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Methods and compositions for detecting transfusion-transmitted pathogens

Abstract

Probe sets capable of detecting pathogen nucleic acids in a sample are described. The probe set can be provided on a solid support, such as a microarray. Methods of detecting pathogen nucleic acids in a sample using the probe set are also provided. In some examples, the probes and methods are capable of detecting one or more RNA viruses, one or more DNA viruses, one or more bacterial nucleic acids, and/or one or more protozoan nucleic acids in a sample.

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Background/Summary

CROSS REFERENCE TO RELATED APPLICATIONS (1) This application is the U.S. National Stage of International Application No. PCT/US2020/016262, filed Jan. 31, 2020, which was published in English under PCT Article 21 (2), which in turn claims the benefit of U.S. Provisional Application No. 62/799,482, filed Jan. 31, 2019, which is incorporated herein by reference in its entirety.

FIELD
(1) This disclosure relates to compositions and methods for detecting pathogens in a sample, particularly probes and microarrays and methods of their use.
BACKGROUND
(2) Each year millions of blood donations are collected globally and millions of blood components are transfused to patients. Though screening of these blood units using serologic and nucleic acid testing (NAT) has greatly reduced the risk of some transfusion-transmitted infections (TTIs), the vast majority of bloodborne agents are not screened (Alter et al., *Semin. Hematol.* 44:32-41, 2007; Glynn et al., *Transfusion* 53:438-454, 2013; Leveton et al., *Transfusion* 36:919-927, 1996). The U.S. Food and Drug Administration-licensed methods for infectious disease screening of donor blood include: 1) nucleic acid testing (NAT) for Hepatitis B virus (HBV), Hepatitis C virus (HCV), HIV-1 and -2, *Babesia*, West Nile virus (WNV) and Zika virus (ZIKV); and 2) immunoassays for HBV, HCV, HIV-1 and -2, cytomegalovirus (CMV), human T-cell lymphotropic virus I and II (HTLV), *Treponema pallidum* (syphilis), and *Trypanosoma cruzi* (Chagas). HTLV, syphilis, and Chagas antibody testing fail to detect these pathogens during a window period and Chagas is screened only once on samples from first-time blood donors (Duncan et al., *Exp. Rev. Mol. Diagn.* 16:83-95, 2016).
(3) The American Association of Blood Banks Transfusion-Transmitted Diseases Committee produced a list of over 30 pathogens of concern for transmission via blood that included bacteria, parasites, prions and viruses (Stramer et al., *Transfusion* 49:1S-29S, 2009). Only prions cannot be detected by currently available technology. Nearly all the other agents currently require individual qPCR or serologic testing and it is logistically impractical and cost prohibitive to test all known and potential agents individually (Stramer *ISBT Science Series* 9:30-37, 2014; Atrey et al., *Transfusion* 51:1855-1871, 2011).

(4) Multiplex PCR-based devices for testing blood-borne pathogens are limited. FDA-approved blood donor screening assays that use transcription-mediated amplification for multiplex detection of HBV, HCV, and HIV 1 and 2 include the cobas TaqScreen MPX Test (Roche Molecular Systems, Inc.) and the Procleix Ultrio Plus (Gen-Probe, Inc.) (Duncan et al., *Exp. Rev. Mol. Diagn.* 16:83-95, 2016).

SUMMARY

(5) A multiplex assay capable of detecting many, most, or all known pathogens of concern in a single small blood sample with high sensitivity and specificity could significantly increase the safety of the blood supply. Further, to counter emerging pathogens, the platform should be adaptable for rapid addition and validation of probes to detect new agents. Microarray-based technology offers the advantage of multiplex detection in a miniaturized format with high adaptability.

(6) Disclosed herein are probe sets that include probes with at least 90% identity (such as at least 90%, at least 95%, at least 98%, or at least 99% identity) with the nucleic acid sequences of SEQ ID NOs: 1-1300, 1391-1570, and 1691-1769, or subsets thereof. In some examples, the probe set includes probes with the nucleic acid sequences of SEQ ID NOs: 1-1300, 1391-1570, and 1691-1769, or a subset thereof. In some embodiments, the probe set includes one or more probes (such as 30 or more probes) for one or more RNA viruses, such as one or more of Chikungunya virus, Dengue virus type 1, Dengue virus type 2, Dengue virus type 3, Dengue virus type 4, Hepatitis A virus, Hepatitis C virus type 1, Hepatitis C virus type 2, Hepatitis C virus type 3, Hepatitis E virus, Human immunodeficiency virus type 1, Human immunodeficiency virus type 2, Human T-lymphotropic virus type I, Human T-lymphotropic virus type II, West Nile virus, and Zika virus.

(7) In other embodiments, the probe set includes one or more probes for one or more DNA viruses, such as one or more of cytomegalovirus (CMV, also known as HHV-5), Epstein Barr virus (EBV, also known as HHV-4, for example subtype B95-8 and/or AG876)), human herpes virus 8 (HHV-8), Hepatitis B virus (such as one or more of Hepatitis B virus subtype adw, subtype ayw, subtype adr, and subtype ayr), human parvovirus B19, and human papillomavirus (HPV, such as one or more of type 6, 11, 16, and 18). In some embodiments, the probe set includes probes with at least 90% identity (such as at least 90%, at least 95%, at least 98%, or at least 99% identity) with the nucleic acid sequences of SEQ ID NOs: 1770-2647, or a subset thereof. In some examples, the probe set includes probes with the nucleic acid sequences of SEQ ID NOs: 1770-2647, or a subset thereof.

(8) Further disclosed are probe sets that include one or more probes for one or more bacterial or protozoan pathogens, such as one or more of *Treponema pallidum, Ehrlichia chaffeensis, Ehrlichia ewingii, Ehrlichia muris, Borrelia burgdorferi, Coxiella burnetii, Trypanosoma brucei, Trypanosoma cruzi Leishmania major, Babesia microti, Plasmodium falciparum,* and *Plasmodium vivax*. In some embodiments, the probe set includes probes with at least 90% identity (such as at least 90%, at least 95%, at least 98%, or at least 99% identity) with the nucleic acid sequences of SEQ ID NOs: 2648-3207, or a subset thereof. In some examples, the probe set includes probes with the nucleic acid sequences of SEQ ID NOs: 2648-3207, or a subset thereof.

(9) In some embodiments, the disclosed probe sets include at least one negative control probe and/or at least one positive control probe. In some examples the negative control probe is a probe with at least 90% identity (such as at least 90%, at least 95%, at least 98%, or at least 99% identity) with the nucleic acid sequences of any one of SEQ ID NOs: 1571-1690. In other examples the control probe is a probe with at least 90% identity (such as at least 90%, at least 95%, at least 98%, or at least 99% identity) with the nucleic acid sequences of any one of SEQ ID NOs: 3208-3628.

(10) In one non-limiting embodiment, the probe set is a set of probes including each of SEQ ID NOs: 1-1769. In another non-limiting embodiment, the probe set is a set of probes including each of SEQ ID NOs: 1770-2647 and 3208-3628, each of SEQ ID NOs: 2648-3628, or each of SEQ ID NOs: 1770-3628. In a further non-limiting embodiment, the microarray includes probes including

each of SEQ ID NOs: 1-3628.

(11) Also disclosed are microarrays that include a probe set described herein, for example, wherein the probes are covalently linked to a solid support. In one non-limiting example, the microarray includes probes with at least 90% identity (such as at least 90%, at least 95%, at least 98%, at least 99%, or at least 100% identity) with the nucleic acid sequences of SEQ ID NOs: 1-1300, 1391-1570, and 1691-1769, or subsets thereof. In another non-limiting example, the microarray includes probes with at least 90% identity (such as at least 90%, at least 95%, at least 98%, at least 99%, or at least 100% identity) with the nucleic acid sequences of SEQ ID NOs: 1770-2647, or subsets thereof. In a further non-limiting example, the microarray includes probes with at least 90% identity (such as at least 90%, at least 95%, at least 98%, at least 99%, or at least 100% identity) with the nucleic acid sequences of SEQ ID NOs: 2648-3207, or subsets thereof. In yet another non-limiting embodiment, the microarray includes probes with at least 90% identity (such as at least 90%, at least 95%, at least 98%, at least 99%, or at least 100% identity) with the nucleic acid sequences of SEQ ID NOs: 1770-3207, or subsets thereof. The microarray may further include negative and/or positive control probes. In one non-limiting embodiment, the microarray includes probes including each of SEQ ID NOs: 1-1769. In other non-limiting embodiments, the microarray includes probes including each of SEQ ID NOs: 1770-2647 and 3208-3628, each of SEQ ID NOs: 2648-3628, each of SEQ ID NOs: 1770-3628. In a further non-limiting embodiment, the microarray includes probes including each of SEQ ID NOs: 1-3628.

(12) Disclosed herein are methods of detecting one or more pathogen nucleic acids in a sample. In some examples, the methods include detecting nucleic acids from one or more RNA viruses, such as one or more of Chikungunya virus, Dengue virus type 1, Dengue virus type 2, Dengue virus type 3, Dengue virus type 4, Hepatitis A virus, Hepatitis C virus type 1, Hepatitis C virus type 2, Hepatitis C virus type 3, Hepatitis E virus, Human immunodeficiency virus type 1, Human immunodeficiency virus type 2, Human T-lymphotropic virus type I, Human T-lymphotropic virus type II, West Nile virus, and Zika virus in a sample. In other examples, the methods include detecting nucleic acids from one or more DNA viruses, such as one or more of cytomegalovirus, Epstein Barr virus, human herpes virus 8, Hepatitis B virus, human parvovirus B19, and human papillomavirus.

(13) Also disclosed are methods of detecting one or more bacterial and/or protozoan nucleic acids in a sample. In some examples, the methods include detecting nucleic acids from one or more of *Treponema pallidum, Ehrlichia chaffeensis, Ehrlichia ewingii, Ehrlichia muris, Borrelia burgdorferi, Coxiella burnetii, Trypanosoma brucei, Trypanosoma cruzi, Leishmania major, Babesia microti, Plasmodium falciparum*, and *Plasmodium vivax.*

(14) In some examples, the methods include contacting a sample with a disclosed probe set or microarray under conditions sufficient to allow hybridization of pathogen nucleic acids present in the sample to the probes of the probe set or microarray and measuring hybridization of the sample to one or more of the probes, thereby detecting one or more nucleic acids in the sample. The sample may be a blood, serum, or plasma sample, or nucleic acids (such as RNA or cDNA) isolated from the sample. In particular examples, the sample is a blood donation sample or nucleic acids isolated from a blood donation sample. In particular examples, nucleic acids (such as RNA or cDNA) from the sample are labeled prior to contacting the probe set or microarray with the nucleic acids. In one example, the method includes preparing cDNA from the sample and labeling the cDNA. In some examples, the method does not include amplifying RNA from the sample prior to preparing the cDNA.

(15) The foregoing and other features of the disclosure will become more apparent from the following detailed description, which proceeds with reference to the accompanying figures.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

(1) FIGS. **1**A-**1**C are a series of panels showing pathogen chip design (FIG. **1**A), sample preparation work flow (FIG. **1**B), and analysis strategy (FIG. **1**C) for pathogen detection microarrays.

(2) FIGS. **2**A-**2**C are a series of graphs showing amplification method and Pathogen Chip assay performance assessed using positive control viral RNAs. FIG. **2**A shows SPIA amplification vs. standard (STD) method. cDNA concentration after amplification for four representative viral RNAs is shown. Starting RNA concentration was <10 ng/μl each. FIG. **2**B shows Pathogen chip assay performance 1. Bars are the mean of Cy3 signal for the Chikungunya and West Nile probes hybridized to test samples positive for CHIKV and WNV and a negative plasma sample. Only probes specific to target showed a specific hybridization signal. No signal was detected for negative plasma. FIG. **2**C shows Pathogen chip assay performance 2. Detection responses of four representative samples (Dengue-4) were measured over a dilution series from 10,000 to 10 genomic copies per sample. Bars are the mean of Cy3 signals for all probes to the indicated viruses hybridized to test samples.

SEQUENCE LISTING

(3) Any nucleic acid and amino acid sequences listed herein or in the accompanying sequence listing are shown using standard letter abbreviations for nucleotide bases and amino acids, as defined in 37 C.F.R. § 1.822. In at least some cases, only one strand of each nucleic acid sequence is shown, but the complementary strand is understood as included by any reference to the displayed strand.

(4) The Sequence Listing is submitted as an ASCII text file in the form of the file named Sequence_Listing.txt, which was created on Jul. 22, 2021, and is 676,876 bytes, which is incorporated by reference herein.

(5) In the accompanying sequence listing: SEQ ID NOs: 1-110 are Hepatitis C virus genotype 1 probes SEQ ID NOs: 111-210 are Hepatitis C virus genotype 2 probes SEQ ID NOs: 211-310 are Hepatitis C virus genotype 3 probes SEQ ID NOs: 311-400 are Human Immunodeficiency virus 1 probes SEQ ID NOs: 401-510 are Human Immunodeficiency virus 2 probes SEQ ID NOs: 511-570 are Human T-lymphotropic virus I probes SEQ ID NOs: 571-660 are Human T-lymphotropic virus II probes SEQ ID NOs: 661-760 are West Nile virus NY99 probes SEQ ID NOs: 761-870 are West Nile virus 956 probes SEQ ID NOs: 871-900 are Chikungunya virus probes SEQ ID NOs: 901-1000 are Dengue virus 1 probes SEQ ID NOs: 1001-1100 are Dengue virus 2 probes SEQ ID NOs: 1101-1199 are Dengue virus 3 probes SEQ ID NOs: 1200-1300 are Dengue virus 4 probes SEQ ID NOs: 1301-1390 are GB virus C/Hepatitis G virus probes SEQ ID NOs: 1391-1500 are Hepatitis A virus probes SEQ ID NOs: 1501-1570 are Hepatitis E virus probes SEQ ID NOs: 1571-1580 are White clover cryptic virus 1 probes SEQ ID NOs: 1581-1620 are Broad bean wilt virus 1 probes SEQ ID NOs: 1621-1690 are Lettuce necrotic yellows virus probes SEQ ID NOs: 1691-1700 are Zika virus isolate Brazil-ZKV2015 probes SEQ ID NOs: 1701-1710 are Zika virus strain PRVABC59 probes SEQ ID NOs: 1711-1720 are Zika virus isolate Z1106033 probes SEQ ID NOs: 1721-1730 are Zika virus isolate SSABR1 probes SEQ ID NOs: 1731-1769 are Zika virus strain ZikaSPH2015 probes SEQ ID NOs: 1770-1852 are Cytomegalovirus probes SEQ ID NOs: 1853-1917 are Epstein Barr virus B95-8 probes SEQ ID NOs: 1918-2023 are Epstein Barr virus AG876 probes SEQ ID NOs: 2024-2108 are Human herpesvirus 8 probes SEQ ID NOs: 2109-2192 are Human papillomavirus subtype 6b probes SEQ ID NOs: 2193-2271 are Human papillomavirus subtype 11 probes SEQ ID NOs: 2272-2342 are Human papillomavirus subtype 16 probes SEQ ID NOs: 2343-2419 are Human papillomavirus subtype 18 probes SEQ ID NOs: 2420-2470 are Hepatitis B virus subtype adw probes SEQ ID NOs: 2471-2520 are Hepatitis B virus subtype ayw probes SEQ ID NOs: 2521-2556 are Hepatitis B virus subtype adr probes SEQ ID NOs: 2557-2602 are Hepatitis B virus subtype ayr probes SEQ ID NOs: 2603-2647 are Human parvovirus B19

probes SEQ ID NOs: 2648-2751 are *Treponema pallidum* probes SEQ ID NOs: 2752-2852 are *Ehrlichia chaffeensis* probes SEQ ID NOs: 2853-2861 are *Ehrlichia ewingii* probes SEQ ID NOs: 2862-2922 are *Ehrlichia muris* probes SEQ ID NOs: 2923-3001 are *Borrelia burgdorferi* probes SEQ ID NOs: 3002-3085 are *Coxiella burnetii* probes SEQ ID NOs: 3086-3097 are *Trypanosoma brucei* probes SEQ ID NO: 3098 is a *Trypanosoma cruzi* probe SEQ ID NOs: 3099-3113 are *Leishmania major* probes SEQ ID NOs: 3114-3154 are *Babesia microti* probes SEQ ID NOs: 3155-3185 are *Plasmodium falciparum* probes SEQ ID NOs: 3186-3207 are *Plasmodium vivax* probes SEQ ID NOs: 3208-3301 are human ACTB probes SEQ ID NOs: 3302-3385 are human ARL1 probes SEQ ID NOs: 3386-3519 are human CCDN1 probes SEQ ID NOs: 3520-3557 are *Aedes albopictus* densovirus 2 probes SEQ ID NOs: 3558-3598 are Maize streak virus probes SEQ ID NOs: 3599-3628 are Tomato pseudo-curly top virus probes

DETAILED DESCRIPTION

(6) Disclosed herein are customized sets of probes, including microarray-based pathogen chips, for simultaneous detection of nucleic acids from RNA viruses, DNA viruses, and/or bacteria or protozoan pathogens in blood samples (such as human plasma) that are designed to have the flexibility to expand to detect emerging agents in a relatively short time frame. The presence of multiple probes per target represents an advantage in comparison to traditional NAT or EIA assays since the pathogen(s) can be detected even in the case of failure of one of the probes due to mutation (Petrik *Vox Sanguinis* 80:1-11, 2001). The flexibility and high-throughput capability of microarrays hold great potential for pathogen detection and identification, but historically have had limitations in detecting the presence of the low viral levels (Chen et al., *J. Vis. Exp.* 50:e2536, 2011; Wang et al., *Proc. Natl. Acad. Sci. USA* 99:15687-15692, 2002; Eckburg et al., *Clin. Infect. Dis.* 43:e71-e76, 2006). Disclosed herein are probe sets and microarray assays that include: 1) a platform design that simultaneously detects and distinguishes multiple pathogens and closely related strains or subtypes; and 2) a combination of amplification and labeling protocols to detect multiple targets present at low levels in a sample.

I. Terms

(7) Unless otherwise noted, technical terms are used according to conventional usage. Definitions of common terms in molecular biology may be found in *Lewin's Genes X*, ed. Krebs et al., Jones and Bartlett Publishers, 2009 (ISBN 0763766321); Kendrew et al. (eds.), *The Encyclopedia of Molecular Biology*, published by Blackwell Publishers, 1994 (ISBN 0632021829); Robert A. Meyers (ed.), *Molecular Biology and Biotechnology: a Comprehensive Desk Reference*, published by Wiley, John & Sons, Inc., 1995 (ISBN 0471186341); and George P. Rédei, *Encyclopedic Dictionary of Genetics, Genomics, Proteomics and Informatics*, 3.sup.rd Edition, Springer, 2008 (ISBN: 1402067534), and other similar references.

(8) Unless otherwise explained, all technical and scientific terms used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this disclosure belongs. The singular terms “a,” “an,” and “the” include plural referents unless the context clearly indicates otherwise. Similarly, the word “or” is intended to include “and” unless the context clearly indicates otherwise. Hence “comprising A or B” means including A, or B, or A and B. It is further to be understood that all base sizes or amino acid sizes, and all molecular weight or molecular mass values, given for nucleic acids or polypeptides are approximate, and are provided for description.

(9) Although methods and materials similar or equivalent to those described herein can be used in the practice or testing of the present disclosure, suitable methods and materials are described below. All publications, patent applications, patents, and other references mentioned herein are incorporated by reference in their entirety. In case of conflict, the present specification, including explanations of terms, will control. In addition, the materials, methods, and examples are illustrative only and not intended to be limiting.

(10) In order to facilitate review of the various embodiments of the disclosure, the following explanations of specific terms are provided:

(11) Array or Microarray: An arrangement of nucleic acids (such as DNA or RNA) or proteins (such as antibodies) in assigned locations on a matrix or substrate. In some examples, the nucleic acid molecules or proteins are attached covalently to the matrix or substrate.
(12) *Babesia*: A tick-borne protozoan parasite that infects vertebrate red blood cells. In humans, *Babesia* species may cause asymptomatic infection or babesiosis, characterized by flu-like symptoms. Most cases of transmission between humans are attributed to a tick vector; however, it may also be transmitted through blood transfusion or organ donation. The most common pathogenic species in humans are *Babesia divergens* and *Babesia* microti. *Babesia* sequences are publicly available, and include GenBank Accession Nos. ASM107745v2 (*Babesia divergens*) and ASM69194v2 and ASM165006v1 (*Babesia microti*), which are incorporated by reference in their entirety as present in GenBank on Jan. 30, 2020.
(13) *Borrelia*: A genus of tick-borne spirochete bacteria that cause Lyme disease. The major species of *Borrelia* that cause Lyme disease include *Borrelia burgdorferi, Borrelia afzelii, Borrelia garinii,* and *Borrelia mayonii. Borrelia* has been identified in blood stored for donation, though there is currently no evidence of Lyme disease linked to blood transfusion. *Borrelia* sequences are publicly available, and include GenBank Accession Nos. ASM868v2 (*Borrelia burgdorferi*), ASM30473v1 (*Borrelia afzelii*), ASM192254v1 (*Borrelia garinii*), and ASM194566v1 (*Borrelia mayonii*), which are incorporated by reference in their entirety as present in GenBank on Jan. 30, 2020).
(14) Chikungunya virus (CHIKV): A positive-sense single-stranded RNA virus of the alphavirus genus in the family Togaviridae. This virus is primarily transmitted by *Aedes* mosquitoes, particularly *A. albopictus* and *A. aegypti*. The symptoms of CHIKV infection include rash, high fever and joint pain. CHIKV was first isolated in Tanzania in 1952 and re-emerged in Kenya in 2004. The evolution and spread of this virus into new geographic areas, and the disease severity resulting from CHIKV infection, present a serious public health concern. CHIKV sequences are publicly available, and include GenBank Accession No. NC_004162 (gi|27754751)), which is incorporated by reference in its entirety as present in GenBank on Jan. 30, 2019.
(15) *Coxiella burnetii*: A Gram-negative bacteria that causes Q fever. Symptoms are typically flu-like and may be mild or severe, and a small percentage of infected individuals develop chronic Q fever. The bacteria infects livestock (such as cows, sheep, and goats) and is transmitted to humans by contact with feces, urine, milk, or other products from an infected animal, typically by breathing dust contaminated with the bacteria. *Coxiella burnetii* sequences are publicly available, and includes GenBank Accession No. ASM776v2, which is incorporated by reference in its entirety as present in GenBank on Jan. 30, 2020.
(16) Cytomegalovirus (CMV): Also known as human herpesvirus 5. A common virus that infects up to 50% of adults by the age of 40. Most people show no symptoms of infection or only mild symptoms; however, babies born with congenital CMV infection may have long-term health problems. CMV is transmitted by body fluids, including blood transfusions. CMV sequences are publicly available, and include GenBank Accession No. NC_006273, which is incorporated by reference in its entirety as present in GenBank on Jan. 30, 2020.
(17) Dengue virus (DEN): An RNA virus of the family Flaviviridae, genus *Flavivirus*. There are four serotypes of dengue virus, referred to as DEN1, DEN2, DEN3 and DEN4. All four serotypes can cause the full spectrum of dengue disease. Infection with one serotype can produce lifelong immunity to that serotype. However, severe complications can occur upon subsequent infection by a different serotype. Dengue virus is primarily transmitted by *Aedes* mosquitoes, particularly *A. aegypti*. Symptoms of dengue virus infection include fever, headache, muscle and joint pain and a skin rash similar to measles. In a small percentage of cases, the infection develops into a life-threatening dengue hemorrhagic fever, typically resulting in bleeding, low platelet levels and blood plasma leakage, or into dengue shock syndrome, characterized by dangerously low blood pressure. DEN sequences are publicly available, and include GenBank Accession Nos. NC_001477 (gi|9626685) (DEN1), NC_001474 (gi|158976983) (DEN2), NC_001475 (gi|163644368) (DEN3),

and NC_002640 (gi|12084822) (DEN4), which are incorporated by reference in their entirety as present in GenBank on Jan. 30, 2019.
(18) Epstein-Barr virus (EBV): Also known as human herpesvirus 4. EBV is a common virus that is spread primarily through saliva, though it can also be spread by sexual contact, blood transfusion, and organ transplantation. EBV causes infectious mononucleosis, characterized by fatigue, fever, swollen lymph nodes, and sore throat; however, EBV infection may also be asymptomatic. EBV sequences are publicly available, and include GenBank Accession Nos. AJ278309 (EBV strain B95-8), DQ279927 (EBV strain AG876), and NC_009334, all of which are incorporated by reference in their entirety as present in GenBank on Jan. 30, 2020.
(19) *Ehrlichia*: A genus of tick-borne bacteria that causes ehrlichiosis. In some cases, *Ehrlichia* has been transmitted through blood transfusion or organ transplantation. Symptoms can include rash, fever, headache, muscle aches, nausea, vomiting, and diarrhea. Severe, late stage illness can include neural damage, respiratory failure, and organ failure. Disease causing species include *Ehrlichia chaffeensis, Ehrlichia ewingii*, and *Ehrlichia muris. Ehrlichia* sequences are publicly available, and include GenBank Accession Nos. NC_007799 (*E. chaffeensis*) and NC_023063 (*E. muris*), which are incorporated by reference in their entirety as present in GenBank on Jan. 30, 2020.
(20) Hepatitis A virus (HAV): A single-stranded RNA virus in the order Picomavirales, family Picornaviridae. The virus is transmitted through fecal-oral and blood routes. HAV causes symptoms such as nausea, vomiting, diarrhea, jaundice, fever, and abdominal pain and typically lasts about 8 weeks. Acute liver failure may occur in some cases. HAV sequences are publicly available, and include GenBank Accession No. NC_001489 (gi|9626732), which is incorporated by reference in its entirety as present in GenBank on Jan. 30, 2019.
(21) Hepatitis B virus (HBV): A DNA virus of the Hepadnaviridae family. HBV is transmitted through blood or bodily fluids and new infections are frequently asymptomatic in healthy adults.
(22) Immunosuppressed adults and children less than 5 years of age more commonly exhibit symptoms, including flu-like symptoms and jaundice. HBV sequences are publicly available and include GenBank Accession Nos. AY518556 (subtype adw), NC_003977 (subtype ayw), AY123041 (subtype adr), and X04615 (subtype ayr), all of which are incorporated by reference in their entirety as present in GenBank on Jan. 30, 2020.
(23) Hepatitis C virus (HCV): A single-stranded positive sense RNA virus of the family Flaviviridae. HCV is transmitted primarily through blood and acute infection typically causes mild or no symptoms. However, chronic infection frequently leads to liver disease, including cirrhosis, liver failure, and/or hepatocellular carcinoma. HCV type 1 sequences are publicly available, and include GenBank Accession No. NC_004102 (gi|22129792). HCV type 2 sequences are also publicly available, and include GenBank Accession No. NC_009823 (gi|157781212). HCV type 3 sequences are also publicly available, and include GenBank Accession No. NC_009824 (gi|157781216). Each of these sequences are incorporated by reference in their entirety as present in GenBank on Jan. 30, 2019.
(24) Hepatitis E virus (HEV): A single-stranded positive sense RNA virus that is currently classified in the Hepeviridae family, genus *Orthohepevirus*. HEV causes liver inflammation, and is typically an acute and self-limiting infection. However, it can cause chronic hepatitis in individuals with weakened immune systems, particularly organ transplant recipients. HEV sequences are publicly available, and include GenBank Accession No. NC_001434 (gi|9626440), which is incorporated by reference in its entirety as present in GenBank on Jan. 30, 2019.
(25) Human Immunodeficiency virus (HIV): A single-stranded positive-sense RNA virus (retrovirus) that causes HIV infection and acquired immunodeficiency syndrome (AIDS). HIV is transmitted by blood or sexual contact. HIV type 1 sequences are publicly available, and include GenBank Accession No. NC_001802 (gi|9629357). HIV type 2 sequences are also publicly available and include GenBank Accession No. NC_001722 (gi|9628880). Each sequence is

incorporated by reference in their entirety as present in GenBank on Jan. 30, 2019
(26) Human Herpesvirus 8 (HHV-8): Also known as Kaposi sarcoma-associated herpesvirus. HHV-8 is associated with Kaposi sarcoma and other cancers, including some lymphomas. It is transmitted through bodily fluids, including blood, saliva, and sexual contact. HHV-8 sequences are publicly available and include GenBank Accession No. NC_009333, which is incorporated by reference in its entirety as present in GenBank on Jan. 30, 2020.
(27) Human parvovirus: A single-stranded DNA virus of the Parvoviridae family. Parvovirus B19 is the only parvovirus known to infect humans. B19 primarily causes disease in children, and causes what is sometimes called “fifth disease,” a mild rash. Parvovirus B19 can be transmitted via respiratory secretions or through blood or blood products. Human parvovirus B19 sequences are publicly available and include GenBank Accession No. NC_000883, which is incorporated by reference in its entirety as present in GenBank on Jan. 30, 2020.
(28) Human papillomavirus (HPV): A DNA virus of the family Papillomaviridae. HPV is a common sexually transmitted virus that can cause warts and cancers, including cervical cancer and head and neck cancer, in some individuals. HPV DNA can be detected in the blood in some cases; however, it is not clear whether it can be transmitted by blood transfusion. There are over 100 known types of HPV to date. HPV sequences are publicly available, and include GenBank Accession Nos. HG793809 (type 6), HE574701 (type 11), NC_001526 (type 16), and NC_001357 (type 18), each of which are incorporated by reference in their entirety as present in GenBank on Jan. 30, 2020.
(29) Human T-lymphotropic virus (HTLV): A group of positive-sense RNA retroviruses that are implicated in cancer (for example, T-cell lymphomas) and myelopathy. HTLV type I sequences are publicly available, and include GenBank Accession Nos. AF033817 and NC_001436 (gi|9626453). HTLV type II sequences are also publicly available and include GenBank Accession No. NC_001488 (gi|9626726). Each sequence is incorporated by reference in their entirety as present in GenBank on Jan. 30, 2019
(30) *Leishmania major*: A trypanosomatid parasite transmitted by sand flies. *L. major* causes cutaneous leishmaniosis. *L. major* sequences are publicly available, and include GenBank Accession No. ASM272v2, incorporated by reference in its entirety as present in GenBank on Jan. 30, 2020.
(31) *Plasmodium*: A genus of mosquito-transmitted protozoan parasites that causes malaria in humans. The two major malaria causing *Plasmodium* species in humans are *P. falciparum* and *P. vivax*. *P. falciparum* is also associated with Burkitt's lymphoma. *Plasmodium* can be transmitted by blood transfusion, causing transfusion-transmitted malaria. *Plasmodium* sequences are publicly available and include GenBank Accession No. ASM276v2 (*P. falciparum*) and ASM241v2 (*P. vivax*), which are incorporated by reference in their entirety as present in GenBank on Jan. 30, 2020.
(32) Probe: A probe typically comprises an isolated nucleic acid (for example, at least 10 or more nucleotides in length, such as 10-60, 15-50, 20-40, 20-50, 25-50, or 30-60 nucleotides in length). In some examples, a probe includes a detectable label, while in other examples a probe does not include a detectable label.
(33) Sample (or biological sample): A biological specimen containing nucleic acids (for example, DNA, RNA, and/or mRNA), proteins, or combinations thereof, obtained from a subject. Examples include, but are not limited to, peripheral blood, serum, plasma, urine, saliva, tissue biopsy, fine needle aspirate, surgical specimen, and autopsy material. In some examples, a sample includes blood, serum, or plasma.
(34) Subject: A living multi-cellular vertebrate organism, a category that includes human and non-human mammals. In one example, a subject is a blood donor.
(35) *Treponema*: A genus of spirochete bacteria. The major pathogenic species in humans is *Treponema pallidum*, of which subspecies *T. pallidum pallidum* causes syphilis. The bacteria is

transmitted primarily by sexual contact. Nucleic acid sequences for *T. pallidum pallidum* are publicly available and include GenBank Accession Nos. NC_016844 and NC_00919, which are incorporated by reference in their entirety as present in GenBank on Jan. 30, 2020.

(36) *Trypanosoma*: A genus of protozoan parasites transmitted by blood-feeding insects. *T. brucei* is transmitted by infected tsetse flies and causes sleeping sickness (trypanosomiasis) in humans. There are two types of trypanosomiasis: East African trypanosomiasis, caused by *Trypanosoma brucei rhodesiense* and West African trypanosomiasis, caused by *Trypanosoma brucei gambiense. Trypanosoma brucei brucei* infects primarily cattle, and does not normally infect humans. *T. cruzi* causes Chagas disease and is transmitted by triatomine bugs. *Trypanosoma* sequences are publicly available and include GenBank Accession Nos. ASM21029v1 (*T. brucei* gambiense), and ASM20906v1 (*T. cruzi*), each of which are incorporated by reference in their entirety as present in GenBank on Jan. 30, 2020.

(37) West Nile virus (WNV): A member of the virus family Flaviviridae and the genus *Flavivirus*. WNV was first isolated from a woman in the West Nile district of Uganda in 1937. The virus was later identified in birds in the Nile delta region in 1953. Human infections attributable to WNV have been reported in many countries for over 50 years. In 1999, a WNV circulating in Israel and Tunisia was imported into New York, producing a large and dramatic outbreak that spread throughout the continental United States in the following years. Human infection is most often the result of bites from infected mosquitoes, but may also be transmitted through contact with other infected animals, their blood or other tissues. Infection with WNV is asymptomatic in about 80% of infected people, but about 20% develop West Nile fever. Symptoms include fever, headache, fatigue, body aches, nausea, vomiting, swollen lymph glands and in some cases, a skin rash. Approximately 1 in 150 of infected individuals develop severe, neuroinvasive disease, such as encephalitis, meningitis, or poliomyelitis. WNV sequences are publicly available, and include GenBank Accession Nos. NC_009942 (gi|158516887) (NY99, lineage 1) and NC_001563 (gi|11528013) (956, lineage 2), which are incorporated by reference in their entirety as present in GenBank on Jan. 30, 2019.

(38) Zika virus (ZKV or ZIKV): A member of the virus family Flaviviridae and the genus *Flavivirus*. ZIKV is spread by the daytime-active mosquitoes *Aedes aegypti* and *A. albopictus*. This virus was first isolated from a Rhesus macaque from the Zika Forest of Uganda in 1947. Since the 1950s, ZIKV has been known to occur within a narrow equatorial belt from Africa to Asia. The virus spread eastward across the Pacific Ocean in 2013-2014, resulting in ZIKV outbreaks in Oceania to French Polynesia, New Caledonia, the Cook islands, and Easter Island. In 2015, ZKV spread to Mexico, Central America, the Caribbean and South America, where ZKV has reached pandemic levels. Infection by ZIKV generally causes either no symptoms or mild symptoms, including mild headache, maculopapular rash, fever, malaise, conjunctivitis and joint pain. However, ZKV infection has been linked to the birth of microcephalic infants following maternal infection. Reports have also indicated that ZIKV has the potential for human blood-borne and sexual transmission. ZIKV sequences are publicly available, and include GenBank Accession Nos. KU497555 (gi|985578255) (isolate Brazil-ZK2015), KU501215 (gi|984874581) (strain PRVABC59), KU312312 (gi|973447404) (isolate Z1106033), KU707826 (gi|992324757) (isolate SSABR1), and KU321639 (strain ZikaSPH2015), which are incorporated by reference in their entirety as present in GenBank on Jan. 30, 2019.

II. Probes and Microarrays

(39) Disclosed herein is a nucleic acid probe set capable of detecting nucleic acid molecules from one or more RNA viruses, including Chikungunya virus (CHIKV), Dengue virus types 1, 2, 3, or 4, (DEN1, DEN2, DEN3, DEN4), Hepatitis A virus (HAV), Hepatitis C virus (HCV) types 1, 2, or 3, Hepatitis E virus (HEV), Human Immunodeficiency virus (HIV) types 1 or 2, Human T-lymphotropic virus (HTLV) types I or II, West Nile virus (WNV), and Zika virus (ZKV). In some embodiments, the probe set includes 30 or more probes for one or more of the viruses (such as 30

or more, 50 or more, 60 or more, 70 or more, 80 or more, 90 or more, 100 or more, 110 or more, or 120 or more), for example 30-120 probes, 50-100 probes, or 70-110 probes for one or more of CHIKV, DEN1, DEN2, DEN3, DEN4, HAV, HCV type 1, HCV type 2, HCV type 3, HEV, HIV type 1, HIV type 2, HTLV type 1, HTLV type 2, WNV, and ZIKV.

(40) In some embodiments, the probe set includes nucleic acid probes that are at least 80%, at least 90%, at least 95%, at least 96%, at least 97%, at least 98%, at least 99%, or 100% identical to the nucleic acid sequences of SEQ ID NOs: 1-1300, 1391-1570, and 1691-1769. In other embodiments, the probe set includes a subset of the probes of SEQ ID NOs: 1-1300, 1391-1570, and 1691-1769, such as at least 10%, at least 20%, at least 30%, at least 40%, at least 50%, at least 60%, at least 70%, at least 80%, at least 90%, at least 95%, at least 96%, at least 97%, at least 98%, at least 99%, or at least 99.9% of the probes of SEQ ID NOs: 1-1300, 1391-1570, and 1691-1769. In some examples, the subset includes at least one probe for each of CHIKV, DEN1, DEN2, DEN3, DEN4, HAV, HCV type 1, HCV type 2, HCV type 3, HEV, HIV type 1, HIV type 2, HTLV type 1, HTLV type 2, WNV, and ZKV, such as at least 1, at least 2, at least 5, at least 10, at least 20, at least 30, or more probes for each virus. In some examples, the subset includes at least 40 probes (such as at least 50, at least 60, at least 70, at least 80, at least 90, at least 100, or at least 110 probes) for one or more of CHIKV, DEN1, DEN2, DEN3, DEN4, HAV, HCV type 1, HCV type 2, HCV type 3, HEV, HIV type 1, HIV type 2, HTLV type 1, HTLV type 2, WNV, and ZKV.

(41) In one non-limiting example, the probe set includes or consists of each of the probes of SEQ ID NOs: 1-1769. In another non-limiting example, the probe set includes or consists of each of the probes of SEQ ID NOs: 1-1300, 1391-1570, and 1691-1769. In another example, the probe set includes or consists of each of the probes of SEQ ID NOs: 1-1300 and 1391-1769. In other embodiments, the probe set includes a subset of the probes of SEQ ID NOs: 1-1300, 1391-1570, and 1691-1769 or a subset of the probes of SEQ ID NOs: 1-1300 and 1391-1769.

(42) Also disclosed herein is a nucleic acid probe set capable of detecting nucleic acid molecules from one or more DNA viruses, including one or more of cytomegalovirus, Epstein Barr virus (e.g., one or more of EBV subtype B95-8 and EBV subtype AG876), human herpes virus 8, Hepatitis B virus (e.g., one or more of HBV subtypes adw, ayw, adr, and ayr), human parvovirus B19, and human papillomavirus (e.g., one or more of HPV types 6, 11, 16, and 18). In some embodiments, the probe set includes 10 or more probes for one or more of the viruses (such as 15 or more, 20 or more, 30 or more, 50 or more, 60 or more, 70 or more, 80 or more, 90 or more, 100 or more, 110 or more, or 120 or more), for example 10-50 probes, 30-120 probes, 50-100 probes, or 70-110 probes for one or more of cytomegalovirus, Epstein Barr virus, human herpes virus 8, Hepatitis B virus, human parvovirus B19, and human papillomavirus.

(43) In some embodiments, the probe set includes nucleic acid probes that are at least 80%, at least 90%, at least 95%, at least 96%, at least 97%, at least 98%, at least 99%, or 100% identical to the nucleic acid sequences of SEQ ID NOs: 1770-2647. In other embodiments, the probe set includes a subset of the probes of SEQ ID NOs: 1770-2647, such as at least 10%, at least 20%, at least 30%, at least 40%, at least 50%, at least 60%, at least 70%, at least 80%, at least 90%, at least 95%, at least 96%, at least 97%, at least 98%, at least 99%, or at least 99.9% of the probes of SEQ ID NOs: 1770-2647. In some examples, the subset includes at least one probe for each of CMV, EBV subtype B95-8, EBV subtype AG876, human herpes virus 8, Hepatitis B virus subtype adw, Hepatitis B virus subtype ayw, Hepatitis B virus subtype adr, Hepatitis B virus subtype ayr, human parvovirus B19, HPV type 6, HPV type 11, HPV type 16, and HPV type 18, such as at least 1, at least 2, at least 5, at least 10, at least 20, at least 30, or more probes for each virus. In some examples, the subset includes at least 10 probes (such as at least 20, at least 30, at least 40, at least 50, at least 60, at least 70, at least 80, at least 90, at least 100, or at least 110 probes) for one or more of CMV, EBV subtype B95-8, EBV subtype AG876, human herpes virus 8, Hepatitis B virus subtype adw, Hepatitis B virus subtype ayw, Hepatitis B virus subtype adr, Hepatitis B virus subtype ayr, human parvovirus B19, HPV type 6, HPV type 11, HPV type 16, and HPV type 18. In

one non-limiting example, the probe set includes or consists of each of the probes of SEQ ID NOs: 1770-2647.

(44) Further disclosed herein is a nucleic acid probe set capable of detecting nucleic acid molecules from one or more bacterial and/or protozoan pathogens, including one or more of *Treponema pallidum, Ehrlichia chaffeensis, Ehrlichia ewingii, Ehrlichia muris, Borrelia burgdorferi, Coxiella burnetii, Trypanosoma brucei, Trypanosoma cruzi, Leishmania major, Babesia microti, Plasmodium falciparum*, and *Plasmodium vivax*. In some embodiments, the probe set includes 10 or more probes for one or more of the viruses (such as 10 or more, 20 or more, 30 or more, 50 or more, 60 or more, 70 or more, 80 or more, 90 or more, 100 or more, 110 or more, or 120 or more), for example 30-120 probes, 50-100 probes, or 70-110 probes for one or more of *Treponema pallidum, Ehrlichia chaffeensis, Ehrlichia ewingii, Ehrlichia muris, Borrelia burgdorferi, Coxiella burnetii, Trypanosoma brucei, Leishmania major, Babesia microti, Plasmodium falciparum*, and *Plasmodium vivax*

(45) In some embodiments, the probe set includes nucleic acid probes that are at least 80%, at least 90%, at least 95%, at least 96%, at least 97%, at least 98%, at least 99%, or 100% identical to the nucleic acid sequences of SEQ ID NOs: 2648-3207. In other embodiments, the probe set includes a subset of the probes of SEQ ID NOs: 2648-3207, such as at least 10%, at least 20%, at least 30%, at least 40%, at least 50%, at least 60%, at least 70%, at least 80%, at least 90%, at least 95%, at least 96%, at least 97%, at least 98%, at least 99%, or at least 99.9% of the probes of SEQ ID NOs: 2648-3207. In some examples, the subset includes at least one probe for each of *Treponema pallidum, Ehrlichia chaffeensis, Ehrlichia ewingii, Ehrlichia muris, Borrelia burgdorferi, Coxiella burnetii, Trypanosoma brucei, Trypanosoma cruzi, Leishmania major, Babesia microti, Plasmodium falciparum*, and *Plasmodium vivax*, such as at least 1, at least 2, at least 5, at least 10, at least 20, at least 30, or more probes for each pathogen. In some examples, the subset includes at least 10 probes (such as at least 20, at least 30, at least 50, at least 60, at least 70, at least 80, at least 90, at least 100, or at least 110 probes) for one or more of *Treponema pallidum, Ehrlichia chaffeensis, Ehrlichia ewingii, Ehrlichia muris, Borrelia burgdorferi, Coxiella burnetii, Trypanosoma brucei, Leishmania major, Babesia microti, Plasmodium falciparum*, and *Plasmodium vivax*. In one non-limiting example, the probe set includes or consists of each of the probes of SEQ ID NOs: 2648-3207.

(46) In further embodiments, one or more of the disclosed probe sets are combined. Thus, some embodiments, the probe set includes probes for detecting at least one RNA virus, at least one DNA virus, at least one bacterial pathogen, at least one protozoan pathogen, or combinations of two or more thereof. In one example, a probe set includes probes capable of detecting nucleic acid molecules from one or more DNA viruses and one or more bacterial and/or protozoan pathogens. In one non-limiting example, a probe set includes probes including or consisting of each of the probes of SEQ ID NOs: 1770-3207. In another example, a probe set includes probes capable of detecting nucleic acid molecules from one or more RNA viruses, one or more DNA viruses, and one or more bacterial and/or protozoan pathogens. In a non-limiting example, the probe set includes probes including or consisting of each of the probes of SEQ ID NOs: 1-1300, SEQ ID NOs: 1391-1570, SEQ ID NOs: 1691-1769, and SEQ ID NOs: 1770-3207.

(47) In additional embodiments, a disclosed probe set further includes one or more control probes, such as one or more positive and/or negative control probes. For testing for validity of the run, intra-array reproducibility control and normalization. positive control probes may include one or more of: 1) one or more reference probes for intensity normalization, 2) one or more internal standards of known concentrations, and 3) one or more probes that are homologous to an internal control included in the hybridization mix. In some embodiments, positive control probes include one or more (such as 1, 10, 25, 50, 96, or more) ERCC probes (External RNA Controls Consortium) and one or more (such as 1, 10, 25, 50, 96, 250, 500, 900, or more) biological replicates targeting human genome sequences (for example, to define possible host contaminant).

(48) Negative control probes may include one or more probes for a virus that is known not to be present in human or mammalian subjects. In some non-limiting examples, negative control probes are specific for a plant virus. In other examples, negative control probes can be a structural negative probe, such as a sequence that forms a hairpin and does not hybridize with nucleic acids from any species.

(49) In some examples, the probe set includes at least 10, at least 20, at least 30, at least 40, at least 50, at least 60, at least 70, at least 80, at least 90, at least 100, at least 110, or at least 120 control probes. In some examples, the control probes are for one or more one or more different negative control viruses (such as 1, 2, 3, 4, 5, or more negative control viruses). In some examples, the probe set includes at least 10, at least 20, at least 30, at least 40, at least 50, at least 60, at least 70, at least 80, at least 90, at least 100, at least 110, at least 120, or more negative control probes. In some examples, the negative control probes are probes for one or more of White clover cryptic virus 1 (e.g. SEQ ID NOs: 1571-1580), Broad bean wilt virus 1 (e.g., SEQ ID NOs: 1582-1620), Lettuce necrotic yellows virus (e.g., SEQ ID NOs: 1621-1690), *Aedes albopictus* densovirus 2 (e.g., SEQ ID NOs: 3520-3557), Maize streak virus (e.g., SEQ ID NOs: 3558-3598), and/or Tomato pseudo-curly top virus (e.g., SEQ ID NOs: 3599-3628). In additional examples, the probe set includes at least 10, at least 20, at least 30, at least 40, at least 50, at least 60, at least 70, at least 80, at least 90, at least 100, at least 110, at least 120, or more positive control probes. In some examples, the positive control probes are probes for one or more housekeeping genes, such as one of more of ACTB (e.g., SEQ ID NOs: 3208-3301), ARL1 (e.g., SEQ ID NOs: 3302-3385), and/or CCDN1 (e.g., SEQ ID NOs: 3386-3519).

(50) In some embodiments, the disclosed probes are between 30 and 80 nucleotides in length (for example 30-50, 40-60, 50-70, or 60-80 nucleotides in length). In some examples, the probes are 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, or 80 nucleotides in length and are capable of hybridizing to the disclosed pathogen (e.g., viral, bacterial, or protozoan) nucleic acid molecules. In some examples, the probes are 60 nucleotides in length. In some examples, each of the probes in the probe set has a Tm between about 72-89° C., such as about 74-88° C., about 75-85° C., or about 76-82° C. In one specific example, each of the probes in the probe set has a Tm between 74.4 and 87.8° C. Tm ranges for exemplary RNA virus probes are shown in Table 1.

(51) In other embodiments the disclosed probe sets, or a subset thereof, are linked to a solid support. In some examples, the disclosed probe sets, or a subset thereof, are included on a microarray. In other examples, the solid support is a bead or plurality of beads, a microplate, column, or microfluidic device.

(52) In some embodiments, the microarray is a solid support or substrate including the probe set (or subset thereof) covalently linked to the support or substrate. Within an array, each arrayed probe is addressable, in that its location can be reliably and consistently determined within at least two dimensions of the array. Addressable arrays usually are computer readable, in that a computer can be programmed to correlate a particular address on the array with information about the sample at that position (such as hybridization or binding data, including for instance signal intensity).

(53) The microarray can include any of the probe sets described above, individually, or in combination. In some embodiments, the microarray includes nucleic acid probes that are at least 80%, at least 90%, at least 95%, at least 96%, at least 97%, at least 98%, at least 99%, or 100% identical to the nucleic acid sequences of SEQ ID NOs: 1-1300, 1391-1570, and 1691-1769. In another embodiment, the microarray includes or consists of nucleic acid probes that are at least 80%, at least 90%, at least 95%, at least 96%, at least 97%, at least 98%, at least 99%, or 100% identical to the nucleic acid sequences of SEQ ID NOs: 1-1300 and 1391-1769. In one non-limiting example, the microarray includes or consists of each of the probes of SEQ ID NOs: 1-1769. In another non-limiting example, the microarray includes or consists of each of the probes of SEQ ID NOs: 1-1300, 1391-1570, and 1691-1769. In a further non-limiting example, the microarray includes or consists of each of the probes of SEQ ID NOs: 1-1300 and 1391-1769.

(54) In another embodiment, the microarray includes nucleic acid probes that are at least 80%, at least 90%, at least 95%, at least 96%, at least 97%, at least 98%, at least 99%, or 100% identical to the nucleic acid sequences of SEQ ID NOs: 1770-2647. In one non-limiting example, the microarray includes or consists of each of the probes of SEQ ID NOs: 1770-2647. In another non-limiting example, the microarray includes or consists of each of the probes of SEQ ID NOs: 1170-2647 and 3250-3628.

(55) In another embodiment, the microarray includes nucleic acid probes that are at least 80%, at least 90%, at least 95%, at least 96%, at least 97%, at least 98%, at least 99%, or 100% identical to the nucleic acid sequences of SEQ ID NOs: 2648-3207. In one non-limiting example, the microarray includes or consists of each of the probes of SEQ ID NOs: 2648-3207. In another non-limiting example, the microarray includes or consists of each of the probes of SEQ ID NOs: 2648-3519.

