCCCGTCAAGCTCAGATTTAAATTGGCATAATGACTTAATAGGCACAGCCA
	TACAAGTCAAAATGCCCAAGAGTCACAAGGCTATTCAAGCAGACGGTTGGATGTGTCATGCTT
	CCAAATGGGTCACTACTTGTGATTTCCGCTGGTATGGACCGAAGTATATAACACAGTCCATCC
	GATCCTTCACTCCATCTGTAGAACAATGCAAGGAAAGCATTGAACAAACGAAACAAGGAACTT
	GGCTGAATCCAGGCTTCCCTCCTCAAAGTTGTGGATATGCAACTGTGACGGATGCCGAAGCAG
	TGATTGTCCAGGTGACTCCTCACCATGTGCTGGTTGATGAATACACAGGAGAATGGGTTGATT
	CACAGTTCATCAACGGAAAATGCAGCAATTACATATGCCCCACTGTCCATAACTCTACAACCT
	GGCATTCTGACTATAAGGTCAAAGGGCTATGTGATTCTAACCTCATTTCCATGGACATCACCT
	TCTTCTCAGAGGACGGAGAGCTATCATCCCTGGGAAAGGAGGGCACAGGGTTCAGAAGTAACT
	ACTTTGCTTATGAAACTGGAGGCAAGGCCTGCAAAATGCAATACTGCAAGCATTGGGGAGTCA
	GACTCCCATCAGGTGTCTGGTTCGAGATGGCTGATAAGGATCTCTTTGCTGCAGCCAGATTCC
	CTGAATGCCCAGAAGGGTCAAGTATCTCTGCTCCATCTCAGACCTCAGTGGATGTAAGTCTAA
	TTCAGGACGTTGAGAGGATCTTGGATTATTCCCTCTGCCAAGAAACCTGGAGCAAAATCAGAG
	CGGGTCTTCCAATCTCTCCAGTGGATCTCAGCTATCTTGCTCCTAAAAACCCAGGAACCGGTC

	CTGCTTTCACCATAATCAATGGTACCCTAAAATACTTTGAGACCAGATACATCAGAGTCGATA
	TTGCTGCTCCAATCCTCTCAAGAATGGTCGGAATGATCAGTGGAACTACCACAGAAAGGGAAC
	TGTGGGATGACTGGGCACCATATGAAGACGTGGAAATTGGACCCAATGGAGTTCTGAGGACCA
	GTTCAGGATATAAGTTTCCTTTATACATGATTGGACATGGTATGTTGGACTCCGATCTTCATC
	TTAGCTCAAAGGCTCAGGTGTTCGAACATCCTCACATTCAAGACGCTGCTTCGCAACTTCCTG
	ATGATGAGAGTTTATTTTTTGGTGATACTGGGCTATCCAAAAATCCAATCGAGCTTGTAGAAG
	GTTGGTTCAGTAGTTGGAAAAGCTCTATTGCCTCTTTTTTCTTTATCATAGGGTTAATCATTG
	GACTATTCTTGGTTCTCCGAGTTGGTATCCATCTTTGCATTAAATTAAAGCACACCAAGAAAA
	GACAGATTTATACAGACATAGAGATGAACCGACTTGGAAAGTAACTCAAATCCTGCACAACAG
	ATTCTTCATGTTTGGACCAAATCAACTTGTGATACCATGCTCAAAGAGGCCTCAATTATATTT
	GAGTTTTTAATTTTTATGAAAAAAACTAACAGCAATCATGGAAGTCCACGATTTTGAGACCGA
	CGAGTTCAATGATTTCAATGAAGATGACTATGCCACAAGAGAATTCCTGAATCCCGATGAGCG
	CATGACGTACTTGAATCATGCTGATTACAATTTGAATTCTCCTCTAATTAGTGATGATATTGA
	CAATTTGATCAGGAAATTCAATTCTCTTCCGATTCCCTCGATGTGGGATAGTAAGAACTGGGA
	TGGAGTTCTTGAGATGTTAACATCATGTCAAGCCAATCCCATCTCAACATCTCAGATGCATAA
	ATGGATGGGAAGTTGGTTAATGTCTGATAATCATGATGCCAGTCAAGGGTATAGTTTTTTACA
	TGAAGTGGACAAAGAGGCAGAAATAACATTTGACGTGGTGGAGACCTTCATCCGCGGCTGGGG
	CAACAAACCAATTGAATACATCAAAAAGGAAAGATGGACTGACTCATTCAAAATTCTCGCTTA
	TTTGTGTCAAAAGTTTTTGGACTTACACAAGTTGACATTAATCTTAAATGCTGTCTCTGAGGT
	GGAATTGCTCAACTTGGCGAGGACTTTCAAAGGCAAAGTCAGAAGAAGTTCTCATGGAACGAA
	CATATGCAGGATTAGGGTTCCCAGCTTGGGTCCTACTTTTATTTCAGAAGGATGGGCTTACTT
	CAAGAAACTTGATATTCTAATGGACCGAAACTTTCTGTTAATGGTCAAAGATGTGATTATAGG
	GAGGATGCAAACGGTGCTATCCATGGTATGTAGAATAGACAACCTGTTCTCAGAGCAAGACAT
	CTTCTCCCTTCTAAATATCTACAGAATTGGAGATAAAATTGTGGAGAGGCAGGGAAATTTTTC
	TTATGACTTGATTAAAATGGTGGAACCGATATGCAACTTGAAGCTGATGAAATTAGCAAGAGA
	ATCAAGGCCTTTAGTCCCACAATTCCCTCATTTTGAAAATCATATCAAGACTTCTGTTGATGA
	AGGGGCAAAAATTGACCGAGGTATAAGATTCCTCCATGATCAGATAATGAGTGTGAAAACAGT
	GGATCTCACACTGGTGATTTATGGATCGTTCAGACATTGGGGTCATCCTTTTATAGATTATTA
	CACTGGACTAGAAAAATTACATTCCCAAGTAACCATGAAGAAAGATATTGATGTGTCATATGC
	AAAAGCACTTGCAAGTGATTTAGCTCGGATTGTTCTATTTCAACAGTTCAATGATCATAAAAA
	GTGGTTCGTGAATGGAGACTTGCTCCCTCATGATCATCCCTTTAAAAGTCATGTTAAAGAAAA
	TACATGGCCCACAGCTGCTCAAGTTCAAGATTTTGGAGATAAATGGCATGAACTTCCGCTGAT
	TAAATGTTTTGAAATACCCGACTTACTAGACCCATCGATAATATACTCTGACAAAAGTCATTC
	AATGAATAGGTCAGAGGTGTTGAAACATGTCCGAATGAATCCGAACACTCCTATCCCTAGTAA
	AAAGGTGTTGCAGACTATGTTGGACACAAAGGCTACCAATTGGAAAGAATTTCTTAAAGAGAT
	TGATGAGAAGGGCTTAGATGATGATGATCTAATTATTGGTCTTAAAGGAAAGGAGAGGGAACT
	GAAGTTGGCAGGTAGATTTTTCTCCCTAATGTCTTGGAAATTGCGAGAATACTTTGTAATTAC
	CGAATATTTGATAAAGACTCATTTCGTCCCTATGTTTAAAGGCCTGACAATGGCGGACGATCT
	AACTGCAGTCATTAAAAAGATGTTAGATTCCTCATCCGGCCAAGGATTGAAGTCATATGAGGC

	AATTTGCATAGCCAATCACATTGATTACGAAAAATGGAATAACCACCAAAGGAAGTTATCAAA
	CGGCCCAGTGTTCCGAGTTATGGGCCAGTTCTTAGGTTATCCATCCTTAATCGAGAGAACTCA
	TGAATTTTTTGAGAAAAGTCTTATATACTACAATGGAAGACCAGACTTGATGCGTGTTCACAA
	CAACACACTGATCAATTCAACCTCCCAACGAGTTTGTTGGCAAGGACAAGAGGGTGGACTGGA
	AGGTCTACGGCAAAAAGGATGGACTATCCTCAATCTACTGGTTATTCAAAGAGAGGCTAAAAT
	CAGAAACACTGCTGTCAAAGTCTTGGCACAAGGTGATAATCAAGTTATTTGCACACAGTATAA
	AACGAAGAAATCGAGAAACGTTGTAGAATTACAGGGTGCTCTCAATCAAATGGTTTCTAATAA
	TGAGAAAATTATGACTGCAATCAAAATAGGGACAGGGAAGTTAGGACTTTTGATAAATGACGA
	TGAGACTATGCAATCTGCAGATTACTTGAATTATGGAAAAATACCGATTTTCCGTGGAGTGAT
	TAGAGGGTTAGAGACCAAGAGATGGTCACGAGTGACTTGTGTCACCAATGACCAAATACCCAC
	TTGTGCTAATATAATGAGCTCAGTTTCCACAAATGCTCTCACCGTAGCTCATTTTGCTGAGAA
	CCCAATCAATGCCATGATACAGTACAATTATTTTGGGACATTTGCTAGACTCTTGTTGATGAT
	GCATGATCCTGCTCTTCGTCAATCATTGTATGAAGTTCAAGATAAGATACCGGGCTTGCACAG
	TTCTACTTTCAAATACGCCATGTTGTATTTGGACCCTTCCATTGGAGGAGTGTCGGGCATGTC
	TTTGTCCAGGTTTTTGATTAGAGCCTTCCCAGATCCCGTAACAGAAAGTCTCTCATTCTGGAG
	ATTCATCCATGTACATGCTCGAAGTGAGCATCTGAAGGAGATGAGTGCAGTATTTGGAAACCC
	CGAGATAGCCAAGTTTCGAATAACTCACATAGACAAGCTAGTAGAAGATCCAACCTCTCTGAA
	CATCGCTATGGGAATGAGTCCAGCGAACTTGTTAAAGACTGAGGTTAAAAAATGCTTAATCGA
	ATCAAGACAAACCATCAGGAACCAGGTGATTAAGGATGCAACCATATATTTGTATCATGAAGA
	GGATCGGCTCAGAAGTTTCTTATGGTCAATAAATCCTCTGTTCCCTAGATTTTTAAGTGAATT
	CAAATCAGGCACTTTTTTGGGAGTCGCAGACGGGCTCATCAGTCTATTTCAAAATTCTCGTAC
	TATTCGGAACTCCTTTAAGAAAAAGTATCATAGGGAATTGGATGATTTGATTGTGAGGAGTGA
	GGTATCCTCTTTGACACATTTAGGGAAACTTCATTTGAGAAGGGGATCATGTAAAATGTGGAC
	ATGTTCAGCTACTCATGCTGACACATTAAGATACAAATCCTGGGGCCGTACAGTTATTGGGAC
	AACTGTACCCCATCCATTAGAAATGTTGGGTCCACAACATCGAAAAGAGACTCCTTGTGCACC
	ATGTAACACATCAGGGTTCAATTATGTTTCTGTGCATTGTCCAGACGGGATCCATGACGTCTT
	TAGTTCACGGGGACCATTGCCTGCTTATCTAGGGTCTAAAACATCTGAATCTACATCTATTTT
	GCAGCCTTGGGAAAGGGAAAGCAAAGTCCCACTGATTAAAAGAGCTACACGTCTTAGAGATGC
	TATCTCTTGGTTTGTTGAACCCGACTCTAAACTAGCAATGACTATACTTTCTAACATCCACTC
	TTTAACAGGCGAAGAATGGACCAAAAGGCAGCATGGGTTCAAAAGAACAGGGTCTGCCCTTCA
	TAGGTTTTCGACATCTCGGATGAGCCATGGTGGGTTCGCATCTCAGAGCACTGCAGCATTGAC
	CAGGTTGATGGCAACTACAGACACCATGAGGGATCTGGGAGATCAGAATTTCGACTTTTTATT
	CCAAGCAACGTTGCTCTATGCTCAAATTACCACCACTGTTGCAAGAGACGGATGGATCACCAG
	TTGTACAGATCATTATCATATTGCCTGTAAGTCCTGTTTGAGACCCATAGAAGAGATCACCCT
	GGACTCAAGTATGGACTACACGCCCCCAGATGTATCCCATGTGCTGAAGACATGGAGGAATGG
	GGAAGGTTCGTGGGGACAAGAGATAAAACAGATCTATCCTTTAGAAGGGAATTGGAAGAATTT
	AGCACCTGCTGAGCAATCCTATCAAGTCGGCAGATGTATAGGTTTTCTATATGGAGACTTGGC
	GTATAGAAAATCTACTCATGCCGAGGACAGTTCTCTATTTCCTCTATCTATACAAGGTCGTAT
	TAGAGGTCGAGGTTTCTTAAAAGGGTTGCTAGACGGATTAATGAGAGCAAGTTGCTGCCAAGT