(56) In a further embodiment, the microarray includes nucleic acid probes that are at least 80%, at least 90%, at least 95%, at least 96%, at least 97%, at least 98%, at least 99%, or 100% identical to the nucleic acid sequences of SEQ ID NOs: 1770-3207. In one non-limiting example, the microarray includes or consists of each of the probes of SEQ ID NOs: 1770-3207. In a further non-limiting example, the microarray includes or consists of each of the probes of SEQ ID NOs: 1770-3628.

(57) In other embodiments, the microarray includes a subset of the probes of SEQ ID NOs: 1-1300, 1391-1570, and 1691-1769, such as at least 10%, at least 20%, at least 30%, at least 40%, at least 50%, at least 60%, at least 70%, at least 80%, at least 90%, at least 95%, at least 96%, at least 97%, at least 98%, at least 99%, or at least 99.9% of the probes of SEQ ID NOs: 1-1300, 1391-1570, and 1691-1769. In some examples, the microarray includes at least one probe for each of CHIKV, DEN1, DEN2, DEN3, DEN4, HAV, HCV type 1, HCV type 2, HCV type 3, HEV, HIV type 1, HIV type 2, HTLV type 1, HTLV type 2, WNV, and ZKV, such as at least 1, at least 2, at least 5, at least 10, at least 20, at least 30, or more probes for each virus. In some examples, the microarray includes at least 40 probes (such as at least 50, at least 60, at least 70, at least 80, at least 90, at least 100, or at least 110 probes) for one or more of CHIKV, DEN1, DEN2, DEN3, DEN4, HAV, HCV type 1, HCV type 2, HCV type 3, HEV, HIV type 1, HIV type 2, HTLV type 1, HTLV type 2, WNV, and ZKV.

(58) In other embodiments, the microarray includes a subset of the probes of SEQ ID NOs: 1770-2647, such as at least 10%, at least 20%, at least 30%, at least 40%, at least 50%, at least 60%, at least 70%, at least 80%, at least 90%, at least 95%, at least 96%, at least 97%, at least 98%, at least 99%, or at least 99.9% of the probes of SEQ ID NOs: 1770-2647. In some examples, the microarray includes at least one probe for each of CMV, EBV subtype B95-8, EBV subtype AG876, human herpes virus 8, Hepatitis B virus subtype adw, Hepatitis B virus subtype ayw, Hepatitis B virus subtype adr, Hepatitis B virus subtype ayr, human parvovirus B19, HPV type 6, HPV type 11, HPV type 16, and HPV type 18, such as at least 1, at least 2, at least 5, at least 10, at least 20, at least 30, or more probes for each virus. In some examples, the microarray includes at least 20 probes (such as at least 40, at least 50, at least 60, at least 70, at least 80, at least 90, at least 100, or at least 110 probes) for one or more of CMV, EBV subtype B95-8, EBV subtype AG876, human herpes virus 8, Hepatitis B virus subtype adw, Hepatitis B virus subtype ayw, Hepatitis B virus subtype adr, Hepatitis B virus subtype ayr, human parvovirus B19, HPV type 6, HPV type 11, HPV type 16, and HPV type 18.

(59) In other embodiments, the microarray includes a subset of the probes of SEQ ID NOs: 2648-3207, such as at least 10%, at least 20%, at least 30%, at least 40%, at least 50%, at least 60%, at least 70%, at least 80%, at least 90%, at least 95%, at least 96%, at least 97%, at least 98%, at least 99%, or at least 99.9% of the probes of SEQ ID NOs: 2648-3207. In some examples, the microarray includes at least one probe for each of *Treponema pallidum, Ehrlichia chaffeensis, Ehrlichia ewingii, Ehrlichia muris, Borrelia burgdorferi, Coxiella burnetii, Trypanosoma brucei,*

Trypanosoma cruzi, Leishmania major, Babesia microti, Plasmodium falciparum, and *Plasmodium vivax*, such as at least 1, at least 2, at least 5, at least 10, at least 20, at least 30, or more probes for each virus. In some examples, the microarray includes at least 10 probes (such as at least 30, at least 30, at least 40, at least 50, at least 60, at least 70, at least 80, at least 90, at least 100, or at least 110 probes) for one or more of *Treponema pallidum, Ehrlichia chaffeensis, Ehrlichia ewingii, Ehrlichia muris, Borrelia burgdorferi, Coxiella burnetii, Trypanosoma brucei, Leishmania major, Babesia microti, Plasmodium falciparum*, and *Plasmodium vivax.*

(60) In additional embodiments, the microarray includes one or more control probes, such as one or more positive and/or negative control probes. In some examples, the microarray includes at least 10, at least 20, at least 30, at least 40, at least 50, at least 60, at least 70, at least 80, at least 90, at least 100, at least 110, or at least 120 negative control probes. In some examples, the microarray includes one or more negative control probes selected from SEQ ID NOs: 1571-1580, SEQ ID NOs: 1582-1620, SEQ ID NOs: 1621-1690, and SEQ ID NOs: 3520-3628. In additional examples, the microarray includes at least 10, at least 20, at least 30, at least 40, at least 50, at least 60, at least 70, at least 80, at least 90, at least 100, at least 110, or at least 120 positive control probes. In some examples, the microarray includes one or more positive control probes selected from SEQ ID NOs: 3208-3519.

(61) The solid support or substrate of the array can be formed from an organic polymer. Suitable materials for the solid support include, but are not limited to: polypropylene, polyethylene, polybutylene, polyisobutylene, polybutadiene, polyisoprene, polyvinylpyrrolidine, polytetrafluroethylene, polyvinylidene difluroide, polyfluoroethylene-propylene, polyethylenevinyl alcohol, polymethylpentene, polycholorotrifluoroethylene, polysulfornes, hydroxylated biaxially oriented polypropylene, aminated biaxially oriented polypropylene, thiolated biaxially oriented polypropylene, ethyleneacrylic acid, thylene methacrylic acid, and blends of copolymers thereof).

(62) A wide variety of array formats can be employed in accordance with the present disclosure. One example includes a two-dimensional pattern of discrete cells (such as 4096 squares in a 64 by 64 array). Other array formats including, but not limited to slot (rectangular) and circular arrays are equally suitable for use. In some examples, the array is a multi-well plate. In one example, the array is formed on a polymer medium, which is a thread, membrane or film. An example of an organic polymer medium is a polypropylene sheet having a thickness on the order of about 1 mil. (0.001 inch) to about 20 mil., although the thickness of the film is not critical and can be varied over a fairly broad range. The array can include biaxially oriented polypropylene (BOPP) films, which in addition to their durability, exhibit low background fluorescence.

(63) The array formats of the present disclosure can be included in a variety of different types of formats. A “format” includes any format to which the solid support can be affixed, such as microtiter plates (e.g., multi-well plates), test tubes, inorganic sheets, dipsticks, and the like. For example, membranes can be affixed to glass slides. The particular format is, in and of itself, unimportant. All that is necessary is that the solid support can be affixed thereto without affecting the functional behavior of the solid support or any biopolymer absorbed thereon, and that the format (such as the slide) is stable to any materials into which the device is introduced (such as clinical samples and hybridization solutions).

(64) The arrays of the present disclosure can be prepared by a variety of approaches. In one example, oligonucleotides (e.g., probes) are synthesized separately and then attached to a solid support (see U.S. Pat. No. 6,013,789). In another example, probes are synthesized directly onto the support to provide the desired array (see U.S. Pat. No. 5,554,501). Suitable methods for covalently coupling oligonucleotides to a solid support and for directly synthesizing oligonucleotides on the support are known; a summary of suitable methods can be found in Matson et al., Anal. Biochem. 217:306-10, 1994. In one example, the oligonucleotides are synthesized onto the support using conventional chemical techniques for preparing oligonucleotides on solid supports (such as PCT applications WO 85/01051 and WO 89/10977, or U.S. Pat. No. 5,554,501).

(65) The oligonucleotides can be bound to the support or substrate by either the 3′ end of the oligonucleotide or by the 5′ end of the oligonucleotide. In one example, the oligonucleotides are bound to the solid support by the 3′ end. In general, the internal complementarity of an oligonucleotide probe in the region of the 3′ end and the 5′ end determines binding to the support.

III. Methods of Detecting Viral Nucleic Acids

(66) Disclosed herein are methods of detecting one or more pathogen nucleic acids (such as one or more viral, bacterial, and/or protozoan nucleic acids) in a sample from a subject. In some embodiments, the methods include preparing or isolating nucleic acids (such as DNA, RNA, or cDNA) from a sample, labeling the nucleic acids, and contacting the probe set, or a microarray including the probe set, with the labeled nucleic acids under conditions sufficient to allow pathogen nucleic acids present in the sample to hybridize with one or more of the probes. The presence and/or identity of pathogen nucleic acids in the sample is determined by detecting hybridization. In one example, hybridization is detected by measuring presence of labeled nucleic acid at an addressable location in an array.

(67) In particular embodiments, the methods include detecting one or more nucleic acids from RNA viruses in a sample, including one or more of CHIKV, DEN1, DEN2, DEN3, DEN4, HAV, HCV type 1, HCV type 2, HCV type 3, HEV, HIV type 1, HIV type 2, HTLV type I, HTLV type II, WNV, and ZKV. In other embodiments, the methods include detecting one or more nucleic acids from DNA viruses, including one or more of CMV, EBV subtype B95-8, EBV subtype AG876, human herpes virus 8, Hepatitis B virus subtype adw, Hepatitis B virus subtype ayw, Hepatitis B virus subtype adr, Hepatitis B virus subtype ayr, human parvovirus B19, HPV type 6, HPV type 11, HPV type 16, and HPV type 18. In still other embodiments, the methods include detecting one or more nucleic acids from bacteria and/or protozoans, including one or more of *Treponema pallidum, Ehrlichia chaffeensis, Ehrlichia ewingii, Ehrlichia muris, Borrelia burgdorferi, Coxiella burnetii, Trypanosoma brucei, Trypanosoma cruzi, Leishmania major, Babesia microti, Plasmodium falciparum,* and *Plasmodium vivax*. In further embodiments, the methods include detecting nucleic acids from at least one RNA virus, DNA virus, bacteria, and protozoan, such as at least one of the RNA viruses, DNA viruses, bacteria, and protozoans disclosed herein, or any combination thereof.

(68) Exemplary samples include peripheral blood, serum, plasma, cerebrospinal fluid, urine, saliva, feces, mucus, nasal wash, tissue biopsy, fine needle aspirate, surgical specimen, placenta, autopsy material, semen, vaginal fluid or tissue, and environmental samples. In particular examples, the sample is a blood sample, such as plasma. In non-limiting examples, the sample is blood or plasma from a blood donor. Thus, in some examples, the methods disclosed herein are used to screen donated blood for one or more pathogens potentially present and/or transmitted through blood transfusions.

(69) In some embodiments, the methods include isolating nucleic acids (such as RNA, cDNA, or a combination thereof) from the sample and contacting the probe set or microarray with the isolated nucleic acids. Methods of isolating RNA (e.g., viral RNA) from a sample are known and include commercially available kits, such as QIAGEN® RNeasy® mini-columns, MASTERPURE® Complete DNA and RNA Purification Kit (EPICENTRE® Madison, Wis.), Paraffin Block RNA Isolation Kit (Ambion, Inc.), and RNA Stat-60 (Tel-Test). cDNA is then prepared from the isolated RNA, and optionally labeled. In some examples, the methods include amplifying RNA prior to cDNA preparation and labeling, for example, using Quick Amp WT labeling kit (Agilent). Other methods of amplifying RNA include commercially available kits such as Ovation® RNA Amplification kit (Nugen), Arcturus™ RiboAmp™ HS kit (ThermoFisher), and Complete Whole Transcriptome Amplification Kit (WTA2, Sigma-Aldrich).

(70) In some embodiments, the methods do not include isolating and/or amplifying RNA from a sample prior to labeling. In some examples, the methods include generating amplified cDNA from a sample, followed by labeling the cDNA (for example with a fluorescent label, such as Cy™3 dye). In one non-limiting example, amplified cDNA is prepared from the sample using single-

primer isothermal amplification (for example, Ribo-SPIA® amplification, NuGen) prior to labeling. Methods of labeling cDNA are known and include commercially available kits, such as Genomic DNA Enzymatic Labeling Kit (Agilent). In some examples, the methods generate amplified and labeled cDNA from about 250 pg of target viral RNA (such as about 500 pg, about 750 pg, about 1 ng, about 2 ng, or more of target viral RNA).

(71) In other examples, the methods include isolating DNA from the sample and contacting the probe set or microarray with the isolated DNA. Methods of isolating DNA (such as viral DNA, bacterial DNA, or protozoan DNA) from a sample are known and include commercially available kits. In some examples, the methods include isolating viral DNA from a sample using a viral nucleic acid isolation kit. In one non-limiting example, the viral DNA is isolated using Dynabeads™ SILANE viral NA kit (Invitrogen). In other examples, bacterial or protozoan DNA is isolated from a sample using a DNA isolation kit. In one non-limiting example, bacterial or protozoan DNA is isolated using QIAamp® DNA Blood Mini kit (Qiagen). One of ordinary skill in the art can select appropriate methods or kits to isolate pathogen DNA from samples, for example, blood or plasma samples.

(72) The sample (such as nucleic acids isolated and/or amplified from a sample) can be labeled with any suitable label. Generally, the label will be selected based on the intended use of the sample or the desired readout. In some examples, the sample or nucleic acids from the sample is labelled with a fluorescent or chemiluminescent compound. In other examples, the label is an enzyme, a fluorophore, or a radioactive isotope. In one specific non-limiting example, the label is Cy™3 or Cy™ 5.

(73) Fluorophores suitable for use with the methods disclosed herein, include, but are not limited to, 6-carboxyfluorescein (FAM), tetrachlorofluorescein (TET), tetramethylrhodamine (TMR), hexachlorofluorescein (HEX), JOE, ROX, CAL Fluor™ dye, Pulsar™ dye, Quasar™ dye, Texas Red™ dye, Cy™3 dye and Cy™5 dye. Other examples of fluorophores that can be used with the methods provided herein include 4-acetamido-4′-isothiocyanatostilbene-2,2′disulfonic acid, acridine and derivatives such as acridine and acridine isothiocyanate, 5-(2′-aminoethyl)amino-naphthalene-1-sulfonic acid (EDANS), 4-amino-N-[3-vinylsulfonyl)phenyl]-naphthalimide-3,5 disulfonate (Lucifer Yellow VS), N-(4-anilino-1-naphthyl)-maleimide, anthranilamide, Brilliant Yellow, coumarin and derivatives such as coumarin, 7-amino-4-methylcoumarin (AMC, Coumarin 120), 7-amino-4-trifluoromethylcouluarin (Coumaran 151); cyanosine; 4′,6-diaminidino-2-phenylindole (DAPI); 5′, 5″-dibromopyrogallol-sulfonephthalein (Bromopyrogallol Red); 7-diethylamino-3-(4′-isothiocyanatophenyl)-4-methylcoumarin; diethylenetriamine pentaacetate; 4,4′-diisothiocyanatodihydro-stilbene-2,2′-disulfonic acid; 4,4′-diisothiocyanatostilbene-2,2′-disulfonic acid; 5-[dimethyl-amino]naphthalene-1-sulfonyl chloride (DNS, dansyl chloride); 4-(4′-dimethyl-aminophenylazo)benzoic acid (DABCYL); 4-dimethylaminophenylazophenyl-4′-isothiocyanate (DABITC); eosin and derivatives such as eosin and eosin isothiocyanate; erythrosin and derivatives such as erythrosin B and erythrosin isothiocyanate; ethidium; fluorescein and derivatives such as 5-carboxyfluorescein (FAM), 5-(4,6-dichlorotriazin-2-yl)aminofluorescein (DTAF), 2′7′-dimethoxy-4′5′-dichloro-6-carboxyfluorescein (JOE), fluorescein, fluorescein isothiocyanate (FITC), and QFITC (XRITC); fluorescamine; IR144; IR1446; Malachite Green isothiocyanate; 4-methylumbelliferone; ortho cresolphthalein; nitrotyrosine; pararosaniline; Phenol Red; B-phycoerythrin; o-phthaldialdehyde; pyrene and derivatives such as pyrene, pyrene butyrate and succinimidyl 1-pyrene butyrate; Reactive Red 4 (Cibacron Brilliant Red 3B-A); rhodamine and derivatives such as 6-carboxy-X-rhodamine (ROX), 6-carboxyrhodamine (R6G), lissamine rhodamine B sulfonyl chloride, rhodamine (Rhod), rhodamine B, rhodamine 123, rhodamine X isothiocyanate, sulforhodamine B, sulforhodamine 101 and sulfonyl chloride derivative of sulforhodamine 101 (Texas Red™ dye); N,N,N′,N′-tetramethyl-6-carboxyrhodamine (TAMRA); tetramethyl rhodamine; tetramethyl rhodamine isothiocyanate (TRITC); riboflavin; rosolic acid and terbium chelate derivatives.

(74) Other fluorophores that can be used include thiol-reactive europium chelates that emit at approximately 617 nm (Heyduk and Heyduk, *Analyt. Biochem.* 248:216-27, 1997; *J. Biol. Chem.* 274:3315-22, 1999). Other fluorophores that can be used include cyanine, merocyanine, styryl, and oxonyl compounds, such as those disclosed in U.S. Pat. Nos. 5,627,027; 5,486,616; 5,569,587; and 5,569,766, and in published PCT application no. US98/00475, each of which is incorporated herein by reference. Specific examples of fluorophores disclosed in one or more of these patent documents include Cy™3 and Cy™5, for instance, and substituted versions of these fluorophores. Additional fluorophores that can be used include GFP, Lissamine™, diethylaminocoumarin, fluorescein chlorotriazinyl, naphthofluorescein, 4,7-dichlororhodamine and xanthene (as described in U.S. Pat. No. 5,800,996 to Lee et al., herein incorporated by reference) and derivatives thereof. Other fluorophores are commercially available from known sources.

(75) The methods include contacting the sample (such as labeled nucleic acids from a sample) with a probe set disclosed herein (or subset thereof), or a microarray including the probe set (or subset thereof), under conditions sufficient to allow hybridization of pathogen nucleic acids present in the sample to one or more probes and detecting presence of pathogen nucleic acids hybridized to the probe set or microarray.

(76) Presence of one or more pathogen nucleic acids in the sample can be detected using any suitable means. For example, detection of hybridization can be accomplished by detecting nucleic acid molecules (such as RNA) using nucleic acid amplification methods (such as real-time RT-PCR) or array analysis. In a specific embodiment of the microarray technique, labeled cDNA prepared from a sample is applied to an array including a probe set disclosed herein. Labeled cDNA from the sample can hybridize specifically to one or more probes on the array. After washing to remove non-specifically bound probes, the chip is scanned by confocal laser microscopy or by another detection method, such as a CCD camera. Quantitation of hybridization of sample to each arrayed element allows for assessment of corresponding RNA abundance (e.g., if cDNA is analyzed). Microarray analysis can be performed by commercially available equipment, following manufacturer's protocols, such as are supplied with Affymetrix GeneChip® technology (Affymetrix, Santa Clara, CA), or Agilent's microarray technology (Agilent Technologies, Santa Clara, CA).

(77) In some examples, a sample is determined to contain nucleic acids from a particular pathogen by detecting hybridization between the sample (nucleic acid) and one or more probes of the pathogen-specific probe set. In some examples, a sample is determined to be positive for a pathogen when the log ratio between the signal intensity mean for the pathogen-specific probe set and the mean of a control group probe set is ≥1.5. In other examples, a sample is determined to be negative for a pathogen when the log ratio between the signal intensity mean for the pathogen-specific probe set and the mean of a control group probe set is <1. In further examples, the sample is determined to be borderline for the pathogen when the log ratio between the signal intensity mean for the pathogen-specific probe set and the mean of a control group probe set is ≥1.0 to ≤1.5. In some examples, a sample that is determined to be borderline for one or more pathogens is retested (for example, retested with the assay disclosed herein and/or tested using a virus-specific nucleic acid based test). In other examples, a sample that is determined to be borderline is discarded (e.g., not administered to a subject). In additional examples, a sample is determined to be positive for a particular pathogen when ≥50% of the individual probes for the particular pathogen have a log ratio of >1.5. In some examples, a sample is determined to be positive for a particular pathogen when ≥50% of the individual probes for the particular pathogen have a log ratio of >1.5 and the log ratio between the signal intensity mean for the pathogen-specific probe set and the mean of a control group probe set is ≥1.5.

EXAMPLES

(78) The following examples are provided to illustrate certain particular features and/or embodiments. These examples should not be construed to limit the disclosure to the particular

features or embodiments described.

Example 1

Materials and Methods

(79) Microarray-Based Platform Design

(80) Selection of transfusion-transmitted RNA viruses: Sequences of 16 RNA viruses of concern for transmission to blood recipients (released by AABB Transfusion-Transmitted Diseases Committee (Stramer et al., *Transfusion* 49:1S-29S, 2009)) were downloaded from GenBank at NCBI (available on the World Wide Web at ncbi.nlm.nih.gov/genbank).

(81) The complete genome for each RNA virus was uploaded in FASTA format using Agilent eArray software (available on the World Wide Web at earray.chem.agilent.com/earray/, Agilent Technologies Inc., Santa Clara, CA). Design settings were chosen to select 60-mer sense probes with 3′ bias from each viral gene, according to the base composition methodology, which considers fusion temperature, GC % and cross-hybridization potential for probes. To get the best quality level probes for viral genome detection the “best probe” (BP) was selected. The probes were checked for vector and low complexity masking. Entire viral genome sequences were covered to the extent possible with all available Agilent-designed probes. The microarray was supplemented with additional predesigned GE (gene expression) array probes for 906 genes from the human genome (replicated 10 times), ERCC probes (replicated 45 times) and probes covering plant virus sequences (negative control). The selected probes and their characteristics are provided in Table 1.

(82) Oligonucleotide probe selection and methodology: Oligonucleotide probes were synthesized in situ from 3′-end base by base with Agilent SurePrint inkjet technology according to the manufacturer's protocol (Wolber et al., *Meth. Enzymol.* 410:28-57, 2006). The microarrays were manufactured with 60-mer oligonucleotides synthesized in 15,000 features on eight replicate arrays per slide.

(83) Sample collection and processing: Specimens positive for CHIKV, DENV1-4, HIV1-2, WNV strain NY99, and ZIKV were prepared, validated, and supplied by the FDA Center for Biologics Evaluation and Research (CBER) (Dong et al., *J. Appl. Microbiol.* 120:1119-1129, 2016).

(84) HCV genotypes 1a, 2a, and 3, and HEV RNA-positive plasma were purchased from Sera Care (Sera Care, Milford, MA). All positive specimens were diluted in negative plasma (Basematrix diluent, Sera Care) to create a range of concentrations. HAV RNA was obtained from Dr. Patrizia Farci, (National Institutes of Health, Bethesda, MD). HTLV types I and II NATtrol (Nucleic Acid Testing Control) were purchased from ZeptoMetrix (ZeptoMetrix, Buffalo, NY) (Table 2).

(85) TABLE-US-00001 TABLE 1 Selected viral probes SEQ BP ID Probe Product Virus Target ID Start NO: Length 5 UTR Hepatitis C gi|22129792:1-341 243 1 60 genotype 1 5 UTR Hepatitis C gi|22129792:1-341 194 2 60 genotype 1 5 UTR Hepatitis C gi|22129792:1-341 193 3 60 genotype 1 5 UTR Hepatitis C gi|22129792:1-341 173 4 60 genotype 1 5 UTR Hepatitis C gi|22129792:1-341 172 5 60 genotype 1 5 UTR Hepatitis C gi|22129792:1-341 171 6 60 genotype 1 5 UTR Hepatitis C gi|22129792:1-341 170 7 60 genotype 1 5 UTR Hepatitis C gi|22129792:1-341 169 8 60 genotype 1 5 UTR Hepatitis C gi|22129792:1-341 168 9 60 genotype 1 5 UTR Hepatitis C gi|22129792:1-341 167 10 60 genotype 1 core protein Hepatitis C gi|22129792:342-914 488 11 60 genotype 1 core protein Hepatitis C gi|22129792:342-914 487 12 60 genotype 1 core protein Hepatitis C gi|22129792:342-914 486 13 60 genotype 1 core protein Hepatitis C gi|22129792:342-914 485 14 60 genotype 1 core protein Hepatitis C gi|22129792:342-914 484 15 60 genotype 1 core protein Hepatitis C gi|22129792:342-914 483 16 60 genotype 1 core protein Hepatitis C gi|22129792:342-914 482 17 60 genotype 1 core protein Hepatitis C gi|22129792:342-914 481 18 60 genotype 1 core protein Hepatitis C gi|22129792:342-914 480 19 60 genotype 1 core protein Hepatitis C gi|22129792:342-914 479 20 60 genotype 1 E1 protein Hepatitis C gi|22129792:915-1494 342 21 60 genotype 1 E1 protein Hepatitis C gi|22129792:915-1494 341 22 60 genotype 1 E1 protein Hepatitis C gi|22129792:915-1494 340 23 60 genotype 1 E1 protein Hepatitis C gi|22129792:915-1494 339 24 60 genotype 1 E1 protein Hepatitis C gi|22129792:915-1494 504 25

60 genotype 1 E1 protein Hepatitis C gi|22129792:915-1494 503 26 60 genotype 1 E1 protein Hepatitis C gi|22129792:915-1494 502 27 60 genotype 1 E1 protein Hepatitis C gi|22129792:915-1494 501 28 60 genotype 1 E1 protein Hepatitis C gi|22129792:915-1494 500 29 60 genotype 1 E1 protein Hepatitis C gi|22129792:915-1494 379 30 60 genotype 1 E2 protein Hepatitis C gi|22129792:1491-2579 703 31 60 genotype 1 E2 protein Hepatitis C gi|22129792:1491-2579 702 32 60 genotype 1 E2 protein Hepatitis C gi|22129792:1491-2579 701 33 60 genotype 1 E2 protein Hepatitis C gi|22129792:1491-2579 700 34 60 genotype 1 E2 protein Hepatitis C gi|22129792:1491-2579 699 35 60 genotype 1 E2 protein Hepatitis C gi|22129792:1491-2579 697 36 60 genotype 1 E2 protein Hepatitis C gi|22129792:1491-2579 696 37 60 genotype 1 E2 protein Hepatitis C gi|22129792:1491-2579 695 38 60 genotype 1 E2 protein Hepatitis C gi|22129792:1491-2579 694 39 60 genotype 1 E2 protein Hepatitis C gi|22129792:1491-2579 693 40 60 genotype 1 p7 protein Hepatitis C gi|22129792:2580-2768 56 41 60 genotype 1 p7 protein Hepatitis C gi|22129792:2580-2768 55 42 60 genotype 1 p7 protein Hepatitis C gi|22129792:2580-2768 54 43 60 genotype 1 p7 protein Hepatitis C gi|22129792:2580-2768 53 44 60 genotype 1 p7 protein Hepatitis C gi|22129792:2580-2768 52 45 60 genotype 1 p7 protein Hepatitis C gi|22129792:2580-2768 51 46 60 genotype 1 p7 protein Hepatitis C gi|22129792:2580-2768 50 47 60 genotype 1 p7 protein Hepatitis C gi|22129792:2580-2768 49 48 60 genotype 1 p7 protein Hepatitis C gi|22129792:2580-2768 48 49 60 genotype 1 p7 protein Hepatitis C gi|22129792:2769-3419 47 50 60 genotype 1 NS2 protein Hepatitis C gi|22129792:2580-2768 366 51 60 genotype 1 NS2 protein Hepatitis C gi|22129792:2769-3419 194 52 60 genotype 1 NS2 protein Hepatitis C gi|22129792:2769-3419 193 53 60 genotype 1 NS2 protein Hepatitis C gi|22129792:2769-3419 192 54 60 genotype 1 NS2 protein Hepatitis C gi|22129792:2769-3419 191 55 60 genotype 1 NS2 protein Hepatitis C gi|22129792:2769-3419 190 56 60 genotype 1 NS2 protein Hepatitis C gi|22129792:2769-3419 189 57 60 genotype 1 NS2 protein Hepatitis C gi|22129792:2769-3419 188 58 60 genotype 1 NS2 protein Hepatitis C gi|22129792:2769-3419 187 59 60 genotype 1 NS2 protein Hepatitis C gi|22129792:2769-3419 186 60 60 genotype 1 NS3 protease/ Hepatitis C gi|22129792:3420-5312 1812 61 60 helicase genotype 1 NS3 protease/ Hepatitis C gi|22129792:3420-5312 1620 62 60 helicase genotype 1 NS3 protease/ Hepatitis C gi|22129792:3420-5312 849 63 60 helicase genotype 1 NS3 protease/ Hepatitis C gi|22129792:3420-5312 1744 64 60 helicase genotype 1 NS3 protease/ Hepatitis C gi|22129792:3420-5312 1497 65 60 helicase genotype 1 NS3 protease/ Hepatitis C gi|22129792:3420-5312 1294 66 60 helicase genotype 1 NS3 protease/ Hepatitis C gi|22129792:3420-5312 1234 67 60 helicase genotype 1 NS3 protease/ Hepatitis C gi|22129792:5313-5474 1092 68 60 helicase genotype 1 NS3 protease/ Hepatitis C gi|22129792:3420-5312 1020 69 60 helicase genotype 1 NS3 protease/ Hepatitis C gi|22129792:3420-5312 765 70 60 helicase genotype 1 NS4A protein Hepatitis C gi|22129792:3420-5312 103 71 60 genotype 1 NS4A protein Hepatitis C gi|22129792:5313-5474 102 72 60 genotype 1 NS4A protein Hepatitis C gi|22129792:5313-5474 101 73 60 genotype 1 NS4A protein Hepatitis C gi|22129792:5313-5474 100 74 60 genotype 1 NS4A protein Hepatitis C gi|22129792:5313-5474 99 75 60 genotype 1 NS4A protein Hepatitis C gi|22129792:5313-5474 98 76 60 genotype 1 NS4A protein Hepatitis C gi|22129792:5313-5474 97 77 60 genotype 1 NS4A protein Hepatitis C gi|22129792:5313-5474 96 78 60 genotype 1 NS4A protein Hepatitis C gi|22129792:5313-5474 95 79 60 genotype 1 NS4A protein Hepatitis C gi|22129792:5313-5474 94 80 60 genotype 1 NS4B protein Hepatitis C gi|22129792:5475-6257 133 81 60 genotype 1 NS4B protein Hepatitis C gi|22129792:5475-6257 723 82 60 genotype 1 NS4B protein Hepatitis C gi|22129792:5475-6257 702 83 60 genotype 1 NS4B protein Hepatitis C gi|22129792:5475-6257 456 84 60 genotype 1 NS4B protein Hepatitis C gi|22129792:5475-6257 416 85 60 genotype 1 NS4B protein Hepatitis C gi|22129792:5475-6257 226 86 60 genotype 1 NS4B protein Hepatitis C gi|22129792:5475-6257 204 87 60 genotype 1 NS4B protein Hepatitis C gi|22129792:5475-6257 182 88 60 genotype 1 NS4B protein Hepatitis C gi|22129792:5475-6257 162 89 60 genotype 1

NS4B protein Hepatitis C gi|22129792:5475-6257 113 90 60 genotype 1 NS5A protein Hepatitis C gi|22129792:6258-7601 402 91 60 genotype 1 NS5A protein Hepatitis C gi|22129792:6258-7601 1138 92 60 genotype 1 NS5A protein Hepatitis C gi|22129792:6258-7601 1078 93 60 genotype 1 NS5A protein Hepatitis C gi|22129792:6258-7601 974 94 60 genotype 1 NS5A protein Hepatitis C gi|22129792:6258-7601 826 95 60 genotype 1 NS5A protein Hepatitis C gi|22129792:6258-7601 578 96 60 genotype 1 NS5A protein Hepatitis C gi|22129792:6258-7601 515 97 60 genotype 1 NS5A protein Hepatitis C gi|22129792:6258-7601 342 98 60 genotype 1 NS5A protein Hepatitis C gi|22129792:6258-7601 214 99 60 genotype 1 NS5A protein Hepatitis C gi|22129792:6258-7601 154 100 60 genotype 1 NS5B RNA- Hepatitis C gi|22129792:7602-9374 1560 101 60 dependent RNA genotype 1 polymerase NS5B RNA- Hepatitis C gi|22129792:7602-9374 1559 102 60 dependent RNA genotype 1 polymerase NS5B RNA- Hepatitis C gi|22129792:7602-9374 1558 103 60 dependent RNA genotype 1 polymerase NS5B RNA- Hepatitis C gi|22129792:7602-9374 1557 104 60 dependent RNA genotype 1 polymerase NS5B RNA- Hepatitis C gi|22129792:7602-9374 1556 105 60 dependent RNA genotype 1 polymerase NS5B RNA- Hepatitis C gi|22129792:7602-9374 1391 106 60 dependent RNA genotype 1 polymerase NS5B RNA- Hepatitis C gi|22129792:7602-9374 1284 107 60 dependent RNA genotype 1 polymerase NS5B RNA- Hepatitis C gi|22129792:7602-9374 1283 108 60 dependent RNA genotype 1 polymerase NS5B RNA- Hepatitis C gi|22129792:7602-9374 1232 109 60 dependent RNA genotype 1 polymerase NS5B RNA- Hepatitis C gi|22129792:7602-9374 1231 110 60 dependent RNA genotype 1 polymerase 5 UTR Hepatitis C gi|157781212:1-321 242 111 60 genotype 2 5 UTR Hepatitis C gi|157781212:1-321 172 112 60 genotype 2 5 UTR Hepatitis C gi|157781212:1-321 171 113 60 genotype 2 5 UTR Hepatitis C gi|157781212:1-321 170 114 60 genotype 2 5 UTR Hepatitis C gi|157781212:1-321 169 115 60 genotype 2 5 UTR Hepatitis C gi|157781212:1-321 168 116 60 genotype 2 5 UTR Hepatitis C gi|157781212:1-321 167 117 60 genotype 2 5 UTR Hepatitis C gi|157781212:1-321 166 118 60 genotype 2 5 UTR Hepatitis C gi|157781212:1-321 163 119 60 genotype 2 5 UTR Hepatitis C gi|157781212:1-321 162 120 60 genotype 2 core protein Hepatitis C gi|157781212:322-906 36 121 60 genotype 2 core protein Hepatitis C gi|157781212:322-906 35 122 60 genotype 2 core protein Hepatitis C gi|157781212:322-906 34 123 60 genotype 2 core protein Hepatitis C gi|157781212:322-906 33 124 60 genotype 2 core protein Hepatitis C gi|157781212:322-906 32 125 60 genotype 2 core protein Hepatitis C gi|157781212:322-906 31 126 60 genotype 2 core protein Hepatitis C gi|157781212:322-906 30 127 60 genotype 2 core protein Hepatitis C gi|157781212:322-906 29 128 60 genotype 2 core protein Hepatitis C gi|157781212:322-906 28 129 60 genotype 2 core protein Hepatitis C gi|157781212:322-906 13 130 60 genotype 2 E1 protein Hepatitis C gi|157781212:921-1498 495 131 60 genotype 2 E1 protein Hepatitis C gi|157781212:921-1498 459 132 60 genotype 2 E1 protein Hepatitis C gi|157781212:921-1498 439 133 60 genotype 2 E1 protein Hepatitis C gi|157781212:921-1498 419 134 60 genotype 2 E1 protein Hepatitis C gi|157781212:921-1498 362 135 60 genotype 2 E1 protein Hepatitis C gi|157781212:921-1498 342 136 60 genotype 2 E1 protein Hepatitis C gi|157781212:921-1498 322 137 60 genotype 2 E1 protein Hepatitis C gi|157781212:921-1498 296 138 60 genotype 2 E1 protein Hepatitis C gi|157781212:921-1498 276 139 60 genotype 2 E1 protein Hepatitis C gi|157781212:1492-2540 24 140 60 genotype 2 E2/NS1 Hepatitis C gi|157781212:921-1498 944 141 60 protein genotype 2 E2/NS1 Hepatitis C gi|157781212:1492-2540 943 142 60 protein genotype 2 E2/NS1 Hepatitis C gi|157781212:1492-2540 941 143 60 protein genotype 2 E2/NS1 Hepatitis C gi|157781212:1492-2540 940 144 60 protein genotype 2 E2/NS1 Hepatitis C gi|157781212:1492-2540 939 145 60 protein genotype 2 E2/NS1 Hepatitis C gi|157781212:1492-2540 726 146 60 protein genotype 2 E2/NS1 Hepatitis C gi|157781212:1492-2540 725 147 60 protein genotype 2 E2/NS1 Hepatitis C gi|157781212:1492-2540 724 148 60 protein genotype 2 E2/NS1 Hepatitis C gi|157781212:1492-2540 723 149 60 protein genotype 2 E2/NS1 Hepatitis C gi|157781212:1492-2540 722 150 60 protein genotype 2 NS2 protein Hepatitis C gi|157781212:2777-3368 524 151 60 genotype 2 NS2 protein Hepatitis C

gi|157781212:2777-3368 484 152 60 genotype 2 NS2 protein Hepatitis C gi|157781212:2777-3368 409 153 60 genotype 2 NS2 protein Hepatitis C gi|157781212:2777-3368 369 154 60 genotype 2 NS2 protein Hepatitis C gi|157781212:2777-3368 281 155 60 genotype 2 NS2 protein Hepatitis C gi|157781212:2777-3368 239 156 60 genotype 2 NS2 protein Hepatitis C gi|157781212:2777-3368 199 157 60 genotype 2 NS2 protein Hepatitis C gi|157781212:3512-4759 101 158 60 genotype 2 NS2 protein Hepatitis C gi|157781212:2777-3368 61 159 60 genotype 2 NS2 protein Hepatitis C gi|157781212:2777-3368 21 160 60 genotype 2 NS3 protease/ Hepatitis C gi|157781212:2777-3368 992 161 60 helicase genotype 2 NS3 protease/ Hepatitis C gi|157781212:3512-4759 991 162 60 helicase genotype 2 NS3 protease/ Hepatitis C gi|157781212:3512-4759 990 163 60 helicase genotype 2 NS3 protease/ Hepatitis C gi|157781212:3512-4759 989 164 60 helicase genotype 2 NS3 protease/ Hepatitis C gi|157781212:3512-4759 988 165 60 helicase genotype 2 NS3 protease/ Hepatitis C gi|157781212:3512-4759 987 166 60 helicase genotype 2 NS3 protease/ Hepatitis C gi|157781212:3512-4759 986 167 60 helicase genotype 2 NS3 protease/ Hepatitis C gi|157781212:3512-4759 985 168 60 helicase genotype 2 NS3 protease/ Hepatitis C gi|157781212:3512-4759 984 169 60 helicase genotype 2 NS3 protease/ Hepatitis C gi|157781212:3512-4759 983 170 60 helicase genotype 2 NS4A protein Hepatitis C gi|157781212:5324-5501 119 171 60 genotype 2 NS4A protein Hepatitis C gi|157781212:5324-5501 118 172 60 genotype 2 NS4A protein Hepatitis C gi|157781212:5324-5501 117 173 60 genotype 2 NS4A protein Hepatitis C gi|157781212:5324-5501 116 174 60 genotype 2 NS4A protein Hepatitis C gi|157781212:5324-5501 115 175 60 genotype 2 NS4A protein Hepatitis C gi|157781212:5324-5501 114 176 60 genotype 2 NS4A protein Hepatitis C gi|157781212:5324-5501 113 177 60 genotype 2 NS4A protein Hepatitis C gi|157781212:5324-5501 112 178 60 genotype 2 NS4A protein Hepatitis C gi|157781212:5324-5501 111 179 60 genotype 2 NS4A protein Hepatitis C gi|157781212:5324-5501 110 180 60 genotype 2 NS4B protein Hepatitis C gi|157781212:5531-6115 88 181 60 genotype 2 NS4B protein Hepatitis C gi|157781212:5531-6115 87 182 60 genotype 2 NS4B protein Hepatitis C gi|157781212:5531-6115 13 183 60 genotype 2 NS4B protein Hepatitis C gi|157781212:5531-6115 12 184 60 genotype 2 NS4B protein Hepatitis C gi|157781212:5531-6115 8 185 60 genotype 2 NS4B protein Hepatitis C gi|157781212:5531-6115 7 186 60 genotype 2 NS4B protein Hepatitis C gi|157781212:5531-6115 6 187 60 genotype 2 NS4B protein Hepatitis C gi|157781212:5531-6115 5 188 60 genotype 2 NS4B protein Hepatitis C gi|157781212:5531-6115 4 189 60 genotype 2 NS4B protein Hepatitis C gi|157781212:5531-6115 3 190 60 genotype 2 NS5A protein Hepatitis C gi|157781212:6266-7670 54 191 60 genotype 2 NS5A protein Hepatitis C gi|157781212:6266-7670 46 192 60 genotype 2 NS5A protein Hepatitis C gi|157781212:6266-7670 45 193 60 genotype 2 NS5A protein Hepatitis C gi|157781212:6266-7670 43 194 60 genotype 2 NS5A protein Hepatitis C gi|157781212:6266-7670 42 195 60 genotype 2 NS5A protein Hepatitis C gi|157781212:6266-7670 41 196 60 genotype 2 NS5A protein Hepatitis C gi|157781212:6266-7670 40 197 60 genotype 2 NS5A protein Hepatitis C gi|157781212:6266-7670 39 198 60 genotype 2 NS5A protein Hepatitis C gi|157781212:6266-7670 38 199 60 genotype 2 NS5A protein Hepatitis C gi|157781212:6266-7670 37 200 60 genotype 2 NS5B RNA- Hepatitis C gi|157781212:7664-9212 1389 201 60 dependent RNA genotype 2 polymerase NS5B RNA- Hepatitis C gi|157781212:7664-9212 1388 202 60 dependent RNA genotype 2 polymerase NS5B RNA- Hepatitis C gi|157781212:7664-9212 1387 203 60 dependent RNA genotype 2 polymerase NS5B RNA- Hepatitis C gi|157781212:7664-9212 1386 204 60 dependent RNA genotype 2 polymerase NS5B RNA- Hepatitis C gi|157781212:7664-9212 1385 205 60 dependent RNA genotype 2 polymerase NS5B RNA- Hepatitis C gi|157781212:7664-9212 1384 206 60 dependent RNA genotype 2 polymerase NS5B RNA- Hepatitis C gi|157781212:7664-9212 1383 207 60 dependent RNA genotype 2 polymerase NS5B RNA- Hepatitis C gi|157781212:7664-9212 1382 208 60 dependent RNA genotype 2 polymerase NS5B RNA- Hepatitis C gi|157781212:7664-9212 1381 209 60 dependent RNA genotype 2 polymerase NS5B RNA- Hepatitis C gi|157781212:7664-9212 1380 210 60 dependent RNA genotype 2 polymerase 5

UTR Hepatitis C gi|157781216:1-339 245 211 60 genotype 3 5 UTR Hepatitis C gi|157781216:1-339 244 212 60 genotype 3 5 UTR Hepatitis C gi|157781216:1-339 242 213 60 genotype 3 5 UTR Hepatitis C gi|157781216:1-339 241 214 60 genotype 3 5 UTR Hepatitis C gi|157781216:1-339 192 215 60 genotype 3 5 UTR Hepatitis C gi|157781216:1-339 191 216 60 genotype 3 5 UTR Hepatitis C gi|157781216:1-339 170 217 60 genotype 3 5 UTR Hepatitis C gi|157781216:1-339 169 218 60 genotype 3 5 UTR Hepatitis C gi|157781216:1-339 168 219 60 genotype 3 5 UTR Hepatitis C gi|157781216:1-339 167 220 60 genotype 3 Core protein Hepatitis C gi|157781216:340-912 486 221 60 genotype 3 Core protein Hepatitis C gi|157781216:340-912 485 222 60 genotype 3 Core protein Hepatitis C gi|157781216:340-912 484 223 60 genotype 3 Core protein Hepatitis C gi|157781216:340-912 483 224 60 genotype 3 Core protein Hepatitis C gi|157781216:340-912 514 225 60 genotype 3 Core protein Hepatitis C gi|157781216:340-912 513 226 60 genotype 3 Core protein Hepatitis C gi|157781216:340-912 512 227 60 genotype 3 Core protein Hepatitis C gi|157781216:340-912 502 228 60 genotype 3 Core protein Hepatitis C gi|157781216:340-912 501 229 60 genotype 3 Core protein Hepatitis C gi|157781216:913-1488 499 230 60 genotype 3 E1 protein Hepatitis C gi|157781216:340-912 37 231 60 genotype 3 E1 protein Hepatitis C gi|157781216:913-1488 36 232 60 genotype 3 E1 protein Hepatitis C gi|157781216:913-1488 35 233 60 genotype 3 E1 protein Hepatitis C gi|157781216:913-1488 34 234 60 genotype 3 E1 protein Hepatitis C gi|157781216:913-1488 33 235 60 genotype 3 E1 protein Hepatitis C gi|157781216:913-1488 32 236 60 genotype 3 E1 protein Hepatitis C gi|157781216:913-1488 31 237 60 genotype 3 E1 protein Hepatitis C gi|157781216:913-1488 30 238 60 genotype 3 E1 protein Hepatitis C gi|157781216:913-1488 29 239 60 genotype 3 E1 protein Hepatitis C gi|157781216:913-1488 28 240 60 genotype 3 E2/NS1 Hepatitis C gi|157781216:1489-2544 925 241 60 protein genotype 3 E2/NS1 Hepatitis C gi|157781216:1489-2544 737 242 60 protein genotype 3 E2/NS1 Hepatitis C gi|157781216:1489-2544 736 243 60 protein genotype 3 E2/NS1 Hepatitis C gi|157781216:1489-2544 735 244 60 protein genotype 3 E2/NS1 Hepatitis C gi|157781216:1489-2544 734 245 60 protein genotype 3 E2/NS1 Hepatitis C gi|157781216:1489-2544 733 246 60 protein genotype 3 E2/NS1 Hepatitis C gi|157781216:1489-2544 732 247 60 protein genotype 3 E2/NS1 Hepatitis C gi|157781216:2545-3375 731 248 60 protein genotype 3 E2/NS1 Hepatitis C gi|157781216:1489-2544 730 249 60 protein genotype 3 E2/NS1 Hepatitis C gi|157781216:1489-2544 729 250 60 protein genotype 3 NS2 Hepatitis C gi|157781216:1489-2544 724 251 60 genotype 3 NS2 Hepatitis C gi|157781216:2545-3375 710 252 60 genotype 3 NS2 Hepatitis C gi|157781216:2545-3375 708 253 60 genotype 3 NS2 Hepatitis C gi|157781216:2545-3375 707 254 60 genotype 3 NS2 Hepatitis C gi|157781216:2545-3375 706 255 60 genotype 3 NS2 Hepatitis C gi|157781216:2545-3375 705 256 60 genotype 3 NS2 Hepatitis C gi|157781216:2545-3375 704 257 60 genotype 3 NS2 Hepatitis C gi|157781216:2545-3375 703 258 60 genotype 3 NS2 Hepatitis C gi|157781216:2545-3375 702 259 60 genotype 3 NS2 Hepatitis C gi|157781216:2545-3375 701 260 60 genotype 3 NS3 protease/ Hepatitis C gi|157781216:3376-5328 1684 261 60 helicase genotype 3 NS3 protease/ Hepatitis C gi|157781216:3376-5328 1682 262 60 helicase genotype 3 NS3 protease/ Hepatitis C gi|157781216:3376-5328 1677 263 60 helicase genotype 3 NS3 protease/ Hepatitis C gi|157781216:3376-5328 1676 264 60 helicase genotype 3 NS3 protease/ Hepatitis C gi|157781216:3376-5328 1674 265 60 helicase genotype 3 NS3 protease/ Hepatitis C gi|157781216:3376-5328 1673 266 60 helicase genotype 3 NS3 protease/ Hepatitis C gi|157781216:3376-5328 1671 267 60 helicase genotype 3 NS3 protease/ Hepatitis C gi|157781216:3376-5328 1645 268 60 helicase genotype 3 NS3 protease/ Hepatitis C gi|157781216:3376-5328 1644 269 60 helicase genotype 3 NS3 protease/ Hepatitis C gi|157781216:3376-5328 1643 270 60 helicase genotype 3 NS4A protein Hepatitis C gi|157781216:5329-5490 103 271 60 genotype 3 NS4A protein Hepatitis C gi|157781216:5329-5490 102 272 60 genotype 3 NS4A protein Hepatitis C gi|157781216:5329-5490 101 273 60 genotype 3 NS4A protein Hepatitis C gi|157781216:5329-5490 100 274 60 genotype 3 NS4A protein Hepatitis C gi|157781216:5329-5490 99 275 60 genotype 3 NS4A protein Hepatitis C

gi|157781216:5329-5490 98 276 60 genotype 3 NS4A protein Hepatitis C gi|157781216:5329-5490 97 277 60 genotype 3 NS4A protein Hepatitis C gi|157781216:5329-5490 96 278 60 genotype 3 NS4A protein Hepatitis C gi|157781216:5329-5490 95 279 60 genotype 3 NS4A protein Hepatitis C gi|157781216:5329-5490 94 280 60 genotype 3 NS4B protein Hepatitis C gi|157781216:5491-6273 237 281 60 genotype 3 NS4B protein Hepatitis C gi|157781216:5491-6273 236 282 60 genotype 3 NS4B protein Hepatitis C gi|157781216:5491-6273 133 283 60 genotype 3 NS4B protein Hepatitis C gi|157781216:5491-6273 132 284 60 genotype 3 NS4B protein Hepatitis C gi|157781216:5491-6273 130 285 60 genotype 3 NS4B protein Hepatitis C gi|157781216:5491-6273 129 286 60 genotype 3 NS4B protein Hepatitis C gi|157781216:5491-6273 118 287 60 genotype 3 NS4B protein Hepatitis C gi|157781216:5491-6273 117 288 60 genotype 3 NS4B protein Hepatitis C gi|157781216:5491-6273 116 289 60 genotype 3 NS4B protein Hepatitis C gi|157781216:5491-6273 115 290 60 genotype 3 NS5A protein Hepatitis C gi|157781216:6274-7629 513 291 60 genotype 3 NS5A protein Hepatitis C gi|157781216:6274-7629 512 292 60 genotype 3 NS5A protein Hepatitis C gi|157781216:6274-7629 511 293 60 genotype 3 NS5A protein Hepatitis C gi|157781216:6274-7629 510 294 60 genotype 3 NS5A protein Hepatitis C gi|157781216:6274-7629 509 295 60 genotype 3 NS5A protein Hepatitis C gi|157781216:6274-7629 508 296 60 genotype 3 NS5A protein Hepatitis C gi|157781216:6274-7629 507 297 60 genotype 3 NS5A protein Hepatitis C gi|157781216:6274-7629 506 298 60 genotype 3 NS5A protein Hepatitis C gi|157781216:6274-7629 505 299 60 genotype 3 NS5A protein Hepatitis C gi|157781216:6274-7629 504 300 60 genotype 3 NS5B RNA- Hepatitis C gi|157781216:7630-9402 1548 301 60 dependent RNA genotype 3 polymerase NS5B RNA- Hepatitis C gi|157781216:7630-9402 1373 302 60 dependent RNA genotype 3 polymerase NS5B RNA- Hepatitis C gi|157781216:7630-9402 1350 303 60 dependent RNA genotype 3 polymerase NS5B RNA- Hepatitis C gi|157781216:7630-9402 1330 304 60 dependent RNA genotype 3 polymerase NS5B RNA- Hepatitis C gi|157781216:7630-9402 1283 305 60 dependent RNA genotype 3 polymerase NS5B RNA- Hepatitis C gi|157781216:7630-9402 1262 306 60 dependent RNA genotype 3 polymerase NS5B RNA- Hepatitis C gi|157781216:7630-9402 672 307 60 dependent RNA genotype 3 polymerase NS5B RNA- Hepatitis C gi|157781216:7630-9402 526 308 60 dependent RNA genotype 3 polymerase NS5B RNA- Hepatitis C gi|157781216:7630-9402 147 309 60 dependent RNA genotype 3 polymerase NS5B RNA- Hepatitis C gi|157781216:7630-9402 99 310 60 dependent RNA genotype 3 polymerase Gag-Pol HIV 1 gi|9629357:336-4642 4241 311 60 Gag-Pol HIV 1 gi|9629357:336-4642 4164 312 60 Gag-Pol HIV 1 gi|9629357:336-4642 4104 313 60 Gag-Pol HIV 1 gi|9629357:336-4642 4013 314 60 Gag-Pol HIV 1 gi|9629357:336-4642 3953 315 60 Gag-Pol HIV 1 gi|9629357:336-4642 3858 316 60 Gag-Pol HIV 1 gi|9629357:336-4642 3762 317 60 Gag-Pol HIV 1 gi|9629357:336-4642 3702 318 60 Gag-Pol HIV 1 gi|9629357:336-4642 3642 319 60 Gag-Pol HIV 1 gi|9629357:336-1838 3582 320 60 gag HIV 1 gi|9629357:336-4642 1295 321 60 gag HIV 1 gi|9629357:336-1838 1235 322 60 gag HIV 1 gi|9629357:336-1838 1162 323 60 gag HIV 1 gi|9629357:336-1838 1102 324 60 gag HIV 1 gi|9629357:336-1838 959 325 60 gag HIV 1 gi|9629357:336-1838 899 326 60 gag HIV 1 gi|9629357:336-1838 837 327 60 gag HIV 1 gi|9629357:336-1838 750 328 60 gag HIV 1 gi|9629357:336-1838 690 329 60 gag HIV 1 gi|9629357:336-1838 601 330 60 Vif HIV 1 gi|9629357:4587-5165 466 331 60 Vif HIV 1 gi|9629357:4587-5165 426 332 60 Vif HIV 1 gi|9629357:4587-5165 386 333 60 Vif HIV 1 gi|9629357:4587-5165 346 334 60 Vif HIV 1 gi|9629357:4587-5165 304 335 60 Vif HIV 1 gi|9629357:4587-5165 264 336 60 Vif HIV 1 gi|9629357:4587-5165 224 337 60 Vif HIV 1 gi|9629357:5105-5396 184 338 60 Vif HIV 1 gi|9629357:4587-5165 144 339 60 Vif HIV 1 gi|9629357:4587-5165 104 340 60 vpr HIV 1 gi|9629357:4587-5165 215 341 60 vpr HIV 1 gi|9629357:5105-5396 195 342 60 vpr HIV 1 gi|9629357:5105-5396 175 343 60 vpr HIV 1 gi|9629357:5105-5396 155 344 60 vpr HIV 1 gi|9629357:5105-5396 135 345 60 vpr HIV 1 gi|9629357:5105-5396 109 346 60 vpr HIV 1 gi|9629357:5105-5396 89 347 60 vpr HIV 1 gi|9629357:5105-5396 69 348 60 vpr HIV 1

gi|9629357:5105-5396 49 349 60 vpr HIV 1 gi|9629357:5105-5396 29 350 60 tat HIV 1
gi|9629357:5377-7970 2504 351 60 tat HIV 1 gi|9629357:5377-7970 2377 352 60 tat HIV 1
gi|9629357:5377-7970 2310 353 60 tat HIV 1 gi|9629357:5377-7970 2250 354 60 tat HIV 1
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gi|9629357:5608-5856 184 375 60 vpu HIV 1 gi|9629357:5608-5856 183 376 60 vpu HIV 1
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gi|9628880:1-855 701 401 60 5′ LTR HIV 2 gi|9628880:1-855 513 402 60 5′ LTR HIV 2
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gi|9628880:1-855 38 409 60 5′ LTR HIV 2 gi|9628880:1-855 8 410 60 gag HIV 2
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Protein gp3-vpx HIV 2 gi|9628880:5898-6239 220 444 60 Protein gp3-vpx HIV 2 gi|9628880:5898-6239 219 445 60 Protein gp3-vpx HIV 2 gi|9628880:5898-6239 217 446 60 Protein gp3-vpx HIV 2 gi|9628880:5898-6239 216 447 60 Protein gp3-vpx HIV 2 gi|9628880:5898-6239 215 448 60 Protein gp3-vpx HIV 2 gi|9628880:5898-6239 214 449 60 Protein gp3-vpx HIV 2 gi|9628880:5898-6239 213 450 60 Protein gp4-vpr HIV 2 gi|9628880:6239-6502 151 451 60 protein gp4-vpr HIV 2 gi|9628880:6239-6502 150 452 60 protein gp4-vpr HIV 2 gi|9628880:6239-6502 149 453 60 protein gp4-vpr HIV 2 gi|9628880:6239-6502 148 454 60 protein gp4-vpr HIV 2 gi|9628880:6239-6502 147 455 60 protein gp4-vpr HIV 2 gi|9628880:6239-6502 146 456 60 protein gp4-vpr HIV 2 gi|9628880:6239-6502 145 457 60 protein gp4-vpr HIV 2 gi|9628880:6239-6502 144 458 60 protein gp4-vpr HIV 2 gi|9628880:6239-6502 143 459 60 protein gp4-vpr HIV 2 gi|9628880:6239-6502 142 460 60 protein gp5-tat HIV 2 gi|9628880:6402-8957 2383 461 60 protein gp5-tat HIV 2 gi|9628880:6402-8957 2314 462 60 protein gp5-tat HIV 2 gi|9628880:6402-8957 2192 463 60 protein gp5-tat HIV 2 gi|9628880:6402-8957 2131 464 60 protein gp5-tat HIV 2 gi|9628880:6402-8957 2047 465 60 protein gp5-tat HIV 2 gi|9628880:6402-8957 1938 466 60 protein gp5-tat HIV 2 gi|9628880:6402-8957 1762 467 60 protein gp5-tat HIV 2 gi|9628880:6402-8957 1702 468 60 protein gp5-tat HIV 2 gi|9628880:6402-8957 1579 469 60 protein gp5-tat HIV 2 gi|9628880:6402-8957 1519 470 60 protein gp6-rev HIV 2 gi|9628880:6628-9102 2355 471 60 protein gp6-rev HIV 2 gi|9628880:6628-9102 2157 472 60 protein gp6-rev HIV 2 gi|9628880:6628-9102 2088 473 60 protein gp6-rev HIV 2 gi|9628880:6628-9102 1966 474 60 protein gp6-rev HIV 2 gi|9628880:6628-9102 1905 475 60 protein gp6-rev HIV 2 gi|9628880:6628-9102 1821 476 60 protein gp6-rev HIV 2 gi|9628880:6628-9102 1712 477 60 protein gp6-rev HIV 2 gi|9628880:6628-9102 1536 478 60 protein gp6-rev HIV 2 gi|9628880:6628-9102 1476 479 60 protein gp6-rev HIV 2 gi|9628880:6628-9102 1353 480 60 protein gp7-env HIV 2 gi|9628880:6704-9286 2279 481 60 protein gp7-env HIV 2 gi|9628880:6704-9286 2081 482 60 protein gp7-env HIV 2 gi|9628880:6704-9286 2012 483 60 protein gp7-env HIV 2 gi|9628880:6704-9286 1890 484 60 protein gp7-env HIV 2 gi|9628880:6704-9286 1829 485 60 protein gp7-env HIV 2 gi|9628880:6704-9286 1745 486 60 protein gp7-env HIV 2 gi|9628880:6704-9286 1636 487 60 protein gp7-env HIV 2 gi|9628880:6704-9286 1460 488 60 protein gp7-env HIV 2 gi|9628880:6704-9286 1400 489 60 protein gp7-env HIV 2 gi|9628880:6704-9286 1277 490 60 protein gp8-nef HIV 2 gi|9628880:9120-9893 709 491 60 protein gp8-nef HIV 2 gi|9628880:9120-9893 594 492 60 protein gp8-nef HIV 2 gi|9628880:9120-9893 526 493 60 protein gp8-nef HIV 2 gi|9628880:9120-9893 453 494 60 protein gp8-nef HIV 2 gi|9628880:9120-9893 423 495 60 protein gp8-nef HIV 2 gi|9628880:9120-9893 393 496 60 protein gp8-nef HIV 2 gi|9628880:9120-9893 359 497 60 protein gp8-nef HIV 2 gi|9628880:9120-9893 308 498 60 protein gp8-nef HIV 2 gi|9628880:9120-9893 278 499 60 protein gp8-nef HIV 2 gi|9628880:9120-9893 248 500 60 protein 3 LTR HIV 2 701 501 60 3 LTR HIV 2 513 502 60 3 LTR HIV 2 384 503 60 3 LTR HIV 2 354 504 60 3 LTR HIV 2 324 505 60 3 LTR HIV 2 209 506 60 3 LTR HIV 2 141 507 60 3 LTR HIV 2 68 508 60 3 LTR HIV 2 38 509 60 3 LTR HIV 2 8 510 60 gag HTLV 1 gb|AF033817.1|:450-1739 927 511 60 gag HTLV 1 gb|AF033817.1|:450-1739 926 512 60 gag HTLV 1 gb|AF033817.1|:450-1739 925 513 60 gag HTLV 1 gb|AF033817.1|:450-1739 924 514 60 gag HTLV 1 gb|AF033817.1|:450-1739 923 515 60 gag HTLV 1 gb|AF033817.1|:450-1739 922 516 60 gag HTLV 1 gb|AF033817.1|:450-1739 921 517 60 gag HTLV 1 gb|AF033817.1|:450-1739 917 518 60 gag HTLV 1 gb|AF033817.1|:450-1739 916 519 60 gag HTLV 1 gb|AF033817.1|:450-1739 915 520 60 pro HTLV 1 gb|AF033817.1|:1718-2404 609 521 60 pro HTLV 1 gb|AF033817.1|:1718-2404 608 522 60 pro HTLV 1 gb|AF033817.1|:1718-2404 607 523 60 pro HTLV 1 gb|AF033817.1|:1718-2404 606 524 60 pro HTLV 1 gb|AF033817.1|:1718-2404 605 525 60 pro HTLV 1 gb|AF033817.1|:1718-2404 604 526 60 pro HTLV 1 gb|AF033817.1|:1718-2404 603 527 60 pro HTLV 1 gb|AF033817.1|:1718-2404 602 528 60 pro HTLV 1 gb|AF033817.1|:1718-2404 583 529 60 pro HTLV 1 gb|AF033817.1|:1718-2404 582 530 60 Pol

HTLV 1 gi|9626453:2245-4836 2376 531 60 Pol HTLV 1 gi|9626453:2245-4836 2262 532 60 Pol HTLV 1 gi|9626453:2245-4836 2202 533 60 Pol HTLV 1 gi|9626453:2245-4836 2051 534 60 Pol HTLV 1 gi|9626453:2245-4836 1984 535 60 Pol HTLV 1 gi|9626453:2245-4836 1914 536 60 Pol HTLV 1 gi|9626453:2245-4836 1475 537 60 Pol HTLV 1 gi|9626453:2245-4836 1333 538 60 Pol HTLV 1 gi|9626453:2245-4836 1242 539 60 Pol HTLV 1 gi|9626453:2245-4836 1182 540 60 rex HTLV 1 gi|9626453:4773-8008 3128 541 60 rex HTLV 1 gi|9626453:4773-8008 3068 542 60 rex HTLV 1 gi|9626453:4773-8008 2975 543 60 rex HTLV 1 gi|9626453:4773-8008 2758 544 60 rex HTLV 1 gi|9626453:4773-8008 2160 545 60 rex HTLV 1 gi|9626453:4773-8008 1489 546 60 rex HTLV 1 gi|9626453:4773-8008 1251 547 60 rex HTLV 1 gi|9626453:4773-8008 1146 548 60 rex HTLV 1 gi|9626453:4773-8008 1086 549 60 rex HTLV 1 gi|9626453:4773-8008 721 550 60 tax HTLV 1 gi|9626453:4829-8008 3072 551 60 tax HTLV 1 gi|9626453:4829-8008 3012 552 60 tax HTLV 1 gi|9626453:4829-8008 2919 553 60 tax HTLV 1 gi|9626453:4829-8008 2702 554 60 tax HTLV 1 gi|9626453:4829-8008 2104 555 60 tax HTLV 1 gi|9626453:4829-8008 1433 556 60 tax HTLV 1 gi|9626453:4829-8008 1195 557 60 tax HTLV 1 gi|9626453:4829-8008 1090 558 60 tax HTLV 1 gi|9626453:4829-8008 1030 559 60 tax HTLV 1 gi|9626453:4829-8008 665 560 60 env HTLV 1 gi|9626453:4829-6295 1192 561 60 env HTLV 1 gi|9626453:4829-6295 1152 562 60 env HTLV 1 gi|9626453:4829-6295 1085 563 60 env HTLV 1 gi|9626453:4829-6295 1045 564 60 env HTLV 1 gi|9626453:4829-6295 662 565 60 env HTLV 1 gi|9626453:4829-6295 621 566 60 env HTLV 1 gi|9626453:4829-6295 454 567 60 env HTLV 1 gi|9626453:4829-6295 388 568 60 env HTLV 1 gi|9626453:4829-6295 297 569 60 env HTLV 1 gi|9626453:4829-6295 257 570 60 5′ LTR HTLV 2 gi|9626726:1-763 262 571 60 5′ LTR HTLV 2 gi|9626726:1-763 261 572 60 5′ LTR HTLV 2 gi|9626726:1-763 260 573 60 5′ LTR HTLV 2 gi|9626726:1-763 258 574 60 5′ LTR HTLV 2 gi|9626726:1-763 257 575 60 5′ LTR HTLV 2 gi|9626726:1-763 256 576 60 5′ LTR HTLV 2 gi|9626726:1-763 255 577 60 5′ LTR HTLV 2 gi|9626726:1-763 254 578 60 5′ LTR HTLV 2 gi|9626726:1-763 253 579 60 5′ LTR HTLV 2 gi|9626726:1-763 251 580 60 gp1-tax protein HTLV 2 gi|9626726:6-119 52 581 60 gp1-tax protein HTLV 2 gi|9626726:6-119 51 582 60 gp1-tax protein HTLV 2 gi|9626726:6-119 50 583 60 gp1-tax protein HTLV 2 gi|9626726:6-119 48 584 60 gp1-tax protein HTLV 2 gi|9626726:6-119 44 585 60 gp1-tax protein HTLV 2 gi|9626726:6-119 43 586 60 gp1-tax protein HTLV 2 gi|9626726:6-119 42 587 60 gp1-tax protein HTLV 2 gi|9626726:6-119 41 588 60 gp1-tax protein HTLV 2 gi|9626726:6-119 40 589 60 gp1-tax protein HTLV 2 gi|9626726:6-119 39 590 60 gs1 HTLV 2 gi|9626726:316-8751 8136 591 60 gs1 HTLV 2 gi|9626726:316-8751 7844 592 60 gs1 HTLV 2 gi|9626726:316-8751 7700 593 60 gs1 HTLV 2 gi|9626726:316-8751 7607 594 60 gs1 HTLV 2 gi|9626726:316-8751 7467 595 60 gs1 HTLV 2 gi|9626726:316-8751 6864 596 60 gs1 HTLV 2 gi|9626726:316-8751 6510 597 60 gs1 HTLV 2 gi|9626726:316-8751 6302 598 60 gs1 HTLV 2 gi|9626726:316-8751 6038 599 60 gs1 HTLV 2 gi|9626726:316-8751 5942 600 60 Gag-Pro-Pol HTLV 2 gi|9626726:807-5187 4170 601 60 Gag-Pro-Pol HTLV 2 gi|9626726:807-5187 4051 602 60 Gag-Pro-Pol HTLV 2 gi|9626726:807-5187 3988 603 60 Gag-Pro-Pol HTLV 2 gi|9626726:807-5187 3878 604 60 Gag-Pro-Pol HTLV 2 gi|9626726:807-5187 3759 605 60 Gag-Pro-Pol HTLV 2 gi|9626726:807-5187 3580 606 60 Gag-Pro-Pol HTLV 2 gi|9626726:807-5187 3276 607 60 Gag-Pro-Pol HTLV 2 gi|9626726:807-5187 2797 608 60 Gag-Pro-Pol HTLV 2 gi|9626726:807-5187 2698 609 60 Gag-Pro-Pol HTLV 2 gi|9626726:807-5187 2471 610 60 gp2-gag HTLV 2 gi|9626726:807-2108 927 611 60 polyprotein gp2-gag HTLV 2 gi|9626726:807-2108 924 612 60 polyprotein gp2-gag HTLV 2 gi|9626726:807-2108 923 613 60 polyprotein gp2-gag HTLV 2 gi|9626726:807-2108 910 614 60 polyprotein gp2-gag HTLV 2 gi|9626726:807-2108 909 615 60 polyprotein gp2-gag HTLV 2 gi|9626726:807-2108 908 616 60 polyprotein gp2-gag HTLV 2 gi|9626726:807-2108 904 617 60 polyprotein gp2-gag HTLV 2 gi|9626726:807-2108 903 618 60 polyprotein gp2-gag HTLV 2 gi|9626726:807-2108 902 619 60 polyprotein gp2-gag HTLV 2 gi|9626726:807-2108 901 620 60 polyprotein gp4-rex 26 kD HTLV 2 gi|9626726:5121-7663 2053 621 60 protein gp4-rex 26 kD HTLV 2 gi|9626726:5121-7663 2003 622 60 protein gp4-rex 26 kD HTLV 2 gi|9626726:5121-7663 1705 623 60 protein gp4-

rex 26 kD HTLV 2 gi|9626726:5121-7663 1488 624 60 protein gp4-rex 26 kD HTLV 2 gi|9626726:5121-7663 1219 625 60 protein gp4-rex 26 kD HTLV 2 gi|9626726:5121-7663 1132 626 60 protein gp4-rex 26 kD HTLV 2 gi|9626726:5121-7663 1092 627 60 protein gp4-rex 26 kD HTLV 2 gi|9626726:5121-7663 680 628 60 protein gp4-rex 26 kD HTLV 2 gi|9626726:5121-7663 455 629 60 protein gp4-rex 26 kD HTLV 2 gi|9626726:5121-7663 293 630 60 protein gp5-tax protein HTLV 2 gi|9626726:5180-8205 2967 631 60 gp5-tax protein HTLV 2 gi|9626726:5180-8205 2836 632 60 gp5-tax protein HTLV 2 gi|9626726:5180-8205 2743 633 60 gp5-tax protein HTLV 2 gi|9626726:5180-8205 2603 634 60 gp5-tax protein HTLV 2 gi|9626726:5180-8205 2000 635 60 gp5-tax protein HTLV 2 gi|9626726:5180-8205 1646 636 60 gp5-tax protein HTLV 2 gi|9626726:5180-8205 1438 637 60 gp5-tax protein HTLV 2 gi|9626726:5180-8205 1174 638 60 gp5-tax protein HTLV 2 gi|9626726:5180-8205 1078 639 60 gp5-tax protein HTLV 2 gi|9626726:5180-8205 624 640 60 gp6-env peptide HTLV 2 gi|9626726:5180-6640 1402 641 60 gp6-env peptide HTLV 2 gi|9626726:5180-6640 1160 642 60 gp6-env peptide HTLV 2 gi|9626726:5180-6640 1073 643 60 gp6-env peptide HTLV 2 gi|9626726:5180-6640 1033 644 60 gp6-env peptide HTLV 2 gi|9626726:5180-6640 621 645 60 gp6-env peptide HTLV 2 gi|9626726:5180-6640 599 646 60 gp6-env peptide HTLV 2 gi|9626726:5180-6640 396 647 60 gp6-env peptide HTLV 2 gi|9626726:5180-6640 375 648 60 gp6-env peptide HTLV 2 gi|9626726:5180-6640 234 649 60 gp6-env peptide HTLV 2 gi|9626726:5180-6640 6 650 60 3 LTR HTLV 2 gi|9626726:8190-8952 262 651 60 3 LTR HTLV 2 gi|9626726:8190-8952 261 652 60 3 LTR HTLV 2 gi|9626726:8190-8952 260 653 60 3 LTR HTLV 2 gi|9626726:8190-8952 258 654 60 3 LTR HTLV 2 gi|9626726:8190-8952 257 655 60 3 LTR HTLV 2 gi|9626726:8190-8952 256 656 60 3 LTR HTLV 2 gi|9626726:8190-8952 255 657 60 3 LTR HTLV 2 gi|9626726:8190-8952 254 658 60 3 LTR HTLV 2 gi|9626726:8190-8952 253 659 60 3 LTR HTLV 2 gi|9626726:8190-8952 251 660 60 anchored capsid WNV NY99 gi|158516887:97-465 299 661 60 protein C anchored capsid WNV NY99 gi|158516887:97-465 298 662 60 protein C anchored capsid WNV NY99 gi|158516887:97-465 297 663 60 protein C anchored capsid WNV NY99 gi|158516887:97-465 296 664 60 protein C anchored capsid WNV NY99 gi|158516887:97-465 295 665 60 protein C anchored capsid WNV NY99 gi|158516887:97-465 294 666 60 protein C anchored capsid WNV NY99 gi|158516887:97-465 286 667 60 protein C anchored capsid WNV NY99 gi|158516887:97-465 282 668 60 protein C anchored capsid WNV NY99 gi|158516887:97-465 281 669 60 protein C anchored capsid WNV NY99 gi|158516887:97-465 279 670 60 protein C membrane WNV NY99 gi|158516887:466-966 355 671 60 glycoprotein precursor prM membrane WNV NY99 gi|158516887:466-966 354 672 60 glycoprotein precursor prM membrane WNV NY99 gi|158516887:466-966 353 673 60 glycoprotein precursor prM membrane WNV NY99 gi|158516887:466-966 352 674 60 glycoprotein precursor prM membrane WNV NY99 gi|158516887:466-966 351 675 60 glycoprotein precursor prM membrane WNV NY99 gi|158516887:466-966 350 676 60 glycoprotein precursor prM membrane WNV NY99 gi|158516887:466-966 349 677 60 glycoprotein precursor prM membrane WNV NY99 gi|158516887:466-966 348 678 60 glycoprotein precursor prM membrane WNV NY99 gi|158516887:466-966 347 679 60 glycoprotein precursor prM membrane WNV NY99 gi|158516887:466-966 346 680 60 glycoprotein precursor prM envelope WNV NY99 gi|158516887:967-2469 1168 681 60 protein E envelope WNV NY99 gi|158516887:967-2469 880 682 60 protein E envelope WNV NY99 gi|158516887:967-2469 850 683 60 protein E envelope WNV NY99 gi|158516887:967-2469 820 684 60 protein E envelope WNV NY99 gi|158516887:967-2469 788 685 60 protein E envelope WNV NY99 gi|158516887:967-2469 595 686 60 protein E envelope WNV NY99 gi|158516887:967-2469 393 687 60 protein E envelope WNV NY99 gi|158516887:967-2469 363 688 60 protein E envelope WNV NY99 gi|158516887:967-2469 319 689 60 protein E envelope WNV NY99 gi|158516887:967-2469 90 690 60 protein E nonstructural WNV NY99 gi|158516887:2470-3525 971 691 60 protein NS1 nonstructural WNV NY99 gi|158516887:2470-3525 598 692 60 protein NS1 nonstructural WNV

NY99 gi|158516887:2470-3525 566 693 60 protein NS1 nonstructural WNV NY99 gi|158516887:2470-3525 517 694 60 protein NS1 nonstructural WNV NY99 gi|158516887:2470-3525 426 695 60 protein NS1 nonstructural WNV NY99 gi|158516887:2470-3525 357 696 60 protein NS1 nonstructural WNV NY99 gi|158516887:2470-3525 325 697 60 protein NS1 nonstructural WNV NY99 gi|158516887:2470-3525 130 698 60 protein NS1 nonstructural WNV NY99 gi|158516887:2470-3525 97 699 60 protein NS1 nonstructural WNV NY99 gi|158516887:2470-3525 54 700 60 protein NS1 nonstructural WNV NY99 gi|158516887:3526-4218 584 701 60 protein NS2A nonstructural WNV NY99 gi|158516887:3526-4218 501 702 60 protein NS2A nonstructural WNV NY99 gi|158516887:3526-4218 413 703 60 protein NS2A nonstructural WNV NY99 gi|158516887:3526-4218 393 704 60 protein NS2A nonstructural WNV NY99 gi|158516887:3526-4218 313 705 60 protein NS2A nonstructural WNV NY99 gi|158516887:3526-4218 293 706 60 protein NS2A nonstructural WNV NY99 gi|158516887:3526-4218 265 707 60 protein NS2A nonstructural WNV NY99 gi|158516887:3526-4218 243 708 60 protein NS2A nonstructural WNV NY99 gi|158516887:3526-4218 147 709 60 protein NS2A nonstructural WNV NY99 gi|158516887:3526-4218 106 710 60 protein NS2A nonstructural WNV NY99 gi|158516887:4219-4611 334 711 60 protein NS2B nonstructural WNV NY99 gi|158516887:4219-4611 249 712 60 protein NS2B nonstructural WNV NY99 gi|158516887:4219-4611 246 713 60 protein NS2B nonstructural WNV NY99 gi|158516887:4219-4611 245 714 60 protein NS2B nonstructural WNV NY99 gi|158516887:4219-4611 242 715 60 protein NS2B nonstructural WNV NY99 gi|158516887:4219-4611 240 716 60 protein NS2B nonstructural WNV NY99 gi|158516887:4219-4611 239 717 60 protein NS2B nonstructural WNV NY99 gi|158516887:4219-4611 238 718 60 protein NS2B nonstructural WNV NY99 gi|158516887:4219-4611 237 719 60 protein NS2B nonstructural WNV NY99 gi|158516887:4219-4611 236 720 60 protein NS2B nonstructural WNV NY99 gi|158516887:4612-6468 1721 721 60 protein NS3 nonstructural WNV NY99 gi|158516887:4612-6468 1591 722 60 protein NS3 nonstructural WNV NY99 gi|158516887:4612-6468 1512 723 60 protein NS3 nonstructural WNV NY99 gi|158516887:4612-6468 1217 724 60 protein NS3 nonstructural WNV NY99 gi|158516887:4612-6468 1157 725 60 protein NS3 nonstructural WNV NY99 gi|158516887:4612-6468 1097 726 60 protein NS3 nonstructural WNV NY99 gi|158516887:4612-6468 960 727 60 protein NS3 nonstructural WNV NY99 gi|158516887:4612-6468 757 728 60 protein NS3 nonstructural WNV NY99 gi|158516887:4612-6468 600 729 60 protein NS3 nonstructural WNV NY99 gi|158516887:4612-6468 428 730 60 protein NS3 nonstructural WNV NY99 gi|158516887:6469-6834 160 731 60 protein NS4A nonstructural WNV NY99 gi|158516887:6469-6834 159 732 60 protein NS4A nonstructural WNV NY99 gi|158516887:6469-6834 158 733 60 protein NS4A nonstructural WNV NY99 gi|158516887:6469-6834 157 734 60 protein NS4A nonstructural WNV NY99 gi|158516887:6469-6834 156 735 60 protein NS4A nonstructural WNV NY99 gi|158516887:6469-6834 155 736 60 protein NS4A nonstructural WNV NY99 gi|158516887:6469-6834 154 737 60 protein NS4A nonstructural WNV NY99 gi|158516887:6469-6834 153 738 60 protein NS4A nonstructural WNV NY99 gi|158516887:6469-6834 152 739 60 protein NS4A nonstructural WNV NY99 gi|158516887:6469-6834 151 740 60 protein NS4A nonstructural WNV NY99 gi|158516887:6916-7680 703 741 60 protein NS4B nonstructural WNV NY99 gi|158516887:6916-7680 683 742 60 protein NS4B nonstructural WNV NY99 gi|158516887:6916-7680 506 743 60 protein NS4B nonstructural WNV NY99 gi|158516887:6916-7680 480 744 60 protein NS4B nonstructural WNV NY99 gi|158516887:6916-7680 185 745 60 protein NS4B nonstructural WNV NY99 gi|158516887:6916-7680 165 746 60 protein NS4B nonstructural WNV NY99 gi|158516887:6916-7680 140 747 60 protein NS4B nonstructural WNV NY99 gi|158516887:6916-7680 48 748 60 protein NS4B nonstructural WNV NY99 gi|158516887:6916-7680 28 749 60 protein NS4B nonstructural WNV NY99 gi|158516887:6916-7680 8 750 60 protein NS4B nonstructural WNV NY99 gi|158516887:7681-10395 2656 751 60 protein NS5 nonstructural WNV NY99 gi|158516887:7681-10395 2596 752 60 protein NS6 nonstructural WNV

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NS2A nonstructural WNV 956 gi|11528013:3514-4206 516 813 60 protein NS2A nonstructural
WNV 956 gi|11528013:3514-4206 496 814 60 protein NS2A nonstructural WNV 956

gi|11528013:3514-4206 476 815 60 protein NS2A nonstructural WNV 956 gi|11528013:3514-4206 401 816 60 protein NS2A nonstructural WNV 956 gi|11528013:3514-4206 345 817 60 protein NS2A nonstructural WNV 956 gi|11528013:3514-4206 325 818 60 protein NS2A nonstructural WNV 956 gi|11528013:3514-4206 305 819 60 protein NS2A nonstructural WNV 956 gi|11528013:3514-4206 279 820 60 protein NS2A nonstructural WNV 956 gi|11528013:4207-4599 249 821 60 protein NS2B nonstructural WNV 956 gi|11528013:4207-4599 248 822 60 protein NS2B nonstructural WNV 956 gi|11528013:4207-4599 247 823 60 protein NS2B nonstructural WNV 956 gi|11528013:4207-4599 246 824 60 protein NS2B nonstructural WNV 956 gi|11528013:4207-4599 245 825 60 protein NS2B nonstructural WNV 956 gi|11528013:4207-4599 244 826 60 protein NS2B nonstructural WNV 956 gi|11528013:4207-4599 243 827 60 protein NS2B nonstructural WNV 956 gi|11528013:4207-4599 242 828 60 protein NS2B nonstructural WNV 956 gi|11528013:4207-4599 241 829 60 protein NS2B nonstructural WNV 956 gi|11528013:4207-4599 240 830 60 protein NS2B nonstructural WNV 956 gi|11528013:4600-6456 1798 831 60 protein NS3 nonstructural WNV 956 gi|11528013:4600-6456 1729 832 60 protein NS3 nonstructural WNV 956 gi|11528013:4600-6456 1668 833 60 protein NS3 nonstructural WNV 956 gi|11528013:4600-6456 1597 834 60 protein NS3 nonstructural WNV 956 gi|11528013:4600-6456 1437 835 60 protein NS3 nonstructural WNV 956 gi|11528013:4600-6456 1212 836 60 protein NS3 nonstructural WNV 956 gi|11528013:4600-6456 1150 837 60 protein NS3 nonstructural WNV 956 gi|11528013:4600-6456 1073 838 60 protein NS3 nonstructural WNV 956 gi|11528013:4600-6456 1013 839 60 protein NS3 nonstructural WNV 956 gi|11528013:4600-6456 809 840 60 protein NS3 nonstructural WNV 956 gi|11528013:6457-6834 206 841 60 protein NS4A nonstructural WNV 956 gi|11528013:6457-6834 205 842 60 protein NS4A nonstructural WNV 956 gi|11528013:6457-6834 204 843 60 protein NS4A nonstructural WNV 956 gi|11528013:6457-6834 203 844 60 protein NS4A nonstructural WNV 956 gi|11528013:6457-6834 202 845 60 protein NS4A nonstructural WNV 956 gi|11528013:6457-6834 201 846 60 protein NS4A nonstructural WNV 956 gi|11528013:6457-6834 200 847 60 protein NS4A nonstructural WNV 956 gi|11528013:6457-6834 199 848 60 protein NS4A nonstructural WNV 956 gi|11528013:6457-6834 198 849 60 protein NS4A nonstructural WNV 956 gi|11528013:6457-6834 197 850 60 protein NS4A nonstructural WNV 956 gi|11528013:6904-7671 517 851 60 protein NS4B nonstructural WNV 956 gi|11528013:6904-7671 513 852 60 protein NS4B nonstructural WNV 956 gi|11528013:6904-7671 512 853 60 protein NS4B nonstructural WNV 956 gi|11528013:6904-7671 511 854 60 protein NS4B nonstructural WNV 956 gi|11528013:6904-7671 510 855 60 protein NS4B nonstructural WNV 956 gi|11528013:6904-7671 509 856 60 protein NS4B nonstructural WNV 956 gi|11528013:6904-7671 508 857 60 protein NS4B nonstructural WNV 956 gi|11528013:6904-7671 507 858 60 protein NS4B nonstructural WNV 956 gi|11528013:6904-7671 506 859 60 protein NS4B nonstructural WNV 956 gi|11528013:6904-7671 505 860 60 protein NS4B nonstructural WNV 956 gi|11528013:7672-10386 2656 861 60 protein NS5 nonstructural WNV 956 gi|11528013:7672-10386 2596 862 60 protein NS5 nonstructural WNV 956 gi|11528013:7672-10386 2495 863 60 protein NS5 nonstructural WNV 956 gi|11528013:7672-10386 2116 864 60 protein NS5 nonstructural WNV 956 gi|11528013:7672-10386 2048 865 60 protein NS5 nonstructural WNV 956 gi|11528013:7672-10386 1908 866 60 protein NS5 nonstructural WNV 956 gi|11528013:7672-10386 1555 867 60 protein NS5 nonstructural WNV 956 gi|11528013:7672-10386 1354 868 60 protein NS5 nonstructural WNV 956 gi|11528013:7672-10386 1241 869 60 protein NS5 nonstructural WNV 956 gi|11528013:7672-10386 1170 870 60 protein NS5 gp1- Chikungunya gi|27754751:77-7501 7323 871 60 nonstructural polyprotein gp1- Chikungunya gi|27754751:77-7501 7262 872 60 nonstructural polyprotein gp1- Chikungunya gi|27754751:77-7501 7166 873 60 nonstructural polyprotein gp1- Chikungunya gi|27754751:77-7501 7088 874 60 nonstructural polyprotein gp1- Chikungunya gi|27754751:77-7501 7016 875 60 nonstructural polyprotein gp1- Chikungunya gi|27754751:77-7501 6874 876 60 nonstructural polyprotein gp1- Chikungunya gi|27754751:77-

7501 6745 877 60 nonstructural polyprotein gp1- Chikungunya gi|27754751:77-7501 6685 878 60 nonstructural polyprotein gp1- Chikungunya gi|27754751:77-7501 6617 879 60 nonstructural polyprotein gp1- Chikungunya gi|27754751:77-7501 6468 880 60 nonstructural polyprotein gp2-structural Chikungunya gi|27754751:7567-11313 3441 881 60 polyprotein gp2-structural Chikungunya gi|27754751:7567-11313 3376 882 60 polyprotein gp2-structural Chikungunya gi|27754751:7567-11313 3109 883 60 polyprotein gp2-structural Chikungunya gi|27754751:7567-11313 2945 884 60 polyprotein gp2-structural Chikungunya gi|27754751:7567-11313 2815 885 60 polyprotein gp2-structural Chikungunya gi|27754751:7567-11313 2750 886 60 polyprotein gp2-structural Chikungunya gi|27754751:7567-11313 2552 887 60 polyprotein gp2-structural Chikungunya gi|27754751:7567-11313 2359 888 60 polyprotein gp2-structural Chikungunya gi|27754751:7567-11313 2052 889 60 polyprotein gp2-structural Chikungunya gi|27754751:7567-11313 1733 890 60 polyprotein gp3-truncated Chikungunya gi|27754751:7567-10040 2359 891 60 polyprotein gp3-truncated Chikungunya gi|27754751:7567-10040 2052 892 60 polyprotein gp3-truncated Chikungunya gi|27754751:7567-10040 1733 893 60 polyprotein gp3-truncated Chikungunya gi|27754751:7567-10040 1631 894 60 polyprotein gp3-truncated Chikungunya gi|27754751:7567-10040 1568 895 60 polyprotein gp3-truncated Chikungunya gi|27754751:7567-10040 1294 896 60 polyprotein gp3-truncated Chikungunya gi|27754751:7567-10040 1224 897 60 polyprotein gp3-truncated Chikungunya gi|27754751:7567-10040 1134 898 60 polyprotein gp3-truncated Chikungunya gi|27754751:7567-10040 988 899 60 polyprotein gp3-truncated Chikungunya gi|27754751:7567-10040 899 900 60 polyprotein anchored capsid DEN 1 gi|9626685:95-436 266 901 60 protein C anchored capsid DEN 1 gi|9626685:95-436 236 902 60 protein C anchored capsid DEN 1 gi|9626685:95-436 216 903 60 protein C anchored capsid DEN 1 gi|9626685:95-436 193 904 60 protein C anchored capsid DEN 1 gi|9626685:95-436 165 905 60 protein C anchored capsid DEN 1 gi|9626685:95-436 145 906 60 protein C anchored capsid DEN 1 gi|9626685:95-436 125 907 60 protein C anchored capsid DEN 1 gi|9626685:95-436 105 908 60 protein C anchored capsid DEN 1 gi|9626685:95-436 81 909 60 protein C anchored capsid DEN 1 gi|9626685:95-436 57 910 60 protein C membrane DEN 1 gi|9626685:437-934 439 911 60 glycoprotein precursor M membrane DEN 1 gi|9626685:437-934 438 912 60 glycoprotein precursor M membrane DEN 1 gi|9626685:437-934 437 913 60 glycoprotein precursor M membrane DEN 1 gi|9626685:437-934 436 914 60 glycoprotein precursor M membrane DEN 1 gi|9626685:437-934 435 915 60 glycoprotein precursor M membrane DEN 1 gi|9626685:437-934 434 916 60 glycoprotein precursor M membrane DEN 1 gi|9626685:437-934 433 917 60 glycoprotein precursor M membrane DEN 1 gi|9626685:437-934 432 918 60 glycoprotein precursor M membrane DEN 1 gi|9626685:437-934 431 919 60 glycoprotein precursor M membrane DEN 1 gi|9626685:437-934 430 920 60 glycoprotein precursor M envelope DEN 1 gi|9626685:935-2419 1381 921 60 protein E envelope DEN 1 gi|9626685:935-2419 1319 922 60 protein E envelope DEN 1 gi|9626685:935-2419 1163 923 60 protein E envelope DEN 1 gi|9626685:935-2419 1082 924 60 protein E envelope DEN 1 gi|9626685:935-2419 954 925 60 protein E envelope DEN 1 gi|9626685:935-2419 892 926 60 protein E envelope DEN 1 gi|9626685:935-2419 820 927 60 protein E envelope DEN 1 gi|9626685:935-2419 734 928 60 protein E envelope DEN 1 gi|9626685:935-2419 674 929 60 protein E envelope DEN 1 gi|9626685:935-2419 550 930 60 protein E nonstructural DEN 1 gi|9626685:2420-3475 997 931 60 protein NS1 nonstructural DEN 1 gi|9626685:2420-3475 897 932 60 protein NS1 nonstructural DEN 1 gi|9626685:2420-3475 837 933 60 protein NS1 nonstructural DEN 1 gi|9626685:2420-3475 777 934 60 protein NS1 nonstructural DEN 1 gi|9626685:2420-3475 717 935 60 protein NS1 nonstructural DEN 1 gi|9626685:2420-3475 656 936 60 protein NS1 nonstructural DEN 1 gi|9626685:2420-3475 596 937 60 protein NS1 nonstructural DEN 1 gi|9626685:2420-3475 496 938 60 protein NS1 nonstructural DEN 1 gi|9626685:2420-3475 436 939 60 protein NS1 nonstructural DEN 1 gi|9626685:2420-3475 359 940 60 protein NS1 nonstructural DEN 1 gi|9626685:3476-4129 592 941 60 protein NS2A nonstructural DEN 1 gi|9626685:3476-4129 517

942 60 protein NS2A nonstructural DEN 1 gi|9626685:3476-4129 477 943 60 protein NS2A nonstructural DEN 1 gi|9626685:3476-4129 437 944 60 protein NS2A nonstructural DEN 1 gi|9626685:3476-4129 397 945 60 protein NS2A nonstructural DEN 1 gi|9626685:3476-4129 357 946 60 protein NS2A nonstructural DEN 1 gi|9626685:3476-4129 309 947 60 protein NS2A nonstructural DEN 1 gi|9626685:3476-4129 269 948 60 protein NS2A nonstructural DEN 1 gi|9626685:3476-4129 131 949 60 protein NS2A nonstructural DEN 1 gi|9626685:3476-4129 86 950 60 protein NS2A nonstructural DEN 1 gi|9626685:4130-4519 331 951 60 protein NS2B nonstructural DEN 1 gi|9626685:4130-4519 330 952 60 protein NS2B nonstructural DEN 1 gi|9626685:4130-4519 329 953 60 protein NS2B nonstructural DEN 1 gi|9626685:4130-4519 328 954 60 protein NS2B nonstructural DEN 1 gi|9626685:4130-4519 327 955 60 protein NS2B nonstructural DEN 1 gi|9626685:4130-4519 326 956 60 protein NS2B nonstructural DEN 1 gi|9626685:4130-4519 325 957 60 protein NS2B nonstructural DEN 1 gi|9626685:4130-4519 324 958 60 protein NS2B nonstructural DEN 1 gi|9626685:4130-4519 323 959 60 protein NS2B nonstructural DEN 1 gi|9626685:4130-4519 321 960 60 protein NS2B nonstructural DEN 1 gi|9626685:4520-6376 1475 961 60 protein NS3 nonstructural DEN 1 gi|9626685:4520-6376 1415 962 60 protein NS3 nonstructural DEN 1 gi|9626685:4520-6376 1213 963 60 protein NS3 nonstructural DEN 1 gi|9626685:4520-6376 1153 964 60 protein NS3 nonstructural DEN 1 gi|9626685:4520-6376 1093 965 60 protein NS3 nonstructural DEN 1 gi|9626685:4520-6376 1033 966 60 protein NS3 nonstructural DEN 1 gi|9626685:4520-6376 973 967 60 protein NS3 nonstructural DEN 1 gi|9626685:4520-6376 845 968 60 protein NS3 nonstructural DEN 1 gi|9626685:4520-6376 785 969 60 protein NS3 nonstructural DEN 1 gi|9626685:4520-6376 725 970 60 protein NS3 nonstructural DEN 1 gi|9626685:6377-6757 302 971 60 protein NS4A nonstructural DEN 1 gi|9626685:6377-6757 231 972 60 protein NS4A nonstructural DEN 1 gi|9626685:6377-6757 208 973 60 protein NS4A nonstructural DEN 1 gi|9626685:6377-6757 154 974 60 protein NS4A nonstructural DEN 1 gi|9626685:6377-6757 134 975 60 protein NS4A nonstructural DEN 1 gi|9626685:6377-6757 113 976 60 protein NS4A nonstructural DEN 1 gi|9626685:6377-6757 86 977 60 protein NS4A nonstructural DEN 1 gi|9626685:6377-6757 66 978 60 protein NS4A nonstructural DEN 1 gi|9626685:6377-6757 23 979 60 protein NS4A nonstructural DEN 1 gi|9626685:6377-6757 3 980 60 protein NS4A nonstructural DEN 1 gi|9626685:6827-7573 685 981 60 protein NS4B nonstructural DEN 1 gi|9626685:6827-7573 634 982 60 protein NS4B nonstructural DEN 1 gi|9626685:6827-7573 506 983 60 protein NS4B nonstructural DEN 1 gi|9626685:6827-7573 466 984 60 protein NS4B nonstructural DEN 1 gi|9626685:6827-7573 424 985 60 protein NS4B nonstructural DEN 1 gi|9626685:6827-7573 383 986 60 protein NS4B nonstructural DEN 1 gi|9626685:6827-7573 336 987 60 protein NS4B nonstructural DEN 1 gi|9626685:6827-7573 224 988 60 protein NS4B nonstructural DEN 1 gi|9626685:6827-7573 184 989 60 protein NS4B nonstructural DEN 1 gi|9626685:6827-7573 144 990 60 protein NS4B nonstructural DEN 1 gi|9626685:7574-10270 2637 991 60 protein NS5 nonstructural DEN 1 gi|9626685:7574-10270 2577 992 60 protein NS5 nonstructural DEN 1 gi|9626685:7574-10270 2508 993 60 protein NS5 nonstructural DEN 1 gi|9626685:7574-10270 2425 994 60 protein NS5 nonstructural DEN 1 gi|9626685:7574-10270 2276 995 60 protein NS5 nonstructural DEN 1 gi|9626685:7574-10270 2102 996 60 protein NS5 nonstructural DEN 1 gi|9626685:7574-10270 2042 997 60 protein NS5 nonstructural DEN 1 gi|9626685:7574-10270 1982 998 60 protein NS5 nonstructural DEN 1 gi|9626685:7574-10270 1919 999 60 protein NS5 nonstructural DEN 1 gi|9626685:7574-10270 1857 1000 60 protein NS5 anchored capsid DEN 2 gi|158976983:97-438 281 1001 60 protein C anchored capsid DEN 2 gi|158976983:97-438 280 1002 60 protein C anchored capsid DEN 2 gi|158976983:97-438 279 1003 60 protein C anchored capsid DEN 2 gi|158976983:97-438 278 1004 60 protein C anchored capsid DEN 2 gi|158976983:97-438 277 1005 60 protein C anchored capsid DEN 2 gi|158976983:97-438 276 1006 60 protein C anchored capsid DEN 2 gi|158976983:97-438 275 1007 60 protein C anchored capsid DEN 2 gi|158976983:97-438 274 1008 60 protein C anchored capsid DEN 2

gi|158976983:97-438 273 1009 60 protein C anchored capsid DEN 2 gi|158976983:97-438 272 1010 60 protein C membrane DEN 2 gi|158976983:439-936 439 1011 60 glycoprotein precursor M membrane DEN 2 gi|158976983:439-936 419 1012 60 glycoprotein precursor M membrane DEN 2 gi|158976983:439-936 366 1013 60 glycoprotein precursor M membrane DEN 2 gi|158976983:439-936 334 1014 60 glycoprotein precursor M membrane DEN 2 gi|158976983:439-936 314 1015 60 glycoprotein precursor M membrane DEN 2 gi|158976983:439-936 254 1016 60 glycoprotein precursor M membrane DEN 2 gi|158976983:439-936 229 1017 60 glycoprotein precursor M membrane DEN 2 gi|158976983:439-936 60 1018 60 glycoprotein precursor M membrane DEN 2 gi|158976983:439-936 40 1019 60 glycoprotein precursor M membrane DEN 2 gi|158976983:439-936 20 1020 60 glycoprotein precursor M envelope DEN 2 gi|158976983:937-2421 1422 1021 60 protein E envelope DEN 2 gi|158976983:937-2421 1362 1022 60 protein E envelope DEN 2 gi|158976983:937-2421 1286 1023 60 protein E envelope DEN 2 gi|158976983:937-2421 1186 1024 60 protein E envelope DEN 2 gi|158976983:937-2421 1126 1025 60 protein E envelope DEN 2 gi|158976983:937-2421 1066 1026 60 protein E envelope DEN 2 gi|158976983:937-2421 1006 1027 60 protein E envelope DEN 2 gi|158976983:937-2421 946 1028 60 protein E envelope DEN 2 gi|158976983:937-2421 886 1029 60 protein E envelope DEN 2 gi|158976983:937-2421 826 1030 60 protein E nonstructural DEN 2 gi|158976983:2422-3477 997 1031 60 protein NS1 nonstructural DEN 2 gi|158976983:2422-3477 916 1032 60 protein NS1 nonstructural DEN 2 gi|158976983:2422-3477 827 1033 60 protein NS1 nonstructural DEN 2 gi|158976983:2422-3477 767 1034 60 protein NS1 nonstructural DEN 2 gi|158976983:2422-3477 707 1035 60 protein NS1 nonstructural DEN 2 gi|158976983:2422-3477 647 1036 60 protein NS1 nonstructural DEN 2 gi|158976983:2422-3477 587 1037 60 protein NS1 nonstructural DEN 2 gi|158976983:2422-3477 520 1038 60 protein NS1 nonstructural DEN 2 gi|158976983:2422-3477 460 1039 60 protein NS1 nonstructural DEN 2 gi|158976983:2422-3477 362 1040 60 protein NS1 nonstructural DEN 2 gi|158976983:3478-4131 550 1041 60 protein NS2A nonstructural DEN 2 gi|158976983:3478-4131 508 1042 60 protein NS2A nonstructural DEN 2 gi|158976983:3478-4131 468 1043 60 protein NS2A nonstructural DEN 2 gi|158976983:3478-4131 428 1044 60 protein NS2A nonstructural DEN 2 gi|158976983:3478-4131 388 1045 60 protein NS2A nonstructural DEN 2 gi|158976983:3478-4131 346 1046 60 protein NS2A nonstructural DEN 2 gi|158976983:3478-4131 306 1047 60 protein NS2A nonstructural DEN 2 gi|158976983:3478-4131 266 1048 60 protein NS2A nonstructural DEN 2 gi|158976983:3478-4131 219 1049 60 protein NS2A nonstructural DEN 2 gi|158976983:3478-4131 119 1050 60 protein NS2A nonstructural DEN 2 gi|158976983:4132-4521 328 1051 60 protein NS2B nonstructural DEN 2 gi|158976983:4132-4521 327 1052 60 protein NS2B nonstructural DEN 2 gi|158976983:4132-4521 326 1053 60 protein NS2B nonstructural DEN 2 gi|158976983:4132-4521 325 1054 60 protein NS2B nonstructural DEN 2 gi|158976983:4132-4521 324 1055 60 protein NS2B nonstructural DEN 2 gi|158976983:4132-4521 306 1056 60 protein NS2B nonstructural DEN 2 gi|158976983:4132-4521 298 1057 60 protein NS2B nonstructural DEN 2 gi|158976983:4132-4521 297 1058 60 protein NS2B nonstructural DEN 2 gi|158976983:4132-4521 296 1059 60 protein NS2B nonstructural DEN 2 gi|158976983:4132-4521 295 1060 60 protein NS2B nonstructural DEN 2 gi|158976983:4522-6375 1795 1061 60 protein NS3 nonstructural DEN 2 gi|158976983:4522-6375 1735 1062 60 protein NS3 nonstructural DEN 2 gi|158976983:4522-6375 1675 1063 60 protein NS3 nonstructural DEN 2 gi|158976983:4522-6375 1590 1064 60 protein NS3 nonstructural DEN 2 gi|158976983:4522-6375 1509 1065 60 protein NS3 nonstructural DEN 2 gi|158976983:4522-6375 1449 1066 60 protein NS3 nonstructural DEN 2 gi|158976983:4522-6375 1389 1067 60 protein NS3 nonstructural DEN 2 gi|158976983:4522-6375 1246 1068 60 protein NS3 nonstructural DEN 2 gi|158976983:4522-6375 1186 1069 60 protein NS3 nonstructural DEN 2 gi|158976983:4522-6375 1126 1070 60 protein NS3 nonstructural DEN 2 gi|158976983:6376-6756 312 1071 60 protein NS4A nonstructural DEN 2 gi|158976983:6376-6756 311 1072 60 protein