	AATACACCGGAGAAGTCTGGCTCATTTGAAGAGGCCGGCCAACGCAGTGTACGGAGGTTTGAT
	TTACTTGATTGATAAATTGAGTGTATCACCTCCATTCCTTTCTCTTACTAGATCAGGACCTAT
	TAGAGACGAATTAGAAACGATTCCCCACAAGATCCCAACCTCCTATCCGACAAGCAACCGTGA
	TATGGGGGTGATTGTCAGAAATTACTTCAAATACCAATGCCGTCTAATTGAAAAGGGAAAATA
	CAGATCACATTATTCACAATTATGGTTATTCTCAGATGTCTTATCCATAGACTTCATTGGACC
	ATTCTCTATTTCCACCACCCTCTTGCAAATCCTATACAAGCCATTTTTATCTGGGAAAGATAA
	GAATGAGTTGAGAGAGCTGGCAAATCTTTCTTCATTGCTAAGATCAGGAGAGGGGTGGGAAGA
	CATACATGTGAAATTCTTCACCAAGGACATATTATTGTGTCCAGAGGAAATCAGACATGCTTG
	CAAGTTCGGGATTGCTAAGGATAATAATAAAGACATGAGCTATCCCCCTTGGGGAAGGGAATC
	CAGAGGGACAATTACAACAATCCCTGTTTATTATACGACCACCCCTTACCCAAAGATGCTAGA
	GATGCCTCCAAGAATCCAAAATCCCCTGCTGTCCGGAATCAGGTTGGGCCAATTACCAACTGG
	CGCTCATTATAAAATTCGGAGTATATTACATGGAATGGGAATCCATTACAGGGACTTCTTGAG
	TTGTGGAGACGGCTCCGGAGGGATGACTGCTGCATTACTACGAGAAAATGTGCATAGCAGAGG
	AATATTCAATAGTCTGTTAGAATTATCAGGGTCAGTCATGCGAGGCGCCTCTCCTGAGCCCCC
	CAGTGCCCTAGAAACTTTAGGAGGAGATAAATCGAGATGTGTAAATGGTGAAACATGTTGGGA
	ATATCCATCTGACTTATGTGACCCAAGGACTTGGGACTATTTCCTCCGACTCAAAGCAGGCTT
	GGGGCTTCAAATTGATTTAATTGTAATGGATATGGAAGTTCGGGATTCTTCTACTAGCCTGAA
	AATTGAGACGAATGTTAGAAATTATGTGCACCGGATTTTGGATGAGCAAGGAGTTTTAATCTA
	CAAGACTTATGGAACATATATTTGTGAGAGCGAAAAGAATGCAGTAACAATCCTTGGTCCCAT
	GTTCAAGACGGTCGACTTAGTTCAAACAGAATTTAGTAGTTCTCAAACGTCTGAAGTATATAT
	GGTATGTAAAGGTTTGAAGAAATTAATCGATGAACCCAATCCCGATTGGTCTTCCATCAATGA
	ATCCTGGAAAAACCTGTACGCATTCCAGTCATCAGAACAGGAATTTGCCAGAGCAAAGAAGGT
	TAGTACATACTTTACCTTGACAGGTATTCCCTCCCAATTCATTCCTGATCCTTTTGTAAACAT
	TGAGACTATGCTACAAATATTCGGAGTACCCACGGGTGTGTCTCATGCGGCTGCCTTAAAATC
	ATCTGATAGACCTGCAGATTTATTGACCATTAGCCTTTTTTATATGGCGATTATATCGTATTA
	TAACATCAATCATATCAGAGTAGGACCGATACCTCCGAACCCCCCATCAGATGGAATTGCACA
	AAATGTGGGGATCGCTATAACTGGTATAAGCTTTTGGCTGAGTTTGATGGAGAAAGACATTCC
	ACTATATCAACAGTGTTTAGCAGTTATCCAGCAATCATTCCCGATTAGGTGGGAGGCTGTTTC
	AGTAAAAGGAGGATACAAGCAGAAGTGGAGTACTAGAGGTGATGGGCTCCCAAAAGATACCCG
	AACTTCAGACTCCTTGGCCCCAATCGGGAACTGGATCAGATCTCTGGAATTGGTCCGAAACCA
	AGTTCGTCTAAATCCATTCAATGAGATCTTGTTCAATCAGCTATGTCGTACAGTGGATAATCA
	TTTGAAATGGTCAAATTTGCGAAGAAACACAGGAATGATTGAATGGATCAATAGACGAATTTC
	AAAAGAAGACCGGTCTATACTGATGTTGAAGAGTGACCTACACGAGGAAAACTCTTGGAGAGA
	TTAAAAAATCATGAGGAGACTCCAAACTTTAAGTATGAAAAAAACTTTGATCCTTAAGACCCT
	CTTGTGGTTTTTATTTTTTATCTGGTTTTGTGGTCTTCGTGGGTCGGCATGGCATCTCCACCT
	CCTCGCGGTCCGACCTGGGCATCCGAAGGAGGACGTCGTCCACTCGGATGGCTAAGGGAGAGC
	TCGGATCCGGCTGCTAACAAAGCCCGAAAGGAAGCTGAGTTGGCTGCTGCCACCGCTGAGCAA
	TAACTAGCATAACCCCTTGGGGCCTCTAAACGGGTCTTGAGGGGTTTTTTGCTGAAAGGAGGA
	ACTATATCCGGATCGAGATCCTCTAGAGTCGACCTGCAGGCATGCAAGCTTGTATTCTATAGT

	GTCACCTAAATCGTATGTGTATGATACATAAGGTTATGTATTAATTGTAGCCGCGTTCTAACG
	ACAATATGTACAAGCCTAATTGTGTAGCATCTGGCTTACTGAAGCAGACCCTATCATCTCTCT
	CGTAAACTGCCGTCAGAGTCGGTTTGGTTGGACGAACCTTCTGAGTTTCTGGTAACGCCGTcC
	CGCACCCGGAAATGGTCAGCGAACCAATCAGCAGGGTCATCGCTAGCCAGATCCTCTACGCCG
	GACGCATCGTGGCCGGCATCACCGGCGCCACAGGTGCGGTTGCTGGCGCCTATATCGCCGACA
	TCACCGATGGGGAAGATCGGGCTCGCCACTTCGGGCTCATGAGCGCTTGTTTCGGCGTGGGTA
	TGGTGGCAGGCCCCGTGGCCGGGGGACTGTTGGGCGCCATCTCCTTGCACCATTCCTTGCGGC
	GGCGGTGCTCAACGGCCTCAACCTACTACTGGGCTGCTTCCTAATGCAGGAGTCGCATAAGGG
	AGAGCGTCGAATGGTGCACTCTCAGTACAATCTGCTCTGATGCCGCATAGTTAAGCCAGCCCC
	GACACCCGCCAACACCCGCTGACGCGCCCTGACGGGCTTGTCTGCTCCCGGCATCCGCTTACA
	GACAAGCTGTGACCGTCTCCGGGAGCTGCATGTGTCAGAGGTTTTCACCGTCATCACCGAAAC
	GCGCGAGACGAAAGGGCCTCGTGATACGCCTATTTTTATAGGTTAATGTCATGATAATAATGG
	TTTCTTAGACGTCAGGTGGCACTTTTCGGGGAAATGTGCGCGGAACCCCTATTTGTTTATTTT
	TCTAAATACATTCAAATATGTATCCGCTCATGAGACAATAACCCTGATAAATGCTTCAATAAT
	ATTGAAAAAGGAAGAGTATGAGTATTCAACATTTCCGTGTCGCCCTTATTCCCTTTTTTGCGG
	CATTTTGCCTTCCTGTTTTTGCTCACCCAGAAACGCTGGTGAAAGTAAAAGATGCTGAAGATC
	AGTTGGGTGCACGAGTGGGTTACATCGAACTGGATCTCAACAGCGGTAAGATCCTTGAGAGTT
	TTCGCCCCGAAGAACGTTTTCCAATGATGAGCACTTTTAAAGTTCTGCTATGTGGCGCGGTAT
	TATCCCGTATTGACGCCGGGCAAGAGCAACTCGGTCGCCGCATACACTATTCTCAGAATGACT
	TGGTTGAGTACTCACCAGTCACAGAAAAGCATCTTACGGATGGCATGACAGTAAGAGAATTAT
	GCAGTGCTGCCATAACCATGAGTGATAACACTGCGGCCAACTTACTTCTGACAACGATCGGAG
	GACCGAAGGAGCTAACCGCTTTTTTGCACAACATGGGGGATCATGTAACTCGCCTTGATCGTT
	GGGAACCGGAGCTGAATGAAGCCATACCAAACGACGAGCGTGACACCACGATGCCTGTAGCAA
	TGGCAACAACGTTGCGCAAACTATTAACTGGCGAACTACTTACTCTAGCTTCCCGGCAACAAT
	TAATAGACTGGATGGAGGCGGATAAAGTTGCAGGACCACTTCTGCGCTCGGCCCTTCCGGCTG
	GCTGGTTTATTGCTGATAAATCTGGAGCCGGTGAGCGTGGGTCTCGCGGTATCATTGCAGCAC
	TGGGGCCAGATGGTAAGCCCTCCCGTATCGTAGTTATCTACACGACGGGGAGTCAGGCAACTA
	TGGATGAACGAAATAGACAGATCGCTGAGATAGGTGCCTCACTGATTAAGCATTGGTAACTGT
	CAGACCAAGTTTACTCATATATACTTTAGATTGATTTAAAACTTCATTTTTAATTTAAAAGGA
	TCTAGGTGAAGATCCTTTTTGATAATCTCATGACCAAAATCCCTTAACGTGAGTTTTCGTTCC
	ACTGAGCGTCAGACCCCGTAGAAAAGATCAAAGGATCTTCTTGAGATCCTTTTTTTCTGCGCG
	TAATCTGCTGCTTGCAAACAAAAAAACCACCGCTACCAGCGGTGGTTTGTTTGCCGGATCAAG
	AGCTACCAACTCTTTTTCCGAAGGTAACTGGCTTCAGCAGAGCGCAGATACCAAATACTGTCC
	TTCTAGTGTAGCCGTAGTTAGGCCACCACTTCAAGAACTCTGTAGCACCGCCTACATACCTCG
	CTCTGCTAATCCTGTTACCAGTGGCTGCTGCCAGTGGCGATAAGTCGTGTCTTACCGGGTTGG
	ACTCAAGACGATAGTTACCGGATAAGGCGCAGCGGTCGGGCTGAACGGGGGGTTCGTGCACAC
	AGCCCAGCTTGGAGCGAACGACCTACACCGAACTGAGATACCTACAGCGTGAGCTATGAGAAA
	GCGCCACGCTTCCCGAAGGGAGAAAGGCGGACAGGTATCCGGTAAGCGGCAGGGTCGGAACAG
	GAGAGCGCACGAGGGAGCTTCCAGGGGGAAACGCCTGGTATCTTTATAGTCCTGTCGGGTTTC

	GCCACCTCTGACTTGAGCGTCGATTTTTGTGATGCTCGTCAGGGGGGCGGAGCCTATGGAAAA ACGCCAGCAACGCGGCCTTTTTACGGTTCCTGGCCTTTTGCTGGCCTTTTGCTCACATGTTCT TTCCTGCGTTATCCCCTGATTCTGTGGATAACCGTATTACCGCCTTTGAGTGAGCTGATACCG CTCGCCGCAGCCGAACGACCGAGCGCAGCGAGTCAGTGAGCGAGGAAGCGGAAGAGCGCCCAA TACGCAAACCGCCTCTCCCCGCGCGTTGGCCGATTCATTAATGCAGGGGGATCTCGATCCCGC GAAATTAATACGACTCACTATAGG

In some embodiments, the recombinant VSV comprises a nucleic acid sequence that is at least 80 (*e.g.*, at least 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, or 99) % identical to: (i) the nucleic acid of SEQ ID NO:5; (ii) the nucleic acid of SEQ ID NO:6; (iii) the nucleic acid of SEQ ID NO:7; or (iv) the nucleic acid of SEQ ID NO:8. In some embodiments, the recombinant VSV comprises a nucleic acid sequence that is identical to: (i) the nucleic acid of SEQ ID NO:5; (ii) the nucleic acid of SEQ ID NO:6; (iii) the nucleic acid of SEQ ID NO:7; or (iv) the nucleic acid of SEQ ID NO:8.

Nucleic acid molecules provided herein can be obtained using standard molecular biology techniques. For example, nucleic acid molecules described herein can be cloned using standard PCR techniques or chemically synthesized.

In certain embodiments, provided herein are vectors that contain the isolated nucleic acid molecules described herein. As used herein, the term "vector," refers to a nucleic acid molecule capable of transporting another nucleic acid to which it has been linked. One type of vector is a "plasmid", which refers to a circular double stranded DNA loop into which additional DNA segments may be ligated. Another type of vector is a viral vector, wherein additional DNA segments may be ligated into the viral genome. Certain vectors are capable of autonomous replication in a host cell into which they are introduced (*e.g.,* bacterial vectors having a bacterial origin of replication and episomal mammalian vectors). Other vectors (*e.g.,* non-episomal mammalian vectors) can be integrated into the genome of a host cell upon introduction into the host cell, and thereby be replicated along with the host genome. Moreover, certain vectors are capable of directing the expression of genes. Such vectors are referred to herein as "recombinant expression vectors" (or simply, "expression vectors").

In another aspect, disclosed herein are recombinant VSV comprising a Zika virus envelope (E) protein or fragment thereof. An exemplary amino acid sequence for a wild type Zika virus envelope protein is as follows (SEQ ID NO: 9):

SEQ ID NO: 9	IRCIGVSNRDFVEGMSGGTWVDVVLEHGGCVTVMAQDKPTVDIELVTTTVSNMAEIRSYCYEA SISDMASDSRCPTQGEAYLDKQSDTQYVCKRTLVDRGWGNGCGLFGKGSLVTCAKFACSKKMT GKSIQPENLEYRIMLSVHGSQHSGMIVNDTGHETDENRAKVEITPNSPRAEATLGGFGSLGLD CEPRTGLDFSDLYYLTMNNKHWLVHKEWFHDIPLPWHAGADTGTPHWNNKEALVEFKDAHAKR QTVVVLGSQEGAVHTALAGALEAEMDGAKGRLSSGHLKCRLKMDKLRLKGVSYSLCTAAFTFT KIPAETLHGTVTVEVQYAGTDGPCKVPAQMAVDMQTLTPVGRLITANPVITESTENSKMMLEL DPPFGDSYIVIGVGEKKITHHWHRSGSTIGKAFEATVRGAKRMAVLGDTAWDFGSVGGALNSL GKGIHQIFGAAFKSLFGGMSWFSQILIGTLLMWLGLNTKNGSISLMCLALGGVLIFLSTAVSA

In some embodiments, the recombinant viruses further comprise a Zika virus precursor membrane (prM) protein or fragment thereof. An exemplary amino acid sequence for a wild type Zika virus prM protein is as follows (SEQ ID NO: 10):

SEQ ID NO: 10	RRGSAYYMYLDRNDAGEAISFPTTLGMNKCYIQIMDLGHMCDATMSYECPMLDEGVEPDDVDC WCNTTSTWVVYGTCHHKKGEARRSRRAVTLPSHSTRKLQTRSQTWLESREYTKHLIRVENWIF RNPGFALAAAAIAWLLGSSTSQKVIYLVMILLIAPAYS

In some embodiments, the recombinant viruses further comprise a Zika virus capsid (C) protein or fragment thereof. An exemplary amino acid sequence for a wild type Zika virus capsid protein is as follows (SEQ ID NO: 11):

SEQ ID NO: 11	MKNPKKKSGGFRIVNMLKRGVARVSPFGGLKRLPAGLLLGHGPIRMVLAILAFLRFTAIKPSL GLINRWGSVGKKEAMEIIKKFKKDLAAMLRIINARKEKKRRGADTSVGIVGLLLTTAMAAEVT

In some embodiments, a protein described herein, or a fragment thereof, has an amino acid sequence that is at least 80 (*e.g.*, at least 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, or 99) % identical to: (i) the amino acid of SEQ ID NO:9; (ii) the amino acid of SEQ ID NO:10; or (iii) the amino acid of SEQ ID NO:11. In some embodiments, a protein described herein, or a fragment thereof, has an amino acid sequence

that is identical to: (i) the amino acid of SEQ ID NO:9; (ii) the amino acid of SEQ ID NO:10; or (iii) the amino acid of SEQ ID NO:11.

Percent amino acid sequence identity is defined as the percentage of amino acids in a candidate sequence that are identical to the amino acids in a reference sequence, after aligning the sequences and introducing gaps, if necessary, to achieve the maximum percent sequence identity. Alignment for purposes of determining percent sequence identity can be achieved in various ways that are within the skill in the art, for instance, using publicly available computer software, such as BLAST software or ClustalW2. Appropriate parameters for measuring alignment, including any algorithms needed to achieve maximal alignment over the full-length of the sequences being compared can be determined by known methods.

Suitable cell lines for propagating a recombinant VSV or producing virus like particles include mammalian cells, such as BSRT7cells, Vero cells, AGMK cells, BHK-21 cells, COS-I or COS-7 cells, MDCK cells, CV-I cells, LLC-MK2 cells, primary cell lines such as fetal Rhesus lung (FRhL-2) cells, BSC-I cells, and MRC-5 cells, or human diploid fibroblasts, as well as avian cells, chicken or duck embryo derived cell lines, *e.g.*, AGEl cells, and primary, chicken embryo fibroblasts, and insect cell lines, such as C6/36 or Sf9 or Sf21. To propagate virus in cell culture, a recombinant vesicular stomatitis virus is used to infect the host cell (for example, selected from among the suitable cell types listed above). After virus adsorption, the cultures are fed with medium capable of supporting growth of the cells. The host cells are maintained in culture until the desired virus titer is achieved.