NS4A nonstructural DEN 2 gi|158976983:6376-6756 310 1073 60 protein NS4A nonstructural DEN 2 gi|158976983:6376-6756 309 1074 60 protein NS4A nonstructural DEN 2 gi|158976983:6376-6756 308 1075 60 protein NS4A nonstructural DEN 2 gi|158976983:6376-6756 307 1076 60 protein NS4A nonstructural DEN 2 gi|158976983:6376-6756 306 1077 60 protein NS4A nonstructural DEN 2 gi|158976983:6376-6756 305 1078 60 protein NS4A nonstructural DEN 2 gi|158976983:6376-6756 304 1079 60 protein NS4A nonstructural DEN 2 gi|158976983:6376-6756 303 1080 60 protein NS4A nonstructural DEN 2 gi|158976983:6826-7569 682 1081 60 protein NS4B nonstructural DEN 2 gi|158976983:6826-7569 632 1082 60 protein NS4B nonstructural DEN 2 gi|158976983:6826-7569 532 1083 60 protein NS4B nonstructural DEN 2 gi|158976983:6826-7569 491 1084 60 protein NS4B nonstructural DEN 2 gi|158976983:6826-7569 451 1085 60 protein NS4B nonstructural DEN 2 gi|158976983:6826-7569 332 1086 60 protein NS4B nonstructural DEN 2 gi|158976983:6826-7569 287 1087 60 protein NS4B nonstructural DEN 2 gi|158976983:6826-7569 168 1088 60 protein NS4B nonstructural DEN 2 gi|158976983:6826-7569 128 1089 60 protein NS4B nonstructural DEN 2 gi|158976983:6826-7569 6 1090 60 protein NS4B RNA- DEN 2 gi|158976983:7570-10269 2641 1091 60 dependent RNA pol. NS5 RNA- DEN 2 gi|158976983:7570-10269 2581 1092 60 dependent RNA pol. NS5 RNA- DEN 2 gi|158976983:7570-10269 2505 1093 60 dependent RNA pol. NS5 RNA- DEN 2 gi|158976983:7570-10269 2440 1094 60 dependent RNA pol. NS5 RNA- DEN 2 gi|158976983:7570-10269 2379 1095 60 dependent RNA pol. NS5 RNA- DEN 2 gi|158976983:7570-10269 2152 1096 60 dependent RNA pol. NS5 RNA- DEN 2 gi|158976983:7570-10269 2092 1097 60 dependent RNA pol. NS5 RNA- DEN 2 gi|158976983:7570-10269 2032 1098 60 dependent RNA pol. NS5 RNA- DEN 2 gi|158976983:7570-10269 1969 1099 60 dependent RNA pol. NS5 RNA- DEN 2 gi|158976983:7570-10269 1894 1100 60 dependent RNA pol. NS5 anchored capsid DEN 3 gi|163644368:95-436 283 1101 60 protein C anchored capsid DEN 3 gi|163644368:95-436 282 1102 60 protein C anchored capsid DEN 3 gi|163644368:95-436 281 1103 60 protein C anchored capsid DEN 3 gi|163644368:95-436 280 1104 60 protein C anchored capsid DEN 3 gi|163644368:95-436 279 1105 60 protein C anchored capsid DEN 3 gi|163644368:95-436 278 1106 60 protein C anchored capsid DEN 3 gi|163644368:95-436 277 1107 60 protein C anchored capsid DEN 3 gi|163644368:95-436 276 1108 60 protein C anchored capsid DEN 3 gi|163644368:95-436 275 1109 60 protein C anchored capsid DEN 3 gi|163644368:95-436 274 1110 60 protein C membrane DEN 3 gi|163644368:437-934 439 1111 60 glycoprotein precursor M membrane DEN 3 gi|163644368:437-934 438 1112 60 glycoprotein precursor M membrane DEN 3 gi|163644368:437-934 437 1113 60 glycoprotein precursor M membrane DEN 3 gi|163644368:437-934 436 1114 60 glycoprotein precursor M membrane DEN 3 gi|163644368:437-934 435 1115 60 glycoprotein precursor M membrane DEN 3 gi|163644368:437-934 434 1116 60 glycoprotein precursor M membrane DEN 3 gi|163644368:437-934 432 1117 60 glycoprotein precursor M membrane DEN 3 gi|163644368:437-934 431 1118 60 glycoprotein precursor M membrane DEN 3 gi|163644368:437-934 430 1119 60 glycoprotein precursor M membrane DEN 3 gi|163644368:437-934 429 1120 60 glycoprotein precursor M envelope DEN 3 gi|163644368:935-2413 1420 1121 60 protein E envelope DEN 3 gi|163644368:935-2413 1359 1122 60 protein E envelope DEN 3 gi|163644368:935-2413 1296 1123 60 protein E envelope DEN 3 gi|163644368:935-2413 1137 1124 60 protein E envelope DEN 3 gi|163644368:935-2413 1077 1125 60 protein E envelope DEN 3 gi|163644368:935-2413 994 1126 60 protein E envelope DEN 3 gi|163644368:935-2413 926 1127 60 protein E envelope DEN 3 gi|163644368:935-2413 866 1128 60 protein E envelope DEN 3 gi|163644368:935-2413 805 1129 60 protein E envelope DEN 3 gi|163644368:935-2413 719 1130 60 protein E nonstructural DEN 3 gi|163644368:2414-3469 997 1131 60 protein NS1 nonstructural DEN 3 gi|163644368:2414-3469 879 1132 60 protein NS1 nonstructural DEN 3 gi|163644368:2414-3469 816 1133 60 protein NS1 nonstructural DEN 3

gi|163644368:2414-3469 711 1134 60 protein NS1 nonstructural DEN 3 gi|163644368:2414-3469 651 1135 60 protein NS1 nonstructural DEN 3 gi|163644368:2414-3469 591 1136 60 protein NS1 nonstructural DEN 3 gi|163644368:2414-3469 492 1137 60 protein NS1 nonstructural DEN 3 gi|163644368:2414-3469 380 1138 60 protein NS1 nonstructural DEN 3 gi|163644368:2414-3469 320 1139 60 protein NS1 nonstructural DEN 3 gi|163644368:2414-3469 256 1140 60 protein NS1 nonstructural DEN 3 gi|163644368:3470-4123 592 1141 60 protein NS2A nonstructural DEN 3 gi|163644368:3470-4123 511 1142 60 protein NS2A nonstructural DEN 3 gi|163644368:3470-4123 463 1143 60 protein NS2A nonstructural DEN 3 gi|163644368:3470-4123 423 1144 60 protein NS2A nonstructural DEN 3 gi|163644368:3470-4123 383 1145 60 protein NS2A nonstructural DEN 3 gi|163644368:3470-4123 301 1146 60 protein NS2A nonstructural DEN 3 gi|163644368:3470-4123 260 1147 60 protein NS2A nonstructural DEN 3 gi|163644368:3470-4123 220 1148 60 protein NS2A nonstructural DEN 3 gi|163644368:3470-4123 117 1149 60 protein NS2A nonstructural DEN 3 gi|163644368:3470-4123 76 1150 60 protein NS2A nonstructural DEN 3 gi|163644368:4124-4513 325 1151 60 protein NS2B nonstructural DEN 3 gi|163644368:4124-4513 324 1152 60 protein NS2B nonstructural DEN 3 gi|163644368:4124-4513 323 1153 60 protein NS2B nonstructural DEN 3 gi|163644368:4124-4513 322 1154 60 protein NS2B nonstructural DEN 3 gi|163644368:4124-4513 321 1155 60 protein NS2B nonstructural DEN 3 gi|163644368:4124-4513 319 1156 60 protein NS2B nonstructural DEN 3 gi|163644368:4124-4513 318 1157 60 protein NS2B nonstructural DEN 3 gi|163644368:4124-4513 317 1158 60 protein NS2B nonstructural DEN 3 gi|163644368:4124-4513 313 1159 60 protein NS2B nonstructural DEN 3 gi|163644368:4124-4513 312 1160 60 protein NS2B nonstructural DEN 3 gi|163644368:4514-6370 1767 1161 60 protein NS3 nonstructural DEN 3 gi|163644368:4514-6370 1698 1162 60 protein NS3 nonstructural DEN 3 gi|163644368:4514-6370 1638 1163 60 protein NS3 nonstructural DEN 3 gi|163644368:4514-6370 1493 1164 60 protein NS3 nonstructural DEN 3 gi|163644368:4514-6370 1402 1165 60 protein NS3 nonstructural DEN 3 gi|163644368:4514-6370 1260 1166 60 protein NS3 nonstructural DEN 3 gi|163644368:4514-6370 1200 1167 60 protein NS3 nonstructural DEN 3 gi|163644368:4514-6370 1137 1168 60 protein NS3 nonstructural DEN 3 gi|163644368:4514-6370 1077 1169 60 protein NS3 nonstructural DEN 3 gi|163644368:4514-6370 1016 1170 60 protein NS3 nonstructural DEN 3 gi|163644368:6371-6751 322 1171 60 protein NS4A nonstructural DEN 3 gi|163644368:6371-6751 321 1172 60 protein NS4A nonstructural DEN 3 gi|163644368:6371-6751 320 1173 60 protein NS4A nonstructural DEN 3 gi|163644368:6371-6751 319 1174 60 protein NS4A nonstructural DEN 3 gi|163644368:6371-6751 318 1175 60 protein NS4A nonstructural DEN 3 gi|163644368:6371-6751 317 1176 60 protein NS4A nonstructural DEN 3 gi|163644368:6371-6751 316 1177 60 protein NS4A nonstructural DEN 3 gi|163644368:6371-6751 315 1178 60 protein NS4A nonstructural DEN 3 gi|163644368:6371-6751 314 1179 60 protein NS4A nonstructural DEN 3 gi|163644368:6371-6751 313 1180 60 protein NS4A nonstructural DEN 3 gi|163644368:6821-7564 685 1181 60 protein NS4B nonstructural DEN 3 gi|163644368:6821-7564 621 1182 60 protein NS4B nonstructural DEN 3 gi|163644368:6821-7564 559 1183 60 protein NS4B nonstructural DEN 3 gi|163644368:6821-7564 492 1184 60 protein NS4B nonstructural DEN 3 gi|163644368:6821-7564 426 1185 60 protein NS4B nonstructural DEN 3 gi|163644368:6821-7564 350 1186 60 protein NS4B nonstructural DEN 3 gi|163644368:6821-7564 290 1187 60 protein NS4B nonstructural DEN 3 gi|163644368:6821-7564 208 1188 60 protein NS4B nonstructural DEN 3 gi|163644368:6821-7564 148 1189 60 protein NS4B nonstructural DEN 3 gi|163644368:6821-7564 37 1190 60 protein NS4B nonstructural DEN 3 gi|163644368:7565-10264 2626 1191 60 protein NS5 nonstructural DEN 3 gi|163644368:7565-10264 2516 1192 60 protein NS5 nonstructural DEN 3 gi|163644368:7565-10264 2456 1193 60 protein NS5 nonstructural DEN 3 gi|163644368:7565-10264 2390 1194 60 protein NS5 nonstructural DEN 3 gi|163644368:7565-10264 2300 1195 60 protein NS5 nonstructural DEN 3 gi|163644368:7565-10264 2198 1196 60 protein NS5 nonstructural DEN 3 gi|163644368:7565-

10264 2137 1197 60 protein NS5 nonstructural DEN 3 gi|163644368:7565-10264 2048 1198 60 protein NS5 nonstructural DEN 3 gi|163644368:7565-10264 1963 1199 60 protein NS5 nonstructural DEN 4 gi|163644368:7565-10264 1903 1200 60 protein NS5 anchored capsid DEN 4 gi|12084822:102-440 278 1201 60 protein C anchored capsid DEN 4 gi|12084822:102-440 277 1202 60 protein C anchored capsid DEN 4 gi|12084822:102-440 276 1203 60 protein C anchored capsid DEN 4 gi|12084822:102-440 275 1204 60 protein C anchored capsid DEN 4 gi|12084822:102-440 274 1205 60 protein C anchored capsid DEN 4 gi|12084822:102-440 273 1206 60 protein C anchored capsid DEN 4 gi|12084822:102-440 272 1207 60 protein C anchored capsid DEN 4 gi|12084822:102-440 271 1208 60 protein C anchored capsid DEN 4 gi|12084822:102-440 270 1209 60 protein C anchored capsid DEN 4 gi|12084822:102-440 269 1210 60 protein C membrane DEN 4 gi|12084822:441-938 422 1211 60 glycoprotein precursor M membrane DEN 4 gi|12084822:441-938 402 1212 60 glycoprotein precursor M membrane DEN 4 gi|12084822:441-938 380 1213 60 glycoprotein precursor M membrane DEN 4 gi|12084822:441-938 281 1214 60 glycoprotein precursor M membrane DEN 4 gi|12084822:441-938 259 1215 60 glycoprotein precursor M membrane DEN 4 gi|12084822:441-938 140 1216 60 glycoprotein precursor M membrane DEN 4 gi|12084822:441-938 96 1217 60 glycoprotein precursor M membrane DEN 4 gi|12084822:441-938 73 1218 60 glycoprotein precursor M membrane DEN 4 gi|12084822:441-938 50 1219 60 glycoprotein precursor M membrane DEN 4 gi|12084822:441-938 26 1220 60 glycoprotein precursor M envelope DEN 4 gi|12084822:939-2423 1405 1221 60 protein E envelope DEN 4 gi|12084822:939-2423 1345 1222 60 protein E envelope DEN 4 gi|12084822:939-2423 1285 1223 60 protein E envelope DEN 4 gi|12084822:939-2423 1216 1224 60 protein E envelope DEN 4 gi|12084822:939-2423 1156 1225 60 protein E envelope DEN 4 gi|12084822:939-2423 1096 1226 60 protein E envelope DEN 4 gi|12084822:939-2423 1026 1227 60 protein E envelope DEN 4 gi|12084822:939-2423 966 1228 60 protein E envelope DEN 4 gi|12084822:939-2423 906 1229 60 protein E envelope DEN 4 gi|12084822:939-2423 846 1230 60 protein E non-structural DEN 4 gi|12084822:2424-3479 993 1231 60 protein NS1 non-structural DEN 4 gi|12084822:2424-3479 823 1232 60 protein NS1 non-structural DEN 4 gi|12084822:2424-3479 710 1233 60 protein NS1 non-structural DEN 4 gi|12084822:2424-3479 638 1234 60 protein NS1 non-structural DEN 4 gi|12084822:2424-3479 570 1235 60 protein NS1 non-structural DEN 4 gi|12084822:2424-3479 510 1236 60 protein NS1 non-structural DEN 4 gi|12084822:2424-3479 450 1237 60 protein NS1 non-structural DEN 4 gi|12084822:2424-3479 390 1238 60 protein NS1 non-structural DEN 4 gi|12084822:2424-3479 330 1239 60 protein NS1 non-structural DEN 4 gi|12084822:2424-3479 209 1240 60 protein NS1 non-structural DEN 4 gi|12084822:3480-4133 576 1241 60 protein NS2A non-structural DEN 4 gi|12084822:3480-4133 536 1242 60 protein NS2A non-structural DEN 4 gi|12084822:3480-4133 496 1243 60 protein NS2A non-structural DEN 4 gi|12084822:3480-4133 456 1244 60 protein NS2A non-structural DEN 4 gi|12084822:3480-4133 416 1245 60 protein NS2A non-structural DEN 4 gi|12084822:3480-4133 376 1246 60 protein NS2A non-structural DEN 4 gi|12084822:3480-4133 336 1247 60 protein NS2A non-structural DEN 4 gi|12084822:3480-4133 296 1248 60 protein NS2A non-structural DEN 4 gi|12084822:3480-4133 256 1249 60 protein NS2A non-structural DEN 4 gi|12084822:3480-4133 90 1250 60 protein NS2A non-structural DEN 4 gi|12084822:4134-4523 331 1251 60 protein NS2B non-structural DEN 4 gi|12084822:4134-4523 330 1252 60 protein NS2B non-structural DEN 4 gi|12084822:4134-4523 329 1253 60 protein NS2B non-structural DEN 4 gi|12084822:4134-4523 328 1254 60 protein NS2B non-structural DEN 4 gi|12084822:4134-4523 327 1255 60 protein NS2B non-structural DEN 4 gi|12084822:4134-4523 326 1256 60 protein NS2B non-structural DEN 4 gi|12084822:4134-4523 325 1257 60 protein NS2B non-structural DEN 4 gi|12084822:4134-4523 324 1258 60 protein NS2B non-structural DEN 4 gi|12084822:4134-4523 323 1259 60 protein NS2B non-structural DEN 4 gi|12084822:4134-4523 311 1260 60 protein NS2B non-structural DEN 4 gi|12084822:4524-6377 1780 1261 60 protein NS3 non-structural DEN 4 gi|12084822:4524-6377 1679 1262 60 protein

NS3 non-structural DEN 4 gi|12084822:4524-6377 1591 1263 60 protein NS3 non-structural DEN 4 gi|12084822:4524-6377 1513 1264 60 protein NS3 non-structural DEN 4 gi|12084822:4524-6377 1442 1265 60 protein NS3 non-structural DEN 4 gi|12084822:4524-6377 1210 1266 60 protein NS3 non-structural DEN 4 gi|12084822:4524-6377 1150 1267 60 protein NS3 non-structural DEN 4 gi|12084822:4524-6377 1088 1268 60 protein NS3 non-structural DEN 4 gi|12084822:4524-6377 1027 1269 60 protein NS3 non-structural DEN 4 gi|12084822:4524-6377 840 1270 60 protein NS3 non-structural DEN 4 gi|12084822:6378-6758 322 1271 60 protein NS4A non-structural DEN 4 gi|12084822:6378-6758 321 1272 60 protein NS4A non-structural DEN 4 gi|12084822:6378-6758 320 1273 60 protein NS4A non-structural DEN 4 gi|12084822:6378-6758 319 1274 60 protein NS4A non-structural DEN 4 gi|12084822:6378-6758 318 1275 60 protein NS4A non-structural DEN 4 gi|12084822:6378-6758 317 1276 60 protein NS4A non-structural DEN 4 gi|12084822:6378-6758 316 1277 60 protein NS4A non-structural DEN 4 gi|12084822:6378-6758 315 1278 60 protein NS4A non-structural DEN 4 gi|12084822:6378-6758 314 1279 60 protein NS4A non-structural DEN 4 gi|12084822:6378-6758 313 1280 60 protein NS4A non-structural DEN 4 gi|12084822:6828-7562 657 1281 60 protein NS4B non-structural DEN 4 gi|12084822:6828-7562 536 1282 60 protein NS4B non-structural DEN 4 gi|12084822:6828-7562 506 1283 60 protein NS4B non-structural DEN 4 gi|12084822:6828-7562 475 1284 60 protein NS4B non-structural DEN 4 gi|12084822:6828-7562 445 1285 60 protein NS4B non-structural DEN 4 gi|12084822:6828-7562 414 1286 60 protein NS4B non-structural DEN 4 gi|12084822:6828-7562 326 1287 60 protein NS4B non-structural DEN 4 gi|12084822:6828-7562 296 1288 60 protein NS4B non-structural DEN 4 gi|12084822:6828-7562 37 1289 60 protein NS4B non-structural DEN 4 gi|12084822:6828-7562 7 1290 60 protein NS4B non-structural DEN 4 gi|12084822:7563-10262 2641 1291 60 protein NS5 non-structural DEN 4 gi|12084822:7563-10262 2510 1292 60 protein NS5 non-structural DEN 4 gi|12084822:7563-10262 2450 1293 60 protein NS5 non-structural DEN 4 gi|12084822:7563-10262 2379 1294 60 protein NS5 non-structural DEN 4 gi|12084822:7563-10262 2153 1295 60 protein NS5 non-structural DEN 4 gi|12084822:7563-10262 2093 1296 60 protein NS5 non-structural DEN 4 gi|12084822:7563-10262 1925 1297 60 protein NS5 non-structural DEN 4 gi|12084822:7563-10262 1865 1298 60 protein NS5 non-structural DEN 4 gi|12084822:7563-10262 1805 1299 60 protein NS5 non-structural DEN 4 gi|12084822:7563-10262 1702 1300 60 protein NS5 polyprotein GB virus C/ gi|9628705:459-9080 8205 1301 60 precursor Hepatitis G polyprotein GB virus C/ gi|9628705:459-9080 7786 1302 60 precursor Hepatitis G polyprotein GB virus C/ gi|9628705:459-9080 7305 1303 60 precursor Hepatitis G polyprotein GB virus C/ gi|9628705:459-9080 7004 1304 60 precursor Hepatitis G polyprotein GB virus C/ gi|9628705:459-9080 6890 1305 60 precursor Hepatitis G polyprotein GB virus C/ gi|9628705:459-9080 6638 1306 60 precursor Hepatitis G polyprotein GB virus C/ gi|9628705:459-9080 5864 1307 60 precursor Hepatitis G polyprotein GB virus C/ gi|9628705:459-9080 5551 1308 60 precursor Hepatitis G polyprotein GB virus C/ gi|9628705:459-9080 5488 1309 60 precursor Hepatitis G polyprotein GB virus C/ gi|9628705:459-9080 3943 1310 60 precursor Hepatitis G putative E1 GB virus C/ gi|9628705:459-1538 545 1311 60 protein Hepatitis G putative E1 GB virus C/ gi|9628705:459-1538 1021 1312 60 protein Hepatitis G putative E1 GB virus C/ gi|9628705:459-1538 964 1313 60 protein Hepatitis G putative E1 GB virus C/ gi|9628705:459-1538 924 1314 60 protein Hepatitis G putative E1 GB virus C/ gi|9628705:459-1538 879 1315 60 protein Hepatitis G putative E1 GB virus C/ gi|9628705:459-1538 783 1316 60 protein Hepatitis G putative E1 GB virus C/ gi|9628705:459-1538 737 1317 60 protein Hepatitis G putative E1 GB virus C/ gi|9628705:459-1538 644 1318 60 protein Hepatitis G putative E1 GB virus C/ gi|9628705:459-1538 601 1319 60 protein Hepatitis G putative E1 GB virus C/ gi|9628705:459-1538 505 1320 60 protein Hepatitis G putative E2 GB virus C/ gi|9628705:1539-2474 877 1321 60 protein Hepatitis G putative E2 GB virus C/ gi|9628705:1539-2474 847 1322 60 protein Hepatitis G putative E2 GB virus C/

gi|9628705:1539-2474 817 1323 60 protein Hepatitis G putative E2 GB virus C/ gi|9628705:1539-2474 671 1324 60 protein Hepatitis G putative E2 GB virus C/ gi|9628705:1539-2474 641 1325 60 protein Hepatitis G putative E2 GB virus C/ gi|9628705:1539-2474 611 1326 60 protein Hepatitis G putative E2 GB virus C/ gi|9628705:1539-2474 573 1327 60 protein Hepatitis G putative E2 GB virus C/ gi|9628705:1539-2474 543 1328 60 protein Hepatitis G putative E2 GB virus C/ gi|9628705:1539-2474 502 1329 60 protein Hepatitis G putative E2 GB virus C/ gi|9628705:1539-2474 310 1330 60 protein Hepatitis G putative protein GB virus C/ gi|9628705:2475-3233 700 1331 60 p7-NS2 Hepatitis G putative protein GB virus C/ gi|9628705:2475-3233 594 1332 60 p7-NS2 Hepatitis G putative protein GB virus C/ gi|9628705:2475-3233 564 1333 60 p7-NS2 Hepatitis G putative protein GB virus C/ gi|9628705:2475-3233 532 1334 60 p7-NS2 Hepatitis G putative protein GB virus C/ gi|9628705:2475-3233 502 1335 60 p7-NS2 Hepatitis G putative protein GB virus C/ gi|9628705:2475-3233 472 1336 60 p7-NS2 Hepatitis G putative protein GB virus C/ gi|9628705:2475-3233 350 1337 60 p7-NS2 Hepatitis G putative protein GB virus C/ gi|9628705:2475-3233 320 1338 60 p7-NS2 Hepatitis G putative protein GB virus C/ gi|9628705:2475-3233 286 1339 60 p7-NS2 Hepatitis G putative protein GB virus C/ gi|9628705:2475-3233 194 1340 60 p7-NS2 Hepatitis G NS3 GB virus C/ gi|9628705:3234-5111 1168 1341 60 proteinase/ Hepatitis G ATPase/helicase NS3 GB virus C/ gi|9628705:3234-5111 1162 1342 60 proteinase/ Hepatitis G ATPase/helicase NS3 GB virus C/ gi|9628705:3234-5111 1156 1343 60 proteinase/ Hepatitis G ATPase/helicase NS3 GB virus C/ gi|9628705:3234-5111 1155 1344 60 proteinase/ Hepatitis G ATPase/helicase NS3 GB virus C/ gi|9628705:3234-5111 1154 1345 60 proteinase/ Hepatitis G ATPase/helicase NS3 GB virus C/ gi|9628705:3234-5111 1153 1346 60 proteinase/ Hepatitis G ATPase/helicase NS3 GB virus C/ gi|9628705:3234-5111 1152 1347 60 proteinase/ Hepatitis G ATPase/helicase NS3 GB virus C/ gi|9628705:3234-5111 1146 1348 60 proteinase/ Hepatitis G ATPase/helicase NS3 GB virus C/ gi|9628705:3234-5111 1145 1349 60 proteinase/ Hepatitis G ATPase/helicase NS3 GB virus C/ gi|9628705:3234-5111 1144 1350 60 proteinase/ Hepatitis G ATPase/helicase putative NS4A GB virus C/ gi|9628705:5112-5309 45 1351 60 protein Hepatitis G putative NS4A GB virus C/ gi|9628705:5112-5309 44 1352 60 protein Hepatitis G putative NS4A GB virus C/ gi|9628705:5112-5309 43 1353 60 protein Hepatitis G putative NS4A GB virus C/ gi|9628705:5112-5309 42 1354 60 protein Hepatitis G putative NS4A GB virus C/ gi|9628705:5112-5309 16 1355 60 protein Hepatitis G putative NS4A GB virus C/ gi|9628705:5112-5309 13 1356 60 protein Hepatitis G putative NS4A GB virus C/ gi|9628705:5112-5309 12 1357 60 protein Hepatitis G putative NS4A GB virus C/ gi|9628705:5112-5309 11 1358 60 protein Hepatitis G putative NS4A GB virus C/ gi|9628705:5112-5309 6 1359 60 protein Hepatitis G putative NS4A GB virus C/ gi|9628705:5112-5309 5 1360 60 protein Hepatitis G putative NS4B GB virus C/ gi|9628705:5310-6152 700 1361 60 protein Hepatitis G putative NS4B GB virus C/ gi|9628705:5310-6152 699 1362 60 protein Hepatitis G putative NS4B GB virus C/ gi|9628705:5310-6152 698 1363 60 protein Hepatitis G putative NS4B GB virus C/ gi|9628705:5310-6152 696 1364 60 protein Hepatitis G putative NS4B GB virus C/ gi|9628705:5310-6152 695 1365 60 protein Hepatitis G putative NS4B GB virus C/ gi|9628705:5310-6152 694 1366 60 protein Hepatitis G putative NS4B GB virus C/ gi|9628705:5310-6152 693 1367 60 protein Hepatitis G putative NS4B GB virus C/ gi|9628705:5310-6152 692 1368 60 protein Hepatitis G putative NS4B GB virus C/ gi|9628705:5310-6152 691 1369 60 protein Hepatitis G putative NS4B GB virus C/ gi|9628705:5310-6152 690 1370 60 protein Hepatitis G putative NS5A GB virus C/ gi|9628705:6153-7388 1174 1371 60 protein Hepatitis G putative NS5A GB virus C/ gi|9628705:6153-7388 1173 1372 60 protein Hepatitis G putative NS5A GB virus C/ gi|9628705:6153-7388 1155 1373 60 protein Hepatitis G putative NS5A GB virus C/ gi|9628705:6153-7388 1154 1374 60 protein Hepatitis G putative NS5A GB virus C/ gi|9628705:6153-7388 1153 1375 60 protein Hepatitis G putative NS5A GB virus C/

gi|9628705:6153-7388 944 1376 60 protein Hepatitis G putative NS5A GB virus C/ gi|9628705:6153-7388 941 1377 60 protein Hepatitis G putative NS5A GB virus C/ gi|9628705:6153-7388 940 1378 60 protein Hepatitis G putative NS5A GB virus C/ gi|9628705:6153-7388 939 1379 60 protein Hepatitis G putative NS5A GB virus C/ gi|9628705:6153-7388 936 1380 60 protein Hepatitis G putative NS5B GB virus C/ gi|9628705:7389-9077 1275 1381 60 RNA- Hepatitis G dependent RNA pol. putative NS5B GB virus C/ gi|9628705:7389-9077 1274 1382 60 RNA- Hepatitis G dependent RNA pol. putative NS5B GB virus C/ gi|9628705:7389-9077 856 1383 60 RNA- Hepatitis G dependent RNA pol. putative NS5B GB virus C/ gi|9628705:7389-9077 375 1384 60 RNA- Hepatitis G dependent RNA pol. putative NS5B GB virus C/ gi|9628705:7389-9077 374 1385 60 RNA- Hepatitis G dependent RNA pol. putative NS5B GB virus C/ gi|9628705:7389-9077 373 1386 60 RNA- Hepatitis G dependent RNA GB virus C/ pol. Hepatitis G putative NS5B GB virus C/ gi|9628705:7389-9077 372 1387 60 RNA- Hepatitis G dependent RNA pol. putative NS5B GB virus C/ gi|9628705:7389-9077 371 1388 60 RNA- Hepatitis G dependent RNA pol. putative NS5B GB virus C/ gi|9628705:7389-9077 74 1389 60 RNA- Hepatitis G dependent RNA pol. putative NS5B GB virus C/ gi|9628705:7389-9077 73 1390 60 RNA- Hepatitis G dependent RNA pol. 1A VP4b Hepatitis gi|9626732:1-805 738 1391 60 mature peptide A virus 1A VP4b Hepatitis gi|9626732:1-805 691 1392 60 mature peptide A virus 1A VP4b Hepatitis gi|9626732:1-805 568 1393 60 mature peptide A virus 1A VP4b Hepatitis gi|9626732:1-805 513 1394 60 mature peptide A virus 1A VP4b Hepatitis gi|9626732:1-805 466 1395 60 mature peptide A virus 1A VP4b Hepatitis gi|9626732:1-805 426 1396 60 mature peptide A virus 1A VP4b Hepatitis gi|9626732:1-805 378 1397 60 mature peptide A virus 1A VP4b Hepatitis gi|9626732:1-805 338 1398 60 mature peptide A virus 1A VP4b Hepatitis gi|9626732:1-805 286 1399 60 mature peptide A virus 1A VP4b Hepatitis gi|9626732:1-805 159 1400 60 mature peptide A virus 1B VP2 Hepatitis gi|9626732:804-1469 606 1401 60 mature peptide A virus 1B VP2 Hepatitis gi|9626732:804-1469 546 1402 60 mature peptide A virus 1B VP2 Hepatitis gi|9626732:804-1469 486 1403 60 mature peptide A virus 1B VP2 Hepatitis gi|9626732:804-1469 397 1404 60 mature peptide A virus 1B VP2 Hepatitis gi|9626732:804-1469 329 1405 60 mature peptide A virus 1B VP2 Hepatitis gi|9626732:804-1469 269 1406 60 mature peptide A virus 1B VP2 Hepatitis gi|9626732:804-1469 203 1407 60 mature peptide A virus 1B VP2 Hepatitis gi|9626732:804-1469 143 1408 60 mature peptide A virus 1B VP2 Hepatitis gi|9626732:804-1469 82 1409 60 mature peptide A virus 1B VP2 Hepatitis gi|9626732:804-1469 22 1410 60 mature peptide A virus 1C VP3 Hepatitis gi|9626732:1470-2207 679 1411 60 mature peptide A virus 1C VP3 Hepatitis gi|9626732:1470-2207 619 1412 60 mature peptide A virus 1C VP3 Hepatitis gi|9626732:1470-2207 559 1413 60 mature peptide A virus 1C VP3 Hepatitis gi|9626732:1470-2207 499 1414 60 mature peptide A virus 1C VP3 Hepatitis gi|9626732:1470-2207 439 1415 60 mature peptide A virus 1C VP3 Hepatitis gi|9626732:1470-2207 379 1416 60 mature peptide A virus 1C VP3 Hepatitis gi|9626732:1470-2207 316 1417 60 mature peptide A virus 1C VP3 Hepatitis gi|9626732:1470-2207 246 1418 60 mature peptide A virus 1C VP3 Hepatitis gi|9626732:1470-2207 185 1419 60 mature peptide A virus 1C VP3 Hepatitis gi|9626732:1470-2207 125 1420 60 mature peptide A virus 1D VP1 Hepatitis gi|9626732:2208-3107 841 1421 60 mature peptide A virus 1D VP1 Hepatitis gi|9626732:2208-3107 781 1422 60 mature peptide A virus 1D VP1 Hepatitis gi|9626732:2208-3107 654 1423 60 mature peptide A virus 1D VP1 Hepatitis gi|9626732:2208-3107 594 1424 60 mature peptide A virus 1D VP1 Hepatitis gi|9626732:2208-3107 534 1425 60 mature peptide A virus 1D VP1 Hepatitis gi|9626732:2208-3107 434 1426 60 mature peptide A virus 1D VP1 Hepatitis gi|9626732:2208-3107 374 1427 60 mature peptide A virus 1D VP1 Hepatitis gi|9626732:2208-3107 314 1428 60 mature peptide A virus 1D VP1 Hepatitis gi|9626732:2208-3107 249 1429 60 mature peptide A virus 1D VP1 Hepatitis gi|9626732:2208-3107 189 1430 60 mature peptide A virus 2A mature Hepatitis gi|9626732:3108-3674 494 1431 60 peptide A virus 2A mature Hepatitis gi|9626732:3108-3674 452 1432 60 peptide A virus 2A mature Hepatitis gi|9626732:3108-3674

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virus 3D mature Hepatitis gi|9626732:5949-7415 777 1499 60 peptide A virus 3D mature Hepatitis gi|9626732:5949-7415 710 1500 60 peptide A virus ORF 1- Hepatitis gi|9626440:4-5085 4891 1501 60 polyprotein E virus ORF 1- Hepatitis gi|9626440:4-5085 4569 1502 60 polyprotein E virus ORF 1- Hepatitis gi|9626440:4-5085 4395 1503 60 polyprotein E virus ORF 1- Hepatitis gi|9626440:4-5085 4138 1504 60 polyprotein E virus ORF 1- Hepatitis gi|9626440:4-5085 3840 1505 60 polyprotein E virus ORF 1- Hepatitis gi|9626440:4-5085 3594 1506 60 polyprotein E virus ORF 1- Hepatitis gi|9626440:4-5085 2791 1507 60 polyprotein E virus ORF 1- Hepatitis gi|9626440:4-5085 2548 1508 60 polyprotein E virus ORF 1- Hepatitis gi|9626440:4-5085 2130 1509 60 polyprotein E virus ORF 1- Hepatitis gi|9626440:4-5085 1211 1510 60 polyprotein E virus Viral Hepatitis gi|9626440:100-1057 15 1511 60 methyltransferase E virus Viral Hepatitis gi|9626440:100-1057 899 1512 60 methyltransferase E virus Viral Hepatitis gi|9626440:100-1057 826 1513 60 methyltransferase E virus Viral Hepatitis gi|9626440:100-1057 650 1514 60 methyltransferase E virus Viral Hepatitis gi|9626440:100-1057 590 1515 60 methyltransferase E virus Viral Hepatitis gi|9626440:100-1057 526 1516 60 methyltransferase E virus Viral Hepatitis gi|9626440:100-1057 409 1517 60 methyltransferase E virus Viral Hepatitis gi|9626440:100-1057 349 1518 60 methyltransferase E virus Viral Hepatitis gi|9626440:100-1057 190 1519 60 methyltransferase E virus Viral Hepatitis gi|9626440:100-1057 115 1520 60 methyltransferase E virus Peptidase Hepatitis gi|9626440:1294-1783 431 1521 60 C41 E virus Peptidase Hepatitis gi|9626440:1294-1783 411 1522 60 C41 E virus Peptidase Hepatitis gi|9626440:1294-1783 391 1523 60 C41 E virus Peptidase Hepatitis gi|9626440:1294-1783 371 1524 60 C41 E virus Peptidase Hepatitis gi|9626440:1294-1783 251 1525 60 C41 E virus Peptidase Hepatitis gi|9626440:1294-1783 227 1526 60 C41 E virus Peptidase Hepatitis gi|9626440:1294-1783 207 1527 60 C41 E virus Peptidase Hepatitis gi|9626440:1294-1783 126 1528 60 C41 E virus Peptidase Hepatitis gi|9626440:1294-1783 106 1529 60 C41 E virus Peptidase Hepatitis gi|9626440:1294-1783 86 1530 60 C41 E virus Viral Hepatitis gi|9626440:2914-3562 590 1531 60 helicase 1 E virus Viral Hepatitis gi|9626440:2914-3562 589 1532 60 helicase 1 E virus Viral Hepatitis gi|9626440:2914-3562 586 1533 60 helicase 1 E virus Viral Hepatitis gi|9626440:2914-3562 585 1534 60 helicase 1 E virus Viral Hepatitis gi|9626440:2914-3562 583 1535 60 helicase 1 E virus Viral Hepatitis gi|9626440:2914-3562 548 1536 60 helicase 1 E virus Viral Hepatitis gi|9626440:2914-3562 547 1537 60 helicase 1 E virus Viral Hepatitis gi|9626440:2914-3562 546 1538 60 helicase 1 E virus Viral Hepatitis gi|9626440:2914-3562 544 1539 60 helicase 1 E virus Viral Hepatitis gi|9626440:2914-3562 543 1540 60 helicase 1 E virus RNA dependent Hepatitis gi|9626440:4191-4684 382 1541 60 RNA pol. E virus RNA dependent Hepatitis gi|9626440:4191-4684 381 1542 60 RNA pol. E virus RNA dependent Hepatitis gi|9626440:4191-4684 380 1543 60 RNA pol. E virus RNA dependent Hepatitis gi|9626440:4191-4684 208 1544 60 RNA pol. E virus RNA dependent Hepatitis gi|9626440:4191-4684 207 1545 60 RNA pol. E virus RNA dependent Hepatitis gi|9626440:4191-4684 205 1546 60 RNA pol. E virus RNA dependent Hepatitis gi|9626440:4191-4684 204 1547 60 RNA pol. E virus RNA dependent Hepatitis gi|9626440:4191-4684 203 1548 60 RNA pol. E virus RNA dependent Hepatitis gi|9626440:4191-4684 202 1549 60 RNA pol. E virus RNA dependent Hepatitis gi|9626440:4191-4684 201 1550 60 RNA pol. E virus ORF 3- Hepatitis gi|9626440:5109-5453 135 1551 60 hypothetical E virus protein ORF 3- Hepatitis gi|9626440:5109-5453 134 1552 60 hypothetical E virus protein ORF 3- Hepatitis gi|9626440:5109-5453 133 1553 60 hypothetical E virus protein ORF 3- Hepatitis gi|9626440:5109-5453 132 1554 60 hypothetical E virus protein ORF 3- Hepatitis gi|9626440:5109-5453 131 1555 60 hypothetical E virus protein ORF 3- Hepatitis gi|9626440:5109-5453 130 1556 60 hypothetical E virus protein ORF 3- Hepatitis gi|9626440:5109-5453 129 1557 60 hypothetical E virus protein ORF 3- Hepatitis gi|9626440:5109-5453 142 1558 60 hypothetical E virus protein ORF 3- Hepatitis gi|9626440:5109-5453 141 1559 60 hypothetical E virus protein ORF 3- Hepatitis gi|9626440:5109-5453 140 1560 60 hypothetical E virus protein ORF 2-capsid Hepatitis

gi|9626440:5123-7105 1661 1561 60 protein E virus ORF 2-capsid Hepatitis gi|9626440:5123-7105 1660 1562 60 protein E virus ORF 2-capsid Hepatitis gi|9626440:5123-7105 1659 1563 60 protein E virus ORF 2-capsid Hepatitis gi|9626440:5123-7105 1658 1564 60 protein E virus ORF 2-capsid Hepatitis gi|9626440:5123-7105 1657 1565 60 protein E virus ORF 2-capsid Hepatitis gi|9626440:5123-7105 1656 1566 60 protein E virus ORF 2-capsid Hepatitis gi|9626440:5123-7105 1655 1567 60 protein E virus ORF 2-capsid Hepatitis gi|9626440:5123-7105 1654 1568 60 protein E virus ORF 2-capsid Hepatitis gi|9626440:5123-7105 1653 1569 60 protein E virus ORF 2-capsid Hepatitis gi|9626440:5123-7105 1652 1570 60 protein E virus RNA dependent WCCV1 gi|52220883:75-1925 1783 1571 60 RNA pol. RNA1 RNA dependent WCCV1 gi|52220883:75-1925 1722 1572 60 RNA pol. RNA1 RNA dependent WCCV1 gi|52220883:75-1925 1638 1573 60 RNA pol. RNA1 RNA dependent WCCV1 gi|52220883:75-1925 1410 1574 60 RNA pol. RNA1 RNA dependent WCCV1 gi|52220883:75-1925 1350 1575 60 RNA pol. RNA1 RNA dependent WCCV1 gi|52220883:75-1925 1290 1576 60 RNA pol. RNA1 RNA dependent WCCV1 gi|52220883:75-1925 1230 1577 60 RNA pol. RNA1 RNA dependent WCCV1 gi|52220883:75-1925 1170 1578 60 RNA pol. RNA1 RNA dependent WCCV1 gi|52220883:75-1925 1087 1579 60 RNA pol. RNA1 RNA dependent WCCV1 gi|52220883:75-1925 999 1580 60 RNA pol. RNA1 Putative BBWV 1 gi|39163640:201-1154 875 1581 60 protease RNA 1 cofactor putative BBWV 1 gi|39163640:201-1154 815 1582 60 protease RNA 1 cofactor putative BBWV 1 gi|39163640:201-1154 731 1583 60 protease RNA 1 cofactor putative BBWV 1 gi|39163640:201-1154 671 1584 60 protease RNA 1 cofactor putative BBWV 1 gi|39163640:201-1154 609 1585 60 protease RNA 1 cofactor putative BBWV 1 gi|39163640:201-1154 546 1586 60 protease RNA 1 cofactor putative BBWV 1 gi|39163640:201-1154 479 1587 60 protease RNA 1 cofactor putative BBWV 1 gi|39163640:201-1154 419 1588 60 protease RNA 1 cofactor putative BBWV 1 gi|39163640:201-1154 330 1589 60 protease RNA 1 cofactor putative BBWV 1 gi|39163640:201-1154 252 1590 60 protease RNA 1 cofactor NTP-binding BBWV 1 gi|39163640:1155-2924 1694 1591 60 protein RNA 1 NTP-binding BBWV 1 gi|39163640:1155-2924 1623 1592 60 protein RNA 1 NTP-binding BBWV 1 gi|39163640:1155-2924 1553 1593 60 protein RNA 1 NTP-binding BBWV 1 gi|39163640:1155-2924 1493 1594 60 protein RNA 1 NTP-binding BBWV 1 gi|39163640:1155-2924 1431 1595 60 protein RNA 1 NTP-binding BBWV 1 gi|39163640:1155-2924 1371 1596 60 protein RNA 1 NTP-binding BBWV 1 gi|39163640:1155-2924 1310 1597 60 protein RNA 1 NTP-binding BBWV 1 gi|39163640:1155-2924 1250 1598 60 protein RNA 1 NTP-binding BBWV 1 gi|39163640:1155-2924 1113 1599 60 protein RNA 1 NTP-binding BBWV 1 gi|39163640:1155-2924 1053 1600 60 protein RNA 1 cysteine BBWV 1 gi|39163640:3003-3629 512 1601 60 protease RNA 1 cysteine BBWV 1 gi|39163640:3003-3629 466 1602 60 protease RNA 1 cysteine BBWV 1 gi|39163640:3003-3629 426 1603 60 protease RNA 1 cysteine BBWV 1 gi|39163640:3003-3629 335 1604 60 protease RNA 1 cysteine BBWV 1 gi|39163640:3003-3629 295 1605 60 protease RNA 1 cysteine BBWV 1 gi|39163640:3003-3629 251 1606 60 protease RNA 1 cysteine BBWV 1 gi|39163640:3003-3629 211 1607 60 protease RNA 1 cysteine BBWV 1 gi|39163640:3003-3629 171 1608 60 protease RNA 1 cysteine BBWV 1 gi|39163640:3003-3629 131 1609 60 protease RNA 1 cysteine BBWV 1 gi|39163640:3003-3629 91 1610 60 protease RNA 1 RNA- BBWV 1 gi|39163640:3630-5726 2038 1611 60 dependent RNA RNA 1 pol. RNA- BBWV 1 gi|39163640:3630-5726 1978 1612 60 dependent RNA RNA 1 pol. RNA- BBWV 1 gi|39163640:3630-5726 1918 1613 60 dependent RNA RNA 1 pol. RNA- BBWV 1 gi|39163640:3630-5726 1858 1614 60 dependent RNA RNA 1 pol. RNA- BBWV 1 gi|39163640:3630-5726 1798 1615 60 dependent RNA RNA 1 pol. RNA- BBWV 1 gi|39163640:3630-5726 1738 1616 60 dependent RNA RNA 1 pol. RNA- BBWV 1 gi|39163640:3630-5726 1678 1617 60 dependent RNA RNA 1 pol. RNA- BBWV 1 gi|39163640:3630-5726 1588 1618 60 dependent RNA RNA 1 pol. RNA- BBWV 1 gi|39163640:3630-5726 1525 1619 60 dependent RNA RNA 1 pol. RNA- BBWV 1 gi|39163640:3630-5726 1362 1620 60 dependent RNA RNA 1 pol. nucleocapsid LNYV

gi|83659771:1-1623 1525 1621 60 protein nucleocapsid LNYV gi|83659771:1-1623 1465 1622 60 protein nucleocapsid LNYV gi|83659771:1-1623 1398 1623 60 protein nucleocapsid LNYV gi|83659771:1-1623 1313 1624 60 protein nucleocapsid LNYV gi|83659771:1-1623 1253 1625 60 protein nucleocapsid LNYV gi|83659771:1-1623 1193 1626 60 protein nucleocapsid LNYV gi|83659771:1-1623 1125 1627 60 protein nucleocapsid LNYV gi|83659771:1-1623 1065 1628 60 protein nucleocapsid LNYV gi|83659771:1-1623 989 1629 60 protein nucleocapsid LNYV gi|83659771:1-1623 901 1630 60 protein phospoprotein LNYV gi|83659771:1631-2712 993 1631 60 phospoprotein LNYV gi|83659771:1631-2712 933 1632 60 phospoprotein LNYV gi|83659771:1631-2712 873 1633 60 phospoprotein LNYV gi|83659771:1631-2712 738 1634 60 phospoprotein LNYV gi|83659771:1631-2712 652 1635 60 phospoprotein LNYV gi|83659771:1631-2712 559 1636 60 phospoprotein LNYV gi|83659771:1631-2712 491 1637 60 phospoprotein LNYV gi|83659771:1631-2712 431 1638 60 phospoprotein LNYV gi|83659771:1631-2712 371 1639 60 phospoprotein LNYV gi|83659771:1631-2712 311 1640 60 gene″4b LNYV gi|83659771:2720-3765 987 1641 60 gene″4b LNYV gi|83659771:2720-3765 927 1642 60 gene″4b LNYV gi|83659771:2720-3765 867 1643 60 gene″4b LNYV gi|83659771:2720-3765 794 1644 60 gene″4b LNYV gi|83659771:2720-3765 734 1645 60 gene″4b LNYV gi|83659771:2720-3765 674 1646 60 gene″4b LNYV gi|83659771:2720-3765 613 1647 60 gene″4b LNYV gi|83659771:2720-3765 553 1648 60 gene″4b LNYV gi|83659771:2720-3765 491 1649 60 gene″4b LNYV gi|83659771:2720-3765 431 1650 60 matrix protein LNYV gi|83659771:3773-4403 554 1651 60 matrix protein LNYV gi|83659771:3773-4403 514 1652 60 matrix protein LNYV gi|83659771:3773-4403 438 1653 60 matrix protein LNYV gi|83659771:3773-4403 391 1654 60 matrix protein LNYV gi|83659771:3773-4403 351 1655 60 matrix protein LNYV gi|83659771:3773-4403 308 1656 60 matrix protein LNYV gi|83659771:3773-4403 244 1657 60 matrix protein LNYV gi|83659771:3773-4403 203 1658 60 matrix protein LNYV gi|83659771:3773-4403 163 1659 60 matrix protein LNYV gi|83659771:3773-4403 51 1660 60 gene G LNYV gi|83659771:4412-6247 1777 1661 60 gene G LNYV gi|83659771:4412-6247 1717 1662 60 gene G LNYV gi|83659771:4412-6247 1657 1663 60 gene G LNYV gi|83659771:4412-6247 1597 1664 60 gene G LNYV gi|83659771:4412-6247 1531 1665 60 gene G LNYV gi|83659771:4412-6247 1448 1666 60 gene G LNYV gi|83659771:4412-6247 1365 1667 60 gene G LNYV gi|83659771:4412-6247 1236 1668 60 gene G LNYV gi|83659771:4412-6247 1160 1669 60 gene G LNYV gi|83659771:4412-6247 1100 1670 60 RNA- LNYV gi|83659771:6278-12613 6101 1671 60 dependent RNA pol. RNA- LNYV gi|83659771:6278-12613 6041 1672 60 dependent RNA pol. RNA- LNYV gi|83659771:6278-12613 5949 1673 60 dependent RNA pol. RNA- LNYV gi|83659771:6278-12613 5887 1674 60 dependent RNA pol. RNA- LNYV gi|83659771:6278-12613 5827 1675 60 dependent RNA pol. RNA- LNYV gi|83659771:6278-12613 5767 1676 60 dependent RNA pol. RNA- LNYV gi|83659771:6278-12613 5707 1677 60 dependent RNA pol. RNA- LNYV gi|83659771:6278-12613 5573 1678 60 dependent RNA pol. RNA- LNYV gi|83659771:6278-12613 5513 1679 60 dependent RNA pol. RNA- LNYV gi|83659771:6278-12613 5423 1680 60 dependent RNA pol. 5′ trailer RNA LNYV gi|83659771:12621-12807 128 1681 60 5′ trailer RNA LNYV gi|83659771:12621-12807 127 1682 60 5′ trailer RNA LNYV gi|83659771:12621-12807 126 1683 60 5′ trailer RNA LNYV gi|83659771:12621-12807 125 1684 60 5′ trailer RNA LNYV gi|83659771:12621-12807 124 1685 60 5′ trailer RNA LNYV gi|83659771:12621-12807 123 1686 60 5′ trailer RNA LNYV gi|83659771:12621-12807 115 1687 60 5′ trailer RNA LNYV gi|83659771:12621-12807 114 1688 60 5′ trailer RNA LNYV gi|83659771:12621-12807 113 1689 60 5′ trailer RNA LNYV gi|83659771:12621-12807 112 1690 60 NS5 protein Zika Brazil-gi|985578255|gb|KU497555.1| 10296 1691 60 ZKV2015 NS5 protein Zika Brazil-gi|985578255|gb|KU497555.1| 10235 1692 60 ZKV2015 NS5 protein Zika Brazil-gi|985578255|gb|KU497555.1| 10162 1693 60 ZKV2015 NS5 protein Zika Brazil-gi|985578255|gb|KU497555.1| 9922 1694 60 ZKV2015 NS5 protein Zika Brazil-

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protease/ 802 86.5 0 25 30 23.33 21.67 55 3 helicase NS3 protease/ 874 85.78 0 21.67 33.33 21.67 23.33 55 5 helicase NS3 protease/ 1129 85.24 0 20 35 25 20 55 4 helicase NS4A protein 60 82.67 0 31.67 20 26.67 21.67 51.67 3 NS4A protein 61 82.67 0 33.33 18.33 26.67 21.67 51.67 3 NS4A protein 62 83 0 31.67 18.33 28.33 21.67 50 3 NS4A protein 63 82.48 0 31.67 18.33 30 20 50 3 NS4A protein 64 82.45 0 31.67 18.33 30 20 50 3 NS4A protein 65 82.74 0 33.33 18.33 28.33 20 51.67 3 NS4A protein 66 83.4 0 33.33 18.33 28.33 20 51.67 3 NS4A protein 67 84.1 0 33.33 20 26.67 20 53.33 3 NS4A protein 68 84.37 0 33.33 21.67 25 20 55 3 NS4A protein 69 84.1 0 31.67 21.67 25 21.67 53.33 3 NS4B protein 651 81.1 0 26.67 18.33 28.33 26.67 45 3 NS4B protein 61 85.12 0 26.67 28.33 23.33 21.67 55 3 NS4B protein 82 85.36 0 23.33 31.67 25 20 55 3 NS4B protein 328 85.9 0 28.33 26.67 21.67 23.33 55 4 NS4B protein 368 86.89 0 35 20 20 25 55 3 NS4B protein 558 85.23 0 16.67 35 23.33 25 51.67 4 NS4B protein 580 86.8 0 21.67 33.33 18.33 26.67 55 4 NS4B protein 602 86.58 0 25 30 18.33 26.67 55 4 NS4B protein 622 84.77 0 28.33 25 21.67 25 53.33 3 NS4B protein 671 84.31 0 26.67 25 26.67 21.67 51.67 3 NS5A protein 943 82.2 0 16.67 28.33 28.33 26.67 45 5 NS5A protein 207 85.98 0 20 35 23.33 21.67 55 3 NS5A protein 267 86.55 0 20 35 23.33 21.67 55 4 NS5A protein 371 85.27 0 26.67 28.33 26.67 18.33 55 5 NS5A protein 519 85.49 0 36.67 18.33 23.33 21.67 55 3 NS5A protein 767 85.27 0 23.33 31.67 25 20 55 3 NS5A protein 830 85.03 0 30 25 23.33 21.67 55 4 NS5A protein 1003 84.8 0 38.33 16.67 25 20 55 5 NS5A protein 1131 85.18 0 31.67 23.33 23.33 21.67 55 4 NS5A protein 1191 84.43 0 26.67 25 28.33 20 51.67 5 NS5B RNA- 214 81.13 0 18.33 26.67 35 20 45 3 dependent RNA polymerase NS5B RNA- 215 80 0 18.33 25 35 21.67 43.33 3 dependent RNA polymerase NS5B RNA- 216 79.91 0 16.67 25 36.67 21.67 41.67 3 dependent RNA polymerase NS5B RNA- 217 80.32 0 16.67 26.67 35 21.67 43.33 3 dependent RNA polymerase NS5B RNA- 218 81.05 0 16.67 28.33 35 20 45 3 dependent RNA polymerase NS5B RNA- 383 81.64 0 15 30 30 25 45 4 dependent RNA polymerase NS5B RNA- 490 80.87 0 21.67 23.33 23.33 31.67 45 3 dependent RNA polymerase NS5B RNA- 491 81.12 0 21.67 23.33 23.33 31.67 45 3 dependent RNA polymerase NS5B RNA- 542 81.8 0 20 25 25 30 45 5 dependent RNA polymerase NS5B RNA- 543 82.09 0 20 25 25 30 45 5 dependent RNA polymerase 5 UTR 80 86.27 0 36.67 18.33 20 25 55 3 5 UTR 150 86.34 0 26.67 28.33 18.33 26.67 55 3 5 UTR 151 85.5 0 26.67 26.67 20 26.67 53.33 3 5 UTR 152 84.8 0 26.67 26.67 20 26.67 53.33 3 5 UTR 153 84.8 0 26.67 26.67 20 26.67 53.33 3 5 UTR 154 85.38 0 25 28.33 20 26.67 53.33 3 5 UTR 155 86.1 0 25 30 20 25 55 3 5 UTR 156 86.64 0 25 30 21.67 23.33 55 3 5 UTR 159 85.77 0 25 30 21.67 23.33 55 3 5 UTR 160 85.03 0 26.67 28.33 21.67 23.33 55 3 core protein 550 82 0 15 30 43.33 11.67 45 5 core protein 551 81.31 0 13.33 30 45 11.67 43.33 5 core protein 552 80.33 0 11.67 30 45 13.33 41.67 5 core protein 553 79.71 0 11.67 30 45 13.33 41.67 5 core protein 554 80.36 0 11.67 30 45 13.33 41.67 5 core protein 555 80.76 0 11.67 30 45 13.33 41.67 5 core protein 556 80.73 0 11.67 30 46.67 11.67 41.67 5 core protein 557 80.23 0 11.67 30 48.33 10 41.67 5 core protein 558 80.17 0 10 30 50 10 40 5 core protein 573 80.76 0 13.33 30 46.67 10 43.33 5 E1 protein 84 85.82 0 30 25 13.33 31.67 55 3 E1 protein 120 86.52 0 31.67 23.33 15 30 55 4 E1 protein 140 85.78 0 31.67 23.33 16.67 28.33 55 4 E1 protein 160 85.1 0 30 25 18.33 26.67 55 4 E1 protein 217 86.77 0 28.33 26.67 23.33 21.67 55 3 E1 protein 237 84.8 0 26.67 26.67 25 21.67 53.33 3 E1 protein 257 85.97 0 21.67 33.33 23.33 21.67 55 3 E1 protein 283 85.94 0 20 35 18.33 26.67 55 3 E1 protein 303 86.01 0 20 33.33 21.67 25 53.33 3 E1 protein 555 85.87 0 23.33 31.67 23.33 21.67 55 2 E2/NS1 106 81.03 0 15 30 30 25 45 4 protein E2/NS1 107 81 0 15 28.33 31.67 25 43.33 4 protein E2/NS1 109 79.92 0 13.33 30 33.33 23.33 43.33 4 protein E2/NS1 110 80.58 0 13.33 30 33.33 23.33 43.33 4 protein E2/NS1 111 81.11 0 13.33 30 35 21.67 43.33 4 protein E2/NS1 324 80.66 0 28.33 16.67 30 25 45 4 protein E2/NS1 325 80.1 0 28.33 16.67 30 25 45 4 protein E2/NS1 326 79.81 0 26.67 16.67 31.67 25 43.33 4 protein E2/NS1 327 79.81 0 26.67 16.67 31.67 25 43.33 4 protein E2/NS1 328 79.81 0 26.67 16.67 31.67 25 43.33 4 protein NS2 protein 69 86.42 0 33.33 21.67 16.67 28.33 55 4 NS2 protein 109 83.87 0 33.33 20 23.33 23.33 53.33 4 NS2 protein 184 85.33 0 23.33 31.67 18.33 26.67 55 4 NS2 protein 224 85.13 0 28.33 26.67 21.67 23.33 55 3 NS2 protein 312 86.25 0 30 25 18.33 26.67 55 4 NS2 protein 354

86.42 0 28.33 26.67 16.67 28.33 55 4 NS2 protein 394 86.1 0 30 25 16.67 28.33 55 3 NS2 protein 492 85.79 0 36.67 18.33 13.33 31.67 55 5 NS2 protein 532 83.84 0 23.33 26.67 13.33 36.67 50 5 NS2 protein 572 85.42 0 25 30 18.33 26.67 55 5 NS3 protease/ 257 80.97 0 25 20 35 20 45 5 helicase NS3 protease/ 258 79.98 0 23.33 20 35 21.67 43.33 5 helicase NS3 protease/ 259 79.94 0 23.33 18.33 35 23.33 41.67 5 helicase NS3 protease/ 260 79.58 0 23.33 20 35 21.67 43.33 5 helicase NS3 protease/ 261 79.13 0 23.33 18.33 35 23.33 41.67 5 helicase NS3 protease/ 262 79.21 0 23.33 18.33 35 23.33 41.67 5 helicase NS3 protease/ 263 79.3 0 23.33 18.33 33.33 25 41.67 5 helicase NS3 protease/ 264 78.66 0 21.67 20 33.33 25 41.67 5 helicase NS3 protease/ 265 79.21 0 21.67 20 33.33 25 41.67 5 helicase NS3 protease/ 266 79.51 0 21.67 21.67 31.67 25 43.33 5 helicase NS4A protein 60 84.4 0 35 18.33 21.67 25 53.33 4 NS4A protein 61 84.4 0 36.67 16.67 21.67 25 53.33 4 NS4A protein 62 84.65 0 38.33 16.67 21.67 23.33 55 4 NS4A protein 63 84.55 0 38.33 16.67 21.67 23.33 55 4 NS4A protein 64 84.5 0 36.67 18.33 21.67 23.33 55 4 NS4A protein 65 84.65 0 36.67 18.33 21.67 23.33 55 4 NS4A protein 66 84.5 0 36.67 18.33 21.67 23.33 55 4 NS4A protein 67 84.64 0 36.67 18.33 21.67 23.33 55 4 NS4A protein 68 84.45 0 35 18.33 21.67 25 53.33 4 NS4A protein 69 84.41 0 33.33 18.33 21.67 26.67 51.67 4 NS4B protein 498 81.45 0 20 25 33.33 21.67 45 3 NS4B protein 499 81.54 0 20 25 33.33 21.67 45 3 NS4B protein 573 81.76 0 16.67 28.33 36.67 18.33 45 3 NS4B protein 574 81.76 0 15 30 36.67 18.33 45 3 NS4B protein 578 82.24 0 15 30 38.33 16.67 45 3 NS4B protein 579 81.73 0 15 30 38.33 16.67 45 3 NS4B protein 580 81.06 0 16.67 28.33 38.33 16.67 45 3 NS4B protein 581 80.87 0 16.67 26.67 38.33 18.33 43.33 3 NS4B protein 582 80.8 0 16.67 26.67 38.33 18.33 43.33 3 NS4B protein 583 81.64 0 18.33 26.67 36.67 18.33 45 3 NS5A protein 1352 82.47 0 15 30 26.67 28.33 45 5 NS5A protein 1360 80.77 0 13.33 30 31.67 25 43.33 5 NS5A protein 1361 80.86 0 13.33 30 31.67 25 43.33 5 NS5A protein 1363 80.94 0 13.33 30 33.33 23.33 43.33 5 NS5A protein 1364 80.21 0 13.33 30 33.33 23.33 43.33 5 NS5A protein 1365 80.37 0 13.33 30 33.33 23.33 43.33 5 NS5A protein 1366 80.16 0 11.67 30 33.33 25 41.67 5 NS5A protein 1367 79.46 0 11.67 28.33 33.33 26.67 40 5 NS5A protein 1368 78.76 0 11.67 26.67 33.33 28.33 38.33 5 NS5A protein 1369 78.05 0 13.33 25 33.33 28.33 38.33 5 NS5B RNA- 161 82.16 0 16.67 28.33 26.67 28.33 45 5 dependent RNA polymerase NS5B RNA- 162 81.45 0 16.67 28.33 26.67 28.33 45 5 dependent RNA polymerase NS5B RNA- 163 81.29 0 16.67 26.67 28.33 28.33 43.33 5 dependent RNA polymerase NS5B RNA- 164 81.01 0 16.67 26.67 26.67 30 43.33 5 dependent RNA polymerase NS5B RNA- 165 80.66 0 16.67 28.33 25 30 45 5 dependent RNA polymerase NS5B RNA- 166 80.8 0 16.67 28.33 25 30 45 5 dependent RNA polymerase NS5B RNA- 167 81.11 0 16.67 26.67 26.67 30 43.33 5 dependent RNA polymerase NS5B RNA- 168 80.73 0 16.67 28.33 25 30 45 5 dependent RNA polymerase NS5B RNA- 169 80.73 0 16.67 28.33 25 30 45 5 dependent RNA polymerase NS5B RNA- 170 80.73 0 16.67 28.33 25 30 45 5 dependent RNA polymerase 5 UTR 95 86.03 0 35 20 16.67 28.33 55 3 5 UTR 96 86.01 0 35 20 18.33 26.67 55 3 5 UTR 98 85.18 0 36.67 18.33 20 25 55 3 5 UTR 99 85.09 0 36.67 18.33 20 25 55 3 5 UTR 148 86.22 0 23.33 31.67 23.33 21.67 55 5 5 UTR 149 86.22 0 21.67 33.33 23.33 21.67 55 5 5 UTR 170 86.32 0 28.33 26.67 21.67 23.33 55 4 5 UTR 171 85.62 0 28.33 26.67 21.67 23.33 55 4 5 UTR 172 85.62 0 28.33 26.67 21.67 23.33 55 4 5 UTR 173 86.2 0 26.67 28.33 21.67 23.33 55 4 Core protein 88 82.34 0 16.67 28.33 15 40 45 4 Core protein 89 82.06 0 16.67 28.33 15 40 45 4 Core protein 90 81.52 0 16.67 28.33 16.67 38.33 45 4 Core protein 91 81.43 0 16.67 28.33 16.67 38.33 45 4 Core protein 60 80.8 0 11.67 31.67 11.67 45 43.33 4 Core protein 61 80.29 0 11.67 31.67 11.67 45 43.33 4 Core protein 62 80.37 0 11.67 31.67 11.67 45 43.33 4 Core protein 72 80.32 0 11.67 30 10 48.33 41.67 4 Core protein 73 80.39 0 13.33 30 10 46.67 43.33 4 Core protein 75 81.25 0 16.67 28.33 8.33 46.67 45 4 E1 protein 540 81.72 0 21.67 23.33 28.33 26.67 45 2 E1 protein 541 80.93 0 21.67 23.33 26.67 28.33 45 2 E1 protein 542 80.8 0 21.67 21.67 26.67 30 43.33 2 E1 protein 543 80.36 0 21.67 23.33 25 30 45 2 E1 protein 544 80.92 0 21.67 23.33 25 30 45 2 E1 protein 545 80.83 0 21.67 23.33 23.33 31.67 45 2 E1 protein 546 80.12 0 23.33 21.67 23.33 31.67 45 2 E1 protein 547 80.69 0 21.67 23.33 23.33 31.67 45 2 E1 protein 548 80.76 0 21.67 23.33 25 30 45 2 E1 protein 549 80.44 0 21.67 21.67 25 31.67 43.33 2

E2/NS1 132 81.65 0 16.67 28.33 28.33 26.67 45 4 protein E2/NS1 320 81.74 0 31.67 13.33 20 35 45 3 protein E2/NS1 321 81.07 0 31.67 13.33 20 35 45 3 protein E2/NS1 322 81.08 0 31.67 13.33 20 35 45 3 protein E2/NS1 323 80.65 0 31.67 11.67 20 36.67 43.33 3 protein E2/NS1 324 80.08 0 31.67 11.67 20 36.67 43.33 3 protein E2/NS1 325 79.81 0 31.67 10 21.67 36.67 41.67 3 protein E2/NS1 326 79.81 0 31.67 10 21.67 36.67 41.67 3 protein E2/NS1 327 80.59 0 31.67 10 21.67 36.67 41.67 3 protein E2/NS1 328 80.31 0 31.67 10 21.67 36.67 41.67 3 protein NS2 108 81.33 0 23.33 21.67 30 25 45 4 NS2 122 81.32 0 18.33 26.67 30 25 45 3 NS2 124 80.65 0 20 25 31.67 23.33 45 3 NS2 125 80.51 0 20 23.33 33.33 23.33 43.33 3 NS2 126 80 0 20 23.33 33.33 23.33 43.33 3 NS2 127 80.1 0 20 23.33 33.33 23.33 43.33 3 NS2 128 80.54 0 20 23.33 33.33 23.33 43.33 3 NS2 129 80.09 0 20 25 31.67 23.33 45 3 NS2 130 80.47 0 20 23.33 31.67 25 43.33 3 NS2 131 80.09 0 21.67 23.33 31.67 23.33 45 3 NS3 protease/ 270 80.7 0 16.67 28.33 28.33 26.67 45 3 helicase NS3 protease/ 272 80.77 0 16.67 28.33 30 25 45 3 helicase NS3 protease/ 277 80.89 0 16.67 28.33 30 25 45 3 helicase NS3 protease/ 278 80.89 0 16.67 28.33 28.33 26.67 45 3 helicase NS3 protease/ 280 80.24 0 15 30 30 25 45 3 helicase NS3 protease/ 281 80.24 0 16.67 28.33 30 25 45 3 helicase NS3 protease/ 283 80.98 0 18.33 26.67 30 25 45 3 helicase NS3 protease/ 309 80.9 0 20 25 23.33 31.67 45 4 helicase NS3 protease/ 310 80.39 0 20 25 21.67 33.33 45 4 helicase NS3 protease/ 311 80.33 0 20 23.33 23.33 33.33 43.33 4 helicase NS4A protein 60 81.66 0 28.33 20 31.67 20 48.33 3 NS4A protein 61 81.66 0 30 18.33 31.67 20 48.33 3 NS4A protein 62 81.97 0 28.33 18.33 33.33 20 46.67 3 NS4A protein 63 81.46 0 28.33 18.33 35 18.33 46.67 3 NS4A protein 64 81.53 0 26.67 20 35 18.33 46.67 3 NS4A protein 65 81.96 0 28.33 20 33.33 18.33 48.33 3 NS4A protein 66 81.96 0 28.33 20 33.33 18.33 48.33 3 NS4A protein 67 82.6 0 28.33 20 33.33 18.33 48.33 3 NS4A protein 68 82.63 0 28.33 20 33.33 18.33 48.33 3 NS4A protein 69 81.96 0 28.33 20 33.33 18.33 48.33 3 NS4B protein 547 81.84 0 15 30 25 30 45 6 NS4B protein 548 81.84 0 15 30 23.33 31.67 45 6 NS4B protein 651 81.96 0 26.67 18.33 26.67 28.33 45 4 NS4B protein 652 82.25 0 26.67 18.33 26.67 28.33 45 4 NS4B protein 654 81.23 0 26.67 18.33 28.33 26.67 45 4 NS4B protein 655 81.95 0 28.33 16.67 28.33 26.67 45 4 NS4B protein 666 82.5 0 25 20 28.33 26.67 45 4 NS4B protein 667 81.99 0 25 20 30 25 45 4 NS4B protein 668 81.65 0 23.33 20 30 26.67 43.33 4 NS4B protein 669 81.37 0 25 20 28.33 26.67 45 4 NS5A protein 844 80.76 0 20 25 23.33 31.67 45 4 NS5A protein 845 80.32 0 20 25 23.33 31.67 45 4 NS5A protein 846 80.22 0 20 25 23.33 31.67 45 4 NS5A protein 847 80.15 0 20 25 25 30 45 4 NS5A protein 848 80.05 0 20 25 25 30 45 4 NS5A protein 849 80.05 0 20 25 26.67 28.33 45 4 NS5A protein 850 79.39 0 21.67 23.33 26.67 28.33 45 3 NS5A protein 851 79.19 0 21.67 21.67 26.67 30 43.33 3 NS5A protein 852 78.49 0 21.67 20 26.67 31.67 41.67 3 NS5A protein 853 78.59 0 23.33 18.33 26.67 31.67 41.67 3 NS5B RNA- 226 82.27 0 20 25 30 25 45 4 dependent RNA polymerase NS5B RNA- 401 81.84 0 16.67 28.33 28.33 26.67 45 3 dependent RNA polymerase NS5B RNA- 424 79.41 0 16.67 26.67 26.67 30 43.33 3 dependent RNA polymerase NS5B RNA- 444 81.36 0 20 25 23.33 31.67 45 4 dependent RNA polymerase NS5B RNA- 491 80.71 0 13.33 30 23.33 33.33 43.33 5 dependent RNA polymerase NS5B RNA- 512 80.85 0 18.33 26.67 25 30 45 5 dependent RNA polymerase NS5B RNA- 1102 80.76 0 26.67 18.33 35 20 45 3 dependent RNA polymerase NS5B RNA- 1248 79.68 0 25 18.33 28.33 28.33 43.33 3 dependent RNA polymerase NS5B RNA- 1627 80.61 0 23.33 21.67 33.33 21.67 45 3 dependent RNA polymerase NS5B RNA- 1675 79.91 0 20 25 28.33 26.67 45 2 dependent RNA polymerase Gag-Pol 67 80.21 0 35 8.33 33.33 23.33 43.33 4 Gag-Pol 144 77.82 0 28.33 11.67 40 20 40 4 Gag-Pol 204 80.91 0 23.33 20 33.33 23.33 43.33 4 Gag-Pol 295 79.33 0 28.33 13.33 43.33 15 41.67 6 Gag-Pol 355 78.04 0 21.67 15 40 23.33 36.67 6 Gag-Pol 450 74.91 0 18.33 16.67 43.33 21.67 35 4 Gag-Pol 546 81.58 0 23.33 21.67 33.33 21.67 45 5 Gag-Pol 606 77.74 0 21.67 15 38.33 25 36.67 4 Gag-Pol 666 77.52 0 26.67 11.67 36.67 25 38.33 4 Gag-Pol 726 79.82 0 25 18.33 35 21.67 43.33 2 gag 209 81.78 0 26.67 18.33 26.67 28.33 45 6 gag 269 80.24 0 31.67 11.67 38.33 18.33 43.33 3 gag 342 82.47 0 28.33 16.67 33.33 21.67 45 3 gag 402 78.85 0 20 18.33 43.33 18.33 38.33 4 gag 545 79.58 0 21.67 20 31.67 26.67 41.67 4 gag 605 78.28 0 21.67 16.67 43.33 18.33 38.33 6 gag 667 80.04 0 21.67 23.33 36.67 18.33 45 3 gag 754 75.62 0

18.33 16.67 40 25 35 4 gag 814 80.67 0 26.67 18.33 38.33 16.67 45 4 gag 903 81.87 0 28.33 16.67 36.67 18.33 45 4 Vif 114 78.8 0 21.67 20 40 18.33 41.67 6 Vif 154 77.98 0 13.33 25 43.33 18.33 38.33 6 Vif 194 78.39 0 23.33 18.33 33.33 25 41.67 3 Vif 234 77.97 0 21.67 18.33 31.67 28.33 40 3 Vif 276 75.46 0 13.33 21.67 28.33 36.67 35 5 Vif 316 78.46 0 20 20 45 15 40 5 Vif 356 79.26 0 33.33 10 38.33 18.33 43.33 5 Vif 396 78.73 0 28.33 13.33 33.33 25 41.67 4 Vif 436 77.87 0 20 20 38.33 21.67 40 4 Vif 476 77.27 0 21.67 18.33 35 25 40 4 vpr 78 81.1 0 30 15 35 20 45 3 vpr 98 79.56 0 21.67 20 26.67 31.67 41.67 4 vpr 118 78.61 0 18.33 20 30 31.67 38.33 4 vpr 138 79.69 0 21.67 18.33 31.67 28.33 40 3 vpr 158 78.79 0 26.67 13.33 33.33 26.67 40 4 vpr 184 81.7 0 28.33 16.67 26.67 28.33 45 4 vpr 204 78.58 0 20 20 25 35 40 4 vpr 224 79.94 0 28.33 15 26.67 30 43.33 4 vpr 244 77.34 0 26.67 13.33 31.67 28.33 40 4 vpr 264 79.95 0 28.33 16.67 38.33 16.67 45 4 tat 91 80.29 0 18.33 26.67 30 25 45 3 tat 218 77.17 0 28.33 6.67 33.33 31.67 35 3 tat 285 76.51 0 15 20 48.33 16.67 35 4 tat 345 79.94 0 26.67 15 38.33 20 41.67 3 tat 405 80.08 0 21.67 21.67 26.67 30 43.33 4 tat 572 82.24 0 28.33 16.67 28.33 26.67 45 3 tat 692 81.72 0 35 10 30 25 45 6 tat 824 79.96 0 30 15 35 20 45 3 tat 884 77.23 0 25 13.33 35 26.67 38.33 3 tat 944 77.7 0 16.67 18.33 45 20 35 4 rev 60 78.01 0 25 16.67 35 23.33 41.67 3 rev 134 80.4 0 23.33 21.67 23.33 31.67 45 2 rev 231 80.23 0 31.67 13.33 38.33 16.67 45 2 rev 320 80.29 0 18.33 26.67 30 25 45 3 rev 447 77.17 0 28.33 6.67 33.33 31.67 35 3 rev 514 76.51 0 15 20 48.33 16.67 35 4 rev 574 79.94 0 26.67 15 38.33 20 41.67 3 rev 634 80.08 0 21.67 21.67 26.67 30 43.33 4 rev 801 82.24 0 28.33 16.67 28.33 26.67 45 3 rev 921 81.72 0 35 10 30 25 45 6 vpu 114 78.38 0 30 11.67 41.67 16.67 41.67 3 vpu 61 85.51 0 40 13.33 18.33 28.33 53.33 5 vpu 62 85.89 0 40 15 16.67 28.33 55 5 vpu 64 86.58 0 40 15 18.33 26.67 55 5 vpu 66 86.64 0 40 15 18.33 26.67 55 5 vpu 67 86.64 0 40 15 20 25 55 5 vpu 68 85.92 0 40 15 18.33 26.67 55 5 vpu 69 85.79 0 38.33 15 20 26.67 53.33 5 vpu 70 85.81 0 38.33 15 21.67 25 53.33 5 vpu 71 85.37 0 38.33 15 21.67 25 53.33 5 asp 93 82.24 0 28.33 16.67 28.33 26.67 45 3 asp 210 81.72 0 35 10 30 25 45 6 asp 256 80.7 0 26.67 16.67 41.67 15 43.33 5 asp 359 80.63 0 30 15 35 20 45 2 asp 389 76.87 0 21.67 13.33 38.33 26.67 35 3 asp 419 79.95 0 18.33 23.33 30 28.33 41.67 4 asp 449 80.68 0 21.67 20 38.33 20 41.67 4 asp 479 78.34 0 16.67 20 46.67 16.67 36.67 4 asp 509 79.23 0 16.67 23.33 43.33 16.67 40 4 asp 539 77.8 0 25 13.33 36.67 25 38.33 3 nef 179 80.47 0 25 20 38.33 16.67 45 3 nef 199 79.2 0 28.33 15 41.67 15 43.33 3 nef 220 79.81 0 23.33 20 31.67 25 43.33 3 nef 300 79.39 0 16.67 28.33 28.33 26.67 45 3 nef 320 80.05 0 15 28.33 33.33 23.33 43.33 3 nef 348 80.65 0 26.67 16.67 40 16.67 43.33 6 nef 368 79.99 0 23.33 18.33 35 23.33 41.67 6 nef 388 80.05 0 26.67 15 35 23.33 41.67 6 nef 408 78.88 0 16.67 25 28.33 30 41.67 5 nef 517 81.69 0 21.67 23.33 38.33 16.67 45 5 5′ LTR 155 79.1 0 18.33 25 25 31.67 43.33 3 5′ LTR 343 79.71 0 20 23.33 21.67 35 43.33 3 5′ LTR 472 79.15 0 25 18.33 41.67 15 43.33 3 5′ LTR 502 77.55 0 21.67 16.67 45 16.67 38.33 3 5′ LTR 532 79.96 0 28.33 13.33 43.33 15 41.67 4 5′ LTR 647 81.97 0 28.33 16.67 33.33 21.67 45 4 5′ LTR 715 80.36 0 26.67 18.33 36.67 18.33 45 2 5′ LTR 788 78.77 0 23.33 18.33 33.33 25 41.67 3 5′ LTR 818 75.67 0 20 16.67 43.33 20 36.67 5 5′ LTR 848 75.56 0 26.67 11.67 41.67 20 38.33 5 gag 430 82.46 0 30 15 38.33 16.67 45 3 polyprotein gag 577 80.03 0 25 20 36.67 18.33 45 4 polyprotein gag 637 81.88 0 16.67 28.33 41.67 13.33 45 6 polyprotein gag 697 81.02 0 21.67 21.67 40 16.67 43.33 4 polyprotein gag 757 79.55 0 21.67 20 41.67 16.67 41.67 4 polyprotein gag 817 80.48 0 23.33 21.67 36.67 18.33 45 4 polyprotein gag 961 80.93 0 25 20 38.33 16.67 45 3 polyprotein gag 1021 79.57 0 20 20 31.67 28.33 40 3 polyprotein gag 1094 81.5 0 31.67 13.33 33.33 21.67 45 4 polyprotein gag 1219 80.48 0 20 25 45 10 45 4 polyprotein gag-pol 60 77.83 0 20 21.67 35 23.33 41.67 4 gag-pol 120 79.05 0 18.33 23.33 35 23.33 41.67 5 gag-pol 180 79.42 0 23.33 20 36.67 20 43.33 5 gag-pol 265 80.72 0 23.33 21.67 33.33 21.67 45 4 gag-pol 380 78.61 0 28.33 15 43.33 13.33 43.33 4 gag-pol 480 80.85 0 28.33 16.67 33.33 21.67 45 3 gag-pol 557 76.38 0 11.67 23.33 50 15 35 3 gag-pol 617 79.46 0 30 11.67 33.33 25 41.67 4 gag-pol 703 76.51 0 23.33 15 45 16.67 38.33 3 gag-pol 764 81.32 0 26.67 18.33 31.67 23.33 45 3 gp2-vif 209 79 0 18.33 25 40 16.67 43.33 4 protein gp2-vif 261 80.96 0 13.33 30 31.67 25 43.33 4 protein gp2-vif 311 80.06 0 28.33 13.33 30 28.33 41.67 4 protein gp2-vif 341 78.94 0 18.33 21.67 28.33 31.67 40 3 protein gp2-vif 372 80.21 0 18.33 25 35 21.67 43.33 4

protein gp2-vif 402 79.16 0 18.33 23.33 31.67 26.67 41.67 4 protein gp2-vif 432 80.3 0 20 23.33 33.33 23.33 43.33 5 protein gp2-vif 464 78.01 0 21.67 16.67 46.67 15 38.33 5 protein gp2-vif 494 79.25 0 21.67 20 38.33 20 41.67 5 protein gp2-vif 591 80.18 0 26.67 18.33 38.33 16.67 45 4 protein gp3-vpx 120 81.55 0 30 15 31.67 23.33 45 6 Protein gp3-vpx 121 81.42 0 28.33 15 33.33 23.33 43.33 6 Protein gp3-vpx 122 81.16 0 28.33 15 33.33 23.33 43.33 6 Protein gp3-vpx 123 80.71 0 28.33 16.67 31.67 23.33 45 6 Protein gp3-vpx 124 81.28 0 28.33 16.67 31.67 23.33 45 6 Protein gp3-vpx 126 81.53 0 28.33 16.67 30 25 45 6 Protein gp3-vpx 127 81.6 0 28.33 16.67 30 25 45 6 Protein gp3-vpx 128 81.7 0 28.33 16.67 28.33 26.67 45 6 Protein gp3-vpx 129 80.99 0 26.67 16.67 28.33 28.33 43.33 5 Protein gp3-vpx 130 80.29 0 25 16.67 28.33 30 41.67 5 Protein gp4-vpr 114 81.27 0 18.33 26.67 38.33 16.67 45 4 protein gp4-vpr 115 80.99 0 18.33 26.67 36.67 18.33 45 4 protein gp4-vpr 116 80.45 0 18.33 26.67 36.67 18.33 45 4 protein gp4-vpr 117 80.03 0 18.33 25 36.67 20 43.33 4 protein gp4-vpr 118 80.37 0 18.33 26.67 35 20 45 4 protein gp4-vpr 119 80.45 0 18.33 26.67 36.67 18.33 45 4 protein gp4-vpr 120 79.46 0 18.33 25 36.67 20 43.33 4 protein gp4-vpr 121 78.83 0 18.33 25 36.67 20 43.33 4 protein gp4-vpr 122 79.54 0 20 23.33 36.67 20 43.33 4 protein gp4-vpr 123 80.24 0 21.67 23.33 35 20 45 3 protein gp5-tat 174 79.14 0 21.67 20 23.33 35 41.67 6 protein gp5-tat 243 75.32 0 25 10 35 30 35 3 protein gp5-tat 365 76.3 0 16.67 18.33 48.33 16.67 35 4 protein gp5-tat 426 80.93 0 26.67 18.33 33.33 21.67 45 5 protein gp5-tat 510 81.51 0 26.67 18.33 31.67 23.33 45 4 protein gp5-tat 619 82.14 0 26.67 18.33 38.33 16.67 45 3 protein gp5-tat 795 81.1 0 16.67 28.33 35 20 45 3 protein gp5-tat 855 78.13 0 25 16.67 35 23.33 41.67 3 protein gp5-tat 978 81.02 0 33.33 11.67 30 25 45 5 protein gp5-tat 1038 77.77 0 15 21.67 45 18.33 36.67 3 protein gp6-rev 121 80.43 0 16.67 28.33 28.33 26.67 45 3 protein gp6-rev 319 79.14 0 21.67 20 23.33 35 41.67 6 protein gp6-rev 388 75.32 0 25 10 35 30 35 3 protein gp6-rev 510 76.3 0 16.67 18.33 48.33 16.67 35 4 protein gp6-rev 571 80.93 0 26.67 18.33 33.33 21.67 45 5 protein gp6-rev 655 81.51 0 26.67 18.33 31.67 23.33 45 4 protein gp6-rev 764 82.14 0 26.67 18.33 38.33 16.67 45 3 protein gp6-rev 940 81.1 0 16.67 28.33 35 20 45 3 protein gp6-rev 1000 78.13 0 25 16.67 35 23.33 41.67 3 protein gp6-rev 1123 81.02 0 33.33 11.67 30 25 45 5 protein gp7-env 305 80.43 0 16.67 28.33 28.33 26.67 45 3 protein gp7-env 503 79.14 0 21.67 20 23.33 35 41.67 6 protein gp7-env 572 75.32 0 25 10 35 30 35 3 protein gp7-env 694 76.3 0 16.67 18.33 48.33 16.67 35 4 protein gp7-env 755 80.93 0 26.67 18.33 33.33 21.67 45 5 protein gp7-env 839 81.51 0 26.67 18.33 31.67 23.33 45 4 protein gp7-env 948 82.14 0 26.67 18.33 38.33 16.67 45 3 protein gp7-env 1124 81.1 0 16.67 28.33 35 20 45 3 protein gp7-env 1184 78.13 0 25 16.67 35 23.33 41.67 3 protein gp7-env 1307 81.02 0 33.33 11.67 30 25 45 5 protein gp8-nef 66 79.96 0 28.33 13.33 43.33 15 41.67 4 protein gp8-nef 181 81.97 0 28.33 16.67 33.33 21.67 45 4 protein gp8-nef 249 80.36 0 26.67 18.33 36.67 18.33 45 2 protein gp8-nef 322 78.77 0 23.33 18.33 33.33 25 41.67 3 protein gp8-nef 352 75.67 0 20 16.67 43.33 20 36.67 5 protein gp8-nef 382 75.56 0 26.67 11.67 41.67 20 38.33 5 protein gp8-nef 416 77.69 0 28.33 10 40 21.67 38.33 5 protein gp8-nef 467 76.63 0 18.33 18.33 40 23.33 36.67 4 protein gp8-nef 497 79.73 0 23.33 20 35 21.67 43.33 3 protein gp8-nef 527 77.26 0 26.67 11.67 31.67 30 38.33 4 protein 3 LTR 155 79.1 0 18.33 25 25 31.67 43.33 3 3 LTR 343 79.71 0 20 23.33 21.67 35 43.33 3 3 LTR 472 79.15 0 25 18.33 41.67 15 43.33 3 3 LTR 502 77.55 0 21.67 16.67 45 16.67 38.33 3 3 LTR 532 79.96 0 28.33 13.33 43.33 15 41.67 4 3 LTR 647 81.97 0 28.33 16.67 33.33 21.67 45 4 3 LTR 715 80.36 0 26.67 18.33 36.67 18.33 45 2 3 LTR 788 78.77 0 23.33 18.33 33.33 25 41.67 3 3 LTR 818 75.67 0 20 16.67 43.33 20 36.67 5 3 LTR 848 75.56 0 26.67 11.67 41.67 20 38.33 5 gag 364 81.2 0 21.67 23.33 35 20 45 5 gag 365 81.2 0 21.67 23.33 36.67 18.33 45 5 gag 366 80.69 0 21.67 23.33 38.33 16.67 45 5 gag 367 80.69 0 20 25 38.33 16.67 45 5 gag 368 81.23 0 20 25 40 15 45 5 gag 369 81.51 0 20 25 40 15 45 5 gag 370 81.54 0 20 25 41.67 13.33 45 5 gag 374 81.41 0 18.33 26.67 40 15 45 5 gag 375 81.36 0 16.67 26.67 41.67 15 43.33 5 gag 376 81.36 0 16.67 26.67 40 16.67 43.33 5 pro 79 81.5 0 16.67 28.33 35 20 45 6 pro 80 81.38 0 15 28.33 36.67 20 43.33 6 pro 81 80.97 0 16.67 28.33 36.67 18.33 45 6 pro 82 80.97 0 18.33 26.67 36.67 18.33 45 6 pro 83 81.28 0 18.33 25 38.33 18.33 43.33 6 pro 84 80.99 0 18.33 26.67 36.67 18.33 45 6 pro 85 80.99 0 16.67 28.33 36.67 18.33 45 6 pro 86 81.71 0 18.33 26.67

36.67 18.33 45 6 pro 105 81.26 0 16.67 28.33 38.33 16.67 45 6 pro 106 81.26 0 15 30 38.33 16.67 45 6 Pol 217 81.86 0 20 25 28.33 26.67 45 3 Pol 331 81.66 0 13.33 30 38.33 18.33 43.33 4 Pol 391 77.91 0 11.67 28.33 31.67 28.33 40 3 Pol 542 79.82 0 11.67 30 31.67 26.67 41.67 3 Pol 609 81.28 0 18.33 26.67 30 25 45 3 Pol 679 80.45 0 18.33 26.67 26.67 28.33 45 4 Pol 1118 79.19 0 11.67 30 25 33.33 41.67 3 Pol 1260 81.34 0 15 30 26.67 28.33 45 5 Pol 1351 81.27 0 16.67 28.33 21.67 33.33 45 4 Pol 1411 79.74 0 16.67 25 33.33 25 41.67 5 rex 109 81.24 0 18.33 26.67 35 20 45 5 rex 169 76.49 0 6.67 30 26.67 36.67 36.67 4 rex 262 77.12 0 6.67 30 30 33.33 36.67 3 rex 479 81.27 0 15 30 26.67 28.33 45 4 rex 1077 80.71 0 18.33 26.67 21.67 33.33 45 4 rex 1748 78.44 0 8.33 30 35 26.67 38.33 3 rex 1986 77.3 0 11.67 28.33 30 30 40 6 rex 2091 82.63 0 18.33 26.67 36.67 18.33 45 5 rex 2151 78.28 0 16.67 21.67 40 21.67 38.33 3 rex 2516 81.15 0 16.67 28.33 20 35 45 2 tax 109 81.24 0 18.33 26.67 35 20 45 5 tax 169 76.49 0 6.67 30 26.67 36.67 36.67 4 tax 262 77.12 0 6.67 30 30 33.33 36.67 3 tax 479 81.27 0 15 30 26.67 28.33 45 4 tax 1077 80.71 0 18.33 26.67 21.67 33.33 45 4 tax 1748 78.44 0 8.33 30 35 26.67 38.33 3 tax 1986 77.3 0 11.67 28.33 30 30 40 6 tax 2091 82.63 0 18.33 26.67 36.67 18.33 45 5 tax 2151 78.28 0 16.67 21.67 40 21.67 38.33 3 tax 2516 81.15 0 16.67 28.33 20 35 45 2 env 276 75.75 0 13.33 23.33 33.33 30 36.67 4 env 316 79.9 0 25 16.67 31.67 26.67 41.67 4 env 383 82.22 0 16.67 28.33 40 15 45 5 env 423 76.35 0 15 20 45 20 35 5 env 806 80.64 0 16.67 28.33 20 35 45 2 env 847 77.56 0 10 26.67 31.67 31.67 36.67 4 env 1014 80.5 0 15 30 18.33 36.67 45 5 env 1080 78.82 0 13.33 25 33.33 28.33 38.33 4 env 1171 80.15 0 13.33 30 23.33 33.33 43.33 4 env 1211 80.16 0 20 23.33 31.67 25 43.33 5 5′ LTR 502 80.91 0 28.33 16.67 36.67 18.33 45 4 5′ LTR 503 80.27 0 26.67 18.33 36.67 18.33 45 4 5′ LTR 504 80.93 0 26.67 18.33 36.67 18.33 45 4 5′ LTR 506 81 0 28.33 16.67 36.67 18.33 45 4 5′ LTR 507 80.3 0 26.67 16.67 36.67 20 43.33 4 5′ LTR 508 80.17 0 25 16.67 36.67 21.67 41.67 4 5′ LTR 509 79.64 0 25 16.67 38.33 20 41.67 4 5′ LTR 510 78.94 0 23.33 16.67 40 20 40 4 5′ LTR 511 78.88 0 21.67 16.67 41.67 20 38.33 4 5′ LTR 513 77.51 0 20 16.67 41.67 21.67 36.67 4 gp1-tax protein 63 83.12 0 15 33.33 26.67 25 48.33 6 gp1-tax protein 64 83.12 0 15 33.33 28.33 23.33 48.33 5 gp1-tax protein 65 83.12 0 15 33.33 30 21.67 48.33 5 gp1-tax protein 67 83.24 0 15 35 31.67 18.33 50 5 gp1-tax protein 71 83.33 0 16.67 35 33.33 15 51.67 4 gp1-tax protein 72 83.33 0 16.67 35 33.33 15 51.67 4 gp1-tax protein 73 83.05 0 16.67 33.33 33.33 16.67 50 4 gp1-tax protein 74 83 0 16.67 31.67 35 16.67 48.33 4 gp1-tax protein 75 82.67 0 16.67 33.33 35 15 50 4 gp1-tax protein 76 83.07 0 16.67 31.67 35 16.67 48.33 4 gs1 301 80.91 0 28.33 16.67 36.67 18.33 45 4 gs1 593 80.6 0 23.33 21.67 30 25 45 4 gs1 737 78.82 0 10 30 30 30 40 5 gs1 830 80.73 0 13.33 30 30 26.67 43.33 4 gs1 970 80.42 0 20 25 35 20 45 4 gs1 1573 80.03 0 13.33 30 30 26.67 43.33 3 gs1 1927 80.81 0 13.33 30 43.33 13.33 43.33 4 gs1 2135 81.49 0 15 30 31.67 23.33 45 4 gs1 2399 81.19 0 16.67 28.33 30 25 45 2 gs1 2495 81.23 0 20 25 36.67 18.33 45 4 Gag-Pro-Pol 212 82.08 0 20 25 28.33 26.67 45 4 Gag-Pro-Pol 331 81.97 0 18.33 26.67 33.33 21.67 45 4 Gag-Pro-Pol 394 77.04 0 8.33 30 36.67 25 38.33 4 Gag-Pro-Pol 504 78.39 0 11.67 30 30 28.33 41.67 4 Gag-Pro-Pol 623 81.77 0 20 25 30 25 45 5 Gag-Pro-Pol 802 81.24 0 15 30 31.67 23.33 45 3 Gag-Pro-Pol 1106 80.47 0 13.33 30 26.67 30 43.33 4 Gag-Pro-Pol 1585 79.64 0 15 30 30 25 45 3 Gag-Pro-Pol 1684 81.71 0 16.67 28.33 28.33 26.67 45 4 Gag-Pro-Pol 1911 80.7 0 20 25 31.67 23.33 45 3 gp2-gag 376 81.37 0 15 30 43.33 11.67 45 6 polyprotein gp2-gag 379 82.65 0 15 30 43.33 11.67 45 6 polyprotein gp2-gag 380 82.37 0 15 30 41.67 13.33 45 6 polyprotein gp2-gag 393 80.15 0 11.67 30 38.33 20 41.67 6 polyprotein gp2-gag 394 79.59 0 11.67 30 38.33 20 41.67 6 polyprotein gp2-gag 395 79.44 0 11.67 30 38.33 20 41.67 6 polyprotein gp2-gag 399 80.74 0 13.33 30 36.67 20 43.33 6 polyprotein gp2-gag 400 81.46 0 13.33 30 36.67 20 43.33 6 polyprotein gp2-gag 401 81.46 0 13.33 30 38.33 18.33 43.33 6 polyprotein gp2-gag 402 81.02 0 13.33 30 40 16.67 43.33 6 polyprotein gp4-rex 26 kD 491 78.63 0 10 30 30 30 40 6 protein gp4-rex 26 kD 541 80.11 0 13.33 30 30 26.67 43.33 6 protein gp4-rex 26 kD 839 80.81 0 13.33 30 43.33 13.33 43.33 4 protein gp4-rex 26 kD 1056 79.23 0 11.67 30 31.67 26.67 41.67 3 protein gp4-rex 26 kD 1325 80.73 0 20 23.33 28.33 28.33 43.33 3 protein gp4-rex 26 kD 1412 81.46 0 18.33 25 38.33 18.33 43.33 5 protein gp4-rex 26 kD 1452 79.8 0 13.33 30 38.33 18.33 43.33 5 protein gp4-rex 26 kD 1864 80.7 0 20 25 26.67 28.33 45 3 protein gp4-rex 26 kD