To recover virus, the virus is harvested by common methods known in the art including slow-speed centrifugation, or by filtration through a filter of pore size of 0.45 μm. Methods for concentrating recovered virus or VLPs are within the scope of a person with ordinary skill in the art and include, for example, ultrafiltration (*e.g.*, with a membrane of no greater than 300 kDa pore size), or precipitation with polyethylene glycol (PEG) 8000. Methods for purifying viruses are known to a person with ordinary skill in the art and include continuous or multi-step sucrose gradients, purification by column chromatography using size exclusion, ion exchange, adsorption, or affinity columns, or purification by partitioning in polymer two-phase or multi-phase systems, and any combination thereof. Methods for assaying for virus positive fractions include plaque assay, hemagglutination (HA) assay, and/or antigen assays such as immunoassays.

Pharmaceutical Compositions and Vaccines

In certain aspects, provided herein are pharmaceutical compositions and/or vaccines comprising a recombinant VSV described herein.

In some embodiments, the pharmaceutical compositions and/or vaccines described herein include a recombinant VSV comprising a Zika virus envelope (E) protein together with one or more excipients and/or adjuvants. In some embodiments, the recombinant VSV further comprises a Zika virus precursor membrane (prM) protein and/or a Zika virus capsid (C) protein or fragment thereof.

In some embodiments, the pharmaceutical composition and/or vaccine described herein comprises a recombinant VSV viral genome and/or a gene encoding a Zika virus envelope (E) protein. In some embodiments, the pharmaceutical composition and/or vaccine described herein comprises a gene encoding a Zika virus precursor membrane (prM) protein and/or a Zika virus capsid (C) protein or fragment thereof. The pharmaceutical composition and/or vaccine can contain genetic material expressing a Zika virus envelope (E), a Zika virus precursor membrane (prM) protein and/or a Zika virus capsid (C) protein or fragment thereof. In such a case, the a Zika virus envelope (E), a Zika virus precursor membrane (prM) protein and/or a Zika virus capsid (C) protein can be expressed in cells of a susceptible species immunized with the vaccine containing a recombinant VSV. The cells infected with these viruses release Zika virus like particles. The viruses, and the virus like particles can be isolated, purified and used as source of antigen for vaccine purposes. Immunity against wild type Zika virus can thereby be conferred in a species and/or tissue normally susceptible to a Zika virus infection.

In some embodiments, the pharmaceutical composition and/or vaccine may further comprise an adjuvant that can augment the immune response by increasing delivery of antigen, stimulating cytokine production, and/or stimulating antigen presenting cells. In some embodiments, the adjuvant can be administered concurrently with the pharmaceutical composition and/or vaccine composition disclosed herein, *e.g.*, in the same composition or in separate compositions. For example, an adjuvant can be administered prior or subsequent to the pharmaceutical composition and/or vaccine composition disclosed herein. Such adjuvants include, but are not limited to: aluminum salts, non-toxic bacterial fragments, cholera toxin (and detoxified fractions thereof), chitosan, homologous heat-labile of *E. coli*

(and detoxified fractions thereof), lactide/glycolide homo and copolymers (PLA/GA), polyanhydride *e.g.* trimellitylimido-L-tyrosine, DEAE-dextran, saponins complexed to membrane protein antigens (immune stimulating complexes—ISCOMS), bacterial products such as lipopolysaccharide (LPS) and muramyl dipeptide, (MDP), liposomes, cochelates, proteinoids, cytokines (interleukins, interferons), genetically engineered live microbial vectors, non-infectious pertussis mutant toxin, neurimidase/galactose oxidase, and attenuated bacterial and viral toxins derived from mutant strains.

In some embodiments, the recombinant VSV is able to induce an immune response in a subject against the Zika virus.

In certain embodiments, the pharmaceutical composition , vaccine and/or adjuvant can be administered to a subject, *e.g.*, a human subject, using a variety of methods that depend, in part, on the route of administration. The route can be, *e.g.*, intravenous injection or infusion (IV), subcutaneous injection (SC), intraperitoneal (IP) injection, or intramuscular injection (IM).

Therapeutic Methods

In certain aspects, provided herein is a method for inducing an immune response against Zika virus in a subject comprising administering to the subject a composition (*e.g.*, a vaccine composition) disclosed herein. In some embodiments, provided herein is a method for protecting a subject from Zika virus, comprising administering to the subject a composition disclosed herein. In some embodiments, provided herein is a method of treating a subject for a Zika virus infection comprising administering to the subject a composition disclosed herein.

A "subject," as used herein, can be any mammal. For example, a subject can be a human, a non-human primate (*e.g.*, monkey, baboon, or chimpanzee), a horse, a cow, a pig, a sheep, a goat, a dog, a cat, a rabbit, a guinea pig, a gerbil, a hamster, a rat, or a mouse. In some embodiments, the subject is an infant (*e.g.*, a human infant). In some embodiments, the subject is female (*e.g.*, a human female). For example, a subject can be a human female of child-bearing age or a human female who is pregnant.

In certain embodiments, the subject is exposed to Zika virus due to the subject's exposure to a mosquito comprising the Zika virus. The subject may be exposed to a Aedes mosquitoes, particularly *A. aegypti*. Such a subject may be at risk of developing a Zika virus infection and disease states related to or caused by such an infection. In certain

embodiments, the subject was exposed to Zika virus or a mosquito, within the last 6 month, within the last month, within the last two weeks, within the last week, within the last 72 hours, within the last 48 hours, within the last 24 hours, within the last 12 hours, within the last 6 hours, within the last 4 hours, within the last 2 hours, or within the last hour.

In certain embodiments, the subject does not have, but is at risk of developing a Zika virus infection. A subject "at risk" may or may not have detectable disease, and may or may not have displayed detectable disease prior to the treatment methods described herein. "At risk" denotes that an individual who is determined to be more likely to develop a symptom based on conventional risk assessment methods or has one or more risk factors that correlate with development of a particular condition. An individual having one or more of these risk factors has a higher probability of developing a condition than an individual without these risk factors. Examples (i.e., categories) of risk groups are well known in the art and discussed herein, such as those subjects who are traveling to a region of the world where Zika virus is prevalent. For example, in some embodiments the region is in the United States, Anguilla, Antigua, Argentina, Aruba, Barbados, Barbuda, Belize, Bolivia, Bonaire, Brazil, Cayman Islands, Colombia, Commonwealth of Puerto Rico, Costa Rica, Cuba, Curacao, Dominica, Dominican Republic, Ecuador, El Salvador, French Guiana, Grenada, Guadeloupe, Guatemala, Guyana, Haiti, Honduras, Jamaica, Martinique, Mexico, Nicaragua, Panama, Paraguay, Peru, Saba, Saint Barthélemy, Saint Lucia, Saint Martin, Saint Vincent and the Grenadines, Sint Eustatius, Sint Maarten, Suriname, Trinidad and Tobago, Turks and Caicos, U.S. Virgin Islands, American Samoa, Fiji, Kosrae, Federated States of Micronesia, Marshall Islands, New Caledonia, Papua New Guinea, Samoa, Tonga, Venezuela, and Cape Verde.

Examples

The invention now being generally described will be more readily understood by reference to the following examples which are included merely for purposes of illustration of certain aspects and embodiments of the present invention, and are not intended to limit the invention in any way.

Example 1 - Construction and recovery of recombinant VSV expressing ZIKV envelope

As a first step to develop recombinant VSV expressing Zika virus envelope protein, or producing Zika virus VLPs, a fragment of the Zika virus spanning the prM (membrane), and E (envelope) proteins was chemically synthesized which generated four different

recombinant VSV . Two variants of Zika fragment were selected that differ in their N-terminus. In one case, the sequence that spans prM-E (prM-E) was included. In the second variant, the N-terminus of prM was extended into the capsid sequence of Zika because this region is predicted to be a transmembrane region that may help with the proper processing and folding of prM, (CprM-E). Those two different Zika fragments, prM-E and C-prM-E were each cloned into two different VSV vectors. In one VSV vector, the Zika coding sequences were cloned into the VSV genome, replacing the endogenous VSV viral glycoprotein (G), to yield rVSVΔGZika-prME and rVSVΔGZika-CprME (see schematic in Fig. 1A). The second vector was designed to maximally express the Zika virus antigens and therefore the Zika sequences were cloned into wild type VSV in front of the N gene of the virus to yield rVSV-Zika-prME and rVSV-Zika-CprME.

Example 2 - Rescue of recombinant virus with Zika envelope replacing VSV envelope: rVSVΔG-Zika-CprME and rVSVΔG-Zika-prME

rVSVΔG-Zika-CprME and rVSVΔG-Zika-prME infectious viruses were recovered by transfection of BSRT7 cells with each of the corresponding constructs together with the necessary VSV expression plasmids N, P, L and G. (as a tool to monitor infection of cells in culture eGFP was included in the VSV genome.) Fig. 1A illustrates the arrangement of coding sequences for the constructs and the method for transfection and recovery of virus.

Following subsequent amplification of each virus in BSRT7 cells by complementation with VSV G expressed in trans, rVSVΔG-Zika-prME and rVSVΔG-Zika-C-prME yielded 1.2 x 10^8 and 1 X 10^7 infectious units per ml respectively as determined by eGFP expression (Fig. 2A – Fig. 2D). By contrast, when virus was propagated in cells that lack VSV G expressed by transfection of plasmid, infectivity of both rVSVΔG-Zika-prME and rVSVΔG-Zika-CprME was reduced approximately 2 logs. It is important to note, however, that infection of the recombinant viruses propagated in the absence of VSV G indicating that infection is mediated by the Zika envelope protein and demonstrating that it is functionally incorporated into infectious particles.

The complete sequence of the recovered viruses was determined by RT-PCR and shown to contain no additional mutations.

Example 3 - Expression of Zika E in cells infected with VSVΔG variants.

Next, the VSV recombinants were confirmed to express the Zika envelope protein. To this end, cells were infected with VSV or the rVSVΔG-Zika variants and were monitored for expression of Zika proteins by metabolic incorporation of ^{35}S-methionine (Fig. 3A). Recombinant virus expresses a unique protein not seen in VSV infected cells of the

molecular weight expected for Zika envelope, together with the expected VSV proteins N, P, L and M.

When analyzed by Western blot using the anti- Dengue envelope monoclonal antibody 4G2 that cross reacts with Zika envelope (Fig. 3B), ZIKV envelope could be detected in extracts from infected cells (Fig. 3B, lanes 4 and 5). Note that the recombinant virus containing sequences of the Zika capsid protein (rVSVΔG-ZikaCprME) produce more envelope protein than the recombinant lacking C (rVSVΔG-Zika-prME). Zika envelope was also present in the cell culture supernatants of infected cells (Fig. 3B, lane 3) and infectious virus stocks (Fig. 3B, lane 6) suggesting that the ZIKV envelope incorporated into VSV particles or that Zika virus like particles were produced from the infected cells. As a control for the western blot, purified Zika virus, MR766 strain (lane 2) was included which confirms that the antibody recognizes E and confirming its mobility. As shown in Fig. 3C, monoclonal antibody 4G2 also uniquely labels cells infected with recombinant virus, but not wild type VSV.

Example 4 - Zika envelope is incorporated into VSVΔG particles.

To determine whether the recombinant VSVΔG-Zika incorporate Zika E into virions, cell culture supernatants were collected and purified by centrifugation. The sedimented particles were analyzed for their protein composition by SDS-PAGE and compared them to rVSV-eGFP. This result (Fig. 4) demonstrates that rVSVΔG-ZikaCprME incorporates Zika E into the virions further substantiating that the infectivity of these particles is mediated by E.

Example 5 - Recovery and growth of recombinant VSV containing both VSV G and Zika E: rVSV-Zika-prME and rVSV-Zika-CprME

rVSV- Zika-prME and rVSV-Zika-CprME were assembled and virus recovered by the schematic of Fig. 1A. Note from the sequence that the Zika encoding sequences were cloned into wild type VSV in front of the N gene, and the wild type VSV G remains in the genome, so that these viruses have the genetic structure 3'-Le-ZIKA-N-P-M-G-L-Tr-5'. Note also that these viruses did not contain GFP as a tool to monitor infection. Infectious virus were recovered from both constructs and a representative plaque assay is shown (Fig. 5) demonstrating routine titers of 1.5×10^8 pfu/ml.

Example 6 - VSV-Zika particles incorporate Zika E

To determine whether the VSV-Zika particles incorporate Zika E, infectious virus were purified through a sucrose cushion and analyzed those particles by SDS-PAGE (Fig. 6). Both VSV-G and Zika E envelope proteins are present in the purified material - despite the presence of the cognate VSV-G protein. This result suggests that either E was incorporated into the VSV particles or Zika like VLPs were generated.

Example 7 - All VSV-Zika recombinants incorporate E and produce Zika VLPs to different extents.

To determine whether the different viruses produce Zika VLPs and incorporate Zika E into the VSV particles, the products of infection were analyzed by sucrose gradient centrifugation. Briefly, Vero cells were infected with the indicated virus (Fig. 7A – 7D and Fig. 8A – 8D) and the cell culture fluids collected at 48h post infection. The cell culture fluids were clarified by low speed centrifugation to eliminate cellular debris and the resultant supernatant subjected to further centrifugation through a sucrose cushion to collect the viral particles and VLPs. The pellet fraction was resuspended in NTE and laid over a preformed linear 15-45% sucrose gradient. Following centrifugation to separate the different particles based on their density, fractions were collected using a gradient fractionator and analyzed for the presence of protein by SDS-PAGE and detection with Coomassie stain and by Western blot with the indicated antibodies (Fig. 7A – 7D and Fig. 8A – 8D). Each of the recombinant viruses generate both VLPs and VSV particles that contained Zika virus E. In addition, the recombinants rVSV-Zika-prME and rVSV-Zika-CprME showed the presence of VSV G in the VSV fractions (Fig. 7A – 7D and Fig. 8A – 8D) reflecting the presence of G in the viral genome and its expression during infection. Note the absence of VSV G in the corresponding fractions of rVSVΔG-Zika-prME and rVSVΔG-Zika-CprME (Fig. 7A – 7D and Fig. 8A – 8D). By comparing the levels of E incorporated into various VSV fractions, it appears that Zika E is most efficiently incorporated by rVSVΔG-Zika-prME. Although all the viruses produce Zika VLPs we note that the rVSV-Zika-CprME appears to be most efficient (compare Fig. 7A – 7D and Fig. 8A – 8D).

To confirm that the fractions correspond to VLPs and VSV particles, the fractions were analyzed by negative-stain electron microscopy. As shown (Fig. 9A and Fig. 9B) the VLP fraction have the spherical appearance of flavivirus VLPs and their dimensions (40nm diameter) are also consistent with this. The VSV-recombinants retain their bullet shape and

are approximately 200 nm by 80 nm. Collectively, these data (EM and gradient fractions) confirm that the recombinants generate Zika VLPs and VSV with Zika envelope. These data also demonstrate that the viruses that express VSV G from their genome also yield particles that incorporate VSV G.

While the present disclosure has been described with reference to the specific embodiments thereof, it should be understood by those skilled in the art that various changes may be made and equivalents may be substituted without departing from the true spirit and scope of the disclosure. In addition, many modifications may be made to adapt a particular situation, material, composition of matter, process, process step or steps, to the objective, spirit and scope of the present disclosure. All such modifications are intended to be within the scope of the disclosure.

All publications, patents, patent applications and sequence accession numbers mentioned herein are hereby incorporated by reference in their entirety as if each individual publication, patent or patent application was specifically and individually indicated to be incorporated by reference. In case of conflict, the present application, including any definitions herein, will control.

What is claimed is:

1. A recombinant vesicular stomatitis virus (VSV) comprising in its genome a nucleic acid sequence encoding a Zika virus envelope (E) protein or fragment thereof.

2. The recombinant VSV of claim 1, further comprising in its genome a nucleic acid sequence encoding a Zika virus precursor membrane (prM) protein or fragment thereof.

3. The recombinant VSV of claim 2, further comprising in its genome a nucleic acid sequence encoding Zika virus capsid (C) protein or fragment thereof.

4. The recombinant VSV of claim 2 or 3, wherein the nucleic acid sequence encoding a Zika virus prM protein is adjacent in the VSV genome to the nucleic acid sequence encoding a Zika virus E protein.

5. The recombinant VSV of claim 3, wherein the nucleic acid sequence encoding a Zika virus prM protein is adjacent in the VSV genome to the nucleic acid sequence encoding a Zika virus C protein.

6. The recombinant VSV of any preceding claim, wherein the nucleic acid sequence encoding a Zika virus E protein substantially replaces the endogenous VSV viral glycoprotein (G) in the VSV genome.

7. The recombinant VSV of any preceding claim, wherein the nucleic acid encoding the Zika virus E protein has a sequence 90% identical to SEQ ID NO:2.

8. The recombinant VSV of claim 7, wherein the nucleic acid encoding Zika virus E protein has a sequence that is identical to SEQ ID NO: 2.

9. The recombinant VSV of any one of claims 2 to 8, wherein the nucleic acid encoding Zika virus prM has a sequence 90% identical to SEQ ID NO: 3.

10. The recombinant VSV of claim 9, wherein the Zika virus prM protein has a nucleic acid sequence that is identical to SEQ ID NO: 3.

11. The recombinant VSV of any one of claims 3 to 8, wherein the nucleic acid encoding Zika virus capsid (C) protein has a sequence 90% identical to SEQ ID NO:4.

12. The recombinant VSV of claim 11, wherein the nucleic acid encoding Zika virus capsid (C) has a sequence that is identical to SEQ ID NO: 4.

13. The recombinant VSV of any one of claim 1, 2, 4, 6 and 7-10, wherein the genome of the recombinant VSV has a nucleic acid sequence 90% identical to SEQ ID NO:5.

14. The recombinant VSV of claim 13, wherein the nucleic acid sequence is identical to SEQ ID NO:5.

15. The recombinant VSV of one of claims 1-12, wherein the genome of the recombinant VSV has a nucleic acid sequence 90% identical to SEQ ID NO:6.

16. The recombinant VSV of claim 15, wherein the nucleic acid sequence is identical to SEQ ID NO:6.

17. The recombinant VSV of any one of claims 1, 2, 4, and 7-10, wherein the genome of the recombinant VSV has a nucleic acid sequence 90% identical to SEQ ID NO:7.

18. The recombinant VSV of claim 17, wherein the nucleic acid sequence is identical to SEQ ID NO:7.

19. The recombinant VSV of any one of claims 1-5 and7-10, wherein the genome of the recombinant VSV has a nucleic acid sequence 90% identical to SEQ ID NO:8.

20. The recombinant VSV of claim 19, wherein the nucleic acid sequence is identical to SEQ ID NO:8.

21. A recombinant VSV comprising a Zika virus envelope (E) protein or fragment thereof.

22. The recombinant VSV of claim 21, wherein the Zika virus envelope (E) protein or fragment thereof comprises an amino acid sequence that is at least 90% identical to SEQ ID No 9.

23. The recombinant VSV of claim 22, wherein the amino acid sequence is identical to SEQ ID No 9.

24. The recombinant VSV of claim 21, further comprising a Zika virus precursor membrane (prM) protein or fragment thereof.

25. The recombinant VSV of claim 24, wherein the Zika virus precursor membrane (prM) or fragment thereof comprises an amino acid sequence that is at least 90% identical to SEQ ID No 10.

26. The recombinant VSV of claim 25, wherein the amino acid sequence is identical to SEQ ID No 10.

27. The recombinant VSV of claim 21, further comprising a Zika virus capsid (C) protein or fragment thereof.

28. The recombinant VSV of claim 27, wherein the a Zika virus capsid (C) protein or fragment thereof comprises an amino acid sequence that is at least 90% identical to SEQ ID No 11.

29. The recombinant VSV of claim 28, wherein the amino acid sequence is identical to SEQ ID No 11.

30. A pharmaceutical composition comprising the recombinant VSV of any preceding claim, and a pharmaceutically acceptable carrier.

31. The pharmaceutical composition of claim 30, further comprising an adjuvant.

32. A Zika virus vaccine comprising the recombinant VSV of any one of claims 1-29.

33. The vaccine of claim 32, wherein the recombinant virus is live.

34. A nucleic acid encoding the recombinant VSV according to any one of claims 1-29.

35. The nucleic acid of claim 34, wherein the nucleic acid has a sequence that is at least 90% identical to SEQ ID No 9.

36. The nucleic acid of claim 35, wherein the sequence is 90% identical to SEQ ID No 9.

37. An expression vector comprising the nucleic acid of any one of claims 34-36.

38. A cell comprising the nucleic acid according to any one of claims 34-36 or the expression vector according to claim 37.

39. A method for inducing an immune response against Zika virus in a subject, the method comprising administering to the subject a composition comprising the recombinant virus of any one of claims 1-29.

40. The method of claim 39, wherein the subject is a human.

41. The method of claim 41, wherein the subject is female.

42. The method of claim 42, wherein the subject is of child-bearing age.

43. The method of claim 42, wherein the subject is pregnant.

44. The method of any one of claims 39-43, wherein the subject has been exposed to Zika virus.

45. The method of any one of claims 39-44, wherein the subject has been exposed to a mosquito comprising or suspected of comprising the Zika virus.

46. The method of any one of claims 39-45, wherein the subject does not have, but is at risk of developing a Zika virus infection.

47. The method of any one of claims 39-46, wherein the subject is traveling to a region where the Zika virus is prevalent.

48. The method of claim 47, wherein the region is in the United States, Anguilla, Antigua, Argentina, Aruba, Barbados, Barbuda, Belize, Bolivia, Bonaire, Brazil, Cayman Islands, Colombia, Commonwealth of Puerto Rico, Costa Rica, Cuba, Curacao, Dominica, Dominican Republic, Ecuador, El Salvador, French Guiana, Grenada, Guadeloupe, Guatemala, Guyana, Haiti, Honduras, Jamaica, Martinique, Mexico, Nicaragua, Panama, Paraguay, Peru, Saba, Saint Barthélemy, Saint Lucia, Saint Martin, Saint Vincent and the Grenadines, Sint Eustatius, Sint Maarten, Suriname, Trinidad and Tobago, Turks and Caicos, U.S. Virgin Islands, American Samoa, Fiji, Kosrae, Federated States of Micronesia, Marshall Islands, New Caledonia, Papua New Guinea, Samoa, Tonga, Venezuela, and Cape Verde.

49. A method for protecting a subject from Zika virus, comprising administering to the subject the recombinant virus of any one of claims 1-29.

50. The method of claims 49, wherein the subject is a human.

51. The method of claim 50, wherein the subject is female.

52. The method of claim 51, wherein the subject is of child-bearing age.

53. The method of claim 51, wherein the subject is pregnant.

54. The method of any one of claims 49-53, wherein the subject is exposed to Zika virus.

55. The method of any one of claims 49-54, wherein the subject is exposed to a mosquito comprising the Zika virus.

56. The method of any one of claims 49-55, wherein the subject does not have, but is at risk of developing a Zika virus infection.

57. The method of any one of claims 49-56, wherein the subject is traveling to a region where the Zika virus is prevalent.

58. The method of claim 57, wherein the region is in the United States, Anguilla, Antigua, Argentina, Aruba, Barbados, Barbuda, Belize, Bolivia, Bonaire, Brazil, Cayman Islands, Colombia, Commonwealth of Puerto Rico, Costa Rica, Cuba, Curacao, Dominica, Dominican Republic, Ecuador, El Salvador, French Guiana, Grenada, Guadeloupe, Guatemala, Guyana, Haiti, Honduras, Jamaica, Martinique, Mexico, Nicaragua, Panama, Paraguay, Peru, Saba, Saint Barthélemy, Saint Lucia, Saint Martin, Saint Vincent and the Grenadines, Sint Eustatius, Sint Maarten, Suriname, Trinidad and Tobago, Turks and Caicos, U.S. Virgin Islands, American Samoa, Fiji, Kosrae, Federated States of Micronesia, Marshall Islands, New Caledonia, Papua New Guinea, Samoa, Tonga, Venezuela, and Cape Verde.

59. A method of treating a Zika virus infection in a subject, the method comprising administering to the subject a composition comprising the recombinant virus of any one of claims 1-29.

60. The method of claim 59, wherein the subject is a human.

61. The method of claim 60, wherein the subject is female.

62. The method of claim 61, wherein the subject is of child-bearing age.

63. The method of claim 61, wherein the subject is pregnant.

64. A method of making virus-like particles (VLP) comprising :
transfecting a cell with the expression vector of claim 37;
culturing the cell under conditions such that the cell produces a Zika virus VLP; and
collecting the Zika virus VLP.

65. The method of claim 64, wherein the cells are BSRT7 cells

Fig. 1A

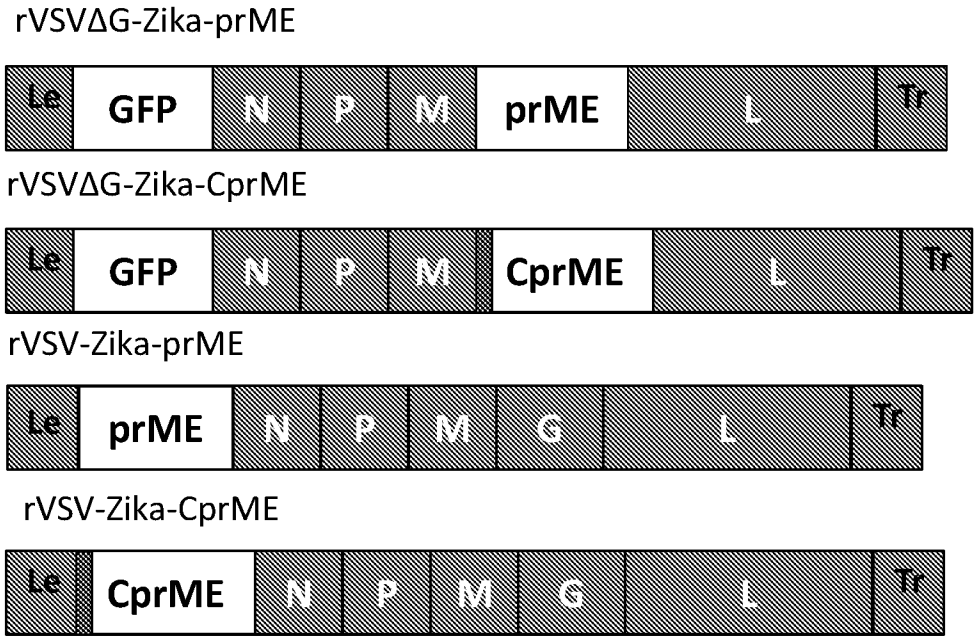

rVSVΔG-Zika-prME
Le
GFP
N
P
M
prME
L
Tr
rVSVΔG-Zika-CprME
Le
GFP
N
P
M
CprME
L
Tr
rVSV-Zika-prME
Le
prME
N
P
M
G
L
Tr
rVSV-Zika-CprME
Le
CprME
N
P
M
G
L
Tr