2089 80.18 0 15 28.33 28.33 28.33 43.33 3 protein gp4-rex 26 kD 2251 80.81 0 18.33 26.67 35 20 45 6 protein gp5-tax protein 60 78.34 0 20 20 33.33 26.67 40 4 gp5-tax protein 191 78.82 0 10 30 30 30 40 5 gp5-tax protein 284 80.73 0 13.33 30 30 26.67 43.33 4 gp5-tax protein 424 80.42 0 20 25 35 20 45 4 gp5-tax protein 1027 80.03 0 13.33 30 30 26.67 43.33 3 gp5-tax protein 1381 80.81 0 13.33 30 43.33 13.33 43.33 4 gp5-tax protein 1589 81.49 0 15 30 31.67 23.33 45 4 gp5-tax protein 1853 81.19 0 16.67 28.33 30 25 45 2 gp5-tax protein 1949 81.23 0 20 25 36.67 18.33 45 4 gp5-tax protein 2403 80.99 0 20 25 25 30 45 3 gp6-env peptide 60 79.45 0 11.67 30 38.33 20 41.67 4 gp6-env peptide 302 80.73 0 20 23.33 28.33 28.33 43.33 3 gp6-env peptide 389 81.46 0 18.33 25 38.33 18.33 43.33 5 gp6-env peptide 429 79.8 0 13.33 30 38.33 18.33 43.33 5 gp6-env peptide 841 80.7 0 20 25 26.67 28.33 45 3 gp6-env peptide 863 80.06 0 13.33 30 33.33 23.33 43.33 4 gp6-env peptide 1066 80.18 0 15 28.33 28.33 28.33 43.33 3 gp6-env peptide 1087 80.45 0 20 25 28.33 26.67 45 3 gp6-env peptide 1228 80.81 0 18.33 26.67 35 20 45 6 gp6-env peptide 1456 79.38 0 11.67 30 21.67 36.67 41.67 4 3 LTR 502 80.91 0 28.33 16.67 36.67 18.33 45 4 3 LTR 503 80.27 0 26.67 18.33 36.67 18.33 45 4 3 LTR 504 80.93 0 26.67 18.33 36.67 18.33 45 4 3 LTR 506 81 0 28.33 16.67 36.67 18.33 45 4 3 LTR 507 80.3 0 26.67 16.67 36.67 20 43.33 4 3 LTR 508 80.17 0 25 16.67 36.67 21.67 41.67 4 3 LTR 509 79.64 0 25 16.67 38.33 20 41.67 4 3 LTR 510 78.94 0 23.33 16.67 40 20 40 4 3 LTR 511 78.88 0 21.67 16.67 41.67 20 38.33 4 3 LTR 513 77.51 0 20 16.67 41.67 21.67 36.67 4 anchored capsid 71 81.86 0 26.67 18.33 41.67 13.33 45 4 protein C anchored capsid 72 81.77 0 26.67 18.33 40 15 45 4 protein C anchored capsid 73 81.13 0 26.67 18.33 40 15 45 4 protein C anchored capsid 74 81.13 0 28.33 16.67 40 15 45 4 protein C anchored capsid 75 80.86 0 26.67 16.67 41.67 15 43.33 4 protein C anchored capsid 76 80.86 0 28.33 15 41.67 15 43.33 4 protein C anchored capsid 84 81.58 0 28.33 15 43.33 13.33 43.33 4 protein C anchored capsid 88 81.3 0 26.67 16.67 43.33 13.33 43.33 4 protein C anchored capsid 89 81.38 0 26.67 18.33 43.33 11.67 45 4 protein C anchored capsid 91 82.19 0 28.33 16.67 41.67 13.33 45 4 protein C membrane 147 81.75 0 28.33 16.67 30 25 45 5 glycoprotein precursor prM membrane 148 81.23 0 28.33 16.67 30 25 45 5 glycoprotein precursor prM membrane 149 80.51 0 28.33 16.67 30 25 45 5 glycoprotein precursor prM membrane 150 80.31 0 26.67 16.67 31.67 25 43.33 5 glycoprotein precursor prM membrane 151 80.31 0 25 18.33 31.67 25 43.33 5 glycoprotein precursor prM membrane 152 80.51 0 25 20 31.67 23.33 45 5 glycoprotein precursor prM membrane 153 80.66 0 25 20 31.67 23.33 45 5 glycoprotein precursor prM membrane 154 81.23 0 25 20 31.67 23.33 45 5 glycoprotein precursor prM membrane 155 81.23 0 25 20 33.33 21.67 45 5 glycoprotein precursor prM membrane 156 80.53 0 25 18.33 35 21.67 43.33 5 glycoprotein precursor prM envelope 336 82.12 0 20 25 36.67 18.33 45 3 protein E envelope 624 81.25 0 26.67 16.67 26.67 30 43.33 3 protein E envelope 654 79.31 0 31.67 10 35 23.33 41.67 5 protein E envelope 684 80.21 0 28.33 13.33 30 28.33 41.67 4 protein E envelope 716 82.63 0 23.33 21.67 25 30 45 4 protein E envelope 909 81.01 0 26.67 18.33 25 30 45 3 protein E envelope 1111 79.43 0 25 18.33 31.67 25 43.33 5 protein E envelope 1141 78.97 0 21.67 20 40 18.33 41.67 3 protein E envelope 1185 82.37 0 20 25 31.67 23.33 45 3 protein E envelope 1414 79.7 0 26.67 18.33 31.67 23.33 45 2 protein E nonstructural 86 81.31 0 30 15 36.67 18.33 45 4 protein NS1 nonstructural 459 82.08 0 33.33 11.67 30 25 45 3 protein NS1 nonstructural 491 81.68 0 23.33 21.67 31.67 23.33 45 3 protein NS1 nonstructural 540 80.7 0 25 20 36.67 18.33 45 2 protein NS1 nonstructural 631 81.55 0 30 15 23.33 31.67 45 4 protein NS1 nonstructural 700 81.52 0 21.67 21.67 28.33 28.33 43.33 4 protein NS1 nonstructural 732 79.8 0 28.33 13.33 33.33 25 41.67 5 protein NS1 nonstructural 927 80.43 0 26.67 18.33 31.67 23.33 45 3 protein NS1 nonstructural 960 80.83 0 18.33 25 40 16.67 43.33 3 protein NS1 nonstructural 1003 80.82 0 26.67 18.33 30 25 45 3 protein NS1 nonstructural 110 80.91 0 20 25 33.33 21.67 45 6 protein NS2A nonstructural 193 81.59 0 31.67 13.33 23.33 31.67 45 2 protein NS2A nonstructural 281 81.21 0 21.67 23.33 30 25 45 3 protein NS2A nonstructural 301 81.07 0 25 20 28.33 26.67 45 2 protein NS2A nonstructural 381 81.95 0 21.67 20 18.33 40 41.67 4 protein NS2A nonstructural 401 81.59 0 26.67 16.67 21.67 35 43.33 4 protein NS2A nonstructural 429 80.89 0 26.67 16.67 26.67 30 43.33 4 protein NS2A

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76.63 0 21.67 13.33 30 35 35 6 peptide 2A mature 472 79.08 0 13.33 25 30 31.67 38.33 6 peptide 2A mature 512 78.94 0 18.33 21.67 40 20 40 5 peptide 2A mature 552 77.38 0 25 13.33 43.33 18.33 38.33 3 peptide 2B mature 60 79.54 0 26.67 15 33.33 25 41.67 3 peptide 2B mature 61 79.47 0 25 15 35 25 40 3 peptide 2B mature 62 78.97 0 25 15 35 25 40 3 peptide 2B mature 64 78.64 0 25 15 36.67 23.33 40 4 peptide 2B mature 65 79.2 0 25 15 36.67 23.33 40 4 peptide 2B mature 66 79.2 0 25 15 35 25 40 4 peptide 2B mature 67 78.5 0 23.33 15 35 26.67 38.33 4 peptide 2B mature 68 78.43 0 21.67 15 35 28.33 36.67 4 peptide 2B mature 69 78.43 0 21.67 15 33.33 30 36.67 4 peptide 2B mature 70 78.71 0 21.67 15 31.67 31.67 36.67 5 peptide 2C mature 60 76.89 0 23.33 13.33 36.67 26.67 36.67 4 peptide 2C mature 124 76.33 0 25 10 21.67 43.33 35 3 peptide 2C mature 232 77.11 0 11.67 23.33 33.33 31.67 35 5 peptide 2C mature 292 77.41 0 16.67 18.33 40 25 35 5 peptide 2C mature 352 77.62 0 20 18.33 25 36.67 38.33 5 peptide 2C mature 412 78.68 0 26.67 13.33 31.67 28.33 40 5 peptide 2C mature 472 77.56 0 25 11.67 28.33 35 36.67 3 peptide 2C mature 557 78.01 0 18.33 16.67 35 30 35 4 peptide 2C mature 617 80.04 0 35 6.67 31.67 26.67 41.67 5 peptide 2C mature 679 75.26 0 20 15 40 25 35 5 peptide 3A mature 131 81.75 0 26.67 18.33 18.33 36.67 45 4 peptide 3A mature 132 81.63 0 25 18.33 18.33 38.33 43.33 5 peptide 3A mature 133 81.68 0 25 20 18.33 36.67 45 5 peptide 3A mature 140 81.4 0 26.67 18.33 18.33 36.67 45 5 peptide 3A mature 141 81.28 0 25 18.33 18.33 38.33 43.33 5 peptide 3A mature 142 81.25 0 25 18.33 20 36.67 43.33 5 peptide 3A mature 143 80.74 0 25 18.33 21.67 35 43.33 5 peptide 3A mature 144 80.68 0 23.33 18.33 23.33 35 41.67 5 peptide 3A mature 145 79.89 0 23.33 18.33 21.67 36.67 41.67 5 peptide 3A mature 146 79.1 0 23.33 18.33 21.67 36.67 41.67 5 peptide 3B (VPg) 60 77.74 0 21.67 18.33 36.67 23.33 40 3 mature peptide 3B (VPg) 61 78.06 0 20 18.33 36.67 25 38.33 3 mature peptide 3B (VPg) 62 77.53 0 20 18.33 36.67 25 38.33 3 mature peptide 3B (VPg) 63 77.19 0 20 16.67 36.67 26.67 36.67 3 mature peptide 3B (VPg) 64 76.75 0 20 16.67 38.33 25 36.67 3 mature peptide 3B (VPg) 65 76.4 0 20 15 38.33 26.67 35 3 mature peptide 3B (VPg) 66 76.59 0 21.67 15 38.33 25 36.67 3 mature peptide 3B (VPg) 67 77.29 0 23.33 15 36.67 25 38.33 3 mature peptide 3B (VPg) 68 77.59 0 25 15 35 25 40 3 mature peptide 3B (VPg) 69 78.22 0 25 15 35 25 40 4 mature peptide 3C mature 90 77.51 0 20 15 30 35 35 4 peptide 3C mature 130 79.93 0 23.33 18.33 30 28.33 41.67 3 peptide 3C mature 214 81.56 0 33.33 11.67 31.67 23.33 45 4 peptide 3C mature 262 77.18 0 23.33 15 41.67 20 38.33 5 peptide 3C mature 302 79.04 0 23.33 18.33 33.33 25 41.67 4 peptide 3C mature 345 81.22 0 26.67 16.67 33.33 23.33 43.33 4 peptide 3C mature 388 75.69 0 18.33 16.67 31.67 33.33 35 4 peptide 3C mature 428 78.44 0 25 15 21.67 38.33 40 3 peptide 3C mature 468 76.48 0 20 15 23.33 41.67 35 3 peptide 3C mature 547 78.48 0 23.33 13.33 26.67 36.67 36.67 3 peptide 3D mature 65 75.79 0 23.33 11.67 26.67 38.33 35 4 peptide 3D mature 175 77.16 0 23.33 11.67 28.33 36.67 35 4 peptide 3D mature 235 77.77 0 23.33 11.67 36.67 28.33 35 6 peptide 3D mature 295 76.15 0 20 15 30 35 35 4 peptide 3D mature 355 80.71 0 20 23.33 33.33 23.33 43.33 3 peptide 3D mature 459 75.3 0 23.33 11.67 21.67 43.33 35 4 peptide 3D mature 568 76.5 0 15 20 25 40 35 3 peptide 3D mature 631 75.91 0 15 20 23.33 41.67 35 3 peptide 3D mature 691 80.51 0 20 23.33 28.33 28.33 43.33 4 peptide 3D mature 758 75.88 0 21.67 13.33 18.33 46.67 35 4 peptide ORF 1- 192 81.49 0 25 20 16.67 38.33 45 3 polyprotein ORF 1- 514 81.26 0 20 25 23.33 31.67 45 3 polyprotein ORF 1- 688 81.52 0 28.33 16.67 20 35 45 5 polyprotein ORF 1- 945 81.1 0 23.33 21.67 31.67 23.33 45 5 polyprotein ORF 1- 1243 81.02 0 25 20 25 30 45 4 polyprotein ORF 1- 1489 82.77 0 20 25 21.67 33.33 45 5 polyprotein ORF 1- 2292 81.07 0 20 25 30 25 45 3 polyprotein ORF 1- 2535 81.77 0 21.67 23.33 28.33 26.67 45 3 polyprotein ORF 1- 2953 79.59 0 18.33 26.67 20 35 45 4 polyprotein ORF 1- 3872 80.53 0 21.67 23.33 25 30 45 3 polyprotein Viral 944 80.72 0 13.33 30 23.33 33.33 43.33 4 methyltransferase Viral 60 84.17 0 18.33 31.67 21.67 28.33 50 4 methyltransferase Viral 133 85.34 0 23.33 31.67 15 30 55 3 methyltransferase Viral 309 85.66 0 25 30 13.33 31.67 55 3 methyltransferase Viral 369 83.02 0 20 30 28.33 21.67 50 3 methyltransferase Viral 433 86.2 0 35 20 18.33 26.67 55 3 methyltransferase Viral 550 86.55 0 26.67 28.33 16.67 28.33 55 3 methyltransferase Viral 610 85.53 0 23.33 31.67 11.67 33.33 55 4 methyltransferase Viral 769 86.83 0 23.33 31.67 18.33 26.67

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binding 718 81.13 0 23.33 21.67 28.33 26.67 45 4 protein cysteine 116 80.72 0 35 8.33 28.33 28.33 43.33 3 protease cysteine 162 80.95 0 28.33 15 26.67 30 43.33 2 protease cysteine 202 79.43 0 23.33 18.33 28.33 30 41.67 4 protease cysteine 293 79.61 0 20 20 30 30 40 3 protease cysteine 333 78.88 0 15 23.33 26.67 35 38.33 4 protease cysteine 377 81.6 0 21.67 23.33 25 30 45 4 protease cysteine 417 80.36 0 15 26.67 28.33 30 41.67 4 protease cysteine 457 77.1 0 25 10 33.33 31.67 35 3 protease cysteine 497 79.67 0 30 13.33 31.67 25 43.33 3 protease cysteine 537 78.55 0 25 15 28.33 31.67 40 6 protease RNA- 60 79.2 0 21.67 16.67 26.67 35 38.33 5 dependent RNA pol. RNA- 120 79.34 0 23.33 16.67 25 35 40 3 dependent RNA pol. RNA- 180 77.5 0 16.67 18.33 28.33 36.67 35 4 dependent RNA pol. RNA- 240 79.94 0 25 16.67 36.67 21.67 41.67 5 dependent RNA pol. RNA- 300 80.36 0 25 18.33 26.67 30 43.33 5 dependent RNA pol. RNA- 360 78.03 0 20 16.67 36.67 26.67 36.67 4 dependent RNA pol. RNA- 420 80.67 0 25 16.67 35 23.33 41.67 4 dependent RNA pol. RNA- 510 81.16 0 25 20 26.67 28.33 45 3 dependent RNA pol. RNA- 573 81.41 0 25 20 33.33 21.67 45 4 dependent RNA pol. RNA- 736 81.66 0 31.67 11.67 31.67 25 43.33 4 dependent RNA pol. nucleocapsid 99 77.34 0 20 15 36.67 28.33 35 3 protein nucleocapsid 159 79.32 0 31.67 10 30 28.33 41.67 3 protein nucleocapsid 226 82.08 0 18.33 26.67 31.67 23.33 45 5 protein nucleocapsid 311 80.47 0 23.33 21.67 26.67 28.33 45 2 protein nucleocapsid 371 76.59 0 20 16.67 35 28.33 36.67 4 protein nucleocapsid 431 79.43 0 31.67 13.33 33.33 21.67 45 3 protein nucleocapsid 499 80.41 0 31.67 13.33 28.33 26.67 45 3 protein nucleocapsid 559 81.55 0 15 30 23.33 31.67 45 3 protein nucleocapsid 635 81.41 0 26.67 18.33 28.33 26.67 45 4 protein nucleocapsid 723 81.28 0 23.33 21.67 25 30 45 3 protein phospoprotein 90 74.7 0 23.33 11.67 31.67 33.33 35 3 phospoprotein 150 78.41 0 25 15 31.67 28.33 40 2 phospoprotein 210 79.22 0 25 15 31.67 28.33 40 4 phospoprotein 345 81.57 0 20 25 41.67 13.33 45 4 phospoprotein 431 81.09 0 23.33 21.67 31.67 23.33 45 3 phospoprotein 524 80.06 0 25 20 28.33 26.67 45 3 phospoprotein 592 78.34 0 30 10 40 20 40 5 phospoprotein 652 80.68 0 26.67 16.67 36.67 20 43.33 3 phospoprotein 712 77.31 0 20 16.67 23.33 40 36.67 3 phospoprotein 772 80.9 0 25 20 26.67 28.33 45 2 gene″4b 60 80.04 0 26.67 13.33 28.33 31.67 40 4 gene″4b 120 80.91 0 28.33 16.67 23.33 31.67 45 3 gene″4b 180 79.39 0 30 13.33 40 16.67 43.33 3 gene″4b 253 81.24 0 25 20 43.33 11.67 45 3 gene″4b 313 78.57 0 21.67 18.33 35 25 40 3 gene″4b 373 74.79 0 16.67 18.33 31.67 33.33 35 3 gene″4b 434 80.65 0 31.67 13.33 30 25 45 4 gene″4b 494 79.78 0 23.33 20 23.33 33.33 43.33 3 gene″4b 556 80.43 0 30 15 30 25 45 4 gene″4b 616 81.19 0 21.67 23.33 30 25 45 3 matrix protein 78 77.42 0 23.33 13.33 30 33.33 36.67 5 matrix protein 118 80.98 0 25 18.33 31.67 25 43.33 5 matrix protein 194 78.92 0 28.33 15 31.67 25 43.33 3 matrix protein 241 76.19 0 23.33 11.67 38.33 26.67 35 3 matrix protein 281 79.78 0 25 18.33 28.33 28.33 43.33 4 matrix protein 324 80.81 0 23.33 21.67 20 35 45 4 matrix protein 388 80.6 0 23.33 21.67 30 25 45 4 matrix protein 429 75.23 0 20 15 33.33 31.67 35 4 matrix protein 469 79.2 0 21.67 18.33 18.33 41.67 40 4 matrix protein 581 81.35 0 21.67 23.33 31.67 23.33 45 3 gene G 60 78.09 0 26.67 11.67 38.33 23.33 38.33 4 gene G 120 78.28 0 25 15 26.67 33.33 40 2 gene G 180 79.75 0 18.33 25 36.67 20 43.33 2 gene G 240 79.25 0 21.67 16.67 46.67 15 38.33 4 gene G 306 81.5 0 23.33 21.67 21.67 33.33 45 3 gene G 389 81.56 0 25 20 30 25 45 4 gene G 472 80.43 0 26.67 18.33 38.33 16.67 45 3 gene G 601 81.23 0 25 20 30 25 45 4 gene G 677 80.45 0 35 8.33 30 26.67 43.33 3 gene G 737 79.98 0 21.67 20 26.67 31.67 41.67 3 RNA- 236 75.47 0 18.33 16.67 31.67 33.33 35 3 dependent RNA pol. RNA- 296 80.36 0 21.67 21.67 20 36.67 43.33 3 dependent RNA pol. RNA- 388 81.57 0 31.67 13.33 20 35 45 5 dependent RNA pol. RNA- 450 80.33 0 26.67 18.33 33.33 21.67 45 3 dependent RNA pol. RNA- 510 78.62 0 26.67 16.67 30 26.67 43.33 4 dependent RNA pol. RNA- 570 77.84 0 16.67 21.67 31.67 30 38.33 4 dependent RNA pol. RNA- 630 78.97 0 21.67 18.33 36.67 23.33 40 3 dependent RNA pol. RNA- 764 81.66 0 28.33 16.67 36.67 18.33 45 3 dependent RNA pol. RNA- 824 77.97 0 30 10 28.33 31.67 40 5 dependent RNA pol. RNA- 914 79.84 0 28.33 15 35 21.67 43.33 3 dependent RNA pol. 5′ trailer RNA 60 77.75 0 25 11.67 18.33 45 36.67 5 5′ trailer RNA 61 77.33 0 25 13.33 18.33 43.33 38.33 5 5′ trailer RNA 62 77 0 23.33 13.33 18.33 45 36.67 5 5′ trailer RNA 63 76.39 0 23.33 13.33 18.33 45 36.67 5 5′ trailer RNA 64 76.82 0 23.33 11.67 20 45 35 5 5′ trailer

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(86) TABLE-US-00002 TABLE 2 Viral pathogens used in testing the Pathogen Chip Virus Type/Strain Source References CHIKV R91064 FDA/CBER Lot Release Panels* HAV SD11 Dr. Farci Lab HCV Genotype 1b Sera Care (Sera Care, Milford, MA) HCV Genotype 2a Sera Care

(Sera Care, Milford, MA) HCV Genotype 3 Sera Care (Sera Care, Milford, MA) HEV Genotype 3a WHO Standard HIV-1 Group M, FDA/CBER Lot Release Panels 1, 2 Subtype B HIV-2 Subtype B FDA/CBER Lot Release Panels 3 DENGUE Serotype 1, *Aedes albopictus* 4 2, 3 and 4 C6/36 cell culture HTLV-I ZeptoMetrix HTLV-II ZeptoMetrix WEST NY99 Cell culture 5 NILE ZIKA PRVABC62 FDA/CBER Lot Release Panels ZIKA FSS13025 FDA/CBER Lot Release Panels *The FDA Center for Biologies Evaluation and Research (CBER), Division of Emerging and Transfusion Transmitted Diseases produces and makes available to blood donor screening test manufacturers panels which are sets of vialed human plasma containing virus particles that are carefully quantified for evaluating virus detection devices. Each set has several vials each one a different virus concentration and some with virus-free plasma. These panels are also used to test each new lot of a licensed blood donor screening device for release to the public, hence they are called Lot Release Panels. There are separate panels prepared for each type of virus. 1 Davis et al., *J Virol Methods*, 107: 37-44 (2003) 2 Lee et al., *J Virol Methods*, 137: 287-291 (2006) 3 Lee et al., *J Virol Methods*, 137: 287-291 (2005). 4 Dong et al., *J Appl Microbiol*, 120: 1119-1129 (2016). 5 Grinev et al., *J Virol Methods*, 154: 27-40 (2008).

(87) Nucleic acids from positive plasma and from NATtrol were extracted using the Dynabeads™ SILANE Viral NA Kit (ThermoFisher Scientific, Waltham, MA) according to the manufacturer's protocol.

(88) cDNA from random-primed, reverse-transcribed total RNA was performed with the Ovation® Pico WTA System (NuGEN, San Carlos, CA) using the manufacturer's recommended protocols and input amounts. For this study, the Agilent SureTag® Labeling Kit was used for generating Cy™3 dye labeled cDNA targets. Labeled cDNA was purified with SureTag® Kit spin columns and specific activities (degree of labeling) were calculated for use in hybridization reactions. A master mix containing 10× blocking agent and 2× GE hybridization buffer HI-RPM, was added to 3-5 µg of labeled cDNA, denatured, and hybridized to arrays under 8-chamber gasket slides at 65° C. with 20-rpm rotation for 24 hours in an Agilent hybridization oven. Arrays were processed using wash procedure A and scanned on an Agilent SureScan® G4900DA microarray scanner using 5-µm resolution.

(89) Microarray-based platform data analysis: After scanning, microarray images were analyzed using Agilent Feature Extraction software (Agilent Technologies, Inc., Santa Clara, CA) with default protocols and settings. Average pixel intensity and subtraction of local background for each feature was calculated. Images were manually examined to note any arrays affected by high background, scratches, or other technical artifacts. Probe sets associated with low signal intensity or bad quality features were considered unreliable and excluded from the analysis. Feature intensities for Cy™3 dye channels were imported into the Partek™ Genomics Suite™ software (Partek Inc., St. Louis, MO, USA).

(90) First, microarray analysis was performed by ranking the highest signal intensity probes by the mean of the set of probes defining each pathogen on the platform. Next, an experimental threshold was defined as a log ratio of signal intensity mean for the set of probes defining each pathogen and the mean of the Agilent control probes set. The threshold was applied to all the arrays tested to define the final parameters for test validation.

(91) RT-qPCR Validation

(92) Altona RT-qPCR: CHIKV, DENV 1-4 and ZIKV positive specimens were quantified using the Altona RealStar RT-qPCR kit (Altona Diagnostic GmbH, Hamburg, Germany) according to the manufacturer's instructions. The positive control and the internal control were provided by the manufacturer. Serial dilutions of CHIKV (ATCC VR-3246SD), DENV (ATCC VR-3231SD), and ZIKV (ATCC VR-1843DQ) quantitative genomic RNA (specification range: 1×10.sup.5-1×10.sup.6 copies/4) obtained from ATCC (American Type Culture Collection Manassas, VA) were prepared to generate a standard curve for copy number quantification.

(93) Primer Design (Genesig) RT-qPCR: HAV (target/5′ NCR), HCV (5′UTR), HEV (ORF2), HIV-

1 (target/POL), HIV-2 (target/POL), HTLVI (target/POL), HTLVII (target/POL), and WNV (5′UTR) positive specimens were quantified using the Primer Design Genesig kit (Primerdesign Ltd, United Kingdom) according to the manufacturer's protocol (OneStep RT-qPCR protocol). Each kit contained a positive control template for the PCR set up and for copy number determination (generated serial dilutions for the standard curve).

(94) The RT-qPCR assays were performed on a ViiA7 Applied Biosystems real-time PCR system (Thermo Fisher Scientific Inc., Waltham, MA, USA). Each sample was tested in duplicate and the mean C.sub.q value was calculated.

Example 2

Microarray Design, Specificity, and Validation

(95) Microarray design: The pathogen chip design strategy was to cover all high priority blood-borne RNA viruses (retroviruses and both positive- and negative-strand RNA viruses) using multiple probes to independent targets sites in the genome of each species. In total, 1,769 unique viral oligonucleotides derived from 16 distinct viral genomes (Table 1) were included that allowed discrimination of pathogens at the level of species, subtypes and genotypes. The microarray was supplemented with an additional number of predesigned GE array probes for 906 genes from the human genome, 84 ERCC probes and 120 probes specific for plant viruses representing negative controls (Table 3).

(96) TABLE-US-00003 TABLE 3 Probe distribution on pathogen chip Probe group Number of Number of type targets probes Purpose All spot 1010 14,716 RNA pathogens coverage and internal controls Pathogen Specific 17 1,769 Probes intensity analysis (not replicated) of pathogen specific genes Internal Control 902 902 Agilent requirement (replicated for probes normalization 10 times) ERCC probes 84 84 Determination of (replicated intra-probe variance 45 times) Negative Control 3 120 Determination of (not replicated) probes cross reactivity

(97) The design included multiple gene targets for each pathogen genome in order to select the best probes for the final platform design. The design strategy was to balance the number of probes for each pathogen with a final count of 90-110 probes each. Probes selected in the final design generated a more intense signal and produced higher percentage coverage of the specific genome across the different experiments (FIG. **1**A).

(98) Microarray specificity: One of the challenges impacting the sensitivity of microarray based multi-pathogen nucleic acid detection in blood specimens is the relatively small concentration of target nucleic acids compared to a high background concentration of human DNA. A novel workflow was designed, combining two different applications (Agilent and Nugen), that had not been previously combined, to address this challenge. Typically, the Agilent amplification WT kit (Oligo dT) is used to amplify total RNA, with a minimum nucleic acid requirement of 25 nanograms, and produces a cRNA final product that is labelled with Cy3 fluorophore. The workflow was modified using a method that generates amplified cDNA from as little as 500 picograms of target viral RNA. One single-primer isothermal amplification using Nugen Ribo-SPIA technology was combined with the Agilent Genomic DNA Enzymatic Labeling Kit for generating Cy3 labeled cDNA. This kit was not previously developed for single color RNA probes and produces 300% the amplified product compared to the standard methodology (FIG. **1**B, FIG. **2**A). Nearly all samples were detected on the platform and all probes generated a strong signal specific for each positive plasma specimen analyzed. No specific signal was produced by negative control plasma (FIG. **2**B). Random non-specific intensity signal was produced in only a few arrays. This indicated that the generation of cDNA instead of amplified RNA followed by Cy3 labelling and hybridization based on a DNA application was successful (FIG. **2**C).

(99) Analysis strategies: Quality of signals generated by probes for each species was assessed according to two experimental criteria: 1) defining a threshold able to distinguish a true signal from its background; and 2) defining true positives only when 50% of probes generated a signal above the set threshold. These two levels of data analysis were needed to detect positive probes in the

presence of multi-pathogen testing at the same time and at different concentrations.
(100) The threshold was defined as the log ratio between the signal intensity mean for each pathogen specific probe set and the mean of the Agilent control group probe set. After comparing the results of the same set of probes across different arrays and selecting the probes showing an inter-array reproducibility, an experimental threshold value was defined as follows: Log Ratio <1 negative; Log Ratio ≥1.0 to ≤1.5 borderline; Log Ratio ≥1.5 positive.
(101) Data analysis at the individual probe level was also performed to assess if the tested samples were false positives. Only when at least 50% of specific probes had Log Ratio >1.5 was the test considered valid (FIG. **1**C).
(102) For nearly all borderline results, only 20-25% of the specific probes showed mean intensity in the correct range, so the test was defined negative. For positive results (Log Ratio >1.5) more than 50% of the specific probes set were in the correct range. One example was an HCV 1a positive plasma samples test that was detected by 110 out of 110 probes at a concentration of 10.sup.5 copies/mL, 90 out of 110 probes at a concentration of 10.sup.4 copies/mL, and 70 out of 110 probes at a concentration of 10.sup.3 copies/mL. On average, at 10.sup.2 copies/mL more than 50% of the probes were generating a fluorescence signal above the set threshold.
(103) Data from more than 168 tested samples (one or multiple targets per array) showed consistent results. The mean of the probes specific for any positive plasma sample was always at least 10-fold higher than the mean of internal control probes (background), showing a wide probe population range of intensity. As shown in Table 4 and Table 5, the Log Ratio was above 1.5 for all the pathogens tested at a concentration of 10.sup.2 copies/mL and there were no cross reactions with other probes across the platform.
(104) Microarray sensitivity: HAV, CHIKV, DENV1-4, HCV Genotypes 1a, 2b, and 3, HIV-1,2 and WNV strain NY99 had 10.sup.2 copies/mL limits of detection. The lowest detectable level for HEV was 10.sup.4 copies/mL. The analytical sensitivity for each assay was determined using a concentration range based on the clinical requirement for pathogen detection. There were no false negatives or false positives when testing the positive plasma. In the presence of very low pathogen concentrations, the log ratio was at the borderline level so the results were qualified according to double level analysis (at least 50% of the probes generated a fluorescence signal above the set threshold). In the presence of negative plasma samples, the log ratio value was always negative (Table 4).
(105) A mix of different positive plasma samples at different concentrations was simultaneously tested in a single experiment. Four different combinations were generated. The multi-pathogens-mixes were composed of 8 (CHIKV, DEN3, DEN1, HAV, HCV1a, HEV, WNV and ZIKV), 4 (CHIKV, DEN1, ZKV, WNV), 4 (DENV3, HAV HCV1a HEV) and 3 (CHIKV, DEN1, ZIKV) different pathogens, respectively at a concentration range from 10.sup.5 to 10.sup.3 copies/mL. (Table 6).
(106) TABLE-US-00004 TABLE 4 Test results based on Log ratio CK DEN1 DEN2 DEN3 DEN4 HAV HCV1a HCV2a CK 2.42 −1.15 −1.22 −0.04 −0.28 −0.50 −0.24 −0.35 DEN1 −0.12 1.60 −0.33 0.09 0.14 −0.08 −0.20 −0.31 DEN2 −0.24 −0.82 1.84 −0.30 −0.25 −0.24 −0.17 −0.28 DEN3 0.03 −0.19 −0.02 1.62 −0.24 −0.28 −0.24 −0.34 DEN4 0.07 −0.31 −0.64 0.18 1.80 −0.64 −0.17 −0.28 HAV −0.06 −0.97 −1.24 −0.25 −0.34 2.97 −0.21 −0.31 HCV1 0.46 −0.53 −0.55 0.63 0.56 0.26 2.91 2.80 HCV2 0.47 −0.60 −0.72 0.66 0.31 0.09 2.16 2.85 HCV3 0.39 −0.73 −0.77 0.06 0.06 −0.07 2.63 2.53 HEV 0.41 −0.62 −0.63 0.23 0.35 1.06 −0.14 −0.24 HIV1 0.96 0.55 0.08 0.77 0.56 0.01 0.05 −0.06 HIV2 −0.13 −0.90 −0.94 0.02 −0.29 −0.07 −0.09 −0.20 HTLVI −0.57 −1.29 −1.43 −0.35 −0.55 −0.51 −0.06 −0.17 HTLVII −0.21 −1.11 −1.19 −0.45 −0.40 −0.21 0.19 0.08 WNV 0.10 −0.50 −0.70 0.21 −0.34 −0.33 −0.19 −0.29 ZKV −0.29 −0.64 −0.92 −0.49 −0.41 −0.45 0.12 0.26 HCV3 HEV HIV-1 HIV-2 HTLVI HTLVII WNV ZKV NC CK −0.56 −0.02 −0.99 −0.68 −0.42 −0.96 −0.97 −0.20 −0.96 DEN1 −0.52 0.46 −0.76 −0.55 −0.28 −0.76 −0.53 0.00 −0.86 DEN2 −0.49 −0.11 −1.13 −0.89 −0.52 −0.84 −1.00 −0.28 −1.01 DEN3 −0.55 0.01 −0.95 −0.81

−0.56 −0.91 −0.22 0.05 −0.96 DEN4 −0.49 −0.20 −1.02 −0.80 −0.66 −1.05 −0.30 −0.36 −1.07 HAV −0.52 0.35 −0.78 −0.47 −0.35 −0.71 −1.22 −0.04 −0.69 HCV1 2.59 0.79 −0.30 0.94 0.44 −0.05 −0.43 0.60 −0.37 HCV2 1.84 0.76 −0.53 0.65 −0.10 −0.37 −0.05 0.50 −0.32 HCV3 2.32 0.34 −0.28 0.92 0.02 −0.51 −0.68 0.28 −0.46 HEV −0.45 1.89 −0.31 −0.17 0.10 −0.04 −0.51 0.54 −0.39 HIV1 −0.27 1.07 1.89 0.46 −0.22 0.06 0.13 0.92 0.23 HIV2 −0.41 0.23 0.91 1.68 −0.07 −0.44 −0.75 0.09 −0.66 HTLVI −0.38 −0.21 −1.08 −0.87 2.67 0.88 −1.47 −0.15 −0.99 HTLVII −0.13 −0.09 −0.92 −0.59 0.38 3.30 −1.13 −0.10 −0.86 WNV −0.51 0.25 −0.62 −0.52 −0.40 −0.64 2.24 0.00 −0.82 ZKV 0.32 0.68 −0.96 −0.68 −0.52 −0.78 0.16 2.07 −0.83 CK, Chikungunya virus; DEN, dengue; HAV, hepatitis A virus; HCV, hepatitis C virus; HEV, hepatitis E virus; HIV, human immunodeficiency virus; HTLV, Human T-cell lymphotropic virus; WNV, West Nile Virus; ZKV, Zika Virus; NC, negative control.

(107) TABLE-US-00005 TABLE 5 Multi-pathogen mix test results based on Log ratio MPM1 MPM2 MPM3 MPM4 CHIKV 3.42 3.37 0.24 2.25 DEN1 3.14 3.10 1.80 2.45 DEN2 1.11 1.10 −0.23 0.35 DEN3 2.72 1.19 3.00 0.51 DEN4 1.31 1.19 0.83 0.59 HAV 1.33 0.12 2.18 −1.13 HCV-1a 2.53 0.61 2.72 −0.59 HCV-2a 2.16 0.66 2.44 −0.65 HCV-3 2.45 0.65 2.60 −0.72 HEV 1.64 0.67 1.21 −0.71 HIV-1 1.05 1.24 1.11 −0.36 HIV-2 0.13 0.24 0.17 −0.81 HTLV-I −0.17 0.06 −0.07 −1.37 HTLV-II −0.02 0.12 −0.09 −1.07 WNV 1.63 1.65 0.11 −0.03 ZKV 3.09 3.04 0.30 1.98 MPM1 = CHIKV, HAV, HCV-1a, HEV, DEN3, DEN1, ZKV, WNV MPM2 = CHIKV, DEN1, ZKV, WNV MPM3 = HAV, HEV, DEN3, HCV-1a MPM4 = CHIKV, ZKV, DEN1

(108) TABLE-US-00006 TABLE 6 Pathogen Chip performance based plasma panel test results Pathogen Copies/mL pos/total qPCR Validation Chikungunya 10{circumflex over ( )}3 1/1 Y Chikungunya 10{circumflex over ( )}2 4/4 Y Dengue1 10{circumflex over ( )}3 3/3 Y Dengue1 10{circumflex over ( )}2 2/2 Y Dengue1 10{circumflex over ( )}1 0/1 Y Dengue2 10{circumflex over ( )}3 3/3 Y Dengue2 10{circumflex over ( )}2 3/3 Y Dengue2 10{circumflex over ( )}1 0/1 Y Dengue3 10{circumflex over ( )}3 3/3 Y Dengue3 10{circumflex over ( )}2 3/3 Y Dengue3 10{circumflex over ( )}1 0/1 Y Dengue4 10{circumflex over ( )}3 3/3 Y Dengue4 10{circumflex over ( )}2 3/3 Y Dengue4 10{circumflex over ( )}1 0/1 Y HAV 10{circumflex over ( )}3 2/2 Y HAV 10{circumflex over ( )}2 2/2 Y HCV-1a 10{circumflex over ( )}3 3/3 Y HCV-1a 10{circumflex over ( )}2 3/3 Y HCV-2a 10{circumflex over ( )}2 2/2 Y HCV-3 10{circumflex over ( )}2 2/2 Y HEV 10{circumflex over ( )}4 3/3 Y HEV 10{circumflex over ( )}3 0/2 Y HEV 10{circumflex over ( )}2 0/2 NA HIV-1 10{circumflex over ( )}3 2/2 y HIV-1 10{circumflex over ( )}2 2/2 y HIV-2 10{circumflex over ( )}3 3/3 y HIV-2 10{circumflex over ( )}2 3/3 y HTLV-I 10{circumflex over ( )}3 2/2 y HTLV-I 10{circumflex over ( )}2 2/2 y HTLV-II 10{circumflex over ( )}3 2/2 y HTLV-II 10{circumflex over ( )}2 2/2 y WNV (NY99) 10{circumflex over ( )}5 1/1 y WNV (NY99) 10{circumflex over ( )}4 1/1 y WNV (NY99) 10{circumflex over ( )}3 3/3 y WNV (NY99) 10{circumflex over ( )}2 4/4 y WNV (NY99) 10{circumflex over ( )}1 0/2 NA ZIKA PRVABC60 10{circumflex over ( )}3 3/3 Y ZIKA PRVABC61 10{circumflex over ( )}2 3/3 Y ZIKA PRVABC62 10{circumflex over ( )}1 0/2 Y ZIKV FSS13025 10{circumflex over ( )}3 3/3 Y ZIKV FSS13025 10{circumflex over ( )}2 3/3 Y ZIKV FSS13025 10{circumflex over ( )}1 0/2 Y MPM1 10{circumflex over ( )}5-10{circumflex over ( )}3 3/3 y MPM2 10{circumflex over ( )}5-10{circumflex over ( )}3 3/3 y MPM3 10{circumflex over ( )}5-10{circumflex over ( )}3 3/3 y MPM4 10{circumflex over ( )}5-10{circumflex over ( )}3 3/3 y NA = not applicable

(109) Among the 99 positive samples tested at a concentration ranking from 10.sup.5 to 10.sup.2 copies/mL, 92 out 92 samples were correctly detected. Only HEV testing resulted correct detection in 3 out of 7 positive samples (42%) at a final concentration of 10.sup.4 copies/mL. No specific signal was detected below this value. There were 21 positive samples that were not detected because the concentration was below the limit of detection of the platform (<10.sup.2 copies/mL). In all four mix combinations all pathogens were detected without interference among the targets.

(110) All of the samples tested (single or multiple pathogens at the same time) were performed at least 3 times each, with at least a week interval between the experiments, in order to test the

reproducibility of the results. The consistency of positive results across the different arrays confirmed that the array design together with the double level analysis model performed well.
(111) Validation of the limit of microarray data by RT-qPCR: Microarray-based pathogen chip results were confirmed by RT-qPCR of the RNA aliquots used for testing. All positive results were confirmed and the copy numbers for each pathogen were calculated to define the limit of the detection for each species on the array (Table 7).
(112) TABLE-US-00007 TABLE 7 Validation of Pathogen Chip detection results Pathogen Chip qPCR Ct Virus Virus Results Value Copy No. CHIKV POS 26.9 3.1 × 10.sup.3 CHIKV POS 31.6 1.4 × 10.sup.2 CHIKV POS 31.5 1.6 × 10.sup.2 CHIKV POS 29.4 6.3 × 10.sup.2 CHIKV POS 29.7 5.8 × 10.sup.2 DENGUE-1 POS 31.1 2.3 × 10.sup.3 DENGUE-1 POS 34.4 3.0 × 10.sup.2 DENGUE-1 NEG 38.7 41 DENGUE-2 POS 29.1 8.4 × 10.sup.3 DENGUE-2 POS 35.9 1.2 × 10.sup.2 DENGUE-2 NEG 38.9 18 DENGUE-3 POS 29.3 7.1 × 10.sup.3 DENGUE-3 POS 32.7 8.4 × 10.sup.2 DENGUE-3 NEG 37.3 31 DENGUE-4 POS 30.3 3.3 × 10.sup.3 DENGUE-4 POS 34.2 2.6 × 10.sup.2 DENGUE-4 NEG 37.0 79 HAV POS 28.4 3.2 × 10.sup.3 HAV POS 39.1 2.8 × 10.sup.3 HAV POS 29.2 8.2 × 10.sup.2 HAV POS 32.2 1.2 × 10.sup.2 HCV-1a POS 26.2 4.1 × 10.sup.3 HCV-1a POS 31.4 1.6 × 10.sup.2 HCV-2a POS 27.4 3.8 × 10.sup.3 HCV-2a POS 32.1 1.8 × 10.sup.2 HCV-3 POS 33.1 1.4 × 10.sup.2 HEV POS 25.4 1.9 × 10.sup.4 HEV NEG 28.4 1.8 × 10.sup.3 HIV-1 POS 27.3 4.6 × 10.sup.3 HIV-1 POS 32.8 1.6 × 10.sup.2 HIV-2 POS 27.4 4.3 × 10.sup.3 HIV-2 POS 30.7 1.8 × 10.sup.2 HTLV-I POS 28.7 3.9 × 10.sup.3 HTLV-I POS 28.3 2.9 × 10.sup.2 HTLV-II POS 25.574 2.7 × 10.sup.3 HTLV-II POS 29.289 2.4 × 10.sup.2 WNV (NY99) POS 21.5 1.9 × 10.sup.5 WNV (NY99) POS 24.5 1.5 × 10.sup.4 WNV (NY99) POS 27.6 2.1 × 10.sup.3 WNV (NY99) POS 31.4 1.0 × 10.sup.2 ZIKA PRVABC60 POS 26.2 1.5 × 10.sup.3 ZIKA PRVABC60 POS 30.1 1.2 × 10.sup.2 ZIKA PRVABC60 NEG 31.8 41 ZIKA FSS13025 POS 25.3 2.4 × 10.sup.3 ZIKA FSS13025 POS 29.1 1.3 × 10.sup.2 ZIKA FSS13025 NEG 33.0 17

Example 3

Microarray for Detection of DNA Viruses, Bacteria, and Protozoan Pathogens

(113) A microarray for DNA viruses, bacteria, and protozoan pathogens was developed. The design included multiple gene targets for each pathogen genome in order to select the best probes for the final platform design. The design strategy was to choose the probes with the best “scores” (homology, thermodynamics, secondary structure and sequence complexity) balancing the cross-hybridization with the host genome and with other pathogens' genomes. The second design strategy was to balance the number of probes for each pathogen with a final count of 50-110 probes each. Probes selected in the final design generated a more intense signal and produced higher percentage coverage of the specific genome across the different experiments.
(114) The final design was supplemented with predesigned DNA array probes (577 control probes, 225 replicates, and 11,620 backbone) specific for the reagents and the assay performance. These are used specifically for image orientation, to assess whether the samples are labeled, for the orientation of the platform during the scan process, and for measuring on element background. These probes form a hairpin and do not hybridize well with labeled sample of any species. In addition, 312 probes specific for three human housekeeping genes (ACTB, ARL1, CCDN1) and 109 probes specific for one Mosquito-specific virus and two plant viruses (*Aedes albopictus* densovirus 2, Maize streak virus, Tomato pseudo-curly top virus) were added to the design.
(115) The microarray includes probes for cytomegalovirus (CMV; also known as HHV-5), Epstein Barr virus (EBV; also known as HHV-4), human herpesvirus 8 (HHV-8), human papilloma virus (HPV) type 6b HPV6, HPV11, HPV 16, HPV 17, hepatitis B virus (HBV) subtype adw, HBV subtype ayw, HBV subtype adr, HBV subtype ayr, and human parvovirus B19. Exemplary probes provided in Table 8 and include SEQ ID NOs: 1770-1852 (CMV), SEQ ID NOs: 1853-1917 (EBV B95-8), SEQ ID NOs: 1918-2023 (EBV AG876), SEQ ID NOs: 2024-2108 (HHV-8), SEQ ID NOs: 2109-2192 (HPV 6b), SEQ ID NOs: 2193-2271 (HPV 11), SEQ ID NOs: 2272-2342 (HPV 16), SEQ ID NOs: 2343-2419 (HPV 18), SEQ ID NOs: 2420-2470 (HBV subtype adw), SEQ ID

NOs: 2471-2520 (HBV subtype ayw), SEQ ID NOs: 2521-2556 (HBV subtype adr), SEQ ID NOs: 2557-2602 (HBV subtype ayr), and SEQ ID NOs: 2603-2647 (human parvovirus B19).

(116) The microarray also includes probes for *Treponema pallidum, Ehrlichia chaffeensis, Ehrlichia ewingii, Ehrlichia muris, Borrelia burgdorferi, Coxiella burnetii, Trypanosoma brucei, Trypanosoma cruzi, Leishmania major, Babesia microti, Plasmodium falciparum*, and *Plasmodium vivax*. Exemplary probes provided in Table 9 and include SEQ ID NOs: 2648-2751 (*Treponema pallidum*), SEQ ID NOs: 2752-2852 (*Ehrlichia chaffeensis*), SEQ ID NOs: 2853-2861 (*Ehrlichia ewingii*), SEQ ID NOs: 2862-2922 (*Ehrlichia muris*), SEQ ID NOs: 2923-3001 (*Borrelia burgdorferi*), SEQ ID NOs: 3002-3085 (*Coxiella burnetii*), SEQ ID NOs: 3086-3097 (*Trypanosoma brucei*), SEQ ID NO: 3098 (*Trypanosoma cruzi*), SEQ ID NOs: 3099-3113 (*Leishmania major*), SEQ ID NOs: 3114-3154 (*Babesia microti*), SEQ ID NOs: 3155-3185 (*Plasmodium falciparum*), and SEQ ID NOs: 3186-3207 (*Plasmodium vivax*).

(117) Finally, the microarray includes housekeeping and negative control probes (Table 10). Exemplary probes include SEQ ID NOs: 3208-3301 (housekeeping gene ACTB), SEQ ID NOs: 3302-3385 (housekeeping gene ARL1), SEQ ID NOs: 3386-3519 (housekeeping gene CCDN1), SEQ ID NOs: 3520-3557 (*Aedes albopictus* densovirus 2), SEQ ID NO: 3558-3598 (Maize streak virus), and SEQ ID NOs: 3599-3628 (Tomato pseudo-curly top virus).

(118) For sample analysis, viral DNA from plasma specimens was extracted with the Invitrogen Dynabeads™ SILANE viral NA kit. The kit is designed for highly predictable and consistent isolation of viral nucleic acids. Beads and buffers are optimized for sensitive isolation of viral DNA. DNA from bacteria and protozoans was extracted from whole blood with the QIAamp® DNA Blood Mini kit (Qiagen) according to the manufacturer's protocol.

(119) SureTag® Labeling Kit (Agilent technology) was used to enzymatically label DNA from plasma and blood. A modified protocol was developed and optimized for efficient sample fragmentation, enzymatic labeling, and clean up. A master mix containing 10×aCGH blocking agent and 2×HI-RPM hybridization buffer, was added to 2.5-3 μg of labeled DNA, denatured, and hybridized to arrays under 8-chamber gasket slides at 67° C. with 20-rpm rotation for 24 hours in an Agilent hybridization oven. Arrays were processed using wash procedure A and scanned on an Agilent SureScan® G4900DA microarray scanner using 5-μm resolution.

(120) CMV, *Trypanosoma*, Parvovirus B19, HBV, EBV (HHV-4), *Treponema, Babesia, Leishmania, Coxiella, Borrelia*, Papilloma Virus (HPV 6, 11, 16, 18), and *P. falciparum* had 10.sup.4-10.sup.3 copies/mL limits of detection. There were no false negatives or false positives when testing the positive plasma. All the results were confirmed by RT-qPCR of the DNA aliquots used for testing. All positive results were confirmed and the copy numbers for each pathogen were calculated to define the limit of the detection for each species on the array.