Fig. 1B

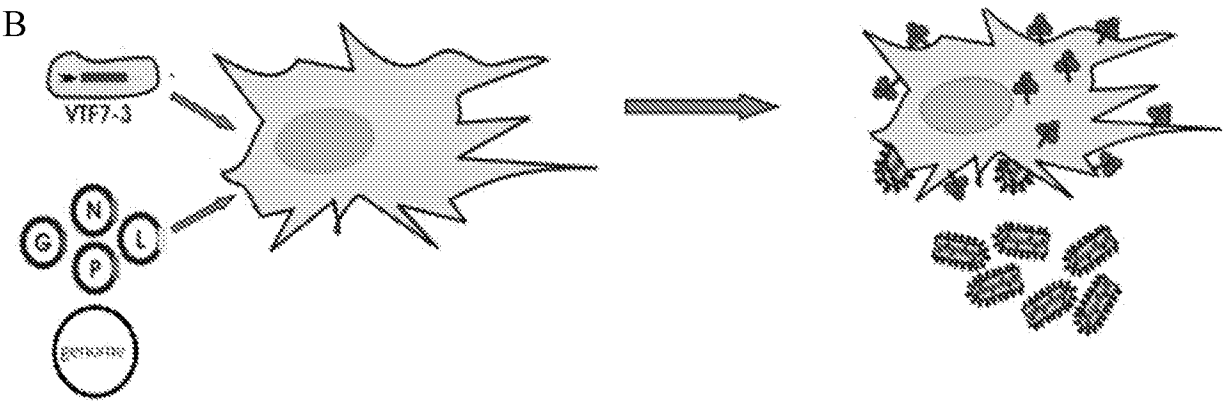

VIF7-3
G
N
P
L

Fig. 2A

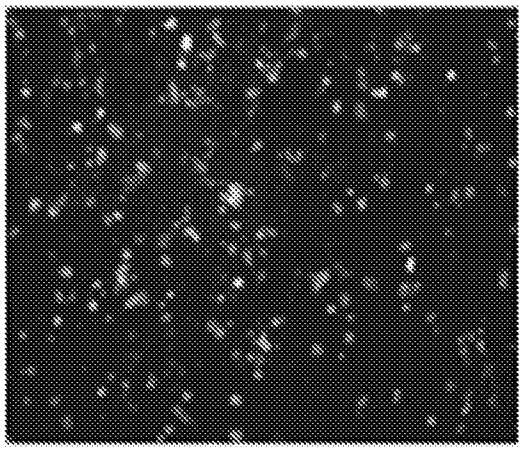


Fig. 2C

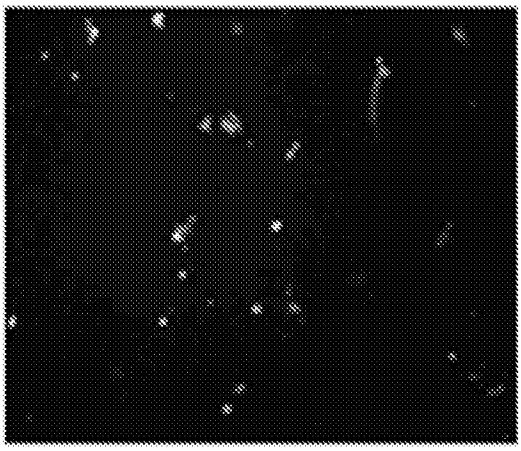


Fig. 2B

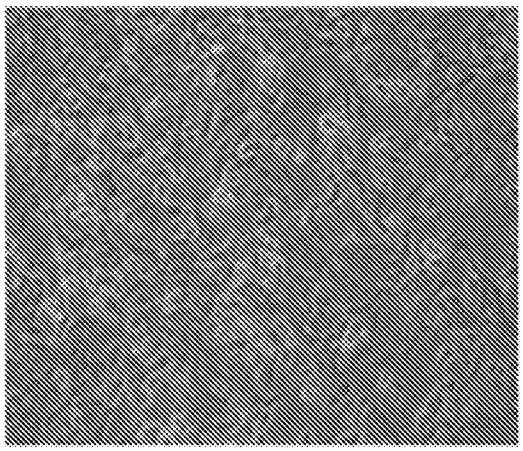


Fig. 2D

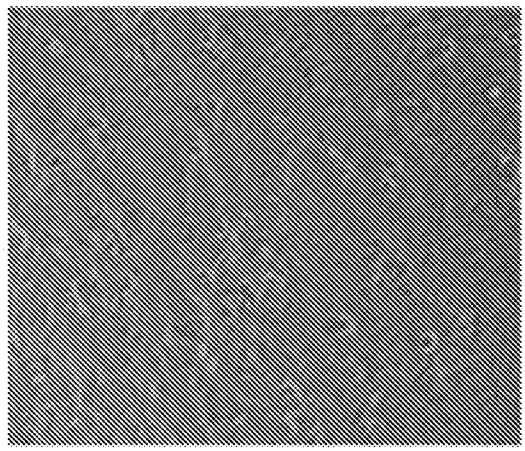


Fig. 3A

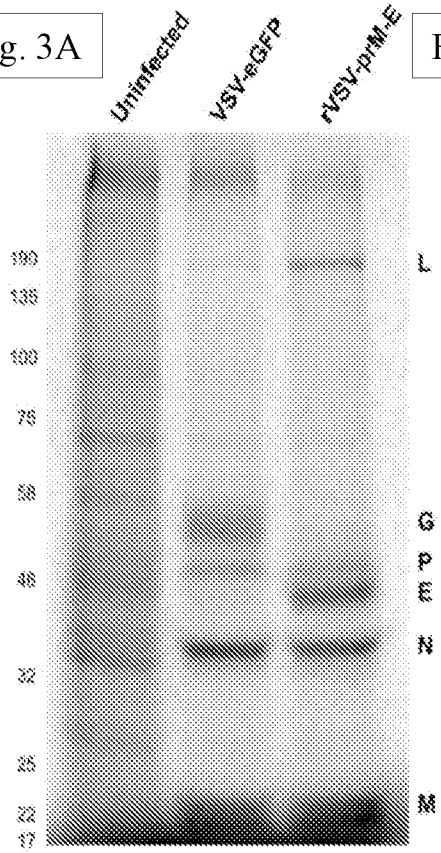


Fig. 3B

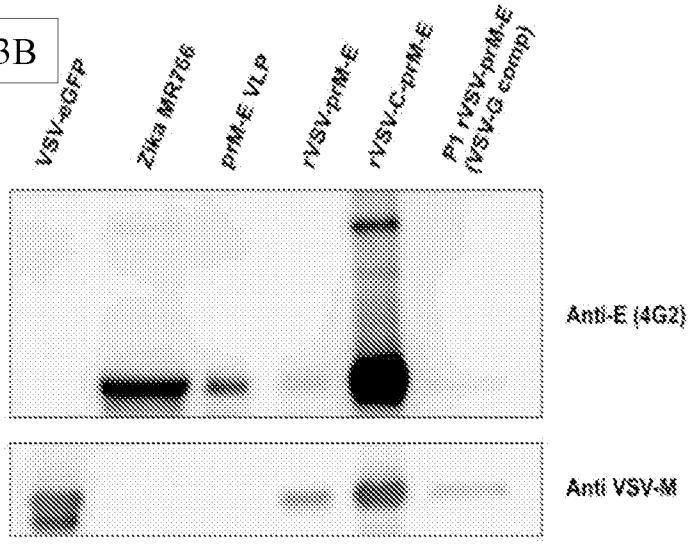


Fig. 3C

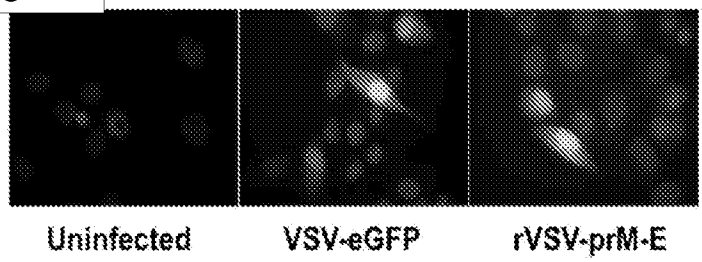


Fig. 4

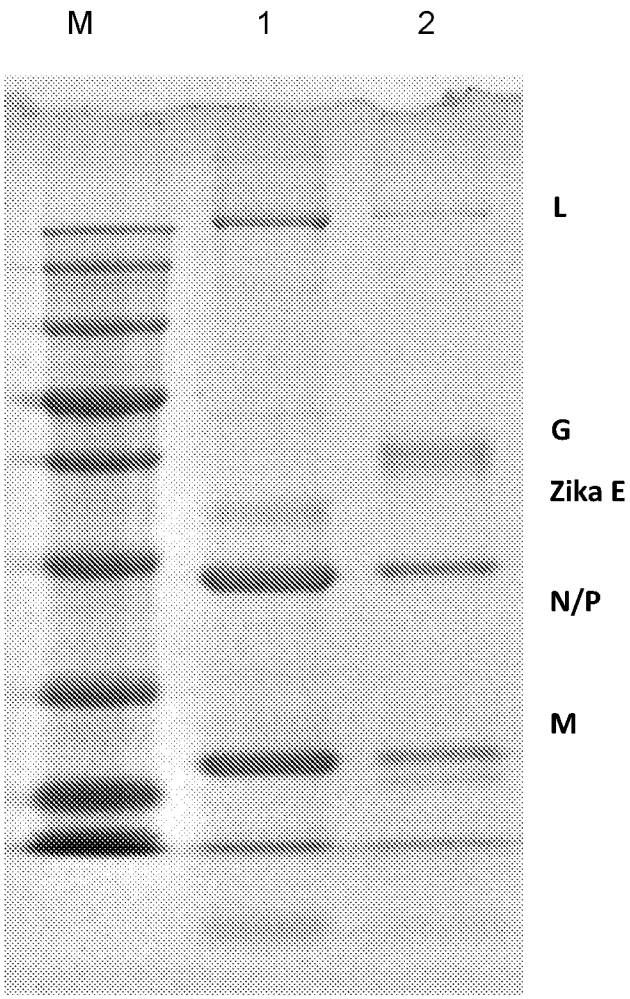


Fig. 5

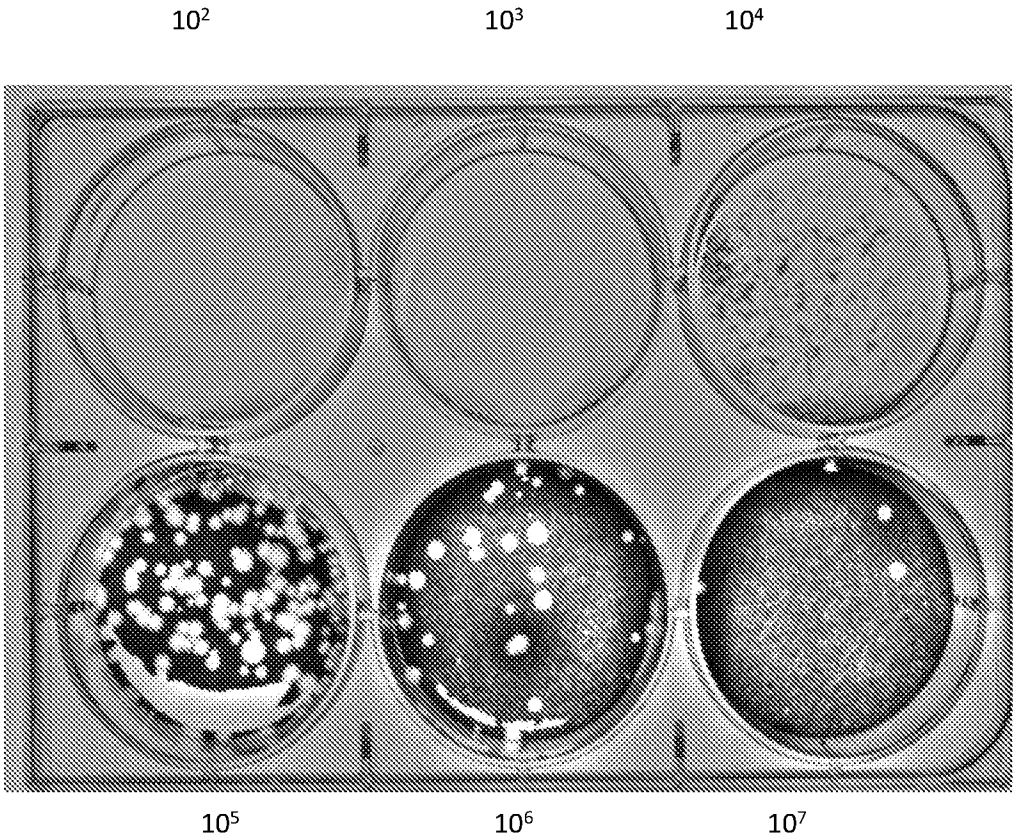


Fig. 6

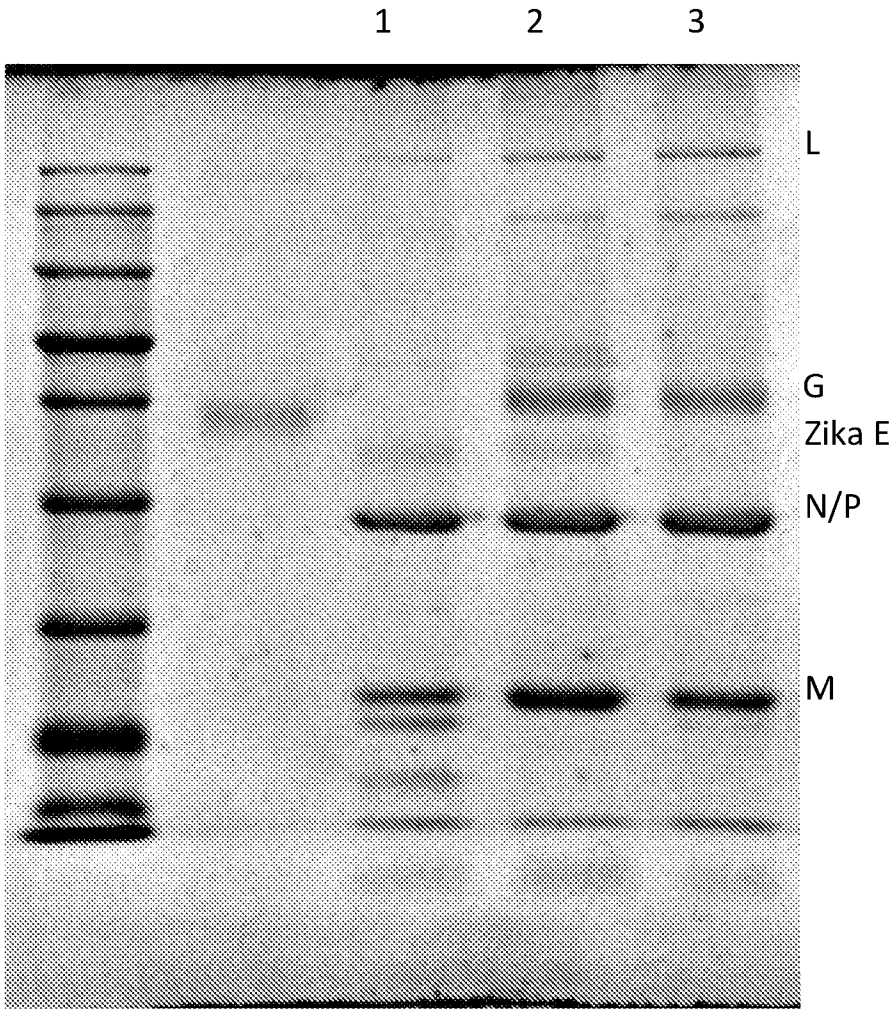


Fig. 7A

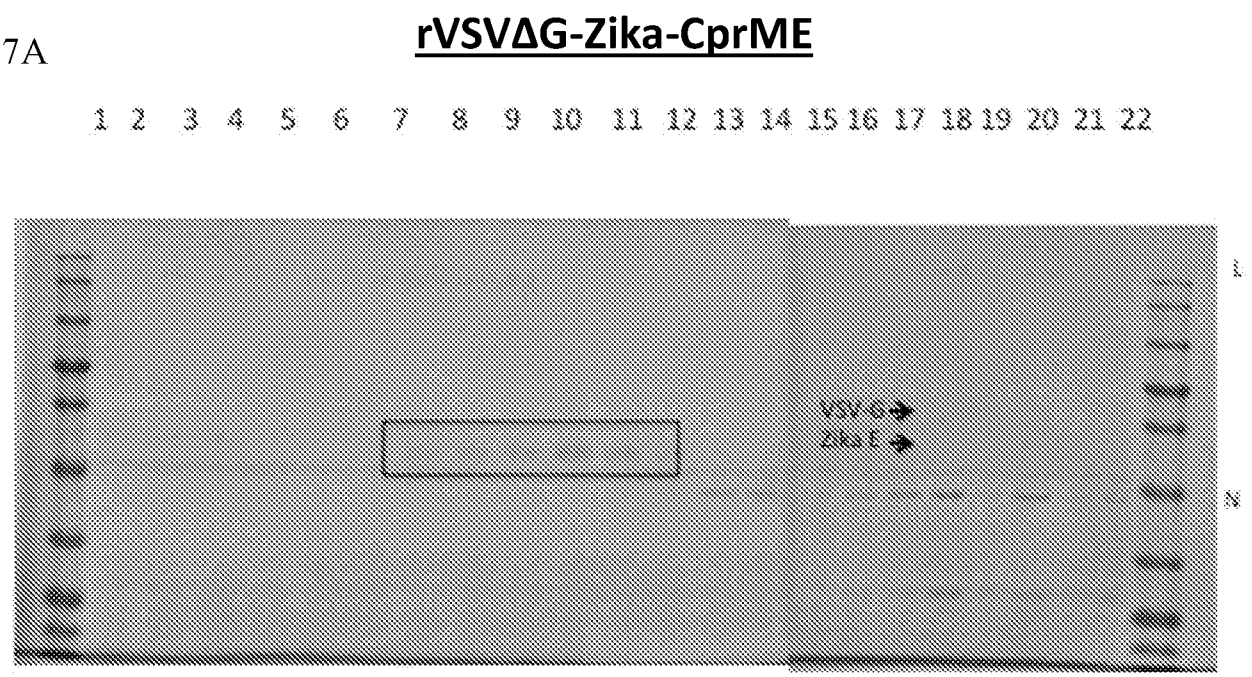

rVSVΔG-Zika-CprME
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
VSV G
Zika E
E
N

Fig. 7B

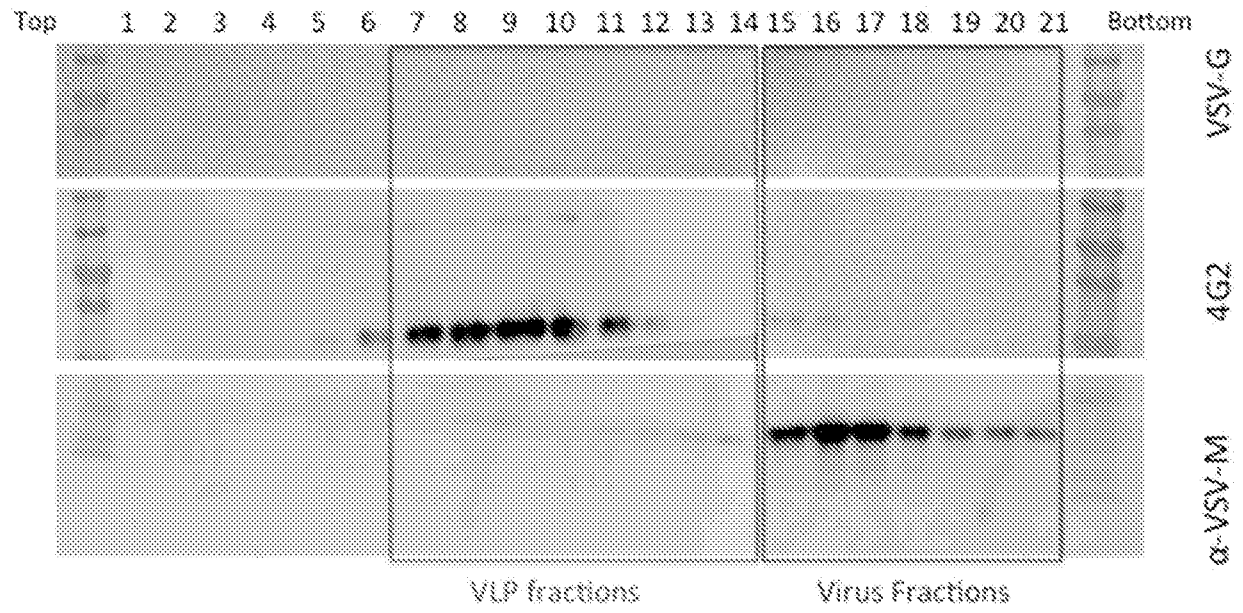

Top 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 Bottom
VSV-G
4G2
α-VSV-M
VLP fractions
Virus Fractions