(121) TABLE-US-00008 TABLE 8 Exemplary DNA virus probes SEQ ID Genomic ProbeID Start End NO: Virus Region Product CUST_P10000630 45812 45860 1770 CMV (HHV-5) Cytomegalovirus UL34 protein CUST_P10000631 45872 45916 1771 CMV (HHV-5) Cytomegalovirus UL34 protein CUST_P10000638 46336 46384 1772 CMV (HHV-5) Cytomegalovirus UL34 protein CUST_P10001082 78547 78591 1773 CMV (HHV-5) Cytomegalovirus UL54 DNA rep CUST_P10001099 79469 79514 1774 CMV (HHV-5) Cytomegalovirus UL54 DNA rep CUST_P10001109 80183 80227 1775 CMV (HHV-5) Cytomegalovirus UL54 DNA rep CUST_P10001111 80253 80301 1776 CMV (HHV-5) Cytomegalovirus UL54 DNA rep CUST_P10001120 80933 80979 1777 CMV (HHV-5) Cytomegalovirus UL54 DNA rep CUST_P10001123 81072 81116 1778 CMV (HHV-5) Cytomegalovirus UL54 DNA rep CUST_P10001126 81245 81289 1779 CMV (HHV-5) Cytomegalovirus UL54 DNA rep CUST_P10001131 81599 81643 1780 CMV (HHV-5) Cytomegalovirus UL54 DNA rep CUST_P10001132 81738 81782 1781 CMV (HHV-5) Cytomegalovirus UL54 DNA rep CUST_P10001140 82327 82375 1782 CMV (HHV-5) Cytomegalovirus UL55 envelop CUST_P10001146 82856 82901 1783 CMV (HHV-5)

Cytomegalovirus UL55 envelop CUST_P10001152 83347 83399 1784 CMV (HHV-5)
Cytomegalovirus UL55 envelop CUST_P10001154 83475 83525 1785 CMV (HHV-5)
Cytomegalovirus UL55 envelop CUST_P10001155 83645 83701 1786 CMV (HHV-5)
Cytomegalovirus UL55 envelop CUST_P10001156 83677 83724 1787 CMV (HHV-5)
Cytomegalovirus UL55 envelop CUST_P10001158 83744 83797 1788 CMV (HHV-5)
Cytomegalovirus UL55 envelop CUST_P10001160 83961 84012 1789 CMV (HHV-5)
Cytomegalovirus UL55 envelop CUST_P10001161 83993 84052 1790 CMV (HHV-5)
Cytomegalovirus UL55 envelop CUST_P10001162 84021 84073 1791 CMV (HHV-5)
Cytomegalovirus UL55 envelop CUST_P10001164 84223 84275 1792 CMV (HHV-5)
Cytomegalovirus UL55 envelop CUST_P10001165 84398 84442 1793 CMV (HHV-5)
Cytomegalovirus UL55 envelop CUST_P10001169 84665 84716 1794 CMV (HHV-5)
Cytomegalovirus UL55 envelop CUST_P10001175 85014 85071 1795 CMV (HHV-5)
Cytomegalovirus UL56 encapsi CUST_P10001177 85085 85132 1796 CMV (HHV-5)
Cytomegalovirus UL56 encapsi CUST_P10001179 85221 85272 1797 CMV (HHV-5)
Cytomegalovirus UL56 encapsi CUST_P10001183 85645 85693 1798 CMV (HHV-5)
Cytomegalovirus UL56 encapsi CUST_P10001189 86404 86461 1799 CMV (HHV-5)
Cytomegalovirus UL56 encapsi CUST_P10001198 87249 87308 1800 CMV (HHV-5)
Cytomegalovirus UL56 encapsi CUST_P10001603 117602 117650 1801 CMV (HHV-5)
Cytomegalovirus UL80 capsid CUST_P10001618 118112 118156 1802 CMV (HHV-5)
Cytomegalovirus UL80 capsid CUST_P10001622 118567 118615 1803 CMV (HHV-5)
Cytomegalovirus UL80 capsid CUST_P10001664 121437 121483 1804 CMV (HHV-5)
Cytomegalovirus UL83 tegumen CUST_P10001665 121470 121522 1805 CMV (HHV-5)
Cytomegalovirus UL83 tegumen CUST_P10001666 121493 121543 1806 CMV (HHV-5)
Cytomegalovirus UL83 tegumen CUST_P10001675 122579 122623 1807 CMV (HHV-5)
Cytomegalovirus UL83 tegumen CUST_P10001945 141984 142028 1808 CMV (HHV-5)
Cytomegalovirus UL97 core CUST_P10001948 142100 142144 1809 CMV (HHV-5)
Cytomegalovirus UL97 core CUST_P10001960 142742 142789 1810 CMV (HHV-5)
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Cytomegalovirus UL97 core CUST_P10002353 170852 170896 1813 CMV (HHV-5)
Cytomegalovirus UL122 Beta Ge CUST_P10002359 171207 171256 1814 CMV (HHV-5)
Cytomegalovirus UL122 Beta Ge CUST_P10002362 171393 171444 1815 CMV (HHV-5)
Cytomegalovirus UL122 Beta Ge CUST_P10002371 171811 171858 1816 CMV (HHV-5)
Cytomegalovirus UL122 Beta Ge CUST_P10002377 172241 172300 1817 CMV (HHV-5)
Cytomegalovirus UL122 Beta Ge CUST_P10002378 172286 172345 1818 CMV (HHV-5)
Cytomegalovirus UL122 Beta Ge CUST_P10002379 172307 172366 1819 CMV (HHV-5)
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Cytomegalovirus UL122 Beta Ge CUST_P10002382 172633 172678 1821 CMV (HHV-5)
Cytomegalovirus UL122 Beta Ge CUST_P10002384 172987 173046 1822 CMV (HHV-5)
Cytomegalovirus UL122 Beta Ge CUST_P10002385 173023 173082 1823 CMV (HHV-5)
Cytomegalovirus UL122 Beta Ge CUST_P10002386 173044 173097 1824 CMV (HHV-5)
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Cytomegalovirus UL124 Prot E CUST_P10002466 178473 178527 1845 CMV (HHV-5)
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Cytomegalovirus UL132 Glyco CUST_P10002471 178825 178870 1847 CMV (HHV-5)
Cytomegalovirus UL132 Glyco CUST_P10002474 178926 178974 1848 CMV (HHV-5)
Cytomegalovirus UL132 Glyco CUST_P10002475 178954 179000 1849 CMV (HHV-5)
Cytomegalovirus UL132 Glyco CUST_P10002927 211545 211592 1850 CMV (HHV-5)
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type 6b E1 Regulatory (HPV 6b) Protein CUST_P10009661 1492 1551 2127 Human papillomavirus type 6b E1 Regulatory (HPV 6b) Protein CUST_P10009662 1852 1908 2128 Human papillomavirus type 6b E1 Regulatory (HPV 6b) Protein CUST_P10009663 1899 1958 2129 Human papillomavirus type 6b E1 Regulatory (HPV 6b) Protein CUST_P10009664 2058 2117 2130 Human papillomavirus type 6b E1 Regulatory (HPV 6b) Protein CUST_P10009665 2086 2145 2131 Human papillomavirus type 6b E1 Regulatory (HPV 6b) Protein CUST_P10009666 2353 2412 2132 Human papillomavirus type 6b E1 Regulatory (HPV 6b) Protein CUST_P10009667 2463 2522 2133 Human papillomavirus type 6b E1 Regulatory (HPV 6b) Protein CUST_P10009668 2507 2566 2134 Human papillomavirus type 6b E1 Regulatory (HPV 6b) Protein CUST_P10009669 2554 2613 2135 Human papillomavirus type 6b E1 Regulatory (HPV 6b) Protein CUST_P10009670 2601 2660 2136 Human papillomavirus type 6b E1 Regulatory (HPV 6b) Protein CUST_P10009671 2686 2734 2137 Human papillomavirus type 6b E2 Regulatory (HPV 6b) Protein CUST_P10009672 2894 2946 2138 Human papillomavirus type 6b E2 Regulatory (HPV 6b) Protein CUST_P10009673 2916 2975 2139 Human papillomavirus type 6b E2 Regulatory (HPV 6b) Protein CUST_P10009674 2942 3001 2140 Human papillomavirus type 6b E2 Regulatory (HPV 6b) Protein CUST_P10009675 2963 3022 2141 Human papillomavirus type 6b E2 Regulatory (HPV 6b) Protein CUST_P10009676 3002 3061 2142 Human papillomavirus type 6b E2 Regulatory (HPV 6b) Protein CUST_P10009677 3030 3089 2143 Human papillomavirus type 6b E2 Regulatory (HPV 6b) Protein CUST_P10009678 3061 3120 2144 Human papillomavirus type 6b E2 Regulatory (HPV 6b) Protein CUST_P10009679 3091 3148 2145 Human papillomavirus type 6b E2 Regulatory (HPV 6b) Protein CUST_P10009680 3265 3324 2146 Human papillomavirus type 6b E2 Regulatory (HPV 6b) Protein CUST_P10009681 3305 3364 2147 Human papillomavirus type 6b E2 Regulatory (HPV 6b) Protein CUST_P10009686 3592 3651 2148 Human papillomavirus type 6b E2 Regulatory (HPV 6b) Protein CUST_P10009687 3614 3673 2149 Human papillomavirus type 6b E2 Regulatory (HPV 6b) Protein CUST_P10009689 3686 3740 2150 Human papillomavirus type 6b E2 Regulatory (HPV 6b) Protein CUST_P10009690 3724 3783 2151 Human papillomavirus type 6b E2 Regulatory (HPV 6b) Protein CUST_P10009691 3751 3810 2152 Human papillomavirus type 6b E2 Regulatory (HPV 6b) Protein CUST_P10009692 3937 3996 2153 Human papillomavirus type 6b E5 Regulatory (HPV 6b) Protein CUST_P10009693 4048 4107 2154 Human papillomavirus type 6b E5 Regulatory (HPV 6b) Protein CUST_P10009694 4077 4136 2155 Human papillomavirus type 6b E5 Regulatory (HPV 6b) Protein CUST_P10009695 4116 4175 2156 Human papillomavirus type 6b E5 Regulatory (HPV 6b) Protein CUST_P10009696 4140 4199 2157 Human papillomavirus type 6b E5 Regulatory (HPV 6b) Protein CUST_P10009697 4281 4340 2158 Human papillomavirus type 6b E5 Regulatory (HPV 6b) Protein CUST_P10009698 4505 4557 2159 Human papillomavirus type 6b L2 Capsid (HPV 6b) CUST_P10009702 4718 4773 2160 Human papillomavirus type 6b L2 Capsid (HPV 6b) CUST_P10009705 4804 4863 2161 Human papillomavirus type 6b L2 Capsid (HPV 6b) CUST_P10009706 4937 4991 2162 Human papillomavirus type 6b L2 Capsid (HPV 6b) CUST_P10009707 4970 5029 2163 Human papillomavirus type 6b L2 Capsid (HPV 6b) CUST_P10009709 5118 5175 2164 Human papillomavirus type 6b L2 Capsid (HPV 6b) CUST_P10009710 5237 5285 2165 Human papillomavirus type 6b L2 Capsid (HPV 6b) CUST_P10009711 5508 5567 2166 Human papillomavirus type 6b L2 Capsid (HPV 6b) CUST_P10009712 5568 5617 2167 Human papillomavirus type 6b L2 Capsid (HPV 6b) CUST_P10009713 5581 5640 2168 Human papillomavirus type 6b L2 Capsid (HPV 6b) CUST_P10009714 5611 5663 2169 Human papillomavirus type 6b L2 Capsid (HPV 6b) CUST_P10009715 5664 5716 2170 Human papillomavirus type 6b L2 Capsid (HPV 6b) CUST_P10009716 5699 5758 2171 Human papillomavirus type 6b L1 PolyA (HPV 6b) CUST_P10009717 5835 5893 2172 Human papillomavirus type 6b L1 PolyA (HPV 6b) CUST_P10009718 5882 5941 2173 Human papillomavirus type 6b L1 PolyA (HPV 6b)

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E2 Regulatory (HPV 11) Protein CUST_P10009776 2458 2517 2223 Human papillomavirus type 6b E2 Regulatory (HPV 11) Protein CUST_P10009777 2590 2649 2224 Human papillomavirus type 6b E2 Regulatory (HPV 11) Protein CUST_P10009778 2625 2684 2225 Human papillomavirus type 6b E2 Regulatory (HPV 11) Protein CUST_P10009779 2655 2708 2226 Human papillomavirus type 6b E2 Regulatory (HPV 11) Protein CUST_P10009780 2692 2740 2227 Human papillomavirus type 6b E2 Regulatory (HPV 11) Protein CUST_P10009781 2920 2979 2228 Human papillomavirus type 6b E2 Regulatory (HPV 11) Protein CUST_P10009782 2985 3035 2229 Human papillomavirus type 6b E2 Regulatory (HPV 11) Protein CUST_P10009783 3047 3106 2230 Human papillomavirus type 6b E2 Regulatory (HPV 11) Protein CUST_P10009784 3081 3140 2231 Human papillomavirus type 6b E2 Regulatory (HPV 11) Protein CUST_P10009785 3120 3176 2232 Human papillomavirus type 6b E2 Regulatory (HPV 11) Protein CUST_P10009786 3265 3324 2233 Human papillomavirus type 6b E2 Regulatory (HPV 11) Protein CUST_P10009787 3380 3424 2234 Human papillomavirus type 6b E2 Regulatory (HPV 11) Protein CUST_P10009788 3432 3476 2235 Human papillomavirus type 6b E2 Regulatory (HPV 11) Protein CUST_P10009789 3505 3560 2236 Human papillomavirus type 6b E2 Regulatory (HPV 11) Protein CUST_P10009790 3678 3735 2237 Human papillomavirus type 6b E2 Regulatory (HPV 11) Protein CUST_P10009791 3709 3768 2238 Human papillomavirus type 6b E2 Regulatory (HPV 11) Protein CUST_P10009792 3901 3960 2239 Human papillomavirus type 6b E5 Regulatory (HPV 11) Protein CUST_P10009793 4136 4195 2240 Human papillomavirus type 6b E5 Regulatory (HPV 11) Protein CUST_P10009794 4283 4342 2241 Human papillomavirus type 6b E5 Regulatory (HPV 11) Protein CUST_P10009795 4408 4458 2242 Human papillomavirus type 6b E5 Regulatory (HPV 11) Protein CUST_P10009796 4497 4556 2243 Human papillomavirus type 6b L2 Capsid (HPV 11)
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CUST_P10009917 422 468 2351 Human papillomavirus type 6b E6 Regulatory (HPV 18) Protein
CUST_P10009918 535 583 2352 Human papillomavirus type 6b E6 Regulatory (HPV 18) Protein
CUST_P10009919 560 619 2353 Human papillomavirus type 6b E6 Regulatory (HPV 18) Protein
CUST_P10009920 594 651 2354 Human papillomavirus type 6b E7 Regulatory (HPV 18) Protein
CUST_P10009921 643 694 2355 Human papillomavirus type 6b E7 Regulatory (HPV 18) Protein
CUST_P10009922 681 740 2356 Human papillomavirus type 6b E7 Regulatory (HPV 18) Protein
CUST_P10009925 1017 1071 2357 Human papillomavirus type 6b E1 Regulatory (HPV 18) Protein CUST_P10009926 1134 1187 2358 Human papillomavirus type 6b E1 Regulatory (HPV 18) Protein CUST_P10009927 1302 1357 2359 Human papillomavirus type 6b E1 Regulatory (HPV 18) Protein CUST_P10009928 1663 1722 2360 Human papillomavirus type 6b E1 Regulatory (HPV 18) Protein CUST_P10009929 1691 1750 2361 Human papillomavirus type 6b E1 Regulatory (HPV 18) Protein CUST_P10009930 1719 1778 2362 Human papillomavirus type 6b E1 Regulatory (HPV 18) Protein CUST_P10009931 1883 1942 2363 Human papillomavirus type 6b E1 Regulatory (HPV 18) Protein CUST_P10009932 1937 1996 2364 Human papillomavirus type 6b E1 Regulatory (HPV 18) Protein CUST_P10009933 2186 2245 2365 Human papillomavirus type 6b E1 Regulatory (HPV 18) Protein CUST_P10009934 2210 2269 2366 Human papillomavirus type 6b E1 Regulatory (HPV 18) Protein CUST_P10009935 2392 2451 2367 Human papillomavirus type 6b E1 Regulatory (HPV 18) Protein CUST_P10009936

2430 2489 2368 Human papillomavirus type 6b E1 Regulatory (HPV 18) Protein CUST_P10009937 2471 2520 2369 Human papillomavirus type 6b E1 Regulatory (HPV 18) Protein CUST_P10009938 2512 2571 2370 Human papillomavirus type 6b E1 Regulatory (HPV 18) Protein CUST_P10009939 2558 2617 2371 Human papillomavirus type 6b E1 Regulatory (HPV 18) Protein CUST_P10009940 2606 2665 2372 Human papillomavirus type 6b E1 Regulatory (HPV 18) Protein CUST_P10009941 2642 2701 2373 Human papillomavirus type 6b E1 Regulatory (HPV 18) Protein CUST_P10009942 2808 2852 2374 Human papillomavirus type 6b E1 Regulatory (HPV 18) Protein CUST_P10009943 2837 2891 2375 Human papillomavirus type 6b E2 Regulatory (HPV 18) Protein CUST_P10009944 2858 2917 2376 Human papillomavirus type 6b E2 Regulatory (HPV 18) Protein CUST_P10009945 2885 2944 2377 Human papillomavirus type 6b E2 Regulatory (HPV 18) Protein CUST_P10009946 2914 2973 2378 Human papillomavirus type 6b E2 Regulatory (HPV 18) Protein CUST_P10009947 3085 3133 2379 Human papillomavirus type 6b E2 Regulatory (HPV 18) Protein CUST_P10009948 3205 3264 2380 Human papillomavirus type 6b E2 Regulatory (HPV 18) Protein CUST_P10009949 3260 3312 2381 Human papillomavirus type 6b E2 Regulatory (HPV 18) Protein CUST_P10009952 3727 3781 2382 Human papillomavirus type 6b E2 Regulatory (HPV 18) Protein CUST_P10009953 3753 3807 2383 Human papillomavirus type 6b E4 Regulatory (HPV 18) Protein CUST_P10009954 4025 4080 2384 Human papillomavirus type 6b E5 Regulatory (HPV 18) Protein CUST_P10009955 4262 4316 2385 Human papillomavirus type 6b L2 Capsid (HPV 18) CUST_P10009956 4357 4414 2386 Human papillomavirus type 6b L2 Capsid (HPV 18) CUST_P10009959 4544 4599 2387 Human papillomavirus type 6b L2 Capsid (HPV 18) CUST_P10009960 4678 4735 2388 Human papillomavirus type 6b L2 Capsid (HPV 18) CUST_P10009961 4704 4762 2389 Human papillomavirus type 6b L2 Capsid (HPV 18) CUST_P10009962 4796 4852 2390 Human papillomavirus type 6b L2 Capsid (HPV 18) CUST_P10009964 4933 4979 2391 Human papillomavirus type 6b L2 Capsid (HPV 18) CUST_P10009965 4947 5002 2392 Human papillomavirus type 6b L2 Capsid (HPV 18) CUST_P10009967 5016 5075 2393 Human papillomavirus type 6b L2 Capsid (HPV 18) CUST_P10009968 5037 5096 2394 Human papillomavirus type 6b L2 Capsid (HPV 18) CUST_P10009969 5067 5119 2395 Human papillomavirus type 6b L2 Capsid (HPV 18) CUST_P10009970 5218 5269 2396 Human papillomavirus type 6b L2 Capsid (HPV 18) CUST_P10009971 5412 5462 2397 Human papillomavirus type 6b L2 Capsid (HPV 18) CUST_P10009972 5437 5495 2398 Human papillomavirus type 6b L2 Capsid (HPV 18) CUST_P10009973 5635 5693 2399 Human papillomavirus type 6b L2 Capsid (HPV 18) CUST_P10009975 5781 5840 2400 Human papillomavirus type 6b L1 PolyA (HPV 18) CUST_P10009976 5823 5882 2401 Human papillomavirus type 6b L1 PolyA (HPV 18) CUST_P10009977 5844 5903 2402 Human papillomavirus type 6b L1 PolyA (HPV 18) CUST_P10009978 5873 5927 2403 Human papillomavirus type 6b L1 PolyA (HPV 18) CUST_P10009979 6014 6068 2404 Human papillomavirus type 6b L1 PolyA (HPV 18) CUST_P10009980 6030 6089 2405 Human papillomavirus type 6b L1 PolyA (HPV 18) CUST_P10009981 6111 6158 2406 Human papillomavirus type 6b L1 PolyA (HPV 18) CUST_P10009982 6122 6167 2407 Human papillomavirus type 6b L1 PolyA (HPV 18) CUST_P10009983 6149 6200 2408 Human papillomavirus type 6b L1 PolyA (HPV 18) CUST_P10009984 6175 6234 2409 Human papillomavirus type 6b L1 PolyA (HPV 18) CUST_P10009985 6284 6343 2410 Human papillomavirus type 6b L1 PolyA (HPV 18) CUST_P10009986 6409 6462 2411 Human papillomavirus type 6b L1 PolyA (HPV 18) CUST_P10009987 6516 6575 2412 Human papillomavirus type 6b L1 PolyA (HPV 18) CUST_P10009988 6547 6606 2413 Human papillomavirus type 6b L1 PolyA (HPV 18) CUST_P10009989 6669 6728 2414 Human papillomavirus type 6b L1 PolyA (HPV 18) CUST_P10009990 6765 6824 2415 Human papillomavirus type 6b L1 PolyA (HPV 18) CUST_P10009991 6890 6947 2416 Human papillomavirus type 6b L1 PolyA (HPV 18)

CUST_P10009992 6911 6970 2417 Human papillomavirus type 6b L1 PolyA (HPV 18)
CUST_P10009993 6954 7013 2418 Human papillomavirus type 6b L1 PolyA (HPV 18)
CUST_P10009994 6997 7042 2419 Human papillomavirus type 6b L1 PolyA (HPV 18)
CUST_P10010004 44 88 2420 Hepatitis B virus subtype adw S surface protein CUST_P10010005 78 126 2421 Hepatitis B virus subtype adw S surface protein CUST_P10010006 158 202 2422 Hepatitis B virus subtype adw S surface protein CUST_P10010008 230 281 2423 Hepatitis B virus subtype adw S surface protein CUST_P10010009 267 311 2424 Hepatitis B virus subtype adw S surface protein CUST_P10010010 328 372 2425 Hepatitis B virus subtype adw S surface protein CUST_P10010011 394 453 2426 Hepatitis B virus subtype adw S surface protein
CUST_P10010012 419 475 2427 Hepatitis B virus subtype adw S surface protein
CUST_P10010013 441 494 2428 Hepatitis B virus subtype adw S surface protein
CUST_P10010015 600 647 2429 Hepatitis B virus subtype adw S surface protein
CUST_P10010016 624 668 2430 Hepatitis B virus subtype adw S surface protein
CUST_P10010017 840 899 2431 Hepatitis B virus subtype adw S surface protein
CUST_P10010018 981 1036 2432 Hepatitis B virus subtype adw C Core CUST_P10010019 1040 1099 2433 Hepatitis B virus subtype adw C Core CUST_P10010020 1085 1144 2434 Hepatitis B virus subtype adw C Core CUST_P10010021 1130 1174 2435 Hepatitis B virus subtype adw C Core CUST_P10010022 1170 1214 2436 Hepatitis B virus subtype adw C Core CUST_P10010023 1216 1260 2437 Hepatitis B virus subtype adw C Core CUST_P10010024 1241 1285 2438 Hepatitis B virus subtype adw C Core CUST_P10010025 1282 1326 2439 Hepatitis B virus subtype adw C Core CUST_P10010026 1453 1497 2440 Hepatitis B virus subtype adw C Core CUST_P10010027 1560 1605 2441 Hepatitis B virus subtype adw C Core CUST_P10010028 1581 1625 2442 Hepatitis B virus subtype adw C Core CUST_P10010029 1623 1667 2443 Hepatitis B virus subtype adw C Core CUST_P10010030 1643 1691 2444 Hepatitis B virus subtype adw C Core CUST_P10010031 1679 1728 2445 Hepatitis B virus subtype adw C Core CUST_P10010032 1696 1743 2446 Hepatitis B virus subtype adw C Core CUST_P10010033 1743 1796 2447 Hepatitis B virus subtype adw C Core CUST_P10010034 1948 1998 2448 Hepatitis B virus subtype adw C Core CUST_P10010035 2054 2099 2449 Hepatitis B virus subtype adw C Core CUST_P10010036 2131 2190 2450 Hepatitis B virus subtype adw C Core CUST_P10010037 2164 2223 2451 Hepatitis B virus subtype adw C Core CUST_P10010038 2208 2267 2452 Hepatitis B virus subtype adw C Core CUST_P10010039 2238 2285 2453 Hepatitis B virus subtype adw C Core CUST_P10010040 2275 2321 2454 Hepatitis B virus subtype adw C Core CUST_P10010041 2293 2349 2455 Hepatitis B virus subtype adw C Core CUST_P10010042 2334 2378 2456 Hepatitis B virus subtype adw C Core CUST_P10010044 2416 2463 2457 Hepatitis B virus subtype adw C Core CUST_P10010045 2431 2490 2458 Hepatitis B virus subtype adw C Core CUST_P10010046 2469 2528 2459 Hepatitis B virus subtype adw C Core CUST_P10010047 2510 2569 2460 Hepatitis B virus subtype adw C Core CUST_P10010048 2539 2598 2461 Hepatitis B virus subtype adw C Core CUST_P10010049 2666 2725 2462 Hepatitis B virus subtype adw C Core CUST_P10010050 2690 2749 2463 Hepatitis B virus subtype adw C Core CUST_P10010051 2723 2782 2464 Hepatitis B virus subtype adw C Core CUST_P10010052 2868 2912 2465 Hepatitis B virus subtype adw C Core CUST_P10010053 2933 2980 2466 Hepatitis B virus subtype adw P Pol CUST_P10010054 2961 3007 2467 Hepatitis B virus subtype adw P Pol CUST_P10010055 2976 3020 2468 Hepatitis B virus subtype adw P Pol CUST_P10010056 3014 3058 2469 Hepatitis B virus subtype adw P Pol CUST_P10010058 3163 3207 2470 Hepatitis B virus subtype adw P Pol CUST_P10010059 1 46 2471 Hepatitis B virus subtype ayw S surface protein CUST_P10010060 74 118 2472 Hepatitis B virus subtype ayw S surface protein CUST_P10010061 93 138 2473 Hepatitis B virus subtype ayw S surface protein
CUST_P10010062 114 158 2474 Hepatitis B virus subtype ayw S surface protein
CUST_P10010063 155 201 2475 Hepatitis B virus subtype ayw S surface protein
CUST_P10010064 190 240 2476 Hepatitis B virus subtype ayw S surface protein

CUST_P10010065 234 283 2477 Hepatitis B virus subtype ayw S surface protein
CUST_P10010066 264 313 2478 Hepatitis B virus subtype ayw S surface protein
CUST_P10010067 295 339 2479 Hepatitis B virus subtype ayw S surface protein
CUST_P10010068 330 374 2480 Hepatitis B virus subtype ayw S surface protein
CUST_P10010069 369 416 2481 Hepatitis B virus subtype ayw S surface protein
CUST_P10010070 392 447 2482 Hepatitis B virus subtype ayw S surface protein
CUST_P10010071 443 493 2483 Hepatitis B virus subtype ayw S surface protein
CUST_P10010072 473 517 2484 Hepatitis B virus subtype ayw S surface protein
CUST_P10010073 600 645 2485 Hepatitis B virus subtype ayw S surface protein
CUST_P10010076 851 907 2486 Hepatitis B virus subtype ayw X x-protein CUST_P10010077 983 1033 2487 Hepatitis B virus subtype ayw X x-protein CUST_P10010078 1028 1087 2488 Hepatitis B virus subtype ayw X x-protein CUST_P10010079 1091 1147 2489 Hepatitis B virus subtype ayw X x-protein CUST_P10010080 1161 1205 2490 Hepatitis B virus subtype ayw X x-protein CUST_P10010081 1218 1262 2491 Hepatitis B virus subtype ayw X x-protein CUST_P10010082 1265 1309 2492 Hepatitis B virus subtype ayw X x-protein CUST_P10010083 1319 1374 2493 Hepatitis B virus subtype ayw X x-protein CUST_P10010084 1384 1429 2494 Hepatitis B virus subtype ayw X x-protein CUST_P10010085 1446 1490 2495 Hepatitis B virus subtype ayw X x-protein CUST_P10010086 1476 1520 2496 Hepatitis B virus subtype ayw X x-protein CUST_P10010087 1528 1572 2497 Hepatitis B virus subtype ayw X x-protein CUST_P10010088 1552 1596 2498 Hepatitis B virus subtype ayw X x-protein CUST_P10010089 1610 1654 2499 Hepatitis B virus subtype ayw X x-protein CUST_P10010090 1636 1685 2500 Hepatitis B virus subtype ayw X x-protein CUST_P10010092 1815 1870 2501 Hepatitis B virus subtype ayw C Core CUST_P10010093 2042 2088 2502 Hepatitis B virus subtype ayw C Core CUST_P10010094 2133 2192 2503 Hepatitis B virus subtype ayw C Core CUST_P10010095 2162 2221 2504 Hepatitis B virus subtype ayw C Core CUST_P10010096 2210 2269 2505 Hepatitis B virus subtype ayw C Core CUST_P10010097 2343 2387 2506 Hepatitis B virus subtype ayw C Core CUST_P10010098 2390 2434 2507 Hepatitis B virus subtype ayw C Core CUST_P10010099 2427 2477 2508 Hepatitis B virus subtype ayw C Core CUST_P10010100 2535 2594 2509 Hepatitis B virus subtype ayw C Core CUST_P10010101 2577 2636 2510 Hepatitis B virus subtype ayw P Pol CUST_P10010102 2641 2700 2511 Hepatitis B virus subtype ayw P Pol CUST_P10010103 2698 2757 2512 Hepatitis B virus subtype ayw P Pol CUST_P10010104 2756 2815 2513 Hepatitis B virus subtype ayw P Pol CUST_P10010105 2794 2845 2514 Hepatitis B virus subtype ayw P Pol CUST_P10010106 2824 2872 2515 Hepatitis B virus subtype ayw P Pol CUST_P10010107 2856 2900 2516 Hepatitis B virus subtype ayw P Pol CUST_P10010108 2885 2929 2517 Hepatitis B virus subtype ayw P Pol CUST_P10010109 2915 2963 2518 Hepatitis B virus subtype ayw P Pol CUST_P10010110 3046 3090 2519 Hepatitis B virus subtype ayw P Pol CUST_P10010111 3121 3165 2520 Hepatitis B virus subtype ayw P Pol CUST_P10010112 8 55 2521 Hepatitis B virus, subtype adr P Pol CUST_P10010113 79 125 2522 Hepatitis B virus, subtype adr P Pol CUST_P10010114 112 156 2523 Hepatitis B virus, subtype adr P Pol CUST_P10010119 325 370 2524 Hepatitis B virus, subtype adr P Pol CUST_P10010122 451 497 2525 Hepatitis B virus, subtype adr P Pol CUST_P10010123 477 521 2526 Hepatitis B virus, subtype adr P Pol CUST_P10010124 638 682 2527 Hepatitis B virus, subtype adr P Pol CUST_P10010125 667 714 2528 Hepatitis B virus, subtype adr P Pol CUST_P10010126 705 754 2529 Hepatitis B virus, subtype adr P Pol CUST_P10010127 839 894 2530 Hepatitis B virus, subtype adr P Pol CUST_P10010128 971 1022 2531 Hepatitis B virus, subtype adr P Pol CUST_P10010129 1088 1145 2532 Hepatitis B virus, subtype adr P Pol CUST_P10010131 1160 1204 2533 Hepatitis B virus, subtype adr P Pol CUST_P10010132 1203 1247 2534 Hepatitis B virus, subtype adr P Pol CUST_P10010133 1315 1361 2535 Hepatitis B virus, subtype adr P Pol CUST_P10010134 1458 1502 2536 Hepatitis B virus, subtype adr P Pol CUST_P10010136 1556 1600 2537 Hepatitis B virus, subtype adr P Pol CUST_P10010137 1635 1683 2538 Hepatitis B

virus, subtype adr P Pol CUST_P10010138 1679 1729 2539 Hepatitis B virus, subtype adr C Core CUST_P10010139 1810 1864 2540 Hepatitis B virus, subtype adr C Core CUST_P10010140 1999 2043 2541 Hepatitis B virus, subtype adr C Core CUST_P10010141 2109 2153 2542 Hepatitis B virus, subtype adr C Core CUST_P10010142 2220 2279 2543 Hepatitis B virus, subtype adr C Core CUST_P10010143 2247 2294 2544 Hepatitis B virus, subtype adr C Core CUST_P10010144 2295 2346 2545 Hepatitis B virus, subtype adr C Core CUST_P10010145 2365 2409 2546 Hepatitis B virus, subtype adr C Core CUST_P10010148 2545 2604 2547 Hepatitis B virus, subtype adr P Pol CUST_P10010149 2575 2634 2548 Hepatitis B virus, subtype adr P Pol CUST_P10010150 2618 2677 2549 Hepatitis B virus, subtype adr P Pol CUST_P10010151 2646 2705 2550 Hepatitis B virus, subtype adr P Pol CUST_P10010152 2672 2731 2551 Hepatitis B virus, subtype adr P Pol CUST_P10010153 2699 2758 2552 Hepatitis B virus, subtype adr P Pol CUST_P10010154 2735 2794 2553 Hepatitis B virus, subtype adr P Pol CUST_P10010156 2928 2972 2554 Hepatitis B virus, subtype adr S1 surface protein CUST_P10010157 2976 3020 2555 Hepatitis B virus, subtype adr S1 surface protein CUST_P10010158 3063 3107 2556 Hepatitis B virus, subtype adr S1 surface protein CUST_P10010159 42 86 2557 Hepatitis B virus, subtype ayr P Pol CUST_P10010160 79 126 2558 Hepatitis B virus, subtype ayr P Pol CUST_P10010161 133 177 2559 Hepatitis B virus, subtype ayr S surface protein CUST_P10010162 158 202 2560 Hepatitis B virus, subtype ayr S surface protein CUST_P10010163 190 238 2561 Hepatitis B virus, subtype ayr S surface protein CUST_P10010164 227 280 2562 Hepatitis B virus, subtype ayr S surface protein CUST_P10010165 272 316 2563 Hepatitis B virus, subtype ayr S surface protein CUST_P10010166 328 372 2564 Hepatitis B virus, subtype ayr S surface protein CUST_P10010167 366 414 2565 Hepatitis B virus, subtype ayr S surface protein CUST_P10010168 390 447 2566 Hepatitis B virus, subtype ayr S surface protein CUST_P10010169 452 500 2567 Hepatitis B virus, subtype ayr S surface protein CUST_P10010170 477 521 2568 Hepatitis B virus, subtype ayr S surface protein CUST_P10010171 598 642 2569 Hepatitis B virus, subtype ayr S surface protein CUST_P10010172 659 707 2570 Hepatitis B virus, subtype ayr S surface protein CUST_P10010173 839 898 2571 Hepatitis B virus, subtype ayr P Pol CUST_P10010174 971 1023 2572 Hepatitis B virus, subtype ayr P Pol CUST_P10010175 1087 1146 2573 Hepatitis B virus, subtype ayr P Pol CUST_P10010176 1116 1163 2574 Hepatitis B virus, subtype ayr P Pol CUST_P10010177 1151 1195 2575 Hepatitis B virus, subtype ayr P Pol CUST_P10010179 1318 1366 2576 Hepatitis B virus, subtype ayr P Pol CUST_P10010180 1356 1400 2577 Hepatitis B virus, subtype ayr X x-protein CUST_P10010181 1388 1432 2578 Hepatitis B virus, subtype ayr X x-protein CUST_P10010182 1419 1463 2579 Hepatitis B virus, subtype ayr X x-protein CUST_P10010183 1472 1516 2580 Hepatitis B virus, subtype ayr X x-protein CUST_P10010185 1565 1609 2581 Hepatitis B virus, subtype ayr X x-protein CUST_P10010187 1643 1690 2582 Hepatitis B virus, subtype ayr X x-protein CUST_P10010188 1675 1725 2583 Hepatitis B virus, subtype ayr X x-protein CUST_P10010189 1808 1856 2584 Hepatitis B virus, subtype ayr X x-protein CUST_P10010190 1941 1996 2585 Hepatitis B virus, subtype ayr C Core CUST_P10010191 2001 2045 2586 Hepatitis B virus, subtype ayr C Core CUST_P10010192 2111 2155 2587 Hepatitis B virus, subtype ayr C Core CUST_P10010193 2210 2266 2588 Hepatitis B virus, subtype ayr C Core CUST_P10010194 2290 2335 2589 Hepatitis B virus, subtype ayr C Core CUST_P10010195 2365 2409 2590 Hepatitis B virus, subtype ayr C Core CUST_P10010196 2410 2456 2591 Hepatitis B virus, subtype ayr C Core CUST_P10010197 2430 2484 2592 Hepatitis B virus, subtype ayr C Core CUST_P10010198 2516 2571 2593 Hepatitis B virus, subtype ayr C Core CUST_P10010199 2577 2636 2594 Hepatitis B virus, subtype ayr C Core CUST_P10010200 2629 2688 2595 Hepatitis B virus, subtype ayr C Core CUST_P10010201 2675 2734 2596 Hepatitis B virus, subtype ayr C Core CUST_P10010202 2702 2761 2597 Hepatitis B virus, subtype ayr C Core CUST_P10010203 2742 2801 2598 Hepatitis B virus, subtype ayr C Core CUST_P10010204 2890 2936 2599 Hepatitis B virus, subtype ayr S surface protein

CUST_P10010205 2955 3001 2600 Hepatitis B virus, subtype ayr S surface protein
CUST_P10010206 2978 3022 2601 Hepatitis B virus, subtype ayr S surface protein
CUST_P10010207 3012 3056 2602 Hepatitis B virus, subtype ayr S surface protein
CUST_P10010208 57 104 2603 Human parvovirus B19 NS non-structural protein NS1
CUST_P10010209 227 271 2604 Human parvovirus B19 NS non-structural protein NS2
CUST_P10010211 637 693 2605 Human parvovirus B19 NS non-structural protein NS1
CUST_P10010212 685 744 2606 Human parvovirus B19 NS non-structural protein NS1
CUST_P10010214 973 1032 2607 Human parvovirus B19 NS non-structural protein NS1
CUST_P10010215 1065 1124 2608 Human parvovirus B19 NS non-structural protein NS1
CUST_P10010216 1165 1210 2609 Human parvovirus B19 NS non-structural protein NS1
CUST_P10010217 1220 1279 2610 Human parvovirus B19 NS non-structural protein NS1
CUST_P10010218 1258 1317 2611 Human parvovirus B19 NS non-structural protein NS1
CUST_P10010219 1357 1416 2612 Human parvovirus B19 NS non-structural protein NS1
CUST_P10010220 1408 1467 2613 Human parvovirus B19 NS non-structural protein NS1
CUST_P10010221 1542 1601 2614 Human parvovirus B19 NS non-structural protein NS1
CUST_P10010222 1628 1687 2615 Human parvovirus B19 NS non-structural protein NS1
CUST_P10010223 1767 1812 2616 Human parvovirus B19 NS non-structural protein NS1
CUST_P10010224 1845 1902 2617 Human parvovirus B19 NS non-structural protein NS1
CUST_P10010225 1911 1970 2618 Human parvovirus B19 NS non-structural protein NS1
CUST_P10010226 2041 2096 2619 Human parvovirus B19 NS non-structural protein NS1
CUST_P10010227 2257 2301 2620 Human parvovirus B19 NS non-structural protein NS1
CUST_P10010228 2351 2399 2621 Human parvovirus B19 NS non-structural protein NS1
CUST_P10010229 2395 2446 2622 Human parvovirus B19 NS non-structural protein NS1
CUST_P10010230 2426 2478 2623 Human parvovirus B19 NS non-structural protein NS1
CUST_P10010231 2552 2607 2624 Human parvovirus B19 NS non-structural protein NS1
CUST_P10010232 2787 2846 2625 Human parvovirus B19 VP1 minor capsid protein
CUST_P10010233 2836 2895 2626 Human parvovirus B19 VP1 minor capsid protein
CUST_P10010234 2868 2915 2627 Human parvovirus B19 VP1 minor capsid protein
CUST_P10010235 2914 2973 2628 Human parvovirus B19 VP1 minor capsid protein
CUST_P10010236 3081 3140 2629 Human parvovirus B19 VP1 minor capsid protein
CUST_P10010237 3252 3297 2630 Human parvovirus B19 VP1 minor capsid protein
CUST_P10010238 3276 3330 2631 Human parvovirus B19 VP1 minor capsid protein
CUST_P10010239 3422 3481 2632 Human parvovirus B19 VP1 minor capsid protein
CUST_P10010240 3524 3583 2633 Human parvovirus B19 VP1 minor capsid protein
CUST_P10010241 3652 3711 2634 Human parvovirus B19 VP1 minor capsid protein
CUST_P10010242 3801 3856 2635 Human parvovirus B19 VP1 minor capsid protein
CUST_P10010243 3826 3885 2636 Human parvovirus B19 VP1 minor capsid protein
CUST_P10010244 3864 3923 2637 Human parvovirus B19 VP1 minor capsid protein
CUST_P10010245 3996 4042 2638 Human parvovirus B19 VP1 minor capsid protein
CUST_P10010246 4097 4156 2639 Human parvovirus B19 VP1 minor capsid protein
CUST_P10010247 4334 4393 2640 Human parvovirus B19 VP1 minor capsid protein
CUST_P10010248 4463 4522 2641 Human parvovirus B19 VP1 minor capsid protein
CUST_P10010249 4587 4646 2642 Human parvovirus B19 VP1 minor capsid protein
CUST_P10010250 4723 4782 2643 Human parvovirus B19 VP1 minor capsid protein
CUST_P10010251 4820 4864 2644 Human parvovirus B19 VP1 minor capsid protein
CUST_P10010252 4915 4960 2645 Human parvovirus B19 VP1 minor capsid protein
CUST_P10010254 5087 5146 2646 Human parvovirus B19 VP2 major capsid protein
CUST_P10010257 5492 5539 2647 Human parvovirus B19 VP2 major capsid protein
(122) TABLE-US-00009 TABLE 9 Exemplary bacterial and protozoan probes SEQ ID Genomic NO: ProbeID Start End Pathogen Region Product 2648 CUST_P10011833 115100 115153

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69254 69313 *Ehrlichia chaffeensis* argF protein 2754 CUST_P10026957 118031 118090 *Ehrlichia*
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ECH_RS00595 protein 2756 CUST_P10027296 155652 155711 *Ehrlichia chaffeensis*
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ECH_RS00710 protein 2758 CUST_P10027972 235733 235792 *Ehrlichia chaffeensis*
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ECH_RS01185 protein 2761 CUST_P10028636 313330 313389 *Ehrlichia chaffeensis*
ECH_RS01325 protein 2762 CUST_P10028976 353675 353734 *Ehrlichia chaffeensis* groL
chaperonin GroEL 2763 CUST_P10028977 353852 353911 *Ehrlichia chaffeensis* groL chaperonin
GroEL 2764 CUST_P10028978 354008 354067 *Ehrlichia chaffeensis* groL chaperonin GroEL
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Coxiella burnetii IS1111A transposase IS1111A transposase 3055 CUST_P10058819 502573 502619 *Coxiella burnetii* IS1111A transposase IS1111A transposase 3056 CUST_P10058820 502696 502746 *Coxiella burnetii* IS1111A transposase IS1111A transposase 3057 CUST_P10058821 502727 502776 *Coxiella burnetii* IS1111A transposase IS1111A transposase 3058 CUST_P10058822 502846 502892 *Coxiella burnetii* IS1111A transposase IS1111A transposase 3059 CUST_P10058823 502868 502915 *Coxiella burnetii* IS1111A transposase IS1111A transposase 3060 CUST_P10058824 502908 502953 *Coxiella burnetii* IS1111A transposase IS1111A transposase 3061 CUST_P10058825 502925 502974 *Coxiella burnetii* IS1111A transposase IS1111A transposase 3062 CUST_P10058826 502960 503012 *Coxiella burnetii* IS1111A transposase IS1111A transposase 3063 CUST_P10058827 503069 503113 *Coxiella burnetii* IS1111A transposase IS1111A transposase 3064 CUST_P10058828 503121 503172 *Coxiella burnetii* IS1111A transposase IS1111A transposase 3065 CUST_P10058829 503226 503276 *Coxiella burnetii* IS1111A transposase IS1111A transposase 3066 CUST_P10058830 503308 503358 *Coxiella burnetii* IS1111A transposase IS1111A transposase 3067 CUST_P10058831 503329 503384 *Coxiella burnetii* IS1111A transposase IS1111A transposase 3068 CUST_P10058832 503374 503433 *Coxiella burnetii* IS1111A transposase IS1111A transposase 3069 CUST_P10058833 503541 503597 *Coxiella burnetii* IS1111A transposase IS1111A transposase 3070 CUST_P10058834 503609 503658 *Coxiella burnetii* IS1111A transposase IS1111A transposase 3071 CUST_P10058835 503681 503725 *Coxiella burnetii* IS1111A transposase IS1111A transposase 3072 CUST_P10058836 503718 503765 *Coxiella burnetii* IS1111A transposase IS1111A transposase 3073 CUST_P10058837 503745 503791 *Coxiella burnetii* IS1111A transposase IS1111A transposase 3074 CUST_P10058838 503852 503911 *Coxiella burnetii* IS1111A transposase IS1111A transposase 3075 CUST_P10065644 1021442 1021488 *Coxiella burnetii* IS1111A transposase IS1111A transposase 3076 CUST_P10065645 1021559 1021607 *Coxiella burnetii* IS1111A transposase IS1111A transposase 3077 CUST_P10065646 1021597 1021650 *Coxiella burnetii* IS1111A transposase IS1111A transposase 3078 CUST_P10065647 1021718 1021762 *Coxiella burnetii* IS1111A transposase IS1111A transposase 3079 CUST_P10065648 1021753 1021800 *Coxiella burnetii* IS1111A transposase IS1111A transposase 3080 CUST_P10065649 1021775 1021826 *Coxiella burnetii* IS1111A transposase IS1111A transposase 3081 CUST_P10065650 1021807 1021851 *Coxiella burnetii* IS1111A transposase IS1111A transposase 3082 CUST_P10065651 1021891 1021944 *Coxiella burnetii* IS1111A transposase IS1111A transposase 3083 CUST_P10065652 1021940 1021984 *Coxiella burnetii* IS1111A transposase IS1111A transposase 3084 CUST_P10065653 1021980 1022024 *Coxiella burnetii* IS1111A transposase IS1111A transposase 3085 CUST_P10065654 1022045 1022094 *Coxiella burnetii* IS1111A transposase IS1111A transposase 3086 CUST_P10079271 1019 1078 *Trypanosoma brucei* kinetoplast apocy kinetoplast apocy 3087 CUST_P10079269 471 530 *Trypanosoma brucei* kinetoplast apocy kinetoplast apocy 3088 CUST_P10079274 1363 1414 *Trypanosoma brucei* kinetoplast apocy kinetoplast apocy 3089 CUST_P10079272 1279 1334 *Trypanosoma brucei* kinetoplast apocy kinetoplast apocy 3090 CUST_P10079270 628 687 *Trypanosoma brucei* kinetoplast apocy kinetoplast apocy 3091 CUST_P10079273 1329 1373 *Trypanosoma brucei* kinetoplast apocy kinetoplast apocy 3092 CUST_P10079280 687 746 *Trypanosoma brucei* kinetoplast DNA m kinetoplast DNA m 3093 CUST_P10079276 478 526 *Trypanosoma brucei* kinetoplast DNA m kinetoplast DNA m 3094 CUST_P10079277 547 601 *Trypanosoma brucei* kinetoplast DNA m kinetoplast DNA m 3095 CUST_P10079275 1 60 *Trypanosoma brucei* kinetoplast DNA m kinetoplast DNA m 3096 CUST_P10079279 677 736 *Trypanosoma brucei* kinetoplast DNA m kinetoplast DNA m 3097 CUST_P10079278 554 610 *Trypanosoma brucei* kinetoplast DNA m kinetoplast DNA m 3098 CUST_P10079281 23 67 *Trypanosoma Cruzi* Mini satellite Mini satellite 3099 CUST_P10079284 267 312 *Leishmania major* kinetoplast DNA kinetoplast DNA 3100 CUST_P10079285 319 365 *Leishmania major* kinetoplast DNA kinetoplast DNA 3101 CUST_P10079286 360 404 *Leishmania*

major kinetoplast DNA kinetoplast DNA 3102 CUST_P10079283 146 205 *Leishmania major* kinetoplast DNA kinetoplast DNA 3103 CUST_P10079287 382 426 *Leishmania major* kinetoplast DNA kinetoplast DNA 3104 CUST_P10079282 1 60 *Leishmania major* kinetoplast DNA kinetoplast DNA 3105 CUST_P10079294 504 548 *Leishmania major* kinetoplast DNA kinetoplast DNA 3106 CUST_P10079292 333 377 *Leishmania major* kinetoplast DNA kinetoplast DNA 3107 CUST_P10079296 588 632 *Leishmania major* kinetoplast DNA kinetoplast DNA 3108 CUST_P10079291 298 342 *Leishmania major* kinetoplast DNA kinetoplast DNA 3109 CUST_P10079290 257 303 *Leishmania major* kinetoplast DNA kinetoplast DNA 3110 CUST_P10079295 551 595 *Leishmania major* kinetoplast DNA kinetoplast DNA 3111 CUST_P10079289 148 200 *Leishmania major* kinetoplast DNA kinetoplast DNA 3112 CUST_P10079288 116 168 *Leishmania major* kinetoplast DNA kinetoplast DNA 3113 CUST_P10079293 462 507 *Leishmania major* kinetoplast DNA kinetoplast DNA 3114 CUST_P10079326 82 141 *Babesia microti* 18S ribosomal RNA 18S ribosomal RNA 3115 CUST_P10079327 140 189 *Babesia microti* 18S ribosomal RNA 18S ribosomal RNA 3116 CUST_P10079328 168 227 *Babesia microti* 18S ribosomal RNA 18S ribosomal RNA 3117 CUST_P10079329 320 364 *Babesia microti* 18S ribosomal RNA 18S ribosomal RNA 3118 CUST_P10079330 336 380 *Babesia microti* 18S ribosomal RNA 18S ribosomal RNA 3119 CUST_P10079331 368 412 *Babesia microti* 18S ribosomal RNA 18S ribosomal RNA 3120 CUST_P10079332 398 450 *Babesia microti* 18S ribosomal RNA 18S ribosomal RNA 3121 CUST_P10079333 434 493 *Babesia microti* 18S ribosomal RNA 18S ribosomal RNA 3122 CUST_P10079334 699 758 *Babesia microti* 18S ribosomal RNA 18S ribosomal RNA 3123 CUST_P10079335 722 781 *Babesia microti* 18S ribosomal RNA 18S ribosomal RNA 3124 CUST_P10079336 771 825 *Babesia microti* 18S ribosomal RNA 18S ribosomal RNA 3125 CUST_P10079337 801 860 *Babesia microti* 18S ribosomal RNA 18S ribosomal RNA 3126 CUST_P10079338 826 885 *Babesia microti* 18S ribosomal RNA 18S ribosomal RNA 3127 CUST_P10079339 891 947 *Babesia microti* 18S ribosomal RNA 18S ribosomal RNA 3128 CUST_P10079340 933 987 *Babesia microti* 18S ribosomal RNA 18S ribosomal RNA 3129 CUST_P10079341 952 1006 *Babesia microti* 18S ribosomal RNA 18S ribosomal RNA 3130 CUST_P10079342 990 1042 *Babesia microti* 18S ribosomal RNA 18S ribosomal RNA 3131 CUST_P10079343 1016 1060 *Babesia microti* 18S ribosomal RNA 18S ribosomal RNA 3132 CUST_P10079344 1055 1101 *Babesia microti* 18S ribosomal RNA 18S ribosomal RNA 3133 CUST_P10079345 1108 1152 *Babesia microti* 18S ribosomal RNA 18S ribosomal RNA 3134 CUST_P10079346 1239 1298 *Babesia microti* 18S ribosomal RNA 18S ribosomal RNA 3135 CUST_P10079347 1357 1405 *Babesia microti* 18S ribosomal RNA 18S ribosomal RNA 3136 CUST_P10079348 1435 1479 *Babesia microti* 18S ribosomal RNA 18S ribosomal RNA 3137 CUST_P10079349 1458 1517 *Babesia microti* 18S ribosomal RNA 18S ribosomal RNA 3138 CUST_P10079350 1620 1675 *Babesia microti* 18S ribosomal RNA 18S ribosomal RNA 3139 CUST_P10079351 1659 1718 *Babesia microti* 18S ribosomal RNA 18S ribosomal RNA 3140 CUST_P10079352 1736 1786 *Babesia microti* 18S ribosomal RNA 18S ribosomal RNA 3141 CUST_P10079353 1758 1802 *Babesia microti* 18S ribosomal RNA 18S ribosomal RNA 3142 CUST_P10079354 1811 1855 *Babesia microti* 18S ribosomal RNA 18S ribosomal RNA 3143 CUST_P10079355 1845 1889 *Babesia microti* 18S ribosomal RNA 18S ribosomal RNA 3144 CUST_P10079356 1894 1938 *Babesia microti* 18S ribosomal RNA 18S ribosomal RNA 3145 CUST_P10079357 1914 1962 *Babesia microti* 18S ribosomal RNA 18S ribosomal RNA 3146 CUST_P10079358 1947 1997 *Babesia microti* 18S ribosomal RNA 18S ribosomal RNA 3147 CUST_P10079359 1975 2019 *Babesia microti* 18S ribosomal RNA 18S ribosomal RNA 3148 CUST_P10079360 2034 2093 *Babesia microti* 18S ribosomal RNA 18S ribosomal RNA 3149 CUST_P10079361 2056 2115 *Babesia microti* 18S ribosomal RNA 18S ribosomal RNA 3150 CUST_P10079362 2125 2174 *Babesia microti* 18S ribosomal RNA 18S ribosomal RNA 3151 CUST_P10079363 2266 2322 *Babesia microti* 18S ribosomal RNA 18S ribosomal RNA 3152