Fig. 7C

rVSV-Zika-CprME

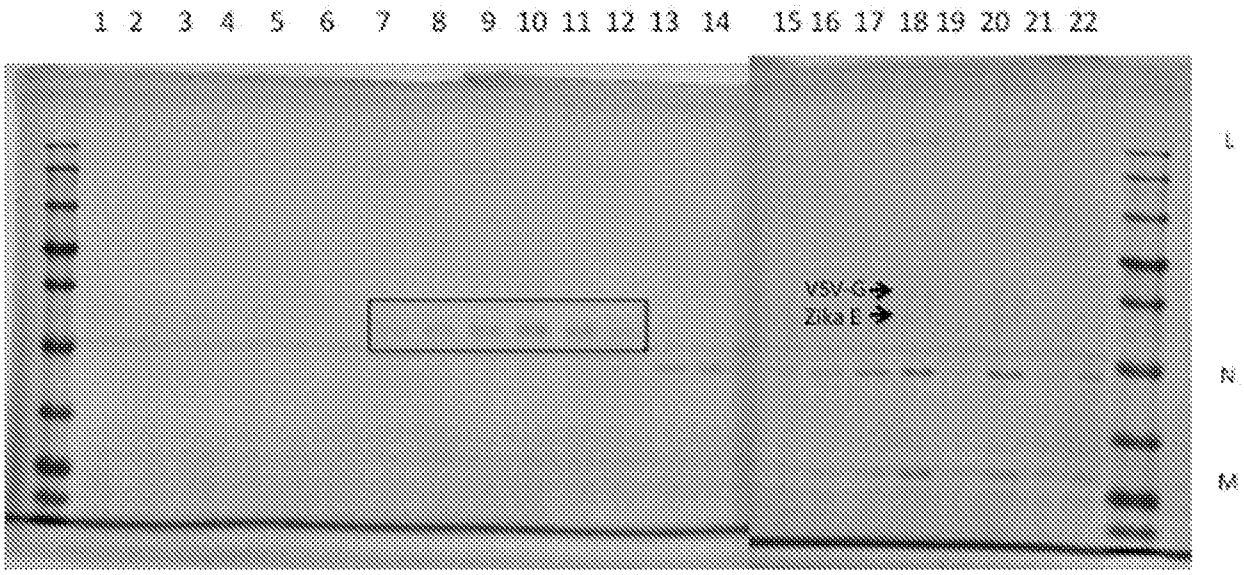


Fig. 7D

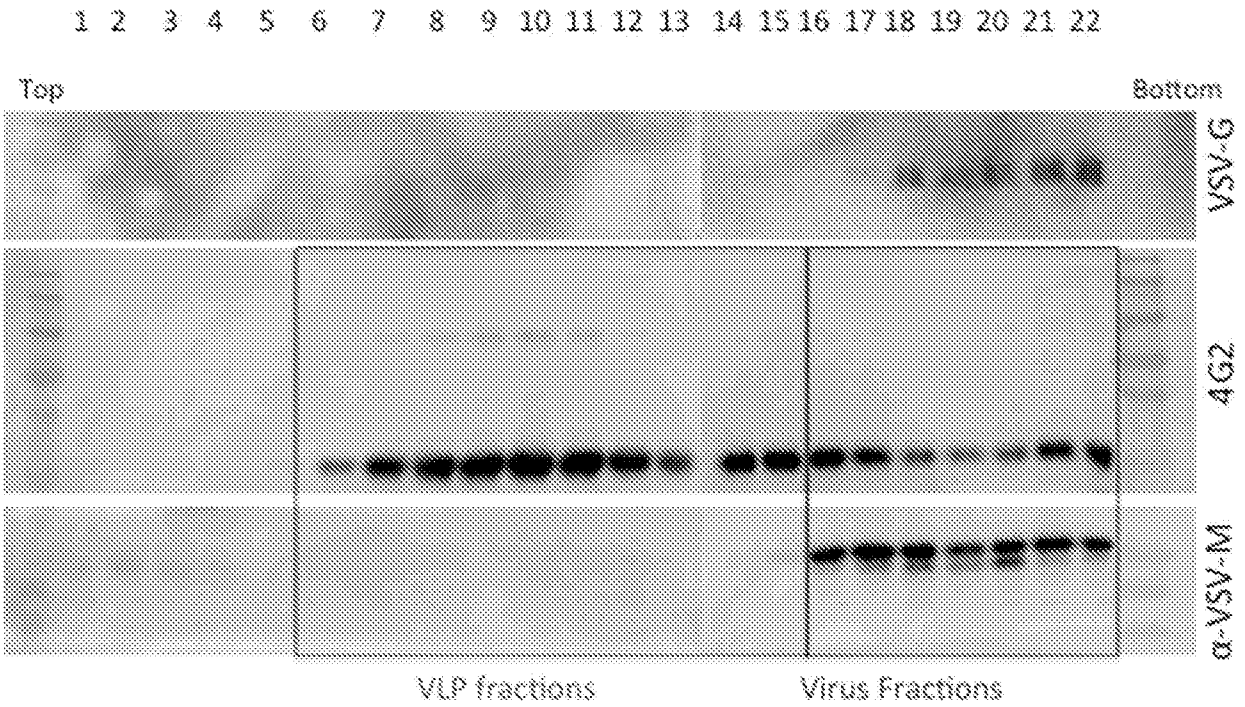


Fig. 8A

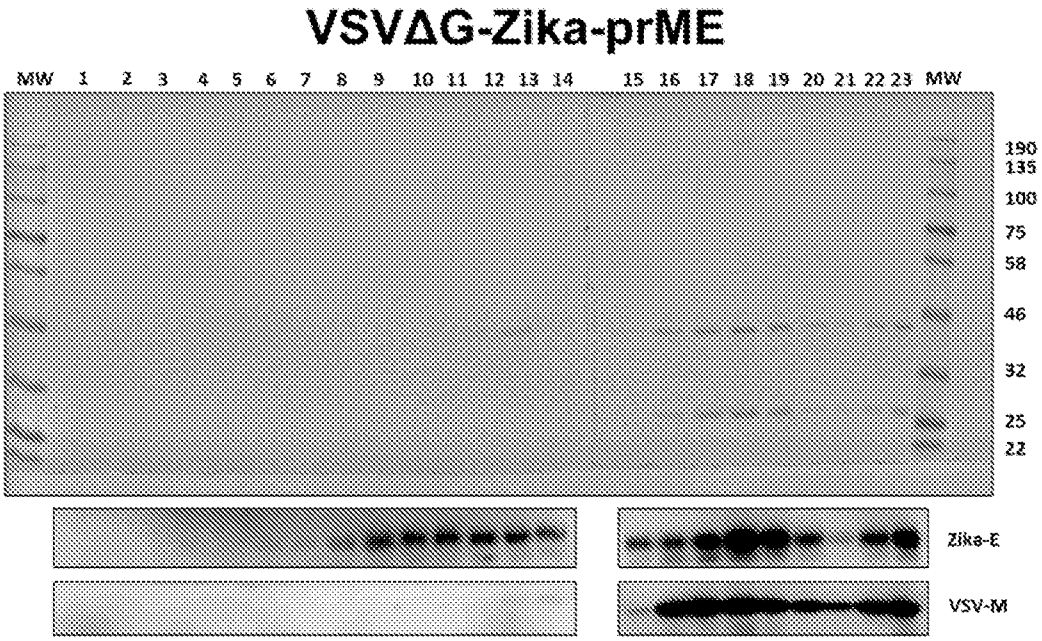


Fig. 8B

Fig. 8C

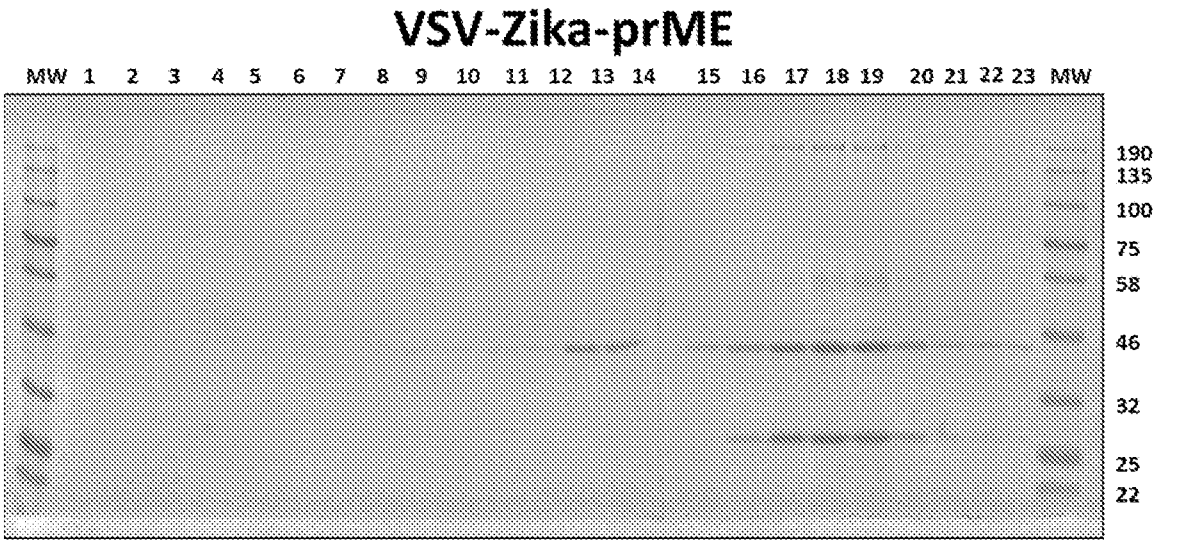


Fig. 8D

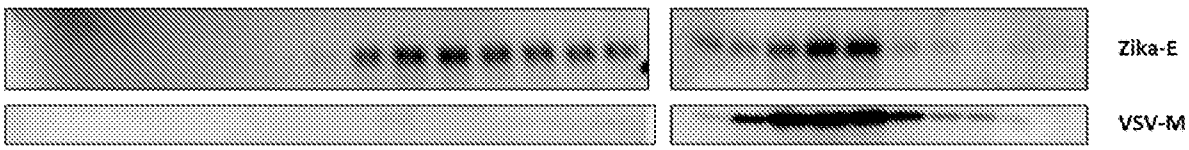


Fig. 9A

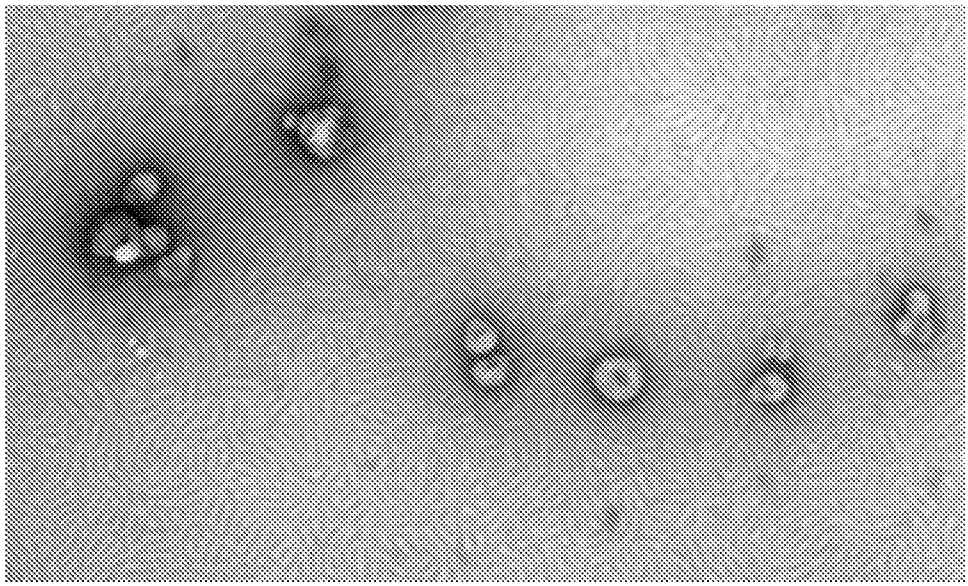


Fig. 9B

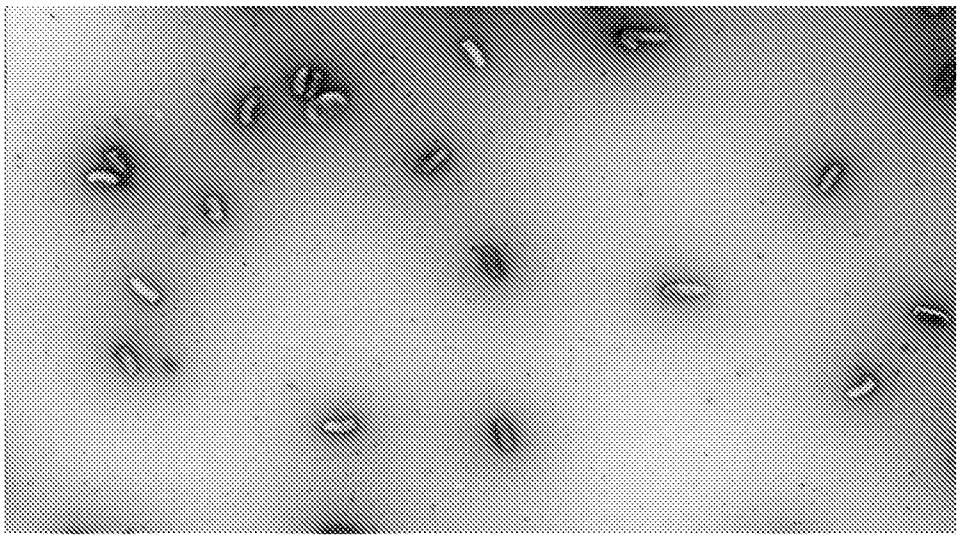


Fig. 10A

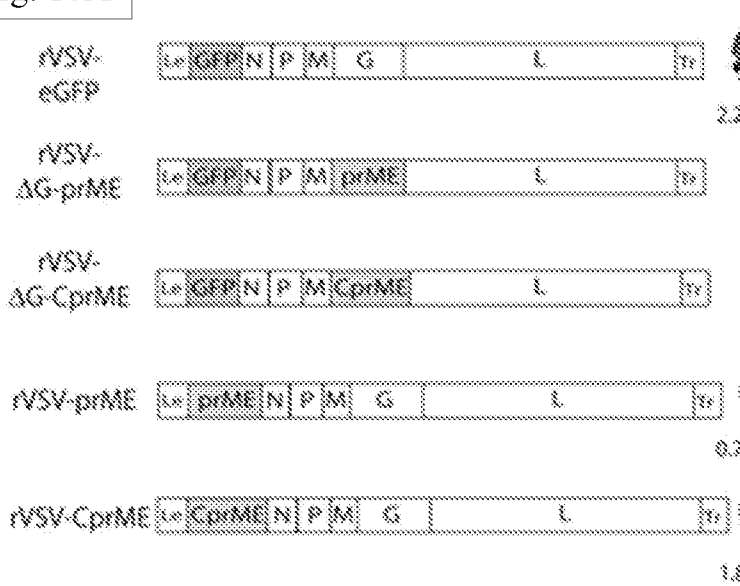


Fig. 10B

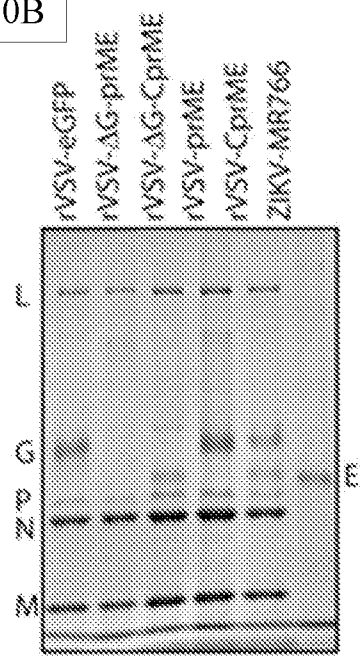


Fig. 10C

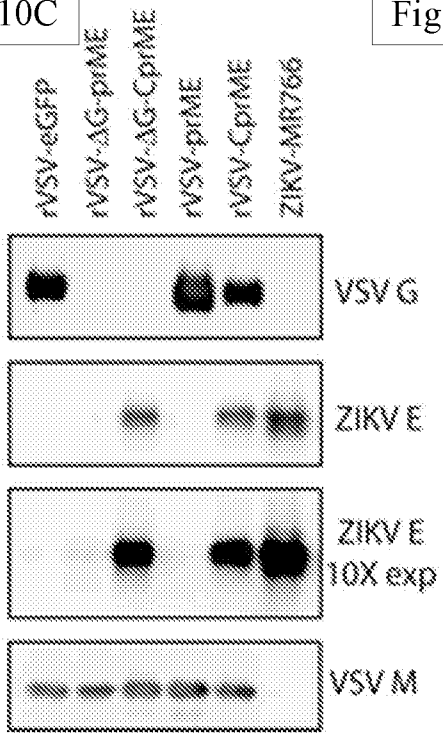


Fig. 10D

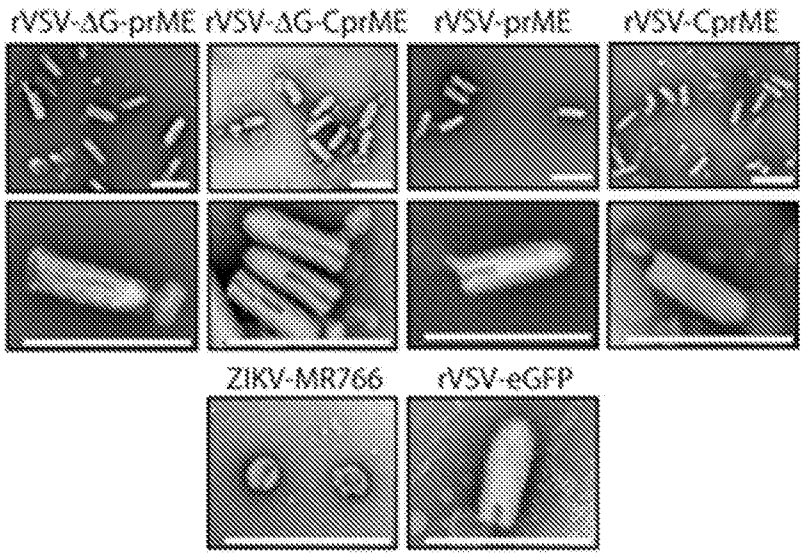


Fig. 11A

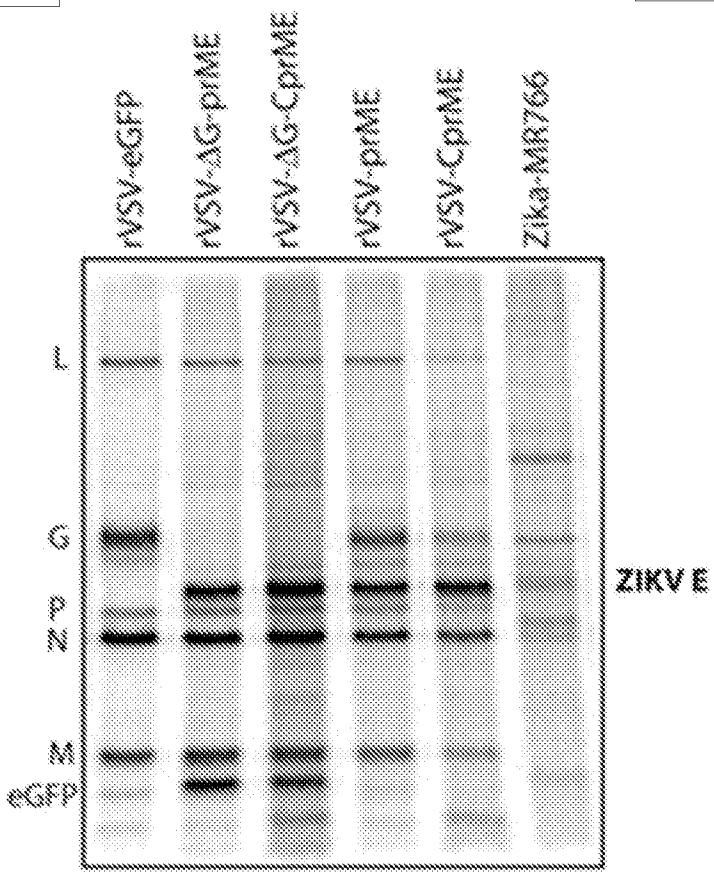


Fig. 11B

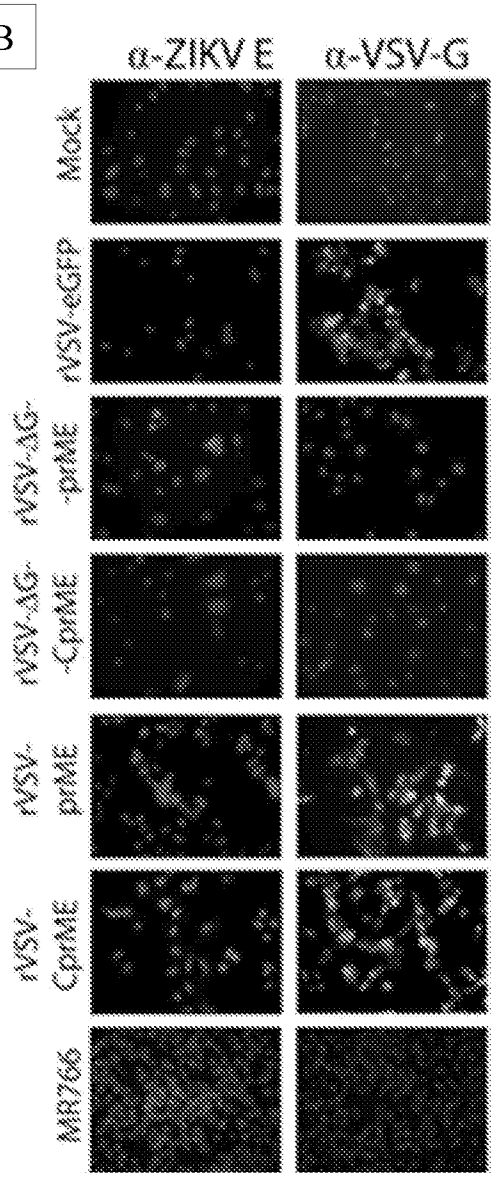


Fig. 12

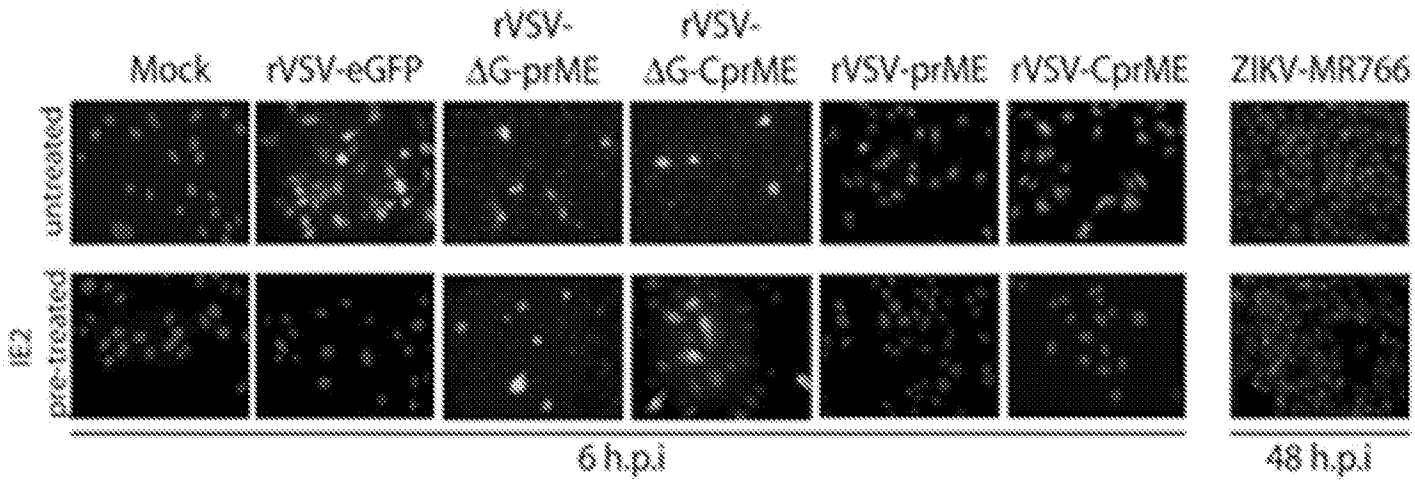

Mock
rVSV-eGFP
rVSV-ΔG-prME
rVSV-ΔG-CprME
rVSV-prME
rVSV-CprME
ZIKV-MR766
untreated
pre-treated
4G2
6 h.p.i
48 h.p.i

Fig. 13A

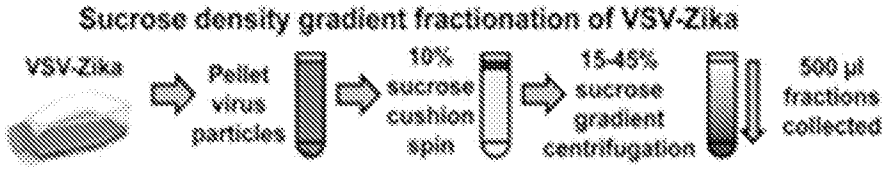


Fig. 13B

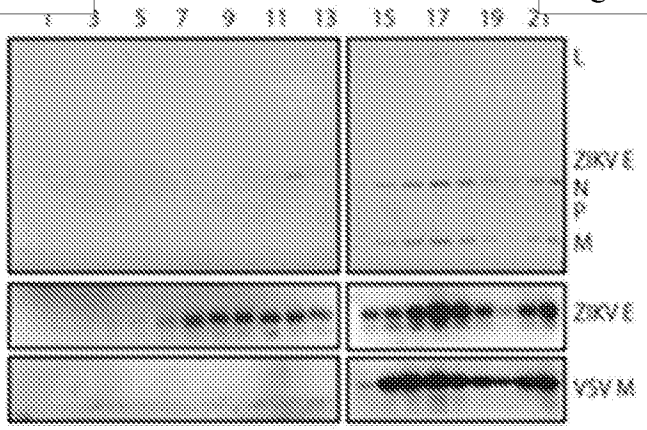


Fig. 13C

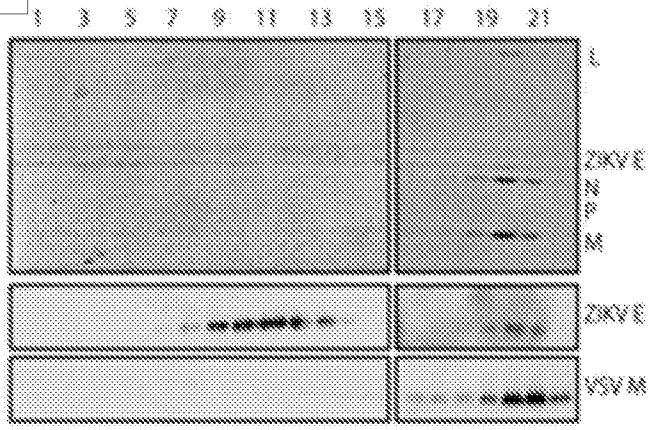


Fig. 13D

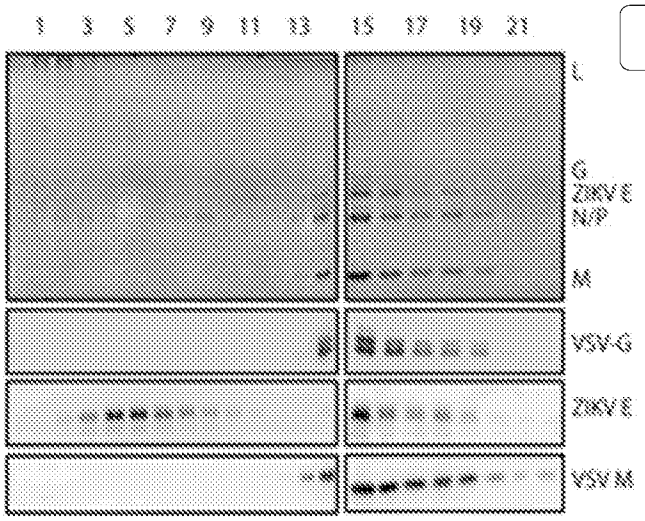


Fig. 13E

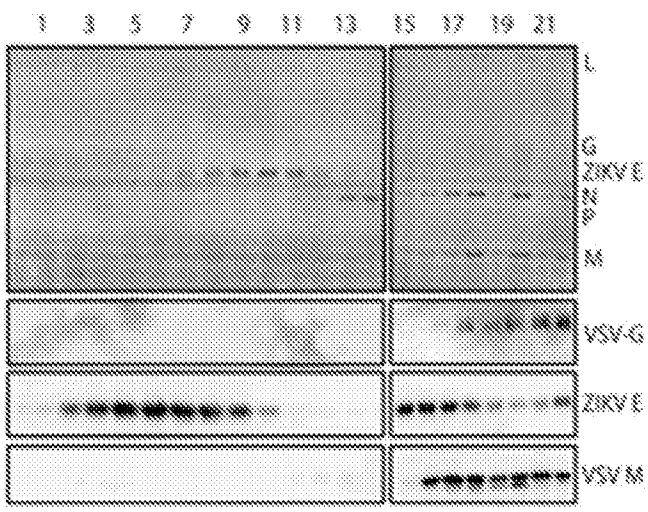


Fig. 14A

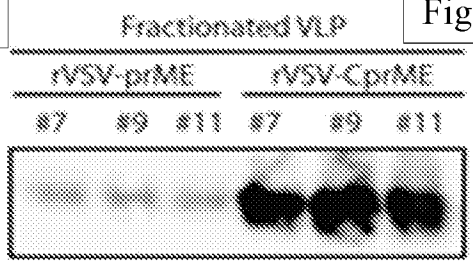


Fig. 14B

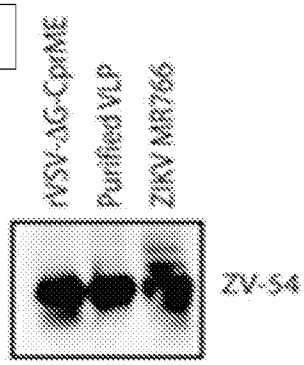


Fig. 14C

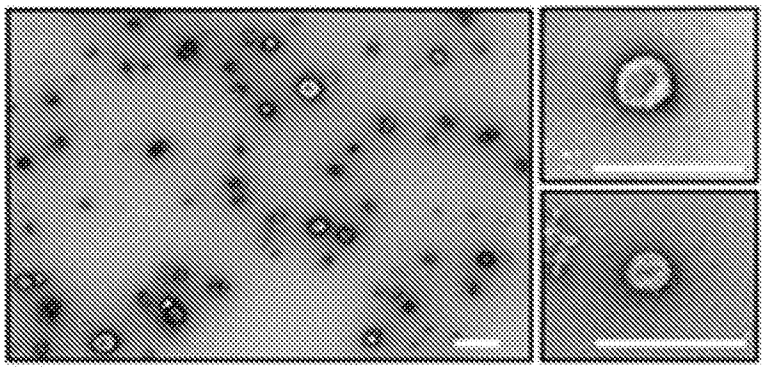


Fig. 14D

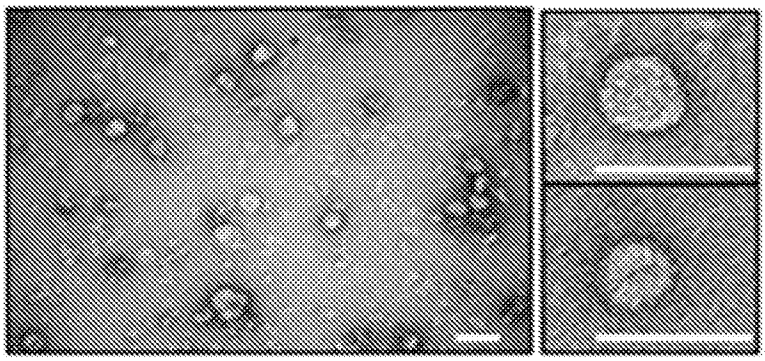


Fig. 14E

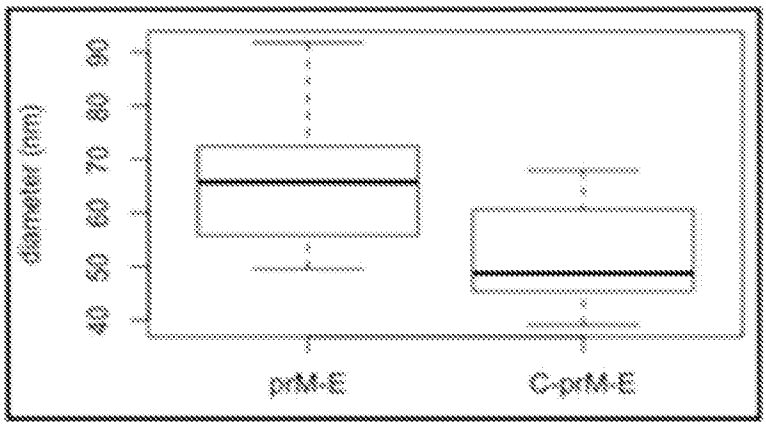


Fig. 15A

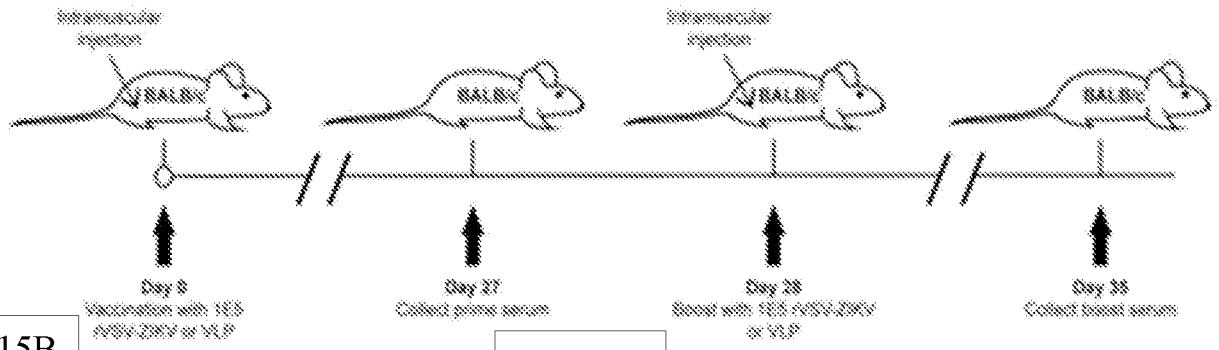


Fig. 15B

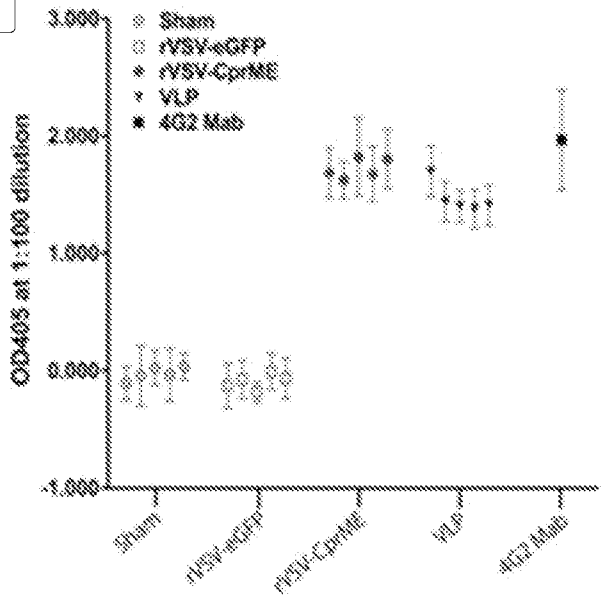
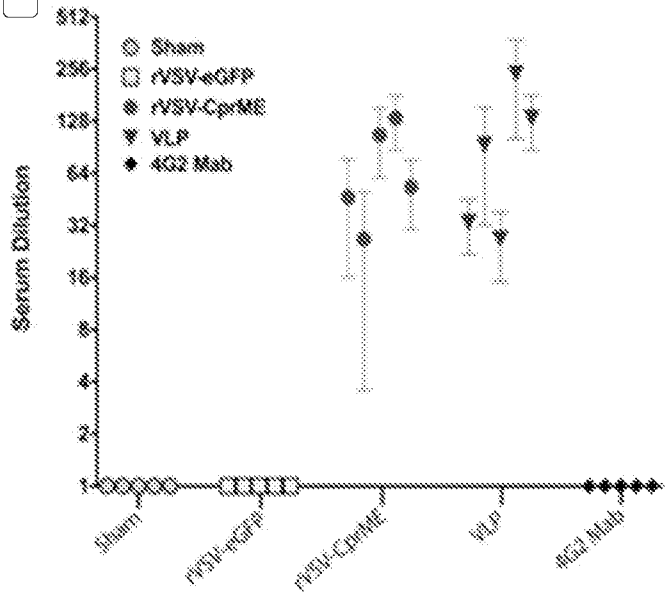


Fig. 15C



INTERNATIONAL SEARCH REPORT

International application No
PCT/US2017/057361

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61K39/12
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A61K C12N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data, BIOSIS, EMBASE

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	EUN KIM ET AL: "Preventative Vaccines for Zika Virus Outbreak: Preliminary Evaluation", EBIOMEDICINE, vol. 13, 3 October 2016 (2016-10-03), pages 315-320, XP055443543, ISSN: 2352-3964, DOI: 10.1016/j.ebiom.2016.09.028 abstract page 319, left-hand column, paragraph 4 - right-hand column, paragraph 1 ----- -/--	1-6,21, 24,27, 30-34, 37-65

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
24 January 2018	19/02/2018

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Malamoussi, A

1

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	P. ABBINK ET AL: "Protective efficacy of multiple vaccine platforms against Zika virus challenge in rhesus monkeys", SCIENCE, vol. 353, no. 6304, 9 September 2016 (2016-09-09), pages 1129-1132, XP055314484, ISSN: 0036-8075, DOI: 10.1126/science.aah6157 abstract	1-6,21, 24,27, 30-34, 37-65
Y	RAFAEL A. LAROCCA ET AL: "Vaccine protection against Zika virus from Brazil", NATURE, vol. 536, no. 7617, 26 June 2016 (2016-06-26), pages 474-478, XP055314483, ISSN: 0028-0836, DOI: 10.1038/nature18952 abstract page 474, right-hand column, paragraph 1	1-6,21, 24,27, 30-34, 37-65
Y	K. A. DOWD ET AL: "Rapid development of a DNA vaccine for Zika virus", SCIENCE, vol. 354, no. 6309, 14 October 2016 (2016-10-14), pages 237-240, XP055428976, ISSN: 0036-8075, DOI: 10.1126/science.aai9137 page 237, right-hand column, paragraph 1 page 240; figures 3,4	1-6,21, 24,27, 30-34, 37-65
Y	Anonymous: "Zika Virus: The Hunt for a Vaccine", , 2 July 2016 (2016-07-02), pages 1-19, XP055444026, Retrieved from the Internet: URL:http://immunitytales.com/zika-virus-the-hunt-for-a-vaccine/ [retrieved on 2018-01-24] page 1	1-6,21, 24,27, 30-34, 37-65
Y	SITA AWASTHI: "Zika Virus: Prospects for the Development of Vaccine and Antiviral Agents", JOURNAL OF ANTIVIRALS & ANTIRETROVIRALS, vol. 08, no. 01, 1 January 2016 (2016-01-01), XP055443605, DOI: 10.4172/jaa.1000e130 page 1, right-hand column, paragraph 2	1-6,21, 24,27, 30-34, 37-65

-/--

1

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	FLAVIO LAURETTI ET AL: "Recombinant vesicular stomatitis virus-based dengue-2 vaccine candidate induces humoral response and protects mice against lethal infection", HUMAN VACCINES AND IMMUNOTHERAPEUTICS, vol. 12, no. 9, 16 May 2016 (2016-05-16), pages 2327-2333, XP055444029, US ISSN: 2164-5515, DOI: 10.1080/21645515.2016.1183857 abstract -----	1-6,21, 24,27, 30-34, 37-65
A	Lianpan Dai ET AL: "Structures of the Zika Virus Envelope Protein and Its Complex with a Flavivirus Broadly Protective Antibody", Cell Host & Microbe, 11 May 2016 (2016-05-11), pages 696-704, XP055444032, United States DOI: 10.1016/j.chom.2016.04.013 Retrieved from the Internet: URL:http://www.cell.com/cms/attachment/2067899602/2067180398/mmc1.pdf [retrieved on 2018-01-24] figure S2 -----	1-6,21, 24,27, 30-34, 37-65
E	WO 2017/192856 A1 (UNIV MIAMI [US]) 9 November 2017 (2017-11-09) page 40, paragraph 0155 -----	1,2,21, 24,30, 32,34, 37-65
X,P	DILLON BETANCOURT ET AL: "Cutting Edge: Innate Immune Augmenting Vesicular Stomatitis Virus Expressing Zika Virus Proteins Confers Protective Immunity", THE JOURNAL OF IMMUNOLOGY, vol. 198, no. 8, 3 April 2017 (2017-04-03) , pages 3023-3028, XP055439172, US ISSN: 0022-1767, DOI: 10.4049/jimmunol.1602180 abstract -----	1,2,21, 24,30, 32,34, 37-65

-/--

1

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	LIANPAN DAI ET AL: "Structures of the Zika Virus Envelope Protein and Its Complex with a Flavivirus Broadly Protective Antibody", CELL HOST & MICROBE, vol. 19, no. 5, 1 May 2016 (2016-05-01), pages 696-704, XP055352074, NL ISSN: 1931-3128, DOI: 10.1016/j.chom.2016.04.013 the whole document -----	1-6,21, 24,27, 30-34, 37-65

1

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2017/057361

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☒ Claims Nos.: 7-20, 22, 23, 25, 26, 28, 29, 35, 36
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
see FURTHER INFORMATION sheet PCT/ISA/210

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

Continuation of Box II.2

Claims Nos.: 7-20, 22, 23, 25, 26, 28, 29, 35, 36

The specific sequences of claims 7-20, 22-23, 25-26, 28-29, and 35-36 have, according to Rule 13ter.1(d) PCT, not been searched since the sequence disclosed in the application does not comply with WIPO standard ST.25 as prescribed under Rule 5.2 PCT. A Standard-compliant sequence listing has not been furnished in text (TXT) format and the applicant has not remedied the deficiencies within the time limit fixed in the invitation pursuant to Rule 13ter.1(a) PCT (see Guidelines for Search and Examination at the EPO as PCT Authority, B-VIII, 3.2).

The applicant's attention is drawn to the fact that claims relating to inventions in respect of which no international search report has been established need not be the subject of an international preliminary examination (Rule 66.1(e) PCT). The applicant is advised that the EPO policy when acting as an International Preliminary Examining Authority is normally not to carry out a preliminary examination on matter which has not been searched. This is the case irrespective of whether or not the claims are amended following receipt of the search report or during any Chapter II procedure. If the application proceeds into the regional phase before the EPO, the applicant is reminded that a search may be carried out during examination before the EPO (see EPO Guidelines C-IV, 7.2), should the problems which led to the Article 17(2) declaration be overcome.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2017/057361

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2017192856 A1	09-11-2017	NONE	