CUST_P10079364 2342 2392 *Babesia microti* 18S ribosomal RNA 18S ribosomal RNA 3153 CUST_P10079365 2363 2418 *Babesia microti* 18S ribosomal RNA 18S ribosomal RNA 3154 CUST_P10079366 2389 2446 *Babesia microti* 18S ribosomal RNA 18S ribosomal RNA 3155 CUST_P10079478 328 375 *Plasmodium falciparum* 18S ribosomal RNA 18S ribosomal RNA 3156 CUST_P10079479 433 492 *Plasmodium falciparum* 18S ribosomal RNA 18S ribosomal RNA 3157 CUST_P10079480 517 566 *Plasmodium falciparum* 18S ribosomal RNA 18S ribosomal RNA 3158 CUST_P10079481 612 671 *Plasmodium falciparum* 18S ribosomal RNA 18S ribosomal RNA 3159 CUST_P10079482 820 879 *Plasmodium falciparum* 18S ribosomal RNA 18S ribosomal RNA 3160 CUST_P10079483 945 1003 *Plasmodium falciparum* 18S ribosomal RNA 18S ribosomal RNA 3161 CUST_P10079484 971 1030 *Plasmodium falciparum* 18S ribosomal RNA 18S ribosomal RNA 3162 CUST_P10079485 1018 1077 *Plasmodium falciparum* 18S ribosomal RNA 18S ribosomal RNA 3163 CUST_P10079486 1211 1257 *Plasmodium falciparum* 18S ribosomal RNA 18S ribosomal RNA 3164 CUST_P10079487 1284 1343 *Plasmodium falciparum* 18S ribosomal RNA 18S ribosomal RNA 3165 CUST_P10079488 1386 1445 *Plasmodium falciparum* 18S ribosomal RNA 18S ribosomal RNA 3166 CUST_P10079489 1673 1727 *Plasmodium falciparum* 18S ribosomal RNA 18S ribosomal RNA 3167 CUST_P10079490 1817 1876 *Plasmodium falciparum* 18S ribosomal RNA 18S ribosomal RNA 3168 CUST_P10079491 1852 1911 *Plasmodium falciparum* 18S ribosomal RNA 18S ribosomal RNA 3169 CUST_P10079492 70 129 *Plasmodium falciparum* 18S ribosomal RNA 18S ribosomal RNA 3170 CUST_P10079493 321 373 *Plasmodium falciparum* 18S ribosomal RNA 18S ribosomal RNA 3171 CUST_P10079494 460 519 *Plasmodium falciparum* 18S ribosomal RNA 18S ribosomal RNA 3172 CUST_P10079495 489 548 *Plasmodium falciparum* 18S ribosomal RNA 18S ribosomal RNA 3173 CUST_P10079496 519 569 *Plasmodium falciparum* 18S ribosomal RNA 18S ribosomal RNA 3174 CUST_P10079497 599 658 *Plasmodium falciparum* 18S ribosomal RNA 18S ribosomal RNA 3175 CUST_P10079498 800 859 *Plasmodium falciparum* 18S ribosomal RNA 18S ribosomal RNA 3176 CUST_P10079499 826 885 *Plasmodium falciparum* 18S ribosomal RNA 18S ribosomal RNA 3177 CUST_P10079500 990 1046 *Plasmodium falciparum* 18S ribosomal RNA 18S ribosomal RNA 3178 CUST_P10079501 1014 1073 *Plasmodium falciparum* 18S ribosomal RNA 18S ribosomal RNA 3179 CUST_P10079502 1053 1112 *Plasmodium falciparum* 18S ribosomal RNA 18S ribosomal RNA 3180 CUST_P10079503 1264 1310 *Plasmodium falciparum* 18S ribosomal RNA 18S ribosomal RNA 3181 CUST_P10079504 1332 1391 *Plasmodium falciparum* 18S ribosomal RNA 18S ribosomal RNA 3182 CUST_P10079505 1450 1509 *Plasmodium falciparum* 18S ribosomal RNA 18S ribosomal RNA 3183 CUST_P10079506 1721 1770 *Plasmodium falciparum* 18S ribosomal RNA 18S ribosomal RNA 3184 CUST_P10079507 1742 1801 *Plasmodium falciparum* 18S ribosomal RNA 18S ribosomal RNA 3185 CUST_P10079508 1890 1949 *Plasmodium falciparum* 18S ribosomal RNA 18S ribosomal RNA 3186 CUST_P10079572 2 61 *Plasmodium vivax* SSU rRNA external transcribed spacer 3187 CUST_P10079573 38 89 *Plasmodium vivax* SSU rRNA external transcribed spacer 3188 CUST_P10079574 68 127 *Plasmodium vivax* SSU rRNA external transcribed spacer 3189 CUST_P10079575 112 171 *Plasmodium vivax* SSU rRNA external transcribed spacer 3190 CUST_P10079576 249 308 *Plasmodium vivax* SSU rRNA external transcribed spacer 3191 CUST_P10079577 279 338 *Plasmodium vivax* SSU rRNA external transcribed spacer 3192 CUST_P10079578 319 372 *Plasmodium vivax* SSU rRNA external transcribed spacer 3193 CUST_P10079579 421 480 *Plasmodium vivax* SSU rRNA external transcribed spacer 3194 CUST_P10079580 590 645 *Plasmodium vivax* SSU rRNA external transcribed spacer 3195 CUST_P10079581 671 719 *Plasmodium vivax* SSU rRNA external transcribed spacer 3196 CUST_P10079582 783 842 *Plasmodium vivax* SSU rRNA external transcribed spacer 3197 CUST_P10079583 803 862 *Plasmodium vivax* SSU rRNA external transcribed spacer 3198 CUST_P10079584 829 888 *Plasmodium vivax* SSU rRNA external transcribed spacer 3199 CUST_P10079585 849 899 *Plasmodium vivax* SSU rRNA

external transcribed spacer 3200 CUST_P10079586 946 1005 *Plasmodium vivax* SSU rRNA external transcribed spacer 3201 CUST_P10079587 1153 1212 *Plasmodium vivax* SSU rRNA external transcribed spacer 3202 CUST_P10079588 1314 1373 *Plasmodium vivax* SSU rRNA external transcribed spacer 3203 CUST_P10079589 1346 1405 *Plasmodium vivax* SSU rRNA external transcribed spacer 3204 CUST_P10079590 1545 1591 *Plasmodium vivax* SSU rRNA external transcribed spacer 3205 CUST_P10079591 1610 1669 *Plasmodium vivax* SSU rRNA external transcribed spacer 3206 CUST_P10079592 1717 1776 *Plasmodium vivax* SSU rRNA external transcribed spacer 3207 CUST_P10079593 1757 1816 *Plasmodium vivax* SSU rRNA external transcribed spacer

(123) TABLE-US-00010 TABLE 10 Exemplary control probes SEQ ID Genomic NO: ProbeID Start End Type Region 3208 CUST_P10079594 1561 1605 Housekeeping Gene ACTB 3209 CUST_P10079595 1703 1750 Housekeeping Gene ACTB 3210 CUST_P10079596 2220 2264 Housekeeping Gene ACTB 3211 CUST_P10079597 2242 2286 Housekeeping Gene ACTB 3212 CUST_P10079598 2276 2320 Housekeeping Gene ACTB 3213 CUST_P10079599 2402 2446 Housekeeping Gene ACTB 3214 CUST_P10079600 2489 2533 Housekeeping Gene ACTB 3215 CUST_P10079601 2659 2703 Housekeeping Gene ACTB 3216 CUST_P10079602 2696 2740 Housekeeping Gene ACTB 3217 CUST_P10079603 2823 2867 Housekeeping Gene ACTB 3218 CUST_P10079604 2847 2891 Housekeeping Gene ACTB 3219 CUST_P10079605 2874 2918 Housekeeping Gene ACTB 3220 CUST_P10079606 3005 3049 Housekeeping Gene ACTB 3221 CUST_P10079607 3046 3090 Housekeeping Gene ACTB 3222 CUST_P10079608 3213 3257 Housekeeping Gene ACTB 3223 CUST_P10079609 3338 3382 Housekeeping Gene ACTB 3224 CUST_P10079610 3376 3420 Housekeeping Gene ACTB 3225 CUST_P10079611 3393 3437 Housekeeping Gene ACTB 3226 CUST_P10079612 3438 3482 Housekeeping Gene ACTB 3227 CUST_P10079613 3545 3593 Housekeeping Gene ACTB 3228 CUST_P10079614 3568 3622 Housekeeping Gene ACTB 3229 CUST_P10079615 3601 3645 Housekeeping Gene ACTB 3230 CUST_P10079616 3744 3788 Housekeeping Gene ACTB 3231 CUST_P10079617 3858 3902 Housekeeping Gene ACTB 3232 CUST_P10079618 3973 4017 Housekeeping Gene ACTB 3233 CUST_P10079619 4130 4177 Housekeeping Gene ACTB 3234 CUST_P10079620 4223 4267 Housekeeping Gene ACTB 3235 CUST_P10079621 4280 4324 Housekeeping Gene ACTB 3236 CUST_P10079622 4304 4348 Housekeeping Gene ACTB 3237 CUST_P10079623 4315 4359 Housekeeping Gene ACTB 3238 CUST_P10079624 4459 4503 Housekeeping Gene ACTB 3239 CUST_P10079625 4592 4636 Housekeeping Gene ACTB 3240 CUST_P10079626 4906 4950 Housekeeping Gene ACTB 3241 CUST_P10079627 4932 4978 Housekeeping Gene ACTB 3242 CUST_P10079628 4972 5016 Housekeeping Gene ACTB 3243 CUST_P10079629 5024 5068 Housekeeping Gene ACTB 3244 CUST_P10079630 5040 5084 Housekeeping Gene ACTB 3245 CUST_P10079631 5076 5120 Housekeeping Gene ACTB 3246 CUST_P10079632 5110 5154 Housekeeping Gene ACTB 3247 CUST_P10079633 5200 5244 Housekeeping Gene ACTB 3248 CUST_P10079634 5357 5401 Housekeeping Gene ACTB 3249 CUST_P10079635 5390 5434 Housekeeping Gene ACTB 3250 CUST_P10079636 5415 5459 Housekeeping Gene ACTB 3251 CUST_P10079637 5453 5497 Housekeeping Gene ACTB 3252 CUST_P10079638 5474 5518 Housekeeping Gene ACTB 3253 CUST_P10079639 5622 5666 Housekeeping Gene ACTB 3254 CUST_P10079640 5662 5706 Housekeeping Gene ACTB 3255 CUST_P10079641 5691 5736 Housekeeping Gene ACTB 3256 CUST_P10079642 5712 5756 Housekeeping Gene ACTB 3257 CUST_P10079643 5760 5804 Housekeeping Gene ACTB 3258 CUST_P10079644 5783 5827 Housekeeping Gene ACTB 3259 CUST_P10079645 5817 5861 Housekeeping Gene ACTB 3260 CUST_P10079646 5963 6007 Housekeeping Gene ACTB 3261 CUST_P10079647 6004 6048 Housekeeping Gene ACTB 3262 CUST_P10079648 6106 6150 Housekeeping Gene ACTB 3263 CUST_P10079649 6310 6354 Housekeeping Gene ACTB 3264 CUST_P10079650 6421 6465 Housekeeping Gene ACTB 3265 CUST_P10079651 6507 6553 Housekeeping Gene ACTB 3266 CUST_P10079652 6696 6740 Housekeeping Gene ACTB 3267 CUST_P10079653 6722 6769

Housekeeping Gene ACTB 3268 CUST_P10079654 6745 6789 Housekeeping Gene ACTB 3269 CUST_P10079655 6772 6816 Housekeeping Gene ACTB 3270 CUST_P10079656 6793 6837 Housekeeping Gene ACTB 3271 CUST_P10079657 6844 6888 Housekeeping Gene ACTB 3272 CUST_P10079658 7000 7044 Housekeeping Gene ACTB 3273 CUST_P10079659 7321 7365 Housekeeping Gene ACTB 3274 CUST_P10079660 7418 7462 Housekeeping Gene ACTB 3275 CUST_P10079661 7554 7598 Housekeeping Gene ACTB 3276 CUST_P10079662 7683 7727 Housekeeping Gene ACTB 3277 CUST_P10079663 7777 7821 Housekeeping Gene ACTB 3278 CUST_P10079664 7825 7869 Housekeeping Gene ACTB 3279 CUST_P10079665 7861 7917 Housekeeping Gene ACTB 3280 CUST_P10079666 8033 8077 Housekeeping Gene ACTB 3281 CUST_P10079667 8138 8182 Housekeeping Gene ACTB 3282 CUST_P10079668 8344 8388 Housekeeping Gene ACTB 3283 CUST_P10079669 8459 8503 Housekeeping Gene ACTB 3284 CUST_P10079670 8519 8563 Housekeeping Gene ACTB 3285 CUST_P10079671 8543 8587 Housekeeping Gene ACTB 3286 CUST_P10079672 8574 8618 Housekeeping Gene ACTB 3287 CUST_P10079673 8628 8672 Housekeeping Gene ACTB 3288 CUST_P10079674 8732 8776 Housekeeping Gene ACTB 3289 CUST_P10079675 8941 8985 Housekeeping Gene ACTB 3290 CUST_P10079676 8962 9006 Housekeeping Gene ACTB 3291 CUST_P10079677 8987 9031 Housekeeping Gene ACTB 3292 CUST_P10079678 9103 9147 Housekeeping Gene ACTB 3293 CUST_P10079679 9155 9199 Housekeeping Gene ACTB 3294 CUST_P10079680 9429 9474 Housekeeping Gene ACTB 3295 CUST_P10079681 9554 9600 Housekeeping Gene ACTB 3296 CUST_P10079682 9739 9785 Housekeeping Gene ACTB 3297 CUST_P10079683 9774 9820 Housekeeping Gene ACTB 3298 CUST_P10079684 9794 9838 Housekeeping Gene ACTB 3299 CUST_P10079685 10015 10062 Housekeeping Gene ACTB 3300 CUST_P10079686 10064 10108 Housekeeping Gene ACTB 3301 CUST_P10079687 10193 10245 Housekeeping Gene ACTB 3302 CUST_P10079715 3325 3369 Housekeeping Gene ARL1 3303 CUST_P10079713 3255 3314 Housekeeping Gene ARL1 3304 CUST_P10079727 5957 6016 Housekeeping Gene ARL1 3305 CUST_P10079741 10779 10838 Housekeeping Gene ARL1 3306 CUST_P10079759 13558 13604 Housekeeping Gene ARL1 3307 CUST_P10079701 934 979 Housekeeping Gene ARL1 3308 CUST_P10079692 526 570 Housekeeping Gene ARL1 3309 CUST_P10079750 11884 11939 Housekeeping Gene ARL1 3310 CUST_P10079730 6728 6787 Housekeeping Gene ARL1 3311 CUST_P10079746 11349 11397 Housekeeping Gene ARL1 3312 CUST_P10079744 11307 11354 Housekeeping Gene ARL1 3313 CUST_P10079732 7235 7286 Housekeeping Gene ARL1 3314 CUST_P10079733 7270 7314 Housekeeping Gene ARL1 3315 CUST_P10079760 13597 13641 Housekeeping Gene ARL1 3316 CUST_P10079762 13648 13693 Housekeeping Gene ARL1 3317 CUST_P10079758 13449 13508 Housekeeping Gene ARL1 3318 CUST_P10079728 6518 6577 Housekeeping Gene ARL1 3319 CUST_P10079738 9891 9950 Housekeeping Gene ARL1 3320 CUST_P10079742 10939 10998 Housekeeping Gene ARL1 3321 CUST_P10079696 746 796 Housekeeping Gene ARL1 3322 CUST_P10079703 1025 1079 Housekeeping Gene ARL1 3323 CUST_P10079688 137 181 Housekeeping Gene ARL1 3324 CUST_P10079755 12703 12762 Housekeeping Gene ARL1 3325 CUST_P10079748 11728 11787 Housekeeping Gene ARL1 3326 CUST_P10079722 5055 5114 Housekeeping Gene ARL1 3327 CUST_P10079724 5213 5268 Housekeeping Gene ARL1 3328 CUST_P10079736 8842 8901 Housekeeping Gene ARL1 3329 CUST_P10079714 3291 3350 Housekeeping Gene ARL1 3330 CUST_P10079726 5923 5982 Housekeeping Gene ARL1 3331 CUST_P10079735 8610 8669 Housekeeping Gene ARL1 3332 CUST_P10079739 10525 10584 Housekeeping Gene ARL1 3333 CUST_P10079747 11552 11599 Housekeeping Gene ARL1 3334 CUST_P10079753 12428 12487 Housekeeping Gene ARL1 3335 CUST_P10079768 14112 14158 Housekeeping Gene ARL1 3336 CUST_P10079690 310 354 Housekeeping Gene ARL1 3337 CUST_P10079691 435 483 Housekeeping Gene ARL1 3338 CUST_P10079702 977 1028 Housekeeping Gene ARL1 3339 CUST_P10079689 209 253 Housekeeping Gene ARL1 3340 CUST_P10079743 11265 11317 Housekeeping Gene ARL1 3341 CUST_P10079745 11327 11379 Housekeeping Gene ARL1 3342 CUST_P10079712 3205 3264

Housekeeping Gene ARL1 3343 CUST_P10079740 10708 10767 Housekeeping Gene ARL1 3344 CUST_P10079710 2561 2620 Housekeeping Gene ARL1 3345 CUST_P10079717 3630 3689 Housekeeping Gene ARL1 3346 CUST_P10079761 13619 13672 Housekeeping Gene ARL1 3347 CUST_P10079707 1616 1675 Housekeeping Gene ARL1 3348 CUST_P10079767 14091 14135 Housekeeping Gene ARL1 3349 CUST_P10079699 861 910 Housekeeping Gene ARL1 3350 CUST_P10079697 794 838 Housekeeping Gene ARL1 3351 CUST_P10079694 683 742 Housekeeping Gene ARL1 3352 CUST_P10079749 11842 11901 Housekeeping Gene ARL1 3353 CUST_P10079716 3606 3665 Housekeeping Gene ARL1 3354 CUST_P10079708 2224 2283 Housekeeping Gene ARL1 3355 CUST_P10079719 4420 4479 Housekeeping Gene ARL1 3356 CUST_P10079763 13695 13749 Housekeeping Gene ARL1 3357 CUST_P10079752 12271 12330 Housekeeping Gene ARL1 3358 CUST_P10079721 4794 4853 Housekeeping Gene ARL1 3359 CUST_P10079766 14055 14099 Housekeeping Gene ARL1 3360 CUST_P10079764 13860 13919 Housekeeping Gene ARL1 3361 CUST_P10079765 13910 13963 Housekeeping Gene ARL1 3362 CUST_P10079706 1514 1573 Housekeeping Gene ARL1 3363 CUST_P10079705 1462 1509 Housekeeping Gene ARL1 3364 CUST_P10079695 715 774 Housekeeping Gene ARL1 3365 CUST_P10079698 836 884 Housekeeping Gene ARL1 3366 CUST_P10079693 655 710 Housekeeping Gene ARL1 3367 CUST_P10079754 12585 12644 Housekeeping Gene ARL1 3368 CUST_P10079731 7083 7139 Housekeeping Gene ARL1 3369 CUST_P10079723 5093 5152 Housekeeping Gene ARL1 3370 CUST_P10079704 1198 1257 Housekeeping Gene ARL1 3371 CUST_P10079756 12839 12888 Housekeeping Gene ARL1 3372 CUST_P10079711 2977 3036 Housekeeping Gene ARL1 3373 CUST_P10079709 2313 2369 Housekeeping Gene ARL1 3374 CUST_P10079770 14253 14312 Housekeeping Gene ARL1 3375 CUST_P10079700 891 939 Housekeeping Gene ARL1 3376 CUST_P10079734 7994 8053 Housekeeping Gene ARL1 3377 CUST_P10079729 6688 6746 Housekeeping Gene ARL1 3378 CUST_P10079718 4205 4249 Housekeeping Gene ARL1 3379 CUST_P10079751 12179 12229 Housekeeping Gene ARL1 3380 CUST_P10079720 4653 4712 Housekeeping Gene ARL1 3381 CUST_P10079725 5683 5733 Housekeeping Gene ARL1 3382 CUST_P10079769 14139 14193 Housekeeping Gene ARL1 3383 CUST_P10079771 14283 14342 Housekeeping Gene ARL1 3384 CUST_P10079737 8984 9043 Housekeeping Gene ARL1 3385 CUST_P10079757 12965 13024 Housekeeping Gene ARL1 3386 CUST_P10079772 69 113 Housekeeping Gene CCDN1 3387 CUST_P10079773 104 148 Housekeeping Gene CCDN1 3388 CUST_P10079774 297 341 Housekeeping Gene CCDN1 3389 CUST_P10079775 332 376 Housekeeping Gene CCDN1 3390 CUST_P10079776 395 439 Housekeeping Gene CCDN1 3391 CUST_P10079777 680 724 Housekeeping Gene CCDN1 3392 CUST_P10079778 844 903 Housekeeping Gene CCDN1 3393 CUST_P10079779 1049 1093 Housekeeping Gene CCDN1 3394 CUST_P10079780 1146 1190 Housekeeping Gene CCDN1 3395 CUST_P10079781 1368 1412 Housekeeping Gene CCDN1 3396 CUST_P10079782 1513 1557 Housekeeping Gene CCDN1 3397 CUST_P10079783 1553 1597 Housekeeping Gene CCDN1 3398 CUST_P10079784 1811 1855 Housekeeping Gene CCDN1 3399 CUST_P10079785 1936 1980 Housekeeping Gene CCDN1 3400 CUST_P10079786 2041 2085 Housekeeping Gene CCDN1 3401 CUST_P10079787 2206 2250 Housekeeping Gene CCDN1 3402 CUST_P10079788 2233 2277 Housekeeping Gene CCDN1 3403 CUST_P10079789 2279 2323 Housekeeping Gene CCDN1 3404 CUST_P10079790 2321 2365 Housekeeping Gene CCDN1 3405 CUST_P10079791 2346 2390 Housekeeping Gene CCDN1 3406 CUST_P10079792 2376 2420 Housekeeping Gene CCDN1 3407 CUST_P10079793 2385 2429 Housekeeping Gene CCDN1 3408 CUST_P10079794 2413 2457 Housekeeping Gene CCDN1 3409 CUST_P10079795 2455 2499 Housekeeping Gene CCDN1 3410 CUST_P10079796 2584 2628 Housekeeping Gene CCDN1 3411 CUST_P10079797 2794 2838 Housekeeping Gene CCDN1 3412 CUST_P10079798 2842 2886 Housekeeping Gene CCDN1 3413 CUST_P10079799 2899 2943 Housekeeping Gene CCDN1 3414 CUST_P10079800 2953 2997 Housekeeping Gene CCDN1 3415 CUST_P10079801 3037 3081 Housekeeping Gene CCDN1 3416 CUST_P10079802 3135 3179 Housekeeping Gene CCDN1 3417 CUST_P10079803

3194 3238 Housekeeping Gene CCDN1 3418 CUST_P10079804 3365 3409 Housekeeping Gene CCDN1 3419 CUST_P10079805 3518 3562 Housekeeping Gene CCDN1 3420 CUST_P10079806 3675 3719 Housekeeping Gene CCDN1 3421 CUST_P10079807 3753 3797 Housekeeping Gene CCDN1 3422 CUST_P10079808 3904 3948 Housekeeping Gene CCDN1 3423 CUST_P10079809 4120 4164 Housekeeping Gene CCDN1 3424 CUST_P10079810 4201 4245 Housekeeping Gene CCDN1 3425 CUST_P10079811 4312 4356 Housekeeping Gene CCDN1 3426 CUST_P10079812 4419 4463 Housekeeping Gene CCDN1 3427 CUST_P10079813 4486 4530 Housekeeping Gene CCDN1 3428 CUST_P10079814 4518 4562 Housekeeping Gene CCDN1 3429 CUST_P10079815 4542 4586 Housekeeping Gene CCDN1 3430 CUST_P10079816 4560 4609 Housekeeping Gene CCDN1 3431 CUST_P10079817 4595 4639 Housekeeping Gene CCDN1 3432 CUST_P10079818 4633 4677 Housekeeping Gene CCDN1 3433 CUST_P10079819 4645 4692 Housekeeping Gene CCDN1 3434 CUST_P10079820 4674 4720 Housekeeping Gene CCDN1 3435 CUST_P10079821 4726 4770 Housekeeping Gene CCDN1 3436 CUST_P10079822 4753 4797 Housekeeping Gene CCDN1 3437 CUST_P10079823 4910 4956 Housekeeping Gene CCDN1 3438 CUST_P10079824 5081 5131 Housekeeping Gene CCDN1 3439 CUST_P10079825 5281 5325 Housekeeping Gene CCDN1 3440 CUST_P10079826 5295 5345 Housekeeping Gene CCDN1 3441 CUST_P10079827 5319 5363 Housekeeping Gene CCDN1 3442 CUST_P10079828 5472 5516 Housekeeping Gene CCDN1 3443 CUST_P10079829 5506 5550 Housekeeping Gene CCDN1 3444 CUST_P10079830 5654 5698 Housekeeping Gene CCDN1 3445 CUST_P10079831 5680 5724 Housekeeping Gene CCDN1 3446 CUST_P10079832 5709 5753 Housekeeping Gene CCDN1 3447 CUST_P10079833 5736 5780 Housekeeping Gene CCDN1 3448 CUST_P10079834 5775 5819 Housekeeping Gene CCDN1 3449 CUST_P10079835 5804 5848 Housekeeping Gene CCDN1 3450 CUST_P10079836 5828 5872 Housekeeping Gene CCDN1 3451 CUST_P10079837 5876 5920 Housekeeping Gene CCDN1 3452 CUST_P10079838 6010 6054 Housekeeping Gene CCDN1 3453 CUST_P10079839 6083 6133 Housekeeping Gene CCDN1 3454 CUST_P10079840 6163 6207 Housekeeping Gene CCDN1 3455 CUST_P10079841 6270 6314 Housekeeping Gene CCDN1 3456 CUST_P10079842 6395 6442 Housekeeping Gene CCDN1 3457 CUST_P10079843 6557 6604 Housekeeping Gene CCDN1 3458 CUST_P10079844 6611 6656 Housekeeping Gene CCDN1 3459 CUST_P10079845 6635 6679 Housekeeping Gene CCDN1 3460 CUST_P10079846 6770 6814 Housekeeping Gene CCDN1 3461 CUST_P10079847 6895 6939 Housekeeping Gene CCDN1 3462 CUST_P10079848 6976 7020 Housekeeping Gene CCDN1 3463 CUST_P10079849 7012 7056 Housekeeping Gene CCDN1 3464 CUST_P10079850 7064 7108 Housekeeping Gene CCDN1 3465 CUST_P10079851 7224 7268 Housekeeping Gene CCDN1 3466 CUST_P10079852 7283 7327 Housekeeping Gene CCDN1 3467 CUST_P10079853 7444 7488 Housekeeping Gene CCDN1 3468 CUST_P10079854 7649 7693 Housekeeping Gene CCDN1 3469 CUST_P10079855 7768 7812 Housekeeping Gene CCDN1 3470 CUST_P10079856 7794 7838 Housekeeping Gene CCDN1 3471 CUST_P10079857 7858 7902 Housekeeping Gene CCDN1 3472 CUST_P10079858 7957 8001 Housekeeping Gene CCDN1 3473 CUST_P10079859 8092 8136 Housekeeping Gene CCDN1 3474 CUST_P10079860 8120 8168 Housekeeping Gene CCDN1 3475 CUST_P10079861 8173 8217 Housekeeping Gene CCDN1 3476 CUST_P10079862 8228 8272 Housekeeping Gene CCDN1 3477 CUST_P10079863 8422 8473 Housekeeping Gene CCDN1 3478 CUST_P10079864 8469 8513 Housekeeping Gene CCDN1 3479 CUST_P10079865 8649 8693 Housekeeping Gene CCDN1 3480 CUST_P10079866 8842 8887 Housekeeping Gene CCDN1 3481 CUST_P10079867 8960 9004 Housekeeping Gene CCDN1 3482 CUST_P10079868 8995 9039 Housekeeping Gene CCDN1 3483 CUST_P10079869 9060 9104 Housekeeping Gene CCDN1 3484 CUST_P10079870 9132 9176 Housekeeping Gene CCDN1 3485 CUST_P10079871 9183 9227 Housekeeping Gene CCDN1 3486 CUST_P10079872 9196 9240 Housekeeping Gene CCDN1 3487 CUST_P10079873 9229 9273 Housekeeping Gene CCDN1 3488 CUST_P10079874 9266 9310 Housekeeping Gene CCDN1 3489 CUST_P10079875 9309 9353 Housekeeping Gene CCDN1 3490 CUST_P10079876 9333 9377 Housekeeping Gene CCDN1 3491 CUST_P10079877 9390 9434 Housekeeping Gene CCDN1 3492 CUST_P10079878

9430 9474 Housekeeping Gene CCDN1 3493 CUST_P10079879 9479 9523 Housekeeping Gene CCDN1 3494 CUST_P10079880 9508 9552 Housekeeping Gene CCDN1 3495 CUST_P10079881 9519 9563 Housekeeping Gene CCDN1 3496 CUST_P10079882 9570 9614 Housekeeping Gene CCDN1 3497 CUST_P10079883 9592 9639 Housekeeping Gene CCDN1 3498 CUST_P10079884 9705 9749 Housekeeping Gene CCDN1 3499 CUST_P10079885 9885 9933 Housekeeping Gene CCDN1 3500 CUST_P10079886 10029 10073 Housekeeping Gene CCDN1 3501 CUST_P10079887 10165 10209 Housekeeping Gene CCDN1 3502 CUST_P10079888 10204 10248 Housekeeping Gene CCDN1 3503 CUST_P10079889 10442 10501 Housekeeping Gene CCDN1 3504 CUST_P10079890 10526 10574 Housekeeping Gene CCDN1 3505 CUST_P10079891 10760 10819 Housekeeping Gene CCDN1 3506 CUST_P10079892 10833 10877 Housekeeping Gene CCDN1 3507 CUST_P10079893 10868 10912 Housekeeping Gene CCDN1 3508 CUST_P10079894 10900 10944 Housekeeping Gene CCDN1 3509 CUST_P10079895 10931 10975 Housekeeping Gene CCDN1 3510 CUST_P10079896 11055 11107 Housekeeping Gene CCDN1 3511 CUST_P10079897 11190 11242 Housekeeping Gene CCDN1 3512 CUST_P10079898 11364 11410 Housekeeping Gene CCDN1 3513 CUST_P10079899 11472 11525 Housekeeping Gene CCDN1 3514 CUST_P10079900 11490 11547 Housekeeping Gene CCDN1 3515 CUST_P10079901 11807 11852 Housekeeping Gene CCDN1 3516 CUST_P10079902 11887 11940 Housekeeping Gene CCDN1 3517 CUST_P10079903 12162 12221 Housekeeping Gene CCDN1 3518 CUST_P10079904 12355 12412 Housekeeping Gene CCDN1 3519 CUST_P10079905 12402 12446 Housekeeping Gene CCDN1 3520 CUST_P10081361 16 63 Negative Control *Aedes albopictus* densovirus 2 3521 CUST_P10081362 47 101 Negative Control *Aedes albopictus* densovirus 2 3522 CUST_P10081363 79 131 Negative Control *Aedes albopictus* densovirus 2 3523 CUST_P10081364 204 248 Negative Control *Aedes albopictus* densovirus 2 3524 CUST_P10081365 302 361 Negative Control *Aedes albopictus* densovirus 2 3525 CUST_P10081366 330 385 Negative Control *Aedes albopictus* densovirus 2 3526 CUST_P10081367 390 435 Negative Control *Aedes albopictus* densovirus 2 3527 CUST_P10081368 426 472 Negative Control *Aedes albopictus* densovirus 2 3528 CUST_P10081369 590 649 Negative Control *Aedes albopictus* densovirus 2 3529 CUST_P10081370 617 673 Negative Control *Aedes albopictus* densovirus 2 3530 CUST_P10081371 654 707 Negative Control *Aedes albopictus* densovirus 2 3531 CUST_P10081372 753 810 Negative Control *Aedes albopictus* densovirus 2 3532 CUST_P10081373 791 844 Negative Control *Aedes albopictus* densovirus 2 3533 CUST_P10081374 824 880 Negative Control *Aedes albopictus* densovirus 2 3534 CUST_P10081375 966 1015 Negative Control *Aedes albopictus* densovirus 2 3535 CUST_P10081376 1174 1233 Negative Control *Aedes albopictus* densovirus 2 3536 CUST_P10081377 1295 1339 Negative Control *Aedes albopictus* densovirus 2 3537 CUST_P10081378 1385 1433 Negative Control *Aedes albopictus* densovirus 2 3538 CUST_P10081379 1538 1582 Negative Control *Aedes albopictus* densovirus 2 3539 CUST_P10081380 1556 1601 Negative Control *Aedes albopictus* densovirus 2 3540 CUST_P10081381 1636 1689 Negative Control *Aedes albopictus* densovirus 2 3541 CUST_P10081382 1752 1811 Negative Control *Aedes albopictus* densovirus 2 3542 CUST_P10081383 1810 1854 Negative Control *Aedes albopictus* densovirus 2 3543 CUST_P10081384 1836 1893 Negative Control *Aedes albopictus* densovirus 2 3544 CUST_P10081385 1858 1913 Negative Control *Aedes albopictus* densovirus 2 3545 CUST_P10081386 1977 2036 Negative Control *Aedes albopictus* densovirus 2 3546 CUST_P10081387 2065 2124 Negative Control *Aedes albopictus* densovirus 2 3547 CUST_P10081388 2093 2152 Negative Control *Aedes albopictus* densovirus 2 3548 CUST_P10081389 2136 2195 Negative Control *Aedes albopictus* densovirus 2 3549 CUST_P10081390 2162 2221 Negative Control *Aedes albopictus* densovirus 2 3550

CUST_P10081391 2209 2257 Negative Control *Aedes albopictus* densovirus 2 3551
CUST_P10081392 2384 2434 Negative Control *Aedes albopictus* densovirus 2 3552
CUST_P10081393 2497 2546 Negative Control *Aedes albopictus* densovirus 2 3553
CUST_P10081394 2530 2589 Negative Control *Aedes albopictus* densovirus 3 3554
CUST_P10081395 2697 2754 Negative Control *Aedes albopictus* densovirus 2 3555
CUST_P10081396 2766 2825 Negative Control *Aedes albopictus* densovirus 2 3556
CUST_P10081397 281 340 Negative Control *Aedes albopictus* densovirus 2 3557
CUST_P10081398 353 404 Negative Control *Aedes albopictus* densovirus 2 3558
CUST_P10081399 411 457 Negative Control Maize streak virus 3559 CUST_P10081400 572 630 Negative Control Maize streak virus 3560 CUST_P10081401 727 786 Negative Control Maize streak virus 3561 CUST_P10081402 760 819 Negative Control Maize streak virus 3562 CUST_P10081403 799 852 Negative Control Maize streak virus 3563 CUST_P10081404 839 891 Negative Control Maize streak virus 3564 CUST_P10081405 871 919 Negative Control Maize streak virus 3565 CUST_P10081406 937 988 Negative Control Maize streak virus 3566 CUST_P10081407 961 1011 Negative Control Maize streak virus 3567 CUST_P10081408 1177 1233 Negative Control Maize streak virus 3568 CUST_P10081409 1316 1365 Negative Control Maize streak virus 3569 CUST_P10081410 1362 1420 Negative Control Maize streak virus 3570 CUST_P10081411 1391 1450 Negative Control Maize streak virus 3571 CUST_P10081412 1447 1506 Negative Control Maize streak virus 3572 CUST_P10081413 1694 1753 Negative Control Maize streak virus 3573 CUST_P10081414 1837 1896 Negative Control Maize streak virus 3574 CUST_P10081415 2047 2106 Negative Control Maize streak virus 3575 CUST_P10081416 2095 2147 Negative Control Maize streak virus 3576 CUST_P10081417 2362 2421 Negative Control Maize streak virus 3577 CUST_P10081418 2387 2446 Negative Control Maize streak virus 3578 CUST_P10081419 2536 2595 Negative Control Maize streak virus 3579 CUST_P10081420 2666 2713 Negative Control Maize streak virus 3580 CUST_P10081421 2893 2952 Negative Control Maize streak virus 3581 CUST_P10081422 2953 3012 Negative Control Maize streak virus 3582 CUST_P10081423 2987 3045 Negative Control Maize streak virus 3583 CUST_P10081424 3014 3071 Negative Control Maize streak virus 3584 CUST_P10081425 3054 3105 Negative Control Maize streak virus 3585 CUST_P10081426 3093 3142 Negative Control Maize streak virus 3586 CUST_P10081427 3144 3203 Negative Control Maize streak virus 3587 CUST_P10081428 3194 3253 Negative Control Maize streak virus 3588 CUST_P10081429 3330 3389 Negative Control Maize streak virus 3589 CUST_P10081430 3390 3438 Negative Control Maize streak virus 3590 CUST_P10081431 3414 3469 Negative Control Maize streak virus 3591 CUST_P10081432 3441 3494 Negative Control Maize streak virus 3592 CUST_P10081433 3525 3584 Negative Control Maize streak virus 3593 CUST_P10081434 3586 3645 Negative Control Maize streak virus 3594 CUST_P10081435 3727 3786 Negative Control Maize streak virus 3595 CUST_P10081436 3879 3923 Negative Control Maize streak virus 3596 CUST_P10081437 3967 4011 Negative Control Maize streak virus 3597 CUST_P10081438 112 169 Negative Control Maize streak virus 3598 CUST_P10081439 272 316 Negative Control Maize streak virus 3599 CUST_P10081440 301 345 Negative Control Tomato pseudo- curly top virus 3600 CUST_P10081441 341 387 Negative Control Tomato pseudo- curly top virus 3601 CUST_P10081442 436 480 Negative Control Tomato pseudo- curly top virus 3602 CUST_P10081443 468 515 Negative Control Tomato pseudo- curly top virus 3603 CUST_P10081444 490 534 Negative Control Tomato pseudo- curly top virus 3604
CUST_P10081446 687 731 Negative Control Tomato pseudo- curly top virus 3605
CUST_P10081447 803 847 Negative Control Tomato pseudo- curly top virus 3606
CUST_P10081448 813 857 Negative Control Tomato pseudo- curly top virus 3607
CUST_P10081449 842 887 Negative Control Tomato pseudo- curly top virus 3608
CUST_P10081451 1031 1090 Negative Control Tomato pseudo- curly top virus 3609
CUST_P10081452 1120 1164 Negative Control Tomato pseudo- curly top virus 3610
CUST_P10081453 1166 1214 Negative Control Tomato pseudo- curly top virus 3611

CUST_P10081454 1187 1246 Negative Control Tomato pseudo- curly top virus 3612
CUST_P10081455 1216 1260 Negative Control Tomato pseudo- curly top virus 3613
CUST_P10081456 1332 1385 Negative Control Tomato pseudo- curly top virus 3614
CUST_P10081457 1370 1429 Negative Control Tomato pseudo- curly top virus 3615
CUST_P10081458 1407 1459 Negative Control Tomato pseudo- curly top virus 3616
CUST_P10081459 1440 1499 Negative Control Tomato pseudo- curly top virus 3617
CUST_P10081460 1600 1650 Negative Control Tomato pseudo- curly top virus 3618
CUST_P10081461 1615 1669 Negative Control Tomato pseudo- curly top virus 3619
CUST_P10081462 1648 1698 Negative Control Tomato pseudo- curly top virus 3620
CUST_P10081463 1740 1797 Negative Control Tomato pseudo- curly top virus 3621
CUST_P10081464 2072 2128 Negative Control Tomato pseudo- curly top virus 3622
CUST_P10081465 2114 2173 Negative Control Tomato pseudo- curly top virus 3623
CUST_P10081466 2158 2217 Negative Control Tomato pseudo- curly top virus 3624
CUST_P10081467 2296 2346 Negative Control Tomato pseudo- curly top virus 3625
CUST_P10081468 2446 2490 Negative Control Tomato pseudo- curly top virus 3626
CUST_P10081470 2548 2592 Negative Control Tomato pseudo- curly top virus 3627
CUST_P10081471 2596 2650 Negative Control Tomato pseudo- curly top virus 3628
CUST_P10081472 2633 2683 Negative Control Tomato pseudo- curly top virus

(124) In view of the many possible embodiments to which the principles of the disclosure may be applied, it should be recognized that the illustrated embodiments are only examples and should not be taken as limiting the scope of the invention. Rather, the scope of the invention is defined by the following claims. We therefore claim as our invention all that comes within the scope and spirit of these claims.

Claims

1. A probe set comprising: (a) probes having at least 90% identity with the nucleic acid sequences of SEQ ID NOs: 1-1300, 1391-1570, and 1691-1769; (b) probes having at least 95% identity with the nucleic acid sequences of SEQ ID NOs: 1-1300, 1391-1570, and 1691-1769; (c) probes comprising the nucleic acid sequence of SEQ ID NOs: 1-1300, 1391-1570, and 1691-1769; or (d) probes comprising the nucleic acid sequence of SEQ ID NOs: 1-1769, wherein each of the probes is covalently linked to a solid support and each of the probes is 60 nucleotides in length.

2. The probe set of claim 1, wherein the probe set comprises probes for each of Chikungunya virus, Dengue virus type 1, Dengue virus type 2, Dengue virus type 3, Dengue virus type 4, Hepatitis A virus, Hepatitis C virus type 1, Hepatitis C virus type 2, Hepatitis C virus type 3, Hepatitis E virus, Human immunodeficiency virus type 1, Human immunodeficiency virus type 2, Human T-lymphotropic virus type I, Human T-lymphotropic virus type II, West Nile virus, and Zika virus.

3. The probe set of claim 1, further comprising at least one negative control probe and/or further comprising at least one positive control probe.

4. The probe set of claim 3, wherein the at least one negative control probe comprises a set of probes with at least 90% identity with each of the nucleic acid sequences of SEQ ID NOs: 1571-1690 and wherein each of the probes is 60 nucleotides in length.

5. The probe set of claim 1, further comprising: (a) probes having at least 90% identity with the nucleic acid sequences of SEQ ID NOs: 1770-2647; (b) probes having at least 95% identity with the nucleic acid sequences of SEQ ID NOS: 1770-2647; or (c) probes comprising the nucleic acid sequence of SEQ ID NOs: 1770-2647; wherein each of the probes is covalently linked to a solid support and each of the probes is 40-60 nucleotides in length.

6. The probe set of claim 5, wherein the probe set comprises probes for each of cytomegalovirus, Epstein Barr virus subtype B95-8, Epstein Barr virus subtype AG876, human herpes virus 8, Hepatitis B virus subtype adw, Hepatitis B virus subtype ayw, Hepatitis B virus subtype adr,

Hepatitis B virus subtype ayr, human parvovirus B19, human papillomavirus type 6, human papillomavirus type 11, human papillomavirus type 16, and human papillomavirus type 18.
7. The probe set of claim 5, further comprising at least one negative control probe and/or further comprising at least one positive control probe.
8. The probe set of claim 7, wherein the at least one negative control probe comprises a set of probes with at least 90% identity with the nucleic acid sequences of each of SEQ ID NOs: 3520-3628 and each of the probes is 45-60 nucleotides in length.
9. The probe set of claim 1, further comprising: (a) probes having at least 90% identity with the nucleic acid sequences of SEQ ID NOs: 2648-3207; (b) probes having at least 95% identity with the nucleic acid sequences of SEQ ID NOs: 2648-3207; or (c) probes comprising the nucleic acid sequence of SEQ ID NOs: 2648-3207; wherein each of the probes is covalently linked to a solid support and each of the probes is 45-60 nucleotides in length.
10. The probe set of claim 9, wherein the probe set comprises at least one probe for each of *Treponema pallidum, Ehrlichia chaffeensis, Ehrlichia ewingii, Ehrlichia muris, Borrelia burgdorferi, Coxiella burnetii, Trypanosoma brucei, Trypanosoma cruzi Leishmania major, Babesia microti, Plasmodium falciparum,* and *Plasmodium vivax.*
11. The probe set of claim 9, further comprising at least one negative control probe and/or further comprising at least one positive control probe.
12. The probe set of claim 11, wherein the at least one positive control probe comprises a set of probes with at least 90% identity with the nucleic acid sequences of each of SEQ ID NOs: 3208-3519 and each of the probes is 45-60 nucleotides in length.
13. A microarray comprising the probe set of claim 1.
14. The microarray of claim 13, wherein the probe set comprises probes comprising the nucleic acid sequence of each of SEQ ID NOs: 1-1769.
15. A method of detecting one or more pathogen nucleic acids in a sample, comprising: contacting the sample with the probe set of claim 1 under conditions sufficient to allow hybridization of pathogen nucleic acids present in the sample to the probes of the probe set; and measuring hybridization of the sample to one or more of the probes, thereby detecting one or more pathogen nucleic acids in the sample.
16. The method of claim 15, wherein the sample comprises a blood, serum, or plasma sample or nucleic acids isolated from a blood, serum, or plasma sample.
17. The method of claim 16, further comprising isolating nucleic acids from the sample prior to contacting the sample with the probe set.
18. The method of claim 17, further comprising labeling the isolated nucleic acids from the sample.
19. The method of claim 18, wherein the isolated nucleic acids are isolated DNA, isolated RNA, isolated cDNA, or a combination of two or more thereof.
20. The method of claim 19, wherein labeling the isolated nucleic acids comprises labeling the nucleic acids with one or more fluorescent labels.
21. The method of claim 17, wherein the isolated nucleic acids are cDNA.
22. The method of claim 17, wherein isolating the nucleic acids does not comprise amplifying total RNA from the sample prior to preparing cDNA.
23. The method of claim 15, wherein measuring hybridization comprises detecting ≥50% of the probes for the virus have a log ratio of >1.5 and/or the log ratio between the signal intensity mean for the probe set and the mean of a control group probe set is ≥1.5.
24. The method of claim 15, wherein the pathogen nucleic acids comprise nucleic acids from one or more of Chikungunya virus, Dengue virus types 1, 2, 3, or 4, Hepatitis A virus, Hepatitis C virus types 1, 2, or 3, Hepatitis E virus, Human immunodeficiency virus types 1 or 2, Human T-lymphotropic virus types I or II, West Nile virus, and Zika virus